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Interpretation of Chapter 17 of *The General Theory* and reconciliation between the endogenous money supply and the liquidity preference theory

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ABSTRACT

The arguments that totally denied Chapter 17 of Keynes' *General Theory* (GT) and the arguments that found the core of Keynesian revolution in Chapter 17 are shown to have a common interpretation that the chapter describes the arbitrage equilibrating process through asset price adjustments, where demand and supply prices are identified with spot and future prices, with the definition of own-rate of interest as the money-rate of interest minus contango. It is shown that such an interpretation inevitably renders Keynes' reasoning self-contradictory, and that if one intends to establish reconciliation between endogenous money supply and the liquidity preference theory, Chapter 17 should be interpreted as what Keynes presented, which means the chapter is in conformity with the previous chapters and with Keynes' articles written after the GT.

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Introduction

In Chapter 17 of *The Gene.ral Theory* (GT), Keynes enquired wherein the peculiarity of money lay and presented the idea that the existence of money and preference for it, or liquidity preference, was the ultimate cause of unemployment. In his argument, the own-rates of interest of capital assets as well as of money were given crucial role. The mysteriousness of the concept and Keynes' way of reasoning have produced diverse interpretations of the chapter. On the one hand, some scholars criticized this chapter as confusing, self-contradictory, and redundant (Barens and Caspari 1997; Ranchetti 2001; Kurz 2010; Deleplace 2004, 2004). The manuscript fragments left by Sraffa (Sraffa Papers (SP), I100) on this chapter were enormously critical to Keynes' reasoning on the own-rate of interest as well as the concept of liquidity preference, which attracted authors such as Ranchetti (2001), Kurz (2010), and Deleplace (2004, 2004). On the other hand, some scholars

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regarded the chapter as crucial for making Keynes' theory novel to orthodox theories (Minsky 1975; Kregel 1988). Based on the understanding of Minsky and Kregel, Wray (1990, 1992, 2006, 2010) developed an interpretation that this chapter is opposed to the previous chapters on interest rates, on the basis of which he attempted to establish a reconciliation between endogenous money supply and theory of liquidity preference.

In this paper, I will show that the arguments that totally denied Chapter 17 and the arguments that found the core of the Keynesian revolution in Chapter 17 have a common interpretation, where the chapter describes the arbitrage equilibrating process through asset price adjustments. I will show that such an interpretation inevitably renders Keynes' reasoning self-contradictory, and that if one intends to establish reconciliation between endogenous money supply and liquidity preference theory, Chapter 17 should be interpreted as what Keynes presented, which means the chapter is in conformity with the previous chapters and with Keynes' articles written after the GT. I will mainly deal with Sraffa's and Wray's arguments as showing the clearest contrast.

First, Wray's proposal for reconciliation between endogenous money supply and liquidity preference theory, with his interpretation of Chapter 17, is described. Second, Sraffa's critique of Keynes' treatment of own-rates of interest and the liquidity preference theory is examined.[1] Based on the difference between Sraffa's and Keynes' notions of equilibrium, I present an interpretation of Chapter 17 of GT that withstands the critique and on which the reconciliation of the endogenous money supply and the liquidity preference theory will be reconstructed.

Wray's interpretation of Chapter 17 and attempt at reconciliation

In order to reconcile the liquidity preference theory with the endogenous money supply, Wray first distinguished money demand from liquidity preference (Wray 1990, 17; 2006, 189). Second he presented an interpretation of Chapter 17 of GT as a liquidity preference theory of nominal asset prices (Wray 1990, 157), which was in contrast to the supply and demand approach of money presented in Chapters 13 and 15 of GT (Wray 2010, 222–223; 2006, 188).

He defines liquidity preference as follows:

> An increase in liquidity preference means a desire to shift portfolios into more liquid positions. This may involve a desire to liquidate assets (exchange less liquid assets for the means of payment), or to retire debts (which may involve the use of means of payment to settle debts). As a last resort, one might borrow to meet payment commitments. (Wray 1990, 18)

Money demand is, in contrast, defined as "a willingness to issue debt, or a willingness to expand one's balance sheet in order to spend on goods,

services or assets" (Wray 1990, 20). This distinction is associated with the differentiation between stock and flow.

> The money demand is linked primarily to expenditure flows. Money demand thus defined does not directly impact interest rates. However, an increase in money demand which is met by expansion of bank balance sheets as banks provide credit will affect stocks. In this way, money demand may indirectly affect interest rates. (Wray 1990, 163)

Liquidity preference is, in contrast, said to be "related to stocks and directly influences interest rates" (Wray 1990, 164). Based on this distinction, Wray found a path to reconciliation in Chapter 17 of the GT.

> Keynes's theory is a liquidity preference theory of nominal asset prices: a decrease in liquidity preference increases the relative money prices of assets, generating profit opportunities, inducing investment, and raising income through the multiplier. The decrease in liquidity preference changes the relation of spot and future prices for all assets in such a way that production and the multiplier will cause changes in income and saving until the relations between spot and future prices are brought back into line with the new interest rate. (Wray 1990, 157)

This argument originates from Kregel's (1988) paper. Kregel argued by quoting Keynes:

> The relation of the spot to forward price of all durable goods are thus seen to be determined by the rate of interest; 'The function of the rate of interest is to modify the money prices of other capital assets in such a way as to equalise the attraction of holding them and holding cash' (*CW*, XIV: p.213). Keynes's 'novelty' could thus be expressed as a theory of money relative prices determined by the rate of interest. (Kregel 1988, 241)

Wray (2006, 2010) emphasized the distinction in the approaches of Chapter 17 and those of Chapters 13 and 15; in Chapters 13 and 15, the supply and demand equilibrium model for money is adopted, whereas in Chapter 17 "Keynes drops money supply and demand in favor of liquidity preference approach to asset prices" (Wray 2010, 222). "Interdependence of money supply and money demand functions does not pose a problem for the Chapter 17 approach—where equilibrium is defined not as money demand equals money supply, but as equality among own rates of interest" (Wray 2010, 224). The following remark that "this is important because few economists today believe that the money supply can be exogenous" (Wray 2010, 224) suggests that the supply and demand equilibrium model is not compatible with the endogenous money supply, which implies that supply may be dependent on demand, but that the liquidity preference approach or the approach of equality among own rates of interest in Chapter 17 is free from such incompatibility. After mentioning that money demand for spending as a flow usually generates money supply and does not necessarily raise interest rates, Wray remarks "Money supply will not

normally rise to meet rising liquidity preference; instead, asset prices adjust across the full spectrum of assets until wealth holders are satisfied to hold the existing set of assets. Hence, endogenous money is reconciled with liquidity preference, with money demand here defined not as a desire for a hoard of money in advance of spending but as a flow demand for finance of spending" (Wray 2010, 228).

Wray's reconciliation is based on distinguishing money demand from liquidity preference. Money demand is a flow and is normally met by money supply without influencing interest rates. Interest rates are related to liquidity preference, which is linked to stocks. An increase in liquidity preference is normally not met by an increase in money supply and causes a rise in interest rates, which gives rise to a change in all asset prices. The liquidity preference theory is free from the demand and supply equilibrium of money; it is thus compatible with the endogenous money supply.

However, the distinction between liquidity preference and money demand is, in fact, somewhat confusing, as shown below. The characterization of Chapter 17 as a liquidity preference theory of asset prices reminds us of the criticism of Chapter 17 by Sraffa and his followers (Sraffa Papers I100; Ranchetti 2001; Kurz 2010; Deleplace 2014), because Wray's interpretation of Chapter 17 is similar to Sraffa's, and Sraffa and his followers denied Keynes' discussion in Chapter 17 and the liquidity preference theory itself. Can we establish reconciliation based on such an interpretation of Chapter 17?

In the next section, I examine Sraffa's criticism of Chapter 17. After overcoming the criticism, I reconstruct reconciliation.

Sraffa's criticism of Chapter 17 of GT

Sraffa left manuscript fragments on Chapter 17 of GT, which are contained in the Sraffa Papers (SP), and annotations in his copy of GT. All of them are quite critical about Keynes' argument in the chapter (Ranchetti 2001, Kurz 2010).

Keynes, at the beginning of Chapter 17, introduced the own-rate of interest. According to his illustration, it seems to be defined as

$$1-\frac{p_f}{p_s}+r, \tag{1}$$

where p_f, p_s are the forward and spot prices, respectively, and r is the money-rate of interest.[2] Keynes mentioned that this relationship was first pointed out by Sraffa (GT, 223, Sraffa 1932a, 50). In a later section, Keynes introduced another definition of the own-rate. It is the definition by three attributes of various assets, that is, to produce a yield or output q, to

involve a carrying cost c, and to have the power of disposal or liquidity premium l, all measured in terms of themselves; $q-c+l$ represents the own-rate of interest of any commodity. He let houses represent an asset with which q is prominent, and referred to q_1 as "the house-rate of interest," and similarly, $-c_2$ as "the wheat-rate of interest," and l_3 as "the money-rate of interest." Next he introduced the expected percentage appreciation of an asset taking money as a standard of measurement (although it does not need to be money and any other commodity can be used as a standard) a, and called the sum a_1+q_1 as "the house-rate of money-interest" and a_2-c_2 as "the wheat-rate of money-interest" (GT, 227). In equilibrium, all the commodity-rates of money-interest are equal to one another and also to the money-rate of money-interest, that is, $a_1+q_1=a_2-c_2=l_3$. Keynes' main conclusion of the chapter is that investment in an asset is carried out as long as its own-rate of money-interest is greater than the greatest one of the other assets, and that the money-rate of interest is more reluctant to fall than those of other assets; in this sense, the money-rate of interest "rules the roost."

According to Sraffa's manuscript and annotations, he believed that Keynes' first definition of the own-rate of interest is the only valid one, that what is represented by the second one, $q-c+l$, was an "advantage," which has no relation to the own-rate of interest, and that it should be called "marginal efficiency" or "marginal productivity" (SP I100, 6, 8–11). On this basis, Sraffa pointed out what Ranchetti referred to as a "self-contradiction" in Keynes' main conclusion (Ranchetti 2001, 323):

> If there is one article the marginal efficiency of which never falls below say 5% (this being the valuation of the pleasure people derived from hoarding any quantity of it) the production of all other durable assets will stop when their stocks are such that marginal efficiency has come down to that level—for otherwise they could not be sold at cost—and all resources saved will be used for producing the hoardable asset. If this asset cannot be produced (paper money), its demand will increase and can only be met by a continuous rise in its value, i.e. fall in general prices. If this hoarding is expected to go on steadily, and all prices are expected to fall in terms of money, the result will be that all own rates of interest of commodities will be higher than the money rate (this is Fisher's case: and the expected appreciation or depreciation is the only possible cause of divergence in rates of interest).
>
> Thus in the Keynes case, the result on rates of interest is opposite to Keynes' conclusion. (Ranchetti 2001, 323–324; SP I100, 11)

Remarks of the same kind of "self-contradiction" are found at several places in Sraffa's manuscript (SP I 100, 7, 8(back)) as well as in his annotations written in the margins of pages 228–229 and 231 of his copy of GT.

Sraffa thus rejected Keynes' main conclusion, "the highest rate rules the roost." In addition, he totally rejected liquidity preference itself. He stated as follows: liquidity preference is a utility from holding money, and a

downward sloping liquidity preference curve reflects a diminishing marginal utility of holding money, but interest rates are related not only to liquidity, but also to stability of capital values, which is related to solvency, as well as to stability of money asset values (SP I100, 1–2), and, therefore, there is no such curve because "liquidity (in the various senses used by Keynes) is an advantage to some people and a positive disadvantage to others" (SP I100, 1). He insisted that if "the fact remains that more cash goes with lower rate of interest" (SP I100, 4), causation is the other way round (SP I100, 3); "when you want to issue more cash you must reduce rate of interest in order to find the borrowers (SP I100, 4). Relating borrowers' diminishing willingness to borrow to "marginal productivity of capital" (SP I100, 5), he attributed the downward sloping curve between amount of money and interest rate to diminishing marginal productivity of capital. Sraffa expressed his idea of rejecting liquidity preference alternatively by saying "in fact people borrow money for parting from it, and buying things; the thing they borrow is, not what they want to use, but the standard in which they fix their debt; thus they might borrow fresh fish for 100 years, although it has neither liquidity preference nor use at so much per annum, and it would have almost infinite carrying costs" (SP I100, 11).

Sraffa's rejection of liquidity preference seems to come from his understanding of money as a thing borrowed to eventually part from and to spend on goods. This understanding is in harmony with Wray's definition of money demand as "willingness to expand one's balance sheet in order to spend on goods, services or assets" (Wray 1990, 18), which is normally met by an accommodating supply from banks. The facts that Sraffa rejected liquidity preference based on his understanding of money that is in harmony with Wray's definition of money demand, that Sraffa expressed his rejection of liquidity preference by referring to Chapter 17, and that he entangled Keynes' argument into contradiction on the basis of the spot and future price adjustment comprehension of Chapter 17 cast doubt on the successfulness of Wray's program.

Sraffa's equilibrium

Sraffa's reasoning was as follows: when the marginal efficiency of money is the most reluctant to decline, and its production cannot be increased, the value of money continues to rise, that is, the prices of the other assets fall, which means that the money-rate of interest is lower than any other own-rates, because the own-rate of an asset is defined as $1-p_f/p_s+r$ and it is greater than r when $p_f < p_s$. This assertion is, however, apparently beside the point of Keynes' argument; for Keynes was concerned of whether own-rates of interest measured in terms of money, that is own-rates of-money

interest, is lower than the money-rate of money-interest or not, whereas $1-p_f/p_s+r$ is the own-rate of interest measured in terms of itself. Why did Sraffa present a comparison of own-rates of own-interest?

Sraffa called Keynes' notion of own-rate of money-interest as a "hybrid," "which is never used again, and indeed has no other use than to patch up the confusion created" (SP I100, 9). He wrote:

> Pages 227-8 Keynes supposes that the expectation of change in price must be added to the alone advantages in order to obtain the rate of interest of each article: and since he says that in [arbitrage-] equilibrium the rates of all articles must be equal, it follows that at any moment the expectation of fall in price must be "complementary" (directly related to) the advantages to be obtained by possession! (SP I100, 10)

Sraffa made a note about Section I of Chapter 17:

> Sect I, Commodity rates. OK as far as it goes, but irrelevant
>
> subsequent use to confuse issue
>
> Note that they are important only in the short period (short loans) till production is adjusted to demand. (SP I100, 6)

He also says:

> If one asset has higher efficiency equilibrium is restored either (or both) by
>
> and as a result ② increasing production or ① rise in value.[3]
>
> For money, both assumed impossible. (SP I100, 6)

and

> Different rates can only be for short loans. As from a year hence probably all equal. But to produce an asset takes time; and to it only the "year hence" rates are relevant. (SP I100, 8(back))

These quotations reveal that Sraffa distinguishded two processes of restoring equilibrium. He referred to the adjustment process which equalizes interest rates in terms of a common standard as "arbitrage" and regarded it as a short-term process. He regarded the increase in production as a longer-term adjustment process.

This two-process comprehension of equilibrium had appeared in Sraffa's article "Dr. Hayek on Money and Capital." He argued that when the demand exceeds the supply of a commodity, the price of the commodity will rise temporarily while the supply cannot increase, but the market expects its future price will go back to the original level reflecting the cost of production, and accordingly the forward price will be lower than the spot price (Sraffa 1932a, 50). This "arbitrage" brings about a discrepancy between the commodity-rate of interest and the money-rate of interest, but it is a phenomenon in transition; in a longer period when production can increase, an equilibrium will be restored, where the forward and the spot

prices are equal to each other and also the commodity-rate and the money-rate of interest are equal to each other. It should be noted that Sraffa thought that the forward price reflects the present cost of production.

Sraffa commented "clear but wrong" to Keynes' description on page 223, and "formally correct but meaningless" to the description on page 236 (SP I100, 8). Both descriptions concerned the proposition "highest rate rules the roost." On page 223 Keynes referred to the proposition just after mentioning that there were own-rates of interest that were represented by $1-p_f/p_s+r$, which can be different only by the differences between the spot and forward prices. Sraffa regarded Keynes' argument on page 223 as wrong, because there is no reason that "the marginal efficiency of a capital-asset must attain" the greatest own-rate, "if it is to be newly produced," and there is no reason "why it is the money-rate of interest which is often the greatest" (GT, 223), that is, why the future prices of all commodities other than money are greater than their spot prices. If production of the commodities is stopped in this event, it is opposite, Sraffa said, to what Keynes asserted on page 231, where it was stated that rise in a-term stimulates production.

On page 236, Keynes wrote:

> No further increase in the rate of investment is possible when the greatest amongst the own-rates of own-interest of all available assets is equal to the greatest amongst the marginal efficiencies of all assets, measured in terms of the assets whose own-rate of own-interest is greatest. (GT, 236)

This expresses Keynes' conclusion precisely. Sraffa regarded this description as meaningless, because in the arbitrage-equilibrium all the own-rates in terms of any common standard are equalized by price adjustment, that is, the term p_f/p_s-1 changes complementarily to any change in q – c; therefore, even when q – c decreases, p_f/p_s-1 must change to cancel it out, and thus the equation $q-c+p_f/p_s-1=r$ must be maintained irrespective of the level of investment. According to this view, investment cannot be determined by the equalization of $q-c+a$ and r; rather, investment increases when $p_f/p_s-1<0$, which is equivalent to $a<0$, in the production adjustment process until $q-c=r$ is restored. This must have been what Sraffa recognized.

Keynes' equilibrium

Keynes' notion of equilibrium is different from either of Sraffa's notions of equilibrium. In Keynes' framework, changes in the magnitudes of investment and production bring the economy to a state of equilibrium. In this sense, it is a production-equilibrium, not an arbitrage-equilibrium. It is, however, also different from Sraffa's production-equilibrium; in Keynes' production adjustment, through the change in the rate of investment (and

thus of the magnitude of production), own-rates of interest for various assets *in terms of money* (not *in terms of the assets themselves*) become equalized with the money-rate of interest as well as with one another, while the rates of the price change for various assets, which are independent of the process of production adjustment, do not necessarily become zero, and thus commodity-rates of interest measured by themselves are not equal to the money rate of interest measured by money itself. In contrast, in Sraffa's long-term equilibrium, through production adjustment, the present price becomes equal to the forward or future price; thus, all the commodity-rates of interest measured by themselves are equal to the money-rate of interest.

However, if the formula (1) is taken as a definition of the own-rate of interest, and the second definition $q - c$ is also accepted, then $1-p_f/p_s + r \equiv q-c$, which means $a + q-c \equiv r$. This is an identity, not an equation that represents equilibrium. In this event, Keynes' notion of equality among "own-rates of money-interest" becomes meaningless, as Sraffa says. In order to rescue Keynes' reasoning, we must cease to treat $1-p_f/p_s + r$ as a definition of own-rate of interest and must regard $q - c$ as the only definition of own-rate of interest in terms of itself. We can understand the description at the beginning of Chapter 17 as only an illustration to show that we can conceive interest rates for commodities other than money and to bring us to a plane where we can compare commodities and money on the same ground.

Keynes wrote in his letter to Hicks: "The accurate definition of rate of interest is on page 226. The illustration on page 223 requires a qualification which I have omitted." (Keynes 1973, 76). The qualification was that the illustration on page 223, i.e. the formula (1), can be applied to commodities "of which there are stocks in existence in excess of current consumption" (Keynes 1973, 76). Keynes mentioned the qualification in response to Hicks' indication that an increase in the demand to hold money relative to the demand to hold coffee will lower the contango on money in coffee terms, i.e. lower p_s relative to p_f, which means a reduction in the price of coffee as well as a reduction in coffee-rate of interest, and which can occur "directly, and not merely via the rate of interest" (Keynes 1973, 74). Keynes was reluctant to accept that the fall in the price of coffee took place "directly, and not merely via the rate of interest" (Keynes 1973, 77), but it was impossible to exclude the possibility of a direct effect on the price if one persists in formula (1), as Sraffa discussed. Keynes was not successful in persuading Hicks to admit that the reduction in the price of coffee occurs merely via an increase in the rate of interest, because he did not give up the seeming definition on page 223, and only mentioned a qualification required for the illustration on page 223. Solely by recourse to the "accurate" and "formal" definition (Keynes 1973, 76) on page 226, he could

realize his intention expressed in his statement that "if you will start from the definition on page 226 instead of from that on page 223, which is, as I say, only valid subject to certain qualifications, there is, I think, no difficulty" (Keynes 1973, 77), and could state successfully the effect of rising demand to hold money on prices of assets via the rate of interest, as shown below.

Keynes adopted the seeming definition (1) on page 223 to illustrate that the phenomenon of interest is not peculiar to money, and to put money and other assets on the same ground. Keynes said regarding Ohlin's theory of interest:

> The above [what Ohlin wrote] is altogether remote from my contention that the rate of interest (as we call it for short) is, strictly speaking, a *monetary* phenomenon in the special sense that it is the *own rate* of interest (*General Theory*, p.223) on money itself, i.e. that it equalises the advantages of holding actual cash and a deferred claim on cash. (Keynes 1937c in Keynes 1973, 206)

This statement implies "own rate of interest," instead of "the rate of interest" as a short expression, is necessary to express the peculiarity of money. Sraffa would propose to use "marginal efficiency (or productivity)" not only for commodities but also for money, rather than to use "rate of interest" not only for money but also for commodities. Keynes used "the own-rate of interest" and "the marginal efficiency" interchangeably, and such use does not cause contradiction.[4]

With respect to the relationship between the price and the cost of production as well, Keynes thinks differently from Sraffa:

> Hence, if q_1 and $-c_2$ continue to fall, a point comes at which it is not profitable to produce any of the commodities, unless *the cost of production at some future date is expected to rise above the present cost* by an amount which will cover the cost of carrying a stock produced now to the date of the prospective higher price. (GT, 228; emphasis added)

He also argues:

> it is that asset's rate of interest which declines most slowly as the stock of assets in general increases, which eventually knocks out the profitable production of each of the others, —except in the contingency, just mentioned, of a special relationship between *the present and prospective costs of production*. (GT, 229; emphasis added)

Keynes compares the prospective production cost at some future date with the present production cost. He thinks that the present supply-price reflects the present production cost and the future supply-price reflects the future production cost,[5] and does not have the idea of Sraffa that the future price will reflect the present production cost. Under Keynes' assumption, p_s and p_f, reflecting different production costs, do not have a tendency to converge. Rather, production and investment adjust even in a short period, and $q - c$ changes without removing the discrepancy between p_s and p_f.

Sraffa seemed to misunderstand what "demand-price" and "(normal) supply-price" meant for Keynes. Keynes defined the demand-price of an asset as the present value of the stream of the expected returns to it over its service period discounted by the money-rate of interest (GT, 137), whereas he defined the marginal efficiency of an asset (in terms of money) as the discount rate with which the stream of the expected returns to the asset is equated to the supply-price of the asset (GT, 135); thus the demand-price D is defined as

$$D = \sum_{t=1}^{T} Q_t (1 + r)^{-t} \tag{2}$$

where Q_t is the expected return at time t, and the supply-price S and marginal efficiency in terms of money m is related to each other as

$$S = \sum_{t=1}^{T} Q_t (1 + m)^{-t}. \tag{3}$$

Keynes' statement on page 228 that:

> Now those assets of which the normal supply-price is less than the demand-price will be newly produced; and these will be those assets of which the marginal efficiency would be greater (on the basis of their normal supply-price) than the rate of interest (both being measured in the same standard of value whatever it is). (GT, 228)

should be understood according to Keynes' definition of demand and supply prices. Sraffa did not do that; commenting that "'marginal efficiency' and 'the' rate of interest are obscure," he identified the demand-price with the present (or current) price and the supply-price as the future price, and wrote in his annotation "the rate of interest (def. 222-3) on an article, the current price of which exceeds cost, is very high." "The" rate of interest here should be understood as the money-rate of interest; then it is easy to understand $D > S$ is equivalent to $m > r$ under the above definition of Keynes.[6]

In the third section of Chapter 17, Keynes identified the causes of the reluctance of the money-rate of interest to decline as its low elasticity of production and of substitution, after which he argued:

> The only qualification to this arises when the rise in the value of money leads to uncertainty as to the future maintenance of this rise; in which event, a_1 and a_2 are increased, which is tantamount to an increase in the commodity-rates of money-interest and is, therefore, stimulating to the output of other assets. (GT, 231)[7]

In the margin of this statement Sraffa wrote "exactly the opposite is said on p. 228." This comment also reveals Sraffa's comprehension of

arbitrage-equilibrium and his identification of demand-price with the present price, and supply-price with the future price, but since Keynes' present price has no relation with demand-price and his future price has no relation with present supply-price or present production cost, the proposition stated with $D > S$ on page 228, which is equivalent to $m > r$, is entirely consistent with the statement on page 231.

Sraffa's critique can, therefore, be dismissed, when we consider Keynes' equilibrating process as a process where $q-c+a$ becomes equal to r through the change in $q - c$ without the tendency to equalize the present and future prices, which reflect different production costs.[8]

Keynes' arguments on asset prices

The understanding that Keynes' demand and supply prices are the spot and future prices in the formula (1), respectively, will inevitably take Keynes' argument in Chapter 17 into contradiction. Therefore, if Chapter 17 is interpreted as presenting the proposition that "the decrease in liquidity preference changes the relation of spot and future prices for all assets in such a way that production and the multiplier will cause changes in income and saving until the relation between spot and future prices are brought into line with the new interest rate" (Wray 1990, 157), it must be entangled in Sraffa's logic, and driven into contradiction.

This interpretation of Wray originates from Kregel (1988). As mentioned above, Kregel expressed his idea that the relation of the spot to the forward price of all durable goods is determined by the rate of interest by quoting Keynes' statement in his paper "Alternative theories of interest rate": "The function of the rate of interest is to modify the money prices of other capital assets in such a way as to equalize the attraction of holding them and holding cash" (Keynes 1937c in Keynes 1973, 213). Kregel also stressed that "Keynes's 'novelty' could be expressed as a theory of money relative prices determined by the rate of interest" by quoting Townshend (1937), which stated that the considerations governing the prices of monetary assets must also apply to determine the prices of other durable assets, because the latter have monetary attributes in a varying degree (Kregel 1988, 241; Townshend 1937, 159). Kregel proceeded to identify the factor to bring about the equality between the marginal efficiency and the rate of interest with the level of income, and thus to state that "it is thus the same adjustment process that equates savings and investment which operates to adjust relative prices and thus brings the rate of return of capital investments (the marginal efficiency of capital) and the rate of interest into equality. A change in liquidity is thus capable of changing prices and output independently of any change in the quantity of money held by the public, as the multiplier

process equates saving and investment at the same time as it adjusts present to future prices so as to equate the marginal efficiency of capital to the new rate of interest resulting from the initial change in liquidity preference." (Kregel 1988, 242).[9]

Several of Keynes' statements about the relationship between the changes in the interest rate and the changes in asset prices might have encouraged Kregel's understanding. In addition to the statement of Keynes quoted by Kregel (from Keynes 1937c), which cited above, Keynes made a similar statement in the same paper:

> If the banks stand firm, an increased propensity to hoard raises the rate of interest, and thereby lowers the prices of capital assets other than cash, until people give up the idea of selling them or of refraining from buying them in order to increase their hoards" (Keynes 1937c in Keynes 1973, 214).

Keynes also stated in his paper "The general theory of employment" (1937b):

> He can lend his money at the current rate of money interest or he can purchase some kind of capital asset. Clearly in equilibrium these two alternatives must offer an equal advantage to the marginal investor in each of them. This is brought about by shifts in the money prices of capital assets relative to the prices of money loans. The prices of capital assets move until, having regard to their prospective yields and account being taken of all those elements of doubt and uncertainty, interested and disinterested advice, fashion, convention and what else you will which affect the mind of the investor, they offer an equal apparent advantage to the marginal investor who is wavering between one kind of investment and another.
>
> This, then, is the first repercussion of the rate of interest, as fixed by the quantity of money and the propensity to hoard, namely, on the prices of capital assets ….
>
> Now for stage three. Capital assets are capable, in general, of being newly produced. The scale on which thay are produced depends, of course, on the relation between their costs of production and the prices which they are expected to realise in the market. Thus if the level of the rate of interest taken in conjunction with opinions about their prospective yield raise the price of capital assets, the volume of current investment (meaning by this the value of output of newly produced capital assets) will be increased; while if, on the other hand, these influences reduce the prices of capital assets, the volume of current investment will be diminished. (Keynes 1937b in Keynes 1973, 117–118)

In these statements, "price" should be regarded as meaning "demand price" in Keynes' terminology as defined by (3); when the price of an asset becomes equal to $\sum_{t=1}^{T} Q_t(1+r)^{-t}$, it will "equalize the attraction of holding it and holding cash," and "an increased propensity to hoard raises the rate of interest, and thereby lowers" it. The process of this adjustment in prices might be seen as the same as Sraffa's arbitrage, but in the case of Keynes, nothing is said about the relation between spot and forward prices, and the own-rate of interest for the capital asset is not assumed to diverge

from the money-rate of interest in the process, because Keynes' own-rate in terms of itself is defined as $q - c$, and will not change when its market price becomes equal to the demand price according to the change in the money-rate of interest.

The next stage of equilibrium is the main concern for Keynes; i.e. the volume of investment will be increased when $D > S$, and vice versa. What will happen with the price of the capital asset in this equilibrating process? As the volume of investment in a capital increases, its marginal efficiency declines along with the declines in Q_t's, which means D will be lowered to be equal to S. This is the same process as m, as defined by (3), declines to be equal to r, r reflecting the liquidity premium of money, l_3. The price of the capital asset will return to the value of S; it will never change from the original level ($= S$) even when liquidity preference changes as long as S does not change.[10] The supply-price S changes only as far as the marginal cost of production changes as the volume of production of the capital asset. Keynes assumed increasing marginal costs of production, and thus stated when investment proceeds, the marginal efficiency of capital decreases as a result of the decrease in Q_t's as well as an increase in the supply-price S in the short run, although he thought that the former factor was important in the long run (Keynes 1936, 136). If one persists in the Sraffian tradition and does not share the idea of increasing marginal costs of production, the supply-price will never change as liquidity preference changes; the demand-price will initially change as liquidity preference changes, but will return to the original level equal to the supply-price, during the equilibrating process.

Nothing is said about the future or forward prices of a capital asset in the above discussion. It is free; it can be higher or lower than the current price; the current price must be equal to S in Keynes' equilibrium. When the future price is higher, $a > 0$, and when it is lower, $a < 0$; the former situation will encourage investment, Keynes thought. In formulae (2) and (3), a change in the future prices should be considered to be included in the values of Q_t's, because all the variables in these formulae are measured in terms of money; when the future prices are expected to rise, Q_t's will increase.

Endogenous money supply and liquidity preference

According to this interpretation, Keynes' argument in Chapter 17 is straightforward, has no ambiguity, and is consistent. It is also consistent with the arguments in Chapters 11, 13, and 15. $D > S$ is equivalent to $m > r$, according to the definitions of D and m in (2) and (3). The only valid interpretation of Chapter 17 in line with Keynes' reasoning is that

it restates the theory of determining the volume of investment established in Chapter 11 added by the proposition that the money-rate of interest is the most reluctant to fall. Most concisely, it is stated that investment proceeds until $m = r$ is met, or equivalently $D = S$ is met, with r reflecting l_3, which is the most reluctant to fall. Chapter 17 cannot be characterized as a liquidity preference theory of asset prices; rather, it is characterized as an $m = r$ (or $D = S$) theory of investment with a peculiarity of $r(\equiv l_3)$. Keynes stated in Chapter 11 that the investment theory itself cannot determine the rate of interest, which has to be determined elsewhere (GT, 140). That is why he developed the liquidity preference theory of interest rate in Chapters 13 and 15 (Keynes 1937c in Keynes 1973, 212). Chapter 17 cannot substitute these chapters, but it is an indispensable part to complete the theory of employment by enquiring about the peculiarity of money; it is consistent with Chapters 13 and 15, where it is stated that "the rate of interest depends on the demand and supply of money" (Keynes 1937c in Keynes 1973, 202), and we have to pursue a reconciliation of the endogenous money supply and the liquidity preference theory on that basis.

To do so, we must tackle problems with the definitions of liquidity preference and money demand and the distinction of them. Wray (1990) linked liquidity preference to stock and money demand to flow. Liquidity preference was defined as the preference for shifting the portfolio to be more liquid. Since the most liquid asset is money, we would be able to use the term "money stock" exchangeably with "liquidity stock"; thus there is no reason to distinguish liquidity preference and money demand at the stock level.

Increases and decreases in stock are, in general, realized through flows. The stock of liquidity (or money) in an economy as a whole increases only through flows of borrowing, government spending, or exporting goods, and it decreases only through flows of repaying debts, taxation, or importing goods. Provided that government spending, taxation, and foreign trade do not change, an increase in demand for liquidity (or money) for an economy as a whole will appear when there is an increased demand for borrowing or decreased willingness to repay debts, although the increased liquidity preference of an individual economic agent may be met by an increased desire of other individuals to offer money in exchange for goods or bonds. Sraffa condemned Keynes for assuming that people borrow money or any commodities "for holding them till the end of the loan" (SP I 100, 9).[11] However, an increase in the desire to hoard money in an economy as a whole must bring about a demand for borrowing somewhere in the economy. This is because when a person who has an increased desire to hoard money wants to sell a good, which, let us assume, has been realized, and

wants to hold the money obtained, the buyer of the good, whose portfolio has become more illiquid, whether the good is a durable asset or has been consumed, must try to acquire money to restore the original degree of liquidity to his portfolio if he has an unchanged level of liquidity preference, and this desire brings about the demand for borrowing. When there emerges an increase in desire to hoard money, the same amount of decrease in desire to hoard elsewhere is necessary for the demand for borrowing not to emerge.

Therefore, the liquidity preference for stocks is inevitably linked with the flow demand for borrowing. Borrowing, if realized, necessarily increases the money stock, whether it is for spending on goods or for meeting payment commitment unless it is offset by the same amount of loan repayment. An increase in liquidity preference has pressure to raise interest rates. Similarly, an increase in willingness to borrow money has a pressure to raise interest rates whether the motive to borrow is to spend, to meet payment commitment, to retire debt, or to hoard, unless willingness to lend money increases. An increase in the willingness to repay loans can lower interest rates. These considerations lead us to a simple conclusion that liquidity preference is defined as a desire to make one's assets more liquid, liquidity and money are equivalent, and any other definition for money is not necessary.[12]

There is thus a "schedule of liquidity-preference" (Keynes 1936, 171), which is equivalent to a downward-sloping money demand curve. When there is an increase in demand for borrowing to spend on goods, if there is an offsetting decrease, for example, from a desire to retire debt, the schedule of liquidity preference will be stable, but it will shift if there is not such an offsetting decrease in demand. Similarly, when there is an increase in demand to hoard, if there is an offsetting decrease, for example, from a desire to purchase goods, the schedule of liquidity preference will be stable, but it will shift if there is not such an offsetting decrease in demand.

When the schedule of liquidity preference shifts upward, if banks are rigid and reluctant to increase lending at the same level of interest rates, which is represented by a stable banks' schedule of liquidity preference, the rate of interest will rise. However, if banks accommodate to increase money supply at the same interest rate, which is represented by a shift of banks' schedule of liquidity preference, the rate of interest will be constant.

A typical situation of the endogenous money supply, where demand for borrowing does not raise the interest rate, is represented by the case where an increase in flow money demand is offset by an increase in willingness to repay debt or by an increase in willingness to accept illiquid assets

elsewhere, or the case where the money demand as a stock increases, but the increase in money demand is completely met by an increase in supply by banks without raising the interest rate. I agree with Wray (1992), who argues that:

> When liquidity preference is low and expectations are high, planned spending (partly planned investment) rises. This rise generates a flow demand for finance. When banks share in this optimism, they will meet this demand by issuing more money. (Wray 1992, 1163)

and also:

> when liquidity preference is high and expectations are low, the flow demand for money will fall as planned spending declines. At the same time, the *stock* demand for money rises. However, banks are unlikely to meet the stock demand for money since it is unlikely that their expectations and preference for liquid positions would move in a direction opposite to those of the general public. (Wray 1992, 1163)

The central bank is at the center of the banking system, and has the power to influence the complex of rates of interest, which means to influence the liquidity preference of banks.

It is in this way that the liquidity preference theory is reconcilable with the endogenous money supply.

Conclusion

I identified the fact that Sraffa denied Chapter 17 of the GT in two respects: (1) Keynes misused the concept of own-rates of interest, and (2) Keynes' characterization of money demand as liquidity preference was baseless, because money is demanded to part from for spending. I also identified the fact that Wray pursued the reconciliation of the liquidity preference theory and the endogenous money supply by interpreting Chapter 17 as presenting a liquidity preference theory of asset prices, thus separating liquidity preference from money demand. I clarified that Wray's interpretation of the liquidity preference theory of asset prices is the same as Sraffa's and that such an interpretation inevitably entangles Chapter 17 into self-contradiction as Sraffa pointed out. I presented an interpretation of Chapter 17 that is consistent with the previous chapters as well as the articles of Keynes after the GT, and a way to identify money demand as liquidity preference, even if money is demanded for parting from it. Money, as banks' debt, is supplied in response to borrowing demands; thus the amount of money is determined endogenously, but the rate of interest represents the state of liquidity preference.

Notes

1. Kaldor (1960) and Barens and Caspari (1997) have a common understanding of Chapter 17 as Sraffa, but they were not so consistent as Sraffa, as shown in footnote 8. Ranchetti (2001), Kurz (2010) and Deleplace (2004, 2014) agree with Sraffa.
2. A different expression $p_s/p_f - 1 + rp_s/p_f$ would represent Keynes' illustration more precisely, but the difference between the two notations is the difference in the reference point in time.
3. The order of the numbers "①" and "②" are as Sraffa puts.
4. In his paper "The theory of the rate of interest" (Keynes 1937a), Keynes referred to marginal efficiency as a common attribute to all the asset including money, rather than referring to own-rate of interest.
5. With regard to the effect of prospective cost of production on marginal efficiency, see also page 141 of GT, where Keynes indicated the possibility of a decrease in the marginal efficiency of capital produced today due to a decrease in the prospective cost of production in the future.
6. Lawlor (1996, 68; 2006) and Conard (1959, 145–147) interpreted that Keynes compared the marginal efficiency of a capital asset with its own-rate of interest here. It cannot be what Keynes intended, who identified the marginal efficiency of an asset as the own-rate of interest of the same asset.
7. Keynes stated also on pages 141–142, "The expectation of a fall in the value of money stimulates investment, and hence employment generally, because it raises the schedule of the marginal efficiency of capital, i.e. the investment demand-schedule; and the expectation of a rise in the value of money is depressing, because it lowers the schedule of the marginal efficiency of capital" (GT, 141–142).
8. Several authors have the same interpretation of Keynes' theory of own-rate of interest as Sraffa, although they have not referred to Sraffa's criticism. Kaldor (1960) thought that Keynes' equilibrium consists of two stages, that is, arbitrage and production, and identified the demand-price with present price and supply-price with future price (Kaldor 1960, 62, 69, 70). Based on this identification, he concluded that an asset would be produced only when its present price is not less than the supply price; i.e., an asset would be produced only when $a \leq 0$. However, he accepted Keynes' assertion that the money-rate of interest rules the roost, although he denied Keynes' argument that any asset other than money, such as land or gold, can prevent the production of other assets if its own-rate of interest is the most reluctant to decline; he attributed the importance of money to its property as the standard of value. Nonetheless, the identification of demand and supply prices with spot and future prices and the acceptance of Keynes' assertion is not compatible, because the logic he applied to gold can be applied to money as the standard of value, the logic being that the gold-rate of money-interest must be equal to all the own-rates of money-interest in arbitrage, and thus it cannot prevent the production of the other assets. Kaldor would have had to say, with Sraffa, that the reluctance to fall of the own-rate of interest of money cannot knock out the production of assets. This is a consequence of his understanding of the function of the term a as arbitrage in a short period. Kaldor's rejection of the liquidity preference theory in his later book (1982) is more consistent to his interpretation of Chapter 17.

   Barens and Caspari (1997) also had the two-stage comprehension of equilibrium and the identification of demand-price with present price, and supply-price with future price. They are more straightforward in denying Keynes' theory. However, they accepted the relations (2) and (3) as definitions of demand-price (D) and marginal

efficiency (m), in addition to the identifications, $D = p_s$ and $S = p_f$; thereby, they derived $m = r - a$. This formula is incompatible with Keynes' equilibrium equation, $m = r$ or $q - l + a = r$. Furthermore it is an identity derived only from the definitions; here m is fixed to r and does not have the power to equilibrate the economy, in contrast to Sraffa, who said Keynes should have used marginal efficiency, not own-rate of interest, when he says about his equilibrium. Barens and Caspari adopted two definitions that are incompatible with each other.

Lawlor (1996, 2006) insisted that Keynes' equilibrium is different from Sraffa's long-term equilibrium that appeared in his paper in 1932, and referred to it as "shifting equilibrium" using Keynes' terminology, but his shifting equilibrium is nothig but Sraffa's arbitrage equilibrium.

9. The process of determining the volume of investments through equating marginal efficiencies of capitals to the rate of interest is distinguished in GT from the process of determining the level of income through equating the volume of investments to the volume of savings. Even if both processes take place at the same time, the mechanisms that underlie them are thought to be different in Keynes' framework. To identify both processes, there must be a common mechanism for bringing them about. What is the common mechanism is not clear in Kregel's explanation. If one can say that propensity to save is equivalent to liquidity preference, for example, there may be a common mechanism, but this question is beyond the scope of this study.
10. Keynes explained about the departure of his theory of interest from the orthodox theory as: "My theory maintains … that the marginal efficiency of money is determined by forces partly appropriate to itself, and that prices move until the marginal efficiency of other assets falls into line with the rate of interest" (Keynes 1937a in Keynes 1973, 103). "Prices" here also means demand-prices, and this statement refers to the process in which D moves to be equal to S.
11. See also the above-quoted comment from page 11 of SP I 100.
12. Rochon emphasized the difference between credit and money, and criticized that post-Keynesian "structuralists" identified credit as money (Rochon 1999, 53–56.). Naito attributed Wray's "peculiar" definitions of money and liquidity preference to his confusion of credit with money (Naito 2011, 175). Rochon argued that the supply of credit allows production to take place which generates income, and that when income is distributed, money arises (Rochon 1999, 55). Wray must have thought that money arises as bank deposits on the debt side of the bank's balance sheet just when credit is supplied. I share this recognition.

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