

Allocation of Time and Consumption-Equivalent Welfare: A Case of South Korea

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Roadmap

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What we did

- We document the allocation of time in market work, nonmarket work, child care, leisure using 2014 KLIPS survey, the first and most detailed time use survey in South Korea.
- We measure household-level consumption-equivalent welfare that consider consumption, (quality of) leisure, life expectancy, etc.
- We show that welfare measures that rely solely on income or consumption may be incomplete and misleading.

Main findings

- Time use in market work, nonmarket work, child care, and leisure
 - ▶ Men work longer hours, but their extra work is well-compensated by more leisure and less hours in nonmarket work and child care.
 - ▶ Leisure hour is a luxury good, consistent with observations in US and other advanced countries.
- Consumption-equivalent welfare

Motivation

- Understanding on how economic agents allocate their time helps explain the various aspects of economic activities.
 - ▶ Ghez and Becker (1975): substitutability of market and nonmarket work
 - ▶ Greenwood et al. (2005): home production and women's labor market participation
 - ▶ Aguiar et al. (2016): video games and a recent decline in hours of young and less-educated men in US
- South Koreans work the second-longest hours among OECD countries, but with relatively low labor productivity.
 - ▶ Huge implication on quality of life and economic welfare
 - ▶ Lack of detailed micro-level data on time use in South Korea

Data

- KLIPS (Korean Labor and Income Panel Study)
 - ▶ Host organization: Korean Labor Institute
 - ▶ Annual panel data of 5,000 households living in urban area, starting from 1998
 - ▶ household/personal/additional survey
- We use 2014 additional survey on “Time Usage and Quality of Life,” the first and most detailed time use data in South Korea
- 2004 vs. 2014 additional survey
 - ▶ 2004 survey has far fewer questions and thus provides far less detailed information.
 - ▶ It reports only total market hours and leisure.

Sample and Classifications

- Respondents aged 25 through 65 that are neither students nor retirees
- we try to follow the classifications in Aguiar and Hurst (2007) as closely as possible to make our results comparable.

Time use classification	Activities included
(1) core market work	main and side job
(2) total market work	(1) + commuting + job search
(3) nonmarket work	house-keeping activities
(4) child care	parenting
(5) leisure measure 1	leisure activities
(6) leisure measure 2	(5) + sleeping + personal care
(7) leisure measure 3	(6) + childcare
(8) leisure measure 4	(7) + others

Individual-level time use

- According to OECD statistics, an average employed South Korean tends to work 2,124 hours in 2014, second to Mexico among OECD countries.
 - ▶ In our dataset, the annual working hours amount to 2,320 hours.
 - ▶ The share of employee who work longer than 52 hours per week is 23.6%.
- Controlling for demographic, job-related variables, and others, men work longer by 3.67 hours.
- However, their extra work is well compensated by less nonmarket work (12.2 hours less), less childcare hours (0.36 hours less), and longer leisure (8-9 hours).

Regression, Individual-level

(a) Average hours per week, by categories

time-use category (hours per week)	employed				
	full	women	men	women	men
(1) core market work	34.84	25.43	44.55	42.81	48.80
(2) total market work	39.89	29.16	50.96	48.64	55.57
(3) nonmarket work	11.89	20.65	2.85	15.85	2.64
(4) child care	4.57	6.69	2.38	3.89	2.54
(5) leisure measure 1	37.73	37.06	38.42	27.83	35.06
(6) leisure measure 2	107.93	107.09	108.78	96.83	104.97
(7) leisure measure 3	112.49	113.78	111.16	100.72	107.51
(8) leisure measure 4	116.22	118.19	114.19	103.51	109.80
(2) + (3)	51.78	49.81	53.81	64.49	58.20
(2) + (3) + (4)	56.35	56.49	56.19	68.38	60.74
sample size	6,727	3,416	3,311	2,021	3,021

Individual-level, weekly

	Dependent Variables				
	core market work	nonmarket work	child care	leisure measure 1	leisure measure 4
male	3.58** (9.11)	-12.15** (-61.76)	-0.36** (-5.32)	8.59** (27.57)	9.43** (23.12)
high-skilled worker	-2.73** (-7.02)	0.18 (1.04)	0.20** (3.51)	0.89** (2.63)	1.65** (3.94)
ln(labor income)	2.85** (8.92)	-1.55** (-11.11)	-0.04 (-0.92)	-0.92** (-3.46)	-1.39** (-4.08)
married	-0.88* (-1.81)	2.72** (12.23)	0.57** (5.57)	-5.69** (-14.11)	-5.65** (-11.27)
part-time job	-10.27** (-9.91)	2.25** (4.10)	0.22* (1.90)	3.83** (4.52)	7.29** (6.10)
regular job	-2.14** (-5.06)	-0.00 (-0.02)	0.27** (4.62)	0.44 (1.27)	0.73* (1.66)
private company	2.52** (5.86)	-0.38* (-1.91)	-0.20** (-3.01)	-1.02** (-2.88)	-2.44** (-5.42)
medium and small firms	-0.33 (-0.89)	-0.09 (-0.48)	-0.08 (-1.38)	-0.49 (-1.57)	0.06 (0.16)
Seoul	2.02** (4.58)	0.39* (1.81)	0.14** (2.00)	-1.20** (-3.20)	-3.52** (-7.64)
metropolitan areas	0.80** (2.01)	0.31* (1.84)	0.14** (2.40)	-0.71** (-2.22)	-1.53** (-3.72)
age (31-40)	-0.68 (-0.99)	3.31** (9.44)	0.36* (1.81)	-1.92** (-3.20)	-3.68** (-4.77)
age (41-50)	-0.58 (-0.80)	4.48** (12.38)	-0.55** (-2.90)	-0.33 (-0.53)	-2.43** (-3.00)
age (51-60)	0.18 (0.23)	3.60** (9.54)	-0.77** (-4.12)	0.53 (0.82)	-1.30 (-1.55)
age (61-65)	-1.77* (-1.71)	2.82** (6.51)	-0.59** (-2.54)	1.79** (2.15)	1.90* (1.74)

Trends in time use over the decade: 2004-2014

- According to OECD statistics, South Korea has the fastest shortening working time in OECD.
- We have 3 comparable time use categories from 2004 and 2014 survey: total market work, leisure measure 1, leisure measure 2
- Trend in total market work
 - ▶ Over the decade, hours in total market work decline by 2.8 hours.
 - ▶ And this decline is more noticeable for employed women by 8.8 hours.
- Trend in leisure
 - ▶ Interestingly, leisure measure 1 does not change much.
 - ▶ Leisure measure 2 increases by 10 hours (mostly from an increase in sleeping and personal care)

Trend, 2004-2014

	total market work		leisure measure 1		leisure measure 2	
	2004	2014	2004	2014	2004	2014
(1) full	40.12	37.36	38.97	38.89	99.30	109.39
(2) women	29.56	26.30	38.86	38.47	99.50	108.94
(3) men	51.01	49.70	39.09	39.35	99.10	109.89
(4) women, employed	57.40	48.64	28.16	27.83	86.86	96.83
(5) men, employed	62.69	55.57	34.57	35.06	93.35	104.97

Household-level time use

- Double-income family works longer, spend less hours in nonmarket work, enjoys less leisure, and spends less hours in child care.
- For single-income family, non-working spouse spends more time in nonmarket work and child care.
- Having an infant (age 0-6) reduces leisure while having a kid (age 7-18) does not much.

Household-level, weekly

(a) Average hours per week, by categories

time-use category (hours per week)	all	double-income family	single-income family	with infant(s)	with children
(1) core market work	34.88	45.44	24.45	30.73	34.85
(2) total market work	39.75	51.45	28.19	35.54	39.85
(3) nonmarket work	13.27	10.73	15.78	13.52	13.53
(4) child care	5.98	4.09	7.85	14.05	7.28
(5) leisure measure 1	35.91	29.98	41.76	30.91	34.53
(6) leisure measure 2	105.94	99.45	112.35	101.08	104.21
(7) leisure measure 3	106.82	100.12	113.43	101.91	105.04
(8) leisure measure 4	109.87	102.40	117.25	105.72	108.16
(2)+(3)	53.02	62.18	43.97	49.05	53.38
(2)+(3)+(4)	59.01	66.28	51.83	63.10	60.67
sample size	2,097	1,042	1,055	463	1,512

Women in double-income family

- Gender inequality in favor of men?

time-use category (hours per week)	double-income family		single-income family	
	women	men	women	men
(1) core market work	41.81	49.07	3.77	45.12
(2) total market work	47.28	55.63	4.70	51.68
(3) nonmarket work	18.90	2.57	29.00	2.57
(4) child care	13.11	5.23	27.03	5.64
(5) leisure measure 1	25.50	34.46	45.97	37.54
(6) leisure measure 2	93.89	105.00	116.59	108.12
(7) leisure measure 3	94.70	105.55	118.17	108.68
(8) leisure measure 4	97.23	107.58	123.45	111.05
(2) + (3)	66.17	58.20	33.70	54.25
(2)+(3)+(4)	79.28	63.43	60.73	59.89
sample size	1,042	1,042	1,055	1,055

Leisure hours as luxury good

- The higher one's income, the less hours in leisure.
- Table 8 with expenditure on leisure

2015 American Time Use Survey vs. 2014 KLIPS

- Average work hours of employed person: 7.6 hours vs. 9.0 hours
- Men works longer than women: 42 minutes vs. 60 minutes
- Share of men doing food preparation and cleanup: 43% vs. 22%
- Average time per day women spend doing homework: 52 minutes vs. 2.85 hours
- For households with children under age 6,
 - ▶ women spend: 1 hour vs. 4 hours
 - ▶ men spend: 25 minutes vs. 1 hour

Background

- Jones and Klenow (2016): consumption-equivalent measure, relative welfare level compared to a target country, such as US
- Merits
 - ▶ easy to compare welfare level among groups since it is a cardinal index like
 - ▶ consumption ratio, preserve multi-dimensional aspect as an welfare index

Concept of consumption-equivalent welfare: an example

- Per capital GDP and consumption in France are just 67% and 60% of the US values, but consumption-equivalent measure that considers leisure, mortality, and inequality is equal to 92% of that in the US
 - ▶ question: “how much would you have been happy if you were born in France, not in the US?”
 - ▶ answer: “I would have enjoyed 92% of happiness as much as I do in the US, because I could have benefitted from lower inequality, lower mortality, and more leisure despite lower consumption and income.”

Conceptual Difficulties

- We need at least one reference group, but in household-level analysis within a country, it is not easy to find a reference group
 - ▶ we take the top 20% group in terms of income as a reference group
 - ▶ better than arbitrarily picking up a household as baseline
- Subtle difficulty in interpreting variables such as inequality or mortality
 - ▶ easy to interpret σ_i^2 as an inequality measure of country i
 - ▶ conceptually vague if i refers to a household or an income quintile in the same country
 - ▶ better to define σ_i^2 as uncertainty of a household income within an income group

How to Calculate

- Simple case of log utility, calculating λ_q where q denotes an income group
- C_q and ℓ_q denote a household's annual consumption and a measure of leisure, respectively

$$\begin{aligned}u(C_q, \ell_q) &= \bar{u} + \log C_q + \nu(\ell_q) \\ &= \bar{u} + \log C_q - \frac{\theta\epsilon}{1 + \epsilon}(1 - \ell_q)^{\frac{1+\epsilon}{\epsilon}}.\end{aligned}$$

How to Calculate

- Simple case of log utility, calculating λ_q where q denote the quintile based on income
- C_q and ℓ_q denote a household's annual consumption and a measure of leisure, respectively

$$\begin{aligned}u(C_q, \ell_q) &= \bar{u} + \log C_q + \nu(\ell_q) \\ &= \bar{u} + \log C_q - \frac{\theta\epsilon}{1 + \epsilon}(1 - \ell_q)^{\frac{1+\epsilon}{\epsilon}}.\end{aligned}$$

- Consumption (C_q): measured real consumption less housing and education expenditure as well as non-consumption payment such as social insurance fee
- Leisure (ℓ_q): quantity or quality of leisure measure 1–4 and housework hours may be comprised depending cases
- Household treated as if it consists of an individual representing overall household characteristics
 - ▶ a : the representative individual's age
 - ▶ $S_q(a)$: average survival rate for a household in each income quintile

Lifetime Utility

- Household's lifetime expected utility

$$U_q = E \left[\sum_{a=1}^{\infty} \beta^a S_q(a) \left(\bar{u} + \log C_q - \frac{\theta \epsilon}{1 + \epsilon} (1 - \ell_q)^{\frac{1+\epsilon}{\epsilon}} \right) \right]$$

Lifetime Utility

- Independently and lognormally distributed household consumption in each income group
 - ▶ arithmetic mean c_q and a variance of log consumption of σ_q^2
 - ▶ $E(\log C_q) = \log c_q - \frac{1}{2}\sigma_q^2$.
- $\beta = 1$ and ℓ as being deterministic, lifetime expected utility is

$$U(c_q, \ell_q) = \text{LE}_q \left(\bar{u} + \log c_q - \frac{\theta\epsilon}{1+\epsilon}(1 - \ell_q)^{\frac{1+\epsilon}{\epsilon}} - \frac{1}{2}\sigma_q^2 \right)$$

- ▶ where life expectancy $\text{LE}_q = \sum_{a=1}^{\infty} S(a)_q$

Consumption Equivalent Measure λ_q

- Consumption-equivalent welfare for quintile q , λ_q from following equation

$$U(c_q, l_q) = U(\lambda_q c_5, l_5)$$

Calibration

- The Frisch elasticity of labor supply, $\epsilon = 1$
 - ▶ household consists of employed as well as non-employed members
 - ▶ Moon and Song (2016): $\epsilon = 0.99$ with intensive and extensive margin
- The weight on the disutility from working, $\theta = w(1 - \ell)^{-1/\epsilon} = 12.8$
 - ▶ w : aftertax real income, $(1 - \ell)$: labor supply c : real consumption at the period,
- \bar{u} is the intercept of utility function, conceptual utility from human dignity
 - ▶ $\bar{u} = U(\text{value of life in KR}) - U(\bar{C}, \bar{\ell})$

Case 1: Log Utility Function

ratio	income quintile				
	1	2	3	4	5
income ratio (y_q/y_5)	0.224	0.349	0.453	0.591	1
consumption ratio (c_q/c_5)	0.505	0.591	0.687	0.783	1
equivalent measures of welfare					
λ^{\log} leisure measure 1	0.541	0.650	0.679	0.762	1
λ^{\log} leisure measure 2	0.515	0.613	0.675	0.766	1
λ^{\log} leisure measure 3	0.515	0.612	0.676	0.766	1
λ^{\log} leisure measure 4	0.519	0.615	0.680	0.761	1

Quality of Leisure in Log Utility Function

- Becker (1965) quantity and quality of commodities consumed is important especially on household's time allocation problem
 - ▶ time and related expenditure determine the quality of consumption
- ℓ : quality of leisure
 - ▶ composite good with leisure hours and related expenditures as input

$$\ell_m = l_m^\alpha x_m^{1-\alpha}$$

- ▶ l_m : leisure measure ($m = 1, 2, 3, 4$), x_m : related expenditure

Quality of Leisure in Log Utility Function

ratio	income quintile				
	1	2	3	4	5
income ratio (y_q/y_5)	0.224	0.349	0.453	0.591	1
consumption ratio (c_q/c_5)	0.505	0.591	0.687	0.783	1
equivalent measures of welfare					
λ^{log} quality of leisure 1	0.278	0.368	0.466	0.613	1
λ^{log} quality of leisure 2	0.208	0.292	0.399	0.548	1
λ^{log} quality of leisure 3	0.208	0.292	0.399	0.547	1
λ^{log} quality of leisure 4	0.209	0.292	0.400	0.544	1

Case 2: Non-Separable Utility Function

- With a non-separable utility function, leisure and consumption are substitute:

$$U_q = \frac{C_q^{1-\gamma}}{1-\gamma} \left(1 + (\gamma - 1) \frac{\theta \epsilon}{1 + \epsilon} (1 - \ell_q)^{\frac{1+\epsilon}{\epsilon}} \right)^\gamma$$

- ▶ $\gamma = 1.5$, consistent λ^{NS} within range 1 to 4
- ▶ $\epsilon = 1$, $\theta = 12.8$
- Derivative of U_q by C_q and ℓ_q .

$$\frac{\partial^2 U_q}{\partial C_q \partial \ell_q} = \underbrace{(1-\gamma)}_{\text{negative}} \underbrace{\gamma \theta (1 - \ell_q)^{\frac{1}{\epsilon}} C_q^{-\gamma} \left(1 + (\gamma - 1) \frac{\theta \epsilon}{1 + \epsilon} (1 - \ell_q)^{\frac{1+\epsilon}{\epsilon}} \right)^{\gamma-1}}_{\text{positive}}$$

- ▶ λ^{NS} is consistently lower than λ^{log} .

Case 2: Non-Separable Utility Function

ratio	income quintile				
	1	2	3	4	5
income ratio (y_q/y_5)	0.224	0.349	0.453	0.591	1
consumption ratio (c_q/c_5)	0.505	0.591	0.687	0.783	1
equivalent measures of welfare					
λ^{NS} leisure measure 1	0.308	0.475	0.574	0.683	1
λ^{NS} leisure measure 2	0.318	0.483	0.577	0.686	1
λ^{NS} leisure measure 3	0.319	0.482	0.578	0.685	1
λ^{NS} leisure measure 4	0.323	0.487	0.583	0.681	1

Quality of Leisure in Non-Separable Utility Function

ratio	income quintile				
	1	2	3	4	5
income ratio (y_q/y_5)	0.224	0.349	0.453	0.591	1
consumption ratio (c_q/c_5)	0.505	0.591	0.687	0.783	1
equivalent measures of welfare					
λ^{NS} leisure measure 1	0.204	0.308	0.421	0.560	1
λ^{NS} leisure measure 2	0.205	0.309	0.422	0.561	1
λ^{NS} leisure measure 3	0.204	0.308	0.421	0.560	1
λ^{NS} leisure measure 4	0.204	0.308	0.421	0.557	1

Decomposing the Equivalent Measures

- Due to additivity, possible to decompose λ into the forces that determine welfare

$$\log \lambda_q = \log c_q - \log c_5 \quad (1)$$

$$+ \frac{\theta\epsilon}{1+\epsilon}(1 - \ell_5)^{\frac{1+\epsilon}{\epsilon}} - \frac{\theta\epsilon}{1+\epsilon}(1 - \ell_q)^{\frac{1+\epsilon}{\epsilon}} \quad (2)$$

$$+ \frac{LE_q - LE_5}{LE_5} \left(\bar{u} + \log c_q - \frac{\theta\epsilon}{1+\epsilon}(1 - \ell_q)^{\frac{1+\epsilon}{\epsilon}} - \frac{1}{2}\sigma_q^2 \right) \quad (3)$$

$$+ \frac{1}{2}\sigma_1^2 - \frac{1}{2}\sigma_q^2 \quad (4)$$

- Four components;
 - ▶ (1) differences in means of log consumption
 - ▶ (2) utility from leisure
 - ▶ (3) life expectancy
 - ▶ (4) uncertainty in log consumption.

Decomposing the Equivalent Measures

components of $\log \lambda^{\log}$	income quintile				
	1	2	3	4	5
(1) mean of log consumption	-0.683	-0.523	-0.375	-0.245	0
(2) utility from leisure	0.129	0.084	0.013	-0.001	0
(3) life expectancy	-0.109	-0.051	-0.031	-0.021	0
(4) uncertainty	0.021	0.022	0.020	0.017	0

Discussion

- Blundell et al. (2016)
- Chiappori and Meghir (2014)
- Borra et al. (2016) isolate selection effects using longitudinal data from Australia, UK and US. We find that selection into marriage by individuals with a higher taste for home-produced goods can explain about half of the observed differences in housework documented in the cross-sectional data.
- Division of labor vs. gender inequality

Future research direction

- Explicit treatment of household production
- Criteria for judging within-household gender inequality