KEYNES, SRAFFA AND THE LATTER'S "SECRET SCEPTICISM"[*]

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1. Introduction

The relationship between Keynes and Sraffa was very close in some respects and quite otherwise in some other respects. Keynes was deeply impressed by Sraffa's breadth and depth of knowledge, his sharpness and intellectual brilliance, and he found his younger Italian colleague a truly likeable person. There are numerous documents that express vividly their close personal relationship which grew into friendship (see recently Ranchetti, 2005). Without Keynes's continuous support up until his premature death in 1946 it is difficult to imagine how Sraffa would have done in an environment like Cambridge, given the peculiarities of his character, his meticulosity and even pedantry. Thanks to Keynes, Sraffa could pursue his work without much interference. Keynes, it seems, had full trust in Sraffa's intellectual capabilities and made no serious effort to direct his research. He allowed Sraffa to follow his course and develop his truly novel ideas, which were eventually born into an environment that was not prepared for them and had difficulties to absorb them. Sraffa was and remained a loner amongst the economics profession in Cambridge. Highly respected and even feared by his colleagues, he was hardly ever fully understood (see Marcuzzo, 2002, and Ranchetti, 2002). Sraffa knew how much his critical and constructive work contradicted the received wisdom in Cambridge and elsewhere. Apart from some early attempts at communication he was reluctant to let his colleagues know what precisely his work was all about, which difficulties he had encountered and which results he had got when. Sraffa kept his cards very much to himself and typically disclosed them only in the moment in which he was absolutely sure that what he had to offer was both new and sound. Unlike Keynes he was horrified by the vision of circulating half-baked ideas and leave it to others to straighten them out. It is telling that apart from Maurice Dobb Sraffa discussed his work typically only with mathematicians: in the late 1920s with Frank Ramsey and in the 1940s and 1950s with Abram S. Besicovitch and Alister Watson.[1]

Sraffa was well aware of how much he owed to Keynes's steadfast support and throughout his life was loyal to the man who had brought him to Cambridge and who looked after him so well. However, there is every reason to believe that the two minds hardly ever fully met when it came to economic theory. The two scholars had high esteem and respect for one another but they followed different lines of thought. They were both engaged in a project that was designed to provide an alternative to contemporary mainstream economics, but they did not directly join forces in this regard. They approached the project from different points of view and they reached different conclusions as to how to best challenge a doctrine they considered problematic if not outright wrong.

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[1] He showed some of his early findings in 1928 to Keynes and Arthur Cecil Pigou.

Since apart from a few instances, on which more below, Sraffa never wrote down in a comprehensive way how he viewed Keynes's achievements as an economic theorist and what he thought in particular of the *General Theory*, we can only indirectly infer from Sraffa's writings, published and unpublished, his assessment of Keynes's work. While Keynes was critical of several of Marshall's views, his thinking was neverthless to a considerable extent "Marshallian" and remained so. At the same time he considered "Say's law" to be the characteristic feature of classical economics and a main obstacle to an understanding of persistent unemployment and depressive tendencies in the economy. Sraffa on the other hand had convinced himself that the Marshallian symmetrical theory of value and distribution could not be sustained and that the old classical approach to the theory of value was the right starting point of a probing into the laws of production and distribution. The two scholars therefore were at cross purposes right from the beginning of their encounter and cooperation, despite the fact that both shared a critical orientation towards orthodox economics. We might perhaps say that in Sraffa's view Keynes never managed to free himself fully from the straightjacket of marginalist economics: his new doctrine of effective demand, while containing some radically new elements, was thwarted by the remnants of the old theory in it (see Garegnani, 1978, 1979). This theory sees a tendency towards full employment, brought about by the "forces" of demand and supply in the various markets, including the "labour market". Because of these remnants of orthodoxy, Keynes's partly revolutionary intellectual message could be tamed and his construction reabsorbed, or so it seemed, into the mainstream, which turned out to be highly elastic with regard to new ideas which at first sight look incompatible with it, viz. the so-called "neoclassical synthesis".

Sraffa had concluded his rejoinder to D. H. Robertson in the 1930 *Economic Journal* symposium on increasing returns and the representative firm with the words:

We seem to be agreed that the [Marshallian] theory cannot be interpreted in a way which makes it logically self-consistent and, at the same time, reconciles it with the facts it sets out to explain. Mr Robertson's remedy is to discard mathematics, and he suggests that my remedy is to discard the facts; perhaps I ought to have explained that, in the circumstances, I think it is Marshall's theory that should be discarded. (Sraffa, 1930, p. 93; emphasis added)

Sraffa's wish did not come true. Keynes and with him most Cambridge economists clung to Marshallian concepts and used his demand and supply apparatus. Seen from Sraffa's point of view this meant that their analyses were flawed. A careful scrutiny would invariably bring the flaws into the open. As regards Keynes's contributions, Sraffa's criticism concerned especially the following:

1. The idea expressed in the *Treatise* that the price level of consumption goods and that of investment goods can be considered as determined independently of one another, and the related idea that the price level of the latter is determined exclusively by the propensity of the public to "hoard" money.

2. The "marginal efficiency of capital" schedule in the *General Theory* which carried over the concept of a given order of fertility of different qualities of land to the ordering of investment projects.

3. The view that the banking system can control the money supply and that therefore the quantity of money in the system can be considered as exogenous.

4.The argument put forward by Keynes to substantiate his view that the liquidity preference of the public prevents the money rate of interest from falling to a level compatible with a volume of investment equal to full employment savings.

While some elements of Sraffa's criticism derived directly from his involvement in discussions of the "Circus", other elements derived from his parallel critical work on the foundations of the received marginalist theory of value and distribution and his endeavour to elaborate an alternative to it.

In this paper we deal with the four problems mentioned. In order to understand better Sraffa's objections we repeatedly have to summarise findings in his parallel work to the extent to which they are pertinent to the issues at hand. It deserves to be mentioned already at this point that while Sraffa was critical of several of Keynes's ideas and concepts, his objections were not meant to undermine Keynes's critical project as such. They were rather destined to knock out elements that could not be sustained and thus eliminate weaknesses of the analysis.

The composition of the paper is the following. Section 2 deals with Sraffa's explicit criticism of Keynes's analysis around his so-called "Fundamental Equations" in the *Treatise*. While this theme is in itself of little importance, not least because Keynes himself later recanted his respective views, it allows us to introduce some of Sraffa's early theoretical findings which form the background of his objections also to later ideas of Keynes's. Section 3 turns to Keynes's view that investment projects can be ordered independently of the level of the rate of interest according to their marginal efficiencies of capital. This idea is but another expression of what Sraffa dubbed the "monotonic prejudice" that permeates much of marginalist analysis and which can be sustained only in exceptionally special cases. A truly "general theory", which Keynes aspired to elaborate, had to dispense with this "prejudice". Section 4 turns to Sraffa's critical account of Friedrich August Hayek's monetary overinvestment theory of the business cycle. In it Sraffa used the concept of "commodity rate of interest", which Keynes then picked up in the *General Theory* in an attempt to counter Hayek's objection that the *Treatise* lacked a proper capital theoretic foundation. In Section 5 we address Sraffa's criticism of Keynes's liquidity preference theory contained in his annotations in his personal copy of the *General Theory* and two manuscript fragments which Sraffa appears to have composed shortly after the book had been published, but which he apparently had never shown to anybody. Section 6 draws some conclusions.

2. Determination of price levels in the *Treatise*

Using a famous formulation of Keynes, we may say that in the late 1920s and early 1930s both Keynes and Sraffa were involved in a "struggle of escape from habitual modes of thought and expression" (CW, Vol. VII, p. xxiii). While Keynes focused on the problem of money and output as a whole, Sraffa focused on the problem of value and distribution.

Sraffa had put forward his criticism of Marshall's partial equilibrium theory in two essays published in the mid 1920s (Sraffa, 1925, 1926), which had impressed the scientific community.[2] Yet, as regards an alternative construction, the two papers contain little, except for a few hints in which direction to search. It was in the winter of 1927-1928 that Sraffa experienced a breakthrough in terms of his "systems of equations" which foreshadow Sraffa (1960, Chapters I and II). Keynes, on the other hand, was working in broadly the same period on "a novel means of approach to the fundamental problems of monetary theory", as he wrote in his preface to the *Treatise* with reference to Books III and IV of the work (CW, Vol. V, p. xvii). He was not happy with the outcome and called it "a collection of material rather than a finished work" (CW, Vol. V, p. xviii). The reason was that "The ideas with which I have finished up are widely different from those with which I began. ... There are many skins which I have sloughed still littering the pages. ... I feel like someone who has been forcing his way through a confused jungle" (CW, Vol. V, p. xvii).

The original novelty of the *Treatise* were the "Fundamental Equations" for the value of money in Book III. They were designed to tackle "The real task of such a [monetary] theory [which] is to treat the problem dynamically, analysing the different elements involved, in such a manner as to exhibit the causal process by which the price level is determined, and the method of transition from one position of equilibrium to another" (CW, Vol. V, p. 120). The quantity theory of money in its various forms, Keynes insisted, was ill adapted for this purpose. He then proposed to break away from the conventional method of starting from a given quantity of money irrespective of the uses to which it is put. Instead he started from the flow of aggregate earnings or money income and "its twofold division (1) into the parts which have been *earned* by the production of consumption goods and of investment goods respectively, and (2) into the parts which are *expended* on consumption goods and on savings respectively" (CW, Vol. V, p. 121; Keynes's emphasis). He maintained that if the two divisions (1) and (2) are in the same proportions, then the price level of consumption goods will equal their respective costs of production. If not, price level and costs will differ from one another, giving rise to (extra, or windfall) profits or losses in the consumption sector.

The price level of consumption goods is said to be "solely determined by the disposition of the public towards 'saving'" and "*entirely independent* of the price level of investment goods" (CW, Vol. V, pp. 129 and 123; emphasis added). The latter is said to depend on the public's choice between "bank deposits" and "securities". This is motivated in terms of the observation that the decision to hold the one or the other relates, "not only to the current increment to the wealth of individuals, but also to the whole block of their existing capital" (CW, Vol. V, p. 127). And while in a footnote on the same page Keynes tells the reader that in the present context he uses the term "investing" not in the sense of "the purchase of securities", but in the sense of "the act of the entrepreneur when he makes an addition to the capital of the community", he nevertheless identifies the price level of newly produced investment goods with the price level of securities. He concludes that the "actual price level of investments is the resultant of the sentiment of

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[2] Sraffa's 1925 paper was praised as a masterpiece by leading authorities in economics; see, for example, Oskar Morgenstern's eulogy (Morgenstern, 1931). Sraffa's assessment of Marshall's analysis contradicted Keynes's opinion, as reported by Harrod (1951, p. 324), that all that one needed in order to be a good economist was a thorough knowledge of Marshall's *Principles* and a careful daily reading of *The Times*.

the public ['bearish' or 'bullish'] and the behaviour of the banking system", or, "by the disposition of the public towards hoarding money" (CW, Vol. V, p. 128 and 129-30).

In the period from January 1930 to 1932 Sraffa exchanged a couple of notes with Keynes in which he raised objections to which Keynes then answered.3 Sraffa's objections concerned inter alia the propositions just mentioned,4 and, at a deeper level, Keynes's view of the determinants of profits. He disputed Keynes's confounding of securities and fixed capital items "under the ambiguous name of 'new investment goods'" (D1/72/3).5 This was misleading: In the short run the (market) prices of new machines depend on the demand of firms who are intent upon expanding (or reducing) their productive capacity, and the prices of securities depend on the demand of investors in financial markets, whereas in the long period the prices of machines are regulated by their costs of production (inclusive of profits at a normal rate) and those of securities by the rate of interest. It is misleading to identify the price level of newly produced capital goods with that of securities.

Contrary to Keynes's view, the price levels relating to industries producing investment and consumption goods were not independent. Sraffa's respective objection has at its background the analysis of systems of equations of production he had started to elaborate from November 1927 until 1930 when he had to focus all his energy on preparing the edition of David Ricardo's works and correspondence on behalf of the Royal Economic Society.6 In a system characterised by a circular flow of commodities Keynes's distinction lacks precision, because one and the same type of commodity may be used both as an investment and as a consumption good. How can the price of such a commodity be determined in two radically different and independent ways?

More important, the two kinds of industries are typically intimately intertwined. In his papers of the 1920s Sraffa had not taken into account the fact that in modern industrial systems commodities are produced by means of commodities. He had defended this neglect by pointing out that "the conditions of simultaneous equilibrium in numerous industries" are far too complex, and that "the present state of our knowledge … does not permit of even much simpler schema being applied to the study of real conditions" (Sraffa, 1926, p. 541). "The process of diffusion of profits throughout the various stages of production and of the process of forming a normal level of profits throughout all the industries of a country", he had then surmised, was "beyond the scope of this article" (Sraffa, 1926, p. 550). It was precisely this problem that Sraffa began to tackle after he had moved to Cambridge in 1927 (see Kurz, 2006, and Kurz and Salvadori, 2005). By the time he was confronted with Keynes's "Fundamental Equations", which dealt with a closely related problem, he had already established a number of important results.

In a simple numerical example of 1928 there are two industries, the first producing an investment and the second a consumption good. Production Sraffa tabulated as follows:

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3 For a detailed account of the correspondence between Keynes and Sraffa, see Ranchetti (2005).

4 He was not the only one who had difficulties wie Keynes's postulate of the independence of the two price levels. For Richard Kahn and Joan Robinson's difficulties with it, see Marcuzzo (2002, pp. 427-9).

5 References to Sraffa's Papers kept at Trinity College Library, Cambridge, follow the catalogue prepared by Jonathan Smith, archivist.

6 On the close collaboration between Keynes and Sraffa regarding the Ricardo edition, see Gehrke and Kurz (2003).

17v = (6v + 10)r
23 = (5v + 4)r
17 (23) units of the first (second) commodity are produced by means of 6 (5) units of the first and 10 (4) units of the second commodity; v is the value of one unit of the capital good in terms of the means of subsistence, and r is the interest factor (= 1 + interest rate). Sraffa calculated r (≈ 1.582) and v (≈ 2.108), represented graphically the relationships between v and r given by the two equations and identified the solution of the system as the intersection of the two curves; see Fig. 1.
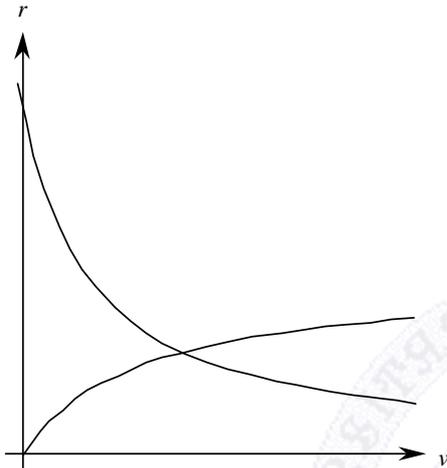

Figure 1

Next Sraffa turned to a problem that had bothered economists since an early time and that bothered also Keynes: How does the rate of return on capital change consequent upon a change in real wages caused, e.g., by a change in the price of the consumption good, given money wages and given the system of production in use? Answering this question implied disclosing the mathematical properties of a given system of production as regards the distributional alternatives it allows for and the corresponding price vectors supporting these alternatives. Sraffa stressed that it is "as clear as sunlight" that a change in income distribution generally affects the price of the intermediate product relative to the consumption good, and that with a fall in real wages the general rate of return on capital would increase (see, for example, D3/12/7: 95). In terms of Figure 1, a change in the real wage rate would involve a shift of the two curves and with them a shift of their point of intersection.

Against this background it should come as no surprise that Sraffa objected to Keynes that "the price of investment goods is determined in the same way as that of consumption goods, and a change in the demand for either may give rise (or fail to give rise) to profits or losses" (D1/72/3; emphasis added). Keynes understood that his position could not be sustained and abandoned the idea.

Before we continue, it should be stressed that in terms of his systems of equations Sraffa had established that the rate of return and relative prices generally depend on two sets of data: (i) the system of production in use, that is, the methods of production actually employed to produce given levels of output, and thus on physical real costs, and (ii) the wages' share.

We now turn to Keynes's view of the inducement to investment in Chapter 11 of the General Theory. There Keynes puts forward his concept of the "marginal efficiency of capital". Could this concept be sustained vis-à-vis Sraffa's theoretical findings.

3. The "marginal efficiency of capital" schedule

Keynes essentially adopted the internal rate of return method when dealing with investment projects from which a manufacturer may choose: "I define the marginal efficiency of capital as being equal to that rate of discount which would make the present value of the series of annuities given by the returns expected from the capital-asset during its life just equal to its supply price" (CW, Vol. VII, p. 135). (This method has serious shortcomings, which, however, need not concern us here.) Keynes goes on to argue that the various projects may be ordered according to their marginal efficiencies and then suggests to aggregate them, "so as to provide a schedule relating the rate of aggregate investment to the corresponding marginal efficiency of capital in general which that rate of investment will establish" (CW, Vol. VII, p. 136). This schedule he calls investment demand-schedule which he confronts with the current rate of interest. He concludes: "the rate of investment will be pushed to the point on the investment demand-schedule where the marginal efficiency of capital in general is equal to the market rate of return" (CW, Vol. VII, pp. 136-7).

Keynes rests his argument on the dubious partial equilibrium method: he assumes that the schedule and the money rate of interest are independent of one another. Yet if one was to depend on the other, or if they were interdependent, the argument in its present form would brake down. Several commentators, including Pasinetti (1974), have emphasized that Keynes's argument consists of an adaptation of the classical doctrine of extensive diminishing returns to the theory of investment. This doctrine (see, e.g., Kurz, 1978) typically assumes that the different qualities of land can be brought into an order of fertility, with the first quality exhibiting the lowest unit costs of production of, say, corn, the second quality the second lowest unit costs, and so on. In competitive conditions, with a rise in "effectual demand" (Adam Smith) the different qualities of land will be taken into cultivation according to this order. The different qualities of land can also be ranked according to the rent they yield per acre; this ranking is known as the order of rentability. It has commonly been assumed that both orders are independent of income distribution and that they coincide.

In the late 1920s Sraffa showed that this is only true in exceedingly special cases. In general, both orders depend on the rate of interest and do not coincide (see also Kurz and Salvadori, 1995, Chapter 10). Sraffa established this result in the course of an analysis of the problem of the choice of technique of cost-minimising (profit-maximising) producers. He first studied the problem of which qualities of land from a set of alternatives will be cultivated in order to match effectual demand. At around mid 1929 he demonstrated that the order of fertility depends on the rate of interest. Hence, different qualities of land cannot generally be ordered monotonically with respect to that rate: with a change in it the order will typically change as well.7 The reason for this is that different methods of production employed in cultivating different qualities of land typically use different capital goods, or the same capital goods in different proportions,

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7 When in 1942 Sraffa resumed his work on his book, he recapitulated his findings of more than a decade ago. In a note composed on 13 November entitled "Order of fertility" he asked: "Is it possible in our scheme to arrange a series of lands of different qualities in a descending order of 'fertility' that will be valid for all values of (independently of) r [rate of interest] and w [wage rate]? No, it is not possible" (D3/12/25: 1). He illustrated the dependence of the order of fertility, and of the reversal of his order, in terms of a simple example.

relative to labour. Since relative prices of (capital) goods will generally change with a change in the rate of interest, relative costs of production and thus the cheapness of methods will also change. A particular quality of land which at one level of the rate of interest is cost-minimising, at a higher (lower) level may be dominated by another quality of land. It may even "come back" at a still higher (lower) level. A similar result Sraffa then established with respect to a pure capital goods model, focusing attention both on circulating and fixed capital.8

Sraffa's findings have a direct bearing on Keynes's investment demand-schedule and his closely related view as regards the long-period relationship between the overall capital-labour ratio and the rate of return on capital. Both as regards the short and the long period, Keynes had fallen victim to the "monotonic prejudice" (see Gehrke and Kurz, 2006). As regards the former, with a change in the rate of interest it cannot be presumed that the ranking of investment projects will remain the same, because both expected gross revenues and costs will generally be affected by the change. The ranking of investment projects in a descending order of marginal efficiency is thus no less dependent on the rate of interest than the ranking of different qualities of land in terms of "fertility". As regards the long period, there is no presumption that an increase in the capital-labour ratio is invariably accompanied by a decrease in the marginal efficiency of capital in general, as Keynes contended (see, e.g., CW, Vol. VII, p. 136).9

Sraffa's findings are indisputable. As Mas-Colell (1989) stressed, the relationship between the capital-labour ratio and the rate of return on capital can have almost any shape whatsoever. This implies that the "demand function" for capital in terms of the rate of interest need not be downward sloping in the perhaps only point in which it cuts the given "supply function" of capital (which we may, for simplicity, take to be a straight vertical line). The resulting equilibrium, while unique, would be unstable. We may ask with Marshall, what is the explanatory power of such an equilibrium?

We now turn to Sraffa's assessment of Keynes's liquidity preference theory. In order to get a better grasp of it, we must, for the reasons given in Section 1, first deal briefly with Sraffa's criticism of Hayek's "Austrian" theory of the business cycle (see Kurz, 2000; see also Ranchetti 2002).

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8 This involved an investigation of fixed capital goods and the extensive and intensive dimension of their utilization. In this context Sraffa studied carefully what Keynes in the *Treatise* had to say about the role of "working" and fixed capital in production (see CW, Vol. V, ch. 8). As Sraffa's hitherto unpublished papers show, he was convinced that the growing importance of durable instruments of production had rendered a great elasticity to the modern economic system, which allowed it to increase and decrease considerably the rate of output in response to varying levels of effective demand. This was possible, for example, by switching between a single- and a double-shift system of capital utilization. Keynes's view in the *General Theory* that employment and real wages are of necessity negatively correlated (see the concept of the "employment function", CW, Vol. VII, Chapter 20) was difficult to reconcile with this observation, at least when starting from low levels of employment and capital utilization. As is well known, Keynes partly recanted his earlier view on the matter in his discussion with Dunlop and Tarshis.

9 In the 1960s the possibility that the capital-labour ratio rises (falls) with a rise (fall) in the rate of profits (and a corresponding fall (rise) in the real wage rate) became known as *capital reversing* or *reverse capital deepening*; for a discussion of this phenomenon, see Kurz and Salvadori (1995, ch. 14). The discussion sets aside the problem of "inventions", i.e., the fact that new methods of production become available as time goes by. Here it suffices to point out that Keynes's view is not *per se* rendered more credible if inventions are taken into account.

4. Sraffa's criticism of Hayek

In the 1930s upon the request of Lionel Robbins of the LSE Friedrich August Hayek assumed the role of a main adversary of Keynes's explanation of unemployment and economic crises in the Treatise (Hayek, 1931a, 1932a). Hayek advocated instead an explanation of the phenomena, building upon the works of Ludwig von Mises, Eugen von Böhm-Bawerk and Vilfredo Pareto. When Sraffa was confronted with Hayek's argument he knew already that its theoretical core – Böhm-Bawerk's theory of capital and interest – was shaky (see Kurz and Gehrke, 2006). Therefore he must have been amused, when in his rejoinder to Keynes's reply to his criticism in Economica Hayek maintained that the main weakness of Keynes's argument was its lack of a proper capital theoretic foundation and that Keynes was well advised to adopt Böhm-Bawerk's theory (Hayek, 1931b).

Keynes appears to have accepted the criticism but not the proposal, presumably because Sraffa had informed him about the deficiencies of Böhm-Bawerk's capital theory. Was there another option available to make good the lacuna? Keynes appears to have convinced himself that there was indeed and that it revolved around the concept of commodity rate of interest. There is no evidence known to me indicating that Sraffa himself played any role in this. Had he in advance been informed about Keynes's idea he would in all probability have expressed his reservation. The concept was, of course, already known to Keynes from his work on foreign currency markets and portfolio decisions and his development of the interest rate parity theorem.10 It had played a role in the Tract on Monetary Reform published in 1923 (CW, Vol. IV), which Sraffa translated into Italian and published in 1925, and was referred to in the Treatise. Last, but not least, it was an indispensable tool in Keynes, Kahn and Sraffa's dealings on the Stock Exchange.11 However, in the General Theory it assumed an entirely new status, elevated to the role of providing a choice- and capital-theoretic foundation of Keynes's theory of investment behaviour, both real and financial. Given its uttermost importance in the central Chapter 17 of the General Theory and Keynes's explicit wish to relate his analysis to Sraffa's, it appears to be appropriate to deal carefully with how Sraffa defined the concept and put it to work in his criticism of Hayek.

Confronted with Hayek's attack, Keynes found himself in an impasse because he was not familiar with the main building blocks of Hayek's argument. Sraffa, who had studied the contributions of Böhm-Bawerk and Pareto, came to Keynes's defense. First, he took issue with Hayek's claim that the possibility of a difference between own rates of interest and thus a divergence of some rates from the "equilibrium" or "natural" rate is a characteristic of a money economy that is absent in a barter economy (1932, p. 49).

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10 See the contributions by Marcello de Cecco and Jan Kregel in this volume.

11 One event is worth telling. In late 1937 Keynes and Sraffa had different views as to the development of the price of lard, one of several pig products, and cotton oil, used to feed pigs. Keynes was convinced that the price of lard could be expected to rise and belittled Sraffa's objections by writing in a letter to Kahn: "If Piero [Sraffa] had ever seen a pig, he would know that the live animal cannot be kept in cold storage waiting till its food stuffs are cheaper" (CW, Vol. XII, pp. 22-3). Keynes therefore decided to job from cotton oil into lard. In a letter to Kahn of October 1937 Sraffa explained his point of view, based on an argument about the fattening of pigs, which culminated in the statement: "The less lard there is in stock, the more (with a multiplier) there is under the skin of pigs" (CW, Vol. XII, p. 24). Sraffa therefore expected a fall in the price of lard. Kahn reported Sraffa's argument to Keynes, yet to no avail. As Moggridge writes in his comment on the incident: "Keynes persisted in his view. His losses continued, by the end of 1937 totalling £27,210 on lard. He also lost over £17,000 on cotton oil" (CW, Vol. XII, p. 24).

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With reference to Wicksell's definition (Wicksell, 1898, pp. 93 et seq.) that interest is the surplus in real units of the exchange of physically homogeneous goods across time, he emphasized:

If money did not exist, and loans were made in terms of all sorts of commodities, there would be a single rate which satisfies the conditions of equilibrium, but there might be at any moment as many "natural" rates of interest as there are commodities, though they would not be "equilibrium" rates. The "arbitrary" action of the banks is by no means a necessary condition for the divergence; if loans were made in wheat and farmers (or for that matter the weather) "arbitrarily changed" the quantity of wheat produced, the actual rate of interest on loans in terms of wheat would diverge from the rate on other commodities and there would be no single equilibrium rate (Sraffa, 1932, p. 49).

Next Sraffa illustrated his argument in terms of two economies, one with and the other without money. In both economies loans can be made in terms of all goods for which forward markets exist. Assume that a cotton spinner at time t borrows a sum of money M for   periods hence in order to buy on the spot market a certain quantity of cotton at price p^t, which he at the same time sells on the forward market   periods later at a price $p^{t+\theta}$. This means that the cotton spinner in fact borrows cotton for   periods. Sraffa expounds:

The rate of interest which he pays, per hundred bales of cotton, is the number of bales that can be purchased with the following sum of money: the interest on the money required to buy spot 100 bales, plus the excess (or minus the deficiency) of the spot over the forward prices of the 100 bales (ibid., S. 50).

Let $i_{t,\theta}$ be the money rate of interest for   periods, then we have

M = (1 + $i_{t,\theta}$) p^t − $p^{t+\theta}$.

The commodity rate of interest of cotton between t and t +   , $_{t,\theta}$, is then given by the amount of cotton that can be purchased by this sum of money at the given forward price, i.e.,

$$_{t,\theta} = \frac{M}{p^{t+\theta}} = \frac{(1+i_{t,\theta})p^t - p^{t+\theta}}{p^{t+\theta}} = \frac{(1+i_{t,\theta})p^t}{p^{t+\theta}} - 1.$$

Sraffa explained:

In equilibrium the spot and forward price coincide, for cotton as for any other commodity; and all the "natural" or commodity rates are equal to one another, and to the money rate. But if, for any reason, the supply and the demand for a commodity are not in equilibrium (i.e. its market price exceeds or falls short of its cost of production), its spot and forward prices diverge, and the "natural" rate of interest on that commodity diverges from the "natural" rates on other commodities (ibid.).

Therefore, out of equilibrium there is not only one "natural rate", as Hayek had wrongly maintained, but there are many natural rates. Sraffa added that under free competition, this divergence of rates is as essential to the effecting of the transition [to a new equilibrium] as is the divergence of prices from the costs of production; it is, in fact, another aspect of the same thing." (Ibid., p. 50; emphasis added)

Using classical terminology, what we have here is the well-known problem of the so-called gravitation of "market prices" towards their normal or "natural" levels, where the

latter are determined in the way Sraffa had analysed in his systems of equations (see Section 2 above). Sraffa illustrated the basic idea underlying this process of gravitation in the following way:

[I]mmediately some [commodities] will rise in price, and others will fall; the market will expect that, after a certain time, the supply of the former will increase, and the supply of the latter fall, and accordingly the forward price, for the date on which equilibrium is expected to be restored, will be below the spot price in the case of the former and above it in the case of the latter; in other words the rate of interest on the former will be higher than on the latter (ibid.).

In a long-period position of the economy, and setting aside different degrees of risk etc., all rates will be equal and their common level depends, as we have seen, on the physical real costs of production and the given rate of interest.12

Keynes was very pleased with Sraffa's performance, not only because it had effectively countered the assault on his intellectual project launched by Lionel Robbins and his circle, but also because it had drawn his attention to a concept upon which he thought he could erect his novel edifice. Most important, perhaps, it allowed him, or so he thought, to drive home the main message of the General Theory, that it is the downward rigidity of the money rate of interest which is the source of all the trouble.

As we see from his library and his yet unpublished papers, Sraffa did not think highly of Keynes's respective argument. We proceed in two steps. We first summarize Sraffa's annotations in Chapter 17 of his working copy of the General Theory. We then deal briefly with two short manuscript fragments that were found in his working copy after he had passed away in 1983 (see also Kurz, 1996, and Ranchetti, 2002).

5. Sraffa's criticism of Keynes's liquidity preference theory
(a) Sraffa's annotations in Chapter 17

Sraffa scrutinised Keynes's chapter essentially in the same manner he had previously scrutinised Hayek's book, asking whether the concepts used were well defined, whether the argument was developed without contradictions and whether it mimicked the essential features of the reality it purported to analyse. Since according to Sraffa the theory of liquidity preference "involves all the functions considered in the system: it is, in fact, Keynes's system!", the latter stood or fell with it.

Keynes starts the chapter by pointing out "that the rate of interest on money plays a peculiar part in setting a limit to the level of employment." Wherein lies "the peculiarity of money as distinct from other assets" (CW, Vol. VII, p. 222)? Keynes defines the money rate of interest à la Wicksell and adds that with regard to all durable goods there is an analogue to the money rate of interest: "Thus for every durable commodity we have a rate of interest in terms of itself, a wheat-rate of interest, a copper-rate of interest, a house-rate of interest" (pp. 222-3). In a footnote he adds: "This relationship was first pointed out by Mr Sraffa, Economic Journal, March 1932, p. 50)" (p. 223, fn.).

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12   According to Sraffa the banking system can control only the money rate(s) of interest and has to leave the decision about the quantity of money and credit in the system to the public. Money is genuinely an endogenous magnitude.

At any given moment of time these rates will generally not be equal to one another: the ratio between spot and future price will be "notoriously different" between different commodities.

This, we shall find, will lead us to the clue we are seeking. For it may be that it is the greatest of the own-rates of interest ... which rules the roost ...; and that there are reasons why it is the money-rate of interest which is often the greatest (because, as we shall find, certain forces, which operate to reduce the own-rates of interest of other assets, do not operate in the case of money) (pp. 223-4; Keynes's emphasis).[13]

Why is this so? Surprisingly, Keynes approaches the question by defining the own rates of different commodities not in terms of expected changes of prices, but in terms of three characteristics that supposedly can all be translated into interest rate equivalents.

These are:
(i)the "yield or output q ... by assisting some process of production or supplying services to a consumer";
(ii)   the costs of holding the object or "carrying cost c"; and
(iii)the "liquidity premium" l, expressing the amount, in terms of the object, its proprietor is willing part company with for the "potential convenience or security" associated with the "power of disposal over an asset during a period" (p. 226).
Keynes concludes:

It follows that the total return expected from the ownership of an asset over a period is equal to its yield minus its carrying cost plus its liquidity-premium, i.e. to $q - c + l$. That is to say, $q - c + l$ is the own-rate of interest of any commodity, where q, c and l are measured in terms of itself as the standard (p. 226).

Sraffa remarks in the margin of this passage: "this contradicts definitions of pp. 222-3".

It is only now that Keynes turns explicitly to the determination of the expected returns of different assets. We ought to know, he writes, "what the changes in relative values during the year are expected to be" (p. 227; emphasis added). Sraffa comments drily that this should have been done right at the beginning, when defining the own rates.
Next Keynes assumes that the expected rates of increase (or decrease) of the prices of the house and of wheat, expressed in money, are a1 and a2 per cent, and goes on to say:

It will also be useful to call a1 + q1, a2 + q2 and l3, which stand for the same quantities reduced to money as the standard of value, the house-rate of money interest, the wheat-rate of money interest and the money-rate of money-interest respectively. With this notation it is easy to see that the demand of wealth-owners will be directed to houses, to wheat or to money, according as a1 + q1, a2 + q2 or l3 is greatest (p. 227).

In the margin of this passage Sraffa puts a big question mark. Indeed, as he had made clear in his criticism of Hayek, the expected changes in prices fully express differences

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[13] Hayek had argued that crises are caused by too low a money rate of interest, Keynes argued exactly the opposite.

in the "yield" of different assets, as perceived by the market. How could Keynes's summing up over the a's and q's not involve double counting?

Sraffa spots immediately that the usual choice of money as standard of value has an important implication: "The point is, that in the case of the rate of the article chosen as standard, the effect upon it of the expected depreciation is concealed" (emphasis added). This is a crucial point, which Keynes apparently had lost sight of, and which had seriously misled him. For example, if an increase in the amount of money happens to lead to a fall in the value of money, then this would imply an increase in the "money-rate of wheat interest", a fact which, alas!, Keynes does not take into account. The same objection reappears in several forms.

Next Keynes brings in the marginal efficiency of capital and compares it with the rate of interest. Sraffa comments: "'Marginal efficiency' and 'the' rate of interest are obscure: the former is not defined in this context and the latter has two definitions on p. 227." It is at any rate misleading what Keynes says, because the rate of interest of an object, whose actual price exceeds cost of production, is according to the definition given on pp. 222-3 (relatively) high, and not low.

Keynes then expounds his view in terms of the three-assets example. Since in equilibrium the own rates, expressed in the same numeraire, must be equal, one gets the following result: With the own rate of money being constant, "it follows that a1 and a2 must be rising. In other words, the present money-price of every commodity other than money tends to fall relatively to its expected future price" (p. 228). Sraffa comments that exactly the opposite follows: "this will lower, not raise, their rates of interest". Keynes simply got it wrong.

On the following page Keynes insists that it is "that asset's rate of interest which declines most slowly as the stocks of assets in general increase, which eventually knocks out the profitable production of each of the others" (p. 229). In the margin Sraffa asks whether here Keynes should have referred to the concept of marginal efficiency of capital.

In the third section of the chapter Keynes argues that the elasticity of production of money is zero and its elasticity of substitution close to zero or zero. Sraffa is obviously not convinced by this and spots a few more contradictions. Keynes's view that if wages were not relatively rigid, "the position might be worse rather than better" (p. 232), prompts Sraffa to the sarcastic remark: "as usual, heads I win, tails you lose."

However, Sraffa vividly expresses his agreement with Keynes's proposition: "The conception of what contributes to 'liquidity' is a partly vague one" (p. 240), by underlining the sentence and adding exclamation marks in the margin.

Looking at Sraffa's annotations one cannot escape the impression that in his judgement the chapter was a mess, confused and confusing. This impression is confirmed by two manuscript fragments to which we now briefly turn (see I 100).

(b) Two manuscript fragments
Sraffa's criticism concerns especially the following elements:

1.   The concept of liquidity Keynes uses is vague and ambiguous.

2.	There is not reason to presume that liquidity is always a good thing for each and every agent.
3.	Keynes advocates different concepts of commodity rate of interest that are not compatible with one another.
4.	Keynes erroneously admits Fisher's effect for all commodities, except money.

With regard to the second element Sraffa observes that the inverse relationship between holding cash and the rate of interest, i.e. the liquidity preference curve, is reminiscent of the usual marginal utility curve: "liquidity is always an advantage, though diminishing". Yet this is not generally true, Sraffa objects. While for some agents it may be the case in a particular situation, for others it may be quite otherwise. Banks, for example, must remain solvent and liquid, but they must also make profits. Since their income consists almost exclusively of interest, they must, with a lower rate of interest, get less liquid in order to keep up their income. Therefore, Sraffa concludes, it is generally impossible to say that there is a definite relationship between the quantity of money and the rate of interest. There is no such thing as the liquidity preference curve.

Sraffa insists that advantages associated with carrying an asset have nothing to do with its commodity rate. People who borrow money or any other asset typically do this not in order to carry what is being borrowed until the expiration of the contract, but in order to buy with it other things. What is being borrowed is not what is wanted to be kept, but the standard in which the debt is fixed. Therefore it is irrelevant whether a person pays in money or wheat and whether what is borrowed is a durable or a perishable good. Sraffa concludes "that K. has in the back of his mind two wrong notions, which have entirely misled him", namely, that (i) that commodities are borrowed to be kept until the end of the loan, and (ii) that only durables can be borrowed.

There remains, however, the fact that a large quantity of money (cash) and a low rate of interest often go together, which gives the curve a certain plausibility. Yet, Sraffa insists, "causation is the other way round": it is a low rate of interest that is responsible for a large quantity of money, and not a large quantity of money that causes a low rate of interest. Attention ought to focus on those who demand loans (investors) and not on those who provide them with liquid funds. Keynes's theory of liquidity preference with its emphasis on the supply of loans, Sraffa concludes, is similar to the old long-period theory of the supply of savings that is elastic with respect to the rate of interest placed into a short-period setting.

The commodity rate of interest, Sraffa insists, depends exclusively on expected price changes and is thus defined with respect to the forward price of a commodity. There are two ways in which the commodity rates of interest can become uniform again: either via changes in prices and/or via changes in production. Surprisingly, Keynes accepts both possibilities for all commodties other than money. This becomes clear when we consider, for example, the case in which agents develop a large propensity to hoard money. Due to the ensuing depressive tendencies in the economy commodity prices will tend to fall. This implies a rise in the value of money. An expected increase in the value of money implies however a lower "own rate of money interest", to use Keynes's peculiar concept. Sraffa emphasizes: "therefore the money rate will be lower than other

rates and not higher".14 Sraffa adds that this is "Fisher's effect, which K. admits for all commodities except money." The reference is obviously to Irving Fisher (1896, 1907), who first elaborated the concept of own rates.15 Sraffa concludes: "Thus in the K. case, the result on rates of int[erest]. is opposite to K.'s conclusion."

In Chapter 17 Keynes did not reason correctly and got entangled in a maze of contradictions. Liquidity preference theory, i.e. "Keynes's system", is logically incoherent. Its basic notion is but another expression of the marginal utility of hoarding, which is but a particular aspect of marginal theory. Keynes who with one foot had managed to escape received modes of thought, with his other foot was still tightly tied to them.

6. Concluding remarks

Sraffa approved of Keynes's critical intention, but was disenchanted with its execution. It was not only Keynes's occasional sloppiness Sraffa found difficult to cope with. In important respects he felt that Keynes had granted too much to received economic theory. Keynes's new theory exhibited several lose ends and contradictions and retained in new garb marginalist concepts which Sraffa deemed untenable.

It is ironic to see that the distinguishing feature of what today is known as "Neo-Keynesian theory" is the premise of sticky prices: Keynes is interpreted as an imperfectionist. While there are traces of imperfectionism to be found in his magnum opus, in the central part of it he assumes fully flexible prices. Keynes's analysis therefore cannot be accused of lacking generality because of an alleged assumption of price rigidities. The problem rather is whether his explanation of a lower boundary to the money rate of interest vis-à-vis flexible prices stands up to close examination. According to Sraffa it doesn't. Keynes's argument suffers in particular from neglecting the implications of flexible prices via the value of money for the level of the "own rate of money interest". However, Keynes's failure is not orthodox theory's triumph. In Sraffa's view, Keynes failed because in his analysis the orthodox elements overwhelm the truly novel ones.

Sraffa developed his criticism of Keynes from an approach that also considers (long-period) prices as fully flexible. This does not mean, however, that the conventionally invoked "forces of demand and supply" can be expected to generally bring about a full employment equilibrium. The irony is that Sraffa established these findings in terms of an elaboration of the classical approach to the theory of value and distribution. This approach, coherently developed, actually effectively undermines Say's law – the law for which Keynes had thought he could put classical analysis on one side. Keynes, keen to free himself of "habitual modes of thought and expression", was only partly successfull.

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14 Keynes in one place uses the concept of "own rate of money interest", which, with money taken as standard of value, Sraffa comments, is a "hybrid" concept that "indeed has no other use than to patch up the confusion created", but in fact is only there "to make confusion more confounded."
15 Copies of Irving Fisher's books with annotations in Sraffa's hand are in Sraffa's library.

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