

# Beyond Walras:

On the Historicity of Walras's Market Equilibrium Concept\*

Shigeki Tomo

## I Introduction

If Léon Walras could have observed the method of market clearing used in the present-day Tokyo Stock Exchange (TSE) or Tokyo Commodity Exchange (TOCOM), his general equilibrium model might not have been born. Of course, it would ordinarily be meaningless to use the word 'if' when discussing history; however, it could be tolerably permitted if doing so helped to emphasize the historicity of Walras's conceptualization of market equilibrium. What Walras observed as economic reality, in his acknowledging the importance of the equilibrium notion as the basis for his economic model, was completely limited by the institutions of his day.

This paper will confirm the historicity of Walras's equilibrium concept based on the market rule, "exchange takes place if and only if the price clears the market" (Market

Clearance rule), by showing that the non-Walrasian market rule, "exchange takes place whenever the minimum quote by sellers equals to the maximum by buyers, even if the price does not clear the market" (Mini-Max quote rule), is actually applied in continuous trading at the TSE, the TOCOM, and almost all of the other free competitive exchanges in the world. In the following sections, after these two rules are explained in detail, it will be demonstrated that the latter is much more efficient than the former in the sense that the function of the auctioneer conducting on the rule of market clearance is not completely programable, whereas the Mini-Max quote rule is fully capable of installation in computer-system trading. The non-Walrasian efficiency of auctioneer saving would explain the slow shift in Japan from the Walrasian ("*Itayose*") to the non-Walrasian ("*Zaraba*") markets in the recent two decades, especially at the TOCOM and

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the Tokyo Grain Exchange (TGE). This historical development also endorses the idea that Walras’s equilibrium concept is a mere historic entity in the free competitive market society.

**II The Walrasian Market (Call Market)**

The Walrasian Market is called a “Call Market”<sup>1)</sup> because the price adjustment towards equilibrium is performed “by being cried out (*à la criée*).” As Walras assumed,<sup>2)</sup> and as all modern economists know, the rule of price adjustment is taught in introductory microeconomics courses as follows: if there is an excess demand, the auctioneer raises the call price, and if there is an excess supply, he lowers it. If an equality of supply and demand is reached, the movement of price is stopped and the transaction is done.

Market clearance is, thus, indispensable to price determination in a Walrasian market. In considering how all markets reach market clearance during the period of time that allows them to establish general equilibrium, Walras developed the *tâtonnement* process in order to prove that the market solution corresponds to the mathematical solution for the simultaneous equations system endorsed by market clearance. Since Walras’s time, many have tried to find the stability condition for the system of his general equilibrium, operating on the presupposition that free competition will necessarily lead all markets to clearance. This is one of the starting axioms for the research programs of almost all stability theorists, and therefore supposedly needs no explanation.<sup>3)</sup> On the contrary, however, Walras’s attempt to explain *tâtonnement* reveals his concern about the un-

questioned belief that price competition always achieves market clearance.

Unfortunately, Walras failed to allay his concerns, not only because of the lack of involvement in asset effects caused by transactions during the adjustment process before equilibrium, as Jaffé (1967) pointed out, but also because of the empirical fact that it is completely possible to organize a free competitive market without the rule of market clearance. The following section explores in detail the substitutive transaction rule for a free competitive organized market, which Walras did not observe.

**III Non-Walrasian Market (Continuous Trading)<sup>4)</sup>**

The Mini-Max quote rule adopted at the TSE and the TOCOM can be illustrated by the following numerical example:

An example of continuous (“*Zaraba*” or “system”) trading organized by computer

Selling limit orders	Quotes ¥	Buying limit orders
13	5008	
4	5007	
15	5006	
8	5005	
	5004	10
	5003	7
	5002	20
	5001	2

This chart indicates the following: 13 units are ordered for sale at any price more than ¥5008, while 10 units are ordered for purchase at less than ¥5004, and so on. In this situation no transaction occurs, because it does not meet the transaction rule which states that the minimum of selling quotes

must equal the maximum of buying quotes. However:

- (1) If a buyer orders 5 units at the limit quote ¥5005, then, even though there exists an excess supply ( $8 > 5$ ), all 5 units are transacted at the price ¥5005 and 3 remain uncleared on the side of selling orders, at the limit quote ¥5005.
- (2) If a seller orders 15 units at the limit quote ¥5004, then, even though there exists an excess supply ( $15 > 10$ ), only 10 units are transacted at the price ¥5004 and 5 remain uncleared on the side of selling orders, at the limit quote ¥5004.
- (3) If a buyer makes a *carte blanche order*<sup>5)</sup> of 20 units, he can get 8 for ¥5005 and 12 for ¥5006 while 3 remain uncleared on the side of the selling order at the quote ¥5006. A movement of price occurs in this case, since two prices take place at the same transaction.

It is clear that there is no auctioneering function, but rather an order-driven mechanism in continuous trading, and that in all three cases transactions take place without market clearance at the price for the transaction. Instead of the Walrasian market clearance rule, the short-side principle (Clower 1960, 319) is adopted for its execution in continuous trading. Since the order of the buyer in Case (1) stands on the short-side at his limit quote ¥5005, it is fully cleared. In Case (2), the seller's order, on the long-side, must be dominated by the short-side amount of the buying order at his limit quote ¥5004, and he can therefore sell only a part of his

limit order at this moment.

The next question is how to make the rationing of the short-side amount to that of the long-side. In Case (1), how should the five items in the buying order be assigned among eight items in the selling order? If eight items are ordered by one seller, then there is no difficulty. Yet, in the case of more than one trader on the long-side, three arbitrary rationing priorities are introduced: time, volume, and lottery. If among the long-side traders A ordered earlier than B, then A's order is preferentially to be cleared regardless of whether fully or partially. If two long-side traders should order at the same time, priority will be given to the one whose ordered amount is much more than the other's. In the final case, in which time and volume are the same, it is done according to the random ordering of traders made prior to transaction.

This example tells us that the Mini-Max quote rule of continuous trading fully represents price competition in the sense that it is a situation in which all traders (both buyers and sellers) do their best to realize their transaction through their quotations. All they have to do for ensuring their transaction is to quote the price most unfavorable among all traders: the highest price for the buyers and the lowest for the sellers. If the quote of a buyer (seller) is less (more) than the maximum (minimum), it is impossible to go through with the purchase (sale) immediately. This competitive framework is perfectly implemented by the "price priority" principle of the Mini-Max quote rule. It is composed of three priority propositions: the selling order with the lowest quote is always the first candidate for transaction; the buying order with the highest quote is always the first can-

didate for transaction; and the *carte blanche* order always occurs prior to any other orders.

These empirical facts tell us that the Walrasian market does not universally represent price determination based on free competition, because market clearance is just one of rules for a competitive market and it is completely possible to organize competitive markets on the non-Walrasian basis of the Mini-Max quote rule. This means that the Walrasian general equilibrium model is just one of formulations of a capitalist market economy.

#### IV *Zaraba* before Computerization

The non-Walrasian aspect (especially the short-side principle) of the *Zaraba* method was fully described by Michio Morishima as early as 1950, when he published his debut book on dynamic economics. Its purpose is not to point out a mere rule as an anomaly to the Walrasian market rule, but to show Morishima's full consciousness of its limitations.<sup>6)</sup> He declared that in order to formulate a general equilibrium model, it is necessary to presume that all the markets are ruled by auction (the *Itayose* method). Furthermore, in criticizing the stability analysis initiated by Samuelson, Morishima referred to its inapplicability to continuous or *Zaraba* trading markets.<sup>7)</sup>

Morishima's pioneering reference might reflect a historical event in Japan: the re-opening of the TSE on 16 May 1949.<sup>8)</sup> There had been much discussion on the order issued by the General Headquarters of the Supreme Commander for the Allied Powers (GHQ) which stated that the function of Specialists at the New York Stock Exchange (NYSE)<sup>9)</sup> should be installed into the new

organization of stock exchanges in Japan. Specialists are non-Walrasian agents who specialize in particular stocks, in order not only to match the orders of purchasing and selling them, but also to buy and sell them "for their own account and risk" (Weiss 1993, 40). It had been thought that the latter practice was required in order for market making to maintain the liquidity of securities as well as the stability of trades. After enacting the revised Law for Security Exchange on 13 April 1948, Thomas Francis Morton Adams, who had been the officer for security matters at the Economic and Scientific Section of the GHQ since March 1946,<sup>10)</sup> insisted on the installation of that practice as a precondition for the re-opening of the Exchanges in Japan.<sup>11)</sup>

Although the Specialist practice of trading securities for trader's own account and risk had not been allowed for the Japanese agents of *Saitori* (才取),<sup>12)</sup> Shonosuke Koyama (1885–1965), one of the first Senate members of the TSE elected on 12 February 1949,<sup>13)</sup> was fully aware of this non-equivalence between Specialist and *Saitori* back in 1921,<sup>14)</sup> and proposed to regard the Japanese *Saitori-Nin* (才取人)<sup>15)</sup> as the new member of the Stock Exchange functioning as the American Specialist.<sup>16)</sup> In order to institutionalize this, the Jitsuei Security Co., Ltd was newly established on 2 March 1949 incorporating the former *Saitori-Nin* of *Jitsuei-Kai*.<sup>17)</sup> It was renamed *Saitori-Kai-in* (才取会員, "the member of *Saitori*") and its practices were modified by the insertion of one clause (Act 29–2) which added the practice of trader's own trading to that of *Saitori-Kai-in* in the constitution of the TSE.<sup>18)</sup> In fact, the ostensible practice that

was added has not actually been executed.<sup>19)</sup>

Thus was institutionalized the Japanese non-Walrasian agent operating continuous or *Zaraba* trading at the TSE. So far there seems to be no direct evidence regarding whether Morishima knew about this recently almost unmentioned episode or not; yet, he may have at any rate noticed that there existed another market rule outside of the Walrasian scope. This was the Note called “The formation of prices” to Chapter 9 of Hicks’s *Value and Capital*,<sup>20)</sup> in which the author discussed the non-Walrasian market (Hicks 1946, 127–29); however, unfortunately it was too early to formulate the non-Walrasian market system of a free society.<sup>20)</sup> All he could do was to declare that “the price theory based on market clearance must presume the institution of a call market” (Morishima 1950, 8).

Morishima’s historic limitation is that he could not refer to the Mini-Max quote rule, but only to the cross (man-to-man, or “*aitai* (相对)”) aspect of *Zaraba* trading.<sup>22)</sup> The main reason for this is that it was just after the public establishment of the real-time reporting system of market quotations, actually realized for the first time in the NASDAQ system in 1972 (Arisawa 1978, 393–94), when the Mini-Max quote rule became capable of being implemented into organized markets. Without such a feedback system publicly showing the minimum of selling quotes and the maximum of buying quotes, it would be impossible to integrate all individual traders outside the market floor. The *Zaraba* of the 1950s still remained very local and could be expensively executed by many market-makers within the marketplace. The local cross situation has neither the compul-

sion nor the incentive for traders to uphold the Mini-Max quote rule and no power to prohibit them from earning some spreads brought about by the inequality of the minimum price of selling orders being less than the maximum price of buying orders. One could not have imagined, before the computerization of the security or commodity markets in the 1970s, that the Mini-Max quote rule would have dominated the Walrasian market clearance rule in the near future.

## V The Efficiency of Continuous Trading

Computerization has revealed that the non-Walrasian continuous-trading market is much more efficient than the Walrasian call market. Computer networking has clearly saved people from having to complete the activities of gathering, sorting, and recording orders from traders. Since it provided a mutual benefit for both types of market, it must be said that there is no significant difference in the discussion of efficiency with respect to the general utility of computers. Yet, from the viewpoint of programming, the two major characteristics in the non-Walrasian as well as in the Walrasian markets allow us to make the above conclusion. One is the procedure of the former, matching orders (the minimum of selling quotes equals the maximum of buying quotes),<sup>23)</sup> and the other is the function of auctioneer. Whereas the first is easily programable, the latter is not. The price-adjusting process by auctioneer has never been completely programmed up to the present,<sup>24)</sup> because it requires a human intuitive judgment: in case of an excess demand, even if it is very slight, the auctioneer stops raising for a moment to wait for its corre-

sponding supply (selling orders) to come out.<sup>25)</sup> Otherwise, the oscillation would continue and the price would fail to settle. The standard for “very slight” fully depends on the auctioneer’s intuition according to his experience. What is more, if the bourse wants to open its market all day with the *Itayose* method, then it must prepare the human auctioneer for every session, whereas the *Zaraba* can proceed without any human regular resources.

The superiority of the efficiency of the non-Walrasian to the Walrasian market is also empirically confirmed by the shifting from the latter to the former at the TOCOM and the TGE. The new establishment of the TOCOM in 1984 by the Tokyo Textile Exchange’s merger with the Tokyo Rubber Exchange and the Tokyo Gold Exchange illustrates the ostensible atmosphere supporting the Walrasian rule: the *Itayose* method was still adopted there for all transactions.

This conventional orientation was soon challenged on the occasion of the computerization of its transactions. In September 1986, when NTT Data, as the main contractor for the computerization project, provided the basic outline of the system (which contains the *Zaraba* system adopted by the TSE on the occasion of the computerization in 1982), strong oppositions arose to the shift from the *Itayose* system to the *Zaraba* (Tsuboi 1992, 175). Certain people conservatively questioned the necessity of the reform and its learning cost for adoption, because the traditional method of *Itayose* was still being exclusively adopted at another future market, viz., the TGE. This claim partly survived the first installation of the computer system in April 1991 at the TOCOM. On this occasion,

the transaction of rubber continued to be executed by the *Itayose* method, whereas gold began to be traded by the *Zaraba*. Two kinds of programs must have been developed in order to implement both the Walrasian and non-Walrasian market rules in the computer system. Yet, since 2005, when rubber converted to the *Zaraba* system, the TOCOM has become completely non-Walrasian.

This trend has recently reached the TGE: in the year 2008, a decision was made by the TGE that the *Itayose* transactions of Arabica coffee, Robusta coffee, and raw sugar should be changed to the *Zaraba* method.<sup>26)</sup> If these historical developments are taken into account, the universality of the Walrasian general equilibrium model as the foundation of our capitalist society based on a free competitive market disappears, and the new task for economists to establish a substitutive theory of price, including the formation of quotations means to go beyond Walras.

## VI Concluding Remarks

The non-Walrasian method of continuous trading has now become a global standard for transactions in three major exchanges in the capitalist market economy: securities, commodities, and foreign currencies. In the historical developments of the stock exchanges in London, New York, and Tokyo, we can distinguish two major phases: the age of booking by human hands and the age of computerization. Jobbers at the London Stock Exchange,<sup>27)</sup> Specialists at the NYSE, and *Saitori-Kai-in* at the TSE are representatives of the former age; two of them, Jobbers and *Saitori-Kai-in*, had been abolished in 1986 and 2001 respectively, and have now become historic entities ripe for research.<sup>28)</sup>

The order-matching role of these human agents was replaced with the computer system, but the non-Walrasian Mini-Max quote rule was not brought about by the IT revolution itself. One can often find non-Walrasian markets in everyday life. An apple that is up for sale at a market, for example, can be purchased by a buyer at the selling price immediately without waiting for the other apples to be cleared. This can be basically understood as a type of continuous trading (*Zaraba*) markets, since the buyer can purchase one apple by *carte blanche*, accepting the quote offered by the seller. Due to its natural cross (man-to-man) origin of exchange, it is understandable that the *Zaraba* method had already been applied in the trading practice at the Dojima Rice Exchange in Osaka, the first future market in the world in the 18th century. The question of why continuous trading was not dominant at the Paris Stock Exchange during Walras's time remains open to future research.<sup>29)</sup>

Several of the major corollaries from this paper are: that Ricardo was non-Walrasian due to his occupation, since he was a jobber at the London Stock Exchange; that Walras as well as Ricardo were subject to the empiricist proposition; that human speculation is always subordinate to people's observations in reality; and that economics should teach not only Walrasian but also non-Walrasian market rules, viz., the Mini-Max quote rule with rationing based on the short-side principle, in order to notice the potential for free competition to reach a transaction without any market clearance.

Shigeki Tomo: Faculty of Economics,  
Kyoto Sangyo University

## Notes

- 1) It can be also called a "recontractable" market (Hicks 1946, 128).
- 2) Jaffé, William tr. (1954, Sec. 42)
- 3) We have to remember that Edward Hastings Chamberlin, a pioneer of experimental economics, asserted as early as 1933 that there does not exist such an axiom that a price establishes for the reason of the equalization of supply and demand on its level (Chamberlin 1933, 15).
- 4) It must be true from the institutional point of view that "call markets are used to supplement existing continuous markets" (Miller 2002, 49), but these markets are completely different with respect to their rules for transaction.
- 5) The "*Nariyuki* (*carte blanche* order)" method was replaced with market order at the TOCOM in May 2009.
- 6) His point is expressed by Hicks as "highly exceptional" (Hicks 1946, 128).
- 7) *Ibid.*, p. 50ff
- 8) A detailed description of the postwar history up to the re-opening of the TSE can be found in the Tokyo Stock Exchange, ed. (1963).
- 9) On the 1875 establishment episode of the specialist system at the NYSE, see the footnote on Sobel (1977, 29–30). On the institution of Specialists, see Stoll (1985) and Weiss (1993).
- 10) Adams ([1977] 1984, 196), which corrects the reference as April 1948 by Shimura (1974, 368). Yet, Adams's recollection includes several fatal errors. See Okamura (1984).
- 11) The Association of the TSE Saitori-Kaiin, ed. [1975] 1990, 171–72.
- 12) On the history of *Saitori* or *Saitori-Nin*, see The Association of the TSE Saitori-Kaiin ([1975] 1990); Jitsuei Security Co., Ltd.

- (1999). The question raised by Prof. Kurose Kazuhiro, the discussant on the occasion of my presentation (Tomo 2009), as to whether the origin of *Saitori* can be traced to the Dojima Rice Exchange in Osaka, still remains open. According to The Association of the TSE Saitori-Kai-in (1990), *Saitori* started as an intermediary between currency exchangers and the export and import traders in Yokohama, where a meeting place was established for them in 1868, the first year of the Meiji Restoration. Every morning the *Saitori-nin* visited shops around the market to purchase Japanese coins and sold them to foreigners in order to earn the spread.
- 13) See The Tokyo Stock Exchange, ed. (1963, 170–71). The main purpose of the Senates was to construct a constitution and detailed regulations for all operations of the TSE, which were minutely inspected by the GHQ.
  - 14) In his 1921 report on the NYSE, Koyama, referring to the classifications of “Two Dollars-half Broker” and “Specialist,” applied the Japanese term *Saitori* to the former only. See Koyama (1921, 32).
  - 15) In 1918, 30 *Saitori-Nin* were officially permitted to enter the floor of the Tokyo *Kabushiki* Exchange (the former name of the TSE). This reflected the increase in security transactions after WWI. See The TSE (1961, 29); Arisawa (1978, 96–97).
  - 16) On Koyama’s recollection, see Tokyo Securities Dealers Association (1971, 137) and Jitsuei Security Co., Ltd (1999, 43).
  - 17) Established as a stock company on 26 January 1933. See Jitsuei Security Co., Ltd (1999, 29, 43–44).
  - 18) Enacted on 1 April 1949. See The Association of the TSE Saitori-Kai-in (1975, 175).
  - 19) Adams seems to have been persuaded to express “Saitori-nin: broker; term used for the Japanese equivalent of ‘specialists’ on a stock exchange” (Adams 1964, 97).
  - 20) The first pagination is misprinted as “117” on page 9 of Morishima’s original and reprinted volumes.
  - 21) The question of where he came to know that the Japanese *Zaraba* method was non-Walrasian still remains open. However, a conjecture is that it would be through one of his mentors, Hideo Aoyama. As early as 1938, he mentioned the problem of endowment effects caused by the transactions before equilibrium, referring to the Appendix on Barter in Marshall’s *Principle*, which was referred to by Hicks in the aforementioned Note (Aoyama 1938–1949, 49).
  - 22) Morishima repeated this in his later work. See Morishima (1973, Ch. 6). Unfortunately, he missed this opportunity to theorize the Mini-Max quote rule again.
  - 23) The cost of matching orders by human agents in the non-Walrasian *Zaraba* method before computerization was so huge that all of the Exchanges of Commodity returned from the mixture of *Zaraba–Itayose* method to the genuine Walrasian *Itayose* in 1980; the TGE and the Tokyo Rubber Exchange in 1973; and the Tokyo Sugar Exchange in 1980.
  - 24) At the Central Japan Commodity Exchange, the price adjustment in its *Itayose* method for trading gasoline, kerosene, and rubber is still executed by human agents, but all of the other procedures are fully computerized.
  - 25) This is practiced at the TGE.
  - 26) The Tokyo Grain Exchange (2007) 12/17 Announcement: “Continuous Trading to Start Jan. 4, 2008.”
  - 27) On the practice of jobbers, see Cope (1978).
  - 28) An interesting task would be to explain the reason why the institution of Specialist still survives in America, the native country of the IT revolution.
  - 29) We already have some insightful related



results as found by Walker (1990).

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