Economic Analysis of Daily Recreational Activities and Subjective Well-being

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Economic Analysis of Daily Recreational Activities and Subjective Well-being

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Economic Analysis of Daily Recreational Activities and Subjective Well-being

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by

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Dedication

This dissertation is dedicated to my family for their unconditional love, continuous support and encouragement.

Parents	:	Mother (Radja Intan Maddi) Father (M. Alam Bakkasang)
Brothers	:	Makmur Alam Ma'ruf Alam Manshur Alam

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List of Abbreviations

ACSM	American College of Sports Medicine
ADL	Activities of Daily Living
COMPAS	Coordinated Monitoring of Participation in Sports
GSOEP	German Socio-Economic Panel
HRQoL	Health-Related Quality of Life
IADL	Intentional Activities of Daily Living
ISSP	International Social Survey Program
IV	Instrumental Variables
JSSP	Japanese Society for the Promotion of Science
LTPA	Leisure Time Physical Activity
LTSB	Leisure Time Sedentary Behavior
MET	Metabolic Equivalent
MIC	Ministry of Internal Affairs and Communications
MVPA	Moderate Vigorous Physical Activity
OECD	Organization for Economic Cooperation and Development
PA	Physically Activity
PARA	Physically Active Recreational Activities
PSRA	Physically Stationary Recreational Activities
RADL	Recreational Activities of Daily Living
SES	Socio Economic Status
SGPALS	Saltin Grimby Physical Activity Level Scale
SLOTH	Sleeping, Leisure, Occupation, Transportation, Home production
SRH	Self-Rated Health
SWB	Subjective Well-Being
WHO	World Health Organization

Economic Analysis of Daily Recreational Activities and Subjective Well-being

-Abstract-

This empirical study was conducted to examine the effects of a person's daily activities on subjective well-being in economically developed countries such as the US, France, and Japan. In recent years, the ways in which people spend daily life during business hours have been changing, reflecting technological development, which has produced more sedentary employment.

According to a report by the World Health Organization (WHO), approximately 31% of adults aged 15 and over worldwide were insufficiently active in 2010 (men 28%, women 34%). An estimated 3.2 million deaths each year are attributable to insufficient physical activity. This severe situation for public health of societies can also affect world economies. Even now, the negative impact of chronic disease has generally been insufficiently appreciated. Therefore, the importance of physical activity for people's health has been growing.

Chapter 1 introduces research objectives and the potential contributions of this dissertation after reviewing earlier studies. In terms of health economics, this chapter provides a theoretical framework of the outcomes of daily recreational activities such as doing sports.

Chapter 2 examines particular characteristics to ascertain a relation of health and daily recreational activities among working generations of people of the US, France, and Japan. These representative countries, located on different continents, have particular cultural backgrounds and social customs. Based on the SLOTH model developed by Cawley (2004), the author used individual datasets from internet surveys to investigate the association between physically active recreational activities and several health indicators. Estimation results show a significant positive association between the level of self-rated health and the frequencies of physically active recreational activities such as doing sports activities for both men and women in the three countries. In addition, continued reflection and thinking activities such as reading, even if they include physically stationary activities, lead to the improvement of health in some cases beyond differences of geography and cultural characteristics.

Chapter 3 presents an investigation of the relation between self-rated health and daily recreational activity among elderly people in three economically developed countries: the US, France, and Japan. Estimation results for the US indicate a significant positive relation between a higher level of health and physically stationary recreational activities such as making handicrafts and watching movies, particularly for women. Physically stationary recreational activities exhibited no effect on either men or women in Japan. Regarding physically demanding recreational activities, doing sports activities secured positive impacts on a person's self-rated health in all three countries. The impact of female labor participation on health in Japan was highest.

Chapter 4 presents an investigation, using individual data, of important socioeconomic factors that influence participation in sport activities. Estimation results of a random intercept model for the US, France and Japan revealed similar and different socioeconomic factors affecting sports participation frequency in the three countries. In the US and France, adults aged 20–59 years old and persons residing with parents tend to participate more in sporting activities. By contrast, elderly Japanese people tend to participate in sports more actively than others. Moreover, high education attainment, high income, and good health habits are positively correlated with the sports activity level.

Chapter 5 confirms the effects of poverty dimensions (time and income poverty) on daily recreational activities such as sports participation and reading. This study revealed that household members who fall into time poverty tend to decrease the frequency of participation in physically active recreational activities such as sports participation.

Chapter 6 presents summaries and conclusion of this dissertation, which supports the view that physical activities such as sports participation, as well as reflection and thinking activities such as reading, during daily life are beneficial for the improvement of their quality of life and subjective well-being. Moreover, higher SES plays an important role for it. Policy implications are derived from empirical evidence.

Chapter1: Introduction

1.1 Background

From the dawn of their existence, human beings have lived in environments for which physical activity and associated movement skills are centrally important, especially in the context of physical competition with other animals. However, the recent dramatic progress of science and technology has influenced various aspects of physical activity. Being overly dependent on labor-saving devices has produced more sedentary lifestyles and has also decreased physical performance in daily activities. Examples of devices that require no physical power include automobiles (cars and trains), automated household appliances (washing and dishwashers machines), automated work equipment (computers, fax, and electronic mail), and entertainment equipment (television and internet). The introduction of these devices has contributed to economic progress, but it has caused a remarkable and sudden decline in human physical activity (Malina and Little, 2008).

Continual physical activity is a well-established element of public health that has been attracting great attention by healthcare professionals. In recent years, the benefits of physical activity for the mind and body have been acknowledged by policy makers and business managers as well (McCann, 2006).

Today, physical inactivity and sedentary behavior are sometimes regarded as having brought about public health problems because they are associated with risks to

health. Physical inactivity is regarded as a main cause of major non-communicable diseases including cardiovascular disease, diabetes, and certain types of cancer. Moreover, physical inactivity sometimes eventually engenders severe disease as well as disability and death. Living a sedentary lifestyle is normal for most people living in economically developed countries. Consequently, the numbers of people who lack physical activity and who have excess weight have been rising sharply.

An estimate by Chenoweth and Leutzinger (2006) has shown that the estimated financial burden, which includes direct medical care, workers' compensation, and productivity loss, in just seven states in the US is about $93 billion for physical inactivity and $94 billion for excess weight. The estimated nationwide cost of these risk factors came to approximately$507 billion during the latter 2000s. According to their results, projected cost-savings of $31 billion per year could be realized with a 5% drop in these risk factors.[1] Despite the existence of effective intervention strategies for promoting physical activity, only modest progress is currently being made at the population level (Pratt et al., 2004, p.1).The trend of physical inactivity of people living in economically developed countries is an important economic phenomenon.

[1]Pratt et al. (2004) also reported that levels of physical inactivity in the United States remain high, costing as much as $76 billion in 2000 in direct medical expenses alone.

In addition, people's leisure-time sedentary behavior (LTSB) is regarded as associated with health-related quality of life (HRQoL) and eventually nationwide medical costs. A growing consensus holds that sedentary behavior has harmful effects of several kinds on health. It is independent of the total volume of physical activity (Balboa Castilo et al., 2011). Balboa Castilo et al. (2011) reported an association between LTSB of elderly people in 2003, expressed in quartiles of sitting hours per week, and HRQoL in 2009, using micro-data of Spain. Results show that, in comparison with subjects in the lower quartile of sitting time, those in the upper quartile had worse scores on the scales of physical function, bodily pain, and vitality, even after adjusting for LTPA and other covariates. However, regarding some physically stationary recreational activities, they might positively affect people's health in psychological terms through mechanisms such as switching of viewpoints, activation of the five senses, and training.

1.2 Purpose of the study

Based on problem consciousness, this paper presents an examination of the economic effects of the change in daily recreational activities, particularly addressing differences between physically active recreational activities (PARA) such as doing sports and physically stationary recreational activities (PSRA) such as watching sports. This classification is based mainly on the Saltin–Grimby Physical Activity Level Scale (SGPALS), originally established by Saltin and Grimby (1968).

The study specifically examines relations among socioeconomic factors, the

degree of daily recreational activities and subjective well-being, and use of econometric techniques. More specifically, the study attempts to uncover answers to the following questions:

- What is the relation between daily recreational activities of workers and their subjective well-being (self-rated health, income satisfaction)?(Chapter 2)
- Would daily recreational activities such as physical activity affect the health level of elderly people? (Chapter 3)
- What are the important socioeconomic factors of participation in sports activities? (Chapter 4)
- Does the degree of time availability influence the frequency of performing physical activities? (Chapter 5)

As an important aspect, the study particularly investigates how daily recreational activities, which are divisible into physically stationary recreational activities (PSRA) and physically active recreational activities (PARA), contribute to improve one's health level. In addition, differences of the effects of daily recreational activities among economically developed countries are discussed.

Numerous reports of the literature particularly address the relation between physical activities and subjective well-being from the viewpoint of both theoretical and empirical approaches. The fundamental theoretical framework used for this study is called the SLOTH model, which presents a connection of physical activities and utility, by expanding Becker's model on the choice of leisure and consumption

(Becker, 1964). A detailed explanation of the SLOTH model is presented in the next section.

An outline of the paper is presented in Figure 1-1. First, the study specifically examines the relations between people's daily recreational activities and subjective well-being. Chapter 2 especially describes particular characteristics to ascertain the relation of health and daily recreational activities among working generations of people. Chapter 3 presents an investigation of the relation between self-rated health and daily recreational activity among elderly people. In both chapters, the study used three economically developed countries as target samples: The US, France, and Japan. These representative countries, located on different continents, have particular cultural backgrounds and social customs. It is interesting that these three countries have particular characteristics related to the degree of sports involvement (doing sports and watching sports) according to the result by the 2007 ISSP-survey ''Leisure Time and Sport'' (Fig. 1-2). On the one hand, Japanese people tend to prefer watching sports to doing sports. On the other hand, French people tend to prefer doing sports to watching sports. American people are likely to be fond of both doing sports and watching sports. Examining the differences of the effects of daily recreational activities on well-being among the three countries, in addition to their social and cultural backgrounds, is a worthwhile subject of study. Results can be expected to elucidate the effects of sports and sedentary lifestyles.

Secondly, Chapter 4 describes a study conducted to grasp important socioeconomic factors that influence participation in sporting activities, using micro datasets of the three countries mentioned above. By comparing the estimation results of econometric models, one can analyze trends in the three countries and ascertain similar important socioeconomic factors that affect sports participation frequency.

Thirdly, Chapter 5 confirms the effects of poverty dimensions (time and income poverty) on daily recreational activities such as sports participation and reading, considering situations in which even economically developed countries have been confronting poverty problems.

1.3 Data Used

For this study, large micro-datasets were collected from results of nationwide international surveys. The settings of surveys were organized by NTT Com Research. All samples in the US, France, and Japan were collected via internet surveys. The surveys, sponsored by the Japanese Society for the Promotion of Science (JSSP), were implemented during 2012–2013 for a research project investigating the socioeconomic determinants of subjective well-being.

The surveys elicited ample information related to individuals' subjective assessments of their own well-being, personal traits, and socioeconomic status, and the frequency and duration time of several types of daily recreational activities. Detailed explanations of the surveys are presented in subsequent chapters.

1.4 SLOTH model

Discretionary activities (e.g., diet, physical activity, smoking, and excessive alcohol consumption) have strongly affected chronic diseases such as heart disease, diabetes, obesity, asthma, and depression (Cawley, 2004, p.117).However, exhorting individuals to exercise more, eat in a healthier fashion, lose weight, stop smoking, or drink responsibly is not necessarily easy because people cannot immediately change their familiar life customs.

The majority of the empirical studies of daily recreational activities such as physical activity behavior in the economics literature use a theoretical framework based on Becker's (1965) household production model, Grossman's (1972) health production model, or Cawley's (2004) SLOTH framework with statistical analysis (Humphreys and Ruseski, 2011, p.5). The frameworks in these papers are extremely useful starting points for consideration of how individuals make decisions about daily activities and for consideration of empirical models.

Among these models, Cawley's (2004) SLOTH model particularly offers an economic framework for understanding and addressing the recent reduction of physical activity. This framework is beneficial for an understanding of how people allocate their scarce resources of time and money to maximize their lifetime utility. According to Cawley (2004), the decision of time allocation to physical activity can be understood and analyzed based on the applied framework of the consumption theory introduced by Becker (1965) (Downward, 2009). This approach basically

models the rational choice of an individual to maximize personal utility subject to several constraints related to time, budget, and biology. The income–leisure tradeoff model is applicable in the choice of daily recreational activity including participation in sports.

In this framework, health is a main factor that contributes to people's utility. The economic view is that people are involved in the production of their own health through daily recreational activities such as physical activity. However, people are sometimes willing to sacrifice health in exchange for other things that they value (Cawley, 2004, p.116).

The economic framework suggested by Cawley (2004) includes the assumption that individuals seek to maximize utility (i.e., happiness and welfare) subject to constraints of time, budget, and biology (Cawley, 2004, p.118). This framework, called the represented as the following functions.

$$U = U(S, L, O, T, HP, F, HE, W, Y)$$

$$HE = HE(S, L, O, T, HP, F, W)$$

Therein, the arguments **S**, **L**, **O**, **T**, and **HP** are vectors of variables representing the number of hours spent in pursuit of different objectives. Therefore, we designate this decomposition of time as the SLOTH model. The arguments represent time spent for some purpose: S stands for time spent sleeping, L represents time at leisure, O time devoted to occupation (paid work), T denotes time in transportation, and HP signifies time spent in home production (unpaid work). In addition, F represents food intake,

HE denotes the health level, W signifies one's weight, and argument Y represents a composite of all goods other than food (Cawley, 2004, p.118).

Within vector L, time spent for daily recreational activities is included. In the model, daily activities affect one's utility level directly and indirectly through a change in health.

> "The vector *L* might contain variables for the number of hours spent in physically active leisure (e.g., recreational sports) and the number of hours spent in sedentary leisure (e.g., watching television)."
>
> "Each of these pursuits directly affects a person's utility (e.g., leisure and sleep are enjoyable, time spent at one's occupation might or might not provide positive utility). These pursuits also affect utility indirectly, by affecting one's weight *W* and one's health *H*. For example, sedentary leisure might lead to higher weight and worse health in the future."
>
> [Cawley, 2004, p.118]

Each person seeks to maximize utility subject to three constraints in the SLOTH model framework. The first is a budget constraint, which states in the simplest version that the money spent on food (F) and all other goods (Y) is equal to one's wage income.[2] Wage income is calculated as the hourly wage times the number of

[2]In the real economy, people might be able to borrow, spend from their savings, and shift resources among family members. However, adding these features complicates the framework while contributing little to the main goal of this study (Cawley, 2004).

hours worked at one's occupation O. If one normalizes the price of all other goods Y to one, then the budget constraint is represented as the following function.

$$Y + F \cdot p_F = w \cdot O$$

In addition, hours spent sleeping (S), at leisure (L), at one's occupation (O), in transport (T), and at unpaid work in the household (HP), must add up to exactly24 each day. This is the time constraint.

$$S + L + O + T + HP = 24$$

Based on the framework presented above, a person who has allocated money and time optimally will receive an equal increment of net utility for the last hour spent in sleep, leisure, at his occupation, transportation, and unpaid household work. This rule is called the "last hour" rule (Cawley, 2004, p.119).

Using comparative static analysis of the extended SLOTH model, one can analyze the effects of changes in income and the opportunity cost of time on the decisions to participate in physical activity (the extensive margin) and the amount of time spent participating in physical activity (the intensive margin) (Humphreys and Ruseski, 2011). However, the signs of these comparative static expressions, $\partial \mathrm{a}/\partial \mathrm{w}$ and $\partial \mathrm{t}/\partial \mathrm{w}$, depend on the signs of the substitution and income effects of a change in the opportunity cost of time in this model. Therefore, empirical estimates are expected to be necessary to shed some light on which effect dominates these comparative static results.

In summary, the SLOTH model developed by Cawley (2004), Humphreys and Ruseski (2011) and others describes people's decision processes related mainly to participation in physical activities and time spent in all other activities. Pratt et al. (2004) considered the possible economic factors for each component of the SLOTH model, which might influence individuals' choices related to utilization of time and physical activity (Table 1-1). Based on those factors, various potential policy interventions might be conducted.[3]

However, few earlier studies have applied the consumer choice model of physical activity behavior for empirical analyses. According to a report by the World Health Organization (WHO), approximately 31% of adults aged 15 and over worldwide were insufficiently active in 2010 (28% men, 34% women). An estimated 3.2 million deaths each year are attributable to insufficient physical activity. This severe condition of public health of societies can also affect world economies.

In addition, earlier research has shown that sedentary activities such as television viewing are positively associated with clinical depression risk (Balboa-Castillo et al., 2011). Even now, the negative effects of chronic disease and mental disorder have generally been insufficiently appreciated. Therefore, the importance of daily recreational activities for people's health has been growing. Constructing and estimating empirical models related to daily recreational activities, including physical

[3]Pratt et al. (2004) advocated that economically justifiable interventions should specifically address market failures such as information deficits, externalities, and lack of rationality.

activity, is an important step for elucidating the mechanisms driving the effects of income and the opportunity cost of time on those behaviors.

Figure 1-1: Outline of the paper.

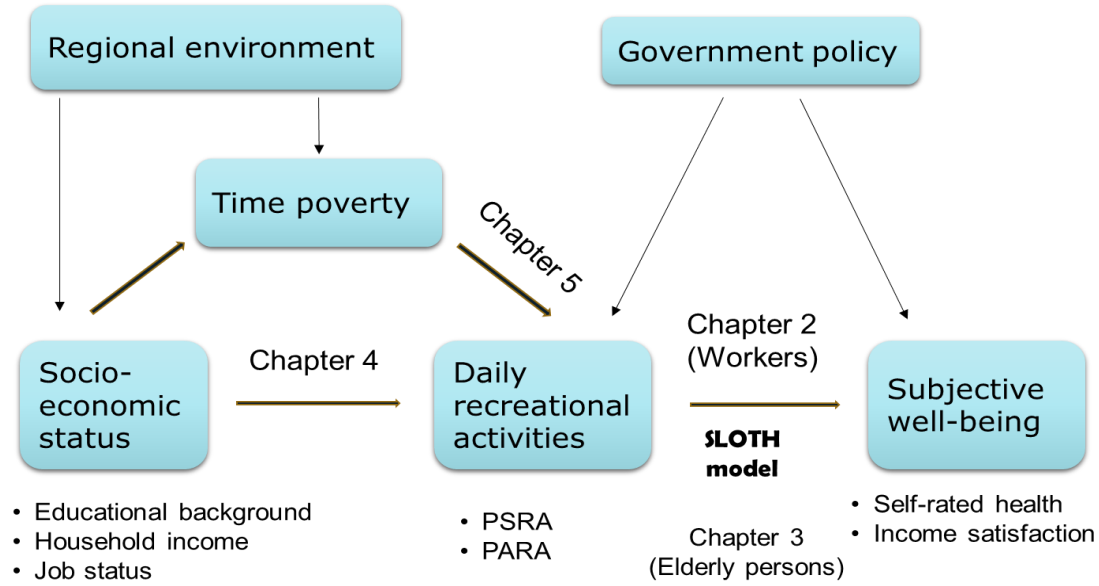
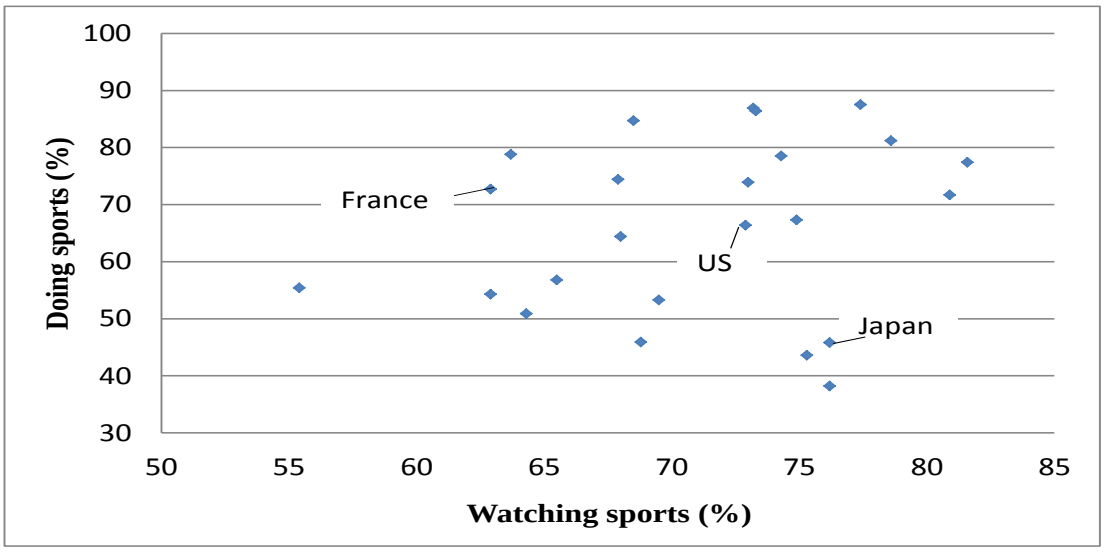


Figure 1-2: International comparison of degree of sports involvement (OECD 24 countries).



(Source) Produced from data of the 2007 International Social Survey Program (ISSP) survey of "Leisure Time and Sport."

(Note) Calculated rates of respondents who responded to "What sport or physical activity do you take part in most frequently?" and "What sport do you watch on TV most frequently?" by country.

Table 1-1: Examples of economic channels and interventions for SLOTH model

SLOTH components	Economic channels	Interventions
Sleep	Technological advances	Subsidies towards the medical progaram to encourage the improvement of mental health or sound sleep.
Leisure	Sports and exercise	Public service announcements or paid advertising promoting physical activity shown on television, especially after school hours, on weekends, and during programs that children are likely to watch.
	Technological advances	Provide “physical activity stamps” to be used for physical activity programs for youth.
Occupation	Globalized workforce	Provide incentives to employers who provide health promotion programs and facilities to employees.
	Technological advances	Support the provision of evidence-based work-site interventions through better dissemination of effective policies and programs.
Transportation	Built environment	Change zoning requirements to allow and encourage mixed-use walkable developments.
	Automobile usage	Allocation of transportation funds for pedestrian, bike, walk-to-school, and transit projects.
Home	Technological advances	Tax computer, telecommunications, and home entertainment technology to support development and maintenance of local infrastructure for physical activity (sidewalks, bike lanes, traffic calming measures, and neighborhood parks).
	Home exercise industry	Incentives or subsidies to encourage the production, purchase, or use of home exercise equipment.

(Note) Augmented contents from Pratt et al. (2004), p.137.

Chapter 2: Comparison self-rated health relation to daily recreational activities of workers in three countries: US, France, and Japan

2.1 Introduction

In recent years, the All-Party Parliamentary Commission on Physical Activity of United Kingdom (UK, 2014) published a report on physical activity, describing that over half of UK adults did not meet guidelines for daily physical activity. An even smaller percentage of children managed to reach the guideline levels. This report also presented estimates showing that physical inactivity engenders around 37,000 premature deaths each year. This numerical value is greater than the number of deaths caused by murder, suicide, and accidents combined.

In addition, the US Department of Health and Human Services, Centers for Disease Control and Prevention (US, 1996) published the first report on physical activity and health in the 1990s. It points out that substantial benefits can be gained from regular physical activity, based on evidence showing a strong relation between physical activity and health. For example, about 30–45 min of brisk walking, bicycling, or even working around the house or yard can reduce risks posed by illnesses such as coronary heart disease, colon cancer, and diabetes.

These reports in the UK and the US offer some clues to good health for people. The key finding is that people of all ages can fundamentally improve their quality

of life through sustained moderate physical activities. However, daily activities of many types exist other than normal moderate physical activities that people normally engage in. It is worth investigating their effects on health because the effects are diverse. They depend on the cultural background and social customs of the respective countries and regions.

Regarding the effects of leisure-time activities on utility, some researchers have been examining them using the theoretical framework of the Sleep–Leisure–Occupation–Transport–Home production model (SLOTH model) developed by Cawley (2004). Vector *L* fundamentally includes variables for the number of hours spent on physically active leisure (e.g., doing recreational sports) and for the number of hours spent on sedentary leisure (e.g., watching television). Each of these pursuits might directly and indirectly affect a person's utility through a change in one's weight and one's fitness. For example, daily activities of physical activity will improve one's health if their frequency is appropriate. Sedentary leisure might engender weight gain and worse future health (Cawley, 2004).

The study examines whether particular characteristics show are lation between health and daily activities of several types among working generations of three countries: The US, France, and Japan. These representative countries, located on different continents, have particular cultural backgrounds and social customs. Therefore, by examining the three countries' cases, one might be able to ascertain universal facts indicating relations between leisure time and health.

The paper contents are the following. Section 2.2 presents outlines of related previous studies. Section 2.3 explains the datasets and our hypotheses. In section 2.4, we summarize *t*-test results related to differences of activity times of daily recreational activities and discuss estimated results obtained from econometric analyses. In section 2.5, we describe the conclusions of these analyses.

2.2 Previous research

Many researchers in the medical field in recent years have already reported the benefits of physical activity on people's health. They found that regular physical activity such as exercise reduces illness risks of several types such as cardiovascular disease, cerebrovascular disease, coronary heart, selected cancers, and other disorders (Bise, 2007; Koba et al., 2011; Södergren et al., 2008).

Lahti et al. (2010) analyzed the association between physical activity and physical health functioning of employees in Helsinki, Finland. Reportedly, the estimation results show that a high level of physical activity helps in maintaining physical health functions. Hyytinen and Lahtonen (2013) also examined the effects of physical activity on future income based on data of male twins from Finland. This estimation result demonstrated that being physically active has a positive effect on increased long-term income. They suggested the possibility that physical activity would enhance the income level via improvement of health and more intense labor market attachment. According to Galan et al. (2013), who examined about 21,000 students aged 11–18 years who responded to questionnaires in 2006

related to Spanish health behaviour. A continuing program of about 60 min of daily moderate vigorous physical activity (MVPA) was linked to their health benefits.

It is particularly interesting that daily activities of several types might have different effects on people's health. From a clinical context, Linden et al. (2009) divided daily activities into three types: basic activities of daily living (ADL), intentional activities of daily living (IADL), and recreational activities of daily living (RADL). They examined the average characteristics for the frequency and duration of each type of RADL for patients, using survey results for 154 patients with mental disorders in Germany. Results show that some differences exist between sexes related to the RADL contents. However, the present study does not specifically examine the relations between RADL and health indicators.

As presented above, several studies have already investigated the effects of daily activities on general health status, but many examine the case of a particular country, and do not compare differences of estimation results by datasets consisting of several countries. In addition, in many cases, these studies did not categorize daily activities into more detailed groups.

Therefore, in this analysis, we mainly specifically examine recreational activities associated with daily activities, and observe the characteristics of daily recreational activities of working people from three countries: The US, France, and

Japan. We examine whether differences in effects on health indicators are attributable to different cultural backgrounds, social customs, and other factors.

To investigate the association between health indicators and daily activities carefully, activities are divided into two categories in this study by application of for the idea by Rodjer et al. (2012): physically active recreational activities (PARA) and physically stationary recreational activities (PSRA).

2.3 Data and analytical framework

2.3.1 Data

The surveys we conducted are described in Table 2-1. We used micro-data collected from nationwide internet surveys conducted in the respective countries. The surveys were designed and implemented during 2012–2013 for a research project that investigated the socioeconomic determinants of subjective well-being. They were sponsored by the Japanese Society for the Promotion of Science (JSPS). The surveys elicited ample information related to individuals' subjective assessments of their own well-being, personal traits, socioeconomic status, and the frequency and duration time of daily recreational activities of several types. Many are useful for examining the relation between self-rated health and recreational activities. [4]

[4] Yagi et al. (2016) used the same survey for the study on the relations between happiness and employment status.

In the case of Japan, to ensure that the sample was representative of the actual population, targeted proportions of 15 population groups were constructed, corresponding to a matrix of five age groups (20s, 30s, 40s, 50s, and 60s) and three household income classes (3 million yen or less, 3–6 million yen, and 6 million yen or more) in advance. Samples were collected until the numerical targets were obtained. In contrast, for the United States (US) and France, data from about 1,000 respondents in each country were simply collected and used. The sample distributions based on official statistics were not modified. Therefore, one must be cautious about interpreting comparisons among the estimated results for Japan and the other two countries.

2.3.2 Hypothesis

As described above, many studies have demonstrated that regular physical activity elicits substantial benefits. However, points that remain unclear include the following: Which types of physical activities would more strongly support the improvement of a person's health status? Are any other daily recreational activities, other than physical activities, associated with health? Daily recreational activities of some types are regarded as associated with the self-rated health of workers through the improvement of productivity and the stability of mental health. It is particularly interesting that those activities might provide different effects among countries that have particular cultural backgrounds and social customs.

We set the following hypotheses and examine their validity.

(i) Physically active recreational activities such as doing sports positively affect people's health.

(ii) Physically stationary recreational activities such as watching movies, watching sports activities, and reading also positively affect people's health.

(iii) According to the differences of cultural backgrounds, social customs and others, daily recreational activities of several types differently influence people's health.

2.3.3 Variables

First, the level of self-rated health is set as an explained variable. As Idler and Benyammini (1997) and Jylha (2009) described, this variable has been proven to be a reliable indicator of objective health status. The contents of questions asking self-rated health in the survey are the following. 'How do you describe the current state of your health?' This question asks respondents to choose an option on a five-point scale ('healthy', 'somewhat healthy', 'average', 'somewhat poor', and 'poor'). Among the alternatives, 'healthy' and 'somewhat healthy' are categorized as a high level of health. A dummy variable was made.

Secondly, we used replies for the frequency of daily recreational activities consisting of 16 items as key independent variables. We categorized these activities into two types based mainly on the Saltin–Grimby Physical Activity Level Scale (SGPALS) originally established by Saltin and Grimby (1968). The first category is

Physically Active Recreational Activity (PARA). This category mainly includes light, moderate, and vigorous physical activities such as cycling or walking to work, walking with family, gardening, fishing, playing tennis, bowling, swimming, and skiing. The second category is Physically Stationary Recreational Activity (PSRA). This category includes physically inactive and passive recreational activity. Reading, watching television, watching movie, using computers, and doing other sedentary activities during leisure time are categorized into this type. This scale has good validity and reliability. It is often used by health science researchers (Aires Selmer & Thelle, 2003).

By consideration of these two categories, our analysis uses the following eight variables as PARA*:* doing sports, visiting interesting places, playing an instrument, singing, cooking, creating artwork, dancing, and gardening. Regarding the variables related to PSRA, we set the following eight variables: watching sports, writing literature, viewing art, enjoying live entertainment (theater and dance performance), watching movies, reading, playing videogames, and gambling.

Thirdly, dummy variables related to gender, age group, and socioeconomic factors such as academic background, job status, and income are included in this analysis to control the effects of other important factors.

2.3.4 Descriptive data

Data of respondents who did not answer questions related to health status and key variables were omitted. Data used for empirical analysis were from 764US

respondents (men, 413; women, 351), 760 respondents (men, 418; women, 342) residing in France, and 4,908 respondents (men, 2,186; women, 2,722) in Japan.

The fundamental characteristics of the samples of respective countries are presented in Table 2-2. The characteristics of the samples for the three countries are given by gender. From the bottom line of the table, one can confirm that a great deal of difference related to gender gaps of income level exists among the three countries. That difference might reflect differences of the labor participation rate and employment of women among the three countries. Regarding the household type, Japan has the highest ratio of respondents in households with a spouse and children. In addition, age distributions do not differ much among the three countries.

Table 2-3 presents basic characteristics of daily recreational activities. The concrete content of questionnaires about daily recreational activities is the following.

[Question]

"Now we will ask you a question about your hobbies and pastimes. How often during the past year have you engaged in each of the hobbies and pastimes listed below?"

[List]

(Physically stationary recreational activity, PSRA)

Watching sports activities, writing literature, viewing art, enjoying entertainment, watching movies, reading, playing videogames, gambling

(Physically active recreational activity, PARA)

Doing sports activities, visiting interesting places, playing instrument, singing, cooking, creating artwork, dancing, gardening

[Alternatives]

(1) 1–4 days, (2) 5–9 days, (3) 10–19 days (once per month),

(4) 20–39 days (a few times per month), (5) 40–99 days (once per week),

(6) 100–199 days (a few times per week), (7) 200 days or more, (8) inactivity

We produced a dummy variable for each activity showing active participation (40 days or more per year) or not (under 40 days per year).Looking at Table 2-3, many differences about characteristics of daily recreational activities exist among the US, France, and Japan. First, the US residents tend to enjoy almost all recreational activities compared to French and Japanese people. Particularly, the percentage of people in the US who read books, watch movies, play videogames, cook, garden, watch sporting activities and do those activities at the pace of once per week or more surpass 50% overall.

Second, in the case of France, as the overall trend, the frequencies of recreational activities are low compared to the US, but the extents of activities of reading, watching movie, playing videogames, cooking, and gardening are higher

than other activities. Third, among the three countries, Japanese people tend least to engage in daily recreational activities actively. Particularly, the percentage of people who sing a song, create artwork, dance, play instruments, enjoy live entertainment, or write literature as a pastime is much lower.

Additionally, we checked the existence of a gender gap related to daily recreational activities by country. As an overall trend, in the US and France, men tend to enjoy daily recreational activities more than women in both PSRA and PARA. However, in the case of Japan, if anything, women tend to participate more frequently in PSRA and PARA. Regarding reading, cooking, and creating artwork, the average values of dummy variables of women are higher than those of men. Nevertheless, regarding sporting activities, the average value for men is higher than that for women.

Table 2-4(a) to Table 2-4(c) shows pairwise correlation matrices among daily recreational activities by country. From the table, one can confirm that consistently close relations exist among some activities: (a) playing instruments, singing and dancing; (b) creating artwork and writing literature; and (c) viewing art and enjoying live entertainment.

2.4 **Estimation results**

2.4.1 *t*-test

Figure 2-1 and Figure 2-2 depict the association between daily leisure time activities (sports and reading) and self-rated health by both sexes. The frequencies

of leisure-time physical activities were classified into three categories according to the number of days of participation: 1. 1–9; 2. 10–99; and 3. more than 99 days per year. From the two figures, one can confirm certain positive relations between participations to sports or reading activity and people's self-rated health in many cases of three countries.

To elucidate the association between self-rated health and leisure time physical activities, *t*-test was applied. Table2-5(a) and Table 2-5(b) present results of *t*-tests for leisure time physical activity, respectively, by gender and country. From the table, one can confirm significant correlation among leisure-time daily activities and self-rated health for some fields.

For example, for women in the US, more frequent watching of sporting activities, more frequent reading, and more frequent sports participation tend to enhance the level of self-rated health (SRH). Less gambling is associated with enhanced health as well. In France, the frequency of doing sports and playing instruments is positively related to SRH. In Japan, more watching sports, more reading, and more doing sports activities show positive effects on SRH.

In addition, for men in the US, more frequent playing instruments exhibited good effects on SRH. In France, doing sports and watching sports showed a positive effect, but in the case of Japan, many leisure-time daily activities were found to be related to the accomplishment of high level of SRH. Particularly, it is

interesting that several physically stationary recreational activities (PSRA) were also related to high SRH for men in Japan.

2.4.2 Probit analysis

Table 2-6(a) – Table 2-6(c) present results of probit estimation on self-rated health (SRH) by gender in three countries. In the US, it is apparent that older men and women tend to present a low level of SRH. For women, managers and regular workers tend to achieve higher SRH. For men, high income is an important factor related to good health. Regarding leisure-time daily activities, doing sporting activities was found to be positively related to high SRH for both men and women. Gambling had no good effects on SRH for either men or women. Reading has a good effect for women, but no effect for men.

For France, significant negative effects on SRH dummy variables were found to be related to men and women in their40s and 50s, just as in the case of the US. Regarding leisure-time daily activities, the results did not confirm particular good effects on SRH for women. However, doing sporting activities was found to be positively related to high SRH for men.

In Japan, higher education and working as a regular employee have good effects on SRH for women. Higher education had a positive effect for SRH for men as well. Results showed that people participating in sports activities tend to show higher SRH in all three countries. In addition, reading had good effects on SRH for both men and women. Therefore, physically stationary recreational activities

(PSRA) also have the potential of improving people's health. The mechanism of PSRA and effects on health must be considered in the near future.

Furthermore, the present study considered the possibility that high subjective well-being such as happiness and self-rated health prompt the participation and intensity of daily recreational activities (Huang and Humphreys, 2012). High correlation between doing sports and health does not always mean that performing daily physical activities leads to a higher level of health. Other omitted variables might affect the association between health and daily recreational activities. Healthy people might be driven by them to participate in physical activities.

The study picked up several variables as candidates of instrumental variables for doing sports, and examined whether these variables satisfy the conditions (validity and endogeneity) as valid IVs (Ruseski et al., 2014). Eventually, the variables commonly used by previous researches didn't satisfy preferable conditions as instrumental variables: residing for a longer time in the current area (more than four years); dummy variables of living in a large city and living in a safe area. Therefore, the present study employed the normal probit estimation and interpreted the main characteristics based on their results.

2.4.3 Monetary value estimation

This study calculated the monetary values of daily recreational activities which had significant positive effects on self-rated health using the method described by

Rosano et al. (2009). This method uses estimation results of the following income satisfaction function model.

$$IS = c_0 + c_1 \log(Y\ ) + c_2 \log(A) + \mathbf{z}\boldsymbol{\gamma} + e$$

Therein, *IS* stands for the income satisfaction level, *Y* signifies the level of household income, and *A* represents the frequency of a daily recreational activity, which exhibited a significant positive effect on self-rated health in each country. Based on the estimated coefficients of income satisfaction function, one can calculate equivalence scales so that respondents can achieve the same level of income satisfaction. The problem is resolved using the following equation: $\exp\left(\frac{c_2}{c_1}\right)$

This approach can reveal the extent to which a meaningful daily recreational activity can compensate for low income from the perspective of achieving the same level of income satisfaction (Rosano et al., 2009). By calculating monetary value indicators of doing sports among three countries, the study obtained the following numerical values for each country. Particularly addressing the significant coefficients of doing sports, US women were 0.32; men were 0.27.For France, men were 0.26. For Japan, women were 0.34; men were 0.11. The monetary value of doing sports activity was the highest for Japanese women.

2.5 Discussion and conclusion

This study examined the association between self-rated health and daily recreational activities in three countries: the US, France, and Japan. Results show that, for physically active recreational activities (PARA), people participating in sports activities in all three countries tend to report higher SRH. In addition, in some countries, reading and watching sports were positively associated with SRH. Moreover, in all three countries, gambling is associated with decreased SRH. Young age and high income predictably showed positive effects on SRH in this estimation, but the results for job status variables and physical stationary recreational activities (PSRA) differ greatly among the countries. Regarding control variables, high academic background in Japan showed positive effects only for SRH.

According to results of UK reports, physically stationary recreational activities (PSRA) fundamentally entail high costs and low levels of health, causing diabetes, cancer, and heart disease. However, based on estimation results of this analysis, moderate participation in some PSRA was associated with high SRH. Therefore, future studies must examine the mechanism of PSRA and effects on health.

These analyses have several limitations. First, the types of physical activities used as independent variables in this study remain limited to those of the survey questionnaires. It is necessary to examine the effects on self-assessed health of other types of physically active and stationary recreational activities such as

chatting, browsing the internet, cycling, walking to work, walking with family, and skiing.

Second, the classification of leisure-time activities based on the Saltin–Grimby Physical Activity Level Scale presents some confusion for some activities such as gambling and playing games. It is necessary to consider how to classify the daily activities and to confirm the robustness of estimation results to ascertain more clearly what daily recreational activities have beneficial effects on people's health levels and why this has been the case.

Table 2-1: Outline of international surveys

	Japan	US	France
A. Title of survey	Survey of living environment in the region and sense of happiness.		
B. Time period of survey	Oct. 1, 2013 – Oct. 31, 2013	Aug. 1, 2012 – Aug. 31, 2012	Aug. 1, 2012 – Aug. 31, 2012
C. Survey method	The survey was organized by NTT Com Research using various internet survey companies in the US and France. All samples were collected via internet panels with multiple sources. Each respondent was verified as having a unique IP address.		
D. Sample controls	Sampling for the Japan dataset is controlled so that the age distribution and income distribution of the survey resemble the actual distributions.		
E. Sample size	4,927	1,001	1,049
F. Response rate	It is not easy to calculate the response rate in such a survey because the respondents were recruited through banner advertisements. Non-responses are not registered.		

Table 2-2: Basic characteristics of variables used

	US				France				Japan			
	Female (435)		Male (359)		Female (461)		Male (371)		Female (2247)		Male (2792)	
	Mean	s.d	Mean	s.d	Mean	s.d	Mean	s.d	Mean	s.d	Mean	s.d
[Health status (dummy)]												
self-rated health (High)	51.5%	0.50	57.4%	0.50	66.4%	0.47	75.5%	0.43	45.9%	0.50	44.4%	0.50
[Household type (dummy)]												
having a spouse	53.6%	0.50	46.0%	0.50	46.9%	0.50	51.8%	0.50	63.2%	0.48	61.4%	0.49
having a child	72.2%	0.45	61.6%	0.49	71.6%	0.45	63.3%	0.48	82.4%	0.38	86.9%	0.34
[Age class (dummy)]												
thirties	25.7%	0.44	24.5%	0.43	24.3%	0.43	27.0%	0.44	25.1%	0.43	27.8%	0.45
forties	23.0%	0.42	27.9%	0.45	22.8%	0.42	27.5%	0.45	23.1%	0.42	25.9%	0.44
fifties	26.0%	0.44	26.2%	0.44	28.6%	0.45	22.4%	0.42	29.2%	0.45	34.6%	0.48
[Educational attainment (dummy)]												
college degree	34.7%	0.48	41.2%	0.49	32.3%	0.47	30.5%	0.46	37.2%	0.48	63.3%	0.48
[Job status (dummy)]												
manager	6.4%	0.25	9.2%	0.29	2.0%	0.14	4.3%	0.20	0.6%	0.08	4.8%	0.21
regular	23.0%	0.42	40.1%	0.49	43.8%	0.50	58.0%	0.49	21.1%	0.41	63.4%	0.48
nonregular work	16.6%	0.37	20.3%	0.40	17.4%	0.38	12.9%	0.34	31.2%	0.46	20.1%	0.40
others (including self-employed)	10.6%	0.31	9.7%	0.30	10.2%	0.30	8.4%	0.28	4.0%	0.20	2.0%	0.14
nonwork	43.4%	0.50	20.6%	0.41	26.7%	0.44	16.4%	0.37	43.0%	0.50	9.8%	0.30
[Income (dummy)]												
high income (above average)	43.9%	0.50	64.6%	0.48	29.5%	0.46	37.5%	0.48	12.7%	0.33	60.3%	0.49

Table 2-3: Basic characteristics of daily recreational activities

	USA			France			Japan		
	Female (351)	Male (413)	Gender gap	Female (342)	Male (418)	Gender gap	Female (2722)	Male (2186)	Gender gap
[Physically active recreational activity (dummy)]									
doing sports	39.31	59.33	***	38.61	54.45	***	21.58	37.00	***
visiting interesting places	38.85	49.58	***	40.78	46.09		13.80	14.94	
playing instrument	18.85	31.20	***	15.84	24.26	**	8.37	8.45	
singing	20.92	26.18	**	12.58	15.36		3.38	2.54	*
cooking	77.01	67.41	***	58.35	49.33	***	32.18	13.97	***
creating artwork	25.52	30.36		18.87	15.36		4.54	3.40	***
dancing	17.01	24.51	***	11.06	14.29		2.36	1.68	*
gardening	53.10	56.27		50.98	54.72		33.02	29.08	**
[Physically stationary recreational activity (dummy)]									
watching sport	46.90	65.74		26.03	45.82	***	14.06	20.02	***
writing literature	25.98	32.59	*	11.06	15.63	*	3.34	2.87	
viewing art	33.33	47.35	***	32.54	39.08	**	9.97	9.17	**
enjoying live entertainment	36.32	50.14	***	35.14	39.89		6.99	5.66	*
watching movie	64.60	68.80		55.97	60.65		21.09	22.10	
reading	79.77	79.94		70.28	60.92	**	53.18	46.99	***
playing video games	64.37	68.80		49.46	57.95	**	41.17	45.92	***
gambling	23.91	39.28	***	26.25	39.08	***	6.45	21.70	***

(Note) *p<0.1; **p<0.05; ***p<0.01

Table 2-4(a): Pairwise correlation among daily recreational activities (US)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	watching sport	1														
2	writing literature	0.13*	1													
3	viewing art	0.34*	0.40*	1												
4	enjoying live entertainment	0.38*	0.36*	0.67*	1											
5	watching movie	0.32*	0.21*	0.40*	0.45*	1										
6	reading	0.16*	0.19*	0.12*	0.15*	0.24*	1									
7	playing video games	0.15*	0.24*	0.21*	0.21*	0.27*	0.37*	1								
8	gambling	0.25*	0.40*	0.34*	0.43*	0.25*	0.17*	0.24*	1							
9	doing sports	0.43*	0.25*	0.43*	0.43*	0.41*	0.16*	0.27*	0.34*	1						
10	visiting interesting place	0.22*	0.33*	040*	0.46*	0.35*	0.18*	0.28*	0.41*	0.37*	1					
11	playing instrument	0.26*	0.52*	0.43*	0.45*	0.24*	0.13*	0.24*	0.37*	0.41*	0.39*	1				
12	singing	0.23*	0.52*	0.42*	0.44*	0.21*	0.13*	0.24*	0.37*	0.35*	0.36*	0.66*	1			
13	cooking	0.19*	0.19*	0.19*	0.19*	0.22*	0.43*	0.34*	0.16*	0.24*	0.22*	0.17*	0.23*	1		
14	creating artwork	0.17*	0.59*	0.44*	0.41*	0.22*	0.16*	0.27*	0.41*	0.32*	0.40*	0.55*	0.54*	0.27*	1	
15	dancing	0.22*	0.42*	0.43*	0.41*	0.25*	0.11	0.25*	0.43*	0.37*	0.42*	0.59*	0.68*	0.22*	0.57*	1
16	gardening	0.20*	0.22*	0.26*	0.26*	0.20*	0.30*	0.24*	0.23*	0.34*	0.27*	0.28*	0.29*	0.42*	0.36*	0.28*

Table 2-4(b): Pairwise correlation among daily recreational activities (France)

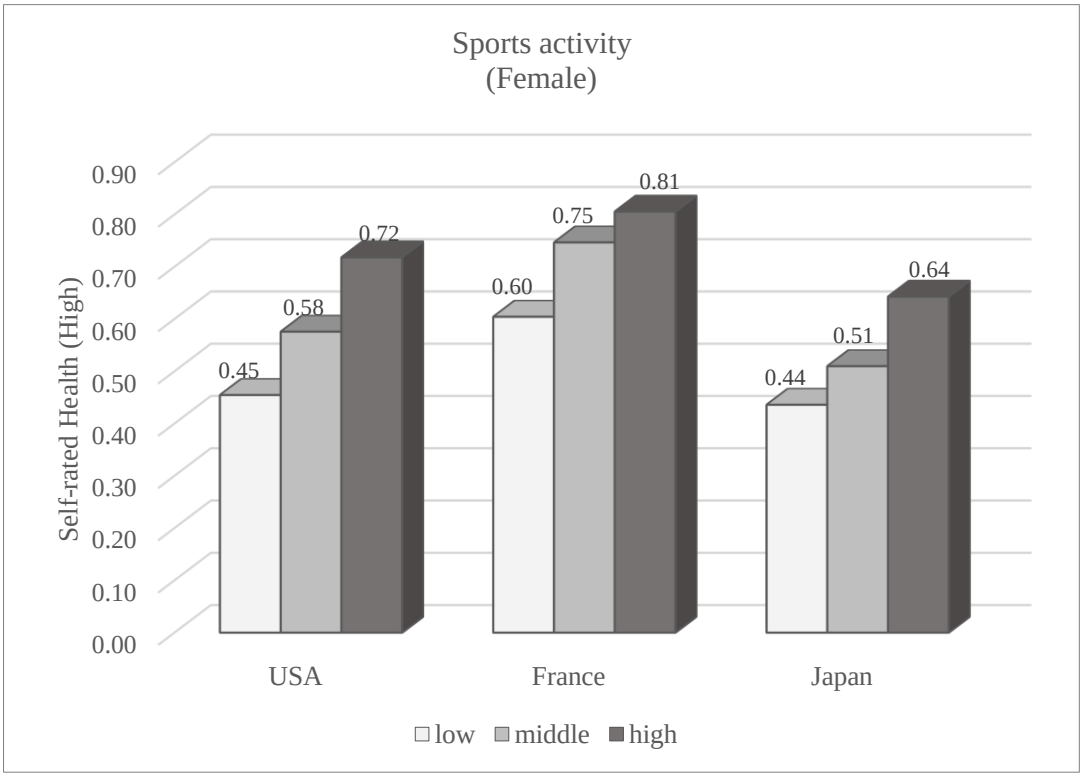
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	watching sport	1														
2	writing literature	0.28*	1													
3	viewing art	0.56*	0.39*	1												
4	enjoying live entertainment	0.44*	0.42*	0.68*	1											
5	watching movie	0.37*	0.25*	0.44*	0.49*	1										
6	reading	0.19*	0.24*	0.28*	0.25*	0.26*	1									
7	playing video games	0.25*	0.23*	0.23*	0.23*	030*	0.29*	1								
8	gambling	0.29*	0.38*	0.29*	0.28*	0.24*	0.22*	0.30*	1							
9	doing sports	0.39*	0.31*	0.44*	0.44*	0.41*	0.29*	0.28*	0.27*	1						
10	visiting interesting place	0.32*	0.35*	0.37*	0.42*	0.40*	0.20*	0.34*	0.26*	0.33*	1					
11	playing instrument	0.27*	0.60*	0.39*	0.41*	0.27*	0.26*	0.25*	0.36*	0.36*	0.33*	1				
12	singing	0.23*	0.68*	0.37*	0.37*	0.26*	0.20*	0.20*	0.34*	0.30*	0.30*	0.67*	1			
13	cooking	0.20*	0.29*	0.31*	0.28*	0.32*	0.33*	0.22*	0.24*	0.26*	0.26*	0.25*	0.26*	1		
14	creating artwork	0.26*	0.65*	0.40*	0.40*	0.27*	0.25*	0.24*	0.36*	0.32*	0.33*	0.53*	0.58*	0.34*	1	
15	dancing	0.24*	0.65*	0.35*	0.36*	0.25*	0.19*	0.22*	0.34*	0.31*	0.30*	0.57*	0.64*	0.29*	0.58*	1
16	gardening	0.23*	0.23*	0.24*	0.18*	0.18*	0.27*	0.22*	0.21*	0.27*	0.22*	0.25*	0.21*	0.39*	0.33*	0.26*

Table 2-4(c): Pairwise correlation among daily recreational activities (Japan)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	watching sport	1														
2	writing literature	0.12*	1													
3	viewing art	0.26*	0.23*	1												
4	enjoying live entertainment	0.21*	0.28*	0.48*	1											
5	watching movie	0.29*	0.14*	0.33*	0.31*	1										
6	reading	0.04	0.14*	0.17*	0.12*	0.13*	1									
7	playing video games	0.06*	0.09*	0.02	0.05*	0.08*	0.16*	1								
8	gambling	0.15*	0.15*	0.10*	0.12*	0.13*	0.07*	0.15*	1							
9	doing sports	0.24*	0.11*	0.18*	0.15*	0.23*	0.15*	0.08*	0.13*	1						
10	visiting interesting place	0.14*	0.18*	0.23*	0.21*	0.21*	0.12*	0.19*	0.12*	0.18*	1					
11	playing instrument	0.10*	0.25*	0.18*	0.19*	0.10*	0.12*	0.09*	0.06*	0.13*	0.14*	1				
12	singing	0.13*	0.37*	0.22*	0.26*	0.14*	0.11*	0.09*	0.14*	0.12*	0.17*	0.40*	1			
13	cooking	0.08*	0.16*	0.14*	0.16*	0.13*	0.20*	0.11*	0.04	0.11*	0.18*	0.16*	0.14*	1		
14	creating artwork	0.11*	0.45*	0.27*	0.29*	0.14*	0.13*	0.09*	0.13*	0.11*	0.19*	0.22*	0.39*	0.2*	1	
15	dancing	0.14*	0.42*	0.23*	0.33*	0.15*	0.10*	0.09*	0.16*	0.12*	0.19*	0.31*	0.53*	0.15*	0.38*	1
16	gardening	0.06*	0.12*	0.11*	0.12*	0.07*	0.18*	0.07*	0.07*	0.14*	0.15*	0.09*	0.12*	0.26*	0.18*	0.11*

(Note) *p<0.05

Figure 2-1: Association between the intensity of sports activity and self-rated health.



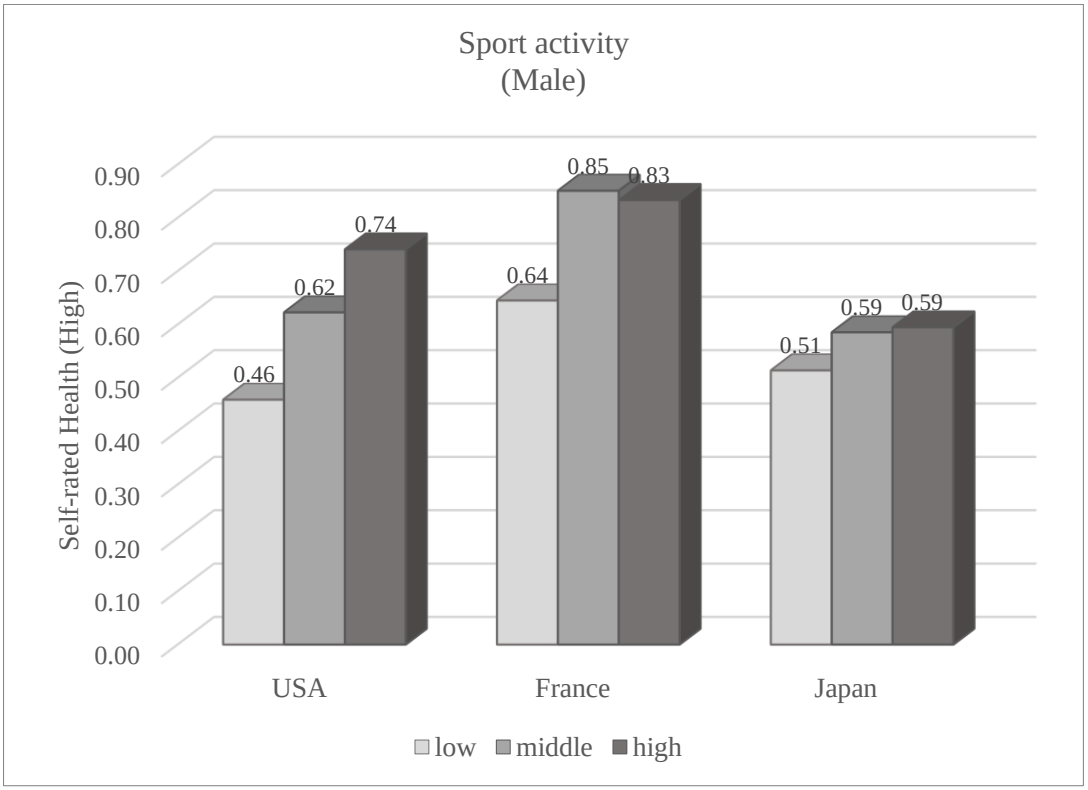
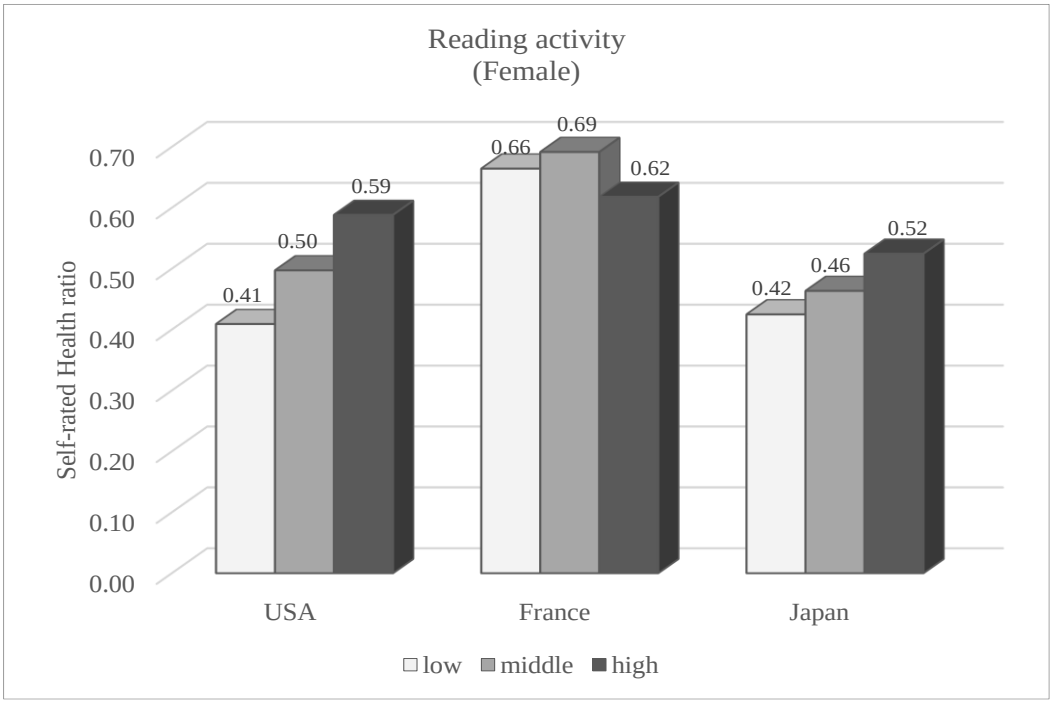


Figure 2-2: Association between the intensity of reading activity and self-rated health.



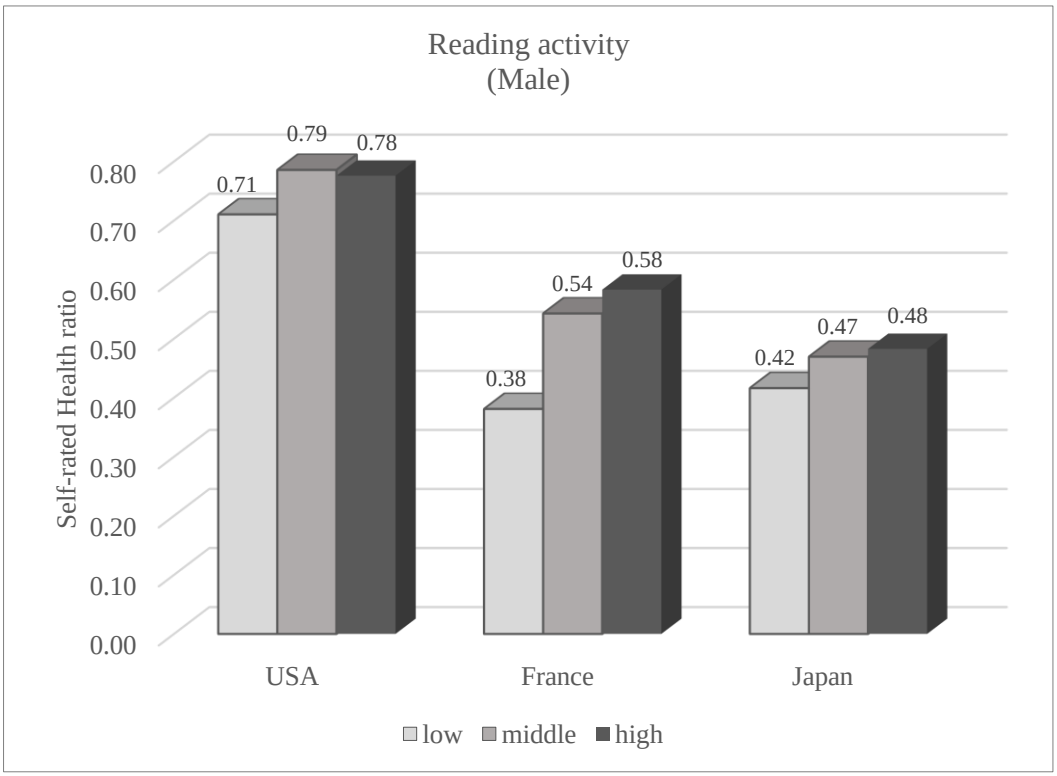


Table 2-5(a): *t*-test results of self-rated health (SRH) and parameters for women

Dummy variables	SRH (USA)			SRH (France)			SRH (Japan)		
	1	0	t value	1	0	t value	1	0	t value
[Age class]									
young worker (20s & 30s)	0.52	0.51	0.32	0.67	0.49	3.55 ***	0.49	0.43	2.60 **
[Educational attainment]									
higher education	0.63	0.45	3.52 ***	0.63	0.54	1.75 *	0.50	0.44	2.94 ***
[Job status]									
nonwork	0.43	0.58	-2.99 ***	0.50	0.59	-1.44	0.43	0.48	-2.62 **
[Income]									
income level (high)	0.55	0.48	1.48	0.63	0.47	2.90 ***	0.48	0.46	0.59
[Physically stationary activity]									
watching sport (high)	0.61	0.49	2.00 **	0.57	0.57	0.02	0.58	0.45	2.23 **
enjoying live entertainment (high)	0.49	0.52	-0.36	0.66	0.56	1.16	0.35	0.46	-1.08
watching movie (high)	0.47	0.53	-1.03	0.58	0.57	0.09	0.51	0.46	0.68
reading (high)	0.55	0.48	1.57	0.57	0.58	-0.23	0.50	0.44	2.50 **
gambling (high)	0.34	0.53	-2.02 **	0.53	0.58	-0.66	0.36	0.46	-1.61
[Physically active activity]									
doing sports (high)	0.71	0.48	3.52 ***	0.69	0.53	2.66 ***	0.54	0.45	2.50 **
visiting interesting place (high)	0.34	0.53	-2.34 **	0.66	0.56	1.22	0.42	0.46	0.34
playing instrument (high)	0.25	0.16	1.42	0.29	0.11	3.50 ***	0.47	0.46	0.17
singing (high)	0.44	0.52	-1.00	0.65	0.57	0.84	0.48	0.46	0.28
cooking (high)	0.52	0.51	0.05	0.60	0.56	0.86	0.47	0.46	0.27

Table 2-5(b): *t*-test results of self-rated health (SRH) and other parameters for men

variables	SRH (USA)			SRH (France)			SRH (Japan)		
	1	0	t value	1	0	t value	1	0	t value
[Age class]									
young worker (20s & 30s)	0.74	0.59	3.45 ***	0.85	0.65	4.61 ***	0.47	0.42	2.66 **
[Educational attainment]									
higher education	0.66	0.67	-0.19	0.77	0.75	0.45	0.48	0.39	4.38 ***
[Job status]									
nonwork	0.62	0.68	-1.26	0.69	0.77	-1.31	0.33	0.46	-4.13 **
[Income]									
income level (high)	0.69	0.65	0.80	0.78	0.74	1.02	0.49	0.38	5.49 ***
[Physically stationary activity]									
watching sport (high)	0.75	0.66	1.07	0.90	0.72	3.07 ***	0.53	0.44	2.27 **
enjoying live entertainment (high)	0.67	0.66	0.15	0.78	0.75	0.34	0.73	0.44	2.69 **
watching movie (high)	0.61	0.68	-1.12	0.81	0.74	1.15	0.50	0.44	1.05
reading (high)	0.62	0.69	-1.52	0.78	0.74	0.77	0.49	0.43	2.97 **
gambling (high)	0.66	0.66	-0.07	0.67	0.77	-1.42	0.40	0.45	1.45
[Physically active activity]									
doing sports (high)	0.72	0.65	1.11	0.89	0.71	3.50 ***	0.60	0.42	6.96 ***
visiting interesting place (high)	0.70	0.66	0.48	0.73	0.76	-0.35	0.34	0.44	1.15
playing instrument (high)	0.13	0.05	1.78 *	0.12	0.09	0.71	0.53	0.44	1.78 *
singing (high)	0.71	0.66	0.58	0.72	0.76	-0.42	0.55	0.44	0.96 *
cooking (high)	0.63	0.68	-0.95 *	0.72	0.76	-0.73	0.49	0.44	0.94

(Note) *p<0.1; **p<0.05; ***p<0.01

Table 2-6(a): Probit estimation results of self-rated health of working people and daily recreational activities (US)

[Dependent variable]	Female (n=413)			Male (n=351)		
Higher health level	*Coef.*	*s.e*	*p value*	*Coef.*	*s.e*	*p value*
[Household type (dummy)]						
Having a spouse	-0.058	0.143	0.686	-0.233	0.161	0.146
Having a child	-0.096	0.150	0.519	0.023	0.157	0.883
[Age class] (twenties)						
Thirties	-0.214	0.196	0.275	0.099	0.229	0.666
Forties	-0.468	0.204	0.022 **	-0.388	0.222	0.081 *
Fifties	0.048	0.198	0.807	-0.384	0.225	0.088 *
[Educational attainment]						
Higher education	0.213	0.150	0.155	0.098	0.159	0.537
[Job status] (nonwork)						
Manager	0.864	0.306	0.005 ***	-0.135	0.327	0.680
Regular	0.775	0.185	0.000 ***	0.200	0.211	0.343
Nonregular worker	0.132	0.195	0.498	0.148	0.238	0.533
Others worker	-0.287	0.235	0.223	-0.344	0.292	0.238
[Income]						
ln income	0.002	0.023	0.941	0.057	0.025	0.022 **
[PSRA]						
Watching sport	0.166	0.185	0.367	-0.018	0.161	0.911
Watching movies	-0.228	0.181	0.208	-0.108	0.204	0.596
Enjoying live entertainment	0.018	0.291	0.952	0.161	0.282	0.568
Reading	0.253	0.144	0.079 *	-0.127	0.153	0.408
Gambling	-0.564	0.311	0.070 *	-0.531	0.243	0.029 **
[PARA]						
Doing sports	0.747	0.224	0.001 ***	0.326	0.196	0.095 *
Visiting interesting place	-0.364	0.284	0.201	0.146	0.268	0.587
Playing instrument	0.246	0.318	0.439	0.429	0.257	0.095 *
Singing	-0.653	0.266	0.014 **	-0.301	0.334	0.366
Cooking	0.004	0.149	0.980	0.150	0.165	0.363
Log likelihood	-246.9			-217.5		

Table 2-6(b): Probit estimation results of self-rated health of working people and daily recreational activities (France)

[Dependent variable]	Female (n=414)			Male (n=341)		
Higher health level	*Coef.*	*s.e*	*p value*	*Coef.*	*s.e*	*p value*
[Household type (dummy)]						
Having a spouse	0.067	0.150	0.654	0.168	0.186	0.367
Having a child	0.013	0.155	0.934	0.017	0.178	0.925
[Age class] (twenties)						
Thirties	-0.289	0.208	0.164	-0.556	0.292	0.057 *
Forties	-0.516	0.210	0.014 **	-1.014	0.294	0.001 ***
Fifties	-0.681	0.202	0.001 ***	-1.359	0.305	0.000 ***
[Educational attainment]						
Higher education	-0.232	0.148	0.117	-0.243	0.194	0.211
[Job status] (nonwork)						
Manager	0.019	0.505	0.969	0.882	0.643	0.170
Regular	0.275	0.178	0.123	0.257	0.261	0.323
Nonregular worker	0.068	0.209	0.746	0.057	0.305	0.851 **
Others worker	-0.429	0.242	0.076 *	-0.095	0.346	0.785
[Income]						
ln income	0.052	0.042	0.214	0.108	0.053	0.041
[PSRA]						
Watching sport	0.493	0.315	0.118	0.616	0.323	0.056 *
Watching movies	-0.378	0.195	0.053 *	0.118	0.269	0.661
Enjoying live entertainment	0.219	0.280	0.435	0.009	0.327	0.977
Reading	-0.218	0.146	0.135	0.035	0.212	0.869
Gambling	0.023	0.240	0.923	-0.386	0.263	0.142
[PARA]						
Doing sports	0.278	0.195	0.154	0.672	0.257	0.009 ***
Visiting interesting place	0.050	0.254	0.845	-0.334	0.292	0.252
Playing instrument	-0.013	0.281	0.962	-0.440	0.369	0.233
Singing	0.046	0.338	0.891	-0.141	0.464	0.761
Cooking	-0.110	0.156	0.483	-0.120	0.248	0.629
Log likelihood	-247.1			-155.9		

Table 2-6(c): Probit estimation results of self-rated health of working people and daily recreational activities (Japan)

[Dependent variable]	Female (n=2186)			Male (n=2722)		
Higher health level	*Coef.*	*s.e*	*p value*	*Coef.*	*s.e*	*p value*
[Household type (dummy)]						
Having a spouse	0.258	0.069	0.000 ***	0.319	0.063	0.000 ***
Having a child	0.045	0.073	0.537	0.168	0.076	0.027
[Age class] (twenties)						
Thirties	-0.137	0.083	0.100	-0.366	0.092	0.000 ***
Forties	-0.295	0.089	0.001 **	-0.537	0.098	0.000 ***
Fifties	-0.261	0.085	0.002 ***	-0.717	0.097	0.000 ***
[Educational attainment]						
Higher education	0.099	0.059	0.093 *	0.098	0.054	0.068 *
[Job status] (nonwork)						
Manager	0.340	0.364	0.350	0.050	0.159	0.754
Regular	0.306	0.098	0.002 ***	0.088	0.105	0.399
Nonregular worker	0.178	0.069	0.009 ***	0.241	0.105	0.022 **
Others worker	0.138	0.146	0.345	0.063	0.200	0.754
[Income]						
ln income	-0.012	0.019	0.511	0.048	0.010	0.000 ***
[PSRA]						
Watching sport	0.343	0.157	0.028 **	0.177	0.112	0.115
Watching movies	0.103	0.229	0.653	0.041	0.159	0.797
Enjoying live entertainment	-0.460	0.328	0.160	0.885	0.328	0.007 ***
Reading	0.147	0.060	0.014 **	0.101	0.057	0.079 *
Gambling	-0.316	0.179	0.078 *	-0.128	0.083	0.125
[PARA]						
Doing sports	0.200	0.091	0.028 **	0.393	0.072	0.000 ***
Visiting interesting place	-0.194	0.316	0.539	-0.687	0.266	0.010 **
Playing instrument	0.014	0.144	0.920	0.167	0.138	0.225
Singing	0.010	0.255	0.968	-0.037	0.312	0.907
Cooking	-0.039	0.114	0.735	0.065	0.128	0.609
Log likelihood	-1,478.3			-1,778.9		

(Note) **p*<0.1; ***p*<0.05; ****p*<0.01

Chapter 3: Physical activity effects on self-rated health of elderly people of three countries: US, France, and Japan

3.1 Introduction

In recent decades, the age structure in most economically developed countries has changed greatly: the composition of elderly people has been increasing gradually every year. Nowadays, the number of people in the world who are 60 years old and older has been greatly increasing. Surprisingly, the number of elderly people is predicted to become about triple the present number during the next 40 years, from 700million in 2010 to around 2 billion by 2050 (United Nations, 2015).

As a result of the decrease in physical activity behavior under an aging society, particularly, the costs of chronic diseases in many countries have been expanding. In the stage of 2005, approximately 35 million deaths have already derived from chronic diseases out of 58 million deaths in all. It is clearly the main cause of death among people in almost all countries (WHO, 2005). However, the negative effect of chronic disease been underestimated continually. The lack of recognition of this growing problem has introduced a very severe situation for societies and economies.

The American College of Sports Medicine (ACSM) has recommended that older adults engage in moderate-intensity physical activity (PA) for at least 30 min for five days per week or engage in vigorous intensity PA for at least 20 min for three days per week (Vallance et al. 2012, p.234). Vallance et al. (2012) showed that the

achievement of such recommendation in the daily life is significantly and positively associated with health-related quality of life (HRQoL) among older-aged men (≥55 years).

Continuous physical activity such as walking and hiking is strongly associated with reduced risk of chronic diseases, especially for elderly people. Despite these benefits, nearly 60% of people aged 65 years and older throughout the world are physically inactive, even today (Hallal et al., 2012).

Maintaining the health of elderly people has become an important issue for the society. The physical activity of elderly people might influence their health status differently compared to its effects on people of the working generation.

This study therefore evaluates the relation of self-rated health and physical activity among elderly people in three economically developed countries: the US, France, and Japan. These countries, which are representative of three continents (America, Europe, and Asia), have several cultural backgrounds and social customs. As an important point, the study also considers the effects of daily recreational activities other than physical activity such as doing sports all together. In doing so, one can estimate the more realistic effects of physical activity on the health status of elderly people.

The contents of the paper are the following. Section.3.2 describes the outlines of main related previous studies. Section 3.3 explains the datasets and our hypotheses. In section 3.4, we summarize *t*-test results related to differences of activity times of

daily recreational activities and discuss estimated results obtained from econometric analyses. In section 3.5, we present and describe the conclusions of these analyses.

3.2 Previous research

As previously noted, the benefits of physical activity on people's health have already been reported, particularly in the medical field, in recent years. Regular physical activity such as exercise reduces illness risks of several types such as cardiovascular disease, cerebrovascular disease, coronary heart, and selected cancers. In addition, physical activity (PA) helps to prevent the cognitive and functional decline associated with the aging process (Bise, 2007; Koba et al., 2011; Paterson and Warburton, 2010; Södergren et al., 2008).

Furthermore, Laurin et al. (2001) explored the association between physical activity and the risk of cognitive impairment and dementia, using the *Canadian Study of Health and Aging* which consists of a community sample of 9008 randomly selected men and women 65 years or older. Dementia is common, costly, and highly age related. Their results showed that, compared with no exercise, physical activity was associated with lower risks of cognitive impairment, Alzheimer disease, and dementia of any type. Particularly high levels of physical activity were associated with reduced risks of cognitive impairment (age, sex, and education adjusted odds ratio, 0.58; 95% confidence interval, 0.41–0.83), Alzheimer disease (odds ratio, 0.50; 95% confidence interval, 0.28–0.90), and dementia of all types (odds ratio, 0.63; 95% confidence interval, 0.40–0.98) (Laurin et al., 2001, p.498).

Consequently, regular physical activity might represent an important and potent protective factor for cognitive decline and several types of disorders in elderly people. In addition, other types of daily activities might have different effects on people's health.

Balboa Castilo et al. (2011) reported an association between leisure-time sedentary behavior (LTSB) of elderly people in 2003, expressed in quartiles of sitting hours per week, and health-related quality of life (HRQoL) in 2009, using micro-data of Spain. Results show that, in comparison with subjects in the lower quartile of sitting time, those in the upper quartile had worse scores on the scales of physical function, bodily pain, and vitality, even after adjusting for leisure time physical activity (LTPA) and other covariates. However, regarding some physically stationary recreational activities, they might positively affect people's health in psychological terms through mechanisms such as switching of viewpoints, activation of the five senses, and training.

Therefore, for this analysis, we observe the characteristics of daily recreational activities of elderly people and specifically examine recreational activities associated with daily activities. Several studies have investigated the effects of daily activities on general health status, but many examine the case of a particular country. They do not compare differences of estimation results by datasets consisting of several countries. Therefore, the study examines three countries: the US, France, and Japan. We examine whether differences in effects on health indicators are attributable to

different cultural backgrounds, social customs, and other factors. As explained in chapter 2, activities are divided into two categories in this study by application of the idea by Rodjer et al. (2012): physically active recreational activities (PARA), and physically stationary recreational activities (PSRA).

3.3. Data and analytical framework

3.3.1 Data

The surveys conducted for this study are described in Table 3-1. Micro-datasets collected from a nationwide internet survey in each country (the US, France and Japan) are used. The surveys were designed and implemented during 2012–2013 for a research project that investigated the socioeconomic determinants of subjective well-being. They were sponsored by the Japanese Society for the Promotion of Science (JSPS). The surveys elicited sample information related to individuals' subjective assessments of their own well-being, personal traits, socioeconomic status, and the frequency and duration of daily recreational activities of several types. Many are useful for examining the relation between self-rated health and recreational activities[5].

As explained previously in chapter 2, in the case of Japan, to ensure that the sample was representative of the actual population, targeted proportions of 15 population groups were constructed, corresponding to a matrix of five age groups (20s, 30s, 40s, 50s, and 60s) and three household income classes (3 million yen or

[5] Yagi et al. (2016) used the same survey for the study on the relations between happiness and employment status.

less, 3–6 million yen, and 6 million yen or more) in advance. Samples were collected until the numerical targets were obtained. In contrast, for the United States (US) and France, about 1,000 respondents in each country were simply collected samples. The sample distributions based on official statistics were not modified. Therefore, one must be cautious about interpreting comparisons among the estimated results for Japan and the other two countries.

3.3.2 Hypothesis

Although several studies have been conducted to explain the substantial benefits that can be gained from regular physical activities, some points remain unclear: Daily recreational activities of some types are regarded as associated with self-rated health of elderly people through the process of improving mind and body function and the stability of mental health. Those activities might produce different effects among countries that have particular cultural backgrounds and social customs.

The study set the following hypotheses and examines their validity.

(i) Continuous physically active recreational activities (PARA) such as doing sports positively affect elderly people's health as well as that of working people.

(ii) Some types of physically stationary recreational activities (PSRA) such as enjoying live entertainment and reading also affect elderly people's health, even after controlling other covariates.

(iii) Several types of daily recreational activities differently influence elderly

people's health between countries because of the differences of cultural backgrounds and social customs.

3.3.3 Variables

First, we use the level of self-rated health as an indicator of people's well-being. As Idler and Benyammini (1997) and Jylha (2009) described, this variable has been proven to be a reliable indicator of objective health status. The contents of questions asking self-rated health in the survey are the following. 'How do you describe the current state of your health?' This question asks respondents to choose an option from a five-point scale ('healthy', 'somewhat healthy', 'average', 'somewhat poor', and 'poor'). Among the alternatives, 'healthy' and 'somewhat healthy' are categorized as a high level of health. A dummy variable was made.

Secondly, replies for the frequency of daily recreational activities consisting of 16 items are used as key independent variables. We categorized these activities into two types, based mainly on the Saltin–Grimby Physical Activity Level Scale (SGPALS) originally established by Saltin and Grimby (1968). The first category is Physically Active Recreational Activity (PARA). This category mainly includes light, moderate, and vigorous physical activities such as cycling or walking to work, walking with family, gardening, fishing, playing tennis, bowling, swimming, and skiing. The second category is Physically Stationary Recreational Activity (PSRA). This category includes physically inactive and passive recreational activity. Reading, watching television, watching movie, using computers, and doing other sedentary

activities during leisure time are categorized into this type. This scale has good validity and reliability. It is often used by health science researchers (Aires et al., 2003).

By consideration of these two categories, this study first picks up the following eight variables as PARA*:* doing sports, shopping, visiting interesting places, playing an instrument, singing, cooking, creating artwork, and gardening. Regarding the variables related to PSRA, this study sets the following eight variables: watching sports, writing literature, viewing art, making handcraft, enjoying live entertainment (theater and dance performance), watching movies, reading, playing videogames, and gambling.

Thirdly, dummy variables related to gender, age group, and socioeconomic factors such as academic background, job status, and income are included in this analysis to control the effects of other important factors.

3.3.4 Descriptive data

Some respondents aged 60 years and older did not answer the question related to their health status and key variables in this survey. Data of those who did not give their answers in the questionnaire were omitted. The numbers of observations used in this empirical analysis were 207 (73women, 134 men) in the US, 217 (94 women, 123 men) in France, and 1,452 (310 women, 1142 men) in Japan.

The basic characteristics of the samples of each country are shown in Table 3-2. The sample characteristics for the three countries are presented by gender. From the

table, Japan has the highest ratio of respondents in households with a spouse and children, and the lowest ratio of respondents who has high income for both genders. French people marked the highest proportion of elderly who still work. Higher income has been achieved in the US for both men and women. Moreover, higher education attainment was larger among men in the US and Japan.

Table 3-3 presents basic characteristics of daily recreational activities for residents of the three countries. Respondents were asked about the frequency of their daily recreational activities in the questionnaire. The original content of the question is the following.

"How often in the past year have you engaged in each of the hobbies and pastimes listed activities below?"

(Physically stationary recreational activity, PSRA)

Watching sport, writing literature, making handicraft, enjoying live entertainment, watching movie, reading, playing video games, and gambling.

(Physically active recreational activity, PARA)

Doing sports, shopping, visiting interesting places, playing instrument, singing, cooking, creating artwork, and gardening.

Eight alternative answers were selected by respondents:

(1) 1–4 days, (2) 5–9 days, (3) 10–19 days (once per month),

(4) 20–39 days (a couple times per month), (5) 40–99 days (once per week),

(6) 100–199 days (a couple times per week), (7) 200 days or more, (8) inactivity.

Based on the answers from respondents, dummy variables were set for each daily recreational activity. Here, we regard the case in which respondents engage in the activity 40 days or more per year (once per week) as the positive participation, and make a dummy variable for each activity, respectively. Several differences exist in relation to the commitment of daily recreational activities characteristics between countries. This standard is based on the WHO recommendation (2011). According to WHO (2011), physical inactivity has been defined as not meeting any of three criteria: (a) 30 min of moderate-intensity physical activity on at least 5 days every week, (b) 20 min of vigorous-intensity physical activity on at least 3 days every week, or (c) an equivalent combination achieving 600 metabolic equivalent (MET) min per week (WHO, 2011).

Looking at Table 3-3, first, the average level of the participation for daily recreational activities is high in the US. Particularly, more than half of inhabitants in the country watch sports and read books.

Secondly, the existence of a gender gap related to the involvement of the daily recreational activities has been confirmed in all three countries. However, the trend of gender gap differs greatly. For the US and France, men tend to more perform daily recreational activities than women for both PARA and PSRA. In Japan, the ratio of women who participate in PARA is fundamentally higher than that of men, the ratio

of men involved in PSRA is higher than that of women.

The pairwise correlation matrix tables of daily recreational activities by each country are shown in Table 4(a) to Table 4(c). We can confirm high correlation coefficients related to the pairs of several activities such as (a) watching sports and enjoying entertainment; (b) making handicraft and enjoying live entertainment; and (c) playing instruments and singing. In later analyses, the study limits the coverage of daily recreational activities to mitigate problems of multi-collinearity.

3.4 Econometric analysis

3.4.1 *t*-test

To elucidate the association between daily recreational activities and self-rated health, a *t*-test is conducted in this analysis. Table 3-5(a) and Table 3-5(b) show the result of *t*-tests for the involvement of daily recreational activities by gender and country. From the table, one can confirm a significant correlation among leisure-time daily activities and self-rated health for some fields.

For example, for women in the US, greater participation in sports tends to be associated with a higher level of self-rated health (SRH). Less shopping tends to be associated with a higher level as well. In France, the frequency of gardening is positively related to SRH. However, in Japan, no clear trend of daily recreational activities on SRH was found.

In addition, for men in the US, more enjoying live entertainment, reading, and gardening were associated with higher SRH. In France and Japan, only doing sports

was associated with higher SRH. Therefore, for elderly people, many leisure-time daily activities were unrelated to a high level of SRH. However, some important socioeconomic factors might be associated with their health status: effects of income, education, and job status should be considered in the analysis. In next the section, we set and estimate some econometric models to grasp more realistic effects of daily recreational activities for three countries.

3.4.2 IV probit estimation

This study applied econometric techniques using instrumental variables (IV). When estimating the effects of daily recreational activities on self-rated health of elderly people, one must recognize endogenous problems for daily recreational activities such as doing sports. High correlation between daily recreational activities and health level might not mean that performing of daily recreational activities causes a higher level of health: other variables might affect both health and daily recreational activities; moreover, healthy people might drive them to participate in daily recreational activities.

Several researchers have already pointed out the endogeneity problem of participation in sporting activities in the subjective well-being function. Ruseski et al. (2014) used the instrumental variables (IV) method to confirm causal evidence of a relation between sports participation and self-rated happiness using data from a 2009 population survey in Germany. The estimation results indicated that individuals who participate in sporting activities have higher life happiness.

To check the endogeneity, this study applied IV probit estimation, constructing two dummy variables for use as instrumental variables for doing sports that are chosen based on previous studies: staying for a longer time in the current area (more than four years) and living in large city areas. The author examined whether these variables satisfy the conditions (validity and endogeneity) as valid IVs (Ruseski et al., 2014), by conducting Hausman test. Eventually, these variables didn't satisfy preferable conditions as instrumental variables in a large majority of econometric models. Therefore, the present study mainly employed the normal probit estimation in such cases.

3.4.3 Estimation results

Table 3-6(a), Table 3-6(b), and Table 3-6(c) respectively show normal probit or IV probit estimation results for the relation of daily activities and self-rated health by gender in three countries: the US, France, and Japan. Estimation results revealed similar and different trends for the three countries.

For the US (Table 3-6(a)), both men and women who regularly participate in sports activities continuously tend to achieve higher SRH even after controlling the influence of other types of daily activities. In addition, female elderly people who engage actively in making handcrafts and watching movie tend to achieve higher SRH compared to those of other people, even if we include the sports participation variable.

For women in France (Table 3-6(b)), a significant positive relation was found for doing sports for female. Elderly people who engage actively in watching movie are found to be significantly related to low SRH, different from the US. Men who have higher participation in sports activities were found to have high SRH. Regarding other SESs covariates, higher education and higher income variables were found to be positively significant for SRH for female.

For elderly women in Japan (Table 3-6(c)), a significant positive relation was found for a working status. Men who engage in working or some regional activities tend to report high SRH. In addition, having a child was found to have a positive and significant effect on SRH. This is a specific trend among the three countries. Elderly men who show high involvement in sports activities have high SRH. Once the variable regarding sports participation is controlled, physically sedentary recreational activities show no positive effect on health status.

In summary, estimation results obtained suggests a causal relation between participation in sporting activities and subjective well-being (here, self-rated health). This cross-border effect of sports participation on health status should support of establishing a policy priority of many governments to increase sports participation of the elderly population.

3.5 Conclusion and discussion

This study analyzed the association between self-rated health (SRH) and daily recreational activities with specific examination of sports activities in three countries

with different geographical and cultural backgrounds: the US, France, and Japan. Using large individual datasets from the three countries, results show that the effect of sports activity on SRH was strong and positively significant after controlling for several other types of daily recreational activities. Importantly, some physically active recreational activities (PARA) excluding sports activity and physically stationary recreational activities (PSRA) had a large effect on SRH after controlling the frequency of sports activity, gender, age, and socioeconomic status variables.

The conduct of effective intervention strategies for promoting physical activity for elderly people has become an important health policy issue. Pratt et al. (2004) also reported that levels of physical inactivity in the United States remain high, costing as much as $76 billion in 2000 in direct medical expenses alone. As Booth et al. (2000) have pointed out, accessibility to neighborhood facilities such as a sports facility is associated significantly with the activity of elderly people. Social support, facility access, and neighborhood safety are regarded as main factors that improve inhabitants' health level. The development of relevant policy interventions should be reinforced to promote the health of older people.

This study has several limitations. First, the types of daily recreational activities used as independent variables for this research remain limited to keep the length of survey questionnaires manageable. Future studies should examine the effects on self-assessed health of other types of physically active and stationary recreational activities such as chatting, browsing the internet, cycling, walking to work, walking

with family, and skiing.

Estimation results in this analysis showed that moderate participation in physically stationary recreational activities (PSRA) had no significant effect on SRH of elderly people. However, more detailed investigation of the effects of PSRA on health status should be considered for future study.

Secondly, as reported also in chapter 2, the classification of leisure-time activities based on the Saltin–Grimby Physical Activity Level Scale presents some confusion for some activities such as gambling and playing games. To ascertain more clearly what daily recreational activities have beneficial effects on elderly person's health levels and to elucidate why this has been the case, one must consider how to classify daily activities and to confirm the robustness of estimation results.

Thirdly, elderly people's health level, their life customs and senses of burden of medical cost might differ greatly according to their affiliated health insurance systems. Future studies should consider information related to health insurance and clinical history.

Table 3-1: Outline of international surveys

	Japan	US	France
A. Title of survey	Survey of living environment in the region and sense of happiness.		
B. Time period of survey	Oct. 1, 2013 – Oct. 31, 2013	Aug. 1, 2012 – Aug. 31, 2012	Aug. 1, 2012 – Aug. 31, 2012
C. Survey method	The survey was organized by NTT Com Research using various internet survey companies in the US and France. All samples were collected via internet panels with multiple sources. Each respondent was verified as having a unique IP address.		
D. Sample controls	Sampling for the Japan dataset is controlled so that the age distribution and income distribution of the survey are close to the actual distributions.		
E. Sample size	4,927	1,001	1,049

Table 3-2: Basic characteristics of the sample

	US				France				Japan			
	Female (75)		Male (134)		Female (94)		Male (123)		Female (310)		Male (1142)	
	mean	s.d	mean	s.d	mean	s.d	mean	s.d	mean	s.d	mean	s.d
[Health status (dummy)]												
self-rated health (High)	80.8%	0.40	72.4%	0.45	86.2%	0.35	87.8%	0.33	78.7%	0.41	75.8%	0.43
[Household type (dummy)]												
having a spouse	53.4%	0.50	73.1%	0.44	60.6%	0.49	74.8%	0.44	66.8%	0.47	87.8%	0.33
having a child	68.5%	0.47	78.4%	0.41	75.5%	0.43	69.9%	0.46	81.3%	0.39	86.8%	0.34
[Educational attainment (dummy)]												
college degree	35.6%	0.48	44.0%	0.50	31.9%	0.47	26.8%	0.44	21.6%	0.41	56.7%	0.50
[Job status (dummy)]												
work	64.4%	0.48	44.0%	0.50	79.8%	0.40	91.1%	0.29	28.4%	0.45	51.3%	0.50
nonwork	35.6%	0.48	23.9%	0.43	20.2%	0.40	8.9%	0.29	71.6%	0.45	48.7%	0.50
[Income (dummy)]												
high income (above average)	46.6%	0.50	70.1%	0.46	33.0%	0.47	41.5%	0.49	10.0%	0.30	40.7%	0.49

Table 3-3: Basic characteristics of daily recreational activities

	USA			France			Japan		
	Female (73)	Male (134)	Gender gap	Female (94)	Male (123)	Gender gap	Female (310)	Male (1142)	Gender gap
[Physically stationary recreational activity (dummy)]									
watching sport	24.66	56.72	***	15.96	26.02	*	7.10	10.86	*
writing literature	8.22	5.97		4.26	5.69		1.94	3.50	
making handicraft	28.77	3.73		7.45	2.44		26.77	0.53	
enjoying live entertainment	19.18	16.42		22.34	25.20		5.16	3.42	
watching movie	31.51	32.09		37.23	36.59		11.29	9.89	
reading	67.12	65.67		65.96	55.28		55.48	50.00	*
playing video games	31.51	34.33		18.09	13.82		18.39	23.03	*
gambling	17.81	23.88		19.15	15.45		1.94	13.49	***
[Physically active recreational activity (dummy)]									
doing sports	17.81	23.13		22.34	26.83		22.90	28.11	*
shopping	8.22	5.22		21.28	21.14		35.48	34.76	
visiting interesting places	15.07	15.67		19.15	20.33		5.81	6.13	
playing instrument	2.74	10.45	**	4.26	9.76		7.42	3.85	***
singing	13.70	5.97	*	3.19	11.38	**	5.81	2.71	***
cooking	50.68	44.78		46.81	23.58	***	20.65	11.38	***
creating artwork	8.22	7.46		5.32	3.25		4.84	4.73	
gardening	43.84	36.57		55.32	44.72		54.52	47.90	**

(Note) *p<0.1; **p<0.05; ***p<0.01

Table 3-4(a): Pairwise correlation among daily recreational activities (US)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	watching sport	1														
2	writing literature	0.02	1													
3	making handicraft	-0.11	0.07	1												
4	enjoying live entertainment	0.09	0.28*	0.38*	1											
5	watching movie	0.13	0.19	0.28*	0.37*	1										
6	reading	0.20	-0.01	0.07	0.14	0.05	1									
7	playing video games	0.08	0.01	0.05	-0.03	-0.02	0.07	1								
8	gambling	0.20	0.00	0.15	0.25*	0.22	-0.04	0.10	1							
9	doing sports	0.29*	0.05	0.25*	0.35*	0.18	0.00	0.11	0.18	1						
10	shopping	0.00	0.09	0.20	0.14	0.12	0.10	-0.01	-0.04	0.01	1					
11	visiting interesting place	0.15	0.20	0.28*	0.33*	0.25*	-0.03	0.12	0.20	0.27*	0.11	1				
12	playing instrument	0.06	0.21	0.12	0.06	0.03	-0.10	0.06	0.11	0.11	-0.02	0.03	1			
13	singing	-0.18	0.12	0.09	0.13	0.01	-0.07	0.04	-0.04	0.05	0.00	-0.04	0.23*	1		
14	cook	-0.04	0.02	0.05	0.05	0.11	0.18	0.08	0.04	0.01	-0.03	0.05	0.13	0.19	1	
15	creating artwork	0.06	0.35*	0.21	0.15	0.23*	-0.06	0.06	0.11	0.20	-0.02	0.38*	0.25*	0.10	0.13	1
16	gardening	0.14	0.06	0.18	0.15	0.19	0.22	0.06	-0.04	0.24*	0.05	0.26*	0.06	-0.07	0.22	0.18

Table 3-4(b): Pairwise correlation among daily recreational activities (France)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	watching sport	1														
2	writing literature	0.03	1													
3	making handicraft	0.04	0.25*	1												
4	enjoying live entertainment	0.52*	0.17	0.62*	1											
5	watching movie	0.36*	0.13	0.41*	0.33*	1										
6	reading	0.09	0.15	0.10	0.13	0.14	1									
7	playing video games	-0.07	0.13	-0.06	0.00	-0.01	0.15	1								
8	gambling	0.00	0.12	-0.02	0.03	0.03	0.17	0.18	1							
9	doing sports	0.27*	0.01	0.21	0.15	0.25*	0.14	0.13	0.02	1						
10	shopping	-0.05	0.03	0.21	0.08	0.09	-0.13	0.12	0.09	0.04	1					
11	visiting interesting place	0.02	0.10	0.10	0.26*	0.17	-0.02	0.17	0.21	0.12	-0.01	1				
12	playing instrument	0.15	0.33*	0.23*	0.21	0.11	0.09	0.12	0.11	0.16	0.04	0.21	1			
13	singing	0.10	0.32*	0.14	0.20	0.20	0.10	0.06	0.10	0.15	0.05	0.16	0.51*	1		
14	cook	0.00	0.01	0.08	0.13	0.14	0.26*	0.15	0.09	0.11	-0.12	0.14	-0.01	-0.03	1	
15	creating artwork	0.12	0.27*	0.09	0.21	0.18	0.08	0.16	0.09	0.20	-0.10	0.36*	0.0*	0.28*	0.19	1
16	gardening	0.11	0.07	0.17	0.18	0.13	0.36*	0.11	0.02	0.16	-0.06	0.09	0.11	0.06	0.33*	0.16

Table 3-4(c): Pairwise correlation among daily recreational activities (Japan)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	watching sport	1														
2	writing literature	0.00	1													
3	making handicraft	0.02	0.00	1												
4	enjoying live entertainment	0.20*	0.05	0.35*	1											
5	watching movie	0.23*	0.02	0.25*	0.34*	1										
6	reading	0.06	0.15*	0.09*	0.06	0.12*	1									
7	playing video games	0.01	0.03	-0.03	-0.04	0.01	0.09*	1								
8	gambling	-0.02	0.01	-0.01	-0.05	0.01	0.03	0.07	1							
9	doing sports	0.12*	0.05	0.05	0.09*	0.05	0.20*	0.07	-0.01	1						
10	shopping	0.05	0.03	-0.02	0.07	0.02	0.01	0.03	-0.01	-0.01	1					
11	visiting interesting place	0.17*	0.07	0.18*	0.15*	0.14*	0.07	0.07	0.02	0.07	0.02	1				
12	playing instrument	0.09*	0.02	0.07	0.13*	0.02	0.09*	0.07	-0.01	0.04	-0.03	0.07	1			
13	singing	-0.01	0.03	0.00	0.04	0.00	0.09*	0.06	0.01	0.06	-0.04	0.06	0.18*	1		
14	cook	0.04	0.04	0.06	0.06	0.01	0.10*	0.03	0.03	0.03	-0.04	0.07	0.07	0.02	1	
15	creating artwork	0.20*	0.14*	0.21*	0.06	0.03	0.08	0.02	-0.01	-0.02	-0.01	0.12*	0.07	-0.01	0.05	1
16	gardening	0.06	0.00	0.03	0.05	0.01	0.12*	0.03	-0.03	0.02	-0.07	0.09*	0.05	0.05	0.20*	0.10*

(Note) *p<0.05

Table 3.5(a): *t*-test of self-rated health and daily recreational activities of elderly women

Dummy variables	SRH (USA)			SRH (France)			SRH (Japan)		
	1	0	t value	1	0	t value	1	0	t value
[Household type (dummy)]									
married	0.97	0.62	4.27 ***	0.86	0.86	-0.07	0.82	0.73	1.79 *
[Educational attainment]									
higher education	0.69	0.87	-1.89 *	0.90	0.84	0.73	0.82	0.78	0.76
[Job status]									
work	0.82	0.80	0.17	0.83	0.96	-1.52	0.87	0.77	1.78 *
[Income]									
income level (high)	0.82	0.79	0.31	0.90	0.84	0.81	0.87	0.78	1.20 *
[Physically stationary activity]									
making handicraft	0.71	0.85	-1.29	0.86	0.86	-0.04	0.77	0.79	-0.42
enjoying live entertainment	0.79	0.81	-0.23	0.86	0.86	-0.07	0.81	0.79	0.25
watching movie	0.74	0.84	-1.01	0.91	0.83	1.13	0.80	0.79	0.20
reading	0.78	0.88	-1.01	0.87	0.84	0.36	0.82	0.75	1.57
playing video games	0.87	0.78	0.90	0.88	0.86	0.27	0.86	0.77	1.48
[Physically active activity]									
doing sports	1.00	0.77	1.96 *	0.90	0.85	0.64	0.85	0.77	1.36
shopping	0.50	0.84	-2.03 **	0.85	0.86	-0.17	0.78	0.79	-0.17
cooking	0.78	0.83	-0.53	0.89	0.84	0.64	0.84	0.77	1.24
creating artwork	0.67	0.82	-0.91	0.60	0.88	-1.75 *	0.73	0.79	-0.52
gardening	0.81	0.80	0.08	0.92	0.79	1.94 *	0.80	0.77	0.55

Table 3.5(b): *t*-test of self-rated health and daily recreational activities for elderly men

variables	SRH (USA)			SRH (France)			SRH (Japan)		
	1	0	t value	1	0	t value	1	0	t value
[Household type (dummy)]									
married	0.76	0.64	1.33	0.88	0.87	0.14	0.76	0.72	1.14
[Educational attainment]									
higher education	0.71	0.73	-0.27	0.88	0.88	0.02	0.76	0.75	0.50
[Job status]									
work	0.78	0.63	1.85 *	0.85	1.00	-2.05 **	0.77	0.75	0.38
[Income]									
income level (high)	0.78	0.60	2.11 **	0.92	0.85	1.24	0.82	0.72	3.87 ***
[Physically stationary activity]									
making handicraft	0.60	0.73	-0.63 ***	1.00	0.88	0.65	0.50	0.76	-1.48
enjoying live entertainment	0.95	0.68	2.70 ***	0.90	0.87	0.49	0.82	0.76	0.92
watching movie	0.77	0.70	0.77	0.93	0.85	1.42	0.79	0.76	0.77
reading	0.78	0.61	2.18 **	0.87	0.89	-0.39	0.76	0.76	0.14
playing video games	0.80	0.68	1.51	0.94	0.87	0.85	0.74	0.76	-0.73
[Physically active activity]									
doing sports	0.84	0.69	1.64	0.97	0.84	1.89 *	0.85	0.72	4.43 ***
shopping	0.86	0.72	0.81	0.92	0.87	0.79	0.76	0.76	0.28
cooking	0.73	0.72	0.22	0.86	0.88	-0.30	0.72	0.76	-1.00
creating artwork	0.90	0.71	1.29	1.00	0.87	0.75	0.72	0.76	-0.63
gardening	0.86	0.65	2.67 ***	0.91	0.85	0.94	0.76	0.75	0.44

(Note) *p<0.1; **p<0.05; ***p<0.01

Table 3-6(a): Probit estimation results of SRH and daily recreational activities (US)

[Dependent variable] Higher health level	Normal probit Female (n=69)			IV probit Male (n=124)		
	Coef.	*s.e*	*p value*	*Coef.*	*s.e*	*p value*
[Household type (dummy)]						
Married	0.694	0.434	0.110	0.173	0.250	0.488
Having a child	-0.087	0.485	0.858	-0.316	0.274	0.249
[Educational attainment]						
Higher education	-0.716	0.489	0.143	0.224	0.219	0.306
[Job status] (nonwork)						
Work	-0.121	0.420	0.774	0.166	0.277	0.548
[Income]						
ln income	0.092	0.090	0.303	-0.040	0.035	0.257
[Regional activity]						
Volunteer activity	0.276	0.538	0.609	-0.225	0.286	0.432
[Physical inactivity]						
Making handicraft	1.292	0.549	0.019 **	0.539	0.764	0.481
Enjoying live entertainment	-0.945	0.744	0.204	-0.316	0.329	0.337
Watching movie	1.275	0.546	0.019 **	-0.385	0.243	0.112
Reading	0.251	0.430	0.559	0.356	0.244	0.144
Playing video games	0.968	0.428	0.024 **	-0.243	0.231	0.294
[Physical activity]						
Doing sports	1.052	0.631	0.096 *	2.397	0.401	0.000 ***
Shopping	-0.370	0.733	0.614	0.242	0.477	0.611
Cooking	-1.142	0.491	0.020 **	0.077	0.211	0.714
Creating artwork	-0.166	0.754	0.826	-0.477	0.552	0.387
Gardening	-0.155	0.408	0.704	-0.311	0.249	0.210
Constant	-1.086	0.703	0.122	-0.266	0.350	0.447
Log likelihood	-35.22			-121.97		
Instrument Variables				Large city and Staying longer		

Table 3-6(b): Probitestimation results of SRH and daily recreational activities (France)

[Dependent variable] Higher health level	Normal probit Female (n=84)			Normal probit Male (n=112)		
	Coef.	*s.e*	*p value*	*Coef.*	*s.e*	*p value*
[Household type (dummy)]						
Married	-0.295	0.369	0.424	0.397	0.384	0.302
Having a child	-0.843	0.481	0.080 *	-0.691	0.333	0.038 **
[Educational attainment]						
Higher education	1.495	0.527	0.005 ***	0.396	0.320	0.215
[Job status] (nonwork)						
Work	0.415	0.440	0.345	-0.662	0.520	0.203
[Income]						
ln income	0.268	0.125	0.032 **	0.021	0.084	0.798
[Regional activity]						
Volunteer activity	-0.508	0.490	0.300	-0.110	0.282	0.697
[Physical inactivity]						
Making handicraft	-0.913	0.656	0.164	-0.012	1.055	0.991
Enjoying live entertainment	1.782	0.711	0.012 **	-0.736	0.381	0.054 *
Watching movie	-1.203	0.500	0.016 **	0.423	0.373	0.256
Reading	-0.115	0.420	0.784	0.033	0.315	0.918
Playing video games	-0.482	0.473	0.308	-0.408	0.442	0.355
[Physical activity]						
Doing sports	1.172	0.516	0.023 **	0.216	0.361	0.549
Shopping	-0.113	0.499	0.822	0.255	0.352	0.469
Cooking	0.452	0.408	0.267	0.743	0.398	0.062 *
Creating artwork	-0.989	0.803	0.218	-0.013	0.981	0.989
Gardening	-0.158	0.407	0.698	-0.086	0.336	0.797
Constant	-0.738	0.822	0.369	0.666	0.649	0.304
Log likelihood	-38.34			-64.39		

Table 3-6(c): Probit estimation results of SRH and daily recreational activities (Japan)

[Dependent variable] Higher health level	Normal probit Female (n=302)			Normal probit Male (n=1093)		
	Coef.	*s.e*	*p value*	*Coef.*	*s.e*	*p value*
[Household type (dummy)]						
Married	0.130	0.168	0.439	0.112	0.124	0.365
Having a child	0.298	0.198	0.131	0.389	0.125	0.002 ***
[Educational attainment]						
Higher education	-0.070	0.193	0.716	0.105	0.082	0.200
[Job status] (nonwork)						
Work	0.325	0.177	0.066 *	0.013	0.083	0.875
[Income]						
ln income	0.060	0.041	0.141	0.038	0.014	0.007 ***
[Regional activity]						
Volunteer activity	0.036	0.185	0.847	0.272	0.102	0.007 ***
[Physical inactivity]						
Making handicraft	-0.078	0.183	0.670	0.758	0.608	0.213
Enjoying live entertainment	0.253	0.386	0.511	-0.233	0.229	0.310
Watching movie	-0.202	0.267	0.449	0.046	0.137	0.737
Reading	0.218	0.167	0.193	-0.042	0.080	0.599
Playing video games	0.227	0.198	0.253	0.085	0.093	0.361
[Physical activity]						
Doing sports	0.500	0.187	0.007 ***	0.349	0.089	0.000 ***
Shopping	0.137	0.162	0.396	0.092	0.083	0.265
Cooking	-0.120	0.203	0.554	-0.127	0.127	0.317
Creating artwork	0.174	0.360	0.629	-0.067	0.188	0.722
Gardening	-0.196	0.164	0.232	0.156	0.082	0.057 *
Constant	-0.814	0.273	0.003	-1.201	0.186	0.000
Log likelihood	-196.81			-714.35		

(Note) **p<0.05; ***p<0.01

Chapter 4: Empirical analysis of socioeconomic factors affecting sports activities in three countries: US, France, and Japan

4.1 Introduction

Sports campaigns began in many advanced countries several decades ago, promoting ideas such as "Sport for All" to encourage people to take part in sports. The campaign had a significant and positive influence on sport participation by the general public. As a result, the numbers of participants in sporting activities has increased greatly in European countries (Gratton and Taylor, 2000). These countries designed sport policy programs to raise levels of participation in sports and other physical activities (Green and Collins, 2008).

Nevertheless, this development has become stagnant in several countries. In the US, for example, the sports activity rate has decreased from the 1990s to 2000s (Sporting Goods Manufacturing Association, 2004). The trend of stagnation in sports participation can present a severe social problem if there is no adequate policy action to address the situation. Some studies have found evidence for a negative effect of physical inactivity on a person's subjective well-being (Downward et al., 2011).

The frequency of sports participation is constrained mainly by the prevailing socioeconomic environment. Earlier reports have described that gender, age, employment status, and time availability are related to the degree of participation of sporting activities (Lera-Lopez and Rapun-Garate, 2011). However, few reports

describe studies particularly addressing similarities and differences of socioeconomic factors affecting sports participation frequency among economically developed countries.

Based on the background related to this problem, this study was conducted to examine important socioeconomic factors that influence sports participation of people in three countries: the US, France, and Japan. Similarities and differences are then compared among them. These countries, located on different continents, are representative of particular cultural backgrounds and social customs. From comparison of econometric model results, we identified trends in the countries and assessed some factors influencing sports participation.

The paper contents are the following. Section 4.2 presents a description of the outlines of some earlier studies. Section 4.3 explains the datasets used and the analytical framework. Section 4.4 summarizes *t*-test results related to the differences of daily activity times of doing sport activities. Estimated results derived from econometric analyses that have used a probit model or random intercept model are discussed. Section 4.5 presents the conclusions derived from analyses.

4.2 **Previous research**

The model presented by Becker (1964) presents decision-making related to non-work activities from the viewpoint of labor and leisure choice. Fundamentally, people are involved in the production of their own health through some activities such as doing sports during leisure time. The SLOTH framework suggested by Cawley

(2004), which puts Becker's model into practice, illustrates decisions about how to allocate time to maximize utility subject to budget, time, and biological constraints (Humphreys and Ruseski, 2006). The SLOTH term is an acronym for activities to which individuals allocate their time: S represents time spent sleeping; L represents time spent at leisure; O represents time spent at paid work; T represents time spent in transportation; and H represents time spent at home production, or unpaid work. Participation in physical activity such as sporting activity is included in L. Time spent in sedentary leisure activities such as watching television or playing computer games is also included in L (Humphreys and Ruseski, 2006).

Several researchers have examined the socioeconomic factors of sport participation. According to the report of the Department for Culture, Media & Sport (DCMS) in the UK, which used a national survey of culture, leisure, and sport, participation in cultural and sporting activities tends to be much more common among higher level socioeconomic groups, even in the wealthiest areas of England. For example, educational attainment positively affects the degree of sport activities (Fujiwara et al., 2010).

Jones and Kirigia (1999) showed the strength of the association between academic background and regular sports participation because higher educated people generally tend to acquire more health knowledge. For Japan, Kajitani and Kohara (2006) examined the demographic and socioeconomic variables that putatively affect the intensity activities for health investment, using prefectural level data (1981–2001),

particularly addressing working men. Results show that high education attainment is positively correlated with the level of sports activity.

In addition, regarding the relation between income and sports participation, Downward et al. (2009) and Breuer et al. (2010) reported that higher income is associated with participation in sports activities. Lower income often poses a barrier to sports participation. However, several studies have demonstrated that no clear relation exists between sports activity and income level (Gratton and Taylor, 2000; Humphreys and Ruseski, 2011). Eberth and Smith (2010) demonstrated that working is negatively correlated to sports involvement.

Kokolakakis et al. (2012, 2014) classified factors affecting sports participation into three categories: socio-demographic, economic, and other important covariates. Both studies showed that age is negatively correlated with sports participation. However, Stamatakis and Chaudhury (2008) presented a contrary result of a positive association with age.

In addition, gender is an important factor influencing sports participation. Consensus holds that men, in general, participate more in sporting activities than women do (Humphreys and Ruseski, 2006; Lera-Lopez and Rapun-Garate, 2007). Kokolakakis et al. (2012) pointed out that gender differences of sports participation can be attributed to differences in family responsibilities as well as differences related to behavior, social expectations, and work. Household structure such as marital status and the number of family members also affect sports participation. Married people

and people with more family members generally participate less in sport activities (Eberth and Smith, 2010; Fridberg, 2010).

Furthermore, the effect of the supply of sports facilities should not be disregarded. Generally speaking, good sports facilities prompt sports participation of local residents to a great extent. The frequency of doing sports is often reduced by the in availability of sports facilities (Wicker et al., 2009).[6]

Based on these points, the study examines the effect of some demographic variables (gender, educational background, and household structure) and economic variables (income and job status) on sports activities using econometric analysis, assuming that a definite relation exists among them. Health enhancement activity improves people's health in the long run, but few analyses have used individual-level data, particularly analyses of Japan. This study specifically examines differences between the three countries attributable to geographical and cultural characteristics.

4.3 Data and analytical framework

4.3.1 Dataset

For this study, large micro-datasets were collected from nationwide international surveys. The setting of surveys was organized by NTT Com Research. All samples in

[6]Halmann et al. (2012) examined the importance of sports facilities for predicting participation in sports activities at the municipal level in Germany. Humphreys and Ruseski (2007) also showed that government spending affects sports involvement and physical activities in the US. Pascual et al. (2012) reported that the availability of sports and recreational facilities is a good predictor of the physical activity level of residents of Madrid, Spain.

the US, France, and Japan were collected via internet surveys. The surveys, sponsored by the Japanese Society for the Promotion of Science (JSSP), were implemented during 2012–2013 for a research project that investigates the socioeconomic determinants of subjective well-being.

The surveys elicited ample information related to individuals' subjective assessments of their own well-being, personal traits, demographic, and socioeconomic status, and the frequency and duration of several types of daily recreational activities. Many of them are adequate to examine the socioeconomic factors affecting sports activities.

The surveys are presented in Table 4-1. In the case of Japan, to ensure that the sample was representative of the actual population, our research group constructed targeted proportions of 15 population groups in advance, which corresponded to a matrix of five age groups (20s, 30s, 40s, 50s, and 60s) and three household income classes (3 million yen or less, 3–6 million yen, and 6 million yen or more). Then we collected survey responses until we obtained the numerical targets. In contrast, for the US and France, we simply collected survey forms from 1,000 respondents in each country. We did not modify the sample distribution based on official statistics. Therefore, one must be careful when making comparisons between the estimated results for Japan and those for the other two countries (Yagi, Urakawa, and Yonezaki,

2016).[7] We conducted an empirical analysis of the relation between socioeconomic status and sports activity, controlling for several important variables that apparently affect sports activities.

4.3.2 Variables

Dependent variable

The benefits of sports participation for people have become widely recognized during the last decade. In the Council of Europe, sports are regarded as all forms of physical activity which, through casual or organized participation, aim at expressing or improving physical fitness and mental well-being, forming social relations or obtaining results in competition at all levels.

For this study, based on the survey responses, we used a dummy variable for sports participation as the dependent variable. For the questionnaire, respondents were asked to report their frequency of doing sports during the prior year. Eight categories were related to the frequency of sports activities: (1) 1–4, (2) 5–9, (3) 10–19, (4) 20–39, (5) 40–99, (6) 100–199, (7) over 200 days per year, and (8) no activity. According to the framework of Coordinated Monitoring of Participation in Sports (COMPAS) in the UK, active involvement in sports activity signifies participation in sports activities at the frequency of at least a few days per week. Therefore, we set a dummy variable as showing a value of one for people who engage in sports activity

[7]Yagi et al. (2016) examined the state of happiness of workers by job status with emphasis on the aspirations of workers using the same nationwide surveys.

more than once a week. Additionally, we used a dummy variable representing participation of more than once a month for sports activities for comparison.

Independent variables

To examine factors affecting sports activities, we used dummy variables related to gender, household structure, age class, educational background, job status, income level and other data. The explanatory variables that are expected to influence sports activities were selected based on a theoretical model and empirical results of previous studies. For gender, a female dummy was made. For the age group, young (under 40s), adult (40s, 50s), and old dummy (60s and more) variables were set according to the respondents' age levels.

Regarding household structure, the information related to the spouse, children, and living with parents were used and set using dummy variables: marital status (spouse), child in household, and living with parents (variable respectively equal to 1 if married, having children, and living with parents).[8]

Furthermore, the perceived neighborhood safety level can be a determinant factor of sports activity participation (Beenackers et al., 2011). Therefore, we used a dummy variable reflecting regional safety based on responses related to the public security conditions of their resident areas.

Similarly, dummy variables related to socioeconomic factors such as income

[8]Married couples, large families, and living with parents were assumed to have less time for participating in sports (Wichstrøm and Wichstrøm, 2008; Pawlowski and Breuer, 2011).

level, educational attainment and job status were set. As explained previously, income and education statuses are regarded as having a strong positive relation to sports involvement (Downward et al., 2009; Breuer et al., 2010).

Lera Lopez and Rapun Garate (2007) reported less sports participation among certain occupational categories. Downward and Riordan (2007) and Eberth and Smith (2010), for example, found negative association of prolonged working with sports participation. In these analyses, we consider the following types as labor status: manager, permanent worker, contract employee, part-time worker, self-employed, and unemployed. For income, a dummy variable showing above average household income was set as a standard. The observations used for these empirical analyses were 1,001 (508 women, 493 men) in the US, 1,041 (551 women, 490 men) in France, and 6,491 (2,557 women, 3,934 men) in Japan.

4.3.3 Descriptive analysis

Basic characteristics of the sample of each country are presented in Table 4-2. Apparently men engage in sports activities more than women in each country, with the highest proportion in France (23%). Regarding household characteristics, about two-thirds of households have children. Few of them live with their parents.

The table presents several characteristics of the respective countries. The US has the highest ratio of both men and women who work as managers. Working as a contract employee is predominant among French people. For Japan, the percentages of having a spouse, having children, living with parents, achieving higher educational

degree (college degree), and living well (eating breakfast/ no smoking) are higher than those in other countries. Among the three countries, Japan has the lowest proportion of people who are involved in sports activities.

Figure 4-1(a) – Figure 4-1(c) respectively show percentages of successive sports participation (more than once a month), particularly addressing the roles of job status and gender gaps in the three countries. The study particularly specifically examines the category of labor status for which the sample size surpasses thirty.

In the US, men showed higher proportions for all job statuses of working (manager, permanent worker, contracted worker, part-time worker, self-employed, and non-work), (Fig. 4-1(a)). Particularly, male managers' frequent participation in sporting activity is prominent.

In France (Fig. 4-1(b)), similar characteristics to those of the US are apparent. Male regular workers tend to participate in sports activities more, although male non-regular workers who work as contracted worker or part-time worker tend to do sports less. French women who are categorized as regular employees do not necessarily show active involvement in sporting activities.

In addition, Japan's case is presented in Figure 4-1(c). Studies conducted in Japan have revealed differences in the average level of worker satisfaction by gender and labor status after controlling for other important covariates (Sano and Ohtake, 2007; Okunishi, 2008). However, no remarkable disparity exists between Japanese men and women in the degree of sports participation. For all labor statuses,

men's participation surpasses women's participation, but that difference is not so large. It might not reflect gender differences in the burden of housework that regular employees must confront. However, regarding non-regular workers such as contracted employees and part-time employees, both men and women tend to engage less in sports activities.

4.4 Estimation Results

4.4.1 *t*-test

To ascertain the main factors affecting sports participation in the three countries (US, France and Japan), *t*-tests were conducted. Table 4-3 presents results for women and men. Dummy variables that represent successive sports activities were defined as the situation in which respondents engage in sports activities at least 40 days per year.

The numerical values of Table 4-3 confirm several points clearly. First, the college degree dummy is positively correlated to sports activities in all countries except for men in the US. A higher level of education engenders greater awareness of the benefits and importance of successive sports activities. The education level also reflects habits acquired as a student, during which time access to facilities is easy and inexpensive (Kokolakakis et al., 2012).

Second, in the case of the US and France, younger people tend to participate more in sports activities. As people grow older, biological and physical limitations restrict the preference for the sports participation. However, in Japan, older women

participate more in sports. Greater experience with age and available leisure time is regarded as positively affecting sports participation.

Third, regarding the level of household income, the case of Japanese women showed a positive effect on sports participation. People from high income households might put themselves in a position of indirectly purchasing free time for doing sports through contracting for home making services (Kokolakakis et al., 2012).

To clarify the characteristics of sports participation in three countries, econometric analyses using probit analysis and random intercept regression were applied as described in the next section.

4.4.2 Probit analysis

Table 4-4(a), Table 4-4(b), and Table 4-4(c), respectively show normal probit or instrumental variable probit (IV probit) estimation results for socioeconomic factors affecting sports activities in three countries (US, France and Japan) by gender.

Past estimation results showed the importance of education level on sports participation, reflecting the level of health knowledge. However, some researchers have pointed out the possibility of reverse causality between sports and academic career. For example, Pfeifer and Cornelisen (2010) analyzed the effect of exercising sports during childhood and adolescence on educational attainment. Using information from the German Socio-Economic Panel (GSOEP), generalized

ordered probit models were applied to estimate the effects of participation in sport activities on secondary school degrees and professional degrees. Results show that, even after controlling for important variables and selection into sport, strong evidence was found that the effect of sporting activities on educational attainment is significant and positive.

Considering the fact presented above, the study finally applies the instrumental variable method, which uses the college-graduate dummy as the endogenous variable. The study used several variables as the candidates of instrumental variables for doing sports, and checked whether these variables satisfy the conditions (validity and endogeneity) as valid IVs (Humphreys and Ruseski, 2011; Huang and Humphreys, 2012; Ruseski et al., 2014). Eventually, instrument variables used were set as follows: dummy variables showing mathematical skills (ability in the field of mathematics) and intellectual skills (ability related to intelligence)

The author examined whether these variables satisfy the conditions (validity and endogeneity) as valid IVs (Ruseski et al., 2014), by conducting Hausman test. Eventually, these variables didn't satisfy preferable conditions as instrumental variables in a large majority of econometric models. Therefore, the present study mainly employed the normal probit estimation in such cases. Probit estimation results revealed similar and different socioeconomic factors affecting sports participation frequency in the three countries.

For the US (Table 4-4(a)), people who follow a sensible diet such as eating breakfast regularly tend to participate in sports activities continuously. Female college graduates and men in high-income households participate actively in sports. Women who live with parents participate less in sports activities.

For women in France (Table 4-4(b)), a significant positive relation was found for a college degree and eating breakfast. Living with parents was found to be negatively and significantly related to sports participation, similarly to the US. Men who have higher income, eat breakfast, and avoid smoking were found to have high involvement in sports activities. Compared to self-employed people, contracted employees, part-time worker, and non-work were found to have a negative association with sports participation. Differences in the degree of leisure time availability by labor status are regarded as affecting the estimation results presented above.

For women in Japan (Table 4-4(c)), a significant positive relation was found for a college degree. Men who have higher household income, eat breakfast, and do not smoke respectively showed high involvement in sports activities. In addition, compared to self-employed people, managers were found to have a positive association with sports participation. The most distinguishing characteristic is the effect of the age-group dummy. Different from the other two countries, younger people in Japan do not actively participate in sports activities. Time and budget

constraints that many people of younger generations confront might affect the estimation results.

4.4.3 Random intercept model

To ascertain whether the superiority of resident areas will affect community residents' degree of sports participation, or not, we estimated the random intercept model as well as the normal discrete choice model. We assumed that, according to regional differences of environmental factors by province level, the effects of socioeconomic variables on sports participation would change. By considering this region-specific effect, the study aims at drawing pure effects of socioeconomic factors to the greatest extent possible. As a dependent variable, the frequency of sports participation per year is used.

Table 4-5(a) presents estimation results of random intercept models on sports participation in the US. For both men and women, results show that a higher education level is related to greater participation in sports activities. Healthy habits such as eating breakfast are also important. However, living with parents is associated with less likelihood of sports participation.

For women, higher household income was associated with more participation. However, no significant relation to household income was found for men. Rather, the subjective evaluation of regional safety affected participation in sports activities by men. In addition, younger men tend to participate in sports more. Regarding

working status, nonworking people do not become involved in vigorous sports activities.

For women in France (Table 4-5(b)), a significant positive relation was found for sports participation, a college degree and eating breakfast. In addition, living with parents was negatively and significantly related to sports participation, as results showed for the US. Men who have a higher income, eat breakfast, and avoid smoking respectively showed high involvement in sports activities. Compared to self-employed people, contracted employees, part-time workers, and unemployed people were found to have a stronger negative association with sports participation. The differences might reflect the degree of leisure time availability by labor status, as explained in probit estimation results.

For women and men in Japan (Table 4-5(c)), significant positive relations to sports participation were found, respectively, with a college degree, higher household income, and eating breakfast. After controlling other important covariates, living with parents was not significantly related to sports participation, which differs from results obtained for the US. Non-smoking men showed high involvement in sports activities. In addition, compared to probit estimation results, the negative part-time worker effect disappeared. Non-work just showed a positive association with sports participation. However, accurate identification is necessary to assess differences shown by retirement and unemployment situations.

Differences in the respective amounts of leisure time availability by labor status are expected to affect the results suggested by probit estimations.

4.5 Conclusion and discussion

The study examined socioeconomic factors related to the degrees of sports participation in the US, France, and Japan, representing countries of three continents: North America, Europe, and Asia. As a conclusion, the main results are summarized.

First, in all three countries, men participate more in sports activities than women do. Next, the results of probit estimations and random intercept estimations exhibited both similar and different socioeconomic factors affecting sports participation frequency in the three countries. In the US and France, adults aged 20–59 years old tend to do sporting activities more. By contrast, elderly Japanese people tend to do sports more actively than others. Increasing age contributes to reduction of sports involvement in the US and France, but in the case of Japan, elderly people tend to do more sports activities, perhaps reflecting the effects of prolonged work that Japanese laborers are now confronting.

Moreover, higher education attainment is an important factor for all three countries that is positively related to people's involvement in sports activities. Particularly, US people with low educational level have unusually less sport participation based on the estimation results. Higher income and good health habits also support sports participation in France and Japan, but less so in the US.

Living with parents constrains opportunities for sports participation, but no negative effect of living with parents was found for Japan. In addition, working as self-employed (reference group in the econometric models) tends to lead people to participate in sports more than working in some other status in the US and France. These estimation results might reflect geographical and cultural characteristics, which can affect the popularity of sports activities. However, these results underscore the importance of sports policies encouraging active sports participation by residents.

This study has several limitations. First, the socioeconomic factors set as independent variables are limited to the responses given to survey questionnaires. For example, it is apparently important to investigate the effects of costs for using sports facilities neighborhoods and their accessibility.

Second, sports participation itself might cause changes in socioeconomic status in terms of income level (Hyytinen and Lahtonen, 2013) and education level. The study originally employed dummy variables of respondents' subjective evaluations for their communication skills and regional safety as candidates of instrumental variables. As a result, a Wald test showed the endogeneity of on sports participation has been confirmed only insufficiently. Regarding more detailed analytical methods, the application of more sophisticated econometric approaches such as panel data analysis is a future research task.

Table 4-1: Outline of international surveys

	Japan	US	France
F. Title of survey	Survey of living environment in the region and sense of happiness		
G. Time period of survey	Oct. 1, 2013 – Oct. 31, 2013	Aug. 1, 2012 – Aug. 31, 2012	Aug. 1, 2012 – Aug. 31, 2012
H. Survey method	The survey was organized by NTT Com Research using various internet survey companies in the US and Europe. All samples were collected via internet panels with multiple sources. Each respondent was verified as unique via IP address.		
I. Sample controls	Sampling for the data for Japan was controlled so that the age distribution and income distribution of the survey are close to real distributions.		
J. Sample size	4,927	1,049	1,088
K. Response rate	It was not easy to calculate the response rate in such a survey because the respondents were recruited through banner advertisements. Non-responses are not registered.		

Table 4-2: Descriptive statistics of the samples (US, France, and Japan)

	US			France			Japan		
	Female (508)	Male (493)	Gender gap	Female (551)	Male (490)	Gender gap	Female (2557)	Male (3934)	Gender gap
[Leisure-time activities (dummy)]									
Doing sports (once a week and more)	0.15	0.22	***	0.17	0.23	***	0.11	0.14	***
Doing sports (once a month and more)									
[Age class (dummy)]									
young	0.44	0.33		0.40	0.38		0.42	0.28	
adult	0.42	0.39		0.43	0.38		0.46	0.43	
elderly	0.14	0.27	***	0.17	0.24	***	0.12	0.29	***
[Household type (dummy)]									
having a spouse	0.54	0.53		0.49	0.57	***	0.64	0.69	***
having a child	0.72	0.66		0.72	0.65		0.82	0.87	***
living with parents	0.09	0.10		0.08	0.07		0.18	0.21	***
[Educational attainment (dummy)]									
college degree	0.35	0.42	**	0.32	0.30		0.35	0.61	***
[Income (dummy)]									
high income (above average)	0.38	0.47	***	0.16	0.18		0.35	0.38	**
[Job status (dummy)]									
manager	0.06	0.08		0.02	0.04	**	0.01	0.05	***
permanent worker	0.27	0.40	***	0.39	0.50	***	0.20	0.54	***
contracted employee	0.01	0.03	**	0.09	0.06		0.07	0.06	
part-time worker	0.23	0.25		0.22	0.28	**	0.22	0.08	
self employed	0.07	0.10	*	0.05	0.03		0.04	0.12	***
nonwork	0.35	0.17		0.22	0.11		0.44	0.19	
[Personal behavior (dummy)]									
breakfast	0.81	0.79		0.87	0.80		0.90	0.89	
no smoking	0.72	0.70		0.68	0.68		0.86	0.72	

*p<0.1; **p<0.05; ***p<0.001

Figure 4-1(a): Percentage of successive sports participation by job status in the US.

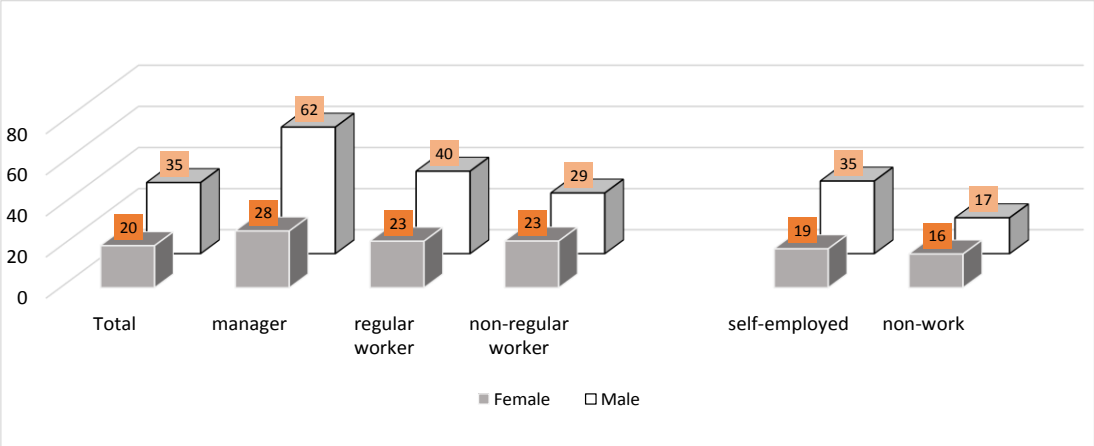


Figure 4-1(b): Percentage of successive sports participation by job status in France.

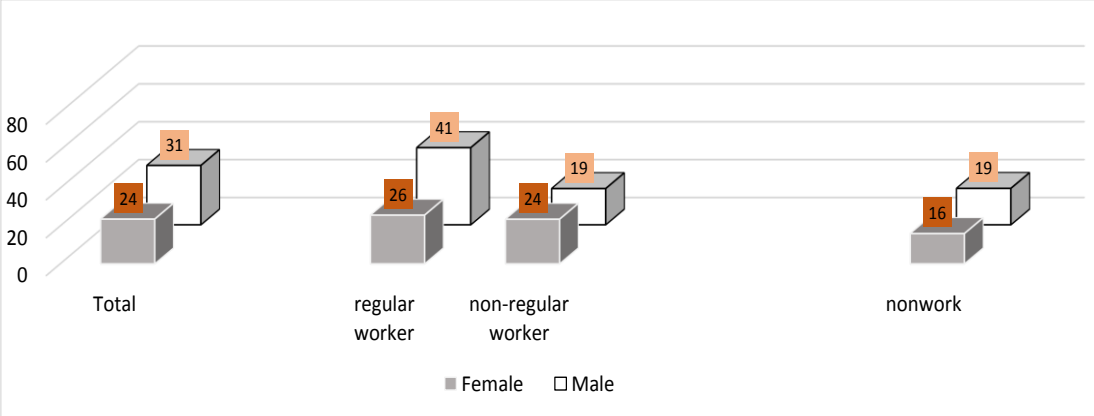


Figure 4-1(c): Percentage of successive sports participation by job status in Japan.

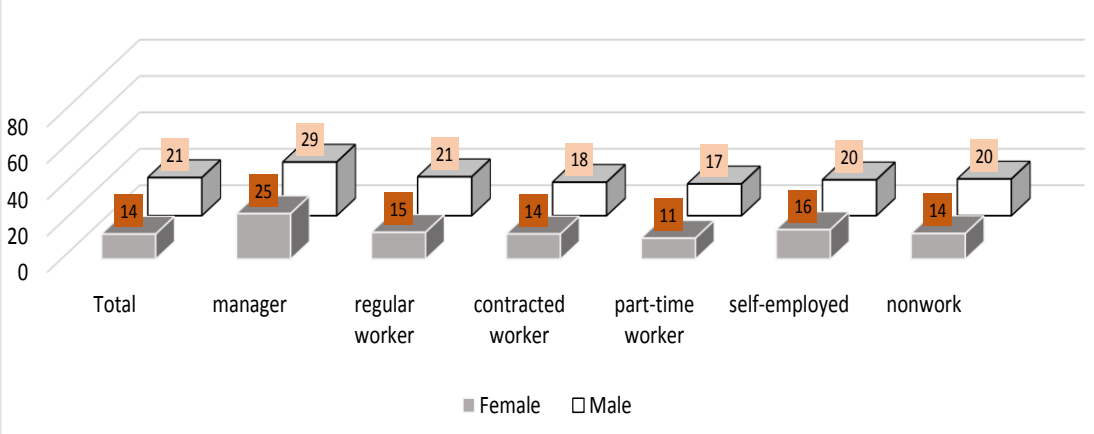


Table 4-3: *t*-test of sports activities and socioeconomic variables in the US, France, and Japan

Variables	Successive sports activities								
	USA			France			Japan		
	1	0	t value	1	0	t value	1	0	t value
Female									
[Age class (dummy)]									
young	17.6%	12.6%	1.57	20.3%	14.3%	1.85 *	7.9%	13.3%	-4.26 ***
adult	12.7%	16.3%	-1.13	13.6%	19.0%	-1.67 *	12.6%	9.7%	2.33 **
elderly	12.3%	15.2%	-0.63	16.0%	16.8%	-0.21	15.8%	10.4%	2.87 ***
[Household type (dummy)]									
having a spouse	15.1%	14.4%	0.21	17.0%	16.4%	0.17	11.9%	9.5%	1.90 *
having a child	14.6%	15.3%	-0.21	16.8%	16.3%	0.14	11.4%	9.3%	1.33
living with parents	8.3%	15.4%	-1.32	16.4%	20.5%	-0.70	9.0%	11.5%	-1.55
[Educational attainment (dummy)]									
college degree	20.9%	11.5%	2.87 ***	21.9%	14.2%	2.27 **	13.5%	9.7%	2.95 ***
[Income (dummy)]									
high income (above average)	14.5%	14.9%	-0.13	20.7%	15.9%	1.09	14.8%	9.0%	4.50 ***
[Daily habitsr (dummy)]									
eating breakfast	16.3%	8.2%	2.05 **	17.2%	13.5%	0.79	11.5%	7.1%	2.13 **
no smoking	15.1%	13.9%	0.35	17.9%	14.2%	1.07	11.1%	10.4%	0.41
Male									
[Age class (dummy)]									
young	33.9%	15.2%	4.87 ***	31.4%	18.4%	3.33 ***	14.7%	13.7%	0.78
adult	18.0%	23.7%	-1.51	20.5%	24.9%	-1.11	14.1%	13.9%	0.19
elderly	11.2%	25.3%	-3.44 ***	15.0%	25.9%	-2.48 **	13.1%	14.3%	-0.98
[Household type (dummy)]									
having a spouse	20.2%	23.0%	-0.78	20.3%	27.3%	-1.81 *	14.3%	13.2%	0.90
having a child	22.1%	20.4%	0.44	20.1%	29.1%	-2.24 **	14.0%	14.1%	-0.12
living with parents	20.9%	27.1%	-0.99	25.0%	23.1%	0.24	15.8%	13.5%	1.73 *
[Educational attainment (dummy)]									
college degree	23.7%	19.9%	1.00	29.0%	20.9%	1.94 *	15.2%	12.1%	2.69 ***
[Income (dummy)]									
high income (above average)	21.9%	21.2%	0.20	25.0%	22.9%	0.42	16.6%	12.4%	3.72
[Daily habits (dummy)]									
eating breakfast	21.0%	23.5%	-0.56	23.5%	22.2%	0.27	14.7%	8.5%	3.46 ***
no smoking	18.9%	27.5%	-2.15 *	23.3%	23.3%	0.00	15.1%	11.0%	3.38 ***

Table 4-4(a): Probit estimation of socioeconomic factors on doing sports (US)

[Dependent variable] Higher health level	Normal probit Female (n=508)			Normal probit Male (n=493)		
	Coef.	*s.e*	*p value*	*Coef.*	*s.e*	*p value*
[Age class (dummy)] (ref: elderly)						
young	0.269	0.187	0.152	0.998	0.201	0.000 ***
adult	0.094	0.183	0.609	0.384	0.165	0.020 **
[Household type (dummy)]						
having a spouse	-0.184	0.147	0.209	0.028	0.156	0.859
having a child	0.002	0.136	0.991	-0.001	0.149	0.997
living with parents	-0.433	0.227	0.056 **	-0.504	0.248	0.042 **
Regional environment) (mean)]						
regional security	0.242	0.952	0.800	2.296	1.090	0.035 **
[Educational attainment (dummy)]						
college degree	0.397	0.134	0.003 ***	0.319	0.137	0.020 **
[Income (dummy)]						
high income (above average)	0.235	0.146	0.107	0.234	0.150	0.118
[Job status (dummy)] (ref: self employed)						
manager	0.467	0.325	0.150	-0.094	0.264	0.723
permanent worker	0.245	0.210	0.244	0.059	0.201	0.770
contract worker	0.301	0.732	0.681	-0.290	0.411	0.480
part-time worker	0.116	0.205	0.572	0.163	0.212	0.443
nonwork	-0.044	0.188	0.817	-0.362	0.220	0.099 **
[Daily habits (dummy)]						
eating breakfast	0.617	0.157	0.000 ***	0.603	0.153	0.000 ***
no smoking	-0.220	0.142	0.122	-0.358	0.146	0.014 **
Constant	-0.565	0.783	0.471	-2.146	0.875	0.014
Log likelihood	-310.09			-269.66		

Table 4-4(b): Probit estimation of socioeconomic factors on doing sports (France)

[Dependent variable] Higher health level	Normal probit Female (n=551)			Normal probit Male (n=490)		
	Coef.	*s.e*	*p value*	*Coef.*	*s.e*	*p value*
[Age class (dummy)] (ref: elderly)						
young	0.150	0.197	0.447	0.144	0.224	0.521
adult	0.001	0.181	0.996	-0.362	0.203	0.075 *
[Household type (dummy)]						
having a spouse	-0.153	0.130	0.236	0.107	0.146	0.463
having a child	0.079	0.131	0.545	-0.210	0.140	0.136
living with parents	-0.488 **	0.230	0.034 **	-0.045	0.300	0.881
Regional environment) (mean)]						
regional security	1.417	1.027	0.168	0.763	1.138	0.503
[Educational attainment (dummy)]						
college degree	0.239 **	0.125	0.056 **	-0.214	0.142	0.131
[Income (dummy)]						
high income (above average)	0.145	0.166	0.383	0.308	0.181	0.089 *
[Job status (dummy)] (ref: self employed)						
manager	0.208	0.487	0.669	0.443	0.414	0.284
permanent worker	-0.026	0.220	0.907	-0.300	0.320	0.348
contract worker	0.140	0.269	0.604	-0.721	0.387	0.062 *
part-time worker	0.040	0.246	0.870	-0.811	0.350	0.021 **
nonwork	-0.133	0.239	0.578	-1.026	0.342	0.003 ***
[Daily habits (dummy)]						
eating breakfast	0.919 ***	0.175	0.000 ***	0.422	0.155	0.006 ***
no smoking	0.082	0.124	0.508	0.233	0.133	0.081 **
Constant	-1.692	0.791	0.033	0.140	0.901	0.876
Log likelihood	-348.69			-281.13		

(Note) *p<0.1; **p<0.05; ***p<0.01

Table 4-4(c): Probit estimation of socioeconomic factors on doing sports (Japan)

[Dependent variable] Higher health level	IV probit Female (n=2557)			Normal probit Male (n=3934)		
	Coef.	*s.e*	*p value*	*Coef.*	*s.e*	*p value*
[Age class (dummy)] (ref: elderly)						
young	-0.596 ***	0.110	0.000	-0.227 ***	0.071	0.001
adult	-0.263 ***	0.098	0.007	-0.357 ***	0.062	0.000
[Household type (dummy)]						
having a spouse	0.052	0.091	0.569	0.011	0.055	0.839
having a child	0.121	0.084	0.151	0.054	0.062	0.385
living with parents	-0.006	0.096	0.947	-0.006	0.055	0.913
Regional environment) (mean)]						
regional security	0.275	0.472	0.560	0.323	0.307	0.292
[Educational attainment (dummy)]						
college degree	0.798 ***	0.280	0.004	0.209 ***	0.043	0.000
[Income (dummy)]						
high income (above average)	0.156 *	0.088	0.076	0.253 ***	0.052	0.000
[Job status (dummy)] (ref: self employed)						
manager	0.293	0.316	0.354	0.173 *	0.095	0.069
permanent worker	-0.073	0.134	0.586	0.033	0.066	0.611
contract worker	-0.033	0.163	0.838	0.132	0.102	0.194
part-time worker	-0.180	0.156	0.247	-0.015	0.092	0.866
nonwork	-0.102	0.149	0.494	0.179 **	0.078	0.021
[Daily habits (dummy)]						
eating breakfast	0.155	0.114	0.172	0.454 ***	0.069	0.000
no smoking	-0.106	0.095	0.262	0.173 **	0.046	0.000
Constant	-1.325	0.400	0.001	-0.843	0.255	0.001
Log likelihood	-2,568.17			-2,614.45		
Instrument variables	Foreign language skill Mathematical_skill					
Wald statistics (p value)	0.051					

Table 4-5(a): Random intercept estimation of socioeconomic factors on doing sports (US)

[Dependent variable] Frequency of sports activity	Female (n=508)			Male (n=493)		
	Coef.	*s.e*	*p value*	*Coef.*	*s.e*	*p value*
[Age class (dummy)] (ref: elderly)						
young	0.097	0.066	0.144	0.308	0.061	0.000 ***
adult	0.033	0.065	0.617	0.131	0.054	0.054 *
[Household type (dummy)]						
having a spouse	-0.062	0.051	0.222	0.000	0.048	0.992
having a child	0.004	0.047	0.926	0.005	0.046	0.911
living with parents	-0.153	0.080	0.056 *	-0.149	0.077	0.053 *
[Regionnal environment (dummy)]						
regional security	0.111	0.333	0.739	0.677	0.320	0.035 **
[Educational attainment (dummy)]						
college degree	0.136	0.046	0.003 ***	0.100	0.042	0.018 **
[Income (dummy)]						
high income (above average)	0.084	0.051	0.096 *	0.079	0.047	0.091
[Job status (dummy)] (ref: self employed)						
manager	0.132	0.097	0.176	-0.033	0.079	0.672
permanent worker	0.082	0.073	0.262	0.008	0.063	0.892
contracted employee	0.103	0.240	0.667	-0.098	0.127	0.439
part-time worker	0.044	0.073	0.547	0.042	0.067	0.526
nonwork	-0.018	0.066	0.792	-0.141	0.071	0.045 **
[Daily habits (dummy)]						
eating breakfast	0.228	0.056	0.000 ***	0.203	0.049	0.000 ***
no smoking	-0.076	0.049	0.122	-0.108	0.044	0.015 **
Constant	0.272	0.274	0.321	-0.138	0.258	0.593
Log likelihood	-326.42288			-283.64653		

Table 4-5(b): Random intercept estimation of socioeconomic factors on doing sports (France)

[Dependent variable]	Female (n=551)			Male (n=490)		
Doing sports	*Coef.*	*s.e*	*p value*	*Coef.*	*s.e*	*p value*
[Age class (dummy)] (ref: elderly)						
young	0.052	0.071	0.467	0.039	0.073	0.592
adult	0.000	0.066	0.995	-0.128	0.067	0.055 *
[Household type (dummy)]						
having a spouse	-0.055	0.047	0.237	0.029	0.048	0.540
having a child	0.030	0.047	0.520	-0.066	0.045	0.144
living with parents	-0.179	0.083	0.031 **	0.003	0.097	0.975
[Regionnal environment (dummy)]						
regional security	0.506	0.371	0.173	0.133	0.483	0.784
[Educational attainment (dummy)]						
college degree	0.086	0.045	0.055 *	0.064	0.046	0.163
[Income (dummy)]						
high income (above average)	0.053	0.060	0.375	0.094	0.057	0.096 *
[Job status (dummy)] (ref: self employed)						
manager	0.065	0.161	0.689	0.105	0.110	0.343
permanent worker	-0.010	0.079	0.895	-0.067	0.091	0.459
contracted employee	0.046	0.097	0.635	-0.215	0.119	0.072 *
part-time worker	0.012	0.089	0.890	-0.240	0.105	0.022 **
nonwork	-0.048	0.086	0.577	-0.324	0.103	0.002 ***
[Daily habits (dummy)]						
eating breakfast	0.343	0.062	0.000 ***	0.149	0.052	0.004 ***
no smoking	0.029	0.045	0.520	0.080	0.044	0.069 **
Constant	-0.108	0.284	0.703	0.608	0.364	0.095
Log likelihood	-365.99			-294.98		

Table 4-5(c): Random intercept estimation of socioeconomic factors on doing sports (Japan)

[Dependent variable]	Female (n=2557)			Male (n=3934)		
Doing sports	*Coef.*	*s.e*	*p value*	*Coef.*	*s.e*	*p value*
[Age class (dummy)]						
young	-0,257	0,033	0,000 ***	-0,087	0,027	0,001 ***
adult	-0,188	0,032	0,000 ***	-0,136	0,024	0,000 ***
[Household type (dummy)]						
having a spouse	-0,025	0,028	0,360	0,006	0,021	0,792
having a child	0,081	0,025	0,001 ***	0,021	0,024	0,370
living with parents	0,025	0,028	0,365	-0,002	0,021	0,909
Regional levels (mean)]						
regional safety	-0,034	0,148	0,818	0,106	0,130	0,416
[Educational attainment (dummy)]						
college degree	0,062	0,021	0,003 ***	0,079	0,017	0,000 ***
[Income (dummy)]						
high income (above average)	0,083	0,024	0,001 ***	0,096	0,020	0,000 ***
[Job status (dummy)]						
manager	-0,123	0,110	0,266	0,064	0,036	0,077 *
permanent worker	0,043	0,042	0,309	0,013	0,025	0,609
contract worker	-0,017	0,051	0,731	0,051	0,039	0,191
part-time worker	-0,051	0,043	0,230	-0,007	0,035	0,844
nonwork	-0,001	0,041	0,985	0,067	0,029	0,022 **
[Personal behave (dummy)]						
breakfast	0,121	0,032	0,000 ***	0,172	0,026	0,000 ***
no-smok	0,061	0,028	0,028 **	0,066	0,018	0,000 ***
Constant	0,369	0,124	0,003	0,192	0,105	0,068
Log likelihood	-1.751,53			-2.742,62		
*p<0.1; **p<0.05; ***p<0.01						

(Note) *p<0.1; **p<0.05; ***p<0.01

Chapter 5: Empirical analysis of time poverty and Daily recreational activities in Japan

5.1 Introduction

Health benefits can be achieved by increasing one's amount of physical activity. Many empirical results of studies suggest that people who actively engage in physical activities are more likely to show better health status and well-being (Bise et al., 2007; Balboa Castilo et al., 2011; Galan et al., 2013).

Income is also an important factor determining the level of a person's health because lower income often acts as a barrier to access to resources that enhance health. Nevertheless, some recent studies have found that not only low income, but also lack of time used for family life will engender higher risks of illness, partly because the probability of participating in physically active recreational activities such as doing sports decreases.

For instance, according to current trends in Canada, economic development has caused a decrease in the amount of leisure time of Canadians in general, presenting severe social policy implications (Spinney and Millward, 2010, p.342). Spinney and Millward (2010) report that time poverty is more important than income poverty as a barrier to regular physical activity. Kalenkoski et al. (2013) pointed out similar points. They demonstrated that time-poor individuals are less likely to engage in active travel using American Time Use Survey data.

Ishii and Urakawa (2014) found that in Japan, some household types, especially single parents with children and double-income couples with children, are now confronting a lack of time. Time poverty, a situation in which people can have only insufficient time to engage in child care and housework as well as leisure and other basic activities such as sleeping, might prevent them from participating actively in daily physical activities.

However, few researchers have examined the association of time poverty and physical activity in Japan, although prolonged work of workers has become a central issue from an international standpoint (Wada et al., 2015). The present study specifically examines relations between income and time poverty, and physical activities. Then this study estimates the effects of multiple poverty dimensions on the degree of daily recreational activities using the household micro-dataset in Japan. By setting two dimensions of the poverty line, which consist of income and time, and by considering other socioeconomic factors, we can examine these hypotheses: (1) income poverty and time poverty are associated with physical inactivity; (2) definite correlation exists between available time and health behaviors; and (3) social-economic factors affect physical activity and health activities.

5.2 Literature review

In pioneering research into time poverty, Vickery (1977) added the concept of time to the conventional measure of poverty based on money (Ishii and Urakawa,

2014). Since then, not a few researchers have defined and calculated time poverty in various countries: Harvey and Mukhopadhyay (2007) for Canada; Burchardt (2010) for the United Kingdom and Kalenkoski, Hamrik, and Andrews (2011) for the United States.

Douthitt (2000) compared alternative approaches to defining time and income poverty and discussed their potential role in antipoverty policies. In the case of Japan, by conducting an estimation of time poverty suggested by Vickery (1977), Ishii and Urakawa (2014) demonstrated that the Japanese government must increase policy support particularly for families with small children.

However, only a few reports have described investigations of the associations of time poverty and individuals' physical activity or health-related behavior. Spinney and Millward (2010) examined the associations between time and income poverty and participation in structured and unstructured physical activities, but other socioeconomic factors, such as educational background, and working conditions were not considered. Indeed, Kalenkoski and Hamrik (2013) estimated the correlation between time poverty and individuals' eating behavior, but the effects of multidimensional poverty were not considered in this study. In addition, longer commutes have been associated with less time spent for exercise and other health-related activities, and have been associated with substitution into lower-intensity exercise (Kalenkoski and Hamrik, 2013).

The concepts of multidimensional poverty have been applied to various fields of studies that examine health outcomes and health-related behaviors. For example, Oshio and Kan (2014) found that multiple dimensions of poverty are more useful to predict individuals' self-reported health using nationwide population survey in Japan. In addition, by application of the four dimensions of income, education, social protection and housing conditions, they suggest that multidimensional poverty affects individuals' smoking behavior.

The present study uses the household micro-datasets in Japan to examine how both income and time poverty affect engagement in physical activity. It analyzes how multidimensional poverty is associated with individuals' health-related behavior in Japan.

5.3 Analytical framework: two-dimensional poverty line based on income and time

This section explains the analytical framework used for this study with Vickery (1977) and Harvey and Mukhopadhyay (2007) as references: The framework is a two-dimensional poverty line based on income and time. Income poverty and time poverty are defined in the next paragraph.

Figure 5-1 presents a two-dimensional poverty line based on income and time. The vertical axis represents income and the horizontal axis time. M_0 is the income-poverty line representing the minimum income required. T_1 is the time-poverty line representing the minimum time necessary for household work. T_m, the largest value

on the horizontal axis, expresses the available time, which, more specifically, is the value left after subtracting time spent for basic activities (sleeping, eating, taking personal care (excretion, bathing, getting dressed, etc.)) from the 24 hours of the day. The value left after subtracting T_1 from T_m is T_a. If actual working hours T_w (including commuting time) exceed T_a near the origin and encroach on the time-poverty line T_1, then the household is regarded as time poor. Household work and market labor are assumed to be conducted by adult members of the household. Parameter values are the total time spent by the adults in the household. The values of all parameters, M_0, T_m, T_1, and T_a vary depending on the household type. Based on the two axes M_0 and T_1, the diagram is divisible into four quadrants: the upper right area for “not poor,” the lower right area for “income poor but not time poor," the upper left area for “not income poor but time poor,” and the lower left area for “income poor and time poor."

Additionally, the area of “not income poor but time poor” is divisible into two types by assuming substitution of time with money such as the purchase of housework services (dining out, using childcare services, etc.). When drawing a curve with the slope of the cost of housework services from point E, at which the income-poverty line and time-poverty line intersect, the intersection M_1 with the vertical axis is the minimum income necessary for outsourcing all necessary household labor. Households can be categorized into the range above the curve, in which households would not be income poor even if they purchased housework

services to cover their time poverty ("not income poor after time adjustment"), and the range below the curve, in which households would be income poor if they purchased housework services ("income poor after time adjustment").

(i). Setting an income-poverty line

Poverty lines are defined generally in two ways: one is an absolute definition; the other is a relative definition. For the absolute definition, the minimum amount necessary to maintain daily life (income in this case) is measured. The poverty line is determined based on that amount.

For the relative definition, however, the poverty line is determined by comparing households against the distribution of the focused variable (income in this case) in the entire society. The study applies the method generally used to determine a relative income-poverty line and set the poverty line at 50% of the median of the distribution of equivalent disposable income that incorporates the economies of scale based on differences in the number of household members. The equivalent scale is set at 0.5.

(ii). Setting a time-poverty line

Definitions of time vary among studies (Burchardt 2010; Kalenkoski 2011). Studies reported by Vickery (1977) and by Harvey and Mukhopadhyay (2007) and other studies define a time-poverty line (T_1 in Figure 5-1) as the minimum time necessary for housework. A household that is incapable of securing the minimum time required for housework because of long working hours in the market is

considered time poor. The minimum time required for housework in this case means the least time needed for housework without outsourcing household chores such as cooking, washing, shopping (dining out or ordering food delivery, purchasing prepared food, using housework-related services in the market, etc.), , and taking care of children, elderly people, or disabled people. Vickery (1977) used a living hour survey of time and defined the minimum time required for housework as the average time spent for housework at households with at least one full-time homemaker. Harvey and Mukhopadhyay (2007) followed this and calculated similar values from the Canadian General Social Survey. The studies used the average value of adults based on the living hour survey for time spent for basic activities (sleeping, eating, personal care (excretion, bathing, getting dressed, etc.)).More specifically, Vickery (1977) used 10.2 hours per day, the average time spent by adults for basic activities, based on the 1966 Michigan Time-use Survey of the United States. Harvey and Mukhopadhyay (2007) used 10.5 hours per day, the average time spent by adults for basic activities calculated from similar survey data of Canada. In addition, both studies considered the minimum necessary leisure time. Vickery (1977) concluded that such time is 10 hours per week. Harvey and Mukhopadhyay (2007) estimated it as 14 hours per week. Burchardt (2008, 2010) also defined time poverty from an absolute perspective. This study determined the minimum time required for basic activities using the values in earlier studies such as those by Vickery (1997), for childcare using the childcare guidelines of the

United Kingdom, and those for housework by application of the average time spent for housework by households that did not outsource their housework.

The present study defines a time-poverty line using these studies as a reference. The specific procedure is to ascertain the time spent for basic activities (sleeping, eating, taking personal care (excretion, bathing, getting dressed, etc.)) and minimum time necessary for housework (T_1) using the 2011 Survey on Time Use and Leisure Activities of the Ministry of Internal Affairs and Communications (MIC) as a reference. The Survey on Time Use and Leisure Activities was conducted by the MIC once every five years to observe the distribution of living hours and major leisure time activities of Japanese people. The 2011 survey included participation by approximately 200,000 members aged 10 and older of approximately 83,000 households.

As the time spent for basic activities, the study used the average time spent in an entire week by men and women, separately, who were aged 20–64 years. The time for basic activities included 7.5 hours per day for men and 7.2 hours per day for women for sleeping, 1.1 hours per day for men and 1.5 hours per day for women for taking personal care, and 1.5 hours per day for men and 1.6 hours per day for women for eating. Following the example of earlier studies, this study further included the minimum leisure time required in the basic activity time. This was assumed to be one hour per day from Monday through Friday and three hours per day on Saturdays and Sundays.

Because the minimum time required for housework (T_1) represents the least time necessary for housework without outsourcing the series of household chores such as cooking, washing, taking care of children, elderly people, or disabled people, and shopping (dining out or ordering food delivery, purchasing prepared food, using housework-related services in the market economy, etc.), for each household type to be analyzed, the study applied the average time spent for housework at households with at least one adult who did not work outside the home. More specifically, as a reference, the study used the time spent for housework at households with a husband working outside the home and wife not working outside the home for households comprising a married couple and children and households only of a married couple. For one-person households and single-parent households, the study applied the housework time of households without a member working outside the home. The housework activities include housework, nursing care, childcare, and shopping based on the Survey of Time Use and Leisure Activities. The average time spent for housework by men of one-person households is significantly shorter than in other households. Because many men living alone are likely to outsource much of their housework by, for instance, dining outside instead of cooking at home, the minimum housework time required at female one-person households was substituted for that at male one-person households.

Table 5-1 presents the time spent for basic activities and the minimum time required for housework (T_1) for each household type, as developed using the 2011

Survey on Time Use and Leisure Activities as a reference. As described later, the household types to be analyzed are consistent with those in the 2011 Survey on Time Use and Leisure Activities. The basic activity time and minimum time necessary for housework assumed in this study are smaller than the values used in earlier studies such as those conducted by Vickery (1977) and by Harvey and Mukhopadhyay (2007). The time-poverty line becomes lower for the difference. The likely reason is that, as revealed also by an international comparison made by the OECD (2011), the time spent by Japanese people for leisure and personal care is less than that in other countries. It is noteworthy that this time-poverty line reflects the conditions and customs of Japanese people.

5.4 Data used and hypotheses

5.4.1 Data

The survey we conducted was collected from a nationwide internet survey in Japan. It was designed and implemented in 2012 for a research project that investigated the socioeconomic determinants of subjective well-being. It was sponsored by the Japanese Society for the Promotion of Science (JSPS). We sent questionnaires to 16,930 randomly selected people who were registered on the members' list of an internet survey institute. We obtained 10,400 responses in all (response rate: 61.4%).

The surveys elicited ample information related to individuals' subjective assessments of their own well-being, personal traits, demographic and

socioeconomic status, and the frequency of several types of daily recreational activities. Many of them are useful for examination of the relation between income and time poverty and daily recreational activities. [9]

To ensure that the sample was representative of the actual population, targeted proportions of 15 population groups were constructed, corresponding to a matrix of five age groups (20s, 30s, 40s, 50s, and 60s) and three household income classes (3 million yen or less, 3–6 million yen, and 6 million yen or more) in advance. They are based on two official statistical publications: The *Population Census* and the *Comprehensive Survey of Living Conditions of the People on Health and Welfare*. Samples were collected until the numerical targets were obtained. In the analysis, we drew 20-69 aged samples, and omitted the samples who didn't answer related questions and students. As a result, we use 5872 samples.

5.4.2 Hypothesis

It has been demonstrated that some types of daily recreational activities such as doing sports are positively associated with personal health status. We set the following three hypotheses related to how the existence of income and time poverty affect daily recreational activities. Then we examine their validity.

(i) Income poverty decreases the frequency and intensity of costly daily recreational activities.

[9] Yagi et al. (2016) used the same survey for the study on the relations between happiness and employment status.

(ii) Time poverty decreases the frequency and intensity of time-consuming daily recreational activities.

(iii) Negative effects of multiple poverty situations (income and time poverty) on daily recreational activities surpass the scale of the coefficient of each poverty situation.

5.4.3 Variables

Explained variable

To examine the validity of the hypotheses presented above, we used replies for the frequency and intensity of daily recreational activities consisting of four items as key dependent variables. We categorized these activities into two types, based mainly on the Saltin Grimby Physical Activity Level Scale (SGPALS) originally established by Saltin and Grimby (1968). The first category is Physically Active Recreational Activity (PARA). This category mainly includes light, moderate, and vigorous physical activities such as cycling or walking to work, walking with family, gardening, fishing, playing tennis, bowling, swimming, and skiing. The second category is Physically Stationary Recreational Activity (PSRA). This category includes physically inactive and passive recreational activity. Reading, watching television, watching movie, using computers or doing other sedentary activities during leisure time are categorized into this type. This scale has good

validity and reliability. It is often used by health science researchers (Aires et al., 2003).

By consideration of these two categories, our analysis uses the following two variables as PARA: doing sports and visiting interesting places. Regarding the variables related to PSRA, we set the following two variables: watching movies and reading. The concrete contents of questionnaires related to daily recreational activities are the following.

[Question]

"Now we will ask you a question about your hobbies and pastimes. How often in the past year have you engaged in each of the hobbies and pastimes listed below?"

[List]

Doing sports activities, and visiting interesting places (PARA)

Watching movie, and reading (PSRA)

[Alternatives]

(1) A few times a week, (2) Once a week, (3) Once a month,

(4) A few times a year, (5) Only slightly ever

(For doing sports)

(1) Almost daily, (2) A few times a week, (3) Once a week,

(4) Once a month, (5) Only slightly ever

(For visiting interesting places, watching movie, and reading)

We produced a dummy variable for each activity showing inactive participation (only slightly ever). Additionally, we set three dummy variables showing health-related behaviors, i.e., smoking, drinking (usually drink more than three 350 ml cans of beer a day), and lack of sleep (below 6 hours per day), as explained by variables of the econometric model set in the next section.

Explaining Variable

Regarding key independent variables, as the preceding chapter has defined, dummy variables are made to reflect the situation of two-dimensional poverty (income and time poverty). In addition, dummy variables related to gender, age groups, and socioeconomic factors such as academic background, job status are included in this analysis to control the effects of other important factors.

Table 5-2 presents basic characteristics of the sample used. The characteristics of the samples in Japan are given by gender. From the table, one can confirm that a certain amount of gender gaps exist regarding poverty level. That difference reflects differences of the labor participation rate of women in Japan. Regarding the household type, about 70% of respondents were residents of households with a spouse. In addition, age distributions do not differ much among age classes.

These descriptive statistics reflect that 19.1% of individuals in the total sample were categorized as income poor but not time poor. Actually, 21.4% of female respondents were classified as having income poverty, which is higher than that of male respondents (17.5%). However, the results of the ratio of time poor but not income poor shows that men (9.7%) were more likely to be time poor than women (5.9%), perhaps because of their greater full time labor force participation (54.6%). However, the ratio of unemployed women was much higher (44%) than the ratio of unemployed men (13.6%). For mixed two-dimensional poverty, no great difference can be found between men and women, only 1.7% of men and 1% of women reported both time and income poverty. In addition, women who are inactive in doing sports had a relative frequency of 54.7%, which is higher than men (41.9%). Women with inactivity of reading (19.8%) also reported a higher relative frequency than men (12.4%). However, regarding inactivity of health related activity, ratios of men who were smoking (29.6%), drinking (20.1%) and lacking sleep (17.6%) showed a higher relative frequency than women who like smoking (14.7%), drinking (4.5%) and sleep less than 6 hours per day (16.2%).

5.5 Econometric analysis

5.5.1 Analytical method

The study estimates normal probit and instrumental variable (IV) probit estimations to examine whether verified hypotheses related to the relation between daily recreational activities and multi-dimensional poverty are valid or not. The IV

probit estimation is applied, considering the possibility that participating in sports improves longer-term labor productivity (Hyytinen and Lahtonen, 2013). For the present study, several dummy variables were set as candidates of instrumental variables for the income poverty dummy. These variables were checked using the Wald test to ascertain whether they have satisfactory validity.

The outline for three dummy variables showing instrument variables is the following: (1) linguistic skills, (2) communication skills, and (3) working experience. For linguistic skills and communication skills, the survey presented questions such as "from the items below, please select all things that you already have (including skills)". We assigned one point for each answer result of linguistic skills and communication skills if respondents responded with them as "things that I already have". For working experience, the survey presented the question of "how many years have you been working at your current place of employment?", to which we assigned one point for respondents who answered "worked more than five years in the current workplace".

5.5.2 Estimation Results

This section presents the results of empirical analysis of poverty and other socioeconomic effect on daily recreational activities and health-related activities. First, we selected four variables to describe physically active activities: doing sports, visiting interesting places, reading, and watching movies. Respondents were asked about their current condition of doing physical activities on a five point scale (*a few*

times a week, *once a week*, *once a month*, *a few times a year* and *only slightly ever*) for doing sports and, (*almost daily*, *a few times a week*, *once a week*, *once a month*, and *only slightly ever*) for visiting interesting places, watching movie, and reading. We constructed a binary variable of doing daily recreational activities less, to which we allocated 1 if the respondent answered *only slightly ever*.

Secondly, we considered smoking, drinking, and sleeping less as indicators of health-related activities, and constructed binary variables for each. For drinking, a binary variable was allocated as 1 if an individual answered "*I usually drink three or more than three 350 ml cans of beer each day*". For sleeping, an individual who sleeps fewer than 6 hours was regarded as sleeping less and was allocated to 1 in dummy variable for this indicator. In addition to the above unhealthy activities, we constructed binary variables for current smoking.

Table 5-3 presents results obtained from a logit model to estimate the socioeconomic effects on daily recreational activities. For doing sports low, we first observe that, among poverty of three types, one dimensional poverty (low income), and two dimensional poverty (low income as well as lacking living time) are highly related with low frequency of doing sports. In addition, people who have low educational background, such as high school graduates and two year college graduates and technical school graduates, are more likely to exercise less than others. Women also tend to do sports less than men do. From the cross terms of

poverty dimension and female dummy, we can confirm that negative impact of two dimensional poverty on sport participation is higher in the case of male than female.

Regarding the results for visiting interesting places, we noticed that one dimensional income poverty positively affects a low frequency of visiting interesting places. Time poverty that female persons confront has the tendency of causing visiting interesting places less compared to male. In addition, high educational background has a significant effect on the behavior of visiting interesting places. Moreover, women and people who are employed full time or employed part time show a higher probability of visiting interesting places than others. For reading behavior, lack of leisure time is associated with the less reading activity. We also observed that men, younger Japanese people, and those with low educational level tend to read less than others.

Table 5-4 presents the estimated results of the socioeconomic effects on health-related activities. We first observed that time poverty has a negative effect on sleeping, particularly for male. Regarding educational background, low educational attainment tends to predict unhealthy activities such as smoking, drinking, and gambling. Men have higher probability of smoking, and drinking than women. However, female who fall into income or time poverty tend to depend on drinking behavior. We also observed that people who have partners tend to do more health-related activities aside from drinking. Moreover, working conditions are associated with health-related activities. For example, full time employed workers

are more likely to smoke and drink; part time employed workers tend to smoke and to sleep less.

Table 5-5 presents the estimation results by gender, obtained using the IV Probit model to estimate the socioeconomic effects on inactivity of doing sports. First, we examine the estimation results of all samples. Household income was found to have a negative relation with the inactivity of doing sports, although one dimensional time poverty was positively related with doing sports inactively. In addition, younger respondents, individuals who were married, individuals who were divorced (or widowed), full timer, part timer, and individuals who have low educational background tend to be inactive in sports participation. Secondly, we examined the estimation result of men, observing that household income is also highly associated with inactivity of doing sports, but time poverty is not significantly associated with inactivity of doing sports. In addition, men who were married or divorced, men who were employed, and men who were graduated from high school were less likely to report doing sports actively. Finally, we examined the estimation results of women obtained using the IV Probit model. We first observed that low household income and one dimensional time poverty are associated with women's inactivity of doing sports. Furthermore, marriage status, full time employment, and part time employment status prevent individuals from being active in doing sports.

5.6 Conclusion

This analysis specifically examined the association between multidimensional poverty, participation of physical activity and participation in health related activities, by defining poverty from two dimensions of income and time in Japan using a micro dataset. Many previous studies have pointed out strong relations among the level of income, health condition, and the probability of doing physical activity. However, time, along with money, is a finite resource. It is an important factor affecting the standard of people's life (Ishii and Urakawa, 2014).

Several studies have grasped poverty from two dimensions of income and time and examined their effects on active participation in physical activity in other countries, but no report in the relevant literature has described the use of this approach in Japan. We investigated the relationships between time, money, and the intensities of daily activities. Furthermore, we considered the effects of other socioeconomic factors.

From the estimation results obtained using econometric models, we first clarified that income poverty is an important factor of low probability of PARA such as doing sport and visiting interesting places. For time poverty, we observed that it is highly associated with low frequency of reading and short duration sleeping.

Indeed, we observed different results for women and men by checking the effects of cross terms. For men, individuals who are deprived in one dimensional

income poverty and deprived in two dimensions of poverty tend not to participate in sports. Men who have income poverty become less likely to visit interesting places, while lack of living time might prevent them from actively reading, while getting less sleep.

For women, individuals who are deprived on one dimensional income poverty tend not to engage in doing sports and visit interesting places. In addition, the negative impact of low income on watching movies is larger for female than male. Time poverty is also an important determinant for women to visit interesting places and to read actively. Regarding health related activities, women whose income is very low might sleep less than others, but the effect is smaller than the case of male. These findings show that time poor people tend to become inactive about doing physical activities, which are regarded as generally related with people's health condition.

As a second point, we confirmed that educational background can contribute to doing physically active activities as well as health related activities. Results show that people who have a low educational level are less likely to do sports, visit interesting places, or read. Furthermore, a low educational level might cause unhealthy behavior such as smoking and drinking too much.

As a third point, we observed different results among full time workers, part time workers, and self-employed people, compared to individuals who are not employed. For physical activities, full timers and part timers tend to be active in

doing sports. Indeed, full time employed workers become more likely to visit interesting places and to read. However, for health-related activities, rather, individuals who are regularly employed showed high probability of smoking and insufficient sleep time, which indicates that regular workers in Japan have a higher risk of unhealthy behaviors.

Finally, we describe several policy implications from estimate results obtained through this study. First, government must increase policy support for people who confront difficult circumstances of time poverty and income poverty, such as single parents.

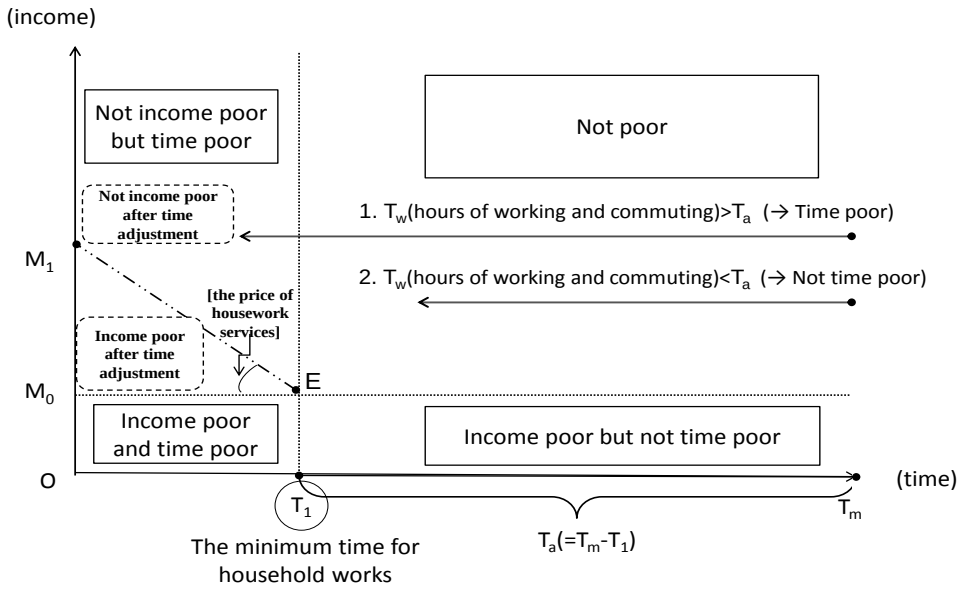
As several previous results of studies have suggested, a well-funded public child care system would help alleviate the problem of ‘‘time poverty.’’ In addition, policy reforms must be done with the knowledge that labor, time, and resources are all required for individuals to survive and to care for their families (Spinney and Millward, 2010). Job assistance is one important policy as a measure for income poverty.

Secondly, government should consider enhancing physical education, especially for people who have a low educational background. Kajitani and Kohara (2006) examined the demographic and socioeconomic variables that putatively affect the intensity activities for health investment, using prefectural level data (1981–2001), particularly addressing working men. Results show that high education attainment is positively correlated with the level of sports activity.

Above all, unstructured physical activities require no memberships or special facilities and might be done anytime throughout the day (e.g., walking and hiking). The prevalence of daily recreational activities that require little money and/or schedule commitments to participate should be reinforced. Some physical recreational activities are expected to help people to achieve capabilities directly and indirectly.

Thirdly, daily recreational activities such as doing sports can contribute to long and healthy lives, can provide more opportunities to participate in the life of the community, and can improve skills of teamwork, discipline, and the value of effort for people in the workplace. Consequently, enterprises also should consider providing more sport-related projects for their workers to improve their access to and participation in appropriate forms of physical activity.

Figure 5-1: Outline of income poverty and time poverty.



(Note) Added to Ishii and Urakawa (2004).

Table 5-1: Minimum time required for basic activities and housework by household types

(hours)	7 days (V)	Essential time (Te)			Tm (V-Te)	Minimum time required for the housework T1					Disposal time Ta (Tm-T1)
			Leisure (weekday)	Leisure (weekend)		Housework	Nusrsing/ Caring	Childcare	Shopping	Total	
	week	week	day	day	week	day	day	day	day	week	week
Couple with children											
with children who are all older than 6	336	165.5	2.0	6.0	170.5	5.5	0.2	0.4	1.2	50.9	119.6
with one child youger than 6	336	165.5	2.0	6.0	170.5	4.0	0.1	5.0	1.1	71.3	99.2
with two or more children younger than 6	336	165.5	2.0	6.0	170.5	3.7	0.1	6.2	1.0	77.0	93.5
Vickery (1977)	336	162.8	2.0	5.0	173.2	-	-	-	-	62.0	111.2
Hervey et al. (2007)	336	175.0	4.0	4.0	161.0	-	-	-	-	74.6	86.4
Couple without children	336	165.5	2.0	6.0	170.5	4.3	0.1	0.1	1.1	39.4	131.1
Vickery (1977)	336	162.8	2.0	5.0	173.2	-	-	-	-	74.6	86.4
Single parent with children	168	83.2	1.0	3.0	84.8	3.5	0.1	1.1	1.0	39.3	45.5
Vickery (1977)	168	81.4	1.0	2.5	86.6	-	-	-	-	57.0	29.6
Hervey et al. (2007)	168	87.5	2.0	2.0	80.5	-	-	-	-	52.0	28.5
Male one-person household	168	82.3	1.0	3.0	85.7	2.3	0.1	0.0	0.6	21.2	64.5
Female one-person household	168	83.2	1.0	3.0	84.8	2.3	0.1	0.0	0.6	21.2	63.6
Vickery (1977)	168	81.4	1.0	2.5	86.6	-	-	-	-	31.0	55.6
Single person with parents	168	91	1.0	3.0	77	1.3	0.1	0.0	0.2	11.2	65.8

(Source) Survey on Time Use and Leisure Activities, 2011, Vickery (1977), Harvey and Mukhopadhyay (2007). Authors' calculations based on Ishii and Urakawa (2015).

Table 5-2: Basic statistics of the samples used

	All (n=5872)		Male (n=3447)		Female (n=2425)	
	Mean	Std.err	Mean	Std.err	Mean	Std.err
Mariage						
marriaged dummy	67.2%	0.47	68.1%	0.47	65.9%	0.47
widow/divoece dummy	6.5%	0.25	5.2%	0.22	8.4%	0.28
single dummy	26.3%	0.44	26.7%	0.44	25.7%	0.44
Age						
20s dummy	11.6%	0.32	7.1%	0.26	18.1%	0.39
30s dummy	22.8%	0.42	22.4%	0.42	23.3%	0.42
40s dummy	21.1%	0.41	20.9%	0.41	21.2%	0.41
50s dummy	27.6%	0.45	28.0%	0.45	27.1%	0.44
60s dummy	16.8%	0.37	21.6%	0.41	10.2%	0.30
Working conditions						
Full time employed dummy	40.4%	0.49	54.6%	0.50	20.2%	0.41
Part time employed dummy	24.4%	0.43	19.2%	0.39	31.7%	0.47
Self employed dummy	9.0%	0.29	12.6%	0.33	4.0%	0.20
No work dummy	26.2%	0.44	13.6%	0.34	44.0%	0.50
Householders' educational level						
High school graduate dummy	27.5%	0.45	26.3%	0.44	29.2%	0.45
Two-year college and technical school dummy	22.1%	0.42	12.4%	0.33	35.9%	0.48
Four-year college and graduate school dummy	50.3%	0.50	61.2%	0.49	34.8%	0.48
Poverty						
Income povery dummy (not time poverty)	19.1%	0.39	17.5%	0.38	21.4%	0.41
Time poverty dummy (not income poverty)	8.2%	0.27	9.7%	0.30	5.9%	0.26
Both income and time poverty dummy	1.4%	0.12	1.7%	0.13	1.0%	0.10
Non poverty dummy	71.3%	0.45	71.1%	0.45	71.6%	0.45
Inactivity of daily reactional activity						
Inactivity of doing sports dummy	47.2%	0.50	41.9%	0.49	54.7%	0.50
Inactivity of visiting intresting places dummy	65.4%	0.48	67.1%	0.47	62.9%	0.48
Inactivity of reading dummy	15.4%	0.36	12.4%	0.33	19.8%	0.40
Inactivity of watching movies dummy	33.9%	0.47	32.8%	0.47	35.4%	0.48
Inactivity of health related activity						
Smoking dummy	23.5%	0.42	29.6%	0.46	14.7%	0.35
Drinking dummy	13.7%	0.34	20.1%	0.4	4.5%	0.21
Lack of sleeping dummy	17.0%	0.38	17.6%	0.38	16.2%	0.37

Table 5-3: Logit model: Factors on inactivity of daily recreational activity

Dependent variables (1= less than once a month; 0= more than once a month)	Inactivity of doing sports		Inactivity of visiting intresting places		Inactivity of reading		Inactivity of watching movies	
	Odds ratio	z-value	Odds ratio	z-value	Odds ratio	z-value	Odds ratio	z-value
Sex								
Female	1.47***	4.85	0.60***	-6.12	1.37**	2.87	1.02	0.20
Male (ref)								
Partner								
Yes	0.96	-0.60	1.38***	4.61	0.64***	-4.92	1.07	0.93
No (ref)								
Age								
30s	1.17	1.55	1.13	1.21	0.94	-0.55	1.01	0.09
40s	1.20*	1.77	1.01	0.05	0.70**	-2.83	0.88	-1.16
50s	1.07	0.67	0.78**	-2.38	0.48***	-5.73	1.04	0.35
60s	0.69**	-3.18	0.68**	-3.16	0.40***	-5.83	1.11	0.85
20s (ref)								
Working conditions								
Full time employed	0.90	-1.22	0.61***	-5.42	0.62***	-4.05	0.83*	-2.07
Part time employed	1.03	0.33	0.76**	-3.33	0.85	-1.61	0.93	-0.95
Self employed	1.04	0.38	0.88	-1.09	0.84	-1.15	0.96	-0.36
No work (ref)								
Householders' educational level								
High school graduate	1.61***	7.28	1.85***	8.69	1.50***	4.50	1.05	0.75
Two-year college and technical school	1.23**	2.92	1.36***	3.99	1.32**	2.84	0.94	-0.78
Four-year college and graduate school (ref)								
Poverty dimension								
Income poverty (one dimension)	1.45***	3.54	1.48***	3.33	1.17	1.06	1.14	1.22
Time poverty (one dimension)	1.03	0.25	1.01	0.10	1.37*	1.87	1.07	0.51
Income and Time poverty	2.20**	2.85	1.22	0.68	1.52	1.25	1.18	0.59
No poverty (ref)								
Intersection variable								
Only Low income × Female	0.97	-0.19	0.96	-0.28	0.82	-1.11	1.32*	1.90
Only Time poverty × Female	1.23	0.96	1.64**	2.18	1.04	0.16	1.16	0.64
Low income and Time poverty × Female	0.29**	-2.49	1.39	0.63	0.58	-0.91	0.58	-0.98
Log likelihood	-3937.8		-3679		-2405.4		-3736.9	

Note 1: ***,**,and * are statistically significant at 1%, 5% and 10% level.

Table 5-4: Logit model: Factors on inactivity of health related activity

Dependent variable	Smoking dummy (1= current smoking; 0=others)		Drinking dummy (1= drink more than 3 cans of beer a day; 0=others)		Lack of sleep dummy (1=sleep less than 6 hours a day; 0=others)	
	Odds ratio	z-value	Odds ratio	z-value	Odds ratio	z-value
Sex						
Female	0.41***	-8.97	0.17***	-11.82	1.14	1.24
Male (ref)						
Partner						
Yes	0.78**	-3.15	0.98	-0.18	0.80**	-2.55
No (ref)						
Age						
30s	1.34**	2.24	2.23**	3.31	0.97	-0.26
40s	1.44**	2.72	3.63***	5.37	1.22	1.50
50s	1.90***	4.95	4.52***	6.36	1.06	0.45
60s	1.44**	2.49	4.74***	6.22	0.88	-0.82
20s (ref)						
Working conditions						
Full time employed	1.38**	2.97	1.17	1.09	1.79***	4.90
Part time employed	1.26**	2.34	1.15	1.03	1.45**	3.32
Self employed	1.73***	4.35	1.31*	1.71	0.91	-0.58
No work (ref)						
Householders' educational level						
High school graduate	1.82***	7.89	1.38***	3.49	0.91	-1.13
Two-year college and technical school	1.65***	5.73	1.40**	2.96	0.99	-0.09
Four-year college and graduate school (ref)						
Poverty dimension						
Only Low income	0.93	-0.63	0.69**	-2.63	0.77*	-1.74
Only Time poverty	1.18	1.26	0.86	-0.92	1.59**	3.40
Low income and Time poverty	1.32	0.97	0.85	-0.45	0.95	-0.14
No poverty (ref)						
Intersection variable						
Only Low income × Female	1.17	0.88	1.61*	1.67	0.89	-0.55
Only Time poverty × Female	0.86	-0.53	2.26**	2.10	0.62*	-1.88
Low income and Time poverty × Female	0.36	-1.29	3.01	1.31	0.53	-0.88
Log likelihood	-3035.74		-2111.5		-2619.5	

Note 1: ***,**,and * are statistically significant at 1%, 5% and 10% level.

Table 5-5: IV probit estimation of socioeconomic factors on inactivity of doing sports

Dependent variable : Inactivity of doing sports	All		Male		Female	
(1= less than once a month; 0=more than once a month)	Coef	s.e	Coef	s.e	Coef	s.e
Age	-0.058	0.017**	0.038	0.027	-0.034	0.037
Marriage situation						
Married	0.607	0.123***	0.244	0.109**	1.217	0.367**
Divorced/Widow	0.335	0.083***	0.216	0.116*	0.347	0.122**
Single (ref)						
Working conditions						
Full time employed	0.179	0.085*	0.573	0.155***	0.408	0.200**
Part time employed	0.152	0.059**	0.338	0.117**	0.242	0.084**
Self employed	0.058	0.074	0.395	0.117**	0.172	0.173
No work (ref)						
Householders' educational level						
High school graduate	0.121	0.057**	0.137	0.070*	-0.007	0.116
Two-year college and technical school	0.101	0.049*	-0.001	0.080	-0.011	0.079
Four-year college and graduate school (ref)						
Income and Time						
Household income	-0.002	0.000***	-0.001	0.001***	-0.002	0.001**
Time poverty (non income poverty)	0.181	0.077**	0.073	0.088	0.370	0.149**
Constant	0.399	0.082***	-0.248	0.128*	0.457	0.120
Number of observations	5553		3274		2279	
Wald chi2 (10) (p<0.000)	169.7		79.27		51.88	
Wald test of exogeneity	20.34		12.08		7.43	
Wald test Prob > chi2	0.0000		0.0005		0.0064	
Instrument variable	Linguistic skills		Linguistic skills		Linguistic skills	
	Communication skills		Communication skills		Communication skills	
	Working experiences		Working experiences		Working experiences	

Note 1: ***,**,and * are statistically significant at 1%, 5% and 10% level.

Chapter 6: Conclusion

6.1 Summary

Some daily recreational activities such as continual physical activity are crucially important components of daily life that decrease the risk of non-communicable diseases, maintain people's quality of life, and contribute to promotion of physical health, mental health, and well-being. In addition, people's daily recreational activities can exert a strong effect on the macro-economy. Results of several studies indicate that a change by people from living a sedentary lifestyle to a physically active life brought produced considerable cost-saving effects.

This empirical study examined the effects of a person's daily activities on subjective well-being using individual datasets of economically developed countries: the US, France, and Japan. Chapter 1 presents introductions of some selected reports of the literature that specifically examine the relations between socioeconomic factors, daily recreational activities, and subjective well-being, along with an outline of theoretical models that explain the roles of daily recreational activities. The theoretical model related to the choice of leisure time by Becker (1964) was developed by Cawley (2004), Humphreys and Ruseski (2009), and others.

Chapter 2 examined particular characteristics to ascertain the relation of health and daily recreational activities among working generations of people of the US,

France, and Japan. These representative countries, located on different continents, have particular cultural backgrounds and social customs. Based on the SLOTH model developed by Cawley (2004), the author used individual datasets from internet surveys to investigate the association between sports activities and several health indicators. Estimation results, which include instrumental variable models, reveal a significant and positive association between the level of self-rated health and the frequencies of physically active recreational activities such as doing sports activities for both men and women in the three countries, except for the case of working men in France. In addition, continued reflection and cognitive activities such as reading, even if they include physically stationary activities, engender the improvement of health in some cases, irrespective of differences of geography and cultural characteristics.

Chapter 3 presented an investigation of the relation between self-rated health and daily recreational activity among elderly people in three economically developed countries: the US, France, and Japan. Estimation results for the US indicate a significant positive relation between a higher level of health and physically stationary recreational activities such as making handicrafts and watching movies, particularly for women. Physically stationary recreational activities exhibited no effect on either men or women in Japan. Regarding physically demanding recreational activities, doing sports activities secured positive effects on a person's self-rated health in all three countries. Particularly, the effect on health in Japan was highest.

Chapter 4 presented an investigation, using individual data, of important socioeconomic factors that influence participation in sport activities. Estimation results of a random intercept model for the US, France, and Japan revealed similar and different socioeconomic factors affecting sports participation frequency in the three countries. In the US and France, adults aged 20–59 years old and people residing with parents tend to participate less in sporting activities. By contrast, elderly Japanese people tend to participate in sports more actively than others. Moreover, high education attainment, high income, and good health habits are positively correlated with the sports activity level.

Chapter 5 confirmed the effects of poverty dimensions (time and income poverty) on daily recreational activities such as sports participation and reading. This study revealed that household members who fall into time poverty tend to decrease the frequency of participation in physically active recreational activities such as sports participation.

Through analyses based on empirical evidence, this report described that physical activities during daily life such as sports participation, as well as reflection and cognitive activities such as reading, are beneficial for the improvement of quality of life and subjective well-being.

6.2 Policy implications and future tasks

Both physically active recreational activities (PARA) and physically stationary recreational activities (PSRA) are regarded as playing important roles for people's

better life based on the estimation results. In terms of achieving a high level of health, successive participation in beneficial daily activities such as doing sports should be reinforced. Some policy implications can be derived from past empirical results.

First, facilities that prompt people to engage in physical activities should be consolidated. Huang and Humphreys (2012) introduced analytical examples showing that British women who can travel to a sports or fitness facility from home within 20 min are more likely to participate in sports, and report a higher level of happiness. In addition, in the case of Japan, the enhancement of library facilities is regarded as playing an important role because reflective activities such as reading positively affect the self-rated health of Japanese people. The built environment might present barriers to participation in some beneficial activities if individuals have no local access to related facilities (Brown and Roberts, 2011).

Secondly, closely related to the first implication, the costs of recreational activities must be lowered to support low income households and encourage their involvement in the activities. For example, Humphreys and Ruseski (2011) emphasized the importance of both fixed costs and variable costs of physical activity on participation.[10] As several reports of the relevant literature, including the present report, have described, the decision to participate in physical activity must be linked

[10] Fixed costs of physical activity are one-time costs or flat recurring costs that individuals incur to participate in physical activity, but which are independent of how many times the individuals participate. An example of a fixed cost is monthly membership dues at a health club. Variable costs of physical activity are costs that depend on the amount of time or number of times the individual engages in physical activity. Examples of variable costs are equipment maintenance costs and personal training fees (Humphreys and Ruseski, 2011, p.7).

explicitly to economic outcomes such as labor status and earnings (Humphreys and Ruseski, 2006). However, some studies such as those of Brown and Roberts (2011) have shown that non-labor income had an extremely small effect on the frequency of physical activity participation for working adults. Therefore, continuous examination must be made of what policies support the reduction of several costs needed to make recreational activities more efficient.

Thirdly, working and commuting hours of workers, which are closely related to the time poverty dimension, should be mitigated so that they can perform adequate daily recreational activities that are beneficial to health. Spinney and Millward (2010) pointed out a significant relation between longer working hours and experiencing a commensurate decline in their leisure time. Prolonged work might cause stressful feelings of limited time resources associated with hurried lifestyles, which unfortunately come mainly at the expense of leisure time (Spinney and Millward, 2010, p.342). In addition, a well-funded public child care system might help alleviate problems of 'time poverty' that eventually cause physical inactivity for families with small children (Bittman, 2002).

Fourth, health promotion which prompts lifestyle changes, including increases in physical activity for disease prevention, should be given higher priority. Increased funding should be offered by the health care system of each government (Haskell et al., 2009).

This study was affected by several limitations. First, the types of daily recreational activities considered in the analyses are limited in terms of the survey questionnaire contents. Future studies should include examination of the effects of broader types of daily recreational activities on well-being: chatting, browsing the internet, cycling, and skiing.

Second, the classification of leisure time activities based on the Saltin–Grimby Physical Activity Level (SGPAL) Scale might cause confusion for some activities such as gambling and playing games. Therefore, it is necessary to reconsider how to classify daily activities to clarify what types of daily recreational activities have beneficial effects on people's well-being and why this has been the case.

Third, geographical information related to the number of facilities and institutions provided for daily recreational activities must be grasped better. Using such information, one might conduct a more robust examination of the relations among people's socioeconomic variables, their daily recreational activities, and their well-being.

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