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Abstract

Time is a finite resource along with money, and it is essential to fulfilling the basic needs of life. This research focuses on '*time poor'* individuals in Japan, where people do not have enough time to engage in child care and housework as well as leisure and other activities. We defined income and time poverty thresholds and estimated the time-adjusted income poverty by considering the situation where households fall into income poverty by purchasing housework-related services in the market to compensate for their time deficit. Based on the estimated results, we demonstrated that the government needs to increase the policy support, especially for single-parents with children and for double-income couples with children.

1. Introduction

Since the late 1990s, much research in Japan has shown the existence of enlarging disparity and poverty. Most of these researches estimate the degrees of disparity and poverty by using monetary indicators such as income and assets (Tachibanaki 2005; Ohtake 2005; Oshio and Urakawa 2008). Indeed, when we evaluate the level of people's standard of living, the monetary criterion is one of the most well-defined and tractable indicators because we can obtain most essentials with money.[1]

In addition, time is also an important factor determining the level of standard of living. Time is a finite resource along with money in life, and we definitely need to obtain a certain amount to keep a certain degree of living standards. Therefore, it's important to focus on the dimensions of time as well as money.

In recent years, the lifestyles have become more diversified, so the time for daily family life such as housework, child-rearing, and shopping are very different by household type. In a household such as double-income family who lacks the necessary time for family life, the additional costs for purchasing homemaker services will occur, and that will change the income level necessary for meeting the basic needs. Taking account of the time deficit, we will be able to more clearly grasp the current status of poverty in Japan.

[1] According to the data from the *National livelihood survey* in 2010 by the Ministry of Health, Labor and Welfare, the relative poverty rate by equivalent disposable income in 2009 is 16.0 percent and it marks higher than the OECD average of 10.6% in mid-2000s.

As far as we know, the estimation of poverty focusing on people's living hours has not been conducted in Japan. Therefore, in this paper we estimate 'time poverty' , which we define as the percentage of households whose minimum times for the housework are lacking by household types, using the household micro data sets in Japan.

By grasping poverty from two dimensions of income and time, we can clarify that: (1) what kind of households are likely to fall into income and time poverty, (2) how are income poverty and time poverty related. (Is it really for "No rest for the wicked" ?), and, (3) how many households eventually fall into time-adjusted income poverty, based on the situation that they need to buy the minimum required level of the housework through the market.

2. Preceding studies

Vickery (1977), the pioneer research in time poverty, added the concept of time to the conventional measure of poverty based on money. Based on the intra-household distribution model of Becker (1965), Vickery (1977) defined that household resources consisted of "assets," "time," and "abilities of household members." The model of Becker (1965) determines the optimal level of housework and balance between saving and consumption by appropriately distributing the time of each household to market labor and household labor based on the household member abilities. Considering this theory, Vickery (1977) presented a two-dimensional poverty line using data of the United States. More specifically, the study estimated the minimum income required (M_0), the minimum time required for household work (T_1), and the minimum income required when outsourcing the household work (M_1) for each household type. The study also calculated the poverty rate for households of each type and critical wage rate to be free from poverty.

There are some studies which have been made by following the concept of the two-dimensional poverty line of Vickery (1977). Douthitt (2000), for instance, used the 1985 American Time Use Survey and attempted to updates the research of Vickery (1977). Harvey and Mukhopadhyay (2007) measured the two-dimensional poverty rates in the late 1990s of Canada and revealed high time-poverty rates of single-parent households (with two or more children). The study subsequently estimated an approximate 2% rise in income-poverty rate by taking into account the cost of outsourcing housework and childcare paid by *'time-poor'* households. Similarly, Kalenkoski et al. (2011) verified variables correlated to time poverty using data from the American Time Use Survey Data and indicated that income poverty had no statistical correlation with time poverty. The study also discovered an increase of one child would reduce approximately 35 min per day of the daily discretionary time (time available for sleeping, getting dressed, doing housework and taking care of children in general, and activities other than labor) of adults. In addition, Burcahrdt (2010) used the UK Time Use Survey 2000 to investigate the relations between time poverty and personal attributes such as education, income, and race.

Other studies have analyzed poverty by focusing only on the aspect of time (Goodin et al. 2005;

McGinnity and Russell 2007; Goodin et al. 2008). Goddin et al. (2008) argued in detail about the definition of time poverty and examined how the welfare policies can be expected to affect the amount of discretionary time of individuals. McGinnity and Russell (2007) and Goodin et al. (2008) analyzed the gender inequalities in time use among households..

Although two-dimensional poverty based on time and money has yet to be studied in Japan to the best knowledge of the authors, some researchers have analyzed living hours. They primarily emphasized the work-life balance of households with small children. Many of them implied the burden of time constraints suffered, in particular, by working single parents with children (Tamiya and Shikata 2007; Japan Institute for Labour Policy and Training 2012; Cabinet Office 2013, etc.). For example, Tamiya and Shikata (2007) focused on single-mother households, analyzed the management of work and childcare in terms of international comparison, and pointed out that single mothers in Japan worked significantly longer hours and spent shorter time taking care of their children than those in the United States and Europe. The Japan Institute for Labour Policy and Training (2012) conducted the Survey on Living Conditions of Households with Children and the Work Arrangement of Parents and developed various statistics based on the results. While only 7.6% of working mothers of two-parent households had answered they have conflict between work and family life “almost every day”, 16.8% of working single mothers and 13.8% of working single fathers had answered so. This also indicates the heavy burden of time constraints on single-parent households. These results suggest that poverty in life, particularly of households with small children, can be understood more accurately by adding time constraints to monetary conditions in the measure of poverty.

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

Figure 1 presents a two-dimensional poverty line based on income and time. The vertical axis represents income and the horizontal axis time, and M_0 is the income-poverty line representing the minimum income required. T_1 is the time-poverty line representing the minimum time needed for household work. T_m is the largest value on the horizontal axis and expresses disposable time, which, more specifically, is the value 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 the actual working hours T_w (including commuting time) exceed T_a near the origin and encroaches the time-poverty line T_1, then the household is regarded as ‘*time poor’*. We assume that 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 can be divided into 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*” can be divided 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 required 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

This study defines an income-poverty line based on the standard of welfare benefits as Japan’s public assistance system. The standard of welfare benefits on which the income-poverty line in this study relies has materialized “the minimum standards of wholesome and cultured living” guaranteed by Article 25 of the Constitution of Japan. Currently, the benefit standard is made consistent with the general consumption level of the people through the “balanced standard method.” In this sense, the standard of public assistance supposedly defines poverty from a relative perspective. Besides, it can also be considered an absolute standard that is necessary for achieving “the minimum standards of wholesome and cultured living.”

The minimum living expenses are calculated for the welfare standards by adding the following [B] through [F] for applicable households to the livelihood assistance standards [A], which are basic operating expenses defined by the ages and number of household members. Considering the differences in lifestyles and commodity prices in different regions, the welfare standard system divides the entire nation into six categories (Region 1-1, Region 1-2, Region 2-1, Region 2-2, Region 3-1, and Region 3-2) and determines the standard values.

[Minimum living expenses under the public assistance system]

- [A] Livelihood assistance standards, which are basic operating expenses defined by the ages and number of household members
- [B] Additional assistance provided to specific households (disabilities, single mothers, childcare allowance, expectant and nursing mothers, etc.)
- [C] Housing assistance provided to households living in rental homes
- [D] Educational assistance and allowance for high school, etc. learning material expenses provided to households raising children
- [E] Long-term care standards for households incurring long-term care expenses
- [F] Medical assistance standards for households incurring expenses such as medical fees

This study regards those households whose after-tax incomes are lower than the minimum living

expenses as being “income poor.” More specifically, the minimum living expenses were calculated for each household by incorporating [A] livelihood assistance standards, [B] additional assistance for single mothers and childcare, [C] housing assistance standards, and [D] educational assistance and allowance for high school, etc. learning material expenses. Vickery (1977) and other preceding studies calculated income poverty in units of households, so comparison with the preceding studies becomes easy.

For [A] livelihood assistance standards, livelihood assistance standards (Type 1) and livelihood assistance standards (Type 2) were calculated for each regional category, age of household members, and the number of household members and standard calculations were performed. For [B] additional assistance for single mothers, the additional amounts of assistance provided to single-mother households were calculated for each regional category and the number of children. For [B] addition for childcare, the additional amounts were calculated according to the ages and numbers of children (children’s numbers in their siblings). For [C] housing assistance standards applicable only to families living in rental homes, the standard amounts and special amounts specified for each regional category. For [D] educational assistance standards and allowance for high school, etc. learning material expenses, the regular amounts were calculated as specified for each type of schools attended by children. The long-term care assistance [E] and medical assistance [F] were excluded from the calculation of minimum living expenses because of the limitation of data. Table 1 presents the average amounts of minimum living expenses estimated for each household type.

(ii). Setting a time-poverty line

Definitions of time vary among studies (Burchardt 2010, Kalenkoski 2011). Vickery (1977), Harvey and Mukhopadhyay (2007) and other studies define a time-poverty line (T_1 in Figure 1) as the minimum time required for housework. A household 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 the series of household chores. Vickery (1977) used a living hour survey of the 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 Vickery (1977) and calculated similar values from the Canadian General Social Survey. The studies used the average values of adults’ living hours for basic activities (sleeping, eating, personal care (excretion, bathing, getting dressed, etc.)). More specifically, Vickery (1977) used 10.2 hours per day as 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 as the average time spent by adults for basic activities calculated from similar survey data of Canada. In addition, both studies considered the minimum leisure time required, and Vickery (1977) concluded such time to be 10 hours per week and Harvey and Mukhopadhyay (2007) 14 hours per week.

Burcahrdt (2010) also defined time poverty from an absolute perspective. This study determined the minimum time required for basic activities referring to the preceding studies, minimum time for childcare using the childcare guidelines of the United Kingdom, and minimum time for housework by applying the average time spent for housework by households that did not outsource their housework at all.

This study defines a time-poverty line using these studies as a reference. The specific procedure is to determine the time spent for basic activities (sleeping, eating, taking personal care (excretion, bathing, getting dressed, etc.)) and minimum time required 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 the Japanese people. The 2011 survey included the participation by approximately 200,000 members of approximately 83,000 households who were aged 10 and above.

As the time spent for basic activities, the study used the average time spent in the 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 the preceding 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) means the least time needed for housework without outsourcing the housework such as dining out, ordering food delivery, purchasing prepared food, and using housework-related services in the market economy, the study applied, for each household type to be analyzed, 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 and wife not working outside 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 on Time Use and Leisure Activities. The average time spent for housework by men of one-person households is significantly shorter than that 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 for female one-person households was substituted for male one-person households.

Table 2 presents the time spent for basic activities and minimum time required for housework (T_1) in each household type. As described later, the types of households to be analyzed are consistent with those in the 2011 Survey on Time Use and Leisure Activities. In addition to the living hours of each household

type used in this study, the living hours used by the preceding studies (Vickery (1977) and Harvey at al. (2006)) are presented for a comparison. The basic activity time and minimum time required for housework assumed in this study are smaller than the values in the preceding studies, and the time-poverty line becomes lower for the difference. The likely reason is that, as revealed also by the international comparison made by the OECD (2011), the time spent by Japanese for leisure and personal care is shorter than that in other countries, and note should be taken to the fact that this time-poverty line reflects the conditions and customs of the Japanese people.

(iii). Setting a substitution rate for household labor

As described earlier, this study assumes the substitution of time with money such as the purchase of housework services (dining out, using childcare services, etc.) and confirms the approximate number of households that fall into income poverty because of such substitution. The price of housework services must be specified in this analysis, and the preceding studies set such a price using their original methods. Vickery (1977) assumed the substitution rate of household labor at 2.00 dollars to 2.50 dollars, stating that these prices were appropriate in comparison to the hourly wages of dishwashers and janitors of the time. The study, then, examined cases with a constant and incremental substitution rate (starting with low-price substitution such as dining out, then using high-price substitution such as childcare services later). Harvey at al. (2006) applied the minimum wage of the time (6.55 Canadian dollars in 1998) as the substitution rate for the calculation. Substitution rates for household labor might be determined in various ways, but this study applies the price per hour for each household service in the actual market. The specific household chores at T_1 include three (shopping, housework, and childcare) and inflection points were placed by following the actual time allocation to each of the household chores[2].

More specifically, home-delivery service for food and daily necessaries was assumed as the substitution for shopping, and the substitution rate was set at 833 yen per hour using the prices of chilled home-delivery service of a large shipping company as a reference[3]. For housework substitution (cleaning, washing, etc.), the study applied the price 3,240 yen (tax included) per hour for housekeeping services of a large housekeeping service company as the substitution rate. For childcare substitution in households with children aged 10 or younger, the hourly childcare service fee calculated from the monthly fees charged by certified day care centers in prefectural capitals presented in the 2011 Retail Price Survey of the MIC was applied to each child attending a preschool, and the hourly fee 4,464 yen (tax included) charged by a large childcare company was applied to each child other than those attending a preschool.

[2] In one-person households and couples without child household, childcare is not included in their household chores, because it is not necessary. Also in households with the youngest children aged 10 years old and over, childcare is not included in their household chores.

[3] We assume that they use chilled home-delivery service of a large shipping company 3 times a week, and it costs 2,916 yen per week (972 yen * 3). Suppose this service substitute for 30-minutes daily shopping, the hourly substitution rate is going to be 833 yen (972 yen / 0.5 hours * 7 days).

4. Data

Dataset used in this study is Japan Household Panel Survey (JHPS) conducted by Panel Data Research Center at Keio University. JHPS is the panel data intended for about 4,000 adult persons from 2009 and includes various fields of questions such as household attributes, employment status, income, life hours and residential status. In this paper, we used pooled samples from year 2011 (JHPS2011) to year 2013 (JHPS2013) including a question about commute time for the analysis.

In addition, we restricted the target sample to households which offer the information on living hours (mainly labor hours) of adult persons. In the JHPS, it only asks for respondents and their spouses about living hours, so in the case of a household which has another adult person, we cannot exactly grasp the information on those persons. Therefore, we excluded elderly households and mainly focused on the following categories in this analysis.

- One-person household (male)
- One-person household (female)
- Single-parent with children
- Couple with one child younger than 6
- Couple with two or more children younger than 6
- Couple with children who are all older than 6
- Couple without child

As a result, we use the samples of 2,544 households. The breakout of the data is as follows: One-person household (male) [n=221], One-person household (female) [n=141], Single-parent with children [n=73], Couple with one child younger than 6 [n=421], Couple with two or more children younger than 6 [n=185], Couple with children who are all older than 6 [n=893] and Couple without child [n=610]

5. Analytical results

A. Time poverty

First, the total working hours of a married couple (or the householder in the case of one-person and single-parent households), which constitute an important decisive factors of time poverty are confirmed in Figure 2. The working hours for one-person and single-parent households are fewer than 40 hours per week. A comparison only of cases in married-couple households work reveals that the working hours of households of double-income couples without children are the longest, followed by households consisting of double-income parents and one preschooler (younger than six years old). The total working hours of households having two or more preschoolers are the shortest. In other words, they may be adjusting their working hours according to their burden of childcare.

This kind of burden of housework might affect the combinations of how married couples work (Figure 3). Among the households with one preschooler, more than half of them are single earners, and 20% of them are double earners where husbands are full time workers and wives are part time workers. Among the households with more than two preschoolers, the share of this type of double earners is decreased, and the share of single earners is increased by 70%. On the other hand, among the households with the youngest child aged 6 years old and over, the share of single earners is decreased by 26%, and the share of double earners is increased significantly.

Subsequently, the level of time poverty by household type can be examined. Table 3 shows leisure time after subtracting the total working and commuting time (T_w) from allocatable time (T_a) and estimates the degree of time poverty of each household. Because the allocatable time (T_a) does not include the minimum time required for housework, a negative amount of leisure time suggests an inability to maintain the minimum required housework time, which is therefore considered a state of being '*time poor'*. Households with little leisure time are typically single-parent households. The average leisure time of all single-parent households is 6.3 hours per week. Among married-couple households, those in which both adults work outside the home apparently have less leisure time. The average leisure time of households with preschoolers (younger than six years old) is known to be particularly little. The percentage of households with a negative amount of leisure time, i.e., being '*time poor'*, by household type is the highest for single-parent households at 40%, followed by households consisting of two working parents and preschoolers(s) at 28%. Surprisingly, the time-poverty rate exceeds 10% even among one-person households. The time-poverty rate is less than 10% among the households with two parents and the youngest child aged six or older and households only of a married couple.

Except for one-person households, childcare is important factor underlying time poverty. What effect, then, does time poverty have on relationships with children in child-rearing households? Figure 4 presents the degree of difference in the frequency of having dinner with child(ren) in a week between '*time-poor'* households and time-rich households. While 70% of parents in the time-rich households answered that they had dinner with their children every day or five to six days a week, less than 50% of those in the '*time-poor'* households had dinner with their children almost every day; about 30% of them answered that they accompanied their children only once or twice a week. Although this is only an example, it demonstrates that time spent with children is reduced by long working hours and burdens of housework.

B. Two-dimensional poverty based on income and time

We estimated the poverty rate for each household type using a two-dimensional poverty line based on income and time exhibited in Figure 1. First, the income-poverty rate, time-poverty rate, and concurrent poverty rate (percentage of being both *income and time poor*) are examined for each household type (Table 4). Income poverty rates are measured somewhat higher, particularly for child-rearing households. One reason for this is that the calculation of the income-poverty line using assistance standards takes into

account childcare and education assistance in addition to housing assistance benefits. As found in the preceding studies, the data reveal that both income-poverty and time-poverty rates become higher in single-parent households and that even the concurrent poverty rate tends to be very high, at nearly 30%. The income-poverty and time-poverty rates in one-person households are also somewhat high at 10% to 20%. The concurrent poverty rate, however, is low, implying that income and time are in a trade-off relationship in one-person households. Among the two-parent households, those with both parents working full-time indicate low income-poverty but a high time-poverty rate.

Among the households that include preschooler(s) (younger than six years old), the concurrent poverty rate of households with two working parents is somewhat high. Both the income-poverty and time-poverty rates are low in households of a married couple without children, suggesting their affluence.

Subsequently, the percentages of the five poverty types presented in Figure 1 (“*not poor*,” “i*ncome poor but not time poor*,” “*both income and time poor*,” “*income poor after time adjustment*,” “*not income poor but time poor*”) were calculated for each household type (Table 5). As noted earlier, the percentage of “not income poor after time adjustment” was calculated on the assumption of substitution of household labor with housework services, including shopping, housework, and childcare, purchased in the market. The data show that 30.3% of the ‘*time poor’* households (2.4% of total households) would fall into income poverty and become “income poor after time adjustment” after increasing their allocatable time by purchasing housework services in the market. In particular, the percentages of one-person households and two-parent households having preschooler(s) are high at 5.2% and 4.1%, respectively. In other words, although the poverty line that measured only income revealed merely “*income-poor and time-poor*” and “*income poor but not time poor*” households as having problems, considering poverty by adding the perspective of time unearthed the need to include the “income poor after time adjustment” households into the poor in terms of income.

C. Multivariate regression analysis

This section presents examination of the relationships of factors such as time poverty, income poverty, and one-sided poverty (either time or income poor) with each variable using a logistic model. Out of the 2,544 households that have been analyzed thus far, the study analyzes 2,462 households having all variables used for multivariate analysis, of which 2,032 are married-couple households (households consisting of two parents and child(ren) and married-couple households without children). The descriptive statistics are presented in Table 6.

Table 7 exhibits the results estimated for all households by the model using time poverty, income poverty, and one-sided poverty as the explained variables. Table 8 displays the results estimated for only married-couple households (households consisting of two parents and child(ren)” and “married-couple households without children”) by the model using time poverty, income poverty, and one-sided poverty (*either income or time poor*) as the explained variables. The model using time poverty (1 if *time poor*,

otherwise 0) as the explained variable was added with income-poverty dummy (1 if income poor, otherwise 0) that would measure the relationship between income poverty and time poverty as a common variable, the householders' educational background categories (high-school graduate, and two-year college or technical college graduate, with university or graduate school graduate as the reference) as variables expressing the householders' productivity, the householders' age categories (every ten years from 20 years old with 60s as the reference), the regional categories of welfare benefits (six categories from Region 1-1 to Region 3-2 with Region 1-1 as the reference) as a variable to control the environmental factors of housing areas, and the survey year categories.

In addition, the analysis of all households used household type categories (one-person households, single-parent households, households with two parents and the youngest child aged six or older, and households with two parents and the youngest child aged less than six years, with married two-person households without child as the reference).

The analysis only of married-couple households used the categories of married couples' forms of work (full-time employed couple, full-time employed husband and part-time employed wife, self-employed couple, full-time employed husband and self-employed wife, other types of two-income households, one-income households, and jobless households, with one-income households as the reference), and number-of-children categories (zero, one, and two or more, with zero as the reference). The model of income poverty (1 if income poor, otherwise 0) used the same explanatory variables, except for the input of time-poverty dummy instead of the income-poverty dummy. The one-sided poverty (1 if *either income poor or time poor*, otherwise 0) model used the same explanatory variables except the income-poverty dummy and time-poverty dummy.

The relation between the household type with time poverty in Table 7 indicates a markedly high possibility of falling into time poverty for one-person households, single-parent households, and households with two parents and child(ren) younger than six years old, in contrast to the case of married two-person households. The potential of becoming *'time poor'* is shown to be particularly high for single-parent households. The odds of single-parent households are substantially high in the relationship between household types and income poverty. The possibility of income poverty is evidently the lowest for the married two-person households used as the reference.

The effect of the form of employment of married couples in Table 8 suggests a significantly high odds ratio of time poverty for two-income households, in contrast to one-income households, and the possibility of falling into time poverty is particularly high for full-time employed couples and self-employed couples. As for the relationships with income poverty, the possibility of becoming income poor is the lowest for households with full-time employed couples.

As for the effect of the number of children, although the possibility of time poverty is significantly higher for households with children than those without children, there is no evident tendency that such possibility changes depending on the number of children. The relationship with income poverty shows

that households with a larger number of children have a significantly higher possibility of falling into income poverty.

Concerning the relationship between time poverty and income poverty, the coefficient of income poverty dummy in the analysis of all households using time poverty as the explained variable is significantly negative (odds ratio of less than 1). The value in the analysis of married-couple households only is indicated also as negative but at a low significance level. In this connection, the effect of time poverty dummy in the analysis using income poverty as the explained variable shows a significantly negative relationship (odds ratio of less than 1) as well. The value in the analysis of married-couple households only, however, does not indicate a significant value.

The effect of the householders' educational background demonstrates that, in all estimation models of income poverty, that the higher the education received, the less likely the households are to fall into income poverty. For time poverty, the possibility of falling into time poverty is significantly low for university or graduate school graduates in the analysis only for the married-couple household. This might indicate that if educational background of individuals suggests the level of productivity, the higher the productivity of householders becomes, the better time can be managed and the less susceptible to time poverty the household becomes. This point, however, demands further examination.

The household heads' ages imply that the younger they are, the less susceptible to time poverty they are. The effect of householder age, however, weakens when the number of children in married-couple households is controlled. As for the effect of householders' ages on income poverty, no significant effect was observed from the analysis of all households, or from analysis of married-couple households: controlling the number of children removes the effect of householder age.

6. Conclusion

This analysis focused on whether people can secure the time required for household life (housework, child rearing and others), by defining poverty from two dimensions of time and income and estimating the time poverty level as well as the income poverty level in Japan by using the JHPS data. Many previous researches have pointed out the enlarging Japanese poverty level, using monetary indicators, but time is also one of the most important factors determining people's standard of living and it's a definite resource along with money.

There are several researches grasping poverty from two dimensions of income and time in other countries, but no research has employed this approach in Japan until now. We firstly clarified that employment statuses of husband and wife and the situation of child-rearing are important factors of time poverty. Particularly, single-parent households can easily fall into time poverty. In single-parent households, only one parent is available to undertake child-rearing and working, so it's very difficult to escape from time shortage without monetary and physical aid. However, this analysis couldn't include multi-generational households, such as with a grandparent (who can offer aids), for the data constraint.

Therefore, it's possible to overestimate the time poverty of single-parent households, and it is necessary to investigate further analyses using another survey.

As a second point, we confirmed that regarding double-earner couples with children, especially for double full-time employed parents, the time poverty rate is high, although income poverty rate is low.

As a third point, we estimated the level of income poor after time adjustment by household types. The normal income poverty rate is 12.5%, but time-adjusted income poverty rate which considered households lacking minimum time for the housework and buying homemaker services through the market amounted to 14.9%, increasing by 2.5 percentage points.

Finally, we describe several policy implications from the estimated results of the analysis. Firstly, the government needs to increase the policy support for single-parents with children because this type of household confronts severe situations of income poverty and time poverty at a high rate. Job assistance is one of the important policies as a measure for income poverty. However, as Tamiya and Shikata (2007) shows, the average labor hours of a single-parent is already too long compared to other OECD countries. Therefore, the assistances related to the direct reduction of their work and/or child-rearing loads are needed.

Secondly, the child-rearing supports for double-income couples with children are also needed. In recent years, the increase in the number of child-care facilities in urban areas has been occurring. However, the problem on 'waiting baby' has been continuing in the heart of Tokyo and other large cities. The female career path which enables them to combine child-bearing at a younger age and career progression after child-birth should be more accepted in the society of Japan.

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Figure 1 Outline of income poverty and time poverty

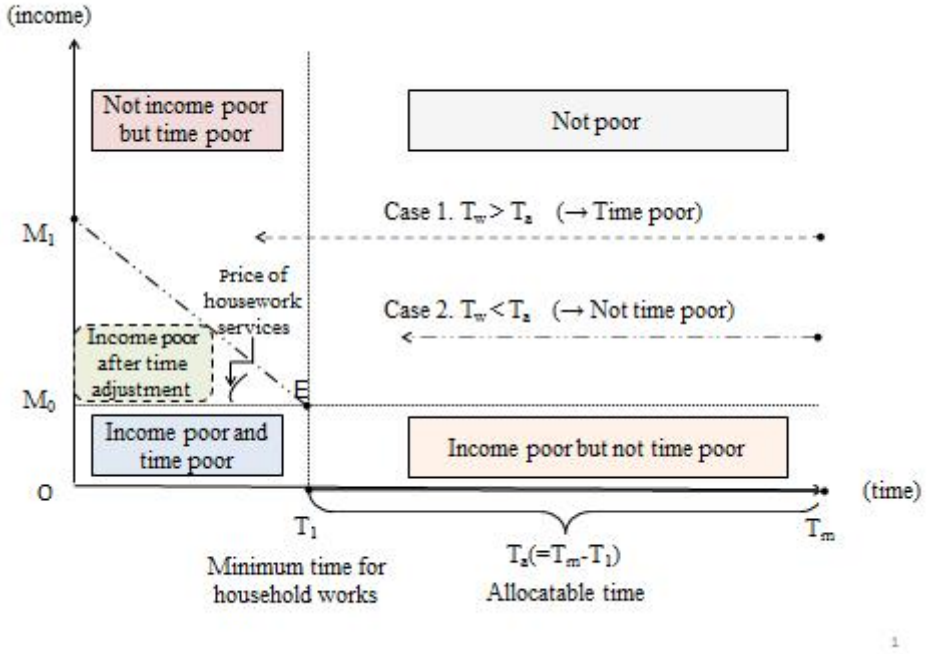


Table1. Average amounts of minimum living expenses by region

(Yen／month)

	Region 1-1, 1-2		Region 2-1, 2-2		Region 3-1, 3-2	
	mean	N	mean	N	mean	N
One-person household	121,698	196	103,805	103	79,415	63
Single-parent with children	239,611	35	189,157	25	184,202	13
Couple with child older than 6	234,897	420	221,643	265	190,865	208
Couple with a child younger than 6	233,906	201	219,492	111	190,723	109
Couple with two or more children younger than 6	242,988	85	218,979	54	204,127	46
Couple without child	145,122	254	117,536	202	107,840	154
Total	197,671	1,191	176,430	760	158,320	593

Source: Authors' calculations based on the JHPS2011-2013.

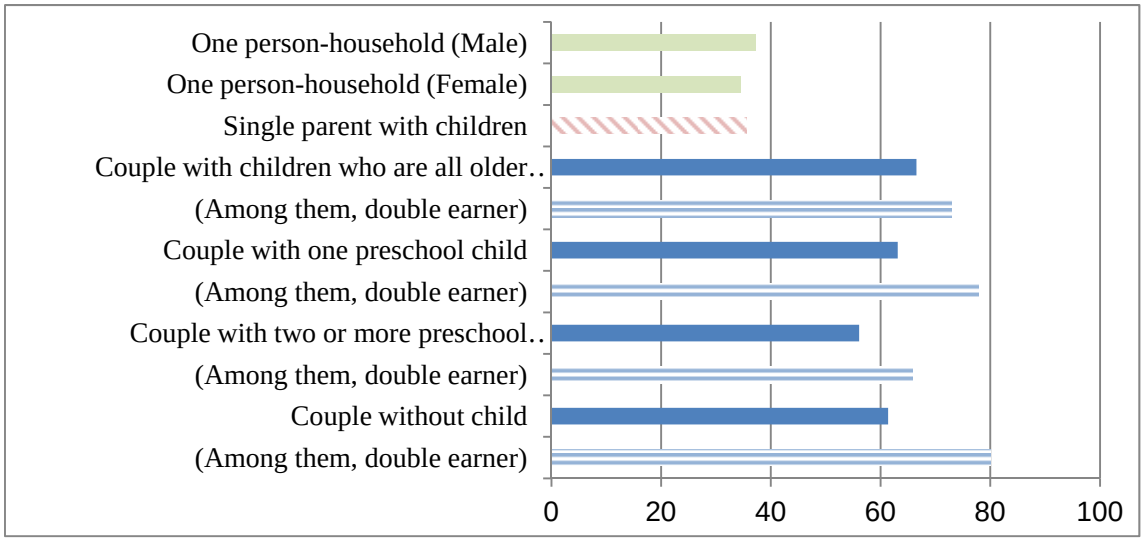
Table2. Minimum time required for basic activities and houseworks by household types

(hours)	7days (V)	Essential time (T_e)		T_m ($V-T_e$)	Minimum time required for the housework (T_1)				Allocatable time T_a (T_m-T_1)
			Leisure (weekday)		Housework	Childcare	Shopping	Total	
	week	week	day	week	day	day	day	week	week
Couple with children									
with children who are all older than 6	336	165.5	2.0	170.5	5.5	0.4	1.2	50.9	119.6
with one child younger than 6	336	165.5	2.0	170.5	4.0	5.0	1.1	71.3	99.2
with two or more children younger than 6	336	165.5	2.0	170.5	3.7	6.2	1.0	77.0	93.5
Vickery (1977): Couple with one child	336	162.8	2.0	173.2	-	-	-	62.0	111.2
Hervey et al. (2006): Couple with one child	336	175.0	4.0	161.0	-	-	-	74.6	86.4
Couple without children	336	165.5	2.0	170.5	4.3	0.1	1.1	39.4	131.1
Vickery (1977): Couple without children	336	162.8	2.0	173.2	-	-	-	43.0	130.2
Single parent with children	168	83.2	1.0	84.8	3.5	1.1	1.0	39.3	45.5
Vickery (1977): Single parent with one child	168	81.4	1.0	86.6	-	-	-	57.0	29.6
Hervey et al. (2006): Single parent with one child	168	87.5	2.0	80.5	-	-	-	52.0	28.5
One-person household (Male)	168	82.3	1.0	85.7	2.3	0.0	0.6	21.2	64.5
One-person household (Female)	168	83.2	1.0	84.8	2.3	0.0	0.6	21.2	63.6
Vickery (1977)	168	81.4	1.0	86.6	-	-	-	31.0	55.6

Note: Household types are categorized according to "Survey on Time Use and Leisure Activities".

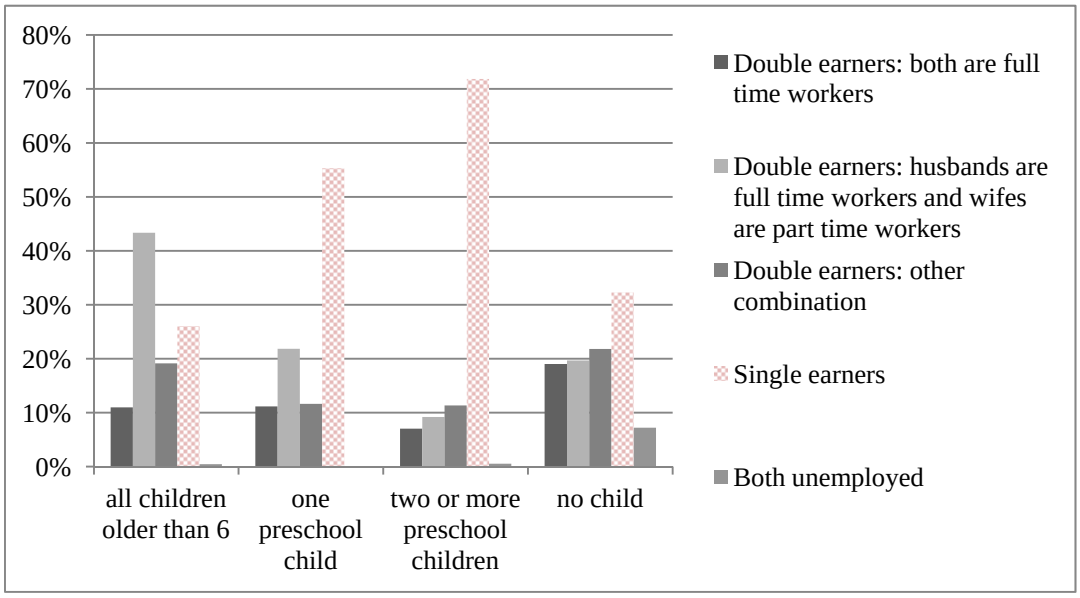
Source: Authors' calculations based on the JHPS2011-2013.

Figure2. Total working hours of adults by household types



Source: Authors' calculations based on the JHPS2011-2013.

Figure3. Working situation of couples by household types



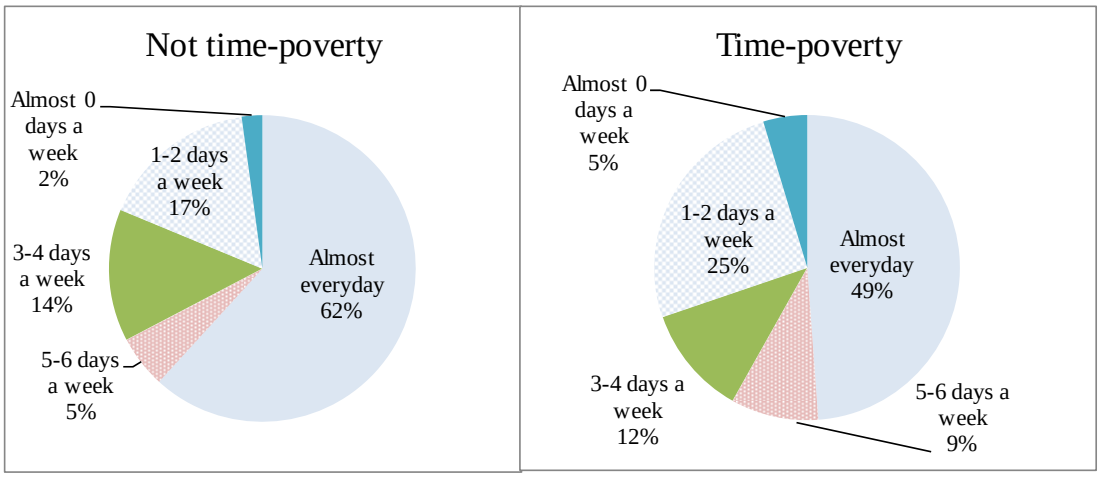
Source: Authors' calculations based on the JHPS2011-2013.

Table3. Amounts of leisure and time-poverty rate by household types

		Ta-Tw (hours/week)		Number of household		Time-poverty rate (%)
		Mean	S.D.		Number of household in time-poverty (Ta-Tw<0)	
One-person household (Male)		23.0	24.2	221	23	10%
One-person household (Female)		24.7	24.2	141	20	14%
Single parent with children		6.3	19.9	73	29	40%
Couple with children who are all older than 6	All	44.9	25.8	893	43	5%
	Double earner	38.1	24.6	656	42	6%
Couple with one or more preschool children	All	28.6	24.3	606	73	12%
	Double earner	13.6	25.4	239	67	28%
Couple without children	All	62.3	35.3	610	20	3%
	Double earner	42.2	25.8	369	20	5%

Source: Authors' calculations based on the JHPS2011-2013.

Figure4. Frequency of having dinner together with children



Source: Authors' calculations based on the JHPS2011-2013.

Table4. Time-poverty rate and income-poverty rate

		N	Income poverty	Time poverty	Both income- and time-poverty
One-person household (Male)		221	15.4%	10.4%	0.0%
One-person household (Female)		141	24.1%	14.2%	2.8%
Single parent with children		73	75.3%	39.7%	28.8%
Couple with children who are all older than 6 yrs old	Double earners: both are full time workers	98	3.1%	17.3%	0.0%
	Double earners: husbands are full time and wifes are part time	387	5.2%	2.6%	0.0%
	Double earners: others	171	19.9%	8.8%	0.6%
	Single earner	233	10.3%	0.4%	0.0%
	Both unemployed	4	-	-	-
Couple with one or more preschool children	Double earners: both are full time workers	60	8.3%	56.7%	5.0%
	Double earners: husbands are full time and wifes are part time	109	12.8%	16.5%	2.8%
	Double earners: others	70	30.0%	21.4%	2.9%
	Single earner	366	13.9%	1.6%	0.3%
	Both unemploted	1	-	-	-
Couple without child	Double earners: both are full time workers	116	1.7%	7.8%	0.9%
	Double earners: husbands are full time and wifes are part time	120	0.0%	2.5%	0.0%
	Double earners: others	133	3.0%	6.0%	0.0%
	Single earner	197	4.6%	0.0%	0.0%
	Both unemployed	44	-	-	-
	Total	2,544	12.5%	8.2%	1.4%

Note：The poverty rates are not shown when the numbers of observation are less than 50.

Source: Authors' calculations based on the JHPS2011-2013.

Table5. Two-dimensional poverty rates by household types

		Income-poverty			
			Time-poverty		
	Not poor	Income poor but not time poor	Both income and time poor	Income poor after time adjusted	Not income poor but time poor
One-person household	70.4%	17.7%	1.1%	5.2%	5.5%
Single parent with children	13.7%	46.6%	28.8%	2.7%	8.2%
Couple with children who are all older than 6	86.0%	9.2%	0.1%	1.5%	3.2%
Couple with one or more preschool children	74.3%	13.7%	1.5%	4.1%	6.4%
Couple without child	93.6%	3.1%	0.2%	0.3%	2.8%
Total	80.7%	11.1%	1.4%	2.4%	4.4%

Source: Authors' calculations based on the JHPS2011-2013.

Table6. Summary statistics

	All households			Married-couple household		
	N	mean	S.D.	N	mean	S.D.
Time-poverty dummy	2,462	0.08	0.28	2,032	0.06	0.25
Income-poverty dummy	2,462	0.13	0.33	2,032	0.09	0.29
One-sided poverty dummy	2,462	0.20	0.40	2,032	0.15	0.36
Household type						
One-person household	2,462	0.15	0.35			
Single-parent with children	2,462	0.03	0.17			
Couple with children who are all older than 6	2,462	0.36	0.48			
Couple with one or more children younger than 6	2,462	0.24	0.42			
Couple without child (ref)	2,462	0.23	0.42			
Working conditions of couples						
Double earner: both employed full time				2,032	0.12	0.33
Double earner: full time employed hasband and part-time employed wife				2,032	0.30	0.46
Double earner: both self-employed				2,032	0.04	0.20
Double earner: full time employed husband nad self-employed wife				2,032	0.05	0.22
Double earner: other combinations				2,032	0.38	0.49
Single earner (ref)				2,032	0.37	0.48
Both unemployed				2,032	0.02	0.15
Number of children						
zero (ref)				2,032	0.28	0.45
one child				2,032	0.20	0.40
two or more children				2,032	0.52	0.50
Householders' educational level						
High school graduate	2,462	0.41	0.49	2,032	0.40	0.49
Two-year college and technical school	2,462	0.16	0.36	2,032	0.15	0.36
Four-year college and graduate school (ref)	2,462	0.43	0.50	2,032	0.45	0.50
Householdres' age category						
20's	2,462	0.05	0.23	2,032	0.04	0.19
30's	2,462	0.29	0.45	2,032	0.30	0.46
40's	2,462	0.35	0.48	2,032	0.38	0.48
50's	2,462	0.18	0.39	2,032	0.18	0.39
60's (ref)	2,462	0.12	0.33	2,032	0.11	0.31
Area of living as the regional category of welfare benefit						
Region 1-1 (ref)	2,462	0.29	0.46	2,032	0.28	0.45
Region 1-2	2,462	0.18	0.38	2,032	0.18	0.39
Region 2-1	2,462	0.23	0.42	2,032	0.23	0.42
Region 2-2	2,462	0.07	0.26	2,032	0.07	0.26
Region 3-1	2,462	0.17	0.38	2,032	0.18	0.39
Region 3-2	2,462	0.06	0.24	2,032	0.06	0.24
Survey year						
2011 dummy	2,462	0.38	0.48	2,032	0.38	0.49
2012 dummy	2,462	0.33	0.47	2,032	0.33	0.47
2013 dummy (ref)	2,462	0.29	0.46	2,032	0.29	0.46

Source: Authors' calculations based on the JHPS2011-2013.

Table7. Logit analysis of time-poverty and income-poverty (All household types)

Model.	1		2		3	
	Time-poverty		Income-poverty		One-sided poverty	
	odds ratio	z	odds ratio	z	odds ratio	z
Household type						
One-person household	3.52 ***	4.15	6.50 ***	6.68	5.40 ***	7.85
Single-parent with children	23.90 ***	7.90	104.01 ***	11.65	78.29 ***	11.07
Couple with children who are all older than 6	1.13	0.39	3.15 ***	4.02	2.13 ***	3.52
Couple with one or more children younger than 6	3.06 ***	3.74	4.70 ***	5.22	3.90 ***	6.11
Couple without child (ref)						
Income-poverty dummy	0.58 **	-2.17				
Time-poverty dummy			0.59 **	-2.04		
Householders' educational level						
High school graduate	0.93	-0.43	2.35 ***	5.48	1.66 ***	4.11
Two-year college and technical school	0.76	-1.18	2.14 ***	3.88	1.25	1.32
Four-year college and graduate school (ref)						
Householdres' age category						
20's	5.39 ***	3.13	1.07	0.18	1.80 *	1.93
30's	4.71 ***	3.13	1.49	1.39	2.25 ***	3.21
40's	4.71 ***	3.13	0.70	-1.20	1.33	1.11
50's	4.27 ***	2.86	1.01	0.02	1.56 *	1.70
60's (ref)						
Area of living as the regional category of welfare benefit						
Region 1-1 (ref)						
Region 1-2	0.68 *	-1.69	0.99	-0.05	0.94	-0.43
Region 2-1	0.54 ***	-2.71	0.54 ***	-3.20	0.59 ***	-3.32
Region 2-2	0.96	-0.12	0.32 ***	-3.50	0.57 **	-2.37
Region 3-1	0.80	-0.97	0.56 ***	-2.76	0.68 **	-2.21
Region 3-2	0.77	-0.77	0.31 ***	-3.36	0.43 ***	-3.13
Survey year						
2011 dummy	1.12	0.58	1.20	1.10	1.12	0.82
2012 dummy	1.06	0.31	1.08	0.47	1.01	0.08
2013 dummy (ref)						
N	2462		2462		2462	
Log likelihood	-629.41		-778.05		-1045.74	
Pseudo R^2	0.102		0.170		0.140	

Source: Authors' calculations based on the JHPS2011-2013.

Note: *** refers to a significant level at 1%, while ** is at 5% and * at 10%.

Table8. Logit analysis of time-poverty and income-poverty (Married-couple households)

	4		5		6	
	Time-poverty		Income-poverty		One-sided poverty	
	odds ratio	z	odds ratio	z	odds ratio	z
Working conditions of couples						
Double earner: both full time employed	41.81 ***	8.85	0.42 **	-2.26	3.52 ***	6.23
Double earner: full time employed hasband and part-time employed wife	0.21 ***	-4.75	0.21 ***	-5.35	0.18 ***	-7.09
Double earner: both self-employed	32.47 ***	6.76	2.94 ***	3.40	5.79 ***	6.15
Double earner: full time employed husband and self-employed wife	5.68 ***	2.87	0.68	-0.95	1.10	0.30
Double earner: other combinations	31.54 ***	7.27	2.44 ***	3.35	5.01 ***	6.95
Single earner (ref)						
Number of children						
zero (ref)						
one child	3.22 ***	3.45	2.34 **	2.18	2.66 ***	3.74
two or more children	2.90 ***	3.43	6.62 ***	5.29	4.78 ***	6.51
Income-poverty dummy	0.49 *	-1.86				
Time-poverty dummy			0.65	-1.16		
Householders' educational level						
High school graduate	0.72	-1.48	1.81 ***	3.16	1.33 *	1.92
Two-year college and technical school	0.52 **	-2.04	1.54 *	1.80	1.03	0.15
Four-year college and graduate school (ref)						
Householdres' age category						
20's	6.05	1.49	3.04 *	1.90	4.09 ***	2.79
30's	14.88 ***	2.57	2.19	1.53	4.23 ***	3.37
40'	6.20 *	1.73	0.90	-0.22	1.69	1.22
50's	4.89	1.50	1.58	0.92	2.24 *	1.88
60's (ref)						
Area of living as the regional category of welfare benefit						
Region 1-1 (ref)						
Region 1-2	0.96	-0.13	1.00	0.01	1.02	0.12
Region 2-1	0.62	-1.53	0.68 *	-1.65	0.65 **	-2.22
Region 2-2	1.68	1.36	0.41 **	-2.21	0.80	-0.80
Region 3-1	0.97	-0.10	0.87	-0.55	0.86	-0.75
Region 3-2	0.47 *	-1.66	0.47 *	-1.83	0.42 ***	-2.58
Survey year						
2011 dummy	1.30	1.06	1.37	1.56	1.29	1.55
2012 dummy	1.25	0.89	1.18	0.76	1.17	0.91
2013 dummy (ref)						
N	2032		2032		2032	
Log likelihood	-376.23		-540.06		-751.02	
Pseudo R^2	0.225		0.147		0.140	

Source: Authors' calculations based on the JHPS2011-2013.

Note: *** refers to a significant level at 1%, while ** is at 5% and * at 10%.