

An Additional Note on the Harrod-Keynes Correspondence

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This note aims at complementing an article *HOPE* published in 1995 on the evolution of Roy Harrod's dynamic thought from the ideas expressed in the 1936 book on *The Trade Cycle* to the 1939 "Essay in Dynamic Theory" (Besomi 1995). The argument was based on the extensive 1937 and 1938 correspondence between Harrod and J. Maynard Keynes but assumed (as was suggested by Donald Moggridge, the editor of *The Collected Writings of John Maynard Keynes* [CW 14:320]) that the original draft of the "Essay" that was the object of the debate did not survive. Fortunately, this supposition proved incorrect: the manuscript draft was later found among Harrod's Papers in the Library of the Chiba University of Commerce in Ichikawa, Japan and is now published in this issue of *HOPE* (Harrod 1996).

The 1938 draft casts additional light on the specific changes Harrod introduced in the final version in response to Keynes's and Jakob

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Marschak's¹ criticisms, and on the internal structure of Harrod's "Dynamics." This note supplements my original argument.

The Origin and Implications of the Changes in the Final Version

Confidence and the Rate of Interest

In Besomi 1995, sections 5 and 8, I argue that while Keynes objected to Harrod's attempt to wrap up "the influence of the rate of interest in the state of technology" and to avoid reference to the state of confidence (Keynes to Harrod, 17 August 1938; CW 14:321–22), actually Harrod was following a different train of thought. Since his axiomatic approach presupposed the possibility of expressing investment as *determined* by some other variable, it required that all the relevant components be condensed into the appropriate parameters. A comparison of the first draft and the published version confirms that in the end Harrod did not identify those factors. When he explained the coefficient and the factors influencing long-range capital outlays, he merely added a clause specifying that, among "other conditions," the rate of interest and the state of confidence were to be included alongside technology (Harrod 1939, 18, 26–27).

Ex Ante

Keynes correctly pointed out that Harrod's use of *ex ante* was quite different from that introduced by the Swedish school (Keynes to Harrod, 17 August 1938; CW 14:322), thereby connoting a peculiarity of Harrod's notion of investment as being related not to the entrepreneur's *decisions* but to what, *ex post*, would be discovered to be the right thing (Besomi 1995, 333–36). Harrod objected that the use of the term was not yet well established and claimed his right to use it in a different sense (Harrod to Keynes, 7 September 1938; CW 14:337). Nevertheless, he introduced the following change. While in the manuscript *ex ante C* was defined as "that quantity of capital goods, which, if producers foresaw the total

development during the period, they would produce, or that which, if they do produce it, makes them feel satisfied that they have neither exceeded nor fallen short of the mark. For convenience *C* in this sense will be referred to as *ex-ante C* in this article" (Harrod 1996, sect. 6), in the final version, it was defined as "that addition to capital goods in any period, which producers regard as ideally suited to the output which they are undertaking in that period. For convenience the term *ex ante* when employed in this article will be used in this sense" (Harrod 1939, 19).²

Rather than stressing the difference between Lindahl's formulation and his own, Harrod rephrased his reference to the difference between the equilibrium and the actual investment, which, as Keynes acutely remarked, was Harrod's true concern.

The Warranted Rate

Keynes remarked that Harrod's use of the terms 'warranted' and '*ex ante*' could generate confusion and suggested that Harrod should stick to the former. Harrod objected that he reserved the use of 'warranted' to indicate "the unknown variable, the rate of growth, the value of which is found by solving the equation" (Harrod to Keynes, 7 September 1938; CW 14:336). Thus, Harrod added to the definition of 'warranted growth' given in the manuscript ("the warranted rate of growth is taken to be that rate of growth, which if it occurs will leave all parties satisfied that they have produced the right amount"; Harrod 1996, section 4) the qualification that they have produced "neither more nor less than" the right amount, and he also provided an alternative definition by appending to the previous definition the following sentence: "Or, to state the matter otherwise, it will put them into a frame of mind which will cause them to give such orders as will maintain the same rate of growth" (Harrod 1939, 16).

Here it must be remarked that Harrod went further than merely stating "the matter otherwise": he also added a postulate regarding the *behavior* of entrepreneurs, in case they should observe that the consequences of their decisions did not entail undesired accumulation or decumulation of stocks or insufficient or excessive provision of productive equipment.

2. Harrod specified that the same definition also applies to *ex-ante* saving (section 8 of the manuscript; p. 20 of the final version); this specification was also introduced to meet Keynes's remark that "*ex ante* saving is surely a chimera" (Keynes to Harrod, 17 August 1938; CW 14:323).

1. Harrod's paper in fact was sent not only to the editor of the *Economic Journal* but also to J. Marschak and D. H. Robertson. Harrod replied with two letters (Marschak Papers, Harrod file) to Marschak's "Remarks" (Harrod Papers, file V-113a) but there is no trace of detailed comments by Robertson on Harrod's manuscript, nor of a reply to him by Harrod.

As was correctly noted by S. S. Alexander (1950, 727–28) and later admitted by Harrod himself (see, for instance, Harrod 1951, 271–75), this postulate did not logically follow from the original proposition but rather was arbitrary (for a discussion of Harrod's reaction to Alexander's criticism, see Asimakopulos 1985, 627–28). In Harrod's view, statics was concerned with the determination of the equilibrium level of income and dynamics with the determination of the equilibrium rate of growth of income; both equilibrium states were seen as those states that *just* satisfy entrepreneurs and "induce . . . them to go on as before" (Harrod to Keynes, 7 September 1938; CW 14:336–37). While in statics this means maintaining the same flow of production, it cannot be assumed that in dynamics entrepreneurs necessarily need to stick to the same rate of growth. It is thus interesting to note that the first draft of Harrod's "Essay" was free of this logical slip.

Normal and 'Proper' Warranted Rates

Without comparing the original draft with the final version of the "Essay," Keynes's comments from section 14 of the manuscript onwards (CW 14:325–27) are virtually unintelligible. In fact, the notion of 'normal warranted rate' disappeared from the published article and was replaced by the notion of "'proper' warranted rate"—whose definition was different from the former—while Keynes—besides giving a new definition of the normal warranted rate—introduces the notion of "temporary warranted rate." Moreover, Marschak's comment also indicated that he did not understand the idea of a normal value of the warranted rate.

Harrod introduced the notion in section 13 of the manuscript: "this special value of G_w may best be thought of as that which would obtain if the actual rate of growth had coincided with the warranted rate for some time" (Harrod 1996). In those conditions, the propensity to save, s , can be thought of as representing "the normal habits of individuals and companies with regard to saving," while the investment coefficient per unit increment of output C is not subject to the distortions affecting it during the slump so that "it may be supposed to be influenced mainly by technological considerations and the regular trend of consumers' choice." Harrod's notion of a 'normal value of the warranted rate' thus seems to imply two different conditions. It requires that for some time, actual and warranted rates coincide. Alternatively, it supposes that some 'normal' state of the economic system as distinct from the 'distortions' that may

be caused by displacements of the actual rate from the normal 'path' thus defined. This concept translates the idea that the upward phase of the cycle constitutes an *actual* process of equilibrium growth; G_w , on the contrary, represents a *notional* idea of equilibrium, for it does not describe what actually happens but only the rate of growth that would *not* lead to undesired accumulation or decumulation of stocks.³ In this sense, the normal warranted rate is closer than G_w to the idea of steady growth that Harrod advanced in his *Trade Cycle* where, as Keynes noted while discussing Harrod's book, the argument seemed to be expressed "as though the conditions of steady growth were satisfied during the boom and the inherent improbability or impossibility only came into existence with the end of the boom" (Keynes to Harrod, 12 April 1937; CW 14:173). The definitional link between the normal warranted rate and the upward phase of the cycle, however, does not imply that the normal value of G_w is constant: as G_w itself fluctuates in the course of the cycle, its normal value depends on the actual conditions of growth experienced by the country in each particular recovery, and may change in the course of the recovery itself (for instance, as income grows, a higher propensity to save and higher interest rates may be considered normal).

It is important to notice that the notion of normal warranted rate implies the flow of a considerable amount of time—that is, the time span necessary to allow s and C to stabilize at a semi-permanent level—and is therefore related to long-period considerations,⁴ while G_w refers to

3. For such an interpretation of the difference between the concepts of equilibrium in *The Trade Cycle* and the "Essay" see Besomi 1995, 318–24; 333–36. For a different view, see Kregel 1980, 104–10.

4. It is extremely difficult, and can also be dangerously misleading, to trace the origin of the notion of "normality" with regard to long-period consideration; but at least two sources must be mentioned concerning Harrod since they were both related to his dynamics and in both cases involved him directly.

One of them appears in a discussion Harrod had with Robertson not long before starting to work on the "Essay," on the notion of a long-period normal state of the economy relating to an advancing society. The issue arose from Harrod's comments on an article by Robertson in which he tried to classify the different attitudes of economists as to the usefulness of the notion of a "normal" state of affairs and the economists' different suggestions about the monetary policies apt to sustain such a state (Robertson 1938). In a letter to Harrod, Robertson accused neo-Keynesian analysts of completely and unnecessarily throwing overboard the whole notion of the distinction between long-period or normal states, which he regarded as unduly revolutionary (Robertson to Harrod, 23 July 1938; Harrod Papers, file IV-990-1069d-55). In his response, Harrod correctly pointed out that Robertson was "still thinking in static terms," meaning "the long period of Marshall;" in his article, Robertson considered in fact a long-run equilibrium state defined in terms of the *level* of the relevant magnitudes. This is what Harrod maintained to be statics (on the methodological origin of Harrod's peculiar notions of statics and dynamics,

a single instant. This notion was therefore appropriate for discussing whether, in the long run, the near-equilibrium actual growth rate prevailing during the recovery was compatible with the ceiling imposed by the natural rate of growth (that is, the limit to actual growth defined by full employment of factors and depending on the growth of population, availability of new technologies, etc.). Harrod, in fact, introduced the idea of the normal warranted rate in connection with these problems (in particular for the discussion of inflation in section 18 of the manuscript). But Keynes was right in pointing out that in the second part of the "Essay" Harrod was "drifting in some confusion between short- and long-period equilibrium" (Keynes to Harrod, 17 August 1938; CW 14:325). Both Marschak and Keynes, for instance, noticed that in paragraph 14 (i) of the manuscript, the cumulative divergence referred not to the actual and normal warranted rate, but to the actual and warranted rate tout court (Keynes to Harrod, 17 August 1938; CW 14:326; Marschak, "Remarks," 12).

Keynes therefore proposed to distinguish between "normal warranted" and "temporary warranted" rates of output, the former being defined as the particular warranted rate associated with a given propensity to save, state of confidence, rate of interest and state of technology; the latter being "that rate which is in fact the warranted rate so long as the actual

see Besomi 1997). He therefore opposed Robertson's notion with the idea of a "normal trend," and thus questioned the pertinence of an approach "in terms of successive adjustments to a long period static equilibrium." Harrod considered this issue to be of particular importance, and, in fact, the theme of the inadequacy of the reduction of steady increase to a succession of states of stable equilibria for the analysis of growth and the plea for a new method of approach, appear in section 3 of both versions of the "Essay" (Harrod to Robertson, 3 August 1938, Harrod Papers, file IV-990-1069d).

A second idea of "normality" in a long-period context is found in a formula Keynes proposed in 1937 to represent Harrod's mechanism of the cycle as devised in *The Trade Cycle*. I have analyzed the connections and the differences between Keynes's and Harrod's formulas (Besomi 1995, 318–24); it suffices here to observe that Keynes suggested that Harrod implied that the acceleration coefficient "has, so to speak, a normal long period value which is a function of the rate of interest," and proposed to discuss the cycle in terms of self-sustaining deviations of the actual from the normal value of the coefficient (Keynes to Harrod, 20 April 1937; CW 14:177–78). Although there were some analogies to the subsequent formulation of Harrod's instability principle, it must be noted that the latter was based on a comparison between actual and instantaneous warranted rates. Both Keynes and Harrod's normal values, however, referred to long-period equilibrium growth; Keynes's notion, therefore, was not subject to the objection of being static in Harrod's sense. On the other hand, while Harrod's idea of normality presupposed that for some period the system actually grew at a rate close to the equilibrium one, Keynes's concept of normality did not imply such a coincidence but only constituted a reference for the study of departures from normality. Finally, Keynes's notion did not refer to full employment.

rate of investment is maintaining its excess over the normal, warranted rate of investment" (Keynes to Harrod, 17 August 1938; CW 14:326–27).

Keynes's proposal, of course, was not going to make things clearer (in his own words, "this is rather a rigmarole"). Harrod therefore turned to another notion, different from those advanced before, and to which he also gave a new name: "Consideration may be given to that warranted rate which would obtain in conditions of full employment; this may be regarded as the warranted rate "proper" to the economy" (Harrod 1939, sect. 16, p. 30).

The new idea was clearly more appropriate in the discussion of the chronic tendency toward unemployment and the policies to address it, but it had a drawback. In fact, instead of facing the problem of the relation between short- and long-period considerations, by getting rid of the normal value of G_w , Harrod eliminated from his trade cycle theory the only link with the flow of time. Therefore, while in the manuscript, Harrod could partially substantiate his claim that the "Essay" was "a development and an extension of certain arguments advanced in [his] Essay on the Trade Cycle" (Harrod 1996, sect. 1; 1939, 14 n.1), in the published version only the accelerator and multiplier mechanisms remained,⁵ and the approach to the study of their interplay was quite different. In his book and to a minor extent in the first draft of the "Essay," Harrod was concerned with the causal links between entrepreneurs' decisions and the actual processes resulting from their interaction,⁶ while the final draft concentrated instead on the *ex-post* registration of the instantaneous (and therefore timeless) difference between actual and equilibrium growth rates, disregarding the processes bringing about such divergence (for a detailed examination of this aspect, see Besomi 1995, 329–33).

The Two Drafts and the Structure of Harrod's Dynamics

The major changes between the original draft and the published version of Harrod's "Essay" occur in the central part of the text, while the beginning

5. As regards the accelerator, moreover, it must be noted that its interpretation changed radically from *The Trade Cycle* to the "Essay" (see Besomi 1995).

6. In the part of the manuscript related to the trade cycle, Harrod also argues in terms of "forces" or "determinants," which disappeared from the ultimate version of the "Essay" but were the core of the treatment of *The Trade Cycle*, where 'forces,' 'causes,' and 'determinants' were synonymous (compare Harrod 1996, section 15, where Harrod listed the forces tending to influence the warranted rate during depression and also referred to the "shift away from profits," *The Trade Cycle*'s second dynamic determinant).

and the end were only subject to minor alterations (see table 1 in Harrod 1996). These three parts precisely correspond to the three stages Harrod thought to characterize the procedure of “mature sciences.”⁷

The first stage consisted of the analytical work necessary to provide a *simultaneous* conspectus of the economic field; the purpose of this analytical map was to “reduce chaos to order” (Harrod 1938a, 390) by means of a classification of economic material. This stage only regarded a single instant; a number of circumstances (“the fundamental data”) were taken as given. In the second stage, he considered “how changes in the fundamental data . . . will govern the course of events” (398), so that “general laws concerning the *succession* of phenomena” (386, 398) could be derived. This stage characterized fully developed sciences. Only after such a body of ‘causal laws’ was established would prediction and the offer of policy advice be possible (Harrod 1938a). Correspondingly, Harrod’s “Essay” was divided as follows: first, the determination of the dynamic equilibrium in one instant and the discussion of its stability (sections 1–11 of the manuscript; the simplified case was discussed first, and in sections 10 and 11 long-range capital outlays and foreign trade were considered). In this stage, the fundamental conditions, that is, the propensity to save and the coefficient *C*, are taken as given. Second, the succession of events occurring in the trade cycle is studied (sections 12–21 of the manuscript): in the second stage, variations in the fundamental conditions not only were allowed but played an important part in the argument. Third, economic policies are discussed (sections 22–25) in light of the preceding analysis, according to the relative positions of natural and normal (and later “proper”) rates of growth.

In the final version of Harrod’s paper, the three stages follow in succession without being clearly demarcated.⁸ In spite of Harrod’s precise

7. In a manuscript found in Harrod’s papers at the Chiba University of Commerce (files V-70, V-71), it clearly emerges that Harrod was already thinking of knowledge—including scientific knowledge—as founded on the inductive principle. This manuscript consists of 14 chapters of a still untitled and unfinished book; it is undated, but the cataloguers of Harrod’s papers attribute it to being circa 1939 (see Riley-Smith 1982, 114). This is probably correct, since many expressions used by Harrod are identical to those appearing in his 1938 methodological essay. Moreover, from a letter Harrod wrote to Robertson on 5 July 1938, it clearly emerges that the main topics of his presidential address—such as to squeeze out “anything I might have had to say about recent monetary literature”—were ‘deduction, induction’ etc. (Harrod to Robertson, 5 July 1938, Harrod Papers, file IV-990-1069d).

8. This was also due in part to the introduction of section 10 before the end of “dynamics proper.” There, in order to prove that the warranted growth rate is unstable, Harrod assumed the possibility of changes in the propensity to save, which should pertain to the second stage

warnings,⁹ it escaped the attention of its first interpreters that dynamics, in the strict sense, exclusively deals with instantaneous states, while the succession of events is a matter for the second stage. Moreover, the implicit assumption Harrod introduces regarding the entrepreneurs’ reaction in the face of unplanned changes of stocks lead to the supposition that some hypothesis regarding the causal sequence was a necessary component of his dynamics.¹⁰ On the one hand, there arose a debate regarding the proper assumptions to be considered, and, on the other hand, there have been attempts to formulate Harrod’s ideas in terms of mathematical models. For this purpose, Ragnar Frisch’s notion of dynamics is certainly more suitable because it directly translates the needs of the functional equations’ formalism. This, together with the dramatic compression of the treatment of the cycle within a couple of short sections of the last version of the “Essay,” was bound to lead to the unfortunate textbook interpretation of Harrod’s dynamics as a definition of paths of growth (see, for example, Sen 1970, 10–12). The debate then turned to the long-period suitability of the assumptions that characterize Harrod’s instantaneous formulation. Harrod himself refuted the “knife-edge” interpretation of his dynamics, but it was only after the publication of the Harrod-Keynes correspondence that this view was consistently challenged (Kregel 1980, where the debates on growth theory are also discussed). In his defense to Keynes’s assaults, Harrod stressed the peculiarity of his analytical

of analysis. The confusion did not escape G. L. S. Shackle’s attention, who accused Harrod of introducing a lag at this point and thus of being inconsistent with his claim that dynamics only regards a single instant (Shackle 1967, 261). But of course at the time, Shackle could not have known of the Harrod-Keynes correspondence, which was not published until 1973).

In spite of the alterations introduced in the final version, the distinction between different analytical stages and the logical priority of the first over the second stage did not escape Jan Kregel’s attention. He thus reached a conclusion similar to my own about the origin of the misinterpretation of Harrod’s notion of dynamics (Kregel 1980, 114, 121).

9. Harrod distinguishes his own approach from the econometricians’ “who define dynamics as having a cross-reference to two points of time” (1939, 21) and he provided reasons “for regarding the dynamic analysis as a necessary propædeutic to trade-cycle studies” (1939, 21). In this respect, the omission from the final version of the “Essay” of section 19 of the manuscript (Harrod 1996) is quite unfortunate because there Harrod discusses the role of lags in the different stages of his dynamics.

10. Such assumption is indeed necessary in order to prove the instability principle, for stability analysis requires the comparison of at least two states of the system; Harrod, however, seemed to believe he proved that instability was a necessary corollary of his instantaneous dynamics: Harrod claimed that all he needed was “to assume that [the coefficients *s* and *t*] are determinate at any given point in order to demonstrate instability” (CW 14:336).

method; this, in turn, stimulated scholars to read his 1939 “Essay” in light of his 1938 methodological article.

The first draft strengthens instead the tie of dynamics with the methodological paper,¹¹ since Harrod himself twice very sharply demarcates the line between “the strictest part of dynamic theory” and the considerations regarding the cycle, which “involve a certain element of conjecture”.¹² In fact, at the end of section 11, he declares: “The strictest part of the theory ceases here.” The first 11 sections of the manuscript, therefore, are the hard core of Harrod’s dynamic theory and passed practically intact through Keynes’s criticism.

The concluding sections of the “Essay” were also not substantially altered by Harrod’s revision. Here, Harrod examines what policies would be suitable in case of a divergence from the normal to the natural warranted rate, showing particular attention to the case he thought to be representative of modern conditions, that is, a normal rate higher than the natural rate. The choice of preserving these sections nearly intact probably reflected two of Harrod’s major concerns about practical policy in the prewar years. First, Harrod saw the problematic decline of the growth rate of the population (that is, of one of the components of the natural growth rate of the economy) as “one of great urgency (some would say the most serious which confronts the present generation)” (Harrod 1937, 12) and devoted much energy to advocating policies to stimulate fertility.¹³ Second, shortly after beginning to work on the first draft of the “Essay,” Harrod engaged in a controversy on the pages of the *Economist*, the *Times* and the *Financial Times* about the appropriate policy to counter the 1937–38 recession. The publication of the “Essay” was, therefore,

11. Harrod first thought of methodology as a subject for his presidential address in January 1938 when he wrote to Keynes that he was “thinking of doing a heavy methodological piece about statics & dynamics, the scope of pure theory, the place of induction’ etc.” (Harrod to Keynes, 24 January 1938, J. N. Keynes Papers, file EJ/1/2/123). The paper was ready around mid-June; at that time, Harrod also announced that he had the “Essay” “on the stocks [. . .] for the December number” of the *Economic Journal* (Harrod to Keynes, 13 June 1938; file RES/1/2/123).

12. These quotations come from the end of section 9 of the manuscript where Harrod was anticipating that, in one of the next sections, he would explain “how the . . . centrifugal forces are eventually checked” (Harrod 1996).

13. From 1936 to 1939 Harrod wrote essays on population trends and problems (Harrod 1938b, 1939a, and 1939b), many articles for, and letters to, the popular press (including to the *Times*, the *Spectator*, and the *Evening Standard*), and also planned to write a book on the subject (he had contact with four publishers). The impressive quantity of correspondence and documents on the population problem that Harrod preserved (among his papers in Ichikawa) testifies to the extent of Harrod’s fears about the gravity of the problem.

an occasion to provide theoretical ground for his diagnosis presented on the basis of intuitive reasoning.¹⁴

Keynes’s “editorial preference for something short” and Harrod’s own concerns about the length of his paper thus inflicted damage upon the central part of the “Essay,” that relating to the trade cycle. Sacrificing these sections undoubtedly also reflected the confusion surrounding Harrod’s notion of the normal value of the warranted growth rate. At any rate, the consequences of the deletions have been most unfortunate because for many years it was not understood that Harrod’s dynamics were elaborated in view of a theoretical treatment of the business cycle—although this necessarily involves “a certain element of conjecture” (Harrod 1996, section 9)—and when it was finally appreciated, the richness of his original analysis escaped the commentators.¹⁵

Only in 1950, in his review of Hicks’s book on the trade cycle, did R. M. Goodwin lay the foundations for considering Harrod’s theory as a forerunner of the nonlinear cycle models; but the main nonlinearity was found in the ‘ceiling’ and ‘floors’¹⁶ that limit the working of the instability principle.¹⁷ Of course, the published version of the “Essay” states quite clearly that the warranted rate of growth is not given definitively, but

14. Harrod described the situation in terms of the “mutually aggravating forces” (“The Boom and the Slump. II. Trade Cycle,” *Manchester Guardian*, 28 July 1937, p. 11) leading to the “vicious spiral of depression” (“Meeting a Trade Recession. Case for Monetary Reflation. Cooperation by the Banks,” *Times*, 11 August 1938, p. 11) to which the principle of instability gives theoretical expression. Harrod first advanced his claims in a letter to the *Economist* (9 July 1938) and later in an article for the *Times* cited above, which was also reprinted as a pamphlet. Following this article, the debate was quite intense and continued all summer, showing the extent of Harrod’s involvement in the discussion of the current policy topics (the newspaper cuttings were preserved by Harrod, together with other correspondence on the subject, and are now collected in Harrod’s Papers).

15. It is interesting to note that the threefold division of analysis is also reflected in the different degrees of fluency with which Harrod actually wrote. The first and the last sections of the manuscript show only minor amendments—all of them regarding rephrasing and verbal adjustments. But the central part is quite messy, with frequent additions, deletions, and insertions (and insertions within previous insertions) of new and long portions of text (sometimes entire paragraphs). The application of the instruments of dynamic analysis to the trade cycle must therefore have been quite painful for Harrod; on the other hand, it seems clear that he already had in mind the general structure of the argument.

16. It might be interesting to note that the terms “ceiling” and “floor” did not appear in the published version of the “Essay,” but they did in the manuscript.

17. This interpretation by Goodwin at first referred to Hicks’s theory; on his part, Hicks recognized that his model characterized by explosive behavior of the variables limited by a “ceiling” and a “floor” was largely inspired by Harrod’s dynamic theory. On the interpretation of the history of formal economic dynamics as a cumulative process of progressive introduction of nonlinear components, see Besomi 1992.

rather that it changes in the course of the cycle, due to variations in the fundamental conditions C and s ; this feature, however, was not given much weight by the interpreters of Harrod's theory. From the manuscript, on the contrary, the nonlinearity of the mechanism postulated by Harrod is striking. In section 15, for instance, Harrod discusses three "forces at work all tending to depress the warranted rate while income falls," while in section 16 he considered the forces tending to influence G_w during recovery.¹⁸

The nonlinearities were so evident that Marschak, the econometrician, could undoubtedly have gone further than Tinbergen did in his review of *The Trade Cycle*, where Harrod's mechanism—interpreted as a linear, first order difference equation—was criticized for not being capable of producing fluctuation but only cumulative growth (Tinbergen 1937). Marschak, on the contrary, besides pointing out to Harrod that a linear approximation for his supply and demand functions for saving could not give rise to oscillations, also recognized that a nonlinear mechanism was responsible for the periodicity of the solution. He only asked Harrod to state explicitly his postulate regarding the changes in C as a function of actual growth or of the divergence between actual and warranted growth rates (Marschak, "Remarks," manuscript, 4, 7).¹⁹ With regard to the interpretation of Harrod's cycle mechanism, from the original draft of Harrod's article Marschak drew a deeper insight than subsequent commentators.

Under these premises, the final revision was bound to leave everyone dissatisfied. From the econometricians' viewpoint, Harrod's model had been deprived of its most interesting feature (although it must be considered that their mathematical knowledge would not have allowed them to develop it anyway, since techniques of nonlinear analysis were

introduced in economics only much later, and their importance was not immediately recognized). Keynes was disturbed by Harrod's disregard for the role of time in economics (this was the topic of his last letter to Harrod on the "Essay") and by his treatment of the issues connected to this aspect (see, for instance, Keynes's comments on Harrod's neglect of the importance of the state of confidence, or on his peculiar definition of *ex ante*). Harrod himself, during the course of the correspondence, was unable to understand Keynes's objection.²⁰ In the end, his disappointment in not having been able to convince his friend turned to bitterness when, in his last letter, he announced to Keynes the final mutilation of the "Essay." These changes set up the strange fate of Harrod's theory, for the separation from the methodological foundations paved the way for its interpretation merely as a theory of economic growth.

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20. "You seem to have some substantial objection to my argument which I am quite unable to see. I cannot feel my mind will move in the coming months since I cannot comprehend the force of your criticism" (Harrod to Keynes, 22 September 1938; CW 14:342).

18. With regard to Marschak's attempt to represent graphically the functions of the various rates of growth, Harrod specified that "I find it hard to depict warranted growth since it may have various ups and downs within one cycle, being high in the early revival, for instance, because of surplus capacity, and again later on because of high saving" (Harrod to Marschak, 7 September 1938, Marschak Papers, file Harrod).

19. Marschak's "Remarks" are paraphrased in Young 1989. Unfortunately, in Young's rendition, the emphasis was shifted from 'linearity' to 'simplicity,' so that it does not emerge that Marschak correctly identified in the assumption of linearity the cause of the incapacity of a system of differential equations to give rise to oscillations (169). Marschak's observation, on the other hand, is really important, since it shows that the econometricians were already aware of the limits of linear analysis. This suggests that Le Corbellier's (1933) article, on the importance of nonlinear analysis, did not pass unnoticed. However, one may doubt that Harrod's mathematical knowledge would have allowed him to appreciate the point.

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