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A THIRD FUNDAMENTAL EQUATION FOR KEYNES'S *TREATISE ON MONEY*

BY
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Keynes abandoned the theoretical approach used in the Treatise on Money*, the fundamental equations approach, very soon after publishing the* Treatise*. One reason why he may have done so is discussed in this paper. Twice in 1931 someone pointed out to Keynes a third fundamental equation, one for the price of investment goods, an equation Keynes had not developed in the* Treatise*. This third fundamental equation may have shown Keynes that his fundamental equation approach may not be promising or fruitful.*

I. INTRODUCTION

Why did John Maynard Keynes discard the theoretical approach used in the *Treatise on Money* so quickly? The day he finished the *Treatise*, September 14, 1930, Keynes wrote his mother, "Artistically it is a failure—I have changed my mind too much during the course of it for it to be a proper unity. But I think it contains an abundance of ideas and material" (Moggridge [1973] 1987, p. 176).[1] In the *Treatise* the "fundamental equations [were] the heart of his theory" (Moggridge [1992] 1995, p. 485). In June 1931 Keynes gave three lectures entitled "An Economic Analysis of Unemployment" in the Harris Foundation lecture series in Chicago. In the second lecture, Keynes, in words, described his fundamental equations approach and said, "That is my secret, the clue to the scientific explanation of booms and slumps" (Moggridge [1973] 1987, p. 354).

Yet, within a few months Keynes was abandoning the fundamental equations approach and moving on. Why? Varied explanations have been given why Keynes discarded the theoretical approach in the *Treatise on Money* and started down the path that led to the

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[1]The *Treatise* was published on October 31, 1930.

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General Theory. One that has not been pointed out previously, though, and may have been an important factor, is that twice within six months in 1931 someone raised a question about Keynes's fundamental equations.

In the *Treatise on Money* Keynes developed two fundamental equations, one for the determination of the price level of output as a whole and one for the determination of the price level of liquid consumption goods. He did not develop a similar equation for the price level of new investment goods (Keynes [1930] 1971, pp. 121–124). Keynes did discuss the determination of the price level of new investment goods, but he argued that their determination was very different from the determination of the price level of output as a whole and the price level of liquid consumption goods. In the *Treatise* Keynes first stated that "the price level of consumption goods is entirely independent of the price level of investment goods" (Keynes [1930] 1971, p. 123), but a few pages later he qualified this statement.

In April 1931, Jagannath Narayan Welingkar, a student at Jesus College, Cambridge University, wrote Keynes to show him the development of a third fundamental equation, one for the price level of investment goods. Welingkar's fundamental equation for the price level of investment goods was developed similarly to Keynes's fundamental equations for the price level of output as a whole and the price level of liquid consumption goods. Plus, in Welingkar's fundamental equation the price levels of consumption goods and investment goods were directly related. A few months later, in a review of the *Treatise*, Friedrich A. von Hayek also presented the same fundamental equation for the price level of investment goods as Welingkar. Hayek later asked Keynes if this fundamental equation was a correct interpretation of his intentions.

Welingkar's and Hayek's showing Keynes this third fundamental equation for the price level of investment goods, one similar to Keynes's two fundamental equations and one for which the price levels of consumption goods and investment goods are directly related, raises a number of questions. As Keynes's biographer, Robert Skidelsky, commented, Keynes was "a punctilious correspondent" (Skidelsky [1992] 1995, p. 614). Keynes tended to respond to letters very quickly, and if for some reason he did not respond quickly he would tend to apologize for his tardiness; e.g., in July 1931 he apologized to John A. Hobson for taking over three weeks to respond to a letter, explaining that he had been in the United States and had just gotten the letter (Moggridge [1973] 1987, p. 330). One question is, did Keynes respond to Welingkar, acknowledging his letter and his development of a third fundamental equation? Also, did Keynes respond to Hayek, answering his question?

In the months after the publication of the *Treatise* two major points of controversy were Keynes's arguments that the determination of the price level of consumption goods was different from the determination of the price level of investment goods and the relationship between the two prices. In this post-*Treatise* discussion, did Keynes acknowledge Welingkar's and Hayek's fundamental equation for the price level of investment goods and its implications?

Most important of all, did this third fundamental equation bring into question Keynes's fundamental equations approach itself? As was mentioned above, Keynes did discuss the determination of the price level of investment goods in the *Treatise*; he had beliefs about how this price was determined. If the third fundamental equation of Welingkar and Hayek was not consistent with Keynes's beliefs about the determination of the price level of investment goods, perhaps this called into question the fundamental equations approach itself.

These questions are addressed in this paper. In section II Keynes's fundamental equations for the price level of output as a whole and for the price level of consumption goods from the *Treatise* are presented. In section III Keynes's theory of the determination of the price level of investment goods in the *Treatise* is discussed. Welingkar's letter, with his third fundamental equation, is presented in section IV. Hayek's third fundamental equation is discussed in section V. The post-*Treatise* controversy about the determination of the price levels of consumption goods and investment goods and the relationship between them are discussed in section VI. Conclusions are drawn in the final section.

II. KEYNES'S TWO FUNDAMENTAL EQUATIONS IN THE *TREATISE ON MONEY*

In the *Treatise* Keynes "had not then understood that, in certain conditions, the system could be in equilibrium with less than full employment" (Keynes [1936] 1998, pp. 242–243). There, as Keynes acknowledged, he was "primarily concerned with what governs *prices*" (Moggridge [1973] 1987, p. 145). Prior to the *Treatise* Keynes had used the quantity theory of money approach to explain the determination of prices, but he came to believe that the quantity theory was inadequate for this.

> The real task of [monetary] theory is to … exhibit the causal process by which the price level is determined, and the method of transition from one position of equilibrium to another. The forms of the quantity theory, however, on which we have all been brought up … are but ill adapted for this purpose … they do not, any of them, have the advantage of separating out those factors through which, in a modern economic system, the causal process actually operates during a period of change. (Keynes [1930] 1971, p. 120)

In the *Treatise* Keynes developed two fundamental equations, one to explain the determination of the price level of liquid consumption goods and one to explain the determination of the price level of output as a whole:

$$P = \frac{E}{O} + \frac{I' - S}{R},$$

and

$$\Pi = \frac{E}{O} + \frac{I - S}{O}.$$

Where P is the price level of liquid consumption goods,
E is the total money income or earnings of the community,
O is the total output of goods,
I' is the cost of production of new investment,
S is the amount as savings,
R is the volume of liquid consumption goods and services flowing on the market and purchased by consumers,
Π is the price level of output as a whole, and
I is the value of the increment of new investment goods (Keynes [1930] 1971, pp. 121–123).

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III. KEYNES ON THE PRICE LEVEL OF INVESTMENT GOODS IN THE *TREATISE*

Keynes did not develop a similar fundamental equation to explain the determination of the price level of investment goods in the *Treatise*. His explanation of the determination of the price level of investment goods was very different from his explanation of the determination of the price level of consumption goods and the price level of output as a whole: "The price level of investment goods … depends on a different set of considerations [than the price level of consumption goods]" (Keynes [1930] 1971, p. 121).

Keynes said someone who saves has two decisions to make. The first decision is the choice between present consumption and the ownership of wealth. The second decision is in which form to hold their wealth. "This second decision might be conveniently described as the choice between 'hoarding' and 'investing', or, alternatively, as the choice between 'bank deposits' and 'securities'" (Keynes [1930] 1971, p. 127). An individual's allocation between these two assets

> depends on his expectations of the future return to be obtained from savings deposits and from other securities respectively, which is obviously affected by the price of the latter—and also by the rate of interest allowed on the former. If, therefore, the price level of other securities falls sufficiently, he can be tempted back into them. If, however, the banking system operates in the opposite direction to that of the public and meets the preference of the latter for savings deposits by buying the securities which the public is *less* anxious to hold and creating against them the additional savings deposits which the public is *more* anxious to hold, then there is no need for the price level of investments to fall at all. Thus the change in the relative attractions of savings deposits and securities respectively has to be met either by a fall in the price of securities or by an increase in the supply of savings deposits, or partly by the one and partly by the other. A fall in the price level of securities is therefore an indication that the 'bearishness' of the public—as we may conveniently designate … an increased preference for savings deposits as against other forms of wealth and a decreased preference for carrying securities with money borrowed from the banks—has been insufficiently offset by the creation of savings deposits by the banking system—or that the 'bullishness' of the public has been more than offset by the contraction of savings deposits by the banking system.
>
> It follows that the actual price level of investments is the resultant of the sentiment of the public and the behavior of the banking system.… The price level of investments as a whole, and hence of new investments, is that price level at which the desire of the public to hold savings deposits is equal to the amount of savings deposits which the banking system is willing and able to create. (Keynes [1930] 1971, pp. 127–129)

Hayek, in a review of the *Treatise*, complained that "the exposition is so difficult, unsystematic, and obscure" (Hayek 1931a, p. 271), and Dennis Robertson, in discussing Keynes's discussion of investment, said "a fog is created" (Robertson 1931, pp. 399–400). This obscurity certainly applies to Keynes's discussion of the relationship between the price level of consumption goods and the price level of investment goods. Initially in the *Treatise* Keynes wrote that "the price level of consumption goods is entirely

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independent of the price level of investment goods" (Keynes [1930] 1971, p. 123). A few pages later, though, he wrote:

> the price level of consumption goods, relatively to the cost of production, depends *solely* on the resultant of the decisions of the public as to the proportion of their incomes which they save and the decisions of the entrepreneurs as to the proportion of their production which they devote to the output of investment goods—though both of these decisions, and particularly the latter, may be partly influenced by the price level of investment goods … the attitude of the public towards savings deposits and other securities respectively may be partly influenced by expectations as to the price level of consumption goods relatively to their cost of production. (Keynes [1930] 1971, pp. 129–130)

So here we have that the price level of investment goods may partly influence the price level of consumption goods and vice versa.[2]

IV. WELINGKAR'S THIRD FUNDAMENTAL EQUATION

On April 27, 1931, Jagannath Narayan Welingkar, a student at Jesus College, Cambridge University, wrote to Keynes:[3]

> Dear Sir,
>
> I wonder why you have not added a third fundamental equation to your two. I mean the equation for the price-level of investment goods: viz:
>
> $$P' = \frac{E}{O} + \frac{Q_2}{C} = \frac{E}{O} + \frac{I - I'}{C}$$
>
> This equation is obvious enough: but a proof can be quite easily given, as follows.
>
> $$\begin{aligned} P'C &= I \\ &= I' + Q_2 \\ &= \frac{E}{O} \cdot C + Q_2 \end{aligned}$$
>
> $$\therefore P' = \frac{E}{O} + \frac{Q_2}{C} = \frac{E}{O} + \frac{I - I'}{C}$$
>
> I daresay, you found it unnecessary to add this because you could say all you wanted to about the causal relations with the two equations for P and Π. Yet I am not quite

[2]Here, Keynes's explanations of the prices of consumption, investment, and output as a whole are just presented. For an analysis of the macroeconomics of the *Treatise* and the role of these three prices therein, see Dimand (1986).

[3]Jagannath Narayan Welingkar was a student at Jesus College from 1928 to 1931. He was class II.2 in the 1929 Economics Tripos Part I, class III in the 1930 History Tripos, and class II.2 in the 1931 Economics Tripos Part II. He received a BA in 1931.

Keynes had links with India throughout his career. His first position on leaving Cambridge University was in the India Office for two years, 1906 to 1908; his first book, published in 1913, was *Indian Currency and Finance*; he served on the Royal Commission on Indian Finance and Currency in 1913 and 1914; and in the decade after World War I he testified before two commissions looking at Indian exchange, currency, and finance. He also dealt with Indian students as a don at King's College (see Chandavarkar 1989).

> sure whether some arguments in the Treatise could not be considerably abridged with the use of this third equation. I cannot at the moment think of any concrete instances: but hope to find some when I read the Treatise again with this equation in my head. At any rate, I do think that this equation deserves a mention with the other two for the sake of completeness.
>
> Yours sincerely
> J. N. Welingkar (*Keynes Papers*, pp. TM/1/4/122-3)

In section II above E, I, I', O, P, and Π are defined. P' is the price level of new investment goods; Q_2, profit on investment goods; and C, the net increment of investment (Keynes [1930] 1971, pp. 122–124).

So here is a fundamental equation for the price level of investment goods, which is developed similarly to Keynes's fundamental equations for the price level of consumption goods and the price level of output as a whole. And in this third fundamental equation the price levels of consumption goods and investment goods are directly related. Both depend on the rate of earnings per unit of output, $\frac{E}{O}$, but more importantly a change in I', the cost of production of new investment, affects both prices. An increase (decrease) in I' increases (decreases) P, the price level of consumption goods, and decreases (increases) P', the price level of new investment goods.

V. HAYEK'S THIRD FUNDAMENTAL EQUATION

Even though Keynes, in his letter to his mother the evening he finished the *Treatise*, expressed his disappointment that "[a]rtistically it is a failure—I have changed my mind too much during the course of it for it to be a proper unity," reviewers praised the book[4] (Moggridge [1973] 1987, p. 176). For example, Josiah Charles Stamp wrote in the *Economic Journal* that the *Treatise* was a "new masterpiece of dynamic economics … [a] work of … remarkable force.… In many respects I regard Mr. Keynes' work as the most penetrating and epoch-making since Ricardo" (Stamp 1931, pp. 241–242). In the *American Economic Review*, Charles O. Hardy wrote that it "is a masterly analysis, comprehensive, penetrating, and extraordinarily free from minor errors" (Hardy 1931, p. 150). And John H. Williams, in the *Quarterly Journal of Economic*s, wrote:

> It is of course a substantial contribution to the literature of the subject. It exhibits a rare combination of penetration in theoretical analysis, grasp of mathematical statistical method, and felicity of expression … one of the most stimulating and attractive books I have read in recent years. (Williams 1931, pp. 547, 587)

The reviewers, of course, did criticize certain aspects of the book. One of the most critical reviewers was F. A. von Hayek, although he did believe that it was "a magnificent performance … and important book" (Hayek 1931a, pp. 294–295). Hayek wrote a long, two-part review (Hayek 1931a, 1932). He criticized the book for several reasons: "the exposition is so difficult, unsystematic, and obscure … the inconsistent use of

[4]See Dimand (1989) for a detailed "review of the reviews" of the *Treatise on Money*.

terms … the lack of a clear concept of investment—and of capital" (Hayek 1931a, pp. 271, 276). In his review Hayek had a diagrammatic version of Keynes's theory. In a footnote to this diagram Hayek presented Keynes's fundamental equations for the price level of total output and the price level of consumption goods. In addition, he presented a fundamental equation for the price level of investment goods, the same fundamental equation that Welingkar, in his letter, had sent Keynes. Hayek noted, "This formula [for the price level of investment goods] is not given by Mr. Keynes"[5] (Hayek 1931a, p. 283).

Hayek did not explicitly mention his fundamental equation for the price level of investment goods in his August 1931 review article. Keynes wrote a reply to this first part of Hayek's review of the *Treatise* (Moggridge [1973] 1987, pp. 243–256), to which Hayek wrote a rejoinder. In his rejoinder, among other points, Hayek asked, "Is the formula which I have substituted for P' [the price level of investment goods], for which Mr. Keynes gives no formula, a correct interpretation of his intentions … ?" (Hayek 1931b, p. 399).

Others also pointed out this third fundamental equation of Welingkar and Hayek. In November 1932 Bellikoth Raghunath Shenoy published an article showing its determination (Shenoy 1932). Shenoy published a second article in 1934, discussing the interdependence of the price levels of output as a whole, consumption goods, and investment goods (Shenoy 1934). Also Albert G. Hart, "following the line marked out by Dr. Hayek," developed Welingkar's and Hayek's third fundamental equation in an October 1933 article (Hart 1933, p. 632).

VI. ON THE RELATIONSHIP BETWEEN THE PRICE LEVELS OF CONSUMPTION GOODS AND INVESTMENT GOODS

In the months after the publication of the *Treatise* two major points of controversy were Keynes's arguments that the determination of the price level of consumption goods was different from the determination of the price level of investment goods and about the relationship between these two prices. Dennis Robertson, Richard Kahn, Piero Sraffa, and Arthur Cecil Pigou corresponded with Keynes concerning these points.

On January 7, 1931, just over two months after the *Treatise* was published, Robertson wrote Keynes, expressing some concerns that he had at that time about the *Treatise*: "I am still bothered by a group of subjects connected with 'the price-level of investment', the functioning of the rate of interest, and the synthesis of the new equations with those which bring in quantity and velocity.… If I can make my difficulties explicit, I shall try to put them into an article eventually" (Moggridge [1973] 1987, p. 202).

Four months later, on May 2, Robertson sent Keynes that article, which was ultimately published in the September 1931 issue of the *Economic Journal* (Robertson 1931). Much of the article was concerned with the determination of the price level of

[5]Hayek has the correct equation for P', but then incorrectly says this is equal to $W_1 + Q/C$. Rather than Q, total profit, it should be Q_2, profit on investment goods (Keynes [1930] 1971, p. 124). The rate of earnings per unit of output, W_1, is equal to E/O (Keynes [1930] 1971, p. 122).

consumption goods and the price of investment. "(I)t is, I think, the main source of weakness in the whole structure that Mr. Keynes has nowhere thought it necessary to reduce the forces determining P' [the price level of investment goods] to an equational form" (Robertson 1931, p. 398). Robertson also quoted Keynes's statement that the price level of consumption goods is entirely independent of the price level of investment goods but noted that Keynes later qualified this statement: "It seems, therefore, that we need not take (this) statement … too much to heart" (Robertson 1931, p. 398).

On April 5, 1931, so before Welingkar's letter to Keynes, Richard Kahn also wrote to Keynes, concerning the determination of the price levels of consumption and investment goods and the relationship between the two prices. Kahn's letter began, "A fundamental question that is offering considerable difficulty is how investment goods can be logically differentiated from consumption goods in regard to the manner in which their price level is determined"[6] (Moggridge [1973] 1987, p. 203). Three other times later that year Kahn also wrote to Keynes, on April 17, May 7, and August 15, concerning the determination of these two price levels and the relationship between them (Moggridge [1973] 1987, pp. 206–207, 212–213, 218–219, 237–238). The last two of these letters were after Welingkar's letter, and from Kahn's letters it does not appear that Keynes had shared with Kahn Welingkar's third fundamental equation for the price level of investment goods.[7]

In May of that year Sraffa and Pigou also exchanged letters with Keynes in which one of the points raised was the determination of the price levels of consumption goods and investment goods[8] (Moggridge [1973] 1987, pp. 207–211, 214–218). In a May 11, 1931 letter to Pigou, discussing the advantages of his equations in the *Treatise*, Keynes had stated, "I am enabled to distinguish the essentially different causes which affect P and P' respectively" (Moggridge [1973] 1987, p. 216). So again Keynes does not appear to be acknowledging Welingkar's third fundamental equation.

There is a puzzling comment by Keynes in a May 15, 1931 letter to Pigou, though. Pigou had written to Keynes, "I had understood you to argue … that the prices of consumption goods were determined in one way according to one formula and the prices of production goods, your P', by an entirely different formula" (Moggridge [1973] 1987, p. 217). Keynes responded that "the formula by which I arrive at P' is by no means fundamentally different from that by which I arrive at P" (Moggridge [1973] 1987, p. 217). This statement by Keynes seems more consistent with Welingkar's formula for the determination of P' than Keynes's approach in the *Treatise*.

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[6]Kahn was a member of the Cambridge "Circus," which was meeting at this time to "discuss, dissect, and of course, criticise the *Treatise*" (Moggridge [1973] 1987, p. 202). Presumably "how investment goods can be logically differentiated from consumption goods in regard to the manner in which their price level is determined" was also offering considerable difficulty to other members of the Circus, not just to Kahn.

[7]It is interesting that in 1978, when writing about "Some Aspects of the Development of Keynes's Thought," Kahn still does not appear to acknowledge the third fundamental equation of Welingkar and Hayek (Kahn 1978, pp. 549–550).

[8]Heinz D. Kurz discusses Sraffa's assessment of Keynes's determination of price levels in the *Treatise on Money*. "Sraffa disputed Keynes's confounding of securities and fixed capital items 'under the ambiguous name of 'new investment goods'" (Kurz 2010, p. 189). And Kurz criticized Keynes's "idea … that the price level of consumption goods and that of investment goods can be considered as determined independently of one another" (Kurz 2010, p. 186).

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In the September 1931 *Economic Journal*, in which Robertson's article mentioned above was printed, Keynes also published a rejoinder. In it Keynes wrote:

> Mr Robertson quotes me, correctly … as holding the view that if P, the price level of consumption goods, declines owing to an excess of saving over the cost of new investment, then there *need* be no counterbalancing rise in P', the price level of investment goods.… We are discussing the relation between the prices of consumption goods and of investment goods—whether, assuming no change in the propensity to hoard, the one must go down when the other goes up, like buckets in a well—which he affirms and I deny. (Keynes 1931, pp. 412, 419)

Keynes reiterated his explanation of the determination of the price level of investment goods from the *Treatise* but then he further explained:

> When, therefore, I said that the price of consumption goods relatively to the cost of production depends solely on the excess of saving over investment, and that the price of investment goods depends solely on the volume of savings deposits in conjunction with the degree of bearishness (or propensity to hoard), both statements were formally correct. But I ought to have added, to prevent misunderstanding, that I did not mean to imply that the price of investment goods is incapable of reacting on the excess of saving over investment, and hence on the price of consumption goods; or that the price of consumption goods is incapable of reacting on the volume of savings deposits or on the propensity to hoard, and hence on the price of investment goods. I meant only that the influence of the one on the other *must*, like the influence on them of any other factor in the total economic situation, operate *through* the excess of saving in the one case and the volume of savings deposits or the propensity to hoard in the other. (Keynes 1931, pp. 415–416)

So here Keynes is much more explicit about the relationship between the two prices than he was in the *Treatise*.

Neither in this rejoinder to Robertson nor in his correspondence with Kahn, Sraffa, and Pigou does Keynes appear to acknowledge Welingkar's and Hayek's third fundamental equation and its implications. Keynes does not acknowledge that his fundamental equation for the price level of consumption goods and Welingkar's and Hayek's fundamental equation for the price level of investment goods are similar in their development, that both depend on the rate of earnings per unit of output, $\frac{E}{O}$, and that with Welingkar's and Hayek's equation, a change in I' affects both prices.

Keynes did not publish a reply to the question that Hayek asked in his rejoinder to Keynes that was mentioned above: "Is the formula which I have substituted for P' [the price level of investment goods], for which Mr. Keynes gives no formula, a correct interpretation of his intentions … ?" (Hayek 1931b, p. 399). Also there is no letter published in Keynes's *Collected Writings* in which he answered this question. It does not appear that Keynes responded to Hayek's question. Also it does not appear that Keynes wrote to Welingkar, responding to his letter acknowledging his fundamental equation for the price level of investment goods. In the *Keynes Papers* related correspondence is typically located together. There is no letter from Keynes to Welingkar located with his letter to Keynes.

Keynes, of course, may have spoken directly to Welingkar, who, after all, was a student at Cambridge University, but that is unlikely. Welingkar almost certainly was not a member of Keynes's Political Economy Club since it "consisted of Keynes's closest colleagues in the Economics Faculty, graduate students and the best of the second- and third-year undergraduates" (Skidelsky [1992] 1995, p. 5). As was shown in footnote 3 above, Welingkar was not one of the "the best of the second- and third-year undergraduates." So Keynes most likely would not have had a chance to talk to Welingkar at one of the Political Economy Club meetings. As for a meeting with Welingkar at some other time, Keynes kept annual engagement diaries in which he listed his appointments. Keynes did not have an appointment with Welingkar at any time entered in his 1931 engagement diary (Keynes 1993, pp. PP/41/31/1-54).

VII. CONCLUSION

In an article entitled "Keynes's Principles of Writing (Innovative) Economics," Rod O'Donnell, based on Keynes's writings, develops seven of his underlying principles on the reading and writing of economics. The seventh is "Authors interested in intellectual progress will welcome criticisms and suggested improvements from readers whose minds have connected with the author's" (O'Donnell 2006, p. 403). Keynes himself had written, in his biography of Alfred Marshall, that "after all, there is no harm in being sometimes wrong—especially if one is promptly found out"[9] (Keynes [1933] 1972, p. 200). It does not appear, though, that Keynes acted consistently with this seventh principle in the situations analyzed in this paper. Based on Welingkar's letter quoted above, it appears that his mind had connected with Keynes, but Keynes does not appear to have welcomed Welingkar's suggested improvement. Keynes does not appear to have welcomed being shown a fundamental equation for the price level of investment goods, one that was similar to Keynes's two fundamental equations and one for which the price levels of consumption goods and investment goods were directly related. Hayek's and Keynes's minds certainly had not connected. Regardless, it appears Keynes also does not appear to have welcomed Hayek's suggested improvement concerning the fundamental equation for the price level of investment goods.

The obvious question is, why was Keynes apparently unwilling to accept this third fundamental equation for the price level of investment goods? The "*Treatise* was not a successful book" (Patinkin 1976, p. 32). It was half-baked.[10] Among other things, Keynes's treatment of investment in the *Treatise* has been criticized. Keynes's "whole concept of investment is ambiguous, and … its meaning is constantly shifting"

[9]In what Austin Robinson believes is an early draft of an introduction to the *General Theory,* Keynes wrote that "a candid author surely enjoys criticism which comes from a thorough understanding of his thesis" (Robinson 1972, p. 539).

[10]Keynes often used the term "half-baked" to describe a theory that was not fully developed. For example, in his biography of Marshall, Keynes wrote that "he was too little willing to cast his half-baked bread on the waters, to trust in the efficacy of the co-operation of many minds, and to let the big world draw from him what sustenance it could" (Keynes [1933] 1972, p. 198). In the case of the *Treatise on Money* Keynes did cast his half-baked bread on the waters. Joseph A. Schumpeter also, in discussing the *Treatise on Money*, commented that Keynes "was offering half-baked bread" (Schumpeter [1951] 1965, p. 277).

(Hayek 1931a, p. 274; also see Hayek 1932, p. 36; and Robertson 1931, pp. 399–400). In the *General Theory* Keynes himself admitted that

> 'bearishness' is there [in the *Treatise*] defined as the functional relationship, not between the rate of interest (or price of debts) and the quantity of money, but between the price of assets and debts, taken together, and the quantity of money. This treatment, however, involved a confusion between results due to a change in the rate of interest and those due to a change in the schedule of the marginal efficiency of capital. (Keynes [1936] 1998, pp. 173–174)

In his Michaelmas 1932 lectures Keynes stated that "bearishness of the *Treatise* … muddled up assets and debts against money" (Moggridge [1973] 1987, p. 412) and is "unsatisfactory" (Rymes 1989, p. 69). In the *Treatise*, under the term "investment," Keynes had lumped together a wide range of assets, capital goods, securities, and loan capital.[11]

As was seen in section III above, in the *Treatise* Keynes argued that the determination of the price level of investments depends on the choice by savers between bank deposits and securities and on the behavior of the banking system. In a January 1936 letter to Ralph Hawtrey, discussing commodities, Keynes wrote, "I do speak on this matter, not merely as a theorist, but from an extremely wide practical acquaintance with commodity markets and their habits" (Moggridge [1973] 1987, p. 627). The same could be said about Keynes's knowledge of financial markets. He had quite a bit of experience in financial markets, from investing for himself and as an advisor to a number of institutions. He was a very successful investor, both in his personal investments and in situations in which he had control of investment decisions. Keynes started investing in securities soon after he graduated from King's College, Cambridge University (Kent 2012). He continued investing in securities throughout his life. He personally made a fortune: at the time of his death he left net assets of just under £480,000, which Justyn Walsh estimated to be equivalent to $30 million in 2008 (Walsh 2008, p. 1). He also speculated in foreign exchange and commodities (Fantacci, Marcuzzo, and Sanfilippo 2010). He was Bursar of King's College for many years and in charge of their investments. There his investment record was excellent (Chua and Woodward 1983); in fact, it has been argued that as bursar his "investment management was … path-breaking" (Chambers and Dimson 2013, p. 226). He was on the board of two insurance companies and involved with the investment decisions of both: the National Mutual Life Assurance Company, of which he became the chairman, and the Provincial Insurance Company. He also was involved with a number of investment trusts (Moggridge 1983, pp. 30–36).

Keynes's investment philosophy evolved over time. Initially, in buying securities, it seems he was most concerned with dividends. In the 1920s he was a momentum investor, moving between assets based on the business cycle. Later he became a value investor, trying to purchase undervalued securities. The important point is that, with all his experience in financial markets, Keynes had beliefs about the determination of the price of various assets. Based on what has been described in this paper, apparently he did not believe that the third fundamental equation of Welingkar and Hayek captured the factors that determined the price level of investments that he was

[11]See Keynes ([1930] 1971, pp. 116–117) on why loan capital is included.

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analyzing in the *Treatise*. He was insistent that his explanation of the determination of the price level of investments was the more correct approach. After all, ultimately "some of the major features of ... [his theory of the determination of the price level of investment goods in the *Treatise*] was to become the theory of liquidity preference of the *General Theory*" (Patinkin 1976, p. 38).

Keynes has been praised for his willingness to accept, with extraordinary magnanimity, criticism of the *Treatise on Money* and to move on rather than stubbornly defend it (Robinson 1947, p. 40; Robinson 1978, p. 35). Donald E. Moggridge identifies three outside influences that he believes are pre-eminent as to why:

> Within a few months of publication [of the *Treatise*] … Keynes was moving on, rethinking the fundamental equations of the *Treatise* and developing the whole apparatus of analysis out of which, over the next few years, the *General Theory* emerged … three outside influences seem to have been pre-eminent: the worldwide slump after 1929, which moved the English 'local difficulties' of 1922–9 on to a broader stage, the general reception given to the *Treatise* and discussions in Cambridge during 1930–1. (Moggridge [1973] 1987, pp. 337–338)

In addition, there were a number of criticisms of Keynes's fundamental equations. Unlike with the *General Theory*, while writing the *Treatise on Money* Keynes did not send page proofs out to many people for comment. One person he did send the proofs to was Ralph Hawtrey. Hawtrey sent Keynes extensive, detailed comments. A fundamental comment Hawtrey made, concerning whether quantities or prices adjusted initially, was that "Mr Keynes's formula only takes account of the reduction of prices in relation to costs, and does not recognise the possibility of a reduction of output being caused directly by a contraction of demand without an intervening fall of price.… The sequence … assumed is *first* a fall of prices and *then* a contraction of output" (Moggridge [1973] 1987, p. 152). Instead, Hawtrey argued, "First there is a falling off of sales, then a reduction in the retailers' orders to the wholesale dealers, then a reduction of output, then a reduction of the price asked by the producer and only then a reduction of the retail price" (Moggridge [1973] 1987, p. 153). This, of course, calls into question Keynes's fundamental equations approach.

In the same letter Hawtrey "fashioned an explicit link between changes in income and savings" (Davis 1980, p. 718), stating that "it may be pointed out that the progressive contraction in the consumers' income could not fail to cause some falling off of savings" (Moggridge [1973] 1987, p. 152). In January 1931, in working paper no. 66 of the Macmillan Committee, Hawtrey "created a model where savings varied with output," giving a numerical example (Davis 1980, p. 720), and a year later, in his analysis of the *Treatise*, Hawtrey "made a further advance by presenting a similar model in symbolic form" (Davis 1980, p. 721; see Hawtrey 1932, pp. 350–359). Eric G. Davis credits Hawtrey, not Keynes, with these two innovations—"the implications of quantity rather than price adjustment, and … an explicit link between changes in income and savings" (Davis 1980, p. 718)—in the transition from the *Treatise* to the *General Theory*. The "implications of this step [changes in output] and, in particular, the effect on savings were missing from the analysis [in the *Treatise*]" (Davis 1980, p. 717).

Also, in the September 1932 *American Economic Review,* Alvin Hansen pointed out an error in Keynes's first fundamental equation for the price of consumption goods. As Keynes had written this equation, it would hold for subsequent years "only if technical progress proceeded at the same pace in the capital goods and consumption goods sectors" (Dimand 1989, p. 91). In the next issue of the *American Economic Review* Keynes showed two alternative ways this "error" could be corrected (Keynes 1932). In an October 11, 1932 letter, Kahn had written to Keynes, "I pointed this out to you years and years ago, but you refused to allow irrelevant difficulties to complicate your equations" (Keynes [1930] 1971, p. 331). Concerning this discussion about Keynes's error, Robert W. Dimand comments, "These discussions are of less interest than they otherwise might be because Keynes' two fundamental equations for the price level of consumption goods and of output as a whole are tautologies, true by definition" (Dimand 1989, p. 92).

Another reason why Keynes may have abandoned the fundamental equations approach, an untold part of the story, and perhaps an important factor, may be what has been described in this paper. After all, in the *Treatise* the fundamental equations were "the heart of his theory" (Moggridge [1992] 1995, p. 485). "Keynes saw in his 'fundamental equations of price' the major contribution of his *Treatise*" (Patinkin 1976, p. 50). Welingkar's and Hayek's third fundamental equation may have shown Keynes that his fundamental equations approach was not promising or fruitful. This may have been another factor in Keynes's being so willing to abandon the *Treatise*, and move on rather than attempt to correct the argument there.

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