Some supplementary explanations on *Microfoundations*

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This is the first draft before English revision. I have still chance to revise this until the end of March 2023. Comments are welcome. Thanks in advance.

Abstract

The paper adds some supplementary explanations on Shiozawa, Morioka, and Taniguchi (2019) *Microfoundations of Evolutionary Economics*, Springer Japan, Tokyo. It explains why the book gives microfoundations both to evolutionary and Post Keynesian economics (§5 & 6). In addition, the paper gives a detailed explanations on how markup rates are determined and their relations to profit rates (§5). Sections 6 to 8 add some methodological explanations which characterize the the *Microfoundations*. Section 9 concludes by showing why many arguments in the *Microfoundations* take the form of cyclic reasoning.

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Section 1. Introduction

This paper treats topics related to Shiozawa, Morioka and Taniguchi (2019) *Microfoundations of Evolutionary Economics*, Springer Japan (*Microfoundations* or SMT here after). The contents of the book is restricted to bare theoretical expositions that are necessary to support our basic contentions. This paper explains why and how the SMT gives microfoundations to both evolutionary economics and Post Keynesian economics (Sections 3 and 4). Section 5 gives a detailed account on how the markup rate of a product is determined, and how the markup rate, capacity utilization rate, and profit rate are related with each other. Section 6 claims that the Microdoundations combined with the circulationist theory of money can be understood as monetary theory of production, while Section7 shows what the Microfoundations suggests to inflation theory. Section 8 is a methodological arguments. The methodology on which SMT draws is neither methodological individualism nor methodological holism, but micro-macro loop.

The book has a little difficult logical structure, because each part (e.g., Chapter 2) draws on the other part (e.g., Chapter 4) and yet the latter draws on some part on the first. This is no circular argument, but reflects the fact that the economy has a self-organizing structure. Some circular arguments are inevitable. Section 1 makes explicit this logical structure which was not explained in the book. Section 9 concludes by showing many arguments in the *Microfoundations* take a form of circular reasoning. It is not the defects of arguments but an inevitable structure that analyses self-organizing systems.

In Section 6, I claim that the theory given in Shiozawa et al. (2019) is in fact a part of monetary theory of production, which Keynes imagined building but could not fulfil. Section 7 gives as an illustration of the claim of the previous section some negative accounts on the conditions inflations occurs as a consequence of our theory. Sections 8 is again some methodological arguments which lies in the background of our Microfoundations.

In this paper, three expressions Shiozawa et al. (2019), SMT, and *Microfoundations*

are used mutually exchangeable terms, although the first expression is used to point the exact place in the book, SMT to hit the book as a whole, *Microfoundations* is used to express the more general idea that is based on SMT but may include those developed after Shiozawa et al. (2019). Indeed, it often includes theories expressed in Shiozawa (2020) and Shiozawa (2021). The term microfoudnations (in roman often with lower case m) is used to indicate the common notion of the term.

Section 2. Logical Structure of *Microfoundations*

There are three pillars in *Microfoundations*:

(1) Independence of price and quantity adjustment

(2) A price theory or the cost of production theory of value

(3) A theory of quantity adjustment

(1) is the basis of all arguments of *Microfoudations*, although there is no chapter that is devoted to the explanation of this claim. This pillar is sometimes expressed as separation of price and quantity or output decisions (Pasinetti 2007 p.19; Lee 2018, p.97; Lavoie 2022 p.191). Chapter 2 mainly treats pillar (2). A supplementary observation is given in Chapter 7. Pillar (3) is treated in Chapters 3 to 6, where Chapter 3 is an introduction to the theory of quantity adjustment, including its short history, Chapter 4 gives the main results on how the total system behaves when each firm behaves as quantity adjusters, and Chapter 5 treats some specific issues related to quantity adjustment processes. Chapter 6 explains non-linear case (such as two-bin method and others). The main result of Chapter 4, which is also the main result for the book itself, is obtained for linear adjustment which requires that firms never face short of inventories of products and input materials. Nonlinear adjustment process is difficult to analyze by linear algebra. Chapter 6 explains the difference between linear and non-linear adjustments and gives a short summery of results of numerical computer experiments.

The most important point for the *Microfoundations* is that three pillars are mutually dependent of others. It is evident that pillar (1) is the premise of both arguments of (2) and (3). Pillar (2) assumes that quantity adjustment smoothly works as far as some ordinary conditions (such as no too rapid increase of final demands or sudden depletion of primary resources) are satisfied. Pillar (3) assumes a set of constant input coefficients. It means that the production techniques of the set remain competitive even if there is a change of relative prices including wage rates. The

minimal price theorem given in Chapter 2 assures that there would be no major change of relative prices. The theorem, which treats only cost relations between possible different production techniques, implicitly assumes a smooth working of the economy as far as quantity adjustment is concerned. If pillar (3) is not assured, the minimal theorem is vain because actors in demand of some products move to procure them, not as price takers but move as price setters. Thus, the mutual dependence of Chapters 2 and 4 is evident. Although it was not sufficiently emphasized, pillars (2) and (3) mutually support the other. Combining Chapters 2 and 4, we get a sufficient reason of why pillars (2) and (3) hold. When pillars (2) and (3) hold, it is evident that pillar (1) holds.

Thus, SMT forms a kind of circular reasoning. This is not a simple false circular logic. This point is argued again in Section 9 Conclusion.

Section 3. How does SMT provide microfoundations for evolutionary economics?

To answer this question, we need a definition on what evolutionary economics is. I have given a provisional definition of evolutionary economics in Shiozawa (2004 Section 2). Let me cite the whole of Section 2:

> Evolutionary economics is a discipline that stands alone on its own theoretical basis and covers the views of how economy works and develops. For this objective, it is insufficient to criticize neoclassical economics. It is necessary to present alternative subject matter, theories, and tools instead of the neoclassical framework from its very foundations. This new framework and tools should be, on one side, a prolongation, and on the other side, a bold innovation of the long tradition of evolutionary economics. This paper is a rough sketch on ideas in pursuit of such a new evolutionary economics.

Although Sections 2 has a section title "Definition of evolutionary economics", this shows more appropriately my research stance with respect of evolutionary economics. It refers to a framework that can replace neoclassical economics, but I lacked a clear vision on how such framework can be constructed. The expression "the long tradition of evolutionary economics" mainly meant the modern development since Nelson and Winter (1982), although I knew it has some relations with Marshall, Veblen, and Schumpeter. Nearly twenty years have passed since my manifesto. I now know what was lacking in Nelson and Winter (1982) or various currents after them. Simply stated, it was the price theory that can replace the neoclassical theory

of prices. In a more articulated explanation, what was lacking was an analytical framework that can explain how technological change induces economic growth. It may sound contentious, because there has been a giant development in evolutionary economics since Nelson and Winter (1982) and economic growth continued to be the main target of various arguments on technological progress.

This is not a denial of various contributions obtained after Nelson and Winter (2018). For example, various themes which are treated in Nelson et al. (2018) are now indispensable knowledge on how technology develops. As Nelson and Winter envisaged in Nelson and Winter (1982), or even before it in Nelson and Winter (1974), evolutionary vision was much fruitful than neoclassical growth theory. Their call for change of perspective was a great contribution to economics ever made. However, the total mechanism that technology change induces economic growth was not developed despite of all studies such as technology, firms (organizations), industrial competition, and long-run change of the economy. To analyze the relations between technological change and economic growth Nelson and Winter (1982) hinted a simulation that draws on Nelson and Winter (1974). The simulation model became a prototype of growth analysis and variety of models were proposed. They include Metcalfe (1998), Dosi et al. (2010), Duménil and Lévy (2010), Almudi et al. (2020), Kmep-Benedict (2022) to cite only a few. However, they had the same defect of being a one-sector producer model (Nelson et al. 2018, p.149). Heinz Kurtz's comment applies: "the commodity produced by the population of firms is a nonbasic of the kind that does not enter, either directly or indirectly, into the production of any other commodity." (Metcalfe 1998, p.127)

Other types of simulation were tried. Dosi et al. (2010) and Almudi and Fatas-Villafranca (2021) are two sector model in which capital and consumption goods are treated separately (two-tier model). While two kinds of goods are distinguished, goods in each sector are interpreted as homogeneous. Saviotti and Pyka (2013) proposed a more complex model which was implemented as a computer simulation program TEVECON (Saviotti et al. 2016). The interactions treated in these models are interesting, but their prices and demands are determined in a quite ad hoc way. Costs are one of most important indices that represent production techniques but, in these models, they are simply given as values that changes through time. There is no internal interaction of costs via production techniques through input-output relations.

Here we should ask what a price theory means. Lee (1998) is a precious work among Post Keynesian economics. It is a detailed study how the pricing customs such as administered, normal and full-cost pricing are introduced in modern industrial economies. It has ample arguments on how prices are set by firms. But in my opinion the book contains a serious defect. There is no examination on how prices interact with each other. If there is no theory about how prices work and are related in the economy as a whole, it is difficult to call it a true price theory. As this will be the topic of Sections 4 and 5, I do not enter into details of this argument. With this concept of price theory in mind, we must say that evolutionary models to date lack a price theory. This lacuna was predicted in Nelson and Winter (1982). The book contains the terms "price" and "prices" everywhere (127 pages for "price" and 68 pages for "prices"), the term "price theory" appears only in three pages (including one in the Reference) and it only refers to price theory in the "orthodoxy," the term Nelson and Winter used to call mainstream economics. There was no alternative vision on how to build a new price theory, although it was evident that they were frustrated by the orthodox price theory. It is my audacious pretention that the price theory that was lacking in Nelson and Winter (1982) was filled by our book Shiozawa et al. (2019).

The lack of price theory had consequences in two aspects. One is negative and the other positive. First, the negative aspect. Studies and models in evolutionary economics try to include institutions and policies into its analyses but, in my understanding, they often ignore material circulation of the economy. After Shiozawa et al. (2019) and Shiozawa (2020), social institutions, public policies, science and technology, and education can influence economics processes (in real economy, i.e., except of financial economy) only through two sets of product and production techniques and final demands, provided that customs of transactions, regulations of markets, and states of competition among firms (and hence markup rates) stay constant. This is because evolutionary economics to date did not clarify the basic structure of the modern industrial economy. This negative recognition is valuable, because it can usefully show why endogenous growth theory is wrong. Human capital matters only as long as it contributes to invention and designs of new products and as long as it contribute to maintaining and improving production techniques.[1]

[1] I do not argue other aspects of endogenous growth theory, because we have already Felipe and McCombie (2013). The notion of aggregate production function is "not even wrong."

Second, positive side. To provide a plausible account of why and how the technological progress induces economic growth was one of long aspired target of evolutionary economics. By the end of 1960's, it became clear that "technological progress was the key driving force behind the economic growth" (Nelson and Winter 2002, p.38) Nelson and Winter were aware of the dissonances between macroeconomics and microeconomics. They could not consider that neoclassical growth theory (including endogenous growth theory) provided a reasonable account of economic growth, because technological change was all included in the change of aggregate production functions. Evolutionary perspective opened the way to study technological change, i.e., how the sets of product ad production techniques are changed, how they evolve, and what effects they produce. Various models were created but there was no framework to analyze how these changes in technology produce economic growth. Shiozawa (2020) provided this framework.

It is important to distinguish framework and models. Shiozawa (2020) provides a general framework on what happens when two series of sets of product $C(t_0)$, … , $C(t_T)$ and sets of production techniques $P(t_0)$, … , $P(t_T)$ are given. It provided a general explanation of how these changes of sets induce economic growth in which conditions. Evolutionary models to date showed the competition between different products and production techniques. They succeeded to show that competition in the market induces to select more "productive" products and production techniques. However, the evolution in each industrial sector does not imply that true economic growth (i.e., the increase of real wage level for workers) occurs. Various models can be implemented in this framework. Shiozawa (2020) shows basic logic or mechanics of economic growth when the set of products and the set of production techniques changes. In these two aspects, we can contend that Shiozawa et al. (2019) and Shiozawa (2020) provide microfoundations to evolutionary economics that was lacking in the evolutionary economics to date.

It is important to note that the framework in Shiozawa (2020) became possible only by drawing on the new microeconomics of Shiozawa et al. (2019) that is characterized by three pillars explained in Section 2. The new microeconomics gives the vision that provides a clear antidote to neoclassical vision. In the latter vision, the market was conceived as the place where demands and supplies are equalized by ups and downs of prices. The new microeconomics consider that market works in a totally different way. Even if the prices are fixed, the demand for products changes day to day. Consequently, the sales volume and productions

change accordingly. As I argued in Shiozawa (2020), prices have more important function than to maintain allocational efficiency. Prices give criterion for the selection of production techniques. This ensures dynamic efficiency of market economy. One thing was not explained there in detail. Product and production techniques are selected in two stages. First, they are chosen by producers. A new product is selected by producers based on if the product is attractive enough. In this judgment, both the charm of the product and the possible cost and price are checked. In order that a new product passes these severe criteria, it is necessary that the firm can get a belief, backed by experience, that the product can attract enough demands at a reasonably low price. However, this is not the final selection. The second stage of selection is done by customers.

A particular mode of second stage selection is often neglected in evolutionary economics to date, because models were structured in one or two sector economy. In the real economy, the products are produced by means of products. A new material (for example, in chemical industry) can obtain a success only when it is employed as input into various production processes. A new machine's success depends to a large extent on how many firms employ the new product for their production process. Rosenbloom (2010 p.11) emphasized as one of two factors that limits the rapid spread of radically new technology, because it must be incorporated as a part of other products or be used as tools in production techniques. Analyzing this kind of interdependence between technologies is only possible for new microeconomics that admits variety of product and production techniques. New microeconomics thus opens a new perspective on how the product and production techniques are employed and obtain a success.

The interdependence above mentioned is a large and extremely complex network between different technologies. Let us imagine a graph G composed of V a set of products (or goods and services) that are sold in an economy and E a set of edges which link two products i and j each time when product i is used as input in the production of product j. An ideal, finely classified Leontief matrix $A = (a_{ij})$ whose entries are composed of input coefficients $a_{ij} > 0$ when product i is linked to j and 0 otherwise. If we replace all positive coefficients a_{ij} by 1, we obtain the incidence matrix of the graph G. As a national economy such as a Japanese economy produces tens of millions of products, the graph G of Japanese economy is gigantic and extremely complex, because common products like cameras and smartphones are composed of hundreds of parts and components. A bit more complex product

like passenger car (gasoline engine case) is said to be composed of ten to twenty thousand parts and components. The total picture of the graph is highly complicated and contains small and big loops connecting sets of products. Some vertices are connected to vertices of very large set of products. Such is the case of integrated circuits (ICs). Gold and copper are used in almost all those ICs as connectors in the form of fine electric wires. ICs are fabricated by a set of various automatic machines, aided by air purification system which is in turn supported by various utilities including water and power supplies. It is impossible to re-arrange the graph in a tree form. A picture of a final product made from various number of production factors, used in many one-sector production schemes, cannot express this complex network full of loops. Only Sraffa's image of production of commodities by means of commodities can respond to this complex network of interrelated input relations.

Last but less important words about why SMT provides microfoundations to evolutionary economics is that all agents including firms are supposed to act under the three limited capabilities in sight, rationality, and execution. As this point is already argued in Chapter 1 of SMT, I simply leave readers to refer to Section 1.3 there.

The theoretical framework given in SMT is not only suitable for representing and analyzing the structure and evolution of technologies, but it provides a suitable vison for agency and behaviors. Economic agents, namely individuals, firms, non-profit organizations, and governments, are rarely optimizers but takers of routine-behaviors that are gained empirically in the courses of lives by learning from experience and the history which may be personal, communal, national or global. In this sense also, the theories presented in SMT provides a good framework for evolutionary economics.

Section 4. How does SMT provide microfoundations for Post Keynesian economics?

Taniguchi contended in the Preface of our book that it provides microfoundations for Post Keynesian economics. This may sound new or strange for some people, because the price theory developed in SMT (mainly in Chapter 2) belongs in a wide

sense Sraffian tradition. Behind this contention, there are two important modifications to its original formulation. One is the introduction of markup pricing which may change from industry to industry or even from product to product. The second modification is the abolition of "no changes in output" assumption that was for some Sraffians a kind of axiom. As for the first modification, I will argue in Section 5 how the markup rates are determined, and how they differ from rate of profit and others. The second modification is the greatest contribution of SMT (in reality, of Morioka's theory of quantity adjustment which is mainly developed in Chapter 4, while Chapter 3 serves as an introduction to his theory. Taniguchi used simulation method to check non-linear adjustment case on which Morioka's theorem does not apply). In my understanding, many of internal frictions among Post Keynesians emerged by the "no changes in output" assumption (see King 2002 Ch.10; King 2015, pp.116-7; Lavoie 2022 §1.4).

4.1 Sraffa and Post Keynesian economics

This assumption comes from phrases in the Preface of Sraffa's small book (Sraffa 1960). The first paragraph reads as follows:

> Anyone accustomed to think in terms of the equilibrium of demand and supply may be inclined, on reading these pages, to suppose that the argument rests on a tacit assumption of constant returns in all industries. If such a supposition is found helpful, there is no harm in the reader's adopting it as a temporary working hypothesis. In fact, however, no such assumption is made. No changes in output and (at any rate in Parts I and II) no changes in the proportions in which different means of production are used by an industry are considered, so that no question arises as to the variation or constancy of returns. The investigation is concerned exclusively with such properties of an economic system as do not depend on changes in the scale of production or in the proportions of 'factors'.

It is a bit unbelievable that many economists at times took the phrase "no changes in output" as something irreversible. If we read Sraffa (1960), the book concerns the theory of value and distribution. As far as theory of value and distribution is

concerned, there is no need to analyze changes in output. In addition, this assumption was a strong tool to counterargue marginal productivity theory of value. If prices are determined without any changes in output and no changes in the proportions in which different means of production are used, it gives the first point of refutation of the marginalist theory of value. It is arguable if this was the sufficient reason to refute the marginalism. However, it is unconceivable that a total theory of economics ends with no changes in output. Simple observation of our economy reveals that outputs are changing constantly. The lack of theory of output was the major lacuna for the Sraffa's system. In my understanding, it was the most important task for all Sraffians to develop or construct a theory of output. The reality did not proceed like this. Many Sraffians sticked to the idea of no changes in output and behaved as if the assumption was something precious to conserve in order to remain loyal to Sraffa. SMT is a manifest objection to this sterile belief.[2]

Morioka-Taniguchi's theory of quantity adjustment is in fact a theory of output. Once it is established as such, there is no big problem in synthesizing Sraffa and Keynes's theories. See for example Shiozawa (2021). It has shown that the principle of effective demand is formulated in individual product level. Consequently, there is no necessity to interpret the principle as a macroeconomic law. Shiozawa (2021) has also shown that there is no need to appeal to "menu cost" (or any such similar effects) as New Keynesians assume. In a normal state of economy's working, firms have no incentive to change their product prices when the production cost does not change substantially.

The significance of SMT for Post Keynesian economics is clear. Geoffrey Hodgson put "a personal recollection" in his book Hodgson (2019, p.27, n.8):

> "If there were to be any synthesis between Sraffa and Keynes – as Robinson, Eatwell and others – proposed, it seemed vital to span this gap. … Some years later … But soon afterwards I realized that a coherent synthesis between Keynes and Sraffa is impossible because of their fundamentally different ontological and other assumptions. Capitalist production is about institutions, albeit played out in a material world. So I turned to American institutionalism – particularly

[2] Another reason to stick to the assumption was that it gives some pretext that Sraffa's theory was not based on narrow law of constant returns to scales. But it is not a good way to defend Sraffa's position.

Veblen – instead."

The gap that young Hodgson concerned was status of money in two theories. Money was central to the analyses in Keynes and Marx, whereas it was completely missing in Sraffa. This understanding may not be very correct, but this recollection conveys a general atmosphere among Cambridge economists in 1970's. Many economists and young students dreamed of a synthesis between Keynes and Sraffa. In 1980's a series of summer school was organized by a group of economists who hope for a synthesis between Keynes and Sraffa. The Trieste Summer School, for it took place in Triste, Italy, worked well for several years and various Post Keynesian economists participated from the world including Hyman Minsky and Basil Moor from the U.S.A. However, the conflict between fundamentalist Keynesians and Sraffians became intense. The summer school did not survive into 1990's (King 2002 pp.158-59). The hoped-for synthesis was not realized. Internal schism between different streams became stronger and stronger. Fragmented into small groupuscules, reproduction of young Post Keynesian economists became difficult. Fred Lee argued in 1995 that there will be no Post Keynesians by 2020 (Fontana and Gerrard 1998; King 2002, pp.255-6). Fortunately for Post Keynesian economics (although it was a disaster for human being), the financial crisis around 2008-2009 saved it from demise.

4.2 Microfoundations of Post Keynesian economics

Our book title contains the word "microfoundations." We claim it provides microfoundations to Post Keynesian (PK) economics. However, "microfoundations" is a controversial idea in economics, particularly in Post Keynesian economics. As for the necessity and possibility of microfoundations for PK economics, opinions are divided. J. E. King 's book *The Microfoundations Delusion* (2012) is a good, detailed, critical history on microfoundations idea, not only of Post Keynesians but macroeconomists in general. As King himself is a Post Keynesian historian of economic thought, turned methodologist, the book has a detailed description on various attitudes of Post Keynesians. King distinguishes four groups with regards to microfoundantions: (1) the supporters, (2) the opponents, (3) the uncertain, and (4) the group of Post Keynesian economists who have no opinion or are ignoring the

problem. Each of first three groups are overviewed covering almost all renowned Post Keynesian economists (King 2012 Chapter 8). Differently from my ill-founded impression, many of late fundamental Keynesians including Paul Davidson, Alfred Eichner, Malcolm Sawyer were supporters who claimed to have or can provide better microfoundations than New Classical and New Keynesians economists. What is astonishing is that it was Sydney Weintraub that first (as early as 1956) used the term "microfoundations" in publications (ibid., p. 75). According to a biographer George Feiwel, Michal Kalecky seems to have pondered to provide microfoundations to his macroeconomics (King 2012 p.151). Fred S. Lee also considered to create microeconomics that is coherent to heterodox macroeconomics (Jo 2015). Among the opponents King counts Luisi Pasinetti, George Shackle, Kurt Rothschild, Paul Ormerod in addition to old Keynesians who were opposed to microfoundations with different reasons (although they had no much chance to write about them). Among the Uncertain group, whose opinions are difficult to determine in either (1) or (2), King lists Sydney Weintraub, Geoffrey Harcourt, John Cornwall, Victoria Chick, Alessandro Vercelli, Amitava Dutt, and Giuseppe Fontana. Most of all three groups of Post Keynesians were against the RARE (representative agent with rational expectations) microfoundations which often included MIRA (methodological individualism with rational expectations). Two pillars of their opposition arguments were (1) fallacy of composition and (2) downward causation, to which I will return soon later.

Arguments of the Uncertain group seem to me most instructive. Alessandro Vercelli is severely critical of New Classical macroeconomics and defends Keynes against Robert Lucas and his allies. While Vercelli is keen to defend the autonomy of macroeconomics, he notes "This does not imply that we should give up making serious efforts to provide micro-foundations for our macroeconomics statements, …" (cited from King 2012 p.184). Dutt argues that "microfoundations were indeed important for heterodox macroeconomics and makes the case for an analysis of the economy that privileges neither the micro nor macro side." (cited from King 2012 p.165). Fontana argues that "it is microeconomics that is on urgent need of macroeconomic foundations", while it must be complemented by the macroeconomic foundations of microeconomics (King 2012 p.165). These opinions are all against King's "microeconomic foundations delusion" thesis.

Our position goes one-step further than the Uncertain group's common stance,

because we claim that the needed microeconomics (at least the core of it) is already constructed by Shioawa, Morioka, and Taniguchi (2019). Let me prove it.

SMT consists of three pillars as I have explained in Section 2. Accusations of being RARE (representative agent with rational expectations) or MIRA (methodological individualism with representative agents) do not apply to our theory, because first there is no representative agent and second we do not stand on methodological individualism (I will argue this point in Section 8 Micro-macro loop). King and many other Post Keynesian economists raised two points as reasons to oppose the microfoundations idea. One is the downward causation. The other is the existence of fallacy of composition. The existence of emergent properties is considered to be the evidence of downward causation. The microeconomics in SMT is not a micro-reduction as it admits emergence and fallacy of composition. This is not an expression of the philosophical stance of the authors. The new microeconomics contains as its consequence a theory that proves emergent properties. An example is given in Section IV of Shiozawa (2021). The section proves that the economic system selects a specific set of production techniques and a set of prices, even when each product has a continuum of production techniques like Cobb-Douglas or CES production functions. When we observe a single industry, input coefficients change if prices change. Thus, input substitution proposition is valid for a single industry. However, for the economy as a whole, the proposition is invalid due to minimal price theorem (Theorem 2 in Shiozawa 2021). Firms cannot change their production technique to other production techniques that do not satisfy the value equations (4-3). This fact proves that microeconomics in SMT is not a theory that implies that all properties can be derived as a collection of individual properties.

As for fallacies of composition, exact argument is a bit difficult. It is not because the SMT framework does not admit fallacy of composition, but because many fallacies of composition are most of cases described verbally and are difficult to give them an exact meaning. Lavoie (2014) gives a table of Post Keynesian macro-paradoxes (Lavoie 2014, p. 18, Table 1.4). The most famous one is Keynes's paradox of thrift. King (2012) and Lavoie (2014) both give a short account of the paradox of thrift (King 2012, p.9; Lavoie 2014, p. 18), but their exact contents are different. King defines paradox of thrift as a fallacy of composition: a decision by any individual to save a larger portion of her income will not be realized in the absence of increased investment. Lavoie explains the paradox of thrift as a phenomenon that an increase

of the propensity to save will lead to a reduced output. The second version of the paradox, i.e., Lavoie's output version, is a paradox in the sense that it seems to contradict the classical economics proposition that increased saving is necessary for more rapid growth. In the SMT framework, it is possible to give the same account more clearly. In the short run, if the propensity to save increases, the effective demand decreases and output decreases. But, in the long run, if workers consume larger portion of their wages, the maximal rate of growth is depressed because it makes the augmented matrix bigger and the associated Frobenius eigen value becomes bigger.[3] It is also possible to give an account of the paradox of thrift by King's definition. As the SMT framework is essentially process analysis, it is easy to explain what happens when saving increases and investment remains constant. This is in fact no paradox for SMT while it may be difficult to explain in the standard equilibrium framework. In this sense, paradox of thrift can be easily explained in the SMT framework, and it becomes no paradox at all. Microfoundations can explain what seems to be paradox better than the standard Post Keynesian economics can do.

The above arguments are a proof that SMT microeconomics passes the negative criteria King gives as evidence that microfoundations are impossible. They may be impossible as far as Walrasian or Marshallian microeconomics are concerned, but the conclusion changes because SMT provides totally different microfoundations. The true contribution of SMT is not restricted to this negative aspect. SMT framework makes it possible to open new fields of analyses for Post Keynesian economics. An example is that of technological change. As I argued in the previous section, Shiozawa (2020), which is a simple application of SMT theories, makes it possible to analyze how technological change induces economic growth. Post Keynesians' (or rather Kaleckians') favorite assumption of Harrod neutral technical progress, i.e., labor-saving technical progress is not sufficient for full-blown analyses of technical change.

One of most important contributions of SMT to Post Keynesian economics is that it gives a new formulation of the principle of effective demand (Shiozawa 2021). When we talk of the principle of effective demand, it is necessary to distinguish two

[3] Augmented Leontief matrix is the Leontief matrix augmented by a matrix that is give as matrix product of the labor input vector and the wage basket vector. Frobenius eigen vector gives the inverse of the maximal growth factor.

different questions. One is the question of determining the "point" of effective point. The other is how the principle of effective demand works. After I published Shiozawa (2021), I am reading various papers that contain the phrase "the principle of effective demand". I was surprised by the fact that many papers interpret the principle of effective demand as something that determines total or aggregate demand of the economy. In other words, they are identifying the principle of effective demand and the point of effective demand. In SMT, it is the final demand as a vector (or a set of different final demand). The size and composition of the final demand are left open. Morioka's theorem proved that the total network of production interconnected by input-output relations can follow changes of the final demand as long as the moving average of the final demand (as vector) changes sufficiently slowly.

The reason of saying "the moving average of the final demand" is that we are considering that final demand for each product changes randomly for an interval of times, say according to a probability distribution such as Poisson, normal or any other random way including the situation where there is no fixed probability distribution (a truly uncertain situation). When we take a moving average for a week or for a month, or for any number T of production periods, this moving average may show a different random property.[4] If this moving average changes sufficiently slowly, the input-output network system can follow the change of the final demand in such a way that average demand and the average production volume run almost parallelly for all products. This is indeed a great theorem, but for the moment we do not have any accurate estimation on what level the permissible speed is. Most probably, we estimate that the system can follow the change of twenty percent of growth or decrease per year. If this estimation is right, an economy can grow quite rapidly when the final demand grows within this permissible speed.

The question of the size of effective demand is not yet examined sufficiently in SMT. As Lavoie (2023 p.191) points it out, this is the most unexplored area of our research. The principle of effective demand, I believe, is different from determining the size and composition of the final demand. If we say "principle", it shows a law or

[4] A production period is a standard time span in which inputs are transformed into an output. Economics had a custom to consider it a year, but in the modern industrial economy (excepting for example some agricultural products) a production period is much shorter than a year, such as a day or a week.

mechanism, or perhaps a doctrine, that governs a phenomenon. What I showed as principle of effective demand in Shiozawa (2021) is the law (in this case a kind of convention backed by a possibility) that stipulates how the producers behave in the market. In other words, the firm that produces a product sets the price of the product and produces and sells it as much as the demand for the product is expressed at the set price. In opposition to traditional understanding on how the market works, firms adjust quantities, i.e., productions and sales volume instead of adjusting pricing.

4.3 The true nature of Keynesian revolution

The above vision on how the principle effective demand work is not new at all. Luisi Pasinetti (1974 II 2) pointed out the same vision as the above. More than thirty years after, explaining the principle, Pasinetti (2007) summarized it, in his Federico Caffé Lectures, as follows:

> Now, it is certainly true that for a monetary production economy, Keynes's claim was that when there is an imbalance between demand and available production capacity, a mechanism of adjustment is at work, which acts through the adaptation of physical quantities rather than (as it was traditionally held) through the adaptation of prices. (Pasinetti 2007 p.14)

This is roughly what we are considering in SMT, or at least what we were considering when we started our research that results to SMT. Curiously, Pasinetti continues as follows:

> But surely the *General Theory* cannot simply be reduced to this market-adjustment mechanism. If it were simply so, then such a quantity-adjustment mechanism could quite easily be inserted into a scheme of demand and supply functions of suitably adapted Walrasian macroeconomics model, which is in fact the gist of what Hicks, implicitly, and Patinkin, quite explicitly, have been claiming (Hicks 1937, Patinkin 1987, 1990). (Pasinetti 2007 p.14)

I believe this is a flaw in the deepest reflection on the reasons on why Keynes revolution failed in its theoretical, methodological, historical, and sociological aspects. It is true that the *General Theory* promptly produced John Hick's *IS-LM* interpretation. I agree that what Hicks presented is a variant of Walrasian

economics. However, Patinkin's arguments are much more indicative than Pasinetti's here. His main question was "why are there such vastly different interpretations of the General Theory?" (Patinkin 1997[1990] p.56)

After examining there are many interpretations which can be classified into two major groups of them, Patinkin changes his point of view and enquires "Why are there not different interpretations of *Value and Capital* and *Foundations of Economic Analysis* [by Paul Samuelson, note added by Shiozawa]?" (Patinkin 1997 p.77) The answer is short but plausible. "There was a fundamental difference between these texts," he answers, for "*Value and Capital* and *Foundations* were books that elaborated, rigorized and extended economic theory within the existing paradigm." While, he adds, "Not so the *General Theory*: here was a book which presented a new and at-the-time strange paradigm. It was a pioneering work that introduced new concepts (e.g. the very notion of an 'aggregate demand function') and new ways of thinking." (Patinkin 1997 p.78)

There was a gigantic jump in the vision on how the economy works, how demand and supply are adjusted when there was an imbalance between demand and available production capacity. Economist before Keynes, this adjustment worked through price mechanism. Keynes suddenly discovered another mode of adjustment: quantity adjustment. It was a gigantic change of view that is comparable to Copernican turn from geocentric system to heliocentric system. What we should remind of in this turn is that Copernican system had not the precision better than that of the geocentric system at the time, i.e., the modified Ptolemaic system. Copernican system became more exact only when Kepler discovered his three laws of orbital motions of planets about seventy years later, Kepler himself working more than ten years to reach the first law.

If we compare Keynes with Copernicus, it is understandable why Keynes was misinterpreted in diverse ways. Keynes himself had no language by which to talk about his new vision. What he could was to hint his idea by some enigmatic phrases: monetary theory of production (in the preparation phase), principle of effective demand, or theory of output as a whole. What added confusion to his revolution was that he talked Marshallian language, a natural language for many economists at the time. Consequently, the *General Theory* is full of strange propositions which may be wrong if once revolution is realized. This was inevitable, because as Otto Neurath

argued researchers who engage in a science revolution are like sailors who on the open sea must reconstruct their ship. They must put a new beam using old materials found on the ship.

In the case of Keynes, the famous phrases like "monetary theory of production" and "theory of output as a whole" are only a vision with no concrete theoretical contents, or framework to express it. The expression "monetary theory of production" does not appear in the *General Theory*. The phrase "theory of output as a whole" appears two times in the Preface. Shorter phrase "output as a whole" appears 20 times in 17 pages, mainly lead by "price of". However, the phrase "theory of output (and employment) as a whole" appears only once each in the Preface and Chapter 21. The "principle of effective demand" may have been much better. It appears only once in the main text but is supported by theses like the opposition to Say's law, the concept of aggregate demand, and more controversial aggregate supply function. Even in this case, as Pasinetti pointed out, there was in fact no true explanation of the principle of effective demand in the *General Theory* (Pasinetti 2007 p.15). Pasinetti distinguishes "point of effective demand" and "the principle of effective demand." (ibid.). In the famous chapter 3 "The principle of effective demand" in the *General Theory,* there is a definition of "the effective demand," i.e., the point of effective demand in Pasinetti's terminology, but there is no explanation of the principle. The phrase "principle of effective demand" appears only once in the whole book except for chapter titles and tables of contents. Therefore, there is no real explanation of the principle of effective demand in the *General Theory*.

Pasinetti's contention that "the *General Theory* cannot simply be reduced to this market-adjustment mechanism" is not right in the sense that he expects too much from the *General Theory*. It hinted a real revolution in economics, but Keynes had no theoretical framework by which to express his ideas. Most of his new claims were contaminated by Marshallian microeconomics, the inconsistency of which was already proved by Sraffa's 1920's papers. It was rather inevitable that Hicks and others interpreted Keynes's ideas in Walrasian framework, because they had no ready-made theory that is appropriate to express the new ideas. Lacking an appropriate theoretical framework all economists after Keynes tried to transform Keynes's ideas into new theories. Almost all economists failed. It was inevitable because they did not have, or failed to construct, a new theory by which to express their ideas.

What was lacking here was in Pasinetti's terms a production paradigm as opposed to exchange paradigm (Pasinetti 2007 Ch. 1, Section 6). Although it seems he did not notice it, a problem lies in this opposition of two paradigms. Production paradigm is not a new paradigm. It was also a paradigm for classical economists including Phyiocrats and British classical political economists. Exchange paradigm may have existed even before classical political economy (I say classical economics as far as no fear of confusion exists with Keynes's notion of "classical economics" which included neoclassical economics), but it became a formal paradigm in 1870's through the so-called marginalist revolution, which I prefer to refer as Neoclassical Revolution (Shiozawa 2017). Marginalism, after Hicks (1976), is but a name of analytical tool which became to be used at the period of revolution. A real content of revolution was a turn from economics of production (Plutology after Hicks) to economics of exchange (Catallactics after him). If Keynesian revolution is a turn of exchange paradigm to production paradigm, is it a restoration of old classical economic? How can we explain the difficulties that Keynes and his followers faced after the revolution? Did they all failed to acknowledge that classical political economy is open to them ready made? What Pasinetti does not understand is the crucial difference between production paradigms of classical pollical economy and Keynesian revolution.

4.4 Where did the difficulty lie?

The answer is almost hinted in Pasinetti's Federic Caffé Lectures (Chapters 1 and 2 in Pasinetti 2007):

> The model, at the level of basic relations, is characterized by separations between a price equation system and a physical quantity equation system. And it requires additional, explicit and specific institutional relations in order to give answers to the problems arising from the inter-relations between the two (price ad physical quantity) equation systems. (Pasinetti 2007 pp.19-20)

Here are present three elements that we discussed in Section 1 of this paper: separation of price and quantity system, a price system, and a quantity system. As for the price system, or the theory of it, there must be no big difference. After 1960, Cambridge Keynesians had Sraffa's price theory. Sraffa himself did not adopt the markup pricing, but it was adopted by Kalecky before Sraffa. This raises a problem

on why this simple combination did not occur. I do not treat here this and other enigmas around the history of the Keynesian revolution. It must be an interesting question to ask.

What was the crucial difference between classical political economy and Keynesian revolution? A hint is what Sraffa called "circular process" (Sraffa 1960, p.93). This vision goes back to Quesnay's *Tableau Economique*. It is a system in which "no changes of output" and "no changes in the proportions" are considered (Sraffa 1960, p.v). Here we find a new meaning in the expression "no changes of output" (and "proportions"). Obviously, importance of "no changes" lies in the equality of the state one-period earlier and the present state. As long as this condition is preserved, the size and the proportion of the production do not matter. The economy is in a self-replacing state. It can repeat the cycle eternally. It is important to note that, strictly speaking, Pasinetti's physical quantity equation system is valid only for this self-replacing state. As long as the cycle is repeated, the inputs are provided from the output of the previous period. If, on the contrary, the volume of production increases, we should enquire from where we procure the increased inputs. This kind of complication does not occur for price equation system. It explains why Sraffa could develop his price theory always supposing self-replacing circular process.

What is the difference between price system and quantity system? The secret lies in the difference in the way two systems are related to time. If I express the conclusion short, the price system is *prograding*; while the quantity system is *retrograding*; with regard to time. We may also use more familiar twin terms: progressive versus retrogressive under the understanding that they contain no political meanings. Loyally following the notations and situations in Chapter 2 of SMT, let us assume a price vector $\mathbf{p}(0)$. The convergence process shown of Theorem 4.10 takes form of (2-19):

$$\mathbf{p}(n) \;=\; (\, min_{t\in T} \;\{\, w\, \mathbf{u}(t) \;+\; \langle \mathbf{a}(t), \mathbf{p}(n-1) \rangle \,\})$$

Note that variable t indicates a production technique and n is here a time variable. The process proceeds from $\mathbf{p}(0)$ to $\mathbf{p}(1)$, $\mathbf{p}(2)$, … , $\mathbf{p}(n)$, … . It converges to a price system $\mathbf{p}^*$ that satisfies the equation

$$\mathbf{p}^* \;=\; A\, \mathbf{p}^* + w\, \boldsymbol{a_0}, \qquad (1)$$

where A is the matrix of input coefficients of production techniques that correspond to the minimal prices. Therefore, price adjustment process in a prograde way.[5]

The case of quantity adjustment is different. Consider, for example, a simple case where a system of production technique is given. Let A be the input coefficient matrix. If we want to produce $\mathbf{y}(0)$ at time 0, the material input vector $\mathbf{x}$ must be prepared at a time point -1 when we assume the production period is the unit of time. Then, we get a series

$$\mathbf{y}(-1) = \mathbf{y}(0)A, \ldots, \mathbf{y}(-n+1) = \mathbf{y}(-n)A, \ldots$$

This means that, in order to obtain an output $\mathbf{y}(0)$ at time 0, we must prepare $\mathbf{y}(-n)$ at time $-n$. If it is necessary to take out of the system a final demand $\mathbf{d}(-n)$ at each time point $-n$, the series of production must satisfy conditions

$$\mathbf{y}(-1) \geqq \mathbf{y}(0)A + \mathbf{d}(0), \ldots, \mathbf{y}(-n-1) \geqq \mathbf{y}(-n)A + \mathbf{d}(-n), \quad (2)$$

Just imagine how it is difficult to find a series that satisfies (2) when the final demand series $\{\mathbf{d}(-n)\}$ is given. If we want to obtain strict equalities, it is practically impossible because decisions must be made far before the actual production. If there is a change at time 0, that change must be reflected at time $-n$ for all n. This difficulty arises because production system has a retrograding determination property. Retrograding does not stop at $-n$. It must go back to an infinite past. How is this process implemented in the economy where all agents are myopic and rationally bounded? It is only possible when each firm adjust the production to keep the product (and input) inventory at a suitable level, calculated from a moving average of the past demand for the product. The fact that firms behave like this is no discovery. Almost all production managers know it. The true contribution of Taniguchi and Morioka was that this process is stable and converging for the *economy as a whole*. Taniguchi found this fact by computer simulation and Morioka proved it mathematically when the process is linear (or as far as no firm face

[5] (2-19) expresses a simultaneous price adjustment process, whereas in reality firms set their product price at a convenient time for each of them. Non-simultaneous case is studied in Shiozawa (1978), as noted in footnote 29 on page 82, SMT.

stockouts). Non-linear adjustment case has no mathematical proof. It seems impossible to get one for the moment (i.e., at the present state of mathematical development). See for more details Subsection 2.7.4. For convenience of explanation, the case of where the final demand is constant is treated. Even when it is moving, say "randomly", if the moving average moves sufficient slowly, Taniguchi-Morioka results applies. As I emphasized in Subsection 2.7.5, this is really of a paramount significance.

Many Post Keynesians tried to go beyond the economy where a circular process prevails, but they could not go beyond it. They could not explain how an economy moves from a circular process to another circular process. They had to satisfy themselves with a shifting series of circular processes. Quantitatively the gaps were small but theoretically there was a giant gap between shifts of circular processes and a true theory of quantity adjustment.[6]

Pasinetti talks about "physical quantity equation system", probably with no deep reflection. Such a system has a meaning when it takes the form

$$\mathbf{y} = \mathbf{y}A + \mathbf{d}, \tag{3}$$

i.e., when there is no change in the production. The final demand and production of the economy form a strict circular process where everything repeats exactly as the previous period. In this case, it is easy to solve the equation above, because the production vector $\mathbf{y}$ is given by the equation (2), but it should be noted that no shifting process is examined. A circular process is simply assumed.

In the economy in which the final demand changes, the total mode of determination must take a different form. A solution is given by means of inventory and an approximate expectation by taking moving average as given in Chapter 4 of SMT. Symmetry of equations (1) and (2) is misleading. When we follow the processes, they are completely different. This process is not almighty. If there is a big sudden change of demand, the input-output system falls into a contradiction. Production might be obliged to stop by the lack of some materials or parts. As a conclusion, the quantity

[6] There was another process, as an exception, in which quantity changes but exactly proportionally. It was von Neumann's balanced-growth economy.

determination is much more complicated than the price determination, because of the difference of time structure in their mode of determination. One is prograding while the other is retrodgrading.

The above short account amply shows that quantity adjustment system is much more complicated than price adjustment system. This is the main reason why Keynesian revolution took so many years (at least more than a half century) until a first core framework is obtained in the form of Taniguchi-Morioka results. To avoid this kind of complication, almost all analyses of quantity adjustment assumed a quasi-circular process in which one can safely assume that the same situation is approximately reproduced using a parable such as shifting equilibrium or shift of circular process. By the shift of circular processes, it was impossible to argue any causal relations between different processes. In other words, people knew by observation how each firm behaves, but they did not know, until Taniguchi-Morioka, how the modern industrial economy works as a system, i.e., as a whole. Joan Robinson talked much about historical time, but she could not see that quantity adjustment mechanism contains inside it the above retrograde structure. Pasinetti noted that production economy must be analyzed as "inherently sequential in time" (Pasinetti 2007 p.20). General equilibrium theorist Frank Hahn stated that he wanted his framework to "be sequential in an *essential* way." (Hahn 1984 p.53) Many other economists hoped to analyze such a process. Retrograding time structure of input-output relations prevented the realization of their hope. Equilibrium was a pseudo framework that made us possible to evade from it.

For classical political economists, circular process was sufficient, because they had no intention to analyze change of the total output. They were satisfied by simply understanding how the giant network works. However, Keynes opened a Pandora's box. He began to talk about (the necessity of) a theory of output as a whole. Keynesian disciples and later economists interpreted it as a change of viewpoint from micro to macro. And dichotomy of microeconomics and macroeconomics emerged. This was a hasty interpretation. In the Preface (of the English edition) of the *General Theory*, Keynes explains himself about the evolution of his thought from the *Treatise on Money* to the *General Theory*. In the Treatise he "failed to deal thoroughly with the effects of *changes* in the level of output" (emphasis by Keynes). The *General Theory*, Keynes contends, "has evolved into what is primarily a study of the forces which determine *changes* in the scale of output and employment as a

whole." (My emphasis) Consequently, if we believe Keynes, the theory of output as a whole must be a theory of changes of output and the forces that regulate them. The recognition of this fact was a great step forward, a real revolution that we can compare with Copernican revolution. The trouble with him was that Keynes did not have any theory with which to deal with changes of output. We had to wait until Taniguchi-Morioka results.

This is not astonishing. When Copernicus published his *De revolutionibus orbium coelestium* (On the Revolutions of the Celestial Spheres), Copernicus did not know that planets revolve on an elliptic orbit. Kepler did not know the law of universal gravitation. And yet Copernicus had to persuade that the Earth goes around the Sun. Keynes was in a situation like Copernicus. When Pasinetti says that "the *General Theory* cannot simply be reduced to this market-adjustment mechanism," (see the citation above in page xx.) he did not imagine that "a quantity-adjustment" contains complications that originates from its retrograding mechanism. Taniguchi-Morioka result for Post Keynesian economics is the eight minutes for Kepler.[7] Few economists were aware of this fact and attacked the problem to build a theory of quantity adjustment process. Lacking the theory, Hicks and others were obliged to formulate the *General Theory* by means of traditional demand and supply equilibrium parable. Keynes and Kalecky had to work by means of accounting balances, which express an identity that holds by definition and indicate no causal relations.

SMT, structured in three pillars as presented in Section 2, provides a theory that was for a long time defective for Post Keynesian economics. At least it provides the core of such a theory. And, in this sense, we believe that SMT provides foundations that Pasinetti claimed to be worked out (Pasinetti 2007 p.36). We also claim that the microeconomics build in SMT provides microfoundations for Post Keynesian economics that were thought to be a "delusion" by J.E. King (2012). We may also claim that microeconomics here presented provides a foundation that "does not privilege macro over micro, money over real, or structure over agency." (Lee 2018 p.201)

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[7] Kepler thought that eight minutes difference of higher precision he got in his system would make a revolution in astronomy.

Many Post Keynesian economists who were accustomed to think in one-sector economy would think that the new framework is too general and invites too complicated situations to analyze. They may think the new framework is unnecessarily complex. However, the real economy is such a complex entity with complex interactions. To be satisfied by getting plausible results by analyzing simplified situations is not the true way to understanding the economy. We should avoid the illusion of thinking that we know how the economy works by a shallow observation or by intuition. It is not the way to accomplish Keynesian revolution. As Pasinetti observes, "Keynes himself, and then Keynesian group proceeded more on the basis of *intuition* than on the basis of a clear vision of the logical steps to take. The clarification of these concepts has remained widely unaccomplished." (Pasinetti 2007 p.37) There lies the cause of the past failure of Keynesian revolution. We should accomplish the task of realizing the revolution. SMT can be the first step for this task.

As the summery of this section, let me add a few words. This section explained how SMT provide Post Keynesian economics with microfoundations and why the latter were difficult. As we have overcome this difficulty, various analyses become easy with greater concreteness. It is now possible to connect more tightly vast knowledge accumulated in behavioral economics (Earl 2022) with Post Keynesian economics through the principle of effective demand in the product level (Shiozawa 2021). Many one-sector analyses will be given a theoretical basis. Various bold attempts, hitherto impossible, can be reorganized in a more concrete framework. We may raise for an example Berger (2009). Authors of this book have a good insight about circular and cumulative causation, but their arguments stay at the general systems analysis level. In other words, they generally lack economically concrete contents, the reasons of which must lie in the fact that they have not find yet a suitable framework by which to analyze the dynamics of circular cumulative causation. There is possibility that SMT fulfills this lacuna.

Section 5. The markup rates, the capacity utilization, and the profit rate

There are three major topics in this section. The first topic of this section is how the markup rates are determined. The second topic is the question of capacity utilization. Both are necessary in order to argue about the profit rate, which is the main topic of this section. The first two subsections are necessary to make the third topic

understandable. These analyses will lead to a new understanding on the capacity building investment. It will be shown that, although the profit rate is closely related to investment, the main factor of capacity investment is not the profit rate but the capacity utilization.

5.1 How are markup rates determined?

The markup rates play the important role in the price theory of SMT. They are introduced as Postulate 3 in Chapter 2 of SMT, where I gave a short account of only one page. It was inevitable to leave the Postulate in a form of a pure assumption in order to avoid full discussion there. I gave there two references: Shiozawa (2016b) and the Appendix in Shiozawa (2014). As the latter was written in Japanese, it meant I explained in only a few pages in the former for those people who do not read Japanese. When one talks about markup rates, it is natural to ask: "How are markup rates determined?" However, this natural question remained unanswered, even if it was an old question since the Oxford Economists' Research Group report (Hall and Hitch 1939). The markup rate was a crucial element for Michał Kalecki and now we have many Kaleckians as an important strand of Post Keynesian economics. Even though, Fred Lee, the author of *Post Keynesian Price Theory* (1998), which is a unique monograph to date written on Post Keynesian price theory, confessed in his posthumous Lee (2018 p.219) that "We don't know anything about how profit mark-ups are set." Lee died on October 23, 2014. King (2015 p.51) explains by citing a personal communication on 22 April 2014 that Lee was dissatisfied with theories from Philip Andrews, Adrian Wood, Alfred Eicher to Marc Lavoie, comprising entry prevention and internal finance motive theories and their synthetic variants. As my explanation does not belong to any of these theories, it seems worthwhile to add some more account on it.[8]

Fundamental premises of my theory are two. First, a negative claim: There is no demand function with independent arguments as prices. Even when a set of all prices $\mathbf{p} = (p_1, \ldots, p_N)$ is given, no definite demand for a product is determined. I refute (the existence of) such a function. The demand for a specific product changes day by day even if the set of prices remain constant. This is no extraordinary claim,

[8] Coutts and Norman (2014), a survey that seems to be the last one to date, does not mention this type of account.

because it is a simple observation for any sales shops. Kinked demand curve arguments are not adopted here. Is there no influence by the price differences for similar products? Yes, there is, but the influence will be expressed as a determinant of shares for sellers of the similar products. Hence, my second, positive claim: Let us adopt a new concept, i.e., share functions. Similar products above may stand for the same product (i.e., of the same mark of the same maker), while the place of sales point may differ. Imagine two supermarkets A and B that are situated at the vicinity of the other.

The same two products, one in A and the other in B, are similar but different goods. Some customers prefer to buy in A instead of B if the goods are sold at the same price. Traditionally, economics assumed that all demand goes to A when A sets a cheaper price than B (Bertrand hypothesis). This is false in general. Knowing that A set prices higher than B, some customers like to buy in A, because A lies near to them. Considering these circumstances, it is natural to assume that the price differences are reflected as the change of demand share for a specific product. The question is how this share function is shaped.

In a famous classical paper, Hotelling (1929) examined a transcontinental railway transport case. Suppose that (i) coal is shipped from two mines A and B near to the railway, say one from Atlantic and the other from Pacific coast, (ii) two mines have the same unit production cost c, (iii) transportation cost t is constant for each weight distance, and finally (iv) the demand for coal is uniformly distributed along the railway. When mines set their FOB price at the shipping place p_A and p_B respectively, the shares of two mines are given by

$$s_A(p_A, p_B) = x/L,\ s_B(p_A, p_B) = (L-x)/L,$$

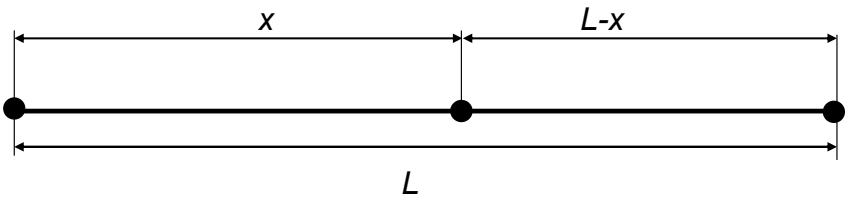

Figure 1

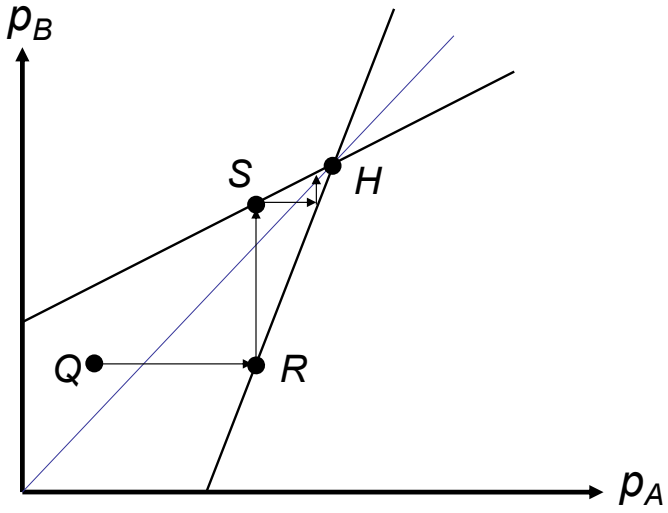

Figure 2

where x is the location (from point A) of the tipping point at which the FOB price plus transportation fare becomes equal:

$$p_A + x\,t = p_B + (L - x)\,t.$$

Solving the last equation, one obtains $x = L/2 + (p_B - p_A)/t$. (See Figure 1.)

If we suppose that the coal is transported from the mine from which the total cost is lower, then x/L and $(L-x)/L$ are the share of two mines of the total demand. Share $s(A)$ and $s(B)$ take the form:

$$s(A) = 1/2 + (p_B - p_A)/2Lt \quad , \quad s(B) = 1/2 + (p_A - p_B)/2Lt.$$

Then, the profits $\pi(A)$ and $\pi(B)$ for mine A and B are given when two mines adopt

prices p_A and p_B:

$$\pi(A) = (p_A - c)\, s(A)\, L\, d, \qquad \pi(B) = (p_B - c)\, s(B)\, L\, d.$$

These are quadratics with respect to p_A and p_B. Taking the differential with respect to p_A and p_B, the maximum of profit is given

$$p_A = (1/2)\, p_B + (1/2)\{Lt + c\}, \qquad p_B = (1/2)\, p_A + (1/2)\{Lt + c\}.$$

If we draw these equations on the (p_A, p_B) plane, the two lines are symmetric with respect to the 45° line. If two mines try to maximize their profits given the price of the competing mine, the pair of prices (p_A, p_B) shifts from point $Q(p_A(1), p_B(1))$ to $R(p_A(2), p_B(2))$ and then from $R(p_A(2), p_B(2))$ to $S(pA(3), pB(3))$ …, where $p_B(1) = p_B(2)$, $p_A(2) = p_A(3)$, and etc., when mine A makes the first move. As we see Figure 2, it is easy to know that this price changing process converges to a point $H(p_A^*, p_B^*)$ where

$$pA^* = pB^* = c + L\, t. \qquad (5\text{-}1)$$

The formula obtained shows that the profit margin per unit is $L\, t$. We can make an interesting observation. The price is indifferent to the total demand $L\, d$, where the demand density is d. The profit margin is proportional to L and t. What does this mean? L, the distance between two shipping points indicates the strength (or rather the weakness) of competition. If the length L becomes greater, the greater becomes the profit margin. The transportation cost t may also indicate the strength of competition. We may also deem it as an indicator of the technology level of the economy.

Hotelling's example gives us a good example on how the profit margin emerges. However, the profit margin obtained here is *additive*. It is not what we assume as markup rate. In the standard interpretation, the markup pricing is given by a *multiplicative* formula:

$$p = (1+m)\, c, \qquad (5\text{-}2)$$

in which markup rate m is considered constant irrespective of c. It is not difficult to explain this when we observe that the shares in Hotelling's case were functions of price differences. If we assume the shares are functions of price ratios, then the profit margin takes the multiplicative form.

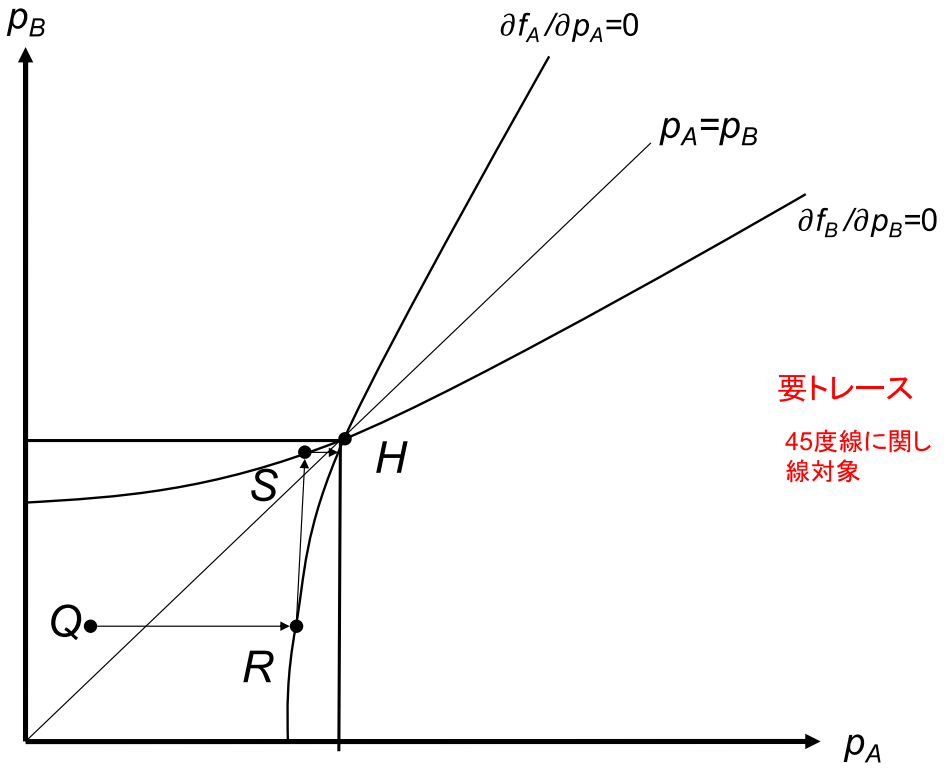

Figure 3. Hotelling's competition

A simple example is given by

$$s(A) = p_A{}^{-\sigma}/(p_A{}^{-\sigma} + p_B{}^{-\sigma}), \quad s(B) = p_B{}^{-\sigma}/(p_A{}^{-\sigma} + p_B{}^{-\sigma}), \quad \sigma>0. \qquad (5\text{-}3)^{9}$$

These are homogeneous of degree 0 and functions of p_A/p_B . The profit function becomes more complicated but the similar calculation of partial derivatives with

[9] The exponent σ in Shiozawa (2014) is positive but two share functions express the same situation, because the variables in the numerator are exchanged.

regard to p_A and p_B gives

$$\frac{\partial \pi(A)}{\partial p_A} = \{1 - \left(1 - \frac{c}{pA}\right) \cdot \frac{\sigma}{1+(p_B/p_A)^{\sigma}}\} \cdot \frac{D}{1+(p_A/p_B)^{\sigma}} = 0,$$

$$\frac{\partial \pi(B)}{\partial p_B} = \{1 - \left(1 - \frac{c}{pB}\right) \cdot \frac{\sigma}{1+(p_A/p_B)^{\sigma}}\} \cdot \frac{D}{1+(p_B/p_A)^{\sigma}} = 0,$$

where D is the total demand of the market for a certain period of time. If we trace two equations above, we get Figure 3, similar to Figure 2. The straight lines in Figure 2 are now curbs. The price changing process, or Hotelling's competition, converges to

$$p_A^* = p_B^* = \frac{\sigma}{\sigma-2} \cdot c. \qquad (5\text{-}4)$$

In difference to (5-1), the formula (5-4) gives the profit margin in a multiplicative form and the markup rate is given

$$m = \frac{2}{\sigma-2}. \qquad (5\text{-}5)$$

The formula has a meaning only when σ is greater than 2. The markup rate m is now independent of cost c. To obtain a general formula of markup pricing, it is necessary to define c appropriately. It cannot be marginal cost nor unit direct cost as often explained in many textbooks. It must be the normal unit cost. The reason of this point is discussed in the next subsection.

The index σ expresses the *resposiveness* or the *sensitivity* of the market to the ratio p_A/p_B. Israel Kirzner would have called it alertness of the side of buyers or consumers. When σ is bigger, the demand for a firm increases more elastically when it reduces its product price relative to the other firm. The bigger the index σ, the

share of seller A becomes bigger even when the ratio of p_A to p_B remains constant.

So far, we have examined 2-seller or 2-producer case. We can generalize this duopoly case into N-seller or N-producer case.[10] In other words, we can generalize it to oligopoly case. Indeed, suppose that the share function of a firm in N-poly case takes the form

$$s(i) = p_n{}^{-\sigma} / (p_1{}^{-\sigma} + \cdots + p_N{}^{-\sigma}) \qquad \forall \mathrm{i} = 1, 2, \ldots, \mathrm{N}. \qquad (5\text{-}6)$$

By a similar calculation, we get the markup pricing formula

$$p^* = \frac{\sigma}{\sigma - \frac{N-1}{N}} \cdot c. \qquad (5\text{-}7)$$

The number 2 in the denominator of (5-4) is replaced by $N - 1/N$. Of course, this includes the duopoly case. It is widely recognized that the market becomes more competitive when the number of competitors increases. Formula (5-7) shows this fact, if it is valid, but it also shows that the market becomes more competitive when σ, or the reponsiveness of the market increases. Even when the sellers situation remains constant, but if the responsiveness of buyers becomes more responsive, the sellers are obliged to use smaller markup rate if they want to secure the maximum of profit in the given situation, in which we should include how exactly they can guess the share functions. (5-4) and (5-7) are symmetric cases. Asymmetric case can be analyzed for duopoly case[11], but general oligopoly case exceeds algebraic analysis.

Is there a mechanism of the market that produces the share functions of the form (5-6)? Well known example is the Dixit-Stiglitz model for product diversity (Dixit and Stiglitz 1977; Oyamada 2020). They assumed a CES utility function for a set of products:

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[10] N-seller case is not analyzed in Shiozawa (2014).

[11] A few results are given in Shiozawa (2014).

$$U(x_1, x_2, \dots, x_N) = (x_1{}^{\rho} + x_2{}^{\rho} + \cdots + x_N{}^{\rho})^{1/\rho} \qquad \rho < 1. \qquad (5\text{-}8)$$

As the utility function, the function $f(x_1, x_2, \dots, x_N) = x_1{}^{\rho} + x_2{}^{\rho} + \cdots + x_N{}^{\rho}$ plays the same role as $U(x_1, x_2, \dots, x_N)$. Taking the partial derivatives of f with regard to x_i, we obtain

$$\partial f / \partial x_i = \rho \cdot x_i{}^{\rho-1} \cdot f(x_1, x_2, \dots, x_N).$$

The maximal utility point $(x_1, x_2, \dots, x_N)$ under the budget constraint has the same direction with the price vector $(p_1, p_2, \dots, p_N)$, i.e.,

$$(x_1{}^{\rho-1}, x_2{}^{\rho-1}, \dots, x_N{}^{\rho-1}) \propto (p_1, p_2, \dots, p_N) \quad \text{or} \quad x_i = \lambda \cdot p_i \ \exists \lambda > 0 \ \forall i = 1, 2, \dots, N.$$

Then,

$$p_i = \lambda \cdot x_i{}^{\rho-1} \quad \text{or} \quad x_i = \mu \cdot p_i{}^{1/\rho-1} \quad \text{for some } \mu > 0.$$

As $\rho < 1$, the exponent of p_i is negative. Note that the denominator in expression (5-6) is only the weight to make all shares sum up to 1. This means that the maximal utility set of goods behaves as if they are share function (5-6) with

$$\sigma = 1/1 - \rho \ .$$

We can obtain a similar result for asymmetric case such as the one where variables $x_1, x_2, \dots, x_N$ have the different weights, although general analyses are difficult.

If we have a representative agent who has preference (5-8), we obtains a market in which the share functions $s(i)$ is expressed by (5-6) with $\sigma = 1/(1-\rho)$. This is the

love of variety case, famous in international trade theory. It may represent a choice behavior of persons, for example, when they want to choose different restaurants. As I have argued in Siozawa (2019), however, variety of products may emerge also as an aggregated result that each person has a *strong preference*. The strong preference is expressed by a utility function of (5-8) but for $\sigma > 1$. This kind of utility function is rarely used, because its isoquants are not convex but concave to the origin. In such cases, the utility maximization (supposing it is possible) gives a corner solution. For a symmetric utility function of the form (5-6) with $\sigma > 1$, the maximal solution (not the maximal value) is given by a single good which has the minimal price among them. This is the reason why I propose to call this case strong preference. For each person and for each set of prices, the maximal solution under budget constraint consists normally of a single good. Of course, if there are several prices that have the minimal value, then those goods are indifferent for the consumer. Probably he or she must choose one randomly among the "best" solutions.

There is a clear reason why strong preference case is avoided in the standard analyses. One cannot apply marginal analysis to corner solutions. As marginal analysis is the core tool of neoclassical economics, economists who are accustomed to marginal analysis have a strong tendency to avoid corner solutions. There were of course some brave person like Xiaokai Yang (1948-2004), who thought that increasing returns to scale is vital for economics and it is necessary to incorporate in the analyses corner solutions which are typical ones under increasing returns. Yang launched a research program that he named *inframarginal approach*. He led a group of economists and at the beginning of the 21st century, he published three books in this orientation: a textbook named simply *Economics* (2001) and more specialized books on trade theory and on development, all of them thick of 500 to 700 pages. However, his premature death stopped this new movement. After Yang, there is no person who dare to succeed Yang's brave step toward inframarginal analysis.

Even though the strong preference case is difficult to analyze, it does not imply that we can neglect the case. In my opinion, there are two cases that should be examined. First case is the example of two competing supermarkets. Except for a very rare occasion, even if they are situated in a vicinity, we do not go to two supermarkets at

the same time. We choose one by convenience of the occasion.[12] Another example is choice of a passenger car. Excepting super rich persons who buy several different cars, one is obliged to buy a car of specific make, model, and year.

A possible explanation of why strong preference produces share functions like (5-6) is the following. Let us take the duopoly case for simplicity and imagine customers for passenger cars. Ordinarily they have their own favorite make and model. They are normally loyal customers. At the time of repurchasing, many people choose the same mark and model. However, we can imagine a small part of people reconsider their choice and may switch to a new make and model. The price ratio may play an important role in this reconsideration although switching may happen even when no price change occurs. Let $\psi(x)$ $(0 \leqq \psi(x) < 1)$ be the speed of switch from maker A to B when x is the logarithm of the price ratio p_A/p_B. Suppose for example, $\psi(x) = \exp(a - b\,x)$ for two positive constants a and b. In a symmetric assumption, the part of people who change from B to A will be $\exp(a + b\,x)$. More precisely, let us assume that

$$\hat{S}(A) = \{\mathrm{d}S(A)/\mathrm{d}t\}/S(A) = \psi(\mathrm{x}), \quad \hat{S}(B) = \{\mathrm{d}S(B)/\mathrm{d}t\}/S(B) = \psi(-\mathrm{x}).$$

Then, $S(A)$ and $S(B)$ will dynamically equilibrate when $\exp(a - b\,x) \cdot S(A) = \exp(a + b\,x) \cdot S(B)$, while the total population $S(A) + S(B)$ remain constant. Taking the share $s(A)$ and $s(B)$, we obtain

$$s(A) = p_A^{-2b}/\{p_A^{-2b} + p_B^{-2b}\} \text{ and } s(B) = p_B^{-2b}/p_A^{-2b} + p_B^{-2b},$$

which coincides with (5-2) when $\sigma = 2b$.

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[12] I have given an explanation on this case in Shiozawa (2014).

I do not claim this is a true process, but this thought experiment shows that strong preference case can generate the same type of share functions as the love of variety case. Considering that markup pricing is almost universal, this suggests that share functions are not necessarily the aggregate result of rational choice of people who have the same type of behavior like love of variety. Majority of Post Keynesian economists accuse the use of representative agent. The above thought experiment shows that markup pricing does not necessitate a foundation based on representative agent. It can be a result of a special type of population dynamics that is totally different from love of variety. (Earl 2022, §11.2, p.342 in particular)

In the long history of economics, Hotelling's example was practically reduced to two ice-candy sellers' competition on a summer seashore and is cited as the original example of location competition. This is but a gross disfiguring. This history conveys how the mainstream economics concentrated its interest on individuals' psychological aspect and evaded from the study that comes from the structure of the economy. Share function is not simply different in its form, but the point of concern is different. Dixit and Stiglitz (1977) were motivated to know the logic of how the product diversity is determined. Love of variety became one of major topics in international trade after Paul Krugman had employed love of variety methods. New and New-New trade theory research heavily depends on the preference of the form (5-6).[13] Strong preference case is avoided simply because it is not adaptable to marginal analyses. As the strong preference case was treated in Shiozawa (2019), I will not argue it here.

On the fortieth anniversary of Dixit and Stiglitz (1977), Stiglitz (2017) reflected that their formulation provided a useful tool for a variety of subdisciplines such as growth theory, macro-economics, and international trade. As the strong preference case reveals, share functions can emerge by what we may call microstructure of the economy. Chapter 1 of SMT showed how the representative agent arguments are weak logic for economics. Reasoning on utility functions have a narrow range than it is ordinarily expected. It is time to reconsider the economic theory based on utility maximization. However, much more important problem remains for economics. It is

[13] Oyamada (2020) reviewed the strength of the love of variety in international trade theory. It seems that all those investigations are neglecting the possibility of strong preference case.

the question of how to characterize markets. They are usually considered under the rubric of imperfect or monopolistic competition. The present analysis given in this subsection does not assume that the markets are imperfect or monopolistic. We should doubt traditional dichotomy of complete versus incomplete or (perfectly) competitive versus monopolistic competitive markets.

No one claims that coffee shops in the street are monopolistic. Even in such a case, product differentiation exists. In the case of recent Japan, the lowest price of a cup of coffee in a coffee shop is less than 300 Yen (or around three US dollars), whereas majority of coffee shops claim somewhere around 500 Yen. Specialty coffee shops set prices set prices from 800 to 1,500 Yen and the coffee lounge in a prestigious hotels cost more than 1,500 Yen. Of course, there are differences of business types. Most of the lowest price shops are located near a railway station. Almost all coffee shops in the common neighborhood set prices around 500 Yen. In the case of this second category, coffee shops are never a monopoly, because there are other coffee shops not very far from another. We can observe a similar situation for may categories of retail shops. The same observation is possible for many products with their own brand. The markets with markup pricing or normal cost pricing are most ubiquitous and real existing ones. The traditional dichotomies perfect and imperfect or free or monopolistic are to be refuted. They are invalid concepts. Excepting organized market that runs by auctions, there is no perfectly competitive market,

5.2 Capacity utilization rate and profit

There is a widely spread misconception on the nature of markup rates and their relations to profit rate. This subsection explains why it is too rough an understanding. It also tries to give what I had to make in Section 2.7.6 in SMT. Despite of my promise I gave in page 94, it was not fulfilled.[14]

For the sake of explanation, I take a simple but typical case. We assume a single product firm in which (1) a clearly defined production capacity exists, (2) within the production capacity the products are produced a constant unit direct cost, and (3) no

[14] As I mentioned in Aspromourgos et al. (2022, p.35), this omission was suggested by Naoki Yoshiwara.

extra cost is charged when the operation rate changes.[15] After Alfred D. Chandler Jr., the assumption of single-product firm is to neglect an important mechanism of the modern industrial firms i.e., the economies of scope. Post Keynesian economists normally assumed constant unit direct cost (Lavoie 2022, §3.5), while Fred Lee claimed it changes (Lavoie 2022 §3.5.4). One point of Toyota production system was to keep production rate as constant as possible. Behind this philosophy lies the fact that change of production burden invites extra costs and increases the average unit costs. In many industries, change of production rate is difficult as in the case of blast furnace iron makers and (Fourdrinier machine using) paper manufacturers. All these complications are neglected here, although it does not mean these are not important. It is important to note, however, that the situation that satisfies (1), (2), and (3) is not exceptional as the neoclassical economics assumes, but in fact a typical case. The famous U-shaped cost function is derived from the necessity to define supply functions for firms and has very weak evidence. Although cost accounting basically assumes (1), (2), and (3), the cost shape must be determined by measuring the actual unit cost at different level of productions. Curiously enough, as far as I know, there are only a few reports of such empirical statistical research. The first of such research is Dean (1976), which is in fact a result of many-years measurement in late 1930's to 1940's. Other reports on cost functions are results of inquiry method, the first of which is famous research by Oxford Economist Research Group. As for constant marginal costs, Lavoie (2022 §3.5.4) cites Blinder et al. (1999). It illustrates well how this question has been treated in the history. The subtitle of the book reads "A new approach to understanding price stickiness." If enquiring managers of firms was a new approach, the same method had been used since Oxford Economists' Research Group (See Harrod 1939) and Lester (1946).[16] The latter triggered a long controversy usually called Marginal Cost Controversy on the shape of cost curves and the validity of neoclassical price theory, inviting more than 16 papers and induced two famous papers to be written: Alchian (1950) on evolutionary interpretation of optimal behaviors and Friedman (1953) on the methodology of positive economics. Despite of this famous controversy, the authors seem to have all forgotten after forty to fifty years later.[17] This proves how short memory American

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[15] Compare Lavoie (2022, p.155; 2014, p.147)

[16] I myself support he validity of inquiry method, but the subtitle signifies that past "wisdom" was not inherited.

[17] Hall and Hitch are mentioned, but no reference is given to Andrews, Lester, or Machlup, without

economics has and lacks inheritance of past study.

The capacity utilization rate, or simply the utilization rate, is defined as production volume for a period divided by the production capacity for the same period. We normally assume that the utilization rate is less than 1, i.e., the output rate is smaller than the production capacity. We can ask why almost always firms operate under the full capacity. I leave this question to another occasion. A possible hint was given in Shiozawa (2019). See also Lavoie (2022 §3.5). It does not follow from this assumption that a production more than full capacity is impossible. The production over the production capacity is possible often with small change of unit cost. The reason of why over capacity production is rare lies in the market. There is no sufficient demand for the producer firms to produce at full capacity.

This was the situation that Piero Sraffa (1926) pointed as the reason of why entrepreneurs do not want to expand their production. After remarking that that "a very large number of undertakings … work under conditions of individual diminishing cost," Sraffa reasons that "almost any producer of such goods … would extend his business enormously," if he can sell as much as he wants at the current price. "Business men, who regard themselves as being subjected to competitive conditions, would consider absurd the assertion that the limit of to their production is to be found in the internal conditions of production of their firm, which do not permit of the production of a greater quantity without increase in cost." Then, Sraffa concluded that "The chief obstacle against which they have to contend when they want gradually to increase their production does not lie in the cost of production, … but in the difficulty of selling larger quantity of goods." (Sraffa 1926 p.543). This is the famous place from which all theories of imperfect or monopolistic competition emerged. However, after nearly 100 years later, I must say that the theory developed in a quite sinuous way before arriving to a simple theory that producers produce as much as their products sell. I have proposed to call the last remark Sraffa principle.[18] Joan Robinson's theory of imperfect competition was a great detour which was

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saying about Dean. As for recent retrospection on the history of marginal costs, see Nubbemeyer (2010) and Frischmann and Hogendorn (2015).

[18] See SMT, page x, in Preface. (The reference to "p. 10" in Shiozawa [2020 p.73] is a typo.) I first proposed this in Japanese papers published in 1978 and then in 1984, both of which were included in my book Shijō no Chitsujogaku (1990).

unnecessary, if we thought more simply, or if we were freer from demand and supply framework. Then, Keynes's struggle of escape would have been much easier. This produces an enigma about Sraffa and Keynes relations: why did they come to cooperate in constructing a new theory of output as a whole?

Now, let us assume that a firm produces a product/ Suppose that the top management wants to decide the price of the product for a certain period, e.g., a quarter, a year, or several years. We name it the planned period. Assume also that the total cost the firm must pay is $C+c\cdot x$, where C is the fixed cost for the planned period and $c\cdot x$ is the variable cost when x is the output. We have assumed here that marginal cost is constant within the full capacity. Does the markup pricing formula (5-2) apply to this case? No, it doesn't, if c stands for the coefficient of the variable cost $c\cdot x$. The unit direct cost we must use is not c, but $c + C/q_n$, where q_n is the units of the product that the top management expects that it is possible to achieve for a planned period. This expected units are ordinarily called the *normal output*, although there is no guarantee that this expectation is normally fulfilled. Then, the markup pricing takes the form

$$p=(1+m)\{c+\frac{C}{q_n}\}. \qquad (5\text{-}9)$$

This is but the normal cost pricing formula (Lee 1998 Part II; Lavoie 2022 §3.5).

Let me explain why we should take the form of (5-9) instead of (5-2). The main point is that we want to decide the price that is valid during the planned period and want to maximize the profit as far as possible. In this case, the period we must consider is much longer than the production period. A production period may be an hour, a day, or a week. When we decide a product price, it is the price for a quarter, semester, accounting year, or on some occasion for several years in which a product of a particular specification is planned to be sold. During this period, the output may change for each production period, from day to day, or from week to week.

What determines this actual output, or the volume of production is the demand for the product that is expressed by the market. Then, we cannot assume that the output $x(t)$ for a production period t is equal to average output for the production period, calculated from q_n, because q_n is simply an expectation of the management

or sellers. The manufacturing manager must decide the output for each production period at the beginning or before the beginning of each period. SMT explains several standard methods. So, I do not enter in the details. I assume the output is realized as the manufacturing manager planned. Let the series of output for the planned period be

$$x(1), x(2), \dots, x(t), \dots, x(T). \qquad (5\text{-}10)$$

The best situation we can expect here is that the total average of the series is equal to the top management's estimation. The estimated profit for the planned period is

$$\sum_{i=1}^{T}(p-c)\cdot x(i) - C = q_n\{p - c - {}^{C}/_{q_n}\}. \qquad (5\text{-}11)$$

Here, I used the equation $\sum_{i=1}^{T} x(i) = q_n$. What we have argued in the previous subsection applies and we get the result that (5-9) gives the best estimate for the expected profit for the planned period.

It is to be noted that the formula gives the maximum of the expected profit only when the following four conditions holds:
(1) The demand expectation is correct in the meaning that the total sum of realized series (5-10) is equal to q_n.
(2) The estimation of m on the basis of the firm's share functions is correct.
(3) The estimations of the share function are exact.
(4) The assumptions on the prices set by competitors are correct.
As it is easily known, the first three conditions are extremely difficult tasks. In view of these facts, the formula (5-11) gives the maximum only in an idealized situation. Even if condition (1) is correct, the estimation gives only a second-best result when the estimation of m is not too big or too small. While the formula (5-11) gives the maximum of profit in the expected situation, if the realized demand was greater than the expectation, the profit can be better than expected. Even in that case, this profit is not the best possible one, because if the firm could gain bigger profit by setting a smaller price (the one that corresponds to the smaller normal unit cost). We may know shares of competing firms but the share functions would be difficult to know even for the neighborhood of actual price ratios.

If we consider these limits of the formula (5-11), one may think this formula is useless. By no means! It signifies that the markup rate is no number that can arbitrarily be manipulated. If one set the product price assuming bigger m than the ideally existing m^*, even if it is not known, the firm would be missing what could be possible. The formula (5-11) or (5-9) tells that the standard explanation of markup rate in the form (5-2) is not a correct explanation (Lavoie 2022 §3.6.5). The standard neoclassical explanation based on the equality $MR = MC$ (marginal revenue = marginal cost) is *not* an exact account when we seek the maximal profit. Considering fixed cost C as a kind of sunk cost is not correct when the product price is fixed while the output varies. Omitting the part where he emphasized that markup pricing is not a result of maximizing behavior in Subsection 3.6.5, because it can be interpreted as a kind of profit maximizing behavior within the limited capabilities of managers, Lavoie (2022)'s explanation is very correct. The standard formula $MR = MC$ is wrong as far as the explanation of price setting decision.

The unit cost $c + C/q_n$ is called *normal unit direct cost*, although it includes non-direct cost part C/q_n. I had interpreted this part as a convenience to obtain a fixed direct cost before I discovered the explanation that follows (5-9). Takahiro Fujimoto named this cost *total direct cost*, as I mentioned it on page 94 in SMT, Chapter 2. The same cost notion is obtained from totally different point-of-views: Fujimoto in seek of better productivity measurement for the production site and the normal direct unit cost in seek of a better markup pricing method.

There is a practical meaning for the normal direct unit cost. If the accumulated output is x under the price setting p,

$$\{p-(c+ C/q_n)\} \cdot x \qquad (5\text{-}11)$$

gives the realized profit. We can use it as profit planning through time, just like simple unit direct cost c is used in the break-even analysis. Another usage is possible when one want to consider the relations between markup rate and profit rate. It is the topic of the next subsection.

5.3 The profit rate and its relations to growth rate

Many people including Kaleckian economists mistakenly identify the markup rate and the profit rate. This understanding is a serious error. Even if the price is set employing the markup rate m with suitable unit cost, e.g., the normal unit direct cost, m does not give the profit rate. The profit Π for an accounting period is given by (5-11).[19] The profit rate r is a ratio between Π and a denominator, which is often ambiguous. The latter may be the circulating capital value, in other words, the total sum of wages and material costs for each production period. In this case, the profit π should also be taken for a production period. In the second possibility, it may be the total amount of fixed capital. In the first case, fixed capital is neglected. In the second possibility, a question arises if it is appropriate to take the face value of all machines and installations or we should take annual "contribution" of the fixed capital like depreciations. Many growth models neglect all these complications assuming off fixed capital goods, or assuming that all are circulating capitals.

Putting this complicated question aside, let us make a calculation for a simple case. Suppose a small manufacturer that produces a product using single specialized machine. The machine costs 1 million dollars. It must be replaced in five years, because of renovation of product and machines (moral depreciation). For simplicity, we assume no fixed costs are required otherwise. For these five years, it is expected that the products sell 100, 000 units (i.e., 0.1 million units). If the firm works 50 weeks a year, this is equivalent of 400 units of sales per week. The machine has the production capability of 500 units of production per week. So, the expected normal or standard rate of capacity utilization is 80%. The normal overhead unit cost is 1 million dollars / 0.1 million = 10 dollars per unit. Assume that the direct unit cost is 80 dollars. The normal unit cost is 90 dollars (10 + 80 = 90). Suppose the markup rate m is 0.1 or 10 %, which is rather a low rate as the markup rate. The selling price is 99 dollars per unit.

Let us assume, for example, the products are sold each year at the capacity utilization rate:

1st year 2nd year 3rd year 4th year 5th year

[19] This presupposes a good attribution of the fixed cost for the period. If the realized output is smaller than the expected normal output, the fixed cost for the period is not fully covered.

70%. 75% 80% 90%. 95%

This amounts in average 80% of the capacity and the total sales for five years is 100, 000 units as expected. Total sales value for the five years is 9.9 million dollars, among which 1 million dollars goes to depreciation of the machine, 8 million dollars is spent for wages, parts and materials, fuels, and others. The profit for the five years is 900 thousand dollars (0.9 million dollars). The capital profit for five years compared to the newly bought machine value is 90%.

We can calculate the profit rate for an accounting year, too. The average profit for a year is 180,00 dollars. If we compare it with the total fixed capital, the profit rate is 18%. If we compare it with the depreciation amount for a year, i.e., 0.2 million dollars, the profit rate is again 90%. How about the profit rate against the circulating capital? This depends much on how to account the circulating capital. If the circulation capital is defined as the total sum that passed production cite away, it is calculated as follows:

(Direct unit cost)・(Produced Units per week)・(Number of weeks in a year)

= 80・50・400 = 160,000 dollars.

The profit rate would be calculated as 88.9%. Of course, this has no good meaning. The circulating capital has turned over 12 (turnover for each four weeks) to 50 times (turnover for each week). In the assumption that circulating capital turns over each week, the necessary circulating capital is equal to

(Direct unit cost)・(Produced units per week)

= 80・400 = 32, 000 dollars.

The profit rate over circulating capital in this assumption is

(Markup rate)・(Normal unit cost)・(Produced units per week)

$= 0.1 \cdot 90 \cdot 400 = 3{,}600$ dollars.

In this calculation, the profit rate is 11.25%, which is not very different from the mark up rate.

The main reason for these differences is not difficult to know. The total profit $\Pi(x)$ for the production x at the unit price set by formula (5.11) is

$$p \cdot x - \{c + (C/q_n)\} \cdot x = m \cdot c \cdot x + (C/q_n) \cdot x$$

Then, when the expected normal sales q_n is realized, the total profit after the capital depreciation is:

$$\pi(q_n) = m \cdot c \cdot q_n + m\,(C/q_n) \cdot q_n = m \cdot c \cdot q_n + m \cdot C.$$

Then, if the indirect cost rate, i.e., the ratio of indirect cost over direct cost, is $C/(c \cdot q_n) = (C/q_n)/c$. In the above case, the ratio is $1/8 = 0.0125$. The total profit $\pi(q_n)$ is then calculated as $(1+1/R_{id}) \cdot m$. In our case, the profit rate over fixed capital value $\pi(q_n)/C$ is

$$(m \cdot c \cdot q_n + m \cdot C)/C = m\{1/\{(c \cdot q_n)/C\} + 1) = 0.1 \cdot (8+1) = 0.9.$$

The profit rate over a circulation capital is $\pi(400)$ over the circulating capital is

$$\{(m \cdot c + m \cdot C/q_n) \cdot 400\} / \{c \cdot 400\} = m \cdot \{1 + (10/80)\} = 0.1125.$$

The above example shows clearly how the profit rate r and the markup rate m are related according as what we take as denominator. Therefore, the profit rate for

different conception moves from $m \cdot (1+R_{id})$ to $m \cdot (1+1/R_{id})$.

We now know that the relation between the markup rate and the profit (for a product or for an industry) is quite weak. A similar relation is also possible between the growth rate g and the profit rate r, because the growth rate is principally determined by the growth rate of the demand. Here we assume that circulation fund is always financed from banks and its cost is negligible in comparison to fixed capital value. We also assume that expected capital utilization rate is

Three situations are possible:

(1) $r > g$,

(2) $r = g$,

(3) $r < g$.

In the first case, if this situation continues, the firm will possess superfluous money and it can accumulate retained profit (even after paying dividend). The second case is rather rare in contrast to the standard assumption often made in growth theory. In the last case, if this situation continues for long, the firm lacks money necessary to support its growth. In the Japanese experience, Japan experienced a rapid growth period for 1959-1980 and firms were in general short of funds. From 1990's, after monetary bubble exploded in 1992, Japan experienced very slow growth (often expressed as Japan's lost 30 years) and the firms were in general excess of funds. This strongly indicates that industrial growth is regulated by the principle of effective demand. See Shiozawa (2021).

The last lesson we should learn is that capacity investment is rather the function of the capacity utilization instead of the profit rate as it is widely believed or claimed.

Section 6. Monetary theory of production

I can be brief for this section. Paul Davison emphasized the importance of money. As Robert W. Clower assured that "Money buys goods and goods buy money, but goods do not buy goods" (Clower 1967, 207–8). A much better formula was given before him by the first sentence of Don Patinkin (1965[1956]): "Money buys goods, but goods do not buy money." It should be noted that the property of money is

assured only when we have three pillars (1), (2), and (3) in Section 2. When one wants any commodities, there are always producers (or their substitutes, providers) who provide their products as much as their clients want. If there is no such structure in the economy, holding money does not serve a near-perfect store of values. It is this structure that assures the function of money and not vice versa. In this sense, the microeconomics of SMT contains an essential part of monetary theory of production. We did not argue problems of finance economy in SMT, but we have assumed the existence and the essential role of money from the very start (See Postulate 1 in SMT, Chapter 2).

SMT did not develop explicitly how money works and how it is created or destroyed, because we have already circulationist theory such as Graziani (2003), which provided how money works and how it is created and destroyed. The theory of production in SMT and circulationist theory of money are complementary with each other (See note 3 in Chapter 2, SMT). Although Graziani (2003) is a good book on money, it lacks a theory of production despite its title. Only the theory that synthesizes the production theory of SMT and the circulationist account of money can have a right to call itself a monetary theory of production in a real sense. The compatibility and even familiarity of both theories is assured by the fact that both are process or sequence analysis instead of equilibrium one.

As for now famous Modern Money Theory (MMT), I believe it also lacks a proper theory of production. A logical consequence of this situation is that MMT lacks a theory of inflation (see the next section), although the latter would be an indispensable part for MMT to be a full theory of monetary and financial policies.

Section 7. Some consequences on inflation

Although SMT lacks a theory of finance economy and it seems difficult to make a rapid unified theory that comprises both real and finance economies, the theory in SMT can provide some negative results on inflation.

As long as Postulates in Chapter 2 are satisfied and production process described in Chapter 4 of SMT works well, the prices remain as they were before. The possibility that these conditions are violated is limited as cases. We can make a list of conditions that assures no inflation takes place unless one of the following conditions is violated:

(1) Wage rates remain constant.
(2) Markup rates remain constant or decreases.
(3) The set of production techniques does not shrink.
(4) No depletion of primary materials occurs.
(5) No shortage of inputs occurs.
(6) The prices of imported goods remain constant.

If these six conditions are satisfied, there will be no inflation. It is notable that these (perhaps except (6)) are all conditions on the real economy. So far, it is often believed that inflation is a monetary phenomenon. Many economists thought that inflation takes place because too much money was created. Classical quantity theory of money is a typical example. However, an increase of the total quantity of money does not induce inflation, unless an excessive quantity of money of a nation invites either an excess demand for consumption, an excessive growth rate, a strong depreciation of national currency with respect to foreign currencies, and wage hikes without comparable productivity growth rendered possible by the easy money policies. Good evidence is given by the ten-years' experience of Bank of Japan's monetary easing policy of "different dimension" under President Kuroda (2013-2023 in office). The policy could not move price level by one percent until the price level jumped up when the hike of imported materials (mainly petrol and natura gas) and the depreciation of Yen. Do not forget that no inflation does not imply there would be no boom in financial and asset markets. Easy money may induce land and housing price to hike, as Japan experienced in 1980's. It is possible that it induces general hike of living costs and increased the pressure for wage hike.

These negative results give some hints on economic policies also in a negative way. They show that monetary policies such as interest rate control or quantity of money control policies have very limited channels through which such policies can produce expected results.

Section 8. Micro-macro loop

Neoclassical economics or economics based on general equilibrium theory stand on the presumption that economic phenomena are the results of interactions of individual agents (including those of firms and governments). We accept this

presumption, although we have a very different idea on how individual agents' behavior is organized.

A best illustration would be given by Josef A. Schumpeter. In Chapter 2 of Schumpeter (1912 and 1926), he starts his story by a closed circular economy that repeats itself. It is the same state of an economy that Sraffa (1960) called self-replacing effect, which he borrowed from François Quesnay's picture of the economy as circular process (See Sraffa 1969, p.93). Schumpeter tells a fictious story of a farmer who was asked a question: how does he know that this consumer wants bread and just so much? Schumpeter makes his farmer answer like this:

> The farmer could easily answer the question put to him; long experience, in part inherited, has taught him how much to produce for his greatest advantage; experience has taught him to know the extent and intensity of the demand to be reckoned with. To this quantity he adheres, as well as he can, and only gradually alters it under the pressure of circumstances. (Schumpeter 1926, translated in 1934 by Redvers Opie, pp. 5-6.)

Schumpeter explains in detail that, if everyone repeats the behavior as he or she did in the previous period, the whole system works well. This picture (of the circular flow to repeat itself) may be refined in order to permit changes in the economy, "by means of a well known device." Schumpeter continues:

> "We assume all this experience to be nonexistent, and reconstruct it *ab ovo*, as if the same people, still having the same culture, tastes, technical knowledge, and the same initial stocks of consumers' and producers' goods, but unaided by experience, had to find their way towards the goal of the greatest possible economics welfare by conscious and rational effort." (ibid., p.10, emphasis in the translation).

As Schumpeter notes on the footnote to *abo ovo*, this is Walras's method. He is also very predictive, because he enumerates all conditions that are required for the existence of Arrow-Debreu competitive equilibrium. The only exception is the share that a consumer receives from the profit of each firm. Despite this clairvoyance, he made a grave error in thinking that *ab ovo* construction works for the economy as large as a national economy. There lies an unsurmountable gap between behaving

based on experiences and the reconstruction *ab ovo*. I cannot understand why Schumpeter could have so easily slipped from circular flow into new logic of reconstruction *ab obo*. For human beings whose capabilities are limited in sight, rationality, and execution (SMT §1.3), such a reconstruction is simply impossible. Moreover, Schumpeter gave no reasons why such a shift in logic of explanation is justifiable. An only possible explanation is that Schumpeter believed the validity of Walras's theory of general equilibrium.

We must ask why wise Schumpeter was so deeply influenced by Walras. A probable explanation is that it was the unique analytical system that had sufficient details of the working of the economy. We should reflect this point seriously. If a lacuna exists in an economic theory, someone tries to fill it. If once it is filled with a theory, it is difficult to go back to the situation before the theory, even though it is apparently false. Macroeconomics without microfoundations risks to fall in this trap. Macroeconomics must coexist even with microeconomics that is logically incompatible with it. Post Keynesian economics without microfoundations may have the same destiny. An old dictum says: It takes a theory to beat a theory. Unless neoclassical microeconomics is not replaced by a new microeconomics, people continue to think in the wrong theory framework. In this sense also, Post Keynesian economics needs its microfoundations.

Ab ovo reconstruction can be a touchstone to differentiate neoclassical and economics that stand on the classical tradition. Any variant of general equilibrium theory takes a form of *ab ovo* construction. Microfoundations in SMT reject the *ab ovo* construction and admit past knowledge as an essential part of the working of the economy. The present is always an inheritance of the past. What is new in the economy is a modification of the past. This is also the reason why our economic theory must be evolutionary.

If we abandon *abo ovo* assumption, it is easy to know that most of our economic behavior draw on the past experiences. Discretionary decision making occupies a very small part of our decision making, while most of our decisions are made based on customs and conventions. Henry Mintzberg (1973) reported that a manger of a factory made 237 to 1,073 decisions a day. Even in a discretionary decision making, it cannot be free of past experiences. As Katona (1951) pointed out, in the decision-making, there is a whole range of decisions from genuine decision to habitual

behavior.

Take the example of price setting of a new product. Although we have no real experience on which to draw, the experience of a similar product may give us precious information. Ideally it is preferable to estimate the share function and decide a suitable price, but we lack sufficient information and are obliged to rely on the hunch. The same is true for the estimation of expected sales volume for the coming period. Even if it is crucially important for the management, it is almost impossible to make an accurate estimation. Any management is the repetitions of such decision making. This explains why many of decision-making is an adoption of a policy, which must be fixed somewhere even if nobody knows it is the best. To fix a product price even if it is not the best has its meaning. Without price setting no business starts.

Economic behavior depends much upon experiences of the past. There are all kinds of causation from the past to present actions. Some of such causation takes the form of structural causation. In the past, money worked as the most convenient medium of exchange. So, the people rely on money in all transactions. The prices are set in money terms. Firms are always willing to receive money in exchange of their products. As people know that it is easy to buy any commodity in exchange of money, they hold money. As we have already explained, this presumes a specific selling attitude of firms and a system that works almost always as Taniguchi-Morioka confirmed. If we consider these situations, it is evident that methodological individualism is wrong. Similarly, we can argue that methodological holism is also wrong. We should study the economy as a *micro-macro loop* interaction. Micro behavior generates a series of economic events. On the opposite way, whole working of the system conditions our behavior. Our behavior is a result of evolutionary selection. We may create or invent a new behavioral pattern. When it works well in an economy, not only it is adopted as a custom, but also it may spread beyond the narrow neighborhood. In the economy, there are various entities which are best analyzed as entities that evolve. Products or commodity, production techniques, economic behavior (including habits and customs), institutions. Shiozawa (2004) raised four typical entities, but evolving entities are not limited to the four. Internet is a technology with which many new products and services flew out. There rest a vast field to be explored from an evolutionary perspective.

Section 9. Conclusion

I have explained how SMT provides microfoundations both for evolutionary economics (§3) and Post Keynesian economics (§4). In the longest Section 5, I have given a theory of markup rates including some new analyses not explored to date.

As I have mentioned in Section 2, arguments in the *Microfoundations* take a logical structure similar to circular logic. For example, three pillars are mutually dependent that the other pillars are valid. This circular reasoning is inevitable by the fact that the economy is always a self-organizing system. There is no absolute start of arguments. Any part of the system assumes other parts of the system to be working well. *Ab ovo* construction as in general equilibrium is impossible.

Out of Section 2, we find various circular reasoning. In Section 6, when I hinted that the Microfoundations can be seen as a theory of monetary production, I argued that in the modern industrial economy money works because we have Taniguchi-Morioka results. On the other side, Postulates 1 to 3, and 5 to 7 in Chapter 2 in SMT are formulated on the assumption that money exists in the economy. Whole arguments in Section 6 on markup rates draws on the price setting custom (Postulate 3, Ch. 2, SMT). The minimal price theorem in Chapter 2 in SMT is valid only in the situation where the price setting custom is widely established. The principle of effective demand formulated in Shiozawa (2021) and output adjustment in Section 5 are meaningful when minimal price theorem holds.

The logical structure that is widely recognized in the *Microfoundations* reflects that fact that the economy is self-organizing system. *Ab ovo* (re-)construction that is implicitly assumed in any general equilibrium ignores that the economy is self-organizing and self-organized system and fantasizes that the working economy can be constructed from various endowments and preferences from scratch. The microfoundations in SMT are exempt of such a fantastic illusion.

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