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The Existence Theorem Revisited

by Masao Fukuoka

The well established general existence theorem allows free goods, which are "forbidden" under such condition as gross substitutability. Since the stability and comparative static properties of our system heavily rely on the latter condition, it would be desirable to provide an alternative proof to ensure the existence of equilibrium on the domain of strictly positive prices. This paper attempts to give an answer to the question how far we can go towards the purpose *with* the aid of fixed point theorems. It might be contrasted with the Kuga-Nikaido approach which shows the existence without using any fixed-point technique.

Our two main assumptions are:

(B) For any sequence p^ν such that $\lim_{\nu \rightarrow \infty} p^\nu = p^0$ in P/P^0 and for any sequence $x^{\nu r}$ in $\hat{\varphi}^r(p^\nu)$

$$\lim_{\nu \rightarrow \infty} \sum_{r=1}^n x_i^{\nu r} = +\infty.$$

(U) Each production possibility set Y^0 is bounded above.

Adding (B) and (U) to the standard basic assumptions, we prove that there exists p^* in P^0 which ensures non-positive z^* in $E(p^*)$. The method of proof consists of a modified version of Grandmont's Theorem 1, which is based upon a non-decreasing sequence of non-empty, compact, convex subsets P^ν of P^0 such that $P^0 \subset \bigcup_{\nu=1}^{\infty} P^\nu$. By defining Z^ν as the convex hull of $E(P^\nu)$, and constructing a mapping from $P^\nu \times Z^\nu$ into itself, we can show by a standard argument that there exists a p^ν in P^ν and an x^ν in $E(p^\nu)$ such that $p z^\nu \leq 0$ for all p in P^ν .

Let $\lim_{\nu \rightarrow \infty} p^\nu = p^*$ and $\lim_{\nu \rightarrow \infty} z^\nu = z^*$. Then we can easily show that (p^*, z^*) is a competitive equilibrium, and that p^* is strictly positive as required.

Finally it is rigorously proved that our Boundary Condition (B) is derived from the monotonicity assumption of preference. The Cobb-Douglas utility which ensures the gross substitutability is obviously a special case of monotonic preference.

A Note on the Long-run Multiplier Effects of Fiscal Policy

by Ichiro Okuma

In this note I discuss the long-run multiplier effect of fiscal policy which includes not only

the normal flow multiplier effects, but also the stock effect of accumulated private financial assets caused by budgetary deficits. Let us assume the increase of the private financial assets (money and/or national debts) is wholly resulted by budgetary deficits. Define the private financial assets as

$$W = M + B + K,$$

$$\dot{M} + \dot{B} = G - tY,$$

where W is the private financial assets, M the money stock, B the outstanding national debts, K the capital stock, G the Government expenditure, Y the national income, and t the marginal rate of taxation.

A long-run equilibrium is said to prevail if the stocks of private assets are constant, that is,

$$\dot{W} = 0.$$

From the above statements,

$$\dot{W} = (\dot{M} + \dot{B}) + \dot{K}$$

$$= (G - tY) + I,$$

where I is investments. Therefore

$$G - tY + I = 0.$$

and

$$dG - tdY + dI = 0.$$

The long-run multiplier will be explained as

$$\frac{dY}{dG} = \left(1 + \frac{dI}{dG}\right) / t.$$

Let us examine the stability condition of the long-run equilibrium. If we assume consumption (C) depends not only income but also assets,

$$\dot{W} = G - t(C(Y, W) + I(i) + G) + I(i),$$

where i is the rate of interest. Differentiating the above equation, we get

$$\frac{\partial \dot{W}}{\partial W} = (1-t) \frac{\partial I}{\partial i} \frac{\partial i}{\partial W} - t \frac{\partial C}{\partial W} < 0.$$

Thus the stability condition is satisfied.

If there are no crowding-out effects, that is, $dI/dG=0$, the multiplier effect is

$$\frac{dY}{dG} = \frac{1}{t},$$

which is first found by C. Christ. But this is a very special case where the condition of liquidity trap exists.

Competition and Monopoly

by *Shigeo Tomita*

In this paper the writer tries to make clear what is meant by the competition in the so-called "perfect competition" which is commonly considered as the most competitive market. Generally speaking, what is ordinarily meant by the competition is, the writer thinks, the rivalry with a person (or persons) in regard of a thing (or things) for a prize. In opposition to it, the meaning of competition in the perfect competition is only the existence of many independent subjects, but it does not always mean to be competitive in the sense that we ordinarily think of it. Because individuals in such a market are taken as price-takers, goods and services are perfectly homogeneous, and every information is costless, with regard to what do they compete with each other? If it is said that the state of perfect competition is the result when competition has come to an end, it could at most exist only in equilibrium point, as K. Arrow pointed out. Perfect competition and perfect monopoly are thought as two extremes concepts, but competition in the ordinary sense is never inconsistent with monopoly as in Schumpeter's "creative destruction," with the only exception of perfect monopoly.

This paper would also discuss the welfare implications of the above defined competition.

A neglected mathematical economist: Giovanni Battista Antonelli

by *Tamotsu Matsuura*

Sulla teoria matematica della economia politica was written by Antonelli and was privately circulated in 1886. This memoir might have remained in obscurity indefinitely but for its rediscovery in 1943 by Herman Wold, one year before the author's death. It had been listed in the extended bibliography added to third edition of Jevons' *Theory of Political Economy* (1888). It appeared again in the bibliography prepared by Fisher (1892, 1897). It appeared once again in the bibliography appended to Pareto's German encyclopedia article of 1902, but was not mentioned in the text; nor, as far as is known, did Pareto ever refer to it again. Following Wold's *A Synthesis of Pure Demand Analysis* (1943), Samuelson gave a prominent

position to the Antonelli integrability condition in his paper (1950). In 1951 this memoir was republished in the *Giornale degli Economisti* by Demaria of Bocconi Commercial University at Milan.

Antonelli's memoir is in many ways a remarkable work. It is one of the earliest uses of determinants in the economic literature. It provides the first recognition of the problem of integrability in utility theory.

Intuitively speaking, the issue of integrability may be described as the relation between a given demand function and some utility function. Given a demand function, if one can deduce from it at least one utility function which yields that demand relationship, the demand function is said to be integrable. This is, it is integrable if one can find a utility function such that an individual whose psyche that function describes would be led to behave in accord with our given demand relation. It is easy to show by example that demand functions are not all integrable. The answer depends on whether or not the demand function satisfies certain "integrability conditions", and the appropriate necessary and sufficient condition are provided by Antonelli, which will be recognised as equivalent to the Slutsky symmetry condition in "Sulle teoria del bilancis del consumatore" of the *Giornale degli Economisti* (1915).

Risk-Aversion of Lenders and Investment Finance of Firms

by Denzo Kamiya

It has been pointed out by many observers that the amount of current investment of a firm tends to increase as, *ceteris paribus*, the amount of its current income increases. There are some attempts at giving economic reasons why this phenomenon occurs. What is to be shown is why the firm prefers the internal sources of finance to the external ones.

Modigliani and Miller have shown that, under a certain set of conditions, the effect of investment on the share-price is the same for all sources of finance, and therefore that, if the firm acts in the best interest of the share-holders, no reason can be found why it prefers one source to another. Thus, if the firm, in fact, differentiates among different sources of finance, either some of the conditions of Modigliani and Miller are not true, or the firm is not acting in the best interest of the share-holders.

In this paper, I take issue on one of the conditions that constitute the ideal situation of Modigliani and Miller. That is the absence of risk-aversion on the part of lenders, or their assumption that the rate of interest is uniform regardless of the amount of debt and of the income-earning power of the borrower. Of course they ignore the problem of moral hazard.

It is asserted, in this paper, that in the presence of aversion to the lender's risk, the external source of finance has a disadvantage of lowering the share-price. Thus, if the firm acts in the best interest of the share-holders, it would prefer the internal sources to the external ones.

The present analysis is restricted to a limiting case in which the risk-aversion is so strong that no one is willing to lend except through the financial intermediaries which monetize debts of various risks.

Inequality of Income Distribution and its Evaluation

by Kunio Kawamata

Consider the alternative ways of distributing a fixed amount of income among n individuals. Such distributions, which we denote by n dimensional real vectors x, y , etc., may be compared from various standpoints:

- (i) x is preferable to y if the Lorenz curve of x is inside that of y .
- (ii) (Pigou=Dalton condition) x is preferable to y if x can be obtained from y by a finite sequence of transfers of income from some individuals to poorer individuals.
- (iii) Any increasing, symmetric and concave welfare function (in fact, any function which satisfies the "Schur condition") values x higher than y .

It is established that

- (A) Conditions (i) (ii) and (iii) are equivalent.

Moreover it is shown that

- (B) If condition (i) is not satisfied then there exists a welfare function of form

$$W(x) = u(x_1) + \dots + u(x_n)$$

(where $x = (x_1, x_2, \dots, x_n)$ and $u(\cdot)$ is an increasing concave function) values y higher than x .

These results modify and extend the theorems of Atkinson; Dasgupta, Sen and Starrett and of Rothschild and Stiglitz.

It is usually required that an index of income inequality satisfy the following:

- (iv) $I(\cdot)$ is a real valued function and defined for all possible income distributions.

The above proposition B implies that if the Lorenz curves of x and y intersects (even though, say, $I(x) > I(y)$) there exists a welfare function $W(\cdot)$ of the above form such that $W(y) \geq W(x)$. In this sense each index which satisfies (iv) can reflexet only a limited class of equality preferring social preferences.

A "good" index I of income inequality is required to satisfy some set of reasonable conditions, including (iv), symmetry, homogeneity and

(ii)' Any transfer of income from an individual to a poorer individual decreases I .

A typical example of such indices is the Gini-coefficient G . We demonstrate that if $0 \leq x_1 \leq x_2 \leq \dots \leq x_n$ and $\mu = \sum x_i/n$ then

(C) $G(x) = 2 \times$ the area between the 45° line and the Lorenz curve

$$\begin{aligned} &= \frac{1}{2n^2\mu} \sum_j \sum_i |x_i - x_j| \\ &= 1 - \frac{1}{n^2\mu} \sum_j \sum_i \min(x_i, x_j) \\ &= \frac{1}{n^2\mu} [(n-1)x_n + (n-3)x_{n-1} + \dots - (n-3)x_2 - (n-1)x_1] \\ &= 1 + \frac{1}{n} - \frac{1}{n^2\mu} [nx_1 + (n-1)x_2 + \dots + x_n] \end{aligned}$$

Each of the above expressions admits an interesting interpretation of the Gini-coefficient.

We also discuss a way of defining an index of income distribution based on a quasi-concave and increasing social welfare function. It is shown that many well-known measures of income inequality (e. g. Dalton's measure, Atkinson's measure and Sen's measure) can be deduced by modifying the coefficient of resource utilization introduced by Debreu in somewhat different context.

On Formulations of a Market Economy

by Hiroaki Osana

If the Walrasian formulation of a market economy is to present a satisfactory explanation of the formation of prices, it requires the presence of a fictitious auctioneer. Even then the auctioneer's behavior remains to be explained in a consistent way. On the other hand, a market economy without auctioneer is also expected to be formulated in a satisfactory way. The present paper discusses some difficulties in explaining the auctioneer's behavior, and develops a tentative model of the market economy without auctioneer. The existence and some properties of an equilibrium are discussed.

On Neo-classical Micro-theoretic Foundations of Investment Behaviour

by Hiroshi Tanaka

This paper attempts to review the development of the neo-classical investment theory at micro-economic level and to derive the well-known relationship between investment and the rate of interest.

In section 1, we shall review the conventional neo-classical micro-economic theory of investment behaviour under certainty in the presence of perfect markets and point out that the theory provides the optimal capital stock, but not the optimal rate of change of the capital stock i. e., investment. Thus, the relationship between investment and the rate of interest, which Keynes asserted, cannot be derived. This view was expressed by Haavelmo, Witte, and Others. Next, we shall examine Sandomo's view that only in the short run, there exists a determinate relationship between investment and the rate of interest.

In section 2, we shall introduce the cost of adjustment into the model and derive the optimal investment as well as the desired capital stock. The optimal investment is determined such that the gains in net revenues from acquiring faster an additional unit of capital is equal to the loss in increasing costs which results from faster adjustment. A determinate relationship between investment and the rate of investment is also derived. The influence of a change in the rate of interest upon investment is twofold: through the change of the desired capital stock and through that of the accelerator. The total effect of a change in the interest rate upon investment is shown to be negative.

Unbalanced Growth in the Public Sector

by Tamon Yamada

We can find many kinds of goods and services in a basket of so-called public goods. In this paper they are classified appropriately into two categories; firstly as for consumption goods, into "time-intensive" public goods and "time-saving" public goods. And then it is shown that as his wage rate increases the individual will consume less of the time-intensive public goods and more of the time-saving public goods, which is the same result in Baumol &

Oates (1975). But in this comparative static model, the consumer is supposed to maximize his utility by adjusting the *amount* of the time-saving public goods that he consumes and the amount of *time* that he is obliged to spend on the time-intensive public goods.

Secondly as for the productive social overhead capital, the public goods are divided into the one that are produced in technologically progressive sector and the other that are produced in non-progressive sector. And through the analysis of two types of 2 sector growth models, it is concluded that the rate of growth in progressive public sector may expand, while that in non-progressive public sector will converge into zero.

From these analytical results we can get the cue to solve the problems of financial crisis in many municipal governments or of income redistributive effects in public utility pricing.

Costs of Adjustment and Investment Behavior

by Yasuo Usami

Recently we have experienced a new wave of rationalization in the fields of dynamic adjustment mechanism. In the case of investment behavior, costs of adjustment is a strategic factor for consistent explanation of the flexible accelerator hypothesis. Four properties of costs of adjustment and their relevance to investment behavior are investigated in this paper.