Decoupling Happiness from CO_2 Emissions: An empirical analysis

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ABSTRACT

In order to achieve a sustainable society, decoupling of both economic growth and quality of life from environmental burden is required. Here we look into the second relationship in order to see whether we find empirical evidence for a coupling or decoupling. In this study, we measure quality of life in terms of happiness, a self-reported subjective measure. The panel analysis is performed on a household level for both environmental burden calculated in terms of CO_2 emission and happiness of the female household member. Therefore, the Japanese Panel Survey of Consumers (JPSC) from the Institute for Research on Household Economics (IRHE) was used for four consecutive years. CO_2 emissions were calculated based on the information on household consumption and a hybrid-LCA analysis. About 14 percent of the sample households had increased happiness during the period of analysis. Among these individuals, 3.8-4.5 achieved an increase in happiness and decrease in CO_2 emissions from household consumptions by >5 percent. The results indicated the possibility that there exist individuals who green their consumption patterns by reducing CO_2 emission and increase their happiness at the same time.

OBJECTIVE

Governments at all levels, corporations, non-governmental organizations, and the general public, are engaging with the concept of sustainability today. The early environmental movement first brought the issue of balancing between economic development and environmental quality to the attention of the public. The concept of "decoupling" that refers to breaking the link between environmental burden and economic goods has become adopted as one of the main focuses in decision-making processes of various stakeholders. For example, the Government of the United Kingdom built its sustainable development strategy to provide details on how to take the agenda of sustainable consumption and production forward [1]. Eighteen indicators were chosen to set out to monitor the effectiveness of the Strategy and planned actions for sustainable consumption and production, including either "absolute" or "relative" decoupling the environmental burden resulting directly or indirectly from household consumption activities. However, most, if not all, of the indicators monitor only changes of economic growth and environmental damage over time.

More recently, the developed countries have been struggling with expanding the original concept of sustainable development from one of meeting environmental concerns while maintaining economic development, to a more holistic concept where economic, environmental and social considerations are integrated in decision-making (a.k.a. Triple-bottom line). For example, the working definition of sustainable consumption from the Norwegian Ministry of Environment (The "Oslo Symposium" in 1994) - that has also been adopted by OECD, the Commission on Sustainable Development (CSD) and many other actors states [2][3]:

> *"The use of services and related products which respond to basic needs and bring a better quality of life while minimizing the use of natural resources and toxic materials as well as the emissions of waste and pollutants over the life cycle so as not to jeopardize the needs of future generations."*

According to this definition, sustainable consumption shall attempt to minimize environmental burden linked to consumption while maximizing quality of life (QoL) and happiness during that time.

QoL is measured by different indicators based on subjective components (feelings) and objective components (conditions) on an individual and on a community level. QoL offers a balanced set of indicators that are valued differently in different cultures but are able to capture most aspects of an utility function. This balanced nature comes at the expense of always defining the set of indicators related to cultural aspects and of having to deal with a multitude of indicators. According to Hancock (2000) [4] the process of which quality of life indicators are developed (particularly at the community level) is at least as important as what is meant by QoL. For our question about the influence of consumption and possibilities to change consumption patterns, the subjective components of quality of life could be relevant. Based on an extensive literature review (Hofstetter and Madjar, 2003) [5], we suggested that self-reported happiness might be a good measure to capture a number of aspects relevant to QoL and subjective well-being. The arguments of relevance of our choice were discussed in Hofstetter *et al.* (2006) [6].

RESEARCH METHODS

Data and variables used

The Japanese Panel Survey of Consumers (JPSC) dataset, provided by the Institute for Research on Household Economics (IRHE) of Japan, was used for this study. All of the respondents chosen for this survey were the same young Japanese women in the midst of various life-stage experiences, such as graduation from college, employment, marriage, childrearing, or remaining single. The JPSC survey, conducted every September, is abundant in variables including: i.e. life events, employment status, household income and expenditure, savings, type of household, and time-use. Questions concerning life satisfaction have been included in the questionnaire survey since 1993, and questions concerning happiness since 1995. Happiness was measured in five scales as follows: Question: Do you consider yourself happy or unhappy? Self-reported scores: 1 = Unhappy, 2 = Rather unhappy, 3 = Average, 4 = Rather happy, 5 = Very happy. The cohort chosen for panel analysis started with 1,500 women, ranging from 24-34 years old in 1993, and geographically distributed throughout the nation. The statistical software SPSS v.12.0J was used to perform the panel analysis[1]. The used variables are: happiness, number of family members, household expenditure for the month of September and household possession of durable consumer goods. The amounts paid through loans are embedded in each category. Only Panels 6 (1998) - 9 (2001) were used because the household expenditure data are not available in the survey years before 1998. Therefore, all the results with time period of analysis are for 1998-2001; otherwise stated. Only individuals who answered the questions for all four years were chosen for the analysis. However, some missing values are found, depending on the individuals and variables.

Empirical analysis on the possibility of decoupling

The followings are the empirical questions for the possibility of decoupling between happiness and household consumption:

Q1: whether there are people that get happier over time and reduce at the same time their environmental impacts,

Q2: how the relative change of consumption over, e.g., four years in terms of environmental impacts differs between the group of people that increased, kept constant and lowered their happiness level, and

Q3: whether the absolute happiness level and the relative change over several years in happiness differs for the 10% of people consuming most and the 10% of people consuming least.

Consuming could be expressed in terms of environmental impacts or CO_2-emissions. We transformed all information on expenditure and possession of durable goods for each of the sample household for each year from 1998-2001 into an aggregate estimate for CO_2-emissions. In order to correct constantly for family size, these CO_2-emissions were divided yearly by the number of family members. Therefore, all the CO_2 emissions results mentioned in the following sections are for "per person."

Calculation of CO_2 emissions from the household consumption data

Detailed calculation method for CO_2 emissions from household consumption data is described elsewhere [7]. Briefly, we looked at three categories of CO_2 emissions; the calculations were expressed in Equations 1, 2 and 3.

- CO_2 emissions due to household expenditure (kg-CO_2/person-year):

  CO_2 (HE) = HE x 12 (months/year) x I_{HE}/n (1)
- CO_2 emissions due to household possession of durable consumer goods (kg-CO_2/person):

  CO_2 (possession) = PDG x price (yen/piece) x I_{DG}/n (2)
- CO_2 emissions due to the use of household durable consumer goods (kg-CO_2/person-year):

  CO_2 (use) = PDG x EI x T x I_{EC}/n (3)

where,

HE: household expenditure per category for the month of September (yen/month-household),

I_{HE}: CO_2 intensity per expense category (kg-CO_2/yen),

I_{DG}: CO_2 intensity per durable consumer good (kg-CO_2/item),

I_{EC}: CO_2 intensity per energy consumed,

PDG: household possession of durable consumer goods (piece/household),

EI: energy intensity (kW or L gasoline, kerosene, or m^3 city gas, etc.),

T: operation time per year (hour/year), and

n: number of family members (person/household).

All three items are calculated based on the data on household expenditure for the month of September (1,000 Yen) and household possession of durable consumer goods (piece) from JPSC data. The CO_2 intensities were obtained either from 3EID based on the Input-Output analysis [8] or process life cycle inventory, depending on the item. We recognized through our previous work that the CO_2 emission based on household expenditure with JPSC data poorly fit other data for Japanese CO_2 emissions due to limitations of JPSC data [7].

RESULTS AND DISCUSSION

Current status of average happiness level and CO_2 emissions linked to household consumption in Japan

Figure 1 show the trends of average happiness and life satisfaction between 1993 and 2001. The average values for happiness level dropped by 0.20 points between 1995 and 2001, whereas the life satisfaction level dropped by 0.14 points between 1993 and 2001, implying a slight decline for

[1] Toshisuke Ozawa, who is an approved user of the JPSC data performed the analysis.

both in the last decade in Japan.

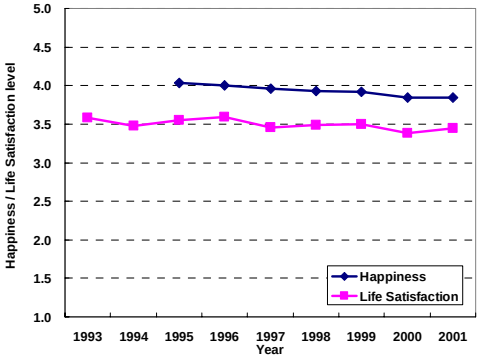

Figure 1 Trends of average happiness and life satisfaction levels

Figure 2 shows CO_2 emissions due to household expenditure. Dominant items for CO_2 emission are utility (water, gas and electricity) (59.4%), food (19.3%) and transportation (18.3%). The total emission is on a rise by 20 percent from 1,950 to 2,310 kg-CO_2/year between 1998 and 2001, and it is mainly due to the increase of utility (126 kg-CO_2) and transportation (173 kg-CO_2).

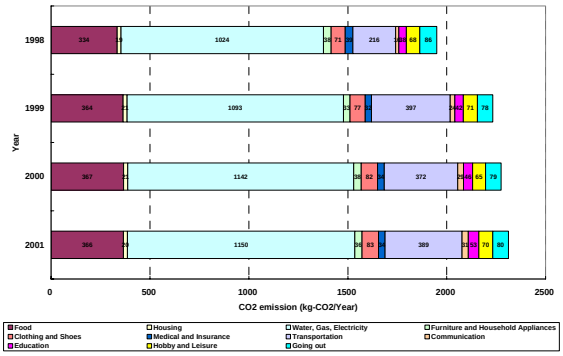

Figure 2 CO_2 emissions due to household expenditure (kg-CO_2/person-year)

Figures 3 and 4 show CO_2 emissions due to possession and use of durable consumer goods, respectively. The total amount of CO_2 emission due to possession of goods increased by 6.1 percent from 2,390 to 2,540 kg-CO_2 in the 1998-2001 period. The dominant cause of the CO_2 emission is automobile which accounts for 67 percent of the entire emission, followed by air conditioner (5%) and fan heater (0.8%). The total CO_2 emissions due to the use of household durable consumer goods (Figure 4) account for about a half of possession emission. Again, the emission increased by 5.1 percent from 1,285 to 1,350 kg-CO_2/year in the same period. The dominant causes are again, automobile (63.7%), fan heater (13.7%) and air conditioner (9.2%).

Empirical analysis on the possibility of decoupling

The numbers of individuals and percentages of cross-tabulation table between shifts of happiness scores and shift of household CO_2 emissions (%) during the 1998-2001 period is shown in Table 1. It appears that about 14 percent of individuals had increased happiness during the period of analysis (12th column from left). Among those individuals, 3.8-4.5 percent (52-61 individuals) achieved an increase in happiness and decrease in CO_2 emissions from household consumptions by over 5 percent. Although small in number, those individuals get happier over time and reduce at the same time their environmental impacts. The results suggest that decoupling of happiness from household consumption is taking place for some individuals.

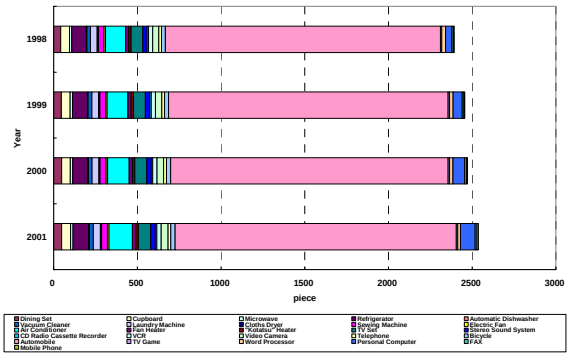

Figure 3 CO_2 emissions due to household possession of durable consumer goods (kg-CO_2/person)

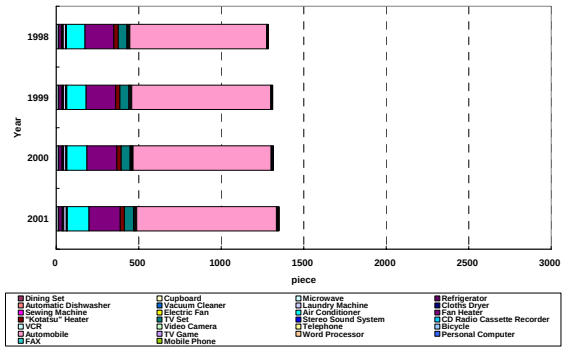

Figure 4 CO_2 emissions due to the use of household durable consumer goods (kg-CO_2/person-year)

	Shift o CO2 emission (%) over time	Shift of Happiness ↓ n	→ n	↑ n	Total	Shift of Happiness ↓ %	Total	→ %	Total	↑ %	Total	Total
Household expenditure	<-50	24	43	15	1334	8.9	24.2	19.6	61.4	4.2	14.4	100
	-50 - -25	38	86	18								
	-24.9 - -5	57	133	23								
	-4.9 - 4.9	29	86	19		6.1		16.4		3.7		
	5-24.9	52	133	31								
	25-49.9	41	122	21		9.2		25.3		6.4		
	50-99.9	42	85	25								
	100-499.9	36	90	29								
	>500	4	41	11								
Possession of household durable consumer goods	<-50	19	37	13	1367	7.5	24.9	15.1	60.7	3.8	14.4	100
	-50 - -25	45	78	20								
	-24.9 - -5	38	92	19								
	-4.9 - 4.9	105	235	40		12.8		30.6		6.5		
	5-24.9	70	183	49								
	25-49.9	20	68	9		4.6		15.0		4.1		
	50-99.9	20	59	10								
	100-499.9	18	52	29								
	>500	5	26	8								
Use of household durable consumer goods	<-50	23	45	12	1366	7.5	24.9	17.0	60.7	4.5	14.4	100
	-50 - -25	36	76	24								
	-24.9 - -5	44	111	25								
	-4.9 - 4.9	115	237	41		12.5		28.3		5.7		
	5-24.9	56	149	37								
	25-49.9	21	73	18		4.8		15.4		4.2		
	50-99.9	23	55	7								
	100-499.9	16	59	26								
	>500	6	24	7								

Table 1 The numbers and share of individuals shifts of happiness levels and of household CO_2 emissions (%) for 1998-2001

In order to assess the relative decoupling between happiness and household CO_2 emission, the mean values of the change of cumulated consumption over four years in terms of CO_2 emissions for the groups of people that increased ($\uparrow$), kept constant ($\rightarrow$) and lowered ($\downarrow$) happiness levels during the period of 1998 and 2001 were plotted in Figure 5. The error bars represent standard deviation. The circles represent significant difference at $p<0.05$ in comparison with the change of CO_2 emissions of those who decreased happiness. The individuals with increased happiness exhibited the largest increase in CO_2 emissions; those who had decreased happiness exhibited lowest increase or even decrease in CO_2 emissions. It suggests that there is a sign of "coupling" between change of happiness level and change of household CO_2 emission.

Figure 5 The mean values of the cumulated emission of CO_2 over four years for the groups of people that increased (↑), kept constant (→) and lowered (↓) happiness levels during the period of 1998 and 2001 (kg-CO_2/person)

Figure 6 shows the comparisons of absolute happiness level and the relative change over four years in happiness between the top 10% of people consuming most (90 percentile) and lowest 10% of people consuming least (10 percentile) in terms of household expenditure.

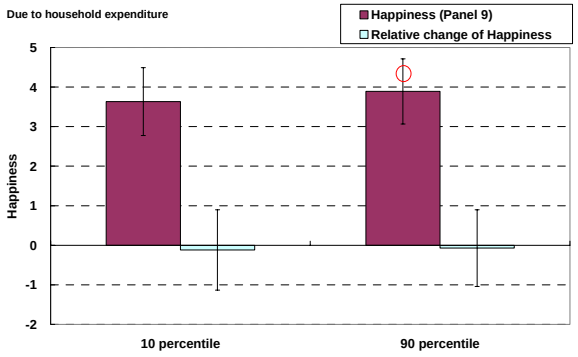

Figure 6 Comparisons of absolute happiness level and the relative change over four years in happiness between the top 10% of people consuming most and lowest 10% of people consuming least in terms of household expenditure.

A statistical significance (○ in Figure 6) was found in the difference in absolute happiness between the 10 percentile and 90 percentile in household consumption. The relative change of happiness was negative value and it has no statistical significance with respect to the degree of household consumption.

SUMMARY OF FINDINGS

Followings are the findings from the three empirical analyses on the possibility of decoupling:

1. Although small in number, there exist people that get happier over time and reduce at the same time their environmental impacts. It indicates that decoupling of happiness and household consumption is taking place.
2. There is an indication of "relative coupling" between consumption over four years in terms of CO_2 emission and happiness level.
3. Absolute happiness level is higher for the 10% of people consuming most than the 10% of people consuming least.

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