Statics and Dynamics in Harrod’s Trade Cycle

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1. Introduction

Roy Harrod gathered the analytical components of his dynamic model of the trade cycle between Fall 1934 and Summer 1935. While reading a draft of what eventually became the first part of Gottfried Haberler’s League of Nations research on Prosperity and Depression (Haberler, 1934), he learned of the possible application of the accelerator to the trade cycle, after having been deceived for years by Pigou’s rejection of its usefulness for that scope.1 What survives of his correspondence with Richard Kahn and John Maynard Keynes shows that in March 1935 he started experimenting with the new tool, trying to work out the connection between capital, interest and technical progress, although it is not possible to assess the degree in which he succeeded (Kahn to Harrod, 6 and 23 March 1935, and Keynes to Harrod, 21 and 28 March 1935).

Harrod’s 1934 correspondence with Kahn shows that up to the end of that year Harrod was not aware of the direction Keynes’s thought was taking. In particular, he failed to understand the implications of the multiplier for the causal relationship between saving and investment (several letters to and from Kahn, between 15 October and 24 November 1934). He did not seem to return to the subject for the next few months, so I would tentatively suggest that only after reading the General Theory in proof in July and August 1935 did Harrod become

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1. Harrod complained to Robertson that while in part VI, ch. 2 of the first edition of Economics of Welfare Pigou (1920) admitted that the accelerator accounts for the greater amplitude of the fluctuations of capital goods with respect to consumption goods, he denied ‘that it can be regarded as a true cause of the cycle’. Harrod remembered that ‘In the days when I first read it I was very much over-awed by Pigou’s authority and tended to accept what he said uncritically. I remember accepting and even expounding that view of his, and for a number of years, it put me off the scent’ (25 December 1936).
aware of the Keynesian idea that any change in investment gives rise to an
increment of income sufficient to generate an amount of saving equal to the
initial change in investment.

The idea that the interrelation between the multiplier and the accelerator
may provide a trade cycle mechanism must have occurred to him towards the
end of 1935: it is first mentioned in a paper written in December 1935 which he
read to members of the British Import Union in Copenhagen on 10 January
1936, while on his return from Denmark he received James Meade's comments
on the first two chapters of The Trade Cycle, where the core of the model was
already outlined. The book was in proof by early June and in book shops by the
beginning of September 1936.

Harrod's reflections on the trade cycle, however, began a decade earlier (see
Young, 1989 for an account of the surviving documents on the subject). His
analytical results were not innovative, as we can expect from a man in his late
twenties and early thirties whose mind was also occupied with several other
activities. However, his considerations on the correct procedure to analyse
economic movement (clearly stated in 1925) and on the character of an
appropriate explanation of the cycle (expressed for the first time in 1934)
eventually provided the core of his dynamic theory. The Trade Cycle was
Harrod's first attempt to work out these premises into a complete model of
business fluctuations.

Harrod's reasoning unfolded on different levels, because the problems he
was facing spanned from the very possibility of a science of dynamics, to the
correct mode of approach to economic movement, to the choice of the appropri-
ate toolbox, and finally to the properties of the object of the study (for
convenience, in what follows I will label these levels with the adjectives
'epistemic', 'methodological', 'analytical' and 'ontological' respectively, all
obviously used in a somewhat loose sense). Harrod's notion of dynamics thus
involved not only the characterisation of the features of a dynamic economy, but
also (and primarily) specific reflections on the conceptual and analytical instru-
ments, on the relationship between the theory and the object of research, and on
the relationship between scientist, theory and object. Harrod did not keep these
levels of his reasoning distinct, so that his notion of statics and dynamics—as
expressed here and there in his four decades of writing on the subject—seems
to vary according to which aspect he emphasised in the specific context. The few
commentators who cared to point out the peculiarity of Harrod's notion of
dynamics, as distinct from that suggested by Ragnar Frisch and soon accepted
by the majority of economists, often stressed one aspect only, sometimes
understanding Harrod's dynamics as being defined with respect to the presence
of saving and investment and thus of growth (e.g. Hansen, 1952; Nardozzi,
1983), or to the presence of a rate of growth among the unknowns (e.g. Hansen,
1949; Kregel, 1971), or again to the continuity of change (Robinson, 1949;
Hansen, 1949; La Tourette, 1964).

The purpose of this essay is to disentangle these components of Harrod's
early reflection on these problems, in order to show how his notion of dynamics
and his model of cyclical growth were organised around the idea that the
instability of equilibrium is the essential ingredient for an appropriate expla-
nation of economic movement. I will proceed as follows. In the first section, I expose Harrod’s early methodological and epistemic reflections on the procedure and the very possibility of trade cycle theorising. In the following section I outline the argument of *The Trade Cycle*, before showing in the section after that Harrod’s toolbox was adapted and devised to suit the methodological and epistemic premises he had set out earlier. The next three sections are dedicated to the characterisation of Harrod’s notions of statics and dynamics, by counterposing the features resulting from the different levels of his reasoning (Section 5) and by examining the connection between static and dynamic laws (Section 6) and the specific mechanism linking static and dynamic forces (Section 7). In Section 8, I point out the existence of a gap between the cognitive structure of Harrod’s model and its analytical counterpart. I conclude by regretting that Harrod himself, and therefore also his commentators, later disregarded the theme of the interaction of static and dynamic forces, thereby relegating to the background reflection on the conditions of possibility of trade cycle theorising.

2. Methodological and Epistemic Premises of Trade Cycle Theorising

Harrod manifested his interest in trade cycle theory very early in his career. Since his first surviving contribution on business fluctuations, an unpublished essay on ‘The trade cycle and the theory of distribution’ (Harrod, 1925), Harrod posed a methodological premise to trade cycle theorising to which he remained faithful when developing the essential ingredients of his dynamic model. He asserted that the methodologically correct approach to business fluctuation is ‘to explain with precision why the volume of production is at any time what it is’ before inquiring on the causes of its variations.

Before plunging into an investigation of all the many alleged causes of the alternating expansion and shrinkage in the volume of trade, ought we not to ask: what in any case are the circumstances which cause the volume of trade to be what it is, neither more nor less? It is absurd to express surprise at the oscillation of an object, while ignorant of what the forces are which determine its movement or its stability. (Harrod, 1925, p. 1)²

In his 1925 essay Harrod attributed the failure of classical economists to explain the cycle precisely to their incapacity to answer satisfactorily this preliminary question. In contrast, Harrod thought that the marginalist approach of Jevons ‘and the modern theory’ ‘gave an outline of the answer to this question’ (Harrod, 1925, p. 1).

Before proceeding further, it is important to notice that, once the problem is posed in these terms, the choice of the partial equilibrium approach (for this, in the version circulating in Cambridge in the mid-1920s, is what Harrod meant by ‘modern theory’), as the key to the preliminary step of trade cycle theory, was

² Harrod insisted on this point in his more mature writings on dynamics: see for instance Harrod, 1934a, p. 465, and 1936b, p. 1.
the natural one, given Harrod’s theoretical formation.\(^3\) On the other hand, the identification of two problems—the determination of the level and of the causes of variation of output—was not the logically inevitable outcome of Harrod’s intellectual environment, nor was it the only possible methodological choice: Robertson, moving from a similar background, reasoned in terms of period analysis, while Frisch, Tinbergen, and Kalecki moved from a different premise and therefore developed a dissimilar method of approach to the same problem. The division into subsequent stages thus constitutes a pre-analytical premise of Harrod’s dynamics. It shaped, at the outset, the posing of the problem of the cycle in the terms, peculiar to Harrod, which the following sections of this essay aim to elucidate, with particular regard to his first systematic attempt at developing a dynamic theory.

From the end of the 1920s, Harrod worked at the problem of the determination of the level of output, which he tackled in terms of a generalised version of the Marshallian toolbox. His reflections on imperfect competition aimed to extend the domain of application of the partial equilibrium approach to the exhaustive continuum of situations ranging from monopoly to perfect competition. In Harrod’s view, orthodox theory was thought to determine, given certain fundamental conditions (cost and utility functions),\(^4\) the price and the level of output which maximised the profit of individual entrepreneurs. The traditional theory of value, generalised by allowing different inclinations of the demand curve, and by relating price and marginal costs in equilibrium by means of the elasticity of demand, thus outlined the scope of determining the amount of production of the individual firm and of the industry. It therefore constituted not only a preliminary stage to, but also the foundation of, any inquiry on the trade cycle, which—in accordance with the methodological premise—Harrod could not possibly renounce (Besomi, 1997).

Having established the fundamental conditions on which the level of output depends, the determination of the causes of its fluctuations immediately ran into a problem, for two alternatives could be considered: trade oscillation could be attributed either to rhythmic fluctuations in the fundamental conditions, or to some other force superimposed on the operation of the fundamental conditions. In his 1925 essay, Harrod had tried the first line of attack, analysing the behaviour of population, technology and distribution of income in the course of the cycle. By 1934, however, he had changed his mind, on the grounds that such an approach would simply have shifted the need for an explanation to the causes of the periodic and regular fluctuations of the fundamental conditions. This argument is worth examining carefully for it eventually provided the epistemic foundation of his dynamics.

The issue concerning the problem of the stability of the equilibrium level

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\(^3\) Although himself an Oxford man, Harrod was brought up in the Cambridge tradition: in 1922 he was tutored by Keynes for a term, and the influence of Keynes’s *Tract* stands out in several of his early writings (see Young, 1989, ch. 1). Later, when using the term ‘traditional’ or ‘orthodox’ theory, Harrod referred to the textbook version of the Marshallian theory of value as it was commonly taught in Cambridge in the mid-1920s (Harrod only rarely referred to Marshall himself; the explicit reference below in this section is Harrod’s own, but represents one of the rare exceptions).

\(^4\) I am here using Harrod’s later terminology, which reflected Pigou’s (1935, p. 4).
of output was left untackled in Harrod’s previous contributions on imperfect competition theory. There, Harrod had discussed the factors affecting the gradient of the cost and demand curves in correspondence to the equilibrium level of production, but had neglected the problem of the stability of the equilibrium point resulting from the entrepreneur’s policy of profit maximisation.

To study this aspect, Harrod reasoned as follows.\(^5\) To simplify matters, he considered an economic system where there are only two firms,\(^6\) whose products in equilibrium are exchanged in a certain proportion. Next, Harrod supposed that, while cost and demand conditions remained unaltered, one of the two firms casually abandoned the position of equilibrium. He then examined the consequences of such deviation from equilibrium on relative prices and on the firms’ subsequent decisions regarding the scale of production. He found the ultimate effect to depend on the cost structure of the firms. If both firms operated in conditions of decreasing returns,

the old position of equilibrium will be a stable one. Any fortuitous contraction of either industry may induce a temporary contraction in the other but will set up forces impelling both to revert to the old position. (Harrod, 1934a, p. 466, emphasis added)

If, instead, competition was not perfect and increasing returns prevailed, then when one of the firms reduces its output the other one finds it convenient to mimic this behaviour and permanently diminish its own level of production.

Thus they may chase each other indefinitely until they chance upon some new equilibrium position at a level of output, which may be much lower than the old one. The old equilibrium will prove not to have been a stable one. (Harrod, 1934a, pp. 466–467; italics mine)

Harrod’s result,\(^7\) by disassociating the notions of equilibrium and stability emancipated the concept of equilibrium from the idea of rest. This entailed important consequences for the possibility of explaining economic change within the framework of traditional analysis.\(^8\) As long as equilibrium is stable, to account for an enduring departure from such a state one has to appeal to some mechanism alien to the laws of value. As an example of the search for *ad hoc*

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\(^5\) Harrod’s argument was long-winded and somewhat involved. I will therefore only expound it in its broad outline, referring the interested reader back to Harrod, 1934a, pp. 465–467 for the details.

\(^6\) Harrod affirmed that ‘the argument from a two industry situation may be extended by like reasoning to the situation in which there are a large number of industries’ (Harrod, 1934a, p. 467).

\(^7\) Harrod’s original discussion of returns in conditions of imperfect competition can be found in 1931. The conclusion that increasing returns may imply instability was already drawn by Young (1928, in particular pp. 533–534). For a discussion of Harrod’s theory of imperfect competition in the light of the development of his dynamics, see Besomi, 1993 and 1997.

\(^8\) This problem was also posed in similar terms by Löwe in 1926, in an article in German in which he asked how trade cycle theory is altogether possible (Löwe, 1926). Although Löwe’s influence indirectly extended to the English language area via his influence on Hayek’s writings of the late 1920s and early 1930s (see Hagemann, 1994), and in spite of an extensive discussion by Kuznets, who also summarised Löwe’s criticism of Pigou (Kuznets, 1930b, pp. 387–390; a reference was also provided in Kuznets, 1930a, p. 128), I doubt Harrod was aware of it. In any case, his solution radically differed (both at this early stage, and later) from Löwe’s, which treated technical progress as the endogenous factor which makes for fluctuations.
causes of business cycles, Harrod cited Pigou’s psychological interpretation advanced in his *Industrial Fluctuations*.

So long as the equilibrium of output as a whole is regarded as stable, departures from it in one direction by conjoint action are essentially connected with the prevalence of error. The error is explained by an abnormal psychological condition. The continuance of recession or over-expansion depends on the persistence of error. Once the error is clearly seen the departure from the long period position of stability is corrected. Other factors may indeed supervene upon the psychological one and be responsible for a longer duration of the departure than the psychological factor would account for. But to that extent the explanation of the cycle ceases to be psychological. (Harrod, 1934a, p. 469)

If, on the contrary, one recognises that in conditions of imperfect competition and decreasing costs, equilibrium is quite unstable, and the economic system can settle on different levels of output according to the state of confidence, the explanation of the cycle does not require reference to exogenous causes. Thus if error is to play any part in the theory, it may be used to account for the initial step. One downward step having been taken by one individual or a group of individuals from error, the rest follows from logical and not psychological reasons. On this explanation error may be called in as a *deus ex machina* to explain the original impetus to a movement; thereafter its services can be dispensed with. While, if perfect competition is postulated, the *deus ex machina* has to be maintained in operation, until the reverse movement begins. The prolonged persistence of these errors is surely an unreasonable hypothesis. (Harrod, 1934a, p. 470)

Harrod thus thought that imperfect competition provided ‘the key […] for solving the mystery’ (Harrod, 1934a, p. 465) of the cycle by introducing the (epistemically) necessary element of instability within the system. He soon realised, however, that other approaches could be interpreted as pointing in the same direction.

A few months after ‘Doctrines of imperfect competition’ was published, Harrod was engaged in correspondence with Haberler on a preliminary draft of Haberler’s inquiry on trade cycle theories commissioned by the League of Nations (Haberler, 1934, unpublished). Harrod complained that Haberler had not paid due attention to Keynes’s *Treatise on Money*, and argued that the importance of this work for trade cycle theory lay on the epistemic level, for it supplied an instability mechanism capable of explaining the cumulative departure from the equilibrium position:

The orthodox view is that if a market price diverges from a natural, forces are set up to bring the market price towards the natural. The case of interest is a special application. Ah, but in the case of credit, it may be objected, this tendency is obstructed if the banks artificially increase (or decrease) supply by their credit policy. But Keynes claims to show that the rates do not tend to converge even if the banks do not artificially alter the supply. Surely if that is right, it is very interesting and important. The puzzle of the cycle is that when a departure from equilibrium occurs, *the system tends to move further from and not back to the equilibrium position*. This movement seems contrary to the principles of supply and demand. Now if Keynes shows that these principles don’t operate in the case of interest, which clearly lies at the heart of the
system, it would seem that he is supplying just the very kind of explanation that is required. Why don't the principles of supply and demand operate? Well, that simply takes one to the heart of his theory, where I can't go in this letter. Suffice it to say here that I do feel a lacuna in your summary, in that you do not note that there is someone professing to give—for reasoning not obviously and palpably absurd—just the very kind of explanation which a rational account of the trade cycle requires. (Harrod to Haberler, 19 October, 1934; emphasis supplied)

On the grounds of this argument, Harrod renounced his earlier attempts to explain the cycle in terms of fluctuations of the fundamental conditions, and reverted to an approach based on the study of the stability of the system. For this second line of attack to be consistent with the methodological premise, it was necessary in the first place that the forces responsible for the oscillations of output were compatible with the forces determining the level of production. Thus, on the one hand, Harrod investigated the possibility of accounting for the phenomena of the trade cycle by means of the 'general theory of value' (Harrod, 1936a), while on the other hand he found it intuitive that in general terms the solution of the problem required, among the fundamental conditions, the presence of an element capable of counteracting any stabilising force that would keep the system permanently tied to a state of rest. Therefore, Harrod's instability principle (to which, in the form of the 'knife edge', Harrod's dynamics owe most of their fame), before being an analytical result, constitutes a postulate of his reasoning.

The consequences of Harrod's approach only emerged in full in his book on The Trade Cycle, where he was able to solve the problem of the nature of the forces responsible for the variation of the level of output and of the precise relationship between these and the determinants of the level of activity. Harrod in fact attributed different ontological, analytical, methodological and epistemic status to these groups of forces, and distinguished their domain of pertinence by different names: dynamics and statics. This aspect is of extreme importance for a discussion of the origins and early development of Harrod's dynamics, for it lies at the heart of the very concept of 'dynamics', and will thus be the topic of the later sections of this paper. Before proceeding further, however, it is necessary to summarise Harrod's argument in the light of his reflections on the possibility of constructing a theory of the trade cycle.

3. The Trade Cycle

The structure of The Trade Cycle reflects Harrod's methodological principle, according to which the analysis of the trade cycle has to provide answers to two questions, the first preliminary to the second: what causes the level of output to be what it is? And what determines its rate of increase? As to the first problem—discussed in Chapter 1 of the book—Harrod found the reply in the orthodox (static) analysis of utility and productivity, which he reformulated in terms of forces inducing (or inhibiting) the individual producers to expand their output. In Chapter 2, he treated the second (dynamic) problem applying the same
approach, that is, by individualising a set of forces responsible for the maintenance, expansion or reduction of the rate of increase of output.

In the opening chapter of his book, dedicated to the quest for the factors determining the level of output, Harrod began by examining the considerations guiding an isolated producer (Robinson Crusoe on his desert island) in his decision as to whether or not to undertake an additional piece of work. He progressively generalised his conclusions for the case of members of a community where products are exchanged (in markets where competition is not necessarily perfect), where capitalists hire workers, and finally where payments are made in money rather than in kind. At the end of this process, Harrod found four static determinants:  
(i) The rate of pay at which prime factors are secured. 
(ii) The efficiency of prime factors. 
(iii) The elasticity of demand for commodities. 
(iv) The general price-level’ (Harrod, 1936b, p. 50). These are the factors producers consider when deciding whether to use their machinery more intensively and/or to hire more workers in order to increase output.

None of these forces, whose strength depends on the actual output, directly determine the level of output, but they only regard the motives for increasing (or decreasing) production; the analogy with the Newtonian forces, causing the acceleration (and not the velocity) of the body, is precise. The first three determinants, and the three associated laws, tend to exert a stabilising effect, in the sense that once equilibrium is reached they discourage abandoning it, while the fourth determinant acts in the opposite way. Equilibrium is the state in which incentives and deterrents balance each other, so that no tendency to change in either way can predominate; in such a case, the producers are satisfied with the prevailing state of affairs. Equilibrium would be stable if any deviation from it would set in motion the tendency to return to it. It would be unstable if, on the contrary, the forces corresponding to the new state would give motive to move further from it. It would be neutral if the new position was indifferent (i.e. if in the new position incentives and deterrents still balanced each other).

Fluctuations and growth of output require as a premise that the level of output can change, without being permanently tied to an equilibrium level. The actual occurrence of the trade cycle thus forbids the attachment of the attribute of absolute stability to equilibrium. Equilibrium must also not be treated as absolutely unstable for this would imply restlessly cumulative growth or depression characterised by systematic irrational behaviour on the part of entrepreneurs. For Harrod the solution lay in the middle: the equilibrium level of production must be conceived as neutral, so that the static determinants will accommodate to whatever the forces responsible for movement decree. In other

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9 It is important to notice that throughout his book, Harrod treated as equivalent the terms ‘determinant’, ‘cause’ and ‘force’. Indeed, in the vast majority of occurrences the term force was associated with the term cause (or effect) or with verbs such as to determine, to ordain, to prescribe, or to govern. A couple of examples will illustrate the case: ‘... the kind of forces that ... cause the level of activity to be what it is’ (Harrod, 1936b, p. 1); ‘the rate of interest must so move as to provide a force which, when operating conjointly with the forces exerted by the propensity to save, the elasticity of the demand for goods, and inventions, causes the three dynamic determinants to justify a continuance of the advance’ (Harrod, 1936b, p. 116). The significance of this equivalence will be discussed in Section 4 below.
words, the static forces must balance over the whole field, and in particular the destabilising influence of the monetary determinant (the general price level) must exactly compensate for the stabilising effect of the other three determinants. For instance, while in a boom—whose causes have still to be explained—the first three determinants tend to counteract the advance, this tendency is offset by the increase of prices: ‘the destabilizing influence of money embodied in the ups and downs of prices may be taken to be a measure of the power of the other three stabilizing forces’ (Harrod, 1936b, p. 43).

Turning to the causes of movement, in his Chapter 2 Harrod considered two mechanisms whose interaction provides the origin of advance: the accelerator (‘Relation’, in Harrod’s terminology) and the multiplier. The former is an arithmetical relation, linking the need for new capital goods to the expectations of demand for consumption goods, and the latter is the doctrine according to which the amount of saving accommodates to the new net investment through changes in the level of income. Their interaction can be best illustrated by means of the scheme in Fig. 1.

The symbol $\Delta C_t^{e_t^{t-1}}$ represents the increment of consumption for time $t$ as expected at time $t-1$, $\Delta$ as usual indicates an increment, $I$ and $Y$ stand respectively for net investment and income.

Harrod had a propensity for interpreting the progress of society in terms of rates of growth (Harrod, 1934b, part II). A similar result was also the natural outcome of the interaction of the multiplier and the accelerator, which requires one to compare the rates of increment involved by the Relation (investment and rate of increase of consumption), and the absolute magnitudes involved by the multiplier (investment and level of income). In particular, Harrod was interested in asking his dynamic mechanism the same questions that traditional theory asked the static system: does there exist some equilibrium rate of growth, possessing the same attributes as static equilibrium? If so, what can we say about its stability?

The procedure followed by Harrod was strictly analogous to that pursued in his reinterpretation of static analysis as a system of forces. His first problem was therefore that of recognising the set of forces determining the magnitude of the effects of expected increases in consumption on net investment, and of net investment on income and thus on consumption. The three dynamic determinants were: (i) the propensity to save, (ii) the distribution of income, and (iii) the quantity of capital necessary for the production of a unit of output involved by the method of production in use. As in the static case, the value of the
determinants is not given once and for all, but varies with the state of affairs: 'there is reason to believe that people tend to save a larger proportion of a higher income', while 'experience is that there usually is a shift to profit in a pronounced upward movement' (Harrod, 1936b, p. 92), so that one can expect the value of the multiplier to fall in the course of a boom and to rise during depressions. On the other hand, new investments provide the occasion to introduce new productive techniques (Harrod, 1936b, pp. 93–94), so that in the course of an advance the amount of capital per unit of output might increase, thus augmenting the quantity of required investment and so possibly counteracting the restrictive force of the other two determinants.

Again analogous with the case of statics, equilibrium corresponds to the contingency in which the dynamic forces balance each other, and is characterised by a steady rate of growth. It is easy to see that in such a circumstance the increase of consumption due to the new net investment is such as to give employment to the capital goods exactly in the measure that was desired by the capitalists on the grounds of their expectations regarding future demand. In other words, the entrepreneurs feel satisfied with the results ensuing from their investment decisions, and—unless a change in the value of the determinants occurs—they feel disposed to continue along the same path of advance.\footnote{It must be noticed that Harrod's conclusion depends on his implicit assumptions regarding the formation of expectations; this aspect will be discussed in Section 4 below.} The analogy with statics also holds regarding the fact that the dynamic determinants do not directly control the rate of growth of income, but only establish 'whether the existing [...] rate of advance is to be increased, maintained or diminished' (Harrod, 1936b, p. 92).

If the dynamic equilibrium was stable, the model would not describe a cycle, but only self-sustained growth at a constant rate. Consistent with his reasoning regarding the stability of static equilibrium and the possibility of growth, Harrod thus maintained that the moving equilibrium cannot be stable: in fact, in his theory there is no mechanism ensuring that the expansive influence of the third dynamic determinant will always balance the restrictive influence of the other two (Harrod, 1936b, p. 104); on the contrary, when disappointment of expectations first occurs, entrepreneurs react by slowing down the rate of investment, with the downward cumulative consequences that can easily be followed iterating the causal chain summarised in the above schematic representation. The depression, however, will reach a lower limit, for the necessity of replacement and the decline of the rate of interest may give scope to the introduction of more capital-intensive methods of production, after which revival is likely to occur (Harrod, 1936b, pp. 100–101).

4. Static and Dynamic Forces, and Equilibrium

With The Trade Cycle, Harrod was able, for the first time, to translate his epistemic considerations regarding the possibility of a theory of the cycle into an analytical mechanism and a corresponding methodological framework. The result was not only an original model of business cycles, but also the implicit
definition of a new concept of economic dynamics, associated with a new notion of equilibrium.

In the previous section, I hinted that the method and the analytical procedure of Harrod’s dynamics were developed in continuity and in strict analogy with the method and procedure of statics. The notion of statics itself, however, was not simply transposed from some other domain or adapted from previously existing definitions given by other authors. On the contrary, Harrod founded it anew on the basis of a re-interpretation of the scope and limits of the traditional theory of value. The notion of Dynamics, in turn, was developed as a complement to Statics, in order to provide the instruments necessary to tackle the problems left unsolved by static theory (Besomi, 1997). This premise suggests that the study of the properties of Harrod’s dynamics cannot take as a starting point the countering of statics and dynamics, because these notions co-evolved in the development of Harrod’s thought. The appropriate starting point must rather be the considerations which induced Harrod to regard the traditional instruments of thought inadequate for providing an explanation of the cycle.

Given the fundamental conditions (the state of preferences, technique etc), the orthodox supply and demand analysis postulated the existence of mechanisms determining the stable equilibrium levels of prices and quantities, so that any attempt to produce more or less would set in motion forces tending to bring the old situation back. In such a mode of thought, the only way to conceive fluctuations or growth of output would be to imagine that the ‘fundamental conditions’ alter accordingly, e.g. by waves of optimism and pessimism, or by systematic mismanagement of the banking policy. Harrod explicitly refused to accept such attempted solutions as true explanations of the cycle:

We do not suppose the cycle to be governed by cyclical variations in the fundamental conditions (utility functions, cost functions etc.). There may be some variations there, but we reject them. (Harrod to Keynes, 7 April, 1937, in Keynes, 1973, p. 169)

As a matter of fact, the orthodox solution negates a dynamic approach by excluding from its own premises the possibility of change as a peculiarity of the economic system, relegating its cause to mistakes, on the part of the authority in the evaluation of the interest of the community or on the part of entrepreneurs in evaluating their own convenience. Equilibrium was thus conceived as a natural state of the system, towards which any accidental deviation would be attracted; in order to be enduring, any other configuration should be sustained by a cause operating permanently.

Harrod’s approach was meant to provide a reply to two needs left unanswered by the approaches following the traditional line: on the one hand, ‘motion’ must be conceivable as a state of the system capable of existing without the necessity of being supported by the action of some ad hoc cause, and on the other hand changes in output must be consistent with the rational pursuit of the entrepreneurs’ self-interest, in the form of maximisation of profits. Correspondingly, on the one hand Harrod revised the notions of motion and equilibrium, and accordingly devised a discipline of economic dynamics with its own method
and domain of application capable of dealing with it; on the other hand, he also revised the traditional static approach in order to make dynamics consistent with it.

As to the first of these problems, I think the best way to understand Harrod’s line of attack is to regard it as analogous to the Galilean rejection of the Aristotelian physics. According to the latter, different bodies reside in their ‘natural’ place and correspondingly move according to different laws of motion: heavenly bodies move in circles and terrestrial bodies in straight lines, heavy bodies fall while light bodies ascend. Any movement along a different, unnatural path could occur only if an impelling force was imposed on the body, and could persist only as long as the impulse persisted. In this conception, movement thus needed a medium in which to take place: hence the indispensable role of air in sustaining motion by perpetuating the cause of its occurrence. Motion was thus conceived as a process of change which could not spontaneously occur or automatically protract unless, and only as long as, the action of its cause or motor persisted. Galileo substituted the Aristotelian notion of motion with an entirely different concept: by opposing the uniformly accelerated motion characterising a perfect sphere rolling down a smooth, inclined surface to the uniformly retarded motion in the case of the same sphere rolling up the surface, he imagined that the sphere rolling on a horizontal, frictionless surface would maintain its constant velocity; in such a concept air, instead of supporting motion, was seen as an obstacle. Galileo’s achievement thus presupposed the elimination of the very factors that enabled motion to occur in the Aristotelian concept (see Koyré, 1966, part III). For Galileo’s contemporaries, his notion of motion was quite paradoxical. It is therefore not surprising that Galileo did not himself formulate the principle of inertia, though his mechanics were implicitly based on it: its full sense and implications were first fully understood only by Descartes, and later the principle was given pride of place in the first Law of Motion that opened Newton’s Principia. This affirms that ‘every body continues in its state of rest or of uniform motion in a straight line, unless it is compelled to change that state by forces impressed upon it.’ The notion of a self-sustaining status of motion, as opposed to the concept of motion as a process maintained by some external action, is the true core of the distinction between the physics of Newton and Galileo on the one hand, and the Aristotelian physics on the other (for a discussion of the notion of status see Koyré, 1965, pp. 66–67).

The analogy with Harrod’s notion of moving equilibrium (Harrod, 1936b, p. ix) is precise: as Galileo substituted the Aristotelian argument, in terms of impressed force (impetus) and displacement from the natural place of a body, with a reasoning based on velocity and direction, Harrod abandoned the traditional (e.g. Pigou’s) explanation, in terms of exogenous and persistent causes of divergence from equilibrium, to replace it with a reasoning in terms of

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11 This analogy, however, was not explicitly pursued by Harrod; it is only a device to illustrate his detachment from traditional theory. I would stress that by comparing Harrod’s rejection of certain aspects of the traditional approach and the Galilean argument against the Aristotelian physics I do not wish to overemphasise the novelty of Harrod’s proposal. In fact, although Harrod himself thought his dynamics to constitute a genuine revolution, his approach was explicitly meant to rescue all the valid elements of orthodoxy; this aspect is discussed in Besomi, 1997.
self-perpetuating rates of advance. Harrod’s equilibrium growth is in fact a state of ‘inertial’ motion, in the sense that once the system is in such a state, its motion persists without the need for additional causes sustaining it. At this juncture, the problem was not that of figuring out the process leading to such a state of affairs, but to assume as a starting point its abstract possibility\textsuperscript{12}, in order to determine the conditions compatible with it, and to study its stability.

To understand this crucial step of Harrod’s reasoning it is necessary to reflect on his reformulation, in terms of static determinants, of the principles at the foundation of the partial equilibrium approach. The traditional schedules of demand and supply were derived respectively from the individual’s considerations regarding the relative utility of money and of goods, and from the firm’s cost function. Harrod resolved these factors in their elementary components, and treated them as independent forces\textsuperscript{13} acting on the entrepreneurs’ decisions regarding increments or decrements of production. His argument was thus expressed in the Newtonian language of vectorial forces conceived as causes of change. The static determinants, in fact, comprise all the forces determining whether the existing state of the system is to be maintained, or whether its size is to be increased or diminished (Harrod, 1936b, pp. 7 and 9–11). The same applies to the dynamic determinants: in such a case, the state to be considered is the equilibrium growth (Harrod, 1936b, p. 92). The next step was to examine how the inducements (or deterrents) exerted by these forces change in correspondence to different levels of output: the gradient of the schedule expressing this relation was interpreted as indicating whether the effect of the force is stabilising, neutral or destabilising (the corresponding step in traditional analysis was to inquire how the utility of goods etc influenced the degree of stability of the equilibrium price and output levels by determining the gradients of the demand and supply curve). Equilibrium in turn was conceived as the configuration of the system characterised by a balance of the inducements and deterrents to alter the established position; in other words, in equilibrium the resultant of all the forces is zero so that there is no cause inducing abandonment.

The possible configurations may be represented graphically, coupling, by way of illustration, the inducement schedules with a diagram representing the forces acting on a marble in the corresponding situations of stable, unstable and neutral equilibrium.

In the upper part of Fig. 2, inducements and deterrents have been added together. Equilibrium is the state of rest corresponding to any situation in which there are no inducements to produce more or less. In the lower part of the figure, such a case occurs when the supporting force of the ground (directed perpendicularly to it) exactly balances the gravitational force (directed vertically downwards).

Up to this point, Harrod has only reformulated the traditional premises and conclusions in other terms: instead of determining the level of output by

\textsuperscript{12} That is, its existence \textit{in potentia}. This is the etymology of ‘dynamics’.

\textsuperscript{13} The independence of any forces from the others is a necessary condition for assuming that they can be added together. Harrod seems to have been conscious of this requirement, and discussed it with reference to a special case on p. 3 of his book.
intersecting supply and demand curves, he has determined it by examining the forces which lay behind these curves. The only difference consists in the fact that the price level is included among the static forces, but its equilibrium value can easily be determined in the new formulation: since in equilibrium $\Sigma$ Forces = 0, the equation can easily be solved in terms of one of the forces involved. What was the purpose of such an exercise? Although in this case Harrod’s rephrasing of the traditional analysis of the determination of the level of output enables restatement of the same results in different terms, in general the two representations are by no means equivalent, since Harrod’s version allows for discussion of a case—of extreme importance for his treatment of the cycle—that would be very awkward to express in terms of demand and supply curves.

Having renounced resort to *ad hoc* causes for explaining fluctuations of output, Harrod had no other choice but to reject the assumption that equilibrium is stable. On the other hand, in Harrod’s eyes the assumption of instability of the static equilibrium would have implied a different but related sort of drawback: as the assumption of stability entailed an explanation of the cycle in terms of a behaviour of entrepreneurs guided by waves of unjustified optimism and pessimism, the assumption of instability would equally imply entrepreneurs acting irrationally, never being able to be satisfied with the amount they have produced\textsuperscript{14}. Harrod’s solution was to take the middle route.

\textsuperscript{14} Accordingly, Harrod criticised the cumulative mechanism postulated by Keynes in the *Treatise* as conceiving entrepreneurs never to be in temporary equilibrium, but always behind the times (Harrod, 1936b, p. 66).
Consistent with the formulation of traditional theory in terms of inducements and deterrents, the wording of Harrod’s criticism of the *Treatise on Money* again suggests that he was thinking of the satisfaction with the level of profits as the actual engine driving the entrepreneurs’ decisions. Simultaneously, Harrod’s criticism of Keynes for not having discussed the marginal position of entrepreneurs in his 1930 book\(^{15}\) reflects his opinion that the theory must postulate the consistency of the fluctuations of output with the entrepreneurs’ rational search for maximum profit (Harrod, 1936b, pp. 75–76).

This reasoning led Harrod to take a twofold decision regarding the construction of his trade cycle theory. On the one hand, he adopted the view that equilibrium is neutral: the stabilising and de-stabilising effects of the static forces balance each other at any point. This requires that the price level (the de-stabiliser) moves on any occasion in such a way as to balance the stabilising effect of the other determinants;\(^{16}\) as we shall see below, this means that given the other determinants, the price level is thus entirely determined by the play of the dynamic forces. On the other hand, Harrod treated the forces determining the growth of output as operating on different grounds to the static forces.

With regard to the first aspect, the neutrality of equilibrium ensures that, instant after instant, entrepreneurs are in equilibrium; that is, they feel they are doing the right thing given the structure of their costs and demand. In the second place, it allows ‘inertial’ motion to occur: no change in output encounters any resistance on the part of the static forces, so that any sort of motion compatible with what the dynamic determinants decree is conceivable.\(^{17}\) The analogy with the case of a marble lying on a flat surface best illustrates Harrod’s point. At any point on the table the force of gravitation is exactly offset by the resistance of the surface; therefore, if the marble is placed anywhere on it, there it stays. At the same time, if the marble is set in motion, its state of uniform (i.e. rectilinear and non-accelerated) motion will persist (until and unless some other force will disturb it—e.g. friction). The analogy with Harrod’s notion of steady (equilib-

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\(^{15}\) Harrod (1936b, pp. 66–67). A few pages later, Harrod complimented instead the *General Theory* for having brought back marginal analysis into its own (Harrod, 1936b, p. 71).

\(^{16}\) Explaining his position to Keynes, Harrod specified that for the system to be ‘in neutral equilibrium over the range within which it swings’, any one force must be equal and opposite to the resultant of all the others. The price movement is a de-stabiliser: the resultant of the others is a stabiliser. If the price drop required to induce a unit change in output is large, the stabilisers must be acting strongly. If I have to exert great strength to make the billiard ball move an inch over the cloth, the forces opposed to that action must be great.

Conversely, if ‘the stabilising forces are weak to the point of non-existence’, ‘an infinitesimal price drop will take the billiard ball right across the table’. (Harrod to Keynes, 7 April, 1937, in Keynes, 1973, p. 169)

\(^{17}\) The case of neutral equilibrium was of course considered by other authors before and after Harrod; however, they did not seem to appreciate its implications as to the possibility of inertial motion. Pigou (1920), for instance, listed this case among the possible ones without further comments (*Economics of Welfare*, 4th edn, App. III, sect. 9, while Edgeworth considered it with some contempt as ‘that sort of indeterminateness which would occur in the case of that neutral equilibrium which [Mill] imagines’ (Edgeworth, 1894, p. 611–612). The discussion of the stability of equilibrium in these terms was permitted by the notion of equilibrium as a balance of force, which also was not new (see, for instance, Marshall, 1961, p. 323).
rium) growth is once again precise: once the economic magnitudes start growing at a constant rate consistent with the configuration of the dynamic determinants, its mode of advance persists until and unless a restrictive or expansive dynamic force prevails, upsetting the harmony of progress.

As regards the different levels on which the static and dynamic forces operate, it must be noticed that the static determinants affect the individual entrepreneur's self-interest on the basis of some given fundamental circumstances, while the dynamic determinants do not affect, and are not affected by, the achievement of self-interest, but rather regard the functioning of the economy as a whole. In fact the accelerator, and the dynamic force determining the intensity of its mode of operation, relate the decision of investment to the prospective increase in the demand for goods. The actual increase depends, in turn, upon the multitude of individual acts of expenditure on investment and consumption goods. This process, which is regulated by the determinants influencing the magnitude of the multiplier, will eventually justify the expectations that set the mechanism in motion: 'You have now to consider the economy as a whole, with the tendency to increase or decrease in all its parts. In fact you are in the dynamic system' (Harrod to Robertson, 8 October, 1937).

Thanks to the distinct nature of static and dynamic determinants, the multiplier–accelerator mechanism can be superimposed on the static equilibrium, and determine a mode of motion which is compatible with it. This is precisely the sort of process that cannot be represented in terms of the old supply and demand curves. In fact, one would have to imagine some mechanism continuously shifting both the demand and supply schedules, and in such a case the level of prices and of output, although still located at the intersection of the demand and supply schedules, would actually be determined by the mechanism causing the transposition of the two curves. The old instrument would therefore prove to be completely inadequate to represent the dynamic interaction of the individuals' motives and their effects.

5. Statics versus Dynamics

In The Trade Cycle Harrod did not formulate an explicit definition either of statics or dynamics. In order to understand what he meant when using these terms it is necessary to examine in the first place how he opposed the characteristics, the tasks and the methods of the two disciplines, and in the second place how he related statics and dynamics. This section is dedicated to the study of the direct comparison between various aspects of the static and dynamic approaches. This will be complemented in the next section by a discussion of how Harrod's statics and dynamics were related to each other, and finally by a section discussing the link between static and dynamic forces.

The argument of the preceding section pointed to an initial opposition, lying in the epistemic domain, between statics and dynamics: the latter is capable of (and means) giving an account of change, while the former must account for the possibility of change, compatibly with the fundamental conditions. This distinction lies at the core of Harrod's notion of dynamics, to which it provides the
foundation. The instability of equilibrium is its corollary: in order to allow
different levels of output, static equilibrium must not be stable, while dynamic
equilibrium must be unstable to allow fluctuations rather than growth at a
constant rate only. With regard to the logical structure of The Trade Cycle, the
instability principle was therefore an epistemic premise to trade cycle theory,
rather than an analytical result of Harrod’s dynamics. On the contrary, the
analytical apparatus had to be conceived at the outset as capable of giving rise
to instability. With regard to statics, an antidote to stability had to be superim-
posed onto the traditional interpretation of the static relations, as is certified by
the otherwise curious idea that since fluctuations in prices and output de facto
occur and are correlated, the price level must act as a de-stabiliser and
compensate the stabilising effect of the other determinants. In relation to
dynamics, the mechanism carrying the seeds of instability is the Relation, for it
translates changes in the first order differentials into variations in the same
direction of absolute magnitudes, which in turn cause a further change in the
differentials; the multiplier, on the contrary, is only responsible for a finite
amplification of the acceleration effect.

Harrod’s aversion to time-lags, which explicitly emerged from The Trade
Cycle at every turn and also characterised his later contributions on dynamics,
also finds its root in his epistemic reflection. Harrod, of course, did not deny the
existence of time-lags, nor their theoretical relevance on certain occasions. The
targets of his contention were rather the attempts to ‘give plausible explanations
[of the trade cycle] on the basis of a time-lag hypothesis’ (Harrod, 1936b, p. 88,
my italics). Harrod was certainly referring to Robertson’s analysis in terms of the
inequality of saving and investment based on the definition of saving as the
unconsumed part of the income of the preceding period, but possibly also to the
econometrician’s notion of dynamics as a theory explaining ‘how one situations
grows out of the foregoing’ and in which ‘magnitudes of certain variables in
different points of time’ are considered (Frisch, 1933, p. 171; see also Frisch,
1936, p. 100). Harrod recognised in the recourse to time-lags the same sort of
fallacy that Galileo detected in the Aristotelian claim that air is the medium
necessary to sustain motion, which he substituted with the opposite conception
that it is an obstacle to movement. Like errors of judgement and miscalculations,
time-lags are a disturbance to the working of the static and dynamic forces
operating in the system. Harrod thus treated their effect as secondary, in contrast
to the approaches that placed them at the heart of the explanation of the cycle.
Harrod placed time-lags, errors and misjudgements in the same epistemic
domain, as analogous attempts to overcome the stability of the system; he
addressed to Robertson the same criticism he had raised, years before, to Pigou’s
psychological theory:

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18 As we shall see in Section 8, Harrod was well aware that a methodological break was involved
in this rather tortuous argument; however, the reason for the possibility of a theory of the cycle had
to prevail over the reason of its methodological consistency.

19 It is thus far from being surprising that a few years later Harrod affirmed that he did not ‘regard
the multiplier principle as belonging to dynamics’ (Harrod to Robertson, 20 March, 1945).

20 See for instance Harrod (1936a).
What I feel about people broadly in your position\(^{21}\) is that you cling a little too tenaciously to the view that the classical analysis shows that the system must be self-adjusting in the end. You are inclined, therefore, to emphasize time-lags and miscalculations. (Harrod to Robertson, 25 December, 1936)

This argument, together with the consideration that in conditions of steady advance time-lags have ‘no significance’ (Harrod, 1936b, p. 129), led Harrod to repute his own approach as providing a more fundamental formulation of a dynamic theory: writers seeking to introduce dynamic considerations have often tended to confine themselves to mere description or to develop a theory regarding time-lags. But is not a theory of time-lags or of friction premature when the fundamental propositions relating to velocity and acceleration remain unformulated? (Harrod, 1936b, p. viii, emphasis added)

From the fundamental differences of statics and dynamics in their capacity to explain change, other distinctions followed. The more direct obviously regarded the object of the two disciplines, i.e. statics were concerned with the level of output and dynamics with its growth. Since it was generally recognised that the ultimate cause of growth was to be found in saving (although the mechanisms postulated as to the precise relationship between saving and growth were quite different), it is not surprising that Harrod excluded the analysis of saving and investment from the domain of statics, and confined it to dynamics (Harrod, 1936b, pp. viii and 150, and his letter to Keynes of 6 April, 1937, in Keynes, 1973, p. 164).

This ontological distinction called for its analytical counterpart, regarding the choice between known and unknown variables, and the determination of the equilibrium behaviour of the system. I have already mentioned that Harrod’s project was that of devising an analysis of the factor of growth based on the same procedure followed by statics, which ensured pride of place to the equilibrium position. In both cases, certain fundamental conditions—the static and dynamic determinants, respectively—were taken as given, and the corresponding state of equilibrium was characterised. In the case of statics, equilibrium corresponded to a state of rest, i.e. of a constant flow of goods per unit of time such that ‘no party to the exchange feels disposed to alter his conduct’ (Harrod, 1936b, p. 150); in other words, in static conditions the system remains equal to itself, simply reproducing the conditions of its own existence.

In the case of dynamics, the requisite for the system to be able to reproduce its own conditions on an enlarged scale was found to be consistent with a constant rate of growth\(^{22}\). On the one hand, this result was a premise of Harrod’s

\(^{21}\) On the same grounds Harrod accommodated in his criticism to the ‘time-lags theories of the cycle’ almost all of the alternative dynamic approaches to his own: Robertson’s and the Swedes’ ‘period analysis’ (Harrod, 1937b, pp. 496–497), Tinbergen and the ‘econometricians’ (Harrod, 1996, section 19), and Harrod to Keynes, 18 September, 1938, in Keynes, 1973, pp. 304–305), and Hicks (Harrod, 1939b, p. 299).

\(^{22}\) Here the analogy of economic moving equilibrium and inertial motion, corresponding to constant velocity, seems to fail, in spite of their sharing the feature of the absence of forces tending to alter the established state of motion. This of course is due to the fact that the analogy is precise as regards the formulation of statics and dynamics in terms of forces acting on the existing state of motion, but it is not meant to be complete nor to apply to the objects of the respective theories. In other words, the analogy is meant to point out an isomorphism between Harrod’s process of escape from orthodox economics and Galileo’s foundation of a new mechanics, but does not imply a corresponding identity of method or content, although the analytical apparatus presented some similarities.
reasoning even before being an analytical result. Already, in 1934 Harrod knew by intuition that a regular advance would imply the preservation of the existing proportions between the different magnitudes of the system: his essay on ‘The expansion of credit in an advancing community’ was in fact meant to be an enquiry into the relation between the rates of increase in a regularly advancing society, with a view to determining what kind of system would allow the full potentialities of progress to be realised while being internally self-consistent. (Harrod, 1934b, p. 287; see also p. 296, and Harrod, 1934c, p. 478)

The growth mechanism resulting from the interaction of the multiplier and the accelerator later provided analytical support to Harrod’s earlier belief. In fact, the accelerator relates an absolute magnitude to the increase in the value of another variable, while the multiplier transmits local variations to the global scale of the system, so that the determination of the mode of advance requires the comparison of the current increase with the past configuration of the system:

This is a matter to which I gave very long thought and reached my conclusions after much trial and error [...] .

Why did I assume a geometric increase? [...] I was on the lookout for a steady rate of advance, in which the rates of increase would be mutually consistent. An arithmetic increase of income won’t do, because then, with inventions neutral, no increase of saving at all is required, only the same amount each year. But that is inconsistent, on your psychological principle, with any increase of income at all. (Harrod to Keynes, 6 April 1937, in Keynes, 1973, p. 164)

Harrod’s solution, however, is vitiated by the peculiar notion of expectations it implies. According to Harrod, the moving equilibrium ‘is the rate of growth which, if maintained, will leave the parties content to continue behaving in a way consistent with it’ (Harrod, 1936b, p. 150). This implies in the first place, that the multiplier–accelerator process will generate an increase in consumption exactly equal to what the entrepreneurs expected when deciding the amount of investment goods to order. In the second place it implies that the ‘justification’ of past anticipations will induce entrepreneurs to expect consumption to increase in the next period at the same rate of the present one. In reality, however, Harrod’s analytical scheme, as illustrated in Section 3 above, allows wildly fluctuating expectations nonetheless to give rise to equilibrium, provided that they are compensated by fluctuations in other parts of the system.

This ambiguity seems to arise from the fact that two different notions of equilibrium coexisted in Harrod’s thought: on the one hand the individualistic equilibrium characterised by the maximisation of profits and the satisfaction of consumers’ desires, on the other hand the capacity of the economic system to reproduce its own status and its own conditions from period to period. Given that ‘statics’ refers to individual motives, static equilibrium belongs to the first

23 For an examination of these notions see Donzelli (1986, ch. 5.4). It is interesting to notice that early commentators of Harrod’s (1939a) article pointed out the ambiguity of his notion of equilibrium (in particular Shellling, 1947, p. 868, and McCord Wright, 1949, p. 326); for a survey of the debates arising out of Harrod’s commentators and Harrod’s own confused attempts to conciliate these distinct notions, see Besomi (1996b, Section 3.1).
class. Dynamic equilibrium belongs to the second class because Harrod's
dynamics refers to the system as a whole. Harrod, however, seemed to think
that his static equilibrium also ensured the reproduction of the stationary state,
while dynamic equilibrium also warranted the satisfaction of the individuals
regarding the actual rate of growth. 'Statics' was in fact seen as determining
which 'flow of goods per unit of time through the exchange process is such that,
given tastes, &c., no party to the exchange feels disposed to alter his conduct'
(Harrod, 1936b, pp. 149–150), for in equilibrium, price and amount of each
commodity are consistent with the given circumstances (Harrod, 1936b, p. 166).
Dynamic equilibrium conversely, was meant to justify to the eyes of en-
trepreneurs the current rate of advance by the experience of the given day (cf.
for example, Harrod, 1936b, p. 90) and thus to induce them to be persistent in
their decisions regarding that rate of advance.

This pair of complementary suppositions certifies Harrod's pre-analytical
belief in the existence of some sort of mechanism harmonising the independent
individual decisions with the economic results of their interactions. His analyti-
cal apparatus was not, however, geared to incorporate this conviction. In the case
of statics there was no variable referring to the whole of the economic system,
while dynamics incorporated no reference to individual motives. These had to be
added afterwards (in a logical sense), in the form of the expectations linking one
period to the other. Such implementation was bound to be inconsistent with the
bones of dynamic analysis, unless some mechanism was postulated explaining
the formation of subjective anticipations on the basis of the objective result of
the global accumulation process. This would have required a different dynamic
model and another analytical set-up.

In the methodological domain, in The Trade Cycle and later in correspon-
dence with Keynes, Harrod returned to a distinction between statics and
dynamics that he had already sketched in 1934 (Harrod, 1934c, p. 478) and
repeated in 1935 (Harrod, 1935, p. 727). Static analysis adopted the following
procedure:

It has been usual to suppose a certain given state of technology and a certain
given set of desires on the part of the consumers, and to ascertain what is the
equilibrium price and the equilibrium amount of each commodity consistent
with these circumstances. If a change in these circumstances occurs, then a
new equilibrium will in due course be reached consistent with the new
situation. (Harrod, 1936b, p. 166, italics mine; see also p. viii)

The method of statics thus allows change to occur, but only as a consequence
of a change in the fundamental circumstances. If such a change occurs, the only

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24 It should be stressed that the distinction only partly relates to what we would nowadays denote
with the opposition micro–macro, nor it can be encompassed by the distinction—clarified in the 1940s
by Samuelson—between 'equilibrium as a behavioural outcome and equilibrium as a mechanical rest
point' (Weintraub, 1988, p. 149). Harrod's dynamic equilibrium rather relates (without, however,
explicitly referring to it) to the classical tradition interpreting production in the light of the possibility
of reproduction of the status of the system, as a result of the multitude of interactions between the
decisions of producers and consumers. It is not a pure accident, therefore, that Harrod's result—as
later expressed in the 'Essay'—resembles that obtained by the Austro-Marxists while giving formal
expression to the reproduction schemes (for the similarities see Orzech & Groll, 1983).
thing statics can say relates to the new equilibrium position: what occurs in between (e.g. oscillations around the new equilibrium position) might be interesting, but it is a matter that lies outside the method of demand and supply curves. In contrast, the factor of growth involved with the occurrence of saving and investment suggests asking a qualitatively different question:

It is no longer appropriate to ask—as in the case of a particular commodity—what amount of saving will be justified on the assumption that the surrounding circumstances remain the same within the period in which the equilibrium is established. For the saving itself entails a change of no little importance in the surrounding circumstances, viz. a growth of productive power. The question has to be asked—what amount of saving will prove justified, taking into account the factor of growth which the saving necessarily entails? (Harrod, 1936b, pp. 166–167)

In other words, in dynamic considerations one cannot forget that saving (or investment) and growth—each other’s cause and consequence—occur at the same time, and the distinction between equilibrium states and ‘what happens in between’ is therefore not legitimate. On this ground, Harrod criticised Keynes for having discussed, in his critical notes on The Trade Cycle, the relationship between the rates of increase of investment, capital and consumption in terms of discrete changes, while Harrod’s technique of analysis presupposed continuous variations of the relevant magnitudes (Harrod to Keynes, 6 April, 1937, in Keynes, 1973, p. 163).

Despite the lack, in The Trade Cycle, of a precise definition of the notions of ‘statics’ and ‘dynamics’, it has been possible, by considering how Harrod opposed the epistemic, methodological and analytical features of his newly coined concepts, to gather a few elements which provide an outline of his notion of dynamics in 1936: he had identified growth as the object of the theory, specified the fundamental mechanisms engendering economic progress, characterised the peculiarity of an equilibrium mode of advance, understood the analytical ground for the methodological requirements regarding continuity and the definition of the domains in which to apply instantaneous and process analysis (on this distinction see Besomi, 1995, 1996a), and posed the principle of instability as the foundation of the possibility of explaining growth and the cycle. It is still necessary, however, to understand how the new discipline of economic dynamics was related to statics, and to explain the nature of the mechanism connecting static and dynamic forces.

6. The Link Between Static and Dynamic Laws

In correspondence with Robertson, Harrod stressed that the structure of his book implied a sharp division between ‘the laws of value and distribution of income’ and ‘the laws of growth’. Such dichotomy posed the problem of studying the relations between these two sets of laws. I have already remarked that static laws regard individuals, while dynamics concern the economic system as a whole; the

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25 Harrod to Robertson, 25 December, 1936. It is interesting to notice that such division reproduces an analogous dichotomy Harrod perceived in Keynes’s General Theory: see Harrod, 1937a, and for a comment Besomi, 1997.
above mentioned question turns therefore into the problem of understanding how changes in magnitudes such as aggregate saving and investment, income etc., determined on the global scale but resulting from the interaction of a multitude of individual and independent resolutions, may be consistent with the conditions leading to these decisions. In other words, at this point Harrod was facing the analytical counterpart of the epistemic problem of the possibility of change of the level of output. It is therefore not surprising that the solution was found in the same locus that is in the balancing of forces giving rise to the neutrality of static equilibrium (see Section 4 above). For the solution to the question of the possibility in principle of variations in output, Harrod had postulated that the static equilibrium is neutral; that is, that the diverging tendencies stimulating or inhibiting an expansion of output were mutually compensated over the possible range of fluctuation of output. The dynamic determinants are thus, in Harrod's model, entirely responsible for movement: their action finds no obstacle nor additional support in the resultant of the forces determining the level of output, but only passive compliance. The problem of how the dynamic forces impose their consequences on the static forces, or, in other words, of how individuals are compelled to behave as the dynamic determinants decree for the whole economic system, required an additional step. Harrod, in fact, had to divide the static determinants into two groups, one being affected by the change of output and the other independent of it, so that, given the state of the latter group, in order to maintain the static equilibrium in a state of neutral stability the dynamic forces must induce the necessary changes in the other group.

As already mentioned, Harrod considered as fundamental the conditions relating to the state of tastes and costs, and refused to attribute the cause of output fluctuation to rhythmic changes in individual preferences. Consequently, the task of ensuring the consistency between the laws of growth and the laws of value and distribution was attributed to changes in the remaining determinant, money—which, the reader will remember, operates with a de-stabilising effect:

The ultimate cause of the cycle is the peculiar relation of the creation of new capital to saving. The price fluctuation is the mechanism by which this ultimate cause operates upon individual units to induce them to carry out the variations of output required. [...] The price fluctuation represents what remains in our complex system of man's natural determination to continue earning his livelihood, even when conditions become less favourable, and of his unwillingness on the other hand to be rushed into overwork. An analysis of how these natural impulses still operate in our modern society was therefore highly relevant. (Harrod, 1936b, p. 171; see also pp. 47 and 179)

Hence the alternative explanation that recognised price fluctuations as the cause of the cycle was, in Harrod's view, fundamentally wrong:

The rise and decline of activity and its present level are determined by dynamic forces. But all the while the static forces remain. The phenomena of price—and profit—fluctuations represent the resistance of the static to the dynamic forces. The prevailing error in cycle analysis heretofore has been in
mistaking these phenomena of resistance for the true cause of the cycle.\(^{26}\) (Harrod, 1936b, p. 172)

The reader may wonder why prices should fluctuate in such an accommodating way. The velocity of circulation of money comes into play here. Harrod turned the conclusion of the Quantity Theorists, that price fluctuations are a consequence of changes in the quantity of money, upside down. He formulated instead the view that it is rather the play of the dynamic and static forces which conjointly determine the fluctuations in the quantity of money (which is determined by banking policy) multiplied by its velocity of circulation.

Before turning to the precise mechanism permitting the fluctuations of the velocity of circulation, it is necessary to notice that this inversion of the causal relation between the left and right-hand sides of the quantity equation constituted the last step in Harrod’s first attempt to reorganise economic theory systematically. His static and dynamic laws, their difference in method, scope and content, and also the mechanisms connecting them and posing statics at the foundation of dynamics, must be interpreted in this sense\(^{27}\). In this attempt we can see the implicit formulation of a project tending towards a reformulation of the science of economics along the same line.

7. Money and Prices

In the preceding section, I have mentioned that price changes are the force that imposes on individual entrepreneurs, given the other static determinants, the variations in production decreed by the interplay of the multiplier and accelerator. I have also hinted that, according to Harrod, such accommodating behaviour of the price level is permitted by the appropriate fluctuations in the velocity of circulation of money. The precise mechanism accounting for these fluctuations, however, was left unexplained, and it is the purpose of this section to fill the gap. In order to understand Harrod’s solution in the context of his view on the link between statics and dynamics, it may be useful to summarise the logical structure of his book by means of a diagram representing the determination nexuses constituting the causal, explanatory scheme of *The Trade Cycle* (see Fig. 3)

It is appropriate to begin our reflection by observing the peculiar role of the price level in Fig. 3. The general price level was meant to be a static determin-

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\(^{26}\) This is a further instance of the analogy of Harrod’s criticism of traditional theory with Galileo’s attack on Aristotelian physics: the latter based its theory of motion on the presence of air, which was meant to provide a medium and to sustain movement, while Galileo saw in the friction of air an obstacle to movement. Thus, Galileo accused the Aristotelian of confusing a resistance with the true cause of the persistence of motion.

\(^{27}\) For this reason I think that Harrod’s article on ‘Mr. Keynes and traditional theory’, where the relationship between prices and money is discussed at length, although not very illuminating about Keynes or about orthodox theory, is enlightening as regards the relationship between Harrod and Traditional Theory. This point is elaborated in Besomi, 1997.
nant, while in fact it is determined by the set of dynamic forces, given the value of the other static determinants. In a sense, the price level belongs to both the static and dynamic domains: as a static force, it contributes to determining the *individual* level of output; but given the output of the preceding period, the *general* level of output of the present period is entirely determined by the interaction of the multiplier and the accelerator, according to the resultant of the dynamic forces. Thus, due to its role of connecting statics and dynamics, the price level fulfils the task of causing the individual entrepreneurs to adapt to the global rate of growth compatible with the state of the dynamic determinants, and its magnitude is determined by the configuration of the latter, given the new state of preferences and costs. In Harrod’s analytical set-up, therefore, the price level is entirely determined by real forces, and is independent of the decisions of the banking system regarding the volume of money. Harrod therefore pointed out that ‘the set of ideas to which the doctrines of this essay are most repugnant are those connected with the Quantity Theory of Money’ (Harrod, 1936b, p. 125). While on the basis of quantity theory it was maintained that real forces determine the relative prices and, at the given volume of transactions and velocity of circulation of money $V$, the general price level is dependent on the quantity of money $M$, Harrod argued that the set of static and dynamic forces determines the effective circulating medium $MV$.

Harrod’s view of money and of statics and dynamics, is thus characterised in the first place by his maintaining that the monetary sector scarcely influences the real working of the multiplier–accelerator mechanism. As the diagrammatic
representation of *The Trade Cycle* illustrates, the only link between the two sectors is provided by the influence of the rate of interest on the third dynamic determinant. This is quite roundabout, for investment primarily depends on the prospected increase in the demand for consumption goods (the Relation), while the rate of interest only affects—jointly with the state of technology—the acceleration coefficient. Robertson therefore rightly pointed out that Harrod saw the causes of the trade cycle in the ‘real’ rather than monetary features of the economy (Robertson, 1937, p. 124).

In the second place, the quantity of money being determined by banking policy, the only place left for money in Harrod’s mechanism was that of behaving ‘as a lubricant to the system’ (Harrod, 1936b, p. 126). Therefore, against the view (e.g. Hayek’s) that ‘money is the original and actuating cause of the cycle’ (Harrod, 1936b, p. 46), Harrod opposed his own conception that money is a passive accomplice in the generation of the cycle, moving up or down, within certain limits, to suit those forces [...] which determine the cyclical movement. [...] Its part is utterly subordinate—it does what it is told, puts up no resistance to the worst happening, has no will of its own, is a useful and abject tool. (Harrod, 1936b, pp. 46–47)

The last element in the scheme illustrated in Figure. 3 is the velocity of circulation. The ultimate cause of its fluctuation lies, on the one hand, on the determinants of the price level and the volume of transactions, and on the other on the choices of the banking system regarding the quantity of the circulating medium. In Harrod’s view, *The Trade Cycle*’s doctrine of trade fluctuation is itself the theory of velocity. Those forces which have been enumerated govern the volume of output and the level of prices; these in turn *cause* the velocity of circulation to be what it is. Or rather, they *cause* the quantity of money multiplied by its velocity of circulation (MV) to be what it is. And velocity is the resultant of banking policy, which determines the quantity of money, and of the forces enumerated, including any effect that banking policy may have, for instance via the rate of interest, on the forces enumerated.

8. A Methodological Break

The study of the particular function that the monetary section was called to play in different parts of *The Trade Cycle*’s set-up suggests that Harrod’s theory consisted of three distinct blocks, hierarchically structured. The hard core of the whole construction was the dynamic model, with the dynamic forces directly

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28 This position was further ‘radicalised’ in the ‘Essay’, from which money almost completely disappeared.

29 Harrod (1936b, p. 126, emphasis added). Harrod based the complicated mechanism through which velocity fluctuates on the accumulation of idle balances, thus enabling the price-level to fall and to overcome the resistance of the static stabilisers as a consequence of the action of the dynamic determinants. This will not be illustrated here, but the interested reader will find it on pp. 125–142 of Harrod (1936b). It may be interesting to notice that Harrod considered this link between prices and velocity of circulation as one of the possible solutions (the other being Keynes’s liquidity preference theory) of the unsatisfactory character of the traditional theory of velocity of circulation (Harrod, 1937a, pp. 84–85; for a discussion see Besomi, 1997).
determining the intensity of the multiplier and accelerator effects and consequently the rate of growth of output (and, given the level of output of the former period, on the present level of production). A second compartment concerned the determination of the price level appropriate to the current output, given the configuration of the 'fundamental conditions' (cost structure, preferences, etc). The third department was the monetary section proper, where the appropriate velocity of circulation was determined to suit the requirements of the combined action of the static and dynamic forces on output and prices (given the volume of money resulting from the decisions of the banking system).

How were these compartments connected within the structure of Harrod's theory? On the one hand they were coupled in a determination chain: dynamics (given the other static forces) determined prices which (given the quantity of money) determined velocity. Conversely, the lower links in the determination chain provided the condition of possibility for the higher links: the conditions enabling velocity of circulation to fluctuate allowed price changes, which in turn satisfied the prerequisite for output to grow or fluctuate according to the prescriptions of the dynamic forces. In the face of this double epistemic connection, there remained an analytical dichotomy between the departments. This is because Harrod did not elucidate the mechanism by which prices change in the face of fluctuations or growth of output, nor is it clear how velocity and prices were connected so that the variations in the former enabled the fourth static force 'to act as the arch-destabiliser'. The reason for this gap lies in a methodological break Harrod introduced when discussing the de-stabilising power of money:

so far in reviewing a determinant after the other we have been able to rely on our knowledge of human nature, on the known purposes of economic activity reduced to their simplest terms, of certain broad principles amounting almost to truisms, and have deduced what may be expected to happen as the level of activity varies. But in this case it is proposed to ask not what may be expected to happen to the general level of prices as output varies, but what does in fact usually happen. This is a complete change in the method of procedure, and it is important to emphasize very strongly that it is a change. (Harrod, 1936b, p. 37)

In Harrod's view, the fact 'that prices rise when goods are turned out in greater abundance and fall in the opposite situation' is 'one of the very few generalizations vouchsafed by empirical observation in economics; and it is probably the best established of any' (Harrod, 1936b, p. 41; see also 1936a, p. 84). He thus concluded:

If this is true, the monetary determinant clearly embodies a de-stabilizing force. The restorative effect of the other stabilizers in the case of a downward departure from a given equilibrium might be entirely offset by a sufficient fall in prices, and conversely in the case of an upward departure. Consequently, if prices tend to fall in the case of a downward departure, the fact constitutes a destabilizing force tending to counteract wholly or in part the forces of the stabilizers; conversely, again, if rising prices accompany increasing activity. (Harrod, 1936b, p. 42)

On the ground of the argument that static stabilising and de-stabilising forces
must balance each other to ensure the neutrality of equilibrium (see above, Section 3), Harrod concluded that 'the de-stabilizing influence of money embodied in the ups and downs of prices may be taken to be a measure of the power of the other three stabilizing forces' (Harrod, 1936b, p. 43). As a consequence, he attributed the cause of the fluctuation of prices to the changes of the strength of the individual static stabilisers entailed by output fluctuations, consistent with his view of the monetary system 'as a neutralizing medium accommodating itself to the other factors, which determine the level of output' (Harrod, 1936b, p. 82). To sum up: the fluctuation of prices was assumed as a premise; this observed behaviour was thought to be compatible only with a de-stabilising effect; the list of static forces being exhaustive (Harrod, 1936b, p. 85), the epistemic necessity of neutrality of static equilibrium over the whole range of fluctuation of output required that the only de-stabilising force continuously balanced the resultant of the other determinants; finally, the variables whose behaviour had an explanation in terms of 'the known purposes of economic activity' were taken as a cause of the behaviour of prices. But no mechanism was suggested to explain how, for example, a joint increase of activity and of prime costs would lead to an increase of the price level. Harrod's argument reduced to the consideration that a rise of price must occur, for otherwise the increased prime costs per unit would dissuade the entrepreneurs from increasing output.

Analogously, Harrod did not provide reasons why the de-stabilising effect of the price-level requires a precise behaviour of the velocity of circulation, although he clearly stated that

it is the variations in velocity that enable money [i.e. the general level of prices] to behave as a lubricant to the system and to allow it to follow its chosen course. In particular they enable money to act as the arch-stabilizer, overcoming the stabilizing forces of the static determinants and allowing the level of output to move up and down as the dynamic determinants prescribe. (Harrod, 1936b, p. 126)

9. Concluding Remark

In spite of some critical reviews of The Trade Cycle stressing these analytical difficulties, Harrod was probably not aware of them, and did not attempt to solve them. Rather, in the subsequent versions of his theory, he side-stepped the problem of the relation between static and dynamic forces and laws altogether, to concentrate instead on his growth rates formulas. This shift of emphasis favoured the interpretation of the instability principle as a result rather than a premise of Harrod's analysis, so that the subsequent comments on his dynamics were mainly directed to the analytical properties of the model rather than to the implications of the epistemic problem of the possibility of trade cycle theorising.

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