A Brief Summary on the Theories of Micro Economics and their Technical Systems

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The macro-economic studies based on the general equilibrium theory do not or cannot tell us the strategy of the present day economic situation effectively. Why don't they or can't they tell us the economic strategy to-day?

One answar for that is the environmental surroundings as well as economical, industrial, and political set-ups have been changing very rapidly. The market functions have been loosing their elaciticity. Hence the subjective value system of economics gradually play the role of the economic behavior of the society. We, therefore, have to come back to the saying of late Prof. Heinrich Von Stackelberg to the effect that the only theory that governs the field of economic science is "Marginal Theory."

There is no room to exist for this marginal theory in the macro economic studies, or in the equation of the general equilibrium theorem.

Suppose we mention the delivations of the marginal theory, such as a demand coefficient, a production or supply coefficient, an elaciticity coefficient. Engel functions, an equilibrium distribution coefficient, you can at once see that these coefficients or theorem belong to the subjective value system of economics.

It is easier for us to evaluate the above various coefficients to-day than the old times, as we are access to Survey of Family Income and Expenditure from Bureau of Statistics, Office of the Prime Minister, Japan, data on the centralization of Japanese Industry from Office of Bureau of Fair Trade, or production data from various Institutes of the Industrial Organizations and Associations.

(1) Definitions

(i) Definition of density with a normal distribution.

Any single social event may be expressed in terms of a normal density with zero distribution parameter, that is, a standard deviation (s) or a coefficient of variation (c. v.).

$$D_{\mathrm{c.v.}0}(x)$$

(ii) Groups of events and their distributions.

Statistically two approaches are distinguishable.

(a) Parameters such as central parameters, distribution parameters, and Ns are to be known, we are expected to find the composition of the distribution.

(b) The sample distribution is known and we are expected to estimate parameters by decomposing the distribution.

In either (a) or (b), we have Stratified Multiple Normal Populations for social events.

Social events may be defined,

If $y=F(x)$ and its derivative be $f(x)$,

Then the Stratified Multiple Normal Populations Model can be applied to the integral.

$$\int_0^\infty f(x)dx = \Sigma D^{N_1}_{\mathrm{c.v.}_1}(x_1) + \Sigma D^{N_2}_{\mathrm{c.v.}_2}(x_2) + \Sigma D^{N_3}_{\mathrm{c.v.}_3}(x_3) + \cdots\cdots + D^{N_n}_{\mathrm{c.v.}_n}(x_n)$$

Here, you see, $\sum D^{N_1}_{c.v\ 1}\ (x_1)$ represents one normal distribution frequency table.

(2) Theorem of Normal Disfribution

Axiom 1. The distribution of a population is nvrmal so far as the variations of a member of the population are caused by nothing but accompanied random errors.

Theorem 1. A skewed distribution is had when a combination of two or more normal distributions with different central means has resulted.

Theorem 2. A kurtosis is had when a combination of two or more normal distributions with different distribution parameters has resulted.

Theorem 3. A skewed distribution can be decomposed into two or more normal distributions having central and distribution parameters.

Theorem 4. A kurtosis can be decomposed into two or more normal distributions having different distribution parameters.

(3) Theory of Exact Information

So far as we know, no conveient measure has been invented to estimate the degree of exact information that the summary or aggregate parameter can represent the structural information while the latter are the constituents of the former.

In discussing an economic problem in macro-economics-state level, the worst part now we are facing is that we do not know how to establish the parametric relationship between Macro-economics-state and Micro-economics-state.

It is a well known fact from the standpoint of the theory of information as well as the theory of probability, that we need at least two parameters to carry a density information.

In order to accertain the degree of exact information that a summation parameter can convey, three simple formulas are prepared.

(1) $$I_{E_1}=1-\frac{\sum\left|\begin{Bmatrix}\text{Actual}\\ \text{Frequency Table}\end{Bmatrix}-\begin{Bmatrix}\text{Frequency Table from}\\ \text{Summation Parameter}\end{Bmatrix}\right|}{2N}$$

(2) $$I_{E_2}=1-\frac{\sum\left|\begin{Bmatrix}\text{Actual}\\ \text{Frequency Table}\end{Bmatrix}-\begin{Bmatrix}\text{Frequency Table from}\\ \text{Stratified Multiple Nor-}\\ \text{mal Populations Model}\end{Bmatrix}\right|}{2N}$$

(3) $$I_{E_3}=1-\frac{\sum\left|\begin{Bmatrix}\text{Frequency Table}\\ \text{from Summation}\\ \text{Parameter}\end{Bmatrix}-\begin{Bmatrix}\text{Frequency Table from}\\ \text{Stratified Multiple}\\ \text{Normal Populations}\end{Bmatrix}\right|}{2N}$$

(4) Decomposition of the Income Distribution (Whole families) in Japan, in 1959

The followings are the results of the decomposition of the Income Distribution in Japan in 1959 by means of FACOM 270-20/30.

STRATIFIED MULTIPLE NORMAL POPULATIONS

XBRI	30.5	COEF1	32.0	CONS1	1174133.0
XBAR2	49.5	COEF2	25.0	CONS2	515268.7
XBAR3	95.0	COEF3	26.9	CONS3	243613.1
ERROR	0.0240				

DATA	STRATUM1	STRATUM2	STRATUM3	SUM	ERROR
10598.9	22456.8	397.9	92.1	22947.0	0.5825
145895.0	155565.5	4497.0	327.7	160390.2	0.0496
444733.0	407808.6	27185.5	1002.9	435997.1	0.0098
528284.0	407808.6	88199.3	2641.3	498649.2	0.0280
312562.0	155563.5	153932.6	5986.1	315484.2	0.0046
261342.0	23667.9	217948.6	31276.4	272886.9	0.0220
132255.0	24.2	23078.2	101139.6	124242.0	0.0302
96055.0	0.0	9.6	101118.9	101128.5	0.0264
	1172897.1	515248.7	243579.0	1931725.2	

From the foregoing computation, we have the income model under 2,000,000 Yen a year as follows:

$$\Sigma D_{32}^{172897}(30.5)+\Sigma D_{25}^{515249}(49.5)+\Sigma D_{27}^{243579}(95.0)$$

(5) **Theory of Half Normal**

The second study in this paper deals with the theory of Half Normal. It sounds somewhat strange, however, it is quite effective approach in establishing parametric relationships among three factors, changes in price level, changes in consumption level, and changes in income level. In Micro economics state, a consumer tends to allocate his income in such a way that the marginal utility that he can realize from each category of goods tend to be equal. How can we be possible to treat Macro-economics-state so that they may be able to behave themselves to allocate their income in such a way that the marginal utility that they can realize from each category of goods tend to be equal?

The only possibility is the asumption of a normal distribution of the same income strata. This is the very important condition which makes it possible to treat a macro-economics-state unit as a micro-economics-state unit, in the application of an economic theory originated in micro-economics-state.

When we came to find the elaciticity coefficients in distribution theory, we realized that the distribution of an income strata was normal and therefore, symmetric on both sides (of course, we deliverately took it so), however, the distribution of the upper half and the lower half of expenditure values were not symmetrical. Therefore, in deriving the elaciticity coefficients, the best combination can be had by letting the lower half of the income distribution corresponds to the lower half of the expenditure value of a category and the upper half of the income distribution corresponds to the upper half of the expenditure value of a category. That is,

$$\sum_{l}^{\bar{x}} D^{N_1}_{c.v_1}(x_1) \, vs \sum_{l}^{\bar{v}} D^{N_1}_{c.v._1}(v_1)$$

$$\sum_{\bar{x}}^{h} D^{N_1}_{c.v._1}(x_1) \, vs \sum_{\bar{v}}^{h} D^{N_1}_{c.v_1}(v_1)$$

(1 means the lowest class, h means the highest class)

(6) Elasticity Coefficients

Let v stands for value and p for price or $y=p$ where y stands for income.

We have two formula for the elaciticity coefficient.

(i) Point formula.

$$\eta_P = \frac{v_1 - v_0}{p_1 - p_0} \Big/ \frac{v_0}{p_0}$$

(ii) Arc formula.

$$\eta_P = \frac{v_1 - v_0}{p_1 - p_0} \Big/ \frac{v_1 + v_0}{p_1 + p_0}$$

(iii) Expanding (i) in distribution theory:

$$\eta_P = \frac{\frac{1}{2}\text{Range of } \alpha\% \ D_{c.v.v0}(v_0)}{\frac{1}{2}\text{Range of } \alpha\% \ D_{c.v.P0}(p_0)} \Big/ \frac{v_0}{p_0}$$

$$= \frac{\text{Range of } \alpha\% \ D_{c.v.v0}(v_0) \cdot p_0}{\text{Range of } \alpha\% \ D_{c.v.P0}(p_0) \cdot v_0}$$

$$= \frac{\text{Range of } \alpha\% \ D_{c.v.v0}(v_0 p_0)}{\text{Range of } \alpha\% \ D_{c.v.P0}(p_0 v_0)}$$

$$= \frac{\text{Range of } 99\% \ D_{c.v.v0}(50)}{\text{Range of } 99\% \ D_{c.v.P0}(50)}$$

……We have the table for this value

(iv) Expanding (ii) in distribution theory:

$$\eta_P=\frac{\frac{1}{2}\text{Range of }\alpha\%\ D_{c.v.v0}(v_0)}{\frac{1}{2}\text{Range of }\alpha\% D_{c.v.P0}(p_0)}\Big/\frac{v_1+v_0}{p_1+p_0}$$

$$=\frac{\text{Range of }\alpha\%\ D_{c.v.}(v_0)\cdot(p_1+p_0)}{\text{Range of }\alpha\%\ D_{c.v.P_0}(p_0)\cdot(v_1+v_0)}$$

$$=\frac{\text{Range of }\alpha\%\ D_{c.v.v0}(p_0v_0+v_0p_1+p_0v_1-p_0v_0)}{\text{Range of }\alpha\%\ D_{c.v.P_0}(p_0v_0+p_0v_1)}$$

$$=\frac{\text{Range of }\alpha\%\ D_{c.v.v0}(p_0v_0+p_0v_1)}{\text{Range of }\alpha\%\ D_{c.v.P0}(p_0v_0+p_0v_1)}$$

$$+\frac{\text{Range of }\alpha\%\ D_{c.v.v0}(p_1v_1-p_0v_1)}{\text{Range of }\alpha\%\ D_{c.v.P0}(p_0v_0+p_0v_1)}$$

$$\frac{\text{Range of }\alpha\%\ D_{c.v.v0}(p_1v_0-p_0v_1)}{\text{Range of }\alpha\%\ D_{c.v.P0}(p_0v_0+p_0v_1)}$$

……Genetally negrigrble.

$$=\frac{\text{Range of }\alpha\%\ D_{c.v.v0}(p_0v_0+p_0v_1)}{\text{Range of }\alpha\%\ D_{c.v.P_0}(p_0v_0+p_0v_1)}$$

$$=\frac{\text{Range of }99\%\ D_{c.v.v0}(50)}{\text{Range of }99\%\ D_{c.v.P_0}(50)}$$

Thus we have the Elasticity Coefficient it for the value of the items against the price and the Elasticity Coefficient for the price against the value of the items.

$$\eta_P=\frac{\text{Range of }99\%\ D_{c.v.v0}(50)}{\text{Range of }99\%\ D_{c.v.P_0}(50)}$$

……We have a table for this value.

$$\eta_v=\frac{\text{Range of }99\%\ D_{c.v.P0}(50)}{\text{Range of }99\%\ D_{c.v.N_v}(50)}$$

……We have a table for this value.

Thus we have the elasticity coefficients for the value of the items against the price and for the price against the value of the items.

(7) Three Systems of Normal Distributions

(i) Gauss-Laplace Normal Distribution $N(0, 1)$

Parametric Simulation of the Consumption Estimate on Butter, Japan in 1960

No.		1	2	3	4	5	6	7	8	9	10	11
Income Change	I	6.5%	6.8%	7.1%	7.4%	7.7%	8.0%	8.3%	8.6%	8.9%	9.2%	9.5%
	II	7.0%	8.0%	9.0%	10.0%	11.0%	12.0%	13.0%	14.0%	15.0%	16.0%	17.0%
	III	8.0%	9.0%	10.0%	11.0%	12.0%	13.0%	14.0%	15.0%	16.0%	17.0%	18.0%
Price Change	Main Food	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%	6.5%	7.0%	7.5%	8.0%	8.5%
	Others	3.5%	4.5%	5.5%	6.5%	7.5%	8.5%	9.5%	10.5%	11.5%	12.5%	13.5%
	Living	2.0%	2.3%	2.6%	2.9%	3.2%	3.5%	3.8%	4.1%	4.4%	4.7%	5.0%
	Lightd & Heat	2.0%	2.2%	2.4%	2.6%	2.8%	3.0%	3.2%	3.4%	3.6%	3.8%	4.0%
	Clotbing	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%	6.5%	7.0%
	Misccled	5.0%	6.0%	7.0%	8.0%	9.0%	10.0%	11.0%	12.0%	13%0%	14.0%	15.0%
Rate of Increase in Number of Families / No.												
	Income Strea Rate I 0.5% II 4.0% III 11.0%	* 9,483,557	* 9,483,403	* 9,483,153	* 9,482,895	* 9,482,641	* 9,482,382	* 9,482,142	* 9,481,889	* 9,531,957	* 9,481,384	* 9,481,130
	I 1.0% II 5.0% III 12.5%	9,560,916	9,560,789	9,560,608	9,580,441	9,560,258	9,560,125	9,559,966	9,559,806	9,951,037	9,559,486	9,559,323
	I 1.5% II 6.0% III 14.0%	9,538,187	9,538,126	9,538,060	9,537,990	9,637,925	9,537,859	9,637,790	9,637,720	9,688,797	9,637,583	9,637,523
	I 2.0% II 7.0% III 15.5%	9,715,462	9,715,487	9,715,519	9,715,536	9,715,585	9,715,589	9,715,618	9,715,642	9,767,223	9,715,692	9,715,724
	I 2.5%% II 8 8.0% III 17.0%	9,792,729	9,792,848	9,792,967	9,793,090	9,793,204	9,793,323	9,793,438	9,793,561	9,845,649	9,793,794	9,793,913
	I 3.0% II 9.0% III 18.5%	9,870,000	9,870,209	9,870,422	9,870,627	9,870,844	9,871,262	9,871,262	9,871,496	9,924,071	9,871,901	9,872,114
	I 3.5% II 10.0% III 20.0%	9,947,271	9,947,570	9,947,873	9,948,484	9,948,484	9,948,787	9,949,090	9,949,397	10,002,493	9,950,003	9,960,314

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* Unit 1000 yen

(ii) R. A. Fisher Normal Distribution $N(1,\ 1)$

(iii) M. Hirayama Normal Distribution $N\left(1,\ \frac{1}{m}\right)$

A. The very important probability integral distribution tables have been constracted in terms of c. v. from c. v. 2 to 170.

B. The tables of Random Number of Normal Distribution in the system of $N\left(1,\ \frac{1}{m}\right)$ has been constracted from 50 $_{\text{c.v.}}$ to 2 $_{\text{c.v.}}$

The equivarence of the random number of the normal probability distribution and the old one is proved as follows:

Before we get a random nuber for an event a, we have to have two parameter X and S

For usual random number,

$$R=\bar{X}_a+R\times S_a$$

For the new system random number,

$$R=R_{\text{c.v.}a}(50)\times\frac{\bar{X}_a}{50}$$

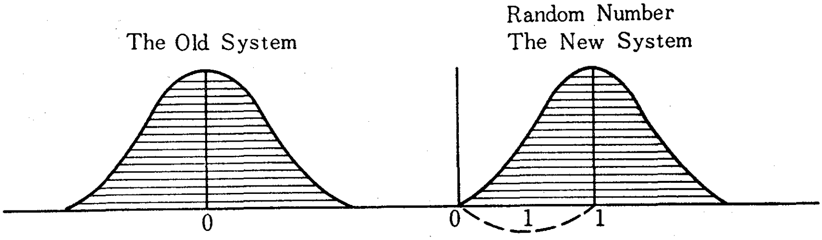
To prove: $\bar{X}_a+R\times S_a=R_{\text{c.v.}a}(50)\times\frac{\bar{X}_a}{50}$

Divided by $\bar{X}_a$

$$1+R\times\frac{S_a}{\bar{X}_a}=R_{\text{c.v.}a}(50)\times\frac{1}{50}$$

$$1+R\times{}_{\text{c.v.}a}=R_{\text{c.v.}}\quad(1)\qquad\frac{S_a}{\bar{X}_a}=\frac{\text{c.v.}a}{100}$$

Random Number



* The new system random number are drawn the axis of which is shifted right by 1 unit.

(8) A System of Sufficient Statistics

According to R. A. Fisher, a sufficient statistics is had when the population is normal, since if it is normal, the parameter, s, $\bar{x}$, and ancillary statistics N, you can reproduce the population in detail and no information loss arises.

E. T. Whittaker and G. Robinson stated in their book "The Calculus of Observations" p. 175 section 88, on Reproductive Property of the Normal Law of Frequency, to the effect, that...."The only seminvariant is therefore of order two and has the value. From the additive property of semiinvariants it follows that a deviation which is formed by the summation of any number of partial deviations each of which obeys the normal law, has all its semiinvariants zero except the second; and therefore this aggregate deviation itself obeys the normal law. This is the reproductive property or group property of the normal law of frequency; an aggregate deviation, formed by the summation of any number of deviations which obey the normal law, itself obeys the normal law."

(9) The Theory and Technical System of an Equilibrium Distribution Coefficient

Under Engel Function, if you have an elaciticity coefficient defined by a normal distribution system $N\left(1, \frac{1}{m}\right)$, we can see the elaciticity coefficient of two variables is a ratio between a range of 99% probability density in term of $d_{\text{c.v.}}$

$$\eta_\alpha = \frac{\frac{1}{2}\text{Range of } 99\% \ D_{\text{c.v.}\bar{v}}(\bar{v}\cdot\bar{y})}{\frac{1}{2}\text{Range of } 99\% \ D_{\text{c.v.}\bar{y}}(\bar{y}\cdot\bar{v})} \Big/ \frac{\bar{y}}{\bar{v}}$$

The Equilibrium Distribution Coefficient is defined as:

$$\phi_i = \frac{\eta_{\alpha i} \bar{v}_i}{\sum \eta_{\alpha i} \bar{v}_i}$$

The Demand Coefficient of ith item is defined as:

$$D_i = \frac{\frac{1}{2}\text{Range of } 99\% \ D_{c.v.\bar{v}}(\bar{v})}{\frac{1}{2}\text{Range of } 99\% \ D_{c.v.\bar{y}}(\bar{y})}$$

The Engel Coefficient of ith item is defined as:

$$E_i = \frac{\bar{v}_i}{y}$$

From the foregoing conceptional relationships, the following identities are to be established among these coefficients.

Please be noted that as soon as we find c. v. of each item and the income strata, we can immediately have D_i, E_i, $\eta_{\alpha i}$ by means of the Elaciticity Coefficient Tables.

(10) Parametric Simulation

As has been stated in (6), the elasticity coefficients coupled with income distributions and corresponding value distributions of the categories of goods consumed in the family not only enable us to find an equal marginal utility relationships among the categories of goods in the household consumption in the micro economic system as well as the total-economic system, but also permit us to make parametric simulation by means of simple arithmetic method.

The following conditions are given in an example of a parametric simulation applied to three income strata.

Income .... 8% up.

1. Cereals ....15% up.
2. Other food........12% up.
3. Housing .... 5% up.

4. Fuel and Light ...stay same.
5. Clothing .... 4% up.
6. Others............ 8% up.
7. Saiving

Elasticity Coefficients and Values of Seven Categories

7 categories / η', η, v	i	ii	iii	iv	v	vi	vii
Upper Income Strata	η'_{P_1} η'_{v_1}	η'_{P_2} η'_{v_2}	η'_{P_2} η'_{v_3}	η'_{P_4} η'_{v_4}	η'_{P_5} η'_{v_5}	η'_{P_5} η'_{v_5}	η'_{P_7} η'_{v_7}
Lower Income Strata	η_{P_1} η_{v_1}	η_{P_2} η_{v_2}	η_{P_3} η_{v_3}	η^d_4 η_{v_4}	η_{P_5} η_{v_5}	η_{P_6} η_{v_6}	η_{P_7} η_{v_7}
Central Varue for BothUpper and Lower Income Strata	v_1	v_2	v_3	v_4	v_5	v_6	v_7

The basic allocation ratio on equal marginal utility in macro economics state for the lower half of the income strata may be had:

$$\eta_{v1}\cdot v_1+\eta_{v2}\cdot v_2+\eta_{v3}\cdot v_3+\eta_{v4}\cdot v_4+\eta_{v5}\cdot v_5+\eta_{v6}\cdot v_6+\eta_{v7}\cdot v_7$$

The basic allocation ratio on equal marginal utility in macro economics-state for the upper half of the income strata may be had:

$$\eta'_{v1}\cdot v_1+\eta'_{v2}\cdot v_2+\eta'_{v3}\cdot v_3+\eta'_{v4}\cdot v_4+\eta'_{v5}\cdot v_5+\eta'_{v6}\cdot v_6+\eta'_{7}\cdot v_7$$

For the lst income strata, 8% increase in income brings 2,033 yen increase per month while increase in prices of the items brings deficit of 571, 968, 118, 120, 644, 2421 (yen), if people don't want to cut the consumption of items of which prices rise. The balance of 2421 yen—2033 yen or 388 yen will be deflated according to the basic allocation percentages.

For the second income strata, we have income increase of 3300 yen and the price increase by 3029 yen. The balance of 197 yen is to be allocated over seven categories of items according to the basic

COMPUTATION SHEET FOR I INCOME STRATA

Income Strata / 7 Categories	Lower Half Income Strata			Upper Half Income Strata		
	$\eta_{P_i} \times v_i$	$\eta_{P_i} v_i$	%	$\eta'_{P_i} \times v_i$	$\eta'_{P_i} v_i$	%
cereals	1.709×3806	6504	17.337	3.851×3806	14657	31.845
Other Food	1.925×8070	15573	41.510	1.025×8070	8272	17.973
Housing	.899×2365	2621	6.986	2.049×2365	4846	10.529
Fuel & Light	1.155×1228	1418	3.780	1.709×1228	2099	4.561
Clothing	.879×3008	2644	7.048	1.419×3008	4286	9.273
Miscellaneous	.879×8053	7079	18.869	1.246×8053	10034	21.801
Saving	.839×1999	1677	4.470	.925×1999	1849	4.017
		37516			46025	

COMPUTATION SHEET FOR II INCOME STRATA

Income Strata / 7 Categories	Lower Half Income Strata			Upper Half Income Strata		
	$\eta_{P_i} \times v_i$	$\eta_{P_i} v_i$	%	$\eta'_{P_i} \times v_i$	$\eta'_{P_i} v_i$	%
Cereal	2.489×4349	10864	18.048	3.537×4349	15382	32.173
Other Food	1.371×10203	13988	23.238	.844×10203	4611	18.011
Housing	1.545×2892	15283	25.389	.962×2892	2782	5.819
Fuel & Light	1.458×1576	2298	3.818	1.088×1576	6219	13.008
Clothing	1.037×4224	4380	7.276	.728×4224	3075	6.432
Miscellaneous	.927×11408	10575	17.568	.844×11408	9628	20.138
Saving	.927×3029	2807	4.663	.696×3029	2108	4.409
		60195			47805	

allocation percentage.

For the third income strata, we have income increase of 6333 yen and the price increase by 4957 yen. The balance of 1376 yen is to be allocated over seven categories of items according to the basic allocation percentage.

COMPUTATION SHEET FOR III INCOME STRATA

Income Strata / 7 Categories	Lower Half Income Strata			Upper Half Income Strata		
	$\eta_{Pi}\times v_i$	$\eta_{Pi}v_i$	%	$\eta'_{Pi}\times v_i$	$\eta'_{Pi}v_i$	%
Cereals	3.811×4837	18434	21.770	6.702×4937	32418	24.424
Other Food	1.480×15274	22606	26.697	2.960×1527	45211	34.062
Housing	1.038×4426	4594	5.425	1.284×4426	5683	4.282
Fuel & Light	1.909×2237	4270	5.043	2.433×2237	5443	4.101
Clothing	.757×10805	8179	9.659	1.284×10805	13874	10.453
Miscellaneous	.961×21814	20963	24.757	1.038×21814	22643	17.059
Saving	.845×6661	5629	6.648	1.120×6661	7460	5.620
		84675			132732	

ALLOCATION TABLE

Income Strata / 7 Categories	I Income Strata		II Income Strata		III Income Strata	
	Lower Half (−)	Upper Half (−)	Lower Half (+)	Upper Half (+)	Lower Half (+)	Upper Half (+)
Cereals	67	124	36	63	300	322
Other Food	161	70	46	35	367	469
Housing	27	41	50	11	75	59
Fuel & Light	15	18	8	26	69	56
Clothing	27	36	14	13	133	144
Miscelleneous	73	85	35	40	341	235
Saving	17	16	9	9	91	77

(11) How can We verfy Non-experimental Science Economics to be True?

In order to establish a scientific system, we should have set up an operational relationships between the distribution of the variation of the causative variable and the distribution of the variation of the resultant variable, both distribution of which must be normal.

The causative variable is of course normal from the begining as it is decomposed as such. Therefore the verification consists of X^2-test

Results of X^2-Test of Normality

Distributions of Resultant Variables					
Income Strata		Degree of Freedom	Sgnificant Level 5%	X^2	Significant None
1	Lower	6	5 %	2.9518	None
1	Uper	5	5 %	4.4502	None
2	Lower	5	5 %	4.3.55	None
2	Uper	5	5 %	3.8156	None
3	Lower	8	5 %	10.8152	None
3	Uper	1	5 %	3.5128	None

of normality for the distribution of the resultant variable.

(12) Producer's Equilibrium Distribution Coefficient

(i) Producer's Distribution

$\sum D\text{c.v.}_{\bar{x}_1}(\bar{x}_1)$

$\vdots$

$\sum D\text{c.v.}_{\bar{x}_2}(\bar{x}_2)$

$\sum D\text{c.v.}_{\bar{x}_n}(x_n)$

(ii) Supply price Dis.

Lower Half	Upper Half
$\sum D\text{c.v.}\bar{p}_1(\bar{p}_1)$	$\sum D\text{c.v.}\bar{p}_1(p_1)$
$\sum D\text{c.v.}\bar{p}_2(\bar{p}_2)$	$\sum D\text{c.v.}\bar{p}(\bar{p}_2)$
$\vdots$	$\vdots$
$\sum D\text{c.v.}\bar{p}_n(\bar{p})$	$\sum D\text{c.v.}\bar{p}_n(p_n)$

(iii) Elaciticity Co.

Lower Half	Upper Half
$\eta\alpha\bar{x}_1$	$\eta\alpha\bar{x}_1$
$\eta\alpha\bar{x}_2$	$\eta\alpha\bar{x}_2$
$\vdots$	$\vdots$
$\eta\alpha\bar{x}_n$	$\eta\alpha\bar{x}_n$

(iv)

$\dfrac{\bar{x}_i}{\bar{p}_i}$

$\dfrac{\bar{x}_1}{p_1}$

$\vdots$

$\dfrac{\bar{x}_n}{\bar{p}_n}$

(v) Supply Co.

Lower Half	Upper Half
$\eta\alpha_1 \times \dfrac{\bar{x}}{\bar{p}_1}$	$\eta\alpha_1 \times \dfrac{\bar{x}_1}{\bar{p}_1}$
$\vdots$	$\vdots$
$\eta\alpha_n \times \dfrac{\bar{x}_n}{\bar{p}_n}$	$\eta\alpha_1 \times \dfrac{x}{p}$

(vi) Equilibrium Dis. Co.

Lower Half

$$\frac{\eta\alpha_1 \times \dfrac{\bar{x}_1}{\bar{p}_1}}{\Sigma\eta\alpha_1 \times \dfrac{x_1}{\bar{p}_1}}$$

$$\vdots$$

$$\frac{\eta\alpha_n \times \dfrac{\bar{x}_n}{\bar{p}_n}}{\Sigma\eta\alpha_n \times \dfrac{\bar{x}_n}{\bar{p}_n}}$$

Upper Half

$$\frac{\eta\alpha_1 \times \dfrac{\bar{x}_1}{\bar{p}_1}}{\Sigma\eta\alpha_1 \times \dfrac{\bar{x}_1}{\bar{p}_1}}$$

$$\vdots$$

$$\frac{\eta\alpha_n \times \dfrac{\bar{x}_n}{\bar{p}_n}}{\Sigma\eta\alpha_n \times \dfrac{x_n}{\bar{p}_n}}$$

Butter Consumption Estimates in 1960.

Equilibrium Distribution Coefficients for Other-foods

Income Strata / Equi. Dis. Coeffi.	1st Income Strata		2nd Income Strata		3rd Income Strata	
	Lower Half	Upper Half	Lower Half	Upper Half	Lower Half	Upper Half
Other Foods Distribution Coef.	.159343	.375536	.227136	.291689	.173549	.111996

A Supply or Production Coefficient is to be determined by a combination of the marginal cost of production and the marginal cost of distribution, both cost curves of which tend to go up after their passing a certain quantity of production and sales line.

A great care is, however, taken to formulate the model. We use a production or a market share in the density model to find the distribution parameter. In so doing we have three assumptions:

(i) A producer producing a commodity, his production density forms one half normal distribution in macro economics-state.

(ii) His present production or market share is supposed to have the outcome of the four factors:

Initial Conditions + Non economic Conditions + Economic Conditions + Random Error

Caluculation on Micro-Economic System to Find a New Equilibrium Point for 10% Increase of Butter Production (1200 tons) for Upper 10 Enterprises in the 35th Year of Showa

Order	Production Distrifution	Suply Priees		η_α		$\frac{\bar{x}}{\bar{p}}$	Supply Coefficient		Distribution Coefficient		Distribution Increased Prod.		Price Decrease New Point		Average Price Lowered	New Equilibrium Point		
		Lower Half	Upper Half	Lower Half	Upper Half		Lower Half $\eta_{\beta i}\cdot\frac{\bar{x}_i}{\bar{p}_i}$	Upper Half $\eta_{\beta i}\cdot\frac{\bar{x}_i}{\bar{p}_i}$	Lower Half $\frac{\eta_\beta\cdot\bar{x}/\bar{p}}{\Sigma_{\eta\beta}\cdot\bar{x}/\bar{p}}$	Upper Half $\frac{\eta_\beta\cdot\bar{x}/\bar{p}}{\Sigma_{\eta\beta}\bar{x}/\bar{p}}$	Lower Half	Upper Holf	Lower Half	Upper Half		Production Distribution	Supply Price Lower Half	Supply Price Upper Half
1	ΣD_{12} (7117)	ΣD_2 (332)	ΣD_4 (332)	6.00348	3.02883	21.437	128.697	64.928	% 74.63	% 58.45	447.78	350.70	−3.340	−5.400	−4.5	ΣD_{12} (7915.48)	ΣD_2 (327.5)	ΣD_4 (327.5)
2	ΣD_7 (1888)	ΣD_2 (332)	ΣD_4 (332)	2.49467	1.76305	5.687	14.187	10.026	8.24	9.02	49.44	54.12	−3.485	−5.400	−4.5	ΣD_7 (1991.56)	ΣD_2 (327.5)	ΣD_4 (327.5)
3	ΣD_{14} (1501)	ΣD_4 (332)	ΣD_4 (332)	3.52609	3.52609	4.521	15.941	15.941	9.24	14.35	55.44	86.10	−3.480	−5.400	−4.5	ΣD_{14} (1642.54)	ΣD_4 (327.5)	ΣD_4 (327.5)
4	ΣD_{18} (847)	ΣD_6 (320)	ΣD_4 (320)	3.00003	4.54277	2.647	7.941	12.025	4.61	10.83	27.66	64.98	−3.485	−5.405	−4.5	ΣD_{18} (939.64)	ΣD_6 (315.5)	ΣD_4 (315.5)
5	ΣD_{17} (206)	ΣD_6 (320)	ΣD_5 (320)	2.82207	4.27332	.644	1.817	2.752	1.05	2.48	6.30	14.88	−3.465	−5.405	−4.5	ΣD_{17} (227.18)	ΣD_6 (315.5)	ΣD_4 (315.5)
6	ΣD_{20} (133)	ΣD_8 (310)	ΣD_6 (310)	2.50081	3.33100	.429	1.073	1.425	.62	1.28	3.72	7.68	−3.465	−5.390	−4.5	ΣD_{20} (144.40)	ΣD_8 (305.5)	ΣD_6 (305.5)
7	ΣD_{23} (97)	ΣD_8 (310)	ΣD_6 (310)	2.87356	3.82746	.313	.899	1.198	.52	1.08	3.12	6.48	−3.470	−5.410	−4.5	ΣD_{23} (106.60)	ΣD_8 (305.5)	ΣD_6 (305.5)
8	ΣD_{26} (85)	ΣD_{10} (310)	ΣD_6 (310)	2.59740	4.32451	.274	.712	1.186	.41	1.07	2.46	6.42	−3.455	−5.420	−4.5	ΣD_{26} (93.88)	ΣD_{10} (305.5)	ΣD_6 (305.5)
9	ΣD_{30} (61)	ΣD_{10} (300)	ΣD_8 (300)	2.97610	3.72018	.203	.604	.755	.35	.68	2.10	4.08	−3.475	−5.405	−4.5	ΣD_{30} (67.18)	ΣD_{10} (295.5)	ΣD_8 (295.5)
10	ΣD_{34} (61)	ΣD_{12} (300)	ΣD_8 (300)	2.78289	4.17899	.203	.565	.848	.33	.76	1.98	4.56	−3.500	−5.375	−4.5	ΣD_{34} (67.58)	ΣD_{12} (295.5)	ΣD_8 (295.5)
計	11996 t						172.436	111.084	100.00	100.00	600.00	600.00				13,196 t		

Caluculation on Macro-Economic System to Find a New Equilibrium Point for 10 Enterprises in the 35th Year of Show.

1 ~ 10	$\Sigma D_{13.2}$(11996)	$\Sigma D_{7.4}$(330)	$\Sigma D_{5.6}$(330)	4.33069	3.27450	36.352	157.429	119.035	100.00	100.00	600.00	600.00	−3,811	−5,041	−4.5	$\Sigma D_{13.2}$ (13196)	$\Sigma D_{7.4}$(325.5)	$\Sigma D_{5.6}$(325.5)

Notice : Being Difficulty in Reading Between Lines, Caluculation in Elaciticity Coefficient, ah Abribiation Method Adopted.

Summary Table for Elasticity Coefficients by Categories, by Income Strata of Japanese Household in 1959.

E. C. \ Income Strata / Categories Expenditures	$\sum_{l}^{30.5} D_{32}^{1172897}(30.5)$ Lower Half	$\sum_{30.5}^{h} D_{32}^{1172897}(30.5)$ Upper Half	$\sum_{l}^{49.5} D_{25}^{515249}(49.5)$ Lower Half	$\sum_{49.5}^{h} D_{25}^{515249}(49.5)$ Upper Half	$\sum_{l}^{95.0} D_{27}^{243579}(95.0)$ Lower Half	$\sum_{95.0}^{h} D_{27}^{243579}(95.0)$ Upper Half
η_p	1.709	3.851	2.489	3.537	3.811	6.702
η_v	.585	.260	.492	.238	.262	.149
Cereals	$\sum D_{18}^{N_1}(3806)$	$\sum D_{8}^{N_1}(3806)$	$\sum D_{10}^{N_2}(4349)$	$\sum D_{7}^{N_2}(4349)$	$\sum D_{7}^{N_3}(4837)$	$\sum D_{4}^{N_3}(4837)$
η_p	1.925	1.025	1.371	.844	1.480	2.960
η_v	.519	.976	.701	1.185	.676	.338
Other Food	$\sum D_{16}^{N_1}(8070)$	$\sum D_{31}^{N_1}(8070)$	$\sum D_{18}^{N_2}(10203)$	$\sum D_{30}^{N_2}(10203)$	$\sum D_{18}^{N_3}(15274)$	$\sum D_{9}^{N_3}(15274)$
η_p	.899	2.049	1.545	.968	1.038	1.284
η_v	1.112	.488	.623	1.040	.963	.779
Housing	$\sum D_{38}^{N_1}(2365)$	$\sum D_{15}^{N_1}(2365)$	$\sum D_{16}^{N_2}(2892)$	$\sum D_{26}^{N_2}(2892)$	$\sum D_{41}^{N_3}(4426)$	$\sum D_{21}^{N_3}(4426)$
η_p	1.155	1.709	1.458	1.088	1.909	2.433
η_v	.860	.585	.660	.919	.524	.411
Fuel & Light	$\sum D_{27}^{N_1}(1228)$	$\sum D_{18}^{N_1}(1228)$	$\sum D_{17}^{N_2}(1576)$	$\sum D_{23}^{N_2}(1576)$	$\sum D_{14}^{N_3}(2237)$	$\sum D_{11}^{N_3}(2237)$
η_p	.879	1.419	1.037	.728	.757	1.284
η_v	1.138	.705	.964	1.374	1.321	.779
Clothing	$\sum D_{40}^{N_1}(3008)$	$\sum D_{22}^{N_1}(3008)$	$\sum D_{24}^{N_2}(4224)$	$\sum D_{37}^{N_2}(4224)$	$\sum D_{41}^{N_3}(10805)$	$\sum D_{21}^{N_3}(10805)$
η_p	.879	1.246	.927	.844	.961	1.038
η_v	1.138	.803	1.079	1.185	1.041	.963
Miscellaneous	$\sum D_{40}^{N_1}(8053)$	$\sum D_{25}^{N_1}(8053)$	$\sum D_{27}^{N_2}(11408)$	$\sum D_{30}^{N_2}(11408)$	$\sum D_{28}^{N_3}(21814)$	$\sum D_{26}^{N_3}(21814)$
η_p	.839	.925	.927	.696	.845	1.120
η_v	1.192	1.081	1.079	1.437	1.183	.893
Saving	$\sum D_{50}^{N_1}(1999)$	$\sum D_{29}^{N_1}(1999)$	$\sum D_{27}^{N_2}(3029)$	$\sum D_{42}^{N_2}(3029)$	$\sum D_{33}^{N_3}(6661)$	$\sum D_{24}^{N_3}(6661)$

Sources : Statistical Report NO. 85, Bureau of National Tax, Minister of Finance, Japanese Government, 1959. 1959 National Survey of Family Income and Expenditure Vol. 1, Family Income and Expenditure in all Japan, Bureau of Statistics, Office of the Prime Minister, Japan.

Notes : $N_1=1172897$ $N_2=515249$ $N_3=243579$

(iii) Assuming an ideal case that the market or production shares each producer enjoying is solely the outcome of random error.

With these three assumptions, can we find any sensible density formula to detect the producer's behaviour?

The following is the formula I have found:

$$p_i = 2 \cdot \sum_{\bar{x}-\frac{\bar{x}}{N}(i)}^{\bar{x}-\frac{\bar{x}}{N}(i-1)} D_{c.v.,k}(\bar{x})$$

The formula tells us immediately what the distribution parameter (in c. v.) is as soon as you find the percentage of the producer's share, his rank, and the number of his camerades competing in the market. Amount of his annual production is also another parameter (in this case, a central parameter, $\bar{x}$).

In the computation of the mathematical table for the above formula, a specially constructed probability integral tables with the central parameter, $\bar{x}=50$, and the distribution parameter in c. v. from 2 to 100. Thus the formula becomes:

The table has been constructed in the range of c. v. 2 to c. v. 100 and $N=11$.

(13) Production Elasticity Coefficient

An Elasticity Coefficient of Production against the price may be defined as,

$$\eta_3 = \frac{\text{Range of } 99\% \ D_{c.v.,s}(50)}{\text{Range of } 99\% \ D_{c.v.,p}(50)}$$

As can be seen in the formula, an elasticity coefficient of production share or production itself against price is a relative value between two densities of the production share and the price. Therefore, we cannot discuss the matter without the other. However, by fixing the price factor at constant level, we may be able to say something from the parameters derived from a production share.

The coefficient of variation of the lst rank producer shows the characteristics of the industry as a whole, that is,

We define the coefficient of variation of the rank lst producer to be,

$$c.v._c = c.v._1$$

Where 1 means rank first, c means characteristics of the industry. We define an average coefficient of variation, c. v. of the industry in certain year. Then we have three criterion in the development of Oligopoly of the industry as.

(i) Oligopoly progressing.

(a) $\overline{c.v.} < c.v._c = c.v._1$ or (b) $\overline{c.v._0} > \overline{c.v._1} > \overline{c.v._2} > \overline{c.v._3}$

(ii) Oligopoly retrogressing.

(a) $\overline{c.v.} > c.v._c = c.v._1$ or (b) $\overline{c.v._0} < c.v._1 < \overline{c.v._2} < \overline{c.v._3}$

(iii) Oligopoly stagnating.

$|c.v._c - \overline{c.v.}| = d$ if this amount has no significance.

Interpretation of $\dfrac{\sqrt{\sum_{2}^{5} p_i c.v.^2_i}}{\sum_{2}^{5} p_i} < c.v._c = c.v._1 \quad \dfrac{\sqrt{\sum_{6}^{10} p_i c.v.^2_i}}{\sum_{6}^{10} p_i} > c.v._c = c.v._1$

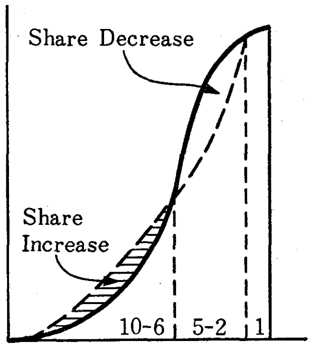
These two inequlities mean that the average coefficient of variation from rank 2nd to rank 5th producer is less than the coefficient of variation of the rank lst producer and the average coefficient of variation of the rank lst producer and the average coefficient of variation from rank 5th to the rank 10th producer is greater than the c. v.# of the industry.

In the industry in Japan where oligopoly is prevailing, it is characterized with a significant decrease in production or market share of producers whose ranks are from 2nd to 5th, because they live up to a high oligopoly prices, while there is a significant increase in production or market share of producers whose ranks are from 6th to 10th, because they are in a position to indulge in price cutting in order to raise their market share.

Correlation Coefficient between Mark-up Rate and c. v.

Mr. M. Kalecki is right when he says, in his book entitled," Theory of Economic Dynamics", in essence, the degree of monopoly can be interpreted in terms of the price fixing policy. In the business world, the price fixing policy is exactly equal to the mark-up rate policy. That is to say where there is a high oligopoly or a monopoly, the high mark-up rate tends to exist, however, there are other important factors for a higher mark-up rate. Such as the higher risks in the industry, the greater demands for the goods, etc.

The graphical representation is as follows:



Oligopoly In Japan

As a space is limited, only annual average c. v. s and c. v. s of the selected industries from 1959 to 1962 are listed below:

Indastries		Year 1959	1960	1961	1962
1. Butter	$c.v._c$	12	12	12	15
	c. v.	12.8	13.2	112.5	12.6
2. Glutamine-acid	$c.v._c$	8	8	9	12
	c. v.	10.2	10	10.4	10
3. News Paper (Material)	$c.v._c$	27	26	24	25
	c. v.	29.9	29.1	24.6	26.4
4. Hemp Yarn	$c.v._c$	19	20	16	15
	c. v.	18.5	18.7	16.2	16.1
5. Poly-Uletun Foam	$c.v._c$		33	25	26
	c. v.		32.8	31.3	29.8
6. Celluloid	$c.v._c$	16	12	11	11
	c. v.	18.3	14.4	13.4	13.4
13. Ingot Pipe	$c.v._c$	11.3	10	13	14
	c. v.	11.8	10.1	13	13.7
14. Aluminum	$c.v._c$	49	50	50	50
	c. v.	49.3	49.8	49.7	53.4
15. Can	$c.v._c$	14	14	14	14
	c. v.	15.2	15.2	15.1	15.4
16. Turbin	$c.v._c$	37	28	28	25
	c. v.	36.3	32.1	25.7	31.3
17. Tractor	$c.v._c$	19	22.5	20	18
	c. v.	19.3	23.4	19.7	18.5
18. Re-Copy	$c.v._c$	23	11	11.3	11.2
	c. v.	22.3	12.2	12.5	13.4
19. Ceeling Crane	$c.v._c$	13.3	12.3	13	16
	c. v.	14	13.5	14	18.3
20. Bearing	$c.v._c$	31	32	35	29
	c. v.	30.2	30.8	31.4	27.3

Indastries		Year 1959	1960	1961	1962
7. Rayon Filment	$c.v._c$	55	55	55	49
	c. v.	51.7	50.4	53	48.1
8. Thynthetic Fiber	$c.v._c$	19	21	21	20
	c. v.	22.4	23.3	21.8	21.4
9. Tire Tube	$c.v._c$	26	23	19	18
	c. v.	24.4	23.2	21.5	21.4
10. Plate Glass	$c.v._c$	41	40	41	44
	c. v.	49.7	48.6	48.9	50.4
11. Wire	$c.v._c$	31	33	28	27
	c. v.	32.2	27.9	30.2	30.1
12. Bearing Steel	$c.v._c$	28	28	19	18.5
	c. v.	28.5	28.3	19.5	19.3
21. Refrigerator	$c.v._c$	34	29	32	33
	c. v.	31.1	32.2	31.9	29.7
22. Tel evision	$c.v._c$	42	44	41	35
	c. v.	46.3	44.1	41.5	42
23. Mini-Trac	$c.v._c$	20.7	22.5	23	23.2
	c. v.	16.5	20.2	21.1	21.3
24. Light Track	$c.v._c$	35	34	40	43
	c. v.	33.9	36.8	37.1	43.3
25. Watches	$c.v._c$	33	36	35.5	34
	c. v.	38.7	35.7	34.8	33.6
26. Piano	$c.v._c$	31.7	36	23.6	25
	c. v.	26.2	28.5	20.6	22.3
27. Freight car	$c.v._c$	24	28	23	26.5
	c. v.	26.1	26.8	21.8	24.3

We need certain technique to segregate the relavent factors from the irrelevant factors. The technique recommended here is nothing but a method of a simple correlation between the mark-up rate or profit rate and c. v. of corresponding years.

Source: "Concentration of Japanese Industry "Dec. 1, 1963, Office of the Commisioner for Fair Trade.

Summary

(1) The Equilibrium Distrbution Theory may apply in any Subjective Economic system, smong others, Fields of Application

i . House-hold Economics (Consumer Economics).

ii . Producer Economics.

iii . Labor Union Economics.

iv. Financial Economics (the Central Government Economics as well as Local Governments)

v . Monopoly, Duopoly, and Oligopoly Economics.

vi. National Monopoly, Duopoly Oligopoly Economics.

vii. International Trade Economics.

viii. Multi-national Enterprise Economics.

(2) A new system of verification for non-experimental economic science.

(3) A new system of economic simulation introduced.

(4) A new table of probability integral.

It may be used in transferring from micro-economics to total (macro) economics in terms of probability density in order to hold the additive property between micro and total or macro-economics.

(5) A new table of elaciticity coefficients.

(6) A new table of an equilibrium distribution of a group. The table

may be used in estimation of production-sales shares, coefficients of variation, elaciticity coefficients, etc.

$$p_i = 2\cdot\sum \frac{\bar{x}-\frac{\bar{x}}{N}(i-1)}{\bar{x}-\frac{x}{N}(i)} D_{c.v.k}(\bar{x})$$

Conclusion

Despite of the fact that the Macro economics basing on the general equilibrium theory is intended to show an average or a mean level of economic variables, does not include variation concepts of the variables in the economic system. J. M. Keynes has developed economic dynamic theory in his book entitled, "the general theory of employment, interest, and money." In the development of his general theor-y, he has used the marginal theory throughout his book. So far as his theory are concerned, I am not in a position at present to say his theory be true, not be true, or his theory be revised or not be revised. However, there are a few comments I should like to make:-

(1) Unless, we, a part of the constituents of the national economy, find the relative importance of the economic subjectivism that determine the marginal value of the goods and services, or the marginal production operation, how can we establish the marginal theory in a macro-economics? Where there is no economic subjectivism there is no marginal theory.

(2) Since no macro-economic variable can satisfy the definition of R. A. Fisher's (normal) population, it is impossible to try to build up an economic science on a macro-economic level straightforward-ness.

(3) Scientific system in economics is to find a system of variations

among economic variables, and not to find a system of functional relationships among them. The former belongs to the system of probability while the latter belongs to the system of a mathematical function.

(4) A micro-economic variable may be so arranged that it satisfies R. A. Fisher's definition of the (normal) population that has a normal or a half-normal distribution. Therefore, an economic science must be built up arround micro-economics and consolidated into a macro-economics in the system of probability.