On the Effects of the X Tax on the Economic Growth and the Equity

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Ⅰ,Introduction

It is said that the structure of the expenditure tax has the efficient points concerning the economic growth and the administrative affairs. The expenditure tax is the tax which the government levies the burden in accordance with the amount of the taxpayer's consumption in a year.This tax is a direct tax,not an indirect tax.The tax-base is defined as follows;「C(consumption)=Y(income)-S(savings)」.C is calculated by the cash-flow method.There is the relationship between the expenditure tax and the X tax.For example,the tax structure without the double taxation on savings or the cash flow method in the expenditure tax is also utilized in the X tax.We should consider the way of utilizing the structure of the expenditure tax or the X tax.In this paper,I treat the X tax which is often discussed in the arguments with respect to the refinement of a corporation taxation and so on.

In this paper,I analyze the effect of the X tax on the economic growth and the equity concerning the tax burden,using the tool of the principal component analysis(by VBA program).So far this analysis hasn't been done.Moreover I take into account the political perspective.In this paper,this point is also the original one.In deciding the affairs concerning a tax system,needless to say,political factors are important. There are several researches over the X tax.This point is designated in the chapter Ⅱ.

Concerning the theme in this paper,so far,there is the following statement;Other reforms produce similar tradeoffs.Switching to a proportional income tax hurts current and future low-lifetime earners but helps everyone else.The X tax,which combines consumption-tax and progressive wage-tax elements,makes everyone better off in the long run and raises output by even more than the flat tax.But this reform harms initial older generations who face an implicit tax on their wealth.[1]

Ⅱ,The outline of the X tax in this paper

D.F.Bradford explains the outline of the X tax.Concerning the structure,there are many proposals.He explains the effects of the X tax on the various problems like wasteful financial innovation,the problems relating to capital gains from the tax base,and so on.[2] Also,it is proposed in Gringerg(2006) that the X tax be divided into the two types of X tax;the subtraction-method X tax and the credit-method X tax.[3]In this article,it is designated that the latter has the advantage of the former with respect to administrative affairs,and so on.In Bradford(2003) and Bradford(2004),and so on,the X tax in the international setting is discussed.[4]But,due to the limitation of the number of the words,in this paper these points aren't taken into account.

The expenditure tax is the tax which the government levies the burden in accordance with the amount of the taxpayer's consumption in a year.This tax is a direct tax,not an indirect tax.The tax-base is defined as follows;「C(consumption)=Y(income)-S(savings)」.C is calculated by cash-flow method;「Inflow - Outflow」.[5] D.F.Bradford introduced the concept of "two-tiered expenditure tax".This tax leads to the X tax which I treat in this article.He explains that the X tax is a variant of the Hall-Rabushka(1995) Flat tax,an example of what he has called "two-tiered consumption tax".[6]

There is the relationship between the expenditure tax and the X tax.The tax base is showed as

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1 Altig David,Alan J. Auerbach,Laurence J. Kotlikoff,Kent A. Smetters,Jan Walliser "Simulating Fundamental Tax Reform in the United States"*The American Economic Review*,91.3,American Economic Association,2001,pp.30-31.

2 Bradford,D.F. "A Tax System for the Twenty-first Century" Alan J.Auerbach,Kevin A.Hassett eds.,*Toward Fundamental Tax Reform*,The AEI Press,2005,pp.13-17.

3 Grinberg,Itai "Implementing a Progressive Consumption Tax : Advantages of Adopting the VAT Credit-Method System" *National Tax Journal* Vol.LIX,4,2006

4 Bradford,D.F. "THE X TAX IN THE WORLD ECONOMY" CESifo Working Paper Series No.1264,2004,Bradford,D.F. "Addressing the Transfer-Pricing Problem in an Origin-Basis X Tax" *International Tax and Public Finance*,10,2003

5 The Meade Committee(1978),op.cit.,p.503.In this literature,the structure of the UET is explained in detail.

6 Bradford,D.F. "Addressing the Transfer-Pricing Problem in an Origin-Basis X Tax" *International Tax and Public Finance*,10,2003,pp.591-610. The structure of the Flat tax is explained in [Hall R.E.,Alvin Rabushka *The Flat Tax* second edition,Hoover Institution Press,1995] and so on.

follows.[7] In this paper,the governmental section and the foreign section are excluded.

C(consumption)+S(savings)=W(wage)+ π (capital income)+D(depreciation)

C(consumption)=W(wage)+π (capital income)－I(investment) (under S=I)

The X tax consists of the compensation tax on W (graduated tax rates) and the business tax on π －I (a single rate, payments to workers are deducted,the top tax rate in the compensation tax is applied).In the structure of the X tax,financial transactions are excluded from both business and compensation tax bases.[8] It is clear that savings aren't taxed in the compensation tax.In this structure,the structure of the expenditure tax is utilized.Of course,this exclusion leads to economic growth.It is said that there is the positive relationship between investment and savings.[9] Moreover, the business tax on π －I is the cash flow corporation tax.The structure of the expenditure tax is also utilized in this structure.This point leads to the administrative simplicity which lowers the administrative cost.[10] In the comprehensive income tax and so on,the calculation of the tax base is complicated because of the adjustment of inflationary factors and so on.

Ⅲ,The model

At first,I explain the outline of the model in this paper,using the model in D.Altig,A.J.Auerbach,L.J.Kotlikoff,K.A.Smetters,J.Walliser(1997).In this paper,the political factor is introduced.In this paper,this point is the original one.In general,the amount of the production in a country is influenced by political factors like the support of the political party,and so on.There is a close relationship between politics and a tax system.We can easily understand that a confidencial policy concerning economic growth leads to the promotion of the economic activities.[11]In this paper,I take this point into account,and it is assumed that the investment toward K is promoted by the introduction of the political factor.

The agents in this model differ by their lifetime labor-productivity endowments.Every cohort includes 3 lifetime-earnings groups,each with its own endowment of human capital.In this paper,it is assumed that an individual's endowment differs according to the educational grades.

U:university graduate(U32:the university graduate person at the age of 32)

H:high school graduate

J:junior high school graduate

All agents live for 55 periods with certainty (corresponding to adult ages 21 through 75),and the population in the 3 lifetime-earnings groups grows by n percent in each period.

And the following time-separable utility function is used.

$$U_t^j = \frac{1}{1-\frac{1}{\gamma}}\left[\sum_{s=21}^{75}\beta^{s-21}\left(c_{s,t+s-21}^{j\;1-\frac{1}{\rho}} + \alpha l_{s,t+s-21}^{j\;1-\frac{1}{\rho}}\right)^{\frac{1-\frac{1}{\gamma}}{1-\frac{1}{\rho}}} + \beta^{54}\mu^j b_{75,t+54}^{j\;1-\frac{1}{\gamma}}\right] \qquad (1)$$

U:utility(In this paper,it is assumed that the utility in one year is the same as the one in the other year.),t:date,j:agent type,γ:the intertemporal elasticity of the substitution in the leisure/consumption composite,ρ:the intratemporal elasticity of the substitution between consumption(c) and leisure(*l*),α:the utility weight on leisure,b:intergenerational transfers,μ^j:a j-type specific utility weight placed on bequests,δ :the rate of time preference,β:β=1/(1+δ),s:age

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7 Kusuya Kiyoshi,Masaharu Yamaguchi,Yoshinaga Sakai "Nihon no Zeiseikaikaku no Hoko to X tax" *Seikeikenkyu*,45.2,Nihondaigakuhogakkai,2008,pp.13-14.

8 Bradford,D.F.(2003),op.cit.,pp.592-593. It is said that the taxation on financial transactions is needed in the case of the X tax.

9 Feldstein,Martin, Charles Horioka "Domestic Saving and International Capital Flows" *The Economic Journal*,Vol.90.358,1980 There are many arguments concerning this point.

10 The difficulties of cash flow method are dictated in [Shome,Parthasarathi,Christian Schutte "Cash-Flow Tax" Staff Papers,International Money Fund,1993]

11 We should see [Amihai,Glazer and Lawrence S. Rothenberg *Why Government Succeeds and Why It Fails?* Harvard University Press,2001].

$$a_{s+1,t+1}^{j} = (1+r_t)(a_{s,t}^{j} + g_{s,t}^{j}) + w_{s,t}^{j}(E_{s,t}^{j} - l_{s,t}^{j}) - c_{s,t}^{j} - \sum_{v=1}^{V} T^{v}(B_{s,t}^{j,v}) - Nb_{s,t}^{j} \qquad (2)$$

$$l_{s,t}^{j} \le E_{s,t}^{j}, a_{75,t}^{j} \ge 0$$

$a_{s,t}^{j}$:the capital holdings for type j agents,of age s,at time t, r_t :the pretax return to savings, $g_{s,t}^{j}$:the inheritances received from parents, $E_{s,t}^{j}$:the time endowment, $b_{s,t}^{j}$:the bequests made to each of the children,T:the function $T^{v}(\cdot)$ (with tax base $B_{s,t}^{j,v}$ as arguments)determine net tax payments from income sources v=1,･･･,V.(All taxes are collected at the household level,and the tax system includes both a personal income tax and a business profits tax.)Concerning a,it is said that there are no liquidity constraints,so the assets in (2) can be negative,although terminal wealth-the wealth left over after final period bequests are made-must be nonnegative.In the equation (2),a is increased by the introduction of the political factor.This introduction leads to the decrease of the leisure(*l*).In this paper,it is assumed that B is heterogeneous.

Government

In this paper,it is assumed that government purchases are assumed to be either (a)unproductive and generate no utility to the households,or (b)be fixed and enter the household utility functions in a separable fashion.

Firms and technology

Aggregate capital(K) and labor(L) are difined as follows in this paper.K is increased by the introduction of the political factor.

$$K_t^{j} = (1+n)^{t} \underline{N}^{j} a_{s,t}^{j} \qquad (3)$$

$$L_t^{j} = (1+n)^{t} \underline{N}^{j} (E_{s,t}^{j} - l_{s,t}^{j}) \qquad (4)$$

$\underline{N}$:the original number of the university graduates,or the high school graduates,or the junior high school graduates

Output (net of depreciation)is produced by identical competitive firms using a neoclassical,constant -return-to-scale production technology.Needless to say,Y^{j}(type j) is increased by the introduction of the political factor.In the base case,the aggregate production technology is the standard Cobb-Douglas form.

$$Y_t = AK_t^{\theta} L_t^{1-\theta} \qquad (5)$$

Y:output,θ:capital's share in production

Ⅳ,Calibration

Parameters and Variables

In the following table,the selected parameters are summarized.

Benchmark Parameter Definitions and Values		
Symbol	Definition	Value
Preferences		
α	Utility weight on leisure	1.000
δ	Rate of time preference (university graduate、high school graduate)	0.002
	Rate of time preference (junior high school graduate)	0.004
γ	Intertemporal substitution elasticity	0.250
u^j	Utility weight placed on bequests by income-class 1 (university graduate)	-10.000
	Utility weight placed on bequests by income-class 2 (high school graduate)	-10.000
	Utility weight placed on bequests by income-class 3 (junior high school graduate)	-10.000
ρ	Intratemporal substitution elasticity	0.66666667
Demographics		
n	Population growth rate	0.010
N	Number of children per adult	1.220
Technology		
λ	Rate of technological change	0.010
φ	Adjustment-cost parameter	0.100
θ	Net capital share	0.250
σ	Constant elasticity of substitution	1.000

	university graduate	high school graduate	junior high school graduate
$C_{s,t}$	50.000	45.000	40.000
Ws,t	1.000	0.900	0.800
$E_{s,t} - l_{s,t}$ (E:100)	50.000	50.000	50.000
N	100.000	60.000	10.000
$g_{21,1}$	100.000	90.000	80.000
$b_{(s:21\sim 74)}$	1.000	1.000	1.000
$b_{75,t+54}$	5.000	5.000	5.000
A	2.000	2.000	2.000
r	0.090	0.090	0.090
the personal tax	3.000	2.000	1.000
(Case (2))	3.000	2.500	2.000
the corporate profit tax	3.000	3.000	3.000

*In this paper,it is assumed that the corporate profit is sufficiently obtained and the working hours are increased by one hour by the introduction of the political factor.

Simulation

In this paper,I analyze the relationship between the equity and the efficiency from the original perspective.To do this work,I use the tool of the principal component analysis.

I should explain the important variables in the APPENDIX in short.

principal component score:The comprehensive property is designated by this variable which is formulated by using plural explanatory variables.In this article,the explanatory variables are “assets”,”utility” and “production”,and these variables are standardized,in calculating the PCSs(Principal Component Scores).The PCS is calculated by the linear combination of the explanatory variables and the eigenvector.PCS2(the second Principal Component Score) is under the condition that PCS1 and PCS2 are vertically crossed.

eigenvalue:There is the relationship that the sum of the eigenvalues equals the sum of the number of the explanatory variables.In this paper,an eigenvalue and an eigenvector are calculated by using the matrix of the correlation coefficient due to the various units.In general,a PCS of which the eigenvalue is above 1 is selected.

proportion:This variable is calculated by dividing an eigenvalue by the number of the explanatory variables.This variable designates what degree each PCS reflects the original information.In general,the following equation is used.In the case of the first PCS;

$$\text{the proportion} = \text{(the amount of the new information over the first PCS)}^2 ／ \text{(the amount of the original information)}^2$$

cumulative proportion:This variable is the sum of the proportions.There is the criterion that the PCSs are selected until the cumulative proportion is above 60 or 70 percent.

factor loading:This variable is the correlation coefficient between a PCS and the explanatory variables.In interpreting a PCS,we should utilize the factor loading.In general, The following equation is often used.

$$\text{(the factor loading)=(the eigenvector)} \times \sqrt{(eigenvalue)}$$

A PCS is calculated in the following manner.For example,I explain the U62 in the case(1).First of all,the eigenvalue and the eigenvector are as follows.

correlation coefficient	assets	utility	production
assets	1.000		
utility	**0.908**	1.000	
production	0.983	*0.956*	1.000

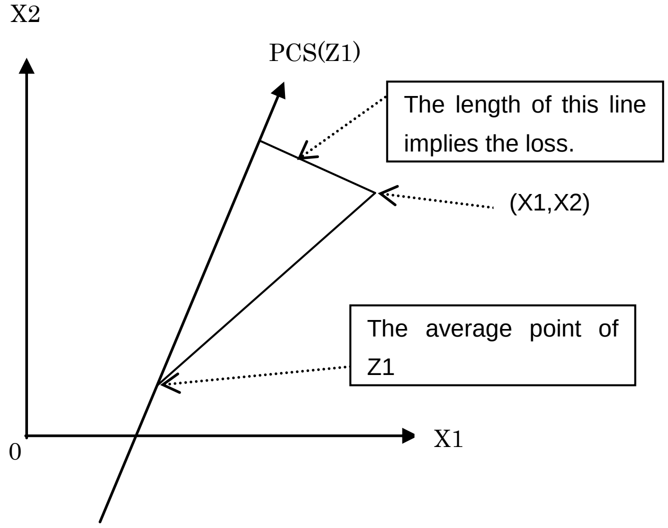
	Z-1	Z-2	Z-3
eigenvalue	2.899	0.095	0.007

eigenvector	Z-1	Z-2	Z-3
assets	0.576	-0.619	-0.534
utility	0.570	0.772	-0.279
production	0.586	-0.144	0.798

In the case of the U62, the first principal component score is as follows.

$$1.51 \approx \frac{1.45 \cdot 0.576 + 1.64 \cdot 0.570 + 1.37 \cdot 0.586}{\sqrt{2.899}}$$

Moreover,we can know the loss of the information from the PCSs.In a principal component analysis,the loss of the information of the original data occurs.This loss is designated as the following figure which treats one PCS and two explanatory variables.In this case,only the first PCS is considered.The analyst using PCA must consider the minimization of this loss.



The loss is designated in the cumulative proportion.It is proved that we must consider the maximization of the variance to minimize the loss.It goes without saying that we should investigate the previous *proportion* or *cumulative proportion*.

First of all,in this simulation,I treat four cases:the basic case:(1),the case of the progressivity being decreased:(2),the case of the political factor being considered:(3),the case of (2) and (3) being considered:(4).In this simulation,to do the accurate analysis,the data concerning the cases of the age 22 and the age 75 is omitted.The detail data of this simulation is showed in the APPENDIX.From this data,it is found that we should consider only the first principal component score which designates the comprehensive efficiency or the efficiency in a wider sense.In this paper,I analyze the equity in a wider sense by using the first PCSs.

The results are analyzed as follows.In this paper,it is designated that the order of “university graduates > high school graduates > junior high school graduates” at each age or the order of “62>52>42>32” in each grade is unchanged in all the cases.

First of all,I describe the results concerning the cases (2)(3)(4) with comparing with the basic case.

<Case 1>

U62	1.51	differential
H62	1.43	0.08
J62	1.36	0.07
U52	0.32	1.04
H52	0.23	0.09
J52	0.15	0.08
U42	-0.47	0.62
H42	-0.56	0.08
J42	-0.64	0.08
U32	-1.04	0.40
H32	-1.11	0.07
J32	-1.18	0.07

<Case 2>

U62	1.92	differential
H62	1.38	0.53
J62	0.83	0.56
U52	0.55	0.27
H52	0.23	0.33
J52	-0.12	0.34
U42	-0.33	0.21
H42	-0.53	0.20
J42	-0.74	0.21
U32	*-0.94*	0.19
H32	-1.06	0.12
J32	-1.19	0.13

<Case 3>

U62	1.58	differential
H62	1.42	0.15
J62	1.28	0.15
U52	0.36	0.91
H52	0.24	0.12
J52	0.12	0.12
U42	-0.45	0.57
H42	-0.55	0.10
J42	*-0.64*	0.09
U32	-1.05	0.41
H32	-1.12	0.07
J32	-1.19	0.07

<Case 4>

U62	1.83	differential
H62	1.39	0.44
J62	0.94	0.45
U52	0.51	0.43
H52	0.24	0.27
J52	-0.05	0.28
U42	-0.36	0.31
H42	-0.53	0.17
J42	*-0.71*	0.18
U32	-0.98	0.27
H32	-1.09	0.10
J32	-1.19	0.11

From these data,we can find that,in the case (2),the differentials between the income classes at each age are spread.But,needless to say,the tendency like this spread is extremely ordinal. And the differentials between U32 and J42,between U42 and J52,between U52 and J62 are decreased.In considering the case (3),we can find that the maldistribution between the income classes at each age is basically spread.This maldistribution is mitigated between the case (2) and the case (4).

Next,I consider the case of introducing the X tax.I treat the basic case:(1),the case of not being taxed:(5),and the case of only the wage being taxed:(6).

<Case 5>

U62	1.71	differential
H62	1.40	0.31
J62	1.09	0.31
U52	0.45	0.64
H52	0.25	0.20
J52	0.06	0.20
U42	-0.40	0.46
H42	-0.53	0.13
J42	-0.66	0.13
U32	*-1.05*	0.39
H32	-1.12	0.08
J32	-1.20	0.08

<Case 6>

U62	1.53	differential
H62	1.42	0.11
J62	1.31	0.11
U52	0.35	0.96
H52	0.25	0.10
J52	0.16	0.09
U42	-0.46	0.62
H42	-0.54	0.08
J42	-0.61	0.07
U32	*-1.08*	0.46
H32	-1.13	0.05
J32	-1.18	0.05

We can tell that the introduction of the X tax leads to the circumstance that the older we grow,the higher the PCS becomes,and the older we grow,the higher the degree being amended concerning the equity at each age becomes.In the case (5) and the case (6),we find that the maldistribution concerning the equity at each age is mitigated by introducing the progressive wage tax.Next,when we compare the case (6) with the case (1),we find that the introduction of the taxation on the corporate sector doesn’t change the PCSs to the extent of its change between the case (5) and the case (6).

And,it is found that the PCSs in all the junior high school graduates and the PCSs of U32 and H62 and H32 become high by levying the X tax and the other PCSs become low by doing so.Broadly speaking,the maldistribution is mitigated.But it is also designated that the order of “university graduates > high school graduates > junior high school graduates” at each age or the order of “62>52>42>32” in each grade is stable.

Ⅴ,Conclusion

In this paper,I analyzed the effect of the X tax on the economic growth and the equity concerning the tax burden,using the tool of the principal component analysis.So far this analysis hasn’t been done.The main results are as follows. We can tell that the introduction of the X tax leads to the circumstance that the older we grow,the higher the PCS becomes,and the older we grow,the higher the degree being amended concerning the equity at each age becomes.And,in this paper,it is designated that the introduction of the political factor leads to the spread of the maldistribution between the income classes at each age or the introduction of the taxation on the corporate sector doesn’t change the PCSs to the extent of its change between the case of not being taxed and the case of only the wage being taxed.Moreover,in this paper,it is also designated that the order of “university graduates > high school graduates > junior high school graduates” at each age or the order of “62>52>42>32” in each grade is unchanged in all the cases.Needless to say,the results are different from the ones in Altig David,Alan J. Auerbach,Laurence J. Kotlikoff,Kent A. Smetters,Jan Walliser(2001).

In introducing the X tax,we must also take account of the problems concerning its implementation.D.F.Bradford points out them in D.F.Bradford(2005)[12].But,in this paper,I can't analyze his insistence in detail due to the limitation of the number of the words.In considering the way of solving problems like them,we should take the utilization of IT into account.From the content in this paper,in doing so,we should take the political factors into account.I analyzed the case of the expenditure tax in the Meade report.In this analysis,the effectiveness of the utilization of the IT on the implementation of the expenditure tax is emphasized.[13]

But in considering the researches over the X tax,we should introduce many important factors like an international perspective,EITC(Earned Income Tax Credit),etc. into the simulation in this paper.I will analyze these points in the future.Particularly,from the results in this paper,the analysis concerning the desirable relationship between the X tax and EITC is noticed.[14]

12 Bradford,D.F. (2005),op.cit.

13 Ohata Satoshi "On the Properties of the Consumption Taxes in the IT Period" *The Journal of the Law and Economic Society at Mie-Tankidaigaku*,139,The Law and Economic Society at Mie-Tankidaigaku,2011

14 We should see [Institute for Fiscal Studies ed. *Dimensions of Tax Design　The Mirrlees Review*,Oxford University Press,2010],and so on.

＜APPENDIX＞the detail data of the simulation

Case 1

	assets	utility	production
U32	131.25732224	0.00328170	127.28826999
U42	201.04086413	0.00601645	141.60499875
U52	366.24388629	0.00875121	164.51295181
U62	757.33951988	0.01148596	197.27868024
H32	123.01335158	0.00294457	125.24072175
H42	196.71731717	0.00539837	140.83744805
H52	371.20140799	0.00785218	165.06686482
H62	784.26870638	0.01030598	199.00945964
J32	114.76938092	0.00262411	123.08751636
J42	192.39377021	0.00481086	140.05713888
J52	376.15892969	0.00699762	165.61525702
J62	811.19789289	0.00918438	200.69622440
total	4425.60234936	0.07965339	1890.29553171

Standard score	assets	utility	production
U32	-0.89	-1.14	-1.04
U42	-0.63	-0.21	-0.55
U52	-0.01	0.72	0.24
U62	1.45	*1.64*	1.37
H32	-0.92	-1.25	-1.11
H42	-0.64	-0.42	-0.57
H52	0.01	0.41	0.26
H62	*1.55*	1.24	1.43
J32	-0.95	-1.36	-1.18
J42	-0.66	-0.62	-0.60
J52	0.03	0.12	0.28
J62	*1.65*	0.86	1.48

PCS	Z-1	Z-2	Z-3
U32	-1.04	-0.59	-0.46
U42	-0.47	0.99	-0.52
U52	0.32	*1.71*	-0.04
U62	*1.51*	0.57	*-1.75*
H32	-1.11	-0.78	-0.55
H42	-0.56	0.51	0.04
H52	0.23	0.89	1.06
H62	1.43	-0.66	-0.47
J32	-1.18	-0.96	-0.70
J42	-0.64	0.05	0.56
J52	0.15	0.12	**2.11**
J62	1.36	*-1.85*	0.73

PCS：principal component scores

	assets	utility	production
average	368.800	0.007	157.525
standard deviation	267.922	0.003	29.101
skewness	0.891	0.127	0.442
kurtosis	-0.837	-1.158	-1.286

	Z-1	Z-2	Z-3
eigenvalue	**2.899**	0.095	0.007
proportion	0.966	0.032	0.002
cumulative proportion	0.966	0.998	1.000

correlation coefficient	assets	utility	production
assets	1.00		
utility	**0.91**	1.00	
production	**0.98**	**0.96**	1.00

factor loading	Z-1	Z-2	Z-3
assets	**0.981**	-0.190	-0.044
utility	**0.971**	0.238	-0.023
production	**0.997**	-0.044	0.065

Case 2

	assets	utility	production
U32	131.25732224	0.00328170	127.28826999
U42	201.04086413	0.00601645	141.60499875
U52	366.24388629	0.00875121	164.51295181
U62	757.33951988	0.01148596	197.27868024
H32	114.23320488	0.00294457	122.94350471
H42	168.33505197	0.00539837	135.45690185
H52	296.41379948	0.00785218	156.03862097
H62	599.62277384	0.01030598	186.09171088
J32	97.20908752	0.00262411	118.08214008
J42	135.62923980	0.00481086	128.33521154
J52	226.58371267	0.00699762	145.90315094
J62	441.90602780	0.00918438	172.42092883
total	3535.81449049	0.07965339	1795.95707060

Standard score	assets	utility	production
U32	-0.78	-1.14	-0.87
U42	-0.44	-0.21	-0.31
U52	0.34	0.72	0.58
U62	**2.20**	*1.64*	*1.85*
H32	-0.86	-1.25	-1.04
H42	-0.60	-0.42	-0.55
H52	0.01	0.41	0.25
H62	1.45	1.24	1.41
J32	-0.94	-1.36	-1.22
J42	-0.76	-0.62	-0.83
J52	-0.32	0.12	-0.15
J62	0.70	0.86	0.88

PCS	Z-1	Z-2	Z-3
U32	-0.94	0.98	*-1.54*
U42	-0.33	-0.65	-0.22
U52	0.55	-1.04	-0.43
U62	*1.92*	*1.54*	1.30
H32	-1.06	1.08	-0.60
H42	-0.53	-0.50	0.49
H52	0.23	-1.11	-0.35
H62	1.38	0.57	-0.66
J32	-1.19	1.16	0.66
J42	-0.74	-0.37	*1.80*
J52	-0.12	-1.22	0.72
J62	0.83	-0.45	-1.16

PCS：principal component scores

	assets	utility	production
average	294.651	0.007	149.663
standard deviation	210.362	0.003	25.798
skewness	1.241	0.127	0.614
kurtosis	0.735	-1.158	-0.751

	Z-1	Z-2	Z-3
eigenvalue	**2.931**	0.066	0.004
proportion	0.977	0.022	0.001
cumulative proportion	0.977	0.999	1.000

correlation coefficient	assets	utility	production
assets	1.00		
utility	**0.93**	1.00	
production	**0.98**	**0.98**	1.00

factor loading	Z-1	Z-2	Z-3
assets	**0.983**	0.184	0.023
utility	**0.983**	-0.179	0.025
production	**0.999**	-0.005	-0.048

Case 3

	assets	utility	production
U32	148.81761563	0.00322182	133.31260450
U42	257.80539454	0.00590666	152.94336034
U52	515.81910330	0.00859151	181.89970020
U62	1126.63138497	0.01127635	221.13276133
H32	138.81761563	0.00287615	131.01432175
H42	247.80539454	0.00527295	151.43815742
H52	505.81910330	0.00766974	181.01161140
H62	1116.63138497	0.01006654	220.64042497
J32	128.81761563	0.00254846	128.58829616
J42	237.80539454	0.00467217	149.88668457
J52	495.81910330	0.00679589	180.11025522
J62	1106.63138497	0.00891960	220.14477058
total	6027.22049533	0.07781785	2052.12294844

Standard score	assets	utility	production
U32	-0.89	-1.13	-1.07
U42	-0.62	-0.20	-0.51
U52	0.03	0.73	0.31
U62	*1.58*	*1.66*	1.42
H32	-0.92	-1.25	-1.13
H42	-0.64	-0.42	-0.56
H52	0.01	0.41	0.28
H62	*1.55*	1.24	1.41
J32	-0.94	-1.36	-1.20
J42	-0.67	-0.63	-0.60
J52	-0.02	0.11	0.26
J62	*1.53*	0.84	1.39

PCS	Z-1	Z-2	Z-3
U32	-1.05	-0.58	0.54
U42	-0.45	1.05	0.50
U52	0.36	*1.73*	0.12
U62	*1.58*	0.28	*1.89*
H32	-1.12	-0.81	0.54
H42	-0.55	0.54	-0.06
H52	0.24	0.96	-0.94
H62	1.42	-0.74	0.37
J32	-1.19	-1.03	0.60
J42	-0.64	0.07	-0.56
J52	0.12	0.24	*-1.94*
J62	1.28	*-1.72*	-1.07

PCS : principal component scores

	assets	utility	production
average	502.268	0.006	171.010
standard deviation	395.854	0.003	35.249
skewness	0.883	0.139	0.381
kurtosis	-0.870	-1.134	-1.328

	Z-1	Z-2	Z-3
eigenvalue	**2.909**	0.083	0.009
proportion	0.970	0.028	0.003
cumulative proportion	0.970	0.997	1.000

correlation coefficient	assets	utility	production
assets	1.00		
utility	**0.92**	1.00	
production	**0.98**	**0.97**	1.00

factor loading	Z-1	Z-2	Z-3
assets	**0.981**	-0.189	0.045
utility	**0.976**	0.215	0.031
production	**0.997**	-0.025	-0.075

Case 4

	assets	utility	production
U32	148.81761563	0.00322182	133.31260450
U42	257.80539454	0.00590666	152.94336034
U52	515.81910330	0.00859151	181.89970020
U62	1126.63138497	0.01127635	221.13276133
H32	130.03746893	0.00287615	128.89164150
H42	219.42312933	0.00527295	146.90217600
H52	431.03149479	0.00766974	173.91413413
H62	931.98545242	0.01006654	210.89190561
J32	111.25732224	0.00254846	123.96234366
J42	181.04086413	0.00467217	140.00765486
J52	346.24388629	0.00679589	164.64674760
J62	737.33951988	0.00891960	198.89529315
total	5137.43263646	0.07781785	1977.40032288

Standard score	assets	utility	production
U32	-0.83	-1.13	-0.96
U42	-0.50	-0.20	-0.36
U52	0.26	0.73	0.52
U62	**2.07**	*1.66*	*1.72*
H32	-0.88	-1.25	-1.09
H42	-0.62	-0.42	-0.54
H52	0.01	0.41	0.28
H62	1.49	1.24	1.40
J32	-0.94	-1.36	-1.24
J42	-0.73	-0.63	-0.75
J52	-0.24	0.11	0.00
J62	0.92	0.84	1.04

PCS	Z-1	Z-2	Z-3
U32	-0.98	0.84	0.88
U42	-0.36	-0.88	-0.49
U52	0.51	-1.35	-0.40
U62	*1.83*	1.28	*-1.75*
H32	-1.09	1.04	0.36
H42	-0.53	-0.57	-0.54
H52	0.24	-1.18	0.31
H62	1.39	0.74	0.63
J32	-1.19	1.23	-0.43
J42	-0.71	-0.28	-1.04
J52	-0.05	-1.03	0.36
J62	0.94	0.16	**2.11**

PCS : principal component scores

	assets	utility	production
average	428.119	0.006	164.783
standard deviation	337.463	0.003	32.836
skewness	1.105	0.139	0.476
kurtosis	0.126	-1.134	-1.056

	Z-1	Z-2	Z-3
eigenvalue	**2.937**	0.059	0.004
proportion	0.979	0.020	0.001
cumulative proportion	0.979	0.999	1.000

correlation coefficient	assets	utility	production
assets	1.00		
utility	**0.94**	1.00	
production	**0.98**	**0.99**	1.00

factor loading	Z-1	Z-2	Z-3
assets	**0.983**	0.184	-0.019
utility	**0.987**	-0.159	-0.029
production	**0.999**	-0.024	0.048

Case 5

	assets	utility	production
U32	236.61908259	0.00328170	147.49250118
U42	541.62804659	0.00601645	181.41900685
U52	1263.69518838	0.00875121	224.21676480
U62	2973.09071046	0.01148596	277.68955140
H32	210.81481854	0.00294457	143.29557604
H42	480.53996922	0.00539837	176.07182995
H52	1119.07749306	0.00785218	217.50664986
H62	2630.72803188	0.01030598	269.32488745
J32	185.01055449	0.00262411	138.69366516
J42	419.45189185	0.00481086	170.18764876
J52	974.45979775	0.00699762	210.11085042
J62	2288.36535329	0.00918438	260.09909426
total	13323.48093809	0.07965339	2416.10802614

Standard score	assets	utility	production
U32	-0.88	-1.14	-1.09
U42	-0.57	-0.21	-0.40
U52	0.15	0.72	0.46
U62	*1.88*	*1.64*	*1.54*
H32	-0.91	-1.25	-1.17
H42	-0.63	-0.42	-0.51
H52	0.01	0.41	0.33
H62	*1.53*	1.24	1.37
J32	-0.93	-1.36	-1.27
J42	-0.70	-0.62	-0.63
J52	-0.14	0.12	0.18
J62	1.19	0.86	1.19

PCS	Z-1	Z-2	Z-3
U32	-1.05	0.73	-0.19
U42	-0.40	-1.00	-0.70
U52	0.45	*-1.55*	-0.79
U62	*1.71*	0.84	*-1.90*
H32	-1.12	0.98	-0.17
H42	-0.53	-0.62	-0.16
H52	0.25	-1.18	0.39
H62	1.40	0.84	0.21
J32	-1.20	1.22	-0.26
J42	-0.66	-0.25	0.21
J52	0.06	-0.83	1.33
J62	1.09	0.81	**2.02**

PCS：principal component scores

	assets	utility	production
average	1110.290	0.007	201.342
standard deviation	992.581	0.003	49.511
skewness	0.967	0.127	0.294
kurtosis	-0.499	-1.158	-1.299

	Z-1	Z-2	Z-3
eigenvalue	**2.930**	0.063	0.007
proportion	0.977	0.021	0.002
cumulative proportion	0.977	0.998	1.000

correlation coefficient	assets	utility	production
assets	1.00		
utility	**0.94**	1.00	
production	**0.97**	**0.99**	1.00

factor loading	Z-1	Z-2	Z-3
assets	**0.980**	0.196	-0.021
utility	**0.987**	-0.152	-0.045
production	**0.997**	-0.042	0.065

Case 6

	assets	utility	production
U32	183.93820242	0.00328170	138.49225394
U42	371.33445536	0.00601645	165.08165380
U52	814.96953733	0.00875121	200.92910178
U62	1865.21511517	0.01148596	247.13811535
H32	175.69423175	0.00294457	136.91368979
H42	367.01090840	0.00539837	164.59901884
H52	819.92705903	0.00785218	201.23397396
H62	1892.14430168	0.01030598	248.02534503
J32	167.45026109	0.00262411	135.27855517
J42	362.68736144	0.00481086	164.11210061
J52	824.88458073	0.00699762	201.53746673
J62	1919.07348819	0.00918438	248.90315429
total	9764.32950260	0.07965339	2252.24442928

Standard score	assets	utility	production
U32	-0.91	-1.14	-1.13
U42	-0.64	-0.21	-0.52
U52	0.00	0.72	0.30
U62	*1.51*	*1.64*	1.37
H32	-0.92	-1.25	-1.17
H42	-0.64	-0.42	-0.53
H52	0.01	0.41	0.31
H62	*1.55*	1.24	1.39
J32	-0.93	-1.36	-1.20
J42	-0.65	-0.62	-0.54
J52	0.02	0.12	0.32
J62	*1.59*	0.86	1.41

PCS	Z-1	Z-2	Z-3
U32	-1.08	-0.55	-0.78
U42	-0.46	1.03	-0.50
U52	0.35	*1.72*	-0.19
U62	*1.53*	0.36	*-1.81*
H32	-1.13	-0.80	-0.60
H42	-0.54	0.53	0.17
H52	0.25	0.95	0.91
H62	1.42	-0.72	-0.41
J32	-1.18	-1.03	-0.46
J42	-0.61	0.05	0.81
J52	0.16	0.21	*1.94*
J62	1.31	*-1.76*	0.91

PCS：principal component scores

	assets	utility	production
average	813.694	0.007	187.687
standard deviation	694.829	0.003	43.503
skewness	0.885	0.127	0.312
kurtosis	-0.866	-1.158	-1.359

	Z-1	Z-2	Z-3
eigenvalue	**2.902**	0.087	0.011
proportion	0.967	0.029	0.004
cumulative proportion	0.967	0.996	1.000

correlation coefficient	assets	utility	production
assets	1.00		
utility	**0.91**	1.00	
production	**0.97**	**0.97**	1.00

factor loading	Z-1	Z-2	Z-3
assets	**0.978**	-0.201	-0.048
utility	**0.976**	0.216	-0.039
production	**0.996**	-0.014	0.086

U:university graduate,H:high school graduate,J:junior high school graduate(U32:the university graduate person in the age of 32)