John Maurice Clark and the Multiplier: A Note

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1. While John Maurice Clark is commonly recognized as the father, together with Thomas Nixon Carver, Albert Aftalion, Ralph Hawtrey and Charles Bickerdicke of the so called "accelerator principle" [Junankar 1987] and as an anticipator of the "multiplier-accelerator" model [Shackle 1967, 264-265], his contribution to the development of the multiplier analysis in relation to public works expenditures is often neglected[2]. In another paper [Fiorito 2001], I have delved into Clark's early formulation of the multiplier contained in his *Economics of Planning Public Works* [Clark 1935b], also providing archival evidence which seems to confirm what Clark had already affirmed in 1935 [1935c, 85n], i.e., that his recognition and use of the multiplier was prior to his seeing Kahn's celebrated article on "The Relation of Home Investment to Unemployment" [Kahn 1931][3]. In this note the historiographic aspects of the story are deliberately omitted, and the attention is turned to the more analytical aspects of Clark's treatment of the multiplier. First, I lay down a simple mathematical formulation of the multiplier in which explicit allowance is made for a time-lag between the receipt of income and the receipt of another income caused by the spending of the first. Then I focus on Clark's analysis of the time dimension of the multiplying process and his attempt to reconcile the traditional Kahn-Keynes approach with the so-called "velocity of circulation" approach, also developing, through the model, his main argument. A conclusion follows in the final section.

2. The mechanism underlying the multiplier principle is familiar to modern readers, therefore it does not require any detailed discussion here. In the following model, I first assume that all injections are in the form of investment. Secondly I introduce the concept of *income propagation period*, by which is usually understood the time lag between successive waves of expenditure of the additional net income deriving from the primary investment. For the sake of simplicity, I attribute the whole lag to the delay between the receipt and the spending of income. We can thus define a traditional Keynesian consumption function as follows:

$$C(t) = \alpha y(t-\theta) + K \qquad 1)$$

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[2] Hints at Clark's contribution to the genesis of the multiplier analysis are to be found in Davis [1971], Dorfman [1970], Hegeland [1966], Shute [1997], Wiles [1971].

[3] The idea of J. M. Clark as an independent discoverer of the multiplier principle has been challenged by Robert W. Dimand. See Dimand [1988; 1990].

Where $C(t)$ is the total consumption at time t, α is the marginal propensity to consume, θ is the time lag, and K is the autonomous consumption. If I is the investment, income received will be:

$$Y(t) = \alpha Y(t-\theta) + K + I(t) \qquad 2)$$

As shown by Samuelson [1943] and Goodwin [1947], the complete solution of 2) will be the sum of two parts. The first obtained by setting K and I equal to zero, describes the so-called "propagation mechanism" [Goodwin 1947, 489] and is given by:

$$Y(t) = \alpha^{t/\theta} \qquad t=\theta, 2\theta, 3\theta\ldots \qquad 3)$$

Where A is a constant to be determined by whatever the value of $Y(t)$ is at time zero. The second part, which is obtained by considering the particular results of the injections I and K, gives the familiar result:

$$Y(t) = \frac{K+I}{1-\alpha} \qquad 4)$$

The complete solution will consist in the sum of 2) and 3). Let us, for instance, analyze the effects of a *permanent* increase in the rate of investment of a unit expenditure. The arbitrary constant A in 3) must in this case be determined so that Y equals one when $t=0$. The solution, for any single period, is then:

$$Y(t) = \left(1 - \frac{1}{1-\alpha}\right)\alpha^{t/\theta} + \frac{1}{1-\alpha} \qquad 5)$$

The limiting value of 5) as t goes to infinity is $\frac{1}{1-\alpha}$ or, to put it differently, the *continual* stream of a unit expenditure will raise income to the *cumulated* multiplier value – the total increment of income throughout all time resulting from a *unit*, *nonrepeated* impulse – and keep it there. In this connection, it is worth noting that, as observed by Hugo Hegeland in his *The Multiplier Theory* [1966, 156], the first to point out such a convergence was John Maurice Clark who also gave a simple graphical illustration of it in his *Economics of Planning Public Works* [1935b], while the general mathematical proof was stated by Samuelson in 1943. Interestingly, in that paper Samuelson refers to the process described by the multiplier as "the familiar Kahn-Clark sequence." [Samuelson 1943, 221].

Following Goodwin [1947], then, we may define a time constant β as the time in which the direct results of an impulse are nine tenths-achieved:

$$\alpha^{\beta/\theta} = 0.1 \qquad \text{which requires that } \beta = \theta \frac{\log 0.1}{\log \alpha} \qquad 6)$$

In words, the longer the time-lag and the smaller the marginal propensity to consume, the longer the time required to attain a substantial portion of the multiplier effect.

3. The simple model sketched above provides us with a convenient vantage point from which to consider Clark's treatment of the dynamic implications of the multiplier. Clark advanced his version of the multiplier in a paper on the "Cumulative Effects of Changes in Aggregate Spending as Illustrated by Public Works," first presented at the American Economic Association in December 1934, then published in the *American Economic Review* [Clark 1935a], and subsequently expanded as chapter IX of his *Economics of Planning Public Works* [Clark 1935b][4].

According to Clark [1935a; 1935b], if one examines the various studies on the secondary effects of public works expenditure, two main approaches to the analysis of the problem are revealed: "one *via* successive cycles of income and spending by ultimate recipients of income" – which the Columbia economist termed the "Kahn-Keynes" approach –, "the other via the volume of money and its velocity of circulation." As it is well known, in the first approach business fluctuations are seen primarily as a consequence of fluctuations in current investment. Accordingly, the amount of the secondary effects is determined by a) the amount of the net increase in investment; b) the marginal propensity to consume; and c) the length of the income propagation period. As it appears from the above, in the "Kahn-Keynes" analysis of the secondary expansion, money plays only a passive role.

As to the second approach, Clark [1935a, 383] affirmed that "it has, so far as I am aware, not found its way into print." A clear and early statement of the view held by the exponents of the "velocity" approach is provided by a letter that Alvin Hansen sent to Clark in 1934[5]. For Hansen the explanation of how an initial

[4] The address was also reprinted under a different title in Clark [1936].

[5] Hansen to Clark, August 8, 1934. Dorfman Papers, Rare Book and Manuscript Library, Columbia University. The letter is reproduced in Fiorito [2001]. Clark had asked Hansen for some comments on an early draft of chapter nine of his *Economics of Planning Public Works*. In his reply the Harvard economist dismissed Clark's reasoning on the ground that it "still follows too much along the Keynes lines" which, at that time, he considered "definitely wrong." On Hansen's early appraisal of Keynes' work, see Asso .[1990, 62-70].

change in the rate of spending will induce further increments in the level of total income was essentially a question of (1) the volume of means of payment and (2) the income velocity of money:

> "Public works may affect either one of these two or both. It is quite correct, as Keynes said, that the public works expenditures may not enlarge the volume of 'money.' In this event, the effect presumably is to transfer money from idle hands to active hands. In other words, the income velocity increases. Or there may actually be injected into the market new 'money,' and the income velocity might conceivably remain on the average as before. Or there may be a combination of these two tendencies."

Also the Keynesian concept of "leakages," i.e. those portions of a given stream of spending which are not respent within the period considered, becomes devoid of any specific content once the "circulation" approach is adopted:

> "Keynes' 'leakages,' I think, are also dangerous. The most important 'leakage' is his saving 'leakage' and this when analyzed amounts to nothing more or less than our old friend, a change in income velocity. If all of us hold idle a half of our income which we formerly spent, – save it without investing it, in other words – the income velocity has been cut in two. Thus the total income of society in the next succeeding period has been reduced to one-half by this process of 'savings running to waste'."

As a consequence of this, there will be no secondary effects unless the primary expenditure results in an increase in the quantity of money, its velocity, or – as it seems more probable – both:

> "All that public expenditures do is to throw new funds into the market, and thereby increase the income, which action, since it is certainly not likely to reduce the income velocity of 'money' is very likely to increase the total 'money' income of society by more than the amount of 'money' injected. It is, therefore, correct to say that public expenditures are likely to have an effect on income in excess of the expenditures. This is all there is to it, it seems to me."[6]

To recapitulate, we may say that according to the "velocity of circulation approach" the primary factors determining the secondary expansion resulting from a primary investment are the effect of the latter on the amount of money in circulation and the number of times these new dollars circulate in a given period of time. To

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[6] Hansen to Clark, August 8, 1934. Dorfman Papers, Rare Book and Manuscript Library, Columbia University.

put it differently, quantity theorists *à la* Hansen would expect that the aggregate income would remain substantially unchanged, in spite of the government's deficit spending, if the financing of the deficit involved no increase in the money supply. If the deficits were financed by a steady creation of new money, they would expect the money income to increase also staidly without limit instead of approaching the level set by the multiplier.

Clark did not share Hansen's criticisms and viewed a possible merging of the two competing approaches. As he put it: "[t]he difference between the two formulations is not necessarily a contradiction, and by comparing the two a better idea may be obtained of the results which are actually to be expected" [Clark 1935b, 85].

Before launching into the discussion of Clark is worth recalling that in his 1931 essay, Kahn decided to ignore the dynamical implications of the multiplier implied by the existence of a lag between the receipt of income, and its spending, and between its spending and its subsequent re-emergence as income:

> "I am here considering the position in the final position of equilibrium when everything has settled down. But some time will, of course, elapse between the point when the primary employment begins, and the point when the secondary employment reaches its full dimensions, because wages and profits are not spent quite as soon as they are earned. *I do not enter into the question of this time-lag*." [Kahn 1931, 183n: emphasis added][7].

Contrary to Kahn, Clark began his discussion of the multiplier by explicitly acknowledging and analyzing the role of the income propagation period in determining the length of time over which the multiplier effects are presumed to operate. Clark estimated this time lag at two months, which corresponds to 6 cycles of secondary effects per year, in consideration of the large amount that wage payments normally constitute of the deficit spending. It is worth pointing out that Clark presented in a chart [Clark 1935b, 02: chart II] the total effects over time of a permanent increase in public expenditure, considering the hypotheses of an income propagation period equal, longer and shorter of 2 months. Clark's discussion of the consequences of the magnitude of the time lag on how long it will take to achieve a given percentage of the final multiplier effect, clearly shows his awareness of the implications of the relationship 6).

Then Clark turned his attention to the more familiar concept of "circuit" (or "income") velocity of money, which he defined as "the ratio between the total amount of circulating media in the country and the total

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[7] Keynes, in *The Means to Prosperity*, recognized the nature of the problem, but dismissed it on the following ground: "The amount of time which it takes for current income to be spent will separate each repercussion from the next one. But it will be seen that seven-eights of the total effects come from the primary expenditure and the first two repercussions, so that the time-lags involved are not unduly serious." [Keynes 1933, 343].

net volume of production, or the total national income, which those media of exchange serve to finance." [Clark 1935b, 96]. Drawing upon Angell's [1933] monetary studies, Clark estimated an average rate of circuit velocity of money of 1.6 per year which, in turn, corresponds to an average cycle of 7½ months for money to flow from a consumer through all the exchanges involved in producing the goods he buys and to get back to an ultimate consumer again. This velocity, however, does not remain constant at 1.6 per year. Clark provided convincing evidence showing that it varies in harmony with the business cycle, increasing with industrial revival and falling with industrial depression. Throughout his discussion Clark warned the reader that the "income propagation period" and the circuit velocity of circulation should not be confused. As he put it "the 6 cycles per year do not represent the velocity of circulation of anything, but rather the speed with which an increased velocity is transmitted through the economic system." [Clark 1935b, 88].

In assuming an income propagation period of two months, whereas the average circuit velocity of money (reckoned at 1.6 per year) implies a period of 7½ months, Clark was also assuming, as he put it, "that the volume of business increases faster than could be accounted for by the existing volume of purchasing media and their existing circuit velocity." Therefore, he argued, in order to finance a permanent increase in investment expenditure, either the circuit velocity of money must increase or business must acquire more circulating media through an expansion of credit, or both. Part of the task could be accomplished by the increased flow of savings injected into the system through the multiplier and which "may take effect in increased credit used by business in financing this expansion without bringing any increase in the volume of business beyond what the formula already calls for." But even if all the leakages were taken and "used" by business, a problem would still emerge. In fact, "[d]uring approximately the first year and a half […] the total amount of otherwise idle funds resulting from the leakages would not be sufficient to finance the indicated expansion of business at the existing rate of the circuit velocity of funds, and so an increase in the circuit velocity will be called for […]." [Clark 1935b, 95][8].

For Clark, also the analysis of the agents' behavior shows that the nature of the process can be seen to tend towards increasing circuit velocity. The actual mechanism whereby income changes in response to investment is explicated in terms of inventory accumulation or decumulation. As a consequence of the increase in effective demand caused by the new investments, sales will exceed production and producers experience an unplanned fall in inventory levels. They react by employing more workers and producing more: All of these activities – he wrote – call for payments:

> "If business has sufficient funds to make these payments it will joyfully make them. In a depression, the ratio of cash balances to volume of business becomes larger than normal […]. These balances are kept, not employed to normal capacity, because nothing better offers. When something

[8] Note that this is true under Clark's assumption, i.e., an income propagation period of two months and a multiplier equal to three.

does offer, they will be promptly used and an increase in rapidity of circulation will naturally result. If a particular business does not have sufficient funds, it will try to borrow them, and in that case will call into active use some of the otherwise idle funds which have been designated as leakages in the Keynes approach to the problem. Or if a business has sufficient funds to make the payments, but not sufficient to make them without drawing down its balances lower than seems desirable, then, again, it will try to borrow, but even if it fails it will not cease to do the increased volume of business […]. Most of the funds will circulate within the business community, using them faster will not exhaust them, and business as a whole will always have funds available to make payments" [Clark 1935b, 101].

In summation, Clark argued that an increase in circuit velocity is required both to provide funds to finance an increase in investment, and to meet the higher transactions demand resulting from the consequent increase in economic activity. On this basis, Clark concluded that the conditions described by Kahn and Keynes would themselves furnish a sufficient cause of increased circuit velocity of money, "simply because they cause an increased volume of business without a proportionate increase in volume of means of payment." [Clark 1935b, 101].

4. We can now develop Clark's argument through the model presented in the previous section. Taking into consideration the time-lag, we can define the flow of savings as follows:

$$S(t) = Y(t-\theta) - aY(t-\theta) - K \qquad 7)$$

Then, following Clark, we consider the gap between the demand for funds for investment at time t represented by expression 2) above, and the supply of savings at time t (out of income at time t-θ):

$$I(t) - S(t) = Y(t) - Y(t-\theta) \qquad 8)$$

If we calculate the gap for each period under the hypothesis of a permanent injection of one unit expenditure, we obtain:

$$\begin{aligned} I(0) - S(0) &= 1 - 0 = 1 \\ I(\theta) - S(\theta) &= 1 + \alpha - 1 = \alpha \\ I(2\theta) - S(2\theta) &= 1 + \alpha + \alpha^2 - 1 + \alpha = \alpha^2 \\ &\dots \end{aligned} \qquad 9)$$

that is:

$$1, \alpha, \alpha^2, \alpha^3 ...$$

which is the multiplier series for a single impulse[9]. Summing up the differences between investments and savings for each period throughout all the series, we find out that the additional funds required are just equal to the increased level of income. Clark was therefore justified in pointing out the dynamical discrepancy between leakages and injections: as shown by 9), the process described by the multiplier requires an increase in the *effective* supply of money in order to be financed. If such an increase is entirely provided by newly created money, and if there was no idle money before, the velocity of circulation will remain constant. Otherwise, the effective supply of money will adjust itself to the new exigencies through an increase in its velocity of circulation. Clark confidently endorsed this second alternative. In his opinion, "there is no absolute necessity at any stage of the process for government outlays to take the form of an increase in the supply of purchasing media. If the attitude here taken toward changes in velocity is correct – and of that the writer has no doubt – this necessity disappears." [Clark 1935b, 102].

It is also worth pointing out that – as shown by 8) – as long as the regular injection of one unit expenditure goes on permanently, it will become self-financing, in the sense of generating the necessary savings out of income. This is simply another way of stating the so called Kahn-Meade relation, namely the tendency of income to rise sufficiently for savings to become equal to investments. In this connection, Hegeland's [1966, 43-44] contention that in his treatment of the multiplier Clark does not seem to have recognized the Kahn-Meade relation appears questionable. In fact, as it appears from the above discussion, Clark's concern was not with a theory of equilibrium in terms of comparative statics where the secondary effects occur simultaneously. The novelty of Clark's contribution lies in its pointing out that, even if the *ex post equality* of the new streams of expenditure and the new streams of saving can be demonstrated, their distribution over time differs substantially, with savings being insufficient, at the outset, to finance the higher level of investment in each period. This, in turn, would necessarily imply an increase in the circuit velocity of money, provided that "there is no literal inflation of the amount of money sufficient to handle the increase in business without an increase in velocity." [Clark 1935a, 388]. Moreover, Hegeland fails to acknowledge that Clark can be shown to be perfectly aware that "if the leakages continued at a substantial rate, the "condition would be reversed" and the process described by the multiplier would generate enough savings to finance the permanent stream of investments; but – as Clark immediately warned – "by the time this happened, the total volume of business expansion would have passed under the control of factors not accounted for in the formula [Clark 1935b, 95]. For Clark, in fact, the multiplier

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[9] Similar results are shown by Goodwin [1947, 492].

had to be conceived just as a "rough approximation" – "No such mechanical formula can do justice to the many variable conditions affecting the problem." [Clark 1935b, 86] – whose "estimates of stimulative effects, based on such an approach as the Kahn-Keynes formula, are hardly worth carrying beyond, let us say, one year, even as rough approximations." [1935a, 387]. In Clark's view, the multiplier overlooked in particular one important long-period deterrent, namely, the impairment of business confidence by "unlimited" deficit financing and a possibility in the fall in private capital investment due to the expectation that growth of demand will cease after after deficit spending disappears.[10].

This is not the place to quarrel with the empirical validity of Clark's assumption about the behavior of velocity of circulation of money, debatable as it may be. What is relevant here is that to Clark the discussion of the so called "velocity approach" mainly served to arrive at an estimate of the time dimension of the multiplier effects, an aspect which, as he stated in his 1934 address, "has not been worked out, as far as I am aware." [Clark 1935a, 385]. After the publication of the *General Theory*, several economists, including its author, followed Clark in exploring in greater detail the dynamic implications of the multiplier, especially in relation with the so-called "finance motive." In 1936, for instance, Dennis Robertson in his comments on the *General Theory* argued, echoing Clark, that if the assumption of an instantaneous multiplier is abandoned, and if time lags are properly considered, then the Keynesian equality between savings and investment breaks down. Differently from Clark, however, Robertson emphasized the need for the monetary authority of adding at each period decreasing quantities of new active money, while keeping constant the income velocity of circulation of the existing one:

> "The point to be noted by those whose methods of thought are as old fashioned as my own is that in each period the Authority is conceived of as acting only partly (and decreasingly) by increasing the supply of money, partly (and increasingly) by maintaining the income velocity of the previously issued supply; i.e. by causing the savings of the public to generate income in circumstances in which they would otherwise failed to do so." [Robertson 1936, 172][11].

Three years later, citing another significant example, Nicholas Kaldor [1939] further developed Clark's argument – albeit without mentioning the name of the American economist – showing that, if the multiplier is

[10] See Wiles [1971] and Fiorito [2001].

[11] Interestingly, in another passage of the same article, Robertson, referring with approval in a footnote to Clark [1935a], adds: "[i]t seems to me doubtful whether, for the analysis of a fluctuating world, the 'multiplier' constitutes much advance over more crudely 'monetary' weapons of thought." [Robertson 1936, 175].

not instantaneous, the Kahn-Meade relation does not hold and arguing that a low propensity to save increases the size of the additional funds needed to finance a permanent increase in investment[12].

5. Clark's version of the multiplier was eminently practical: the principles underlying the cumulative effects of public spending were in fact developed and analyzed, by Clark's own admission [1935b, i-iv], not with an eye to theoretical consistency and elegance, but as guides to understand and policy. Nevertheless, Clark's contribution to the multiplier deserves our attention. Not only did Clark arrive at the formulation of the principle independently from Kahn and Keynes – as I attempted to show in another paper [Fiorito 2001] – but he was among the first writers, if not the first, who explicitly pointed out that the secondary effects do not do not occur simultaneously and to attempt a "period analysis"[13] of the multiplier even before the publication of the *General Theo*ry. As he wrote in a later reappraisal of his 1935 monograph: "The reader may note that my assumptions as to time are different from those which appear to underlie Keynes's form of this theory. *The kind of adjustment I have in mind does not appear to be one that can take place instantaneously*." [Clark 1941a, 47: emphasis added]. On the other hand, as we have pointed out, Clark considered the multiplier just as a "rough approximation;" a formula which would work only under ideal conditions. In more than one occasion [Clark 1941b; 1942, 9] he did not hesitate to warn his colleagues against the risks of "blind dogmatism," caused by an unqualified application of what – after the sixties – has come to be known as "hydraulic Keynesism."

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[12] In this connection, it is important to point out that the instantaneous *versus* lagged multiplier debate is still well alive among post Keynesians economists. In particular, the debate received new impetus after the publication of Moore's *Horizontalists and Verticalists* [1994] which triggered a whole controversy over the about the compatibility of Post-Keynesian theories of the multiplier, liquidity preference, and endogenous money.

[13] On period analysis, see Machlup [1939] classic contribution.

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