

Optimum saving and growth: Harrod on dynamic welfare economics

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I would affirm that maximum economic growth in accordance with the potential supply capacity of the country is the primary objective and that all other objectives are subordinate to this ... I do not think that this is merely a personal view. I hold that it expresses what economics has always been thought to be about. (Harrod 1969, p. 334)

1. Introduction

Roy Harrod’s (1939, 1948) seminal contributions to economic dynamics have been discussed by historians of thought mostly from the perspective of his “instability principle”, that is, the proposition that departures of the economy from its equilibrium (“warranted”) growth path are not self-correcting but cumulative in effect (see e.g. Kregel 1980; Asimakopulos 1985; Halmayer & Hoover 2015). Although the short-run instability of the actual growth rate – associated with “centrifugal forces” at work

around the line of steady advance – was a topic of permanent interest for the Oxford economist, he would in the 1960s shift the focus of his research agenda to the investigation of what he called the “natural” growth rate as determined by population growth and technical progress. In fact, at the concluding paragraph of his reply to Joan Robinson’s critical interpretation of his economic dynamics, Harrod (1970, p. 741) pointed out that “this instability principle, much stressed by Mrs. Robinson, is only one part, and perhaps by now a minor part, of my total growth theory”. Some commentators (e.g. Besomi 2001, p. 91) have noticed Harrod’s shift of emphasis from business cycles to the process of economic growth in his last contributions, without any discussion of what was behind that change, though. Harrod (1964, p. 905) made clear, in an article about macroeconomic policy, that “for some time now I have come to consider my concept of a ‘natural’ rate of growth (G_n) as more important [than the concept of] a ‘warranted’ rate of growth (G_w)”. As documented below, this reflected a reaction to both the emergence of neoclassical growth economics in the late 1950s and the increasing interest in the economic development of backward countries in the post-war period. It may be also seen as a result of Harrod’s concern with economic policy, which came to dominate his research agenda in the postwar years (Phelps Brown 1980, pp. 25-26). Harrod (1963a, p. 421) stated in his second presidential address to the Royal Economic Society that “many economists are finding, as I do, their attention attracted to the developing countries. That partly accounts for my continuing interest in growth economics”. In 1961 he organized for the International Economic Association a conference in Brissago (Switzerland) on trade and development (Harrod 1963d).

Harrod’s (1938, pp. 396-7) first presidential address became well known for his remarks about the difficulty of assessing the aggregate welfare effects of episodes like the repeal of corn laws in 19th century England, if the comparability of utility to different individuals was assumed away. Harrod’s claim – that under those circumstances economists would have to give up welfare economics and hence their role as policy makers – would lead soon after to the formulation of the “compensation principle” by N. Kaldor and J. Hicks as one of the main features of “new welfare economics” based on ordinalism. Welfare economics would become a matter of concern for Harrod again in the 1950s and after, still under the general assumption of cardinal utility, but this time seen from the point of view of economic growth. Maximization of economic welfare should be considered “through time”,

something economists had asserted long before him. What was new, argued Harrod (1969, p. 334), was the “recognition that the tools of thought appropriate for the analysis of how economic welfare can be maximized at a given point of time are not by themselves adequate for analyzing how economic welfare can be maximized through time”. The main issue was whether market forces would bring the equilibrium (warranted) growth rate to the welfare optimum (natural) rate. Whereas Harrod’s “instability principle” was about divergences between the actual and warranted growth rates, his dynamic welfare economics addressed mostly differences between the latter and the natural rate, and their implications for economic policy.

Harrod (1953, 1955, 1957, 1960, 1963a, 1963b, 1963c, 1964, 1966, 1968, 1969 chapter 8, 1973 chapters 5 and 7, 1974, 1976) wrote extensively on the concept of the “welfare optimum” growth rate and how to achieve it. His 1960 and 1963a essays in the *Economic Journal* are entirely dedicated to those questions. Discussions about the notion of optimal growth started to come out in the 1950s (Tinbergen 1956; Horvat 1958), but it was only in the 1960s, after the development of the neoclassical growth model by Robert Solow (1956) and Trevor Swan (1956), that they became part and parcel of growth economics. Growth economists at the time deployed the golden rule of capital accumulation (Phelps 1961), together with Frank Ramsey’s (1928) model of optimal saving and capital deepening. The Solow-Swan model led to the result that the steady state rate of growth of income per capita is governed entirely by technical progress. Because of diminishing returns to capital accumulation, increases in savings rates would have no permanent effect on the rate growth of income, only on its level. Hence, optimal growth was essentially about choosing the capital-labor ratio that maximizes permanent consumption per capita, as expressed by the so-called “golden rule” (see Boianovsky and Hoover 2014, pp. 212-14). Koopmans (1965) and others would soon give optimal growth its final formulation by combining intertemporal utility maximization *à la* Ramsey with the golden rule in an economy with growing population and technical progress.

Harrod (1960, 1963a) shared with the dominant optimal growth literature the view that the natural growth rate is exogenous in respect with the rate of savings. Moreover, his 1960 essay was probably the first attempt to build growth economics on Ramsey’s saving model. Nevertheless, as discussed in the present paper, Harrod’s approach to optimal growth differed in essential aspects from the neoclassical version. He restated in the early 1960s his concept of natural growth rate originally

introduced in 1939, now in the context of a Ramseyan formulation of saving decisions. Harrod's objective was to deduce an expression for the "natural" or "welfare optimum" rate of interest, which should be the target of monetary policy. He claimed that his "second fundamental equation" illustrated the "supply" side of economic growth, whereas his better-known 1939 fundamental equation for the warranted rate expressed the "demand" dimension. Divergences between the warranted and natural growth rates were associated with differences between the actual and optimum (or "required") rate of savings when the interest rate is not at its "natural" level. Harrod's formulation of the optimal growth problem attracted scattered critical attention from a few contemporary commentators (Graaff 1960, Sen 1961, Robertson 1961, Chakravarty 1962, Asimakopulos & Weldon 1963, Wan 1971, Guillaumont 1971), but neoclassical models, which were often mathematically sophisticated, swallowed it up. In correspondence with Solow, Harrod tried to engage the American economist in discussion about his 1960 "Second essay in dynamic theory", with only limited success. Except for brief mentions by Walter Eltis (1987, p. 600), Warren Young (1989, pp. 182-83 and 192-93) and David Collard (2011, p. 268), Harrod's discussion of optimal growth has gone unnoticed by historians of thought. A close examination of Harrod's ideas about dynamic welfare economics may illuminate not just hitherto unexplored aspects of his approach to growth, but may also contribute to a better understanding of the history of growth and development economics as a whole at the time.

2. Economic welfare and the natural rate of growth

Harrod's (1953, pp. 553-55) first identification of the "optimum" growth rate with the full-employment natural rate of growth may be found in his reaction to Harold Pilvin's (1953) critical note that the so-called Harrod-Domar growth model overlooked the role of substitution between capital and labor. Harrod (*op. cit.*) suggested that there are two distinct analogues between static economic theory and economic dynamics as conceived by him. The first is that, in contrast with static economics, the equilibrium concept of dynamics – that is, the "steady rate of growth" – is not stable but "surrounded by a field of centrifugal forces". The analogue that

Harrod considered pertinent in the context of Pilvin's criticism was another one. Economists had discussed in what circumstances the pattern of stable equilibrium constitutes an "optimal arrangement". As Harrod (1963a, p. 406) would express later, "the beauty of classical economics" was that it claimed to demonstrate, under perfect competition, an agreement between "the long-run equilibrium ... and the welfare optimum". Whereas the "warranted rate" corresponded to the equilibrium pattern of statics, Harrod (1953, p. 554) explained that "in dynamics I have used the expression 'natural rate of growth' for something that may be regarded as corresponding to an optimal static pattern". Harrod (1939, p. 30) had originally defined the natural rate as the "maximum rate of growth allowed by the increase in population, accumulation of capital, technological improvement and the work/leisure preference schedule, supposing there is always full employment in some sense". The reference to capital accumulation as a determinant of natural growth was imprecise and later removed (see e.g. Harrod 1948, p. 87).¹ The natural rate G_n excludes involuntary unemployment, but it takes into account frictional unemployment caused by search in the labor market (Harrod 1976, p. 72). Technical progress must be of the form known as "Harrod-neutral" or "labor-augmenting" in order to be consistent with steady growth (Harrod 1948, pp. 22-28). Like the rate of population growth, it is essentially exogenous, in contrast with other dynamic approaches, such as the old classical system (ibid, p. 21; 1973, pp. 21-27).²

Apart from securing full-employment, growth at the optimal natural rate is conducive to the adaptation of methods of production to the "latest findings in technology, so as to secure utilization of the cheapest current methods" (Harrod 1957, pp. 2-3). In his "Second Essay", Harrod (1960, p. 279) defined G_n as a "welfare optimum" in which resources are fully employed and the "best available technology" used. That was relevant for Harrod's (1969, pp. 185-87) preference for full economic growth over full-employment output level as the goal of economic policy. Although

¹ "One must not at this point introduce the rate of increase of capital equipment [as a determinant of the natural or optimal growth rate]: that would be to put the cart before the horse" (Harrod 1973, p. 21). He stressed that the growth of potential output is "constituted without residue by the increase in the number of persons and the increase in output per person. Some writers like to add a third factor of increase,
² As pointed out by Robinson (1962), "Harrod set us off on a fresh line by treating technical progress as a built-in propensity in the economy, instead of occasional shocks which shift the equilibrium position".

fully employed, workers may not be supplied with the optimum amount of up-to-date capital goods.

The fact there is full employment at a given point of time is *not* evidence that the growth potential of the economy is being realized. Employers may continue to employ an existing labor force on old-fashioned equipment because their estimate of the prospect of rising demand is not sufficient to justify them in going to the cost of introducing more highly productive methods. It is idle to expect them to devote capital to increasing [workers'] efficiency if they foresee no sales for the extra product resulting therefrom. (Harrod 1969, p. 187)³

Moreover, the concept of natural growth embodies not only technological progress as such, but also the increase of skilled workers and know-how (Harrod 1960, p. 289; 1973, p. 27). This is particularly relevant for underdeveloped countries at the periphery of the creation of new technology. In mature economies the greatest feasible increase in output per head is governed by the application of new discoveries in science and technology. In developing countries, on the other hand, there are in general extensive fields for the application of knowledge created in developed economies. What limits the rate of technical progress, and therefore the natural rate of growth, in those countries is “the maximum possible rate at which cadres of qualified personnel can be increased” (Harrod 1966, p. 170; see also 1963b, p. 113). As Harrod pointed out in correspondence with Solow of 26 November 1963 (underlined in the original), although the fundamental determinants of the natural rate of growth of income per capita differ in developed and developing countries, “both presuppose the presence of sufficient demand” (Harrod 1960-1963). The role of aggregate demand in bringing out the optimum natural rate of growth is further discussed in section 4 below.

Maximizing economic growth is not the same as maximizing the rate of growth of GNP (Gross National Product), as the latter does not provide a precise index of economic welfare (Harrod 1969, pp. 334-35; 1973, pp. 168-69). Leisure is

³ See also Harrod (1948, pp. 73-74) for an argument in favor of a “steady rate of progress conformable with fundamental conditions” as the target of economic policy instead of Keynes’s goal of full employment.

an economic good, bought in exchange for money income foregone. An increase in (voluntary) leisure involves an increase in happiness, although it may cause a reduction of GDP growth. Moreover, as people grow rich they tend to increase the share of services consumed instead of goods. Given the weights given in GNP to the various goods and services, and assuming that the increase of productivity is higher in the goods sector than in the services sector, GNP growth (but not economic welfare) is proportionally lower when the demand for services increases with the “higher degree of civilization” (1969, p. 335).⁴ Economic welfare is broader than GNP, but more limited than the notion of happiness. As seen by Harrod (1963a, p. 417), economics had been based on the “greatest happiness principle” since the classical school and up to Jevons and Edgeworth. He described himself as “an unrepentant believer in inter-personal comparisons and cardinal measurements”. That was partly based on his view that the compensation principle cannot be applied in cases where a given change modifies income distribution and it is impracticable to make compensation (ibid).

Whereas Harrod agreed with the Cambridge approach to utility (see Boianovsky 2014), he parted company with Pigou’s (1920, p. 20) assumption that economic welfare moves in the same direction as total welfare. According to Harrod (1963a, p. 420), “happiness does not depend only on *economic* welfare”. That applied to the common view, criticized by Harrod, that social and cultural institutions should be changed to bring about a higher rate of growth in developing countries.

I recently read a report on a developing country, to the effect that, in order to get growth, it would be needful first to eliminate certain social and religious attitudes. This made me very uneasy. There came into my mind the possibility that we economists of growth might unwittingly, through our excessive zeal for economic welfare, plunge millions of happy human beings, kept joyful by their social and religious attitudes, into stark misery. Economic gain might go but a trifling way towards compensating them for the loss of that happiness

⁴ As observed by Harrod (1954, p. 172), new welfare economics asserts that there can be no more than an ordinal assessment of economic welfare and, therefore, any attempt to measure a percentage increase in welfare is flawed. If one rejects the ordinalist position, as Harrod did, than one accepts the law of diminishing marginal utility associated with cardinalism, which brings about other sorts of measurement problems. The law of diminishing marginal utility entails that GNP statistics overrate increases in economic welfare and reduces the real increase in welfare below its money measure (Harrod, ibid).

that had been dependent on their age-old traditional way of life... *Of course* we must strive to bring more economic welfare to the famished populations of the developing countries. But we should strive to do that in the hard way (Harrod 1963a, pp. 420-21)

In strong contrast with poverty in India and other developing countries, rich countries such as the United States faced the “possibility of economic satiety”, as indicated in the title of Harrod’s ([1958] 1961) invited contribution to the 1958 American Committee for Economic Development. Harrod (p. 7) expected a continuing average increase of per capita income of the United States of 3% a year for the next 20 years, or 80% in total. This raised the issue of whether the American economy was approaching satiation point, which led to critical assessment of the view that needs or desires are unlimited. Harrod rejected such a view, on the grounds that the maximum income level that can give satisfaction to the rich minority of population (i.e. its satiation point) is necessarily above the satiation point of the majority. His argument was based on the distinction between what he called *oligarchic wealth* and *democratic wealth*. The former comprises a large fraction of the consumption of the rich, formed by the purchase of personal services and service-intensive consumption goods (such as large houses). An individual whose income is well above average can enjoy those services, but an overall rise in the incomes of the majority of population will not enable them to reach such consumption standard. It is “impossible for one man”, however high the average income per capita, “to engage in any one year the services of more than one man-year of the labor of others”, which puts a “severe limitation upon the range of possible satisfactions achievable” through a general increase of income (Harrod, p. 8).⁵ Another aspect of oligarchic wealth is that the price of scarce or rare goods, which contain a substantial rent component (such as the “choicest part of New York”), is determined by demand from richer people, beyond the purchasing ability of the average consumer. *Democratic wealth*,

⁵ As put by Hirsch (1976, p. 24) in his discussion of Harrod’s concept of oligarchic wealth, “one man’s servant is another man’s service”. Behind the argument is the implicit assumption that the productivity of an hour’s service remains constant. The average man, no matter how high his income, can never command the service of more than one other average man. Hence, as pointed out by Abramovitz (1979, p. 13) in his interpretation of Harrod’s paradox, there is an absolute fixed amount of ‘services’ which average men can command, no matter how rich they become”.

on the other hand, comprises consumption available to all, and increases according with average productivity. It “can be raised only by more material things, capable of mass production, being made available” – not in respect of direct personal services or of the enjoyment of intrinsically scarce goods.

The upshot of Harrod’s ([1958] 1961) brief essay is that the threshold of economic satiety must always be lower for society as whole than for the rich minority, which may end the “economic struggle” of scarcity and bring the growth process of income per capita to a halt. But that is not the end of history, since “leisure” takes the place of effort time devoted to production. The question then is “how to fill in the leisure?” (p. 10). The relation between leisure and wealth had come up in an open anonymous letter written to Lord John Russell in 1821.⁶ For Harrod it was not just a matter of the amount of free time, but of its quality. Good use of leisure involved culture, which is not limited in range like material wealth. Harrod (p. 12) concluded that future welfare of the United States and other affluent countries would be increased if quality resources were channeled into education, particularly on the arts side, so as to enable citizens to make appropriate use of their more “leisured way of life” ahead. That was, however, a normative matter. As far as the pure market economy was concerned, as observed by Hirsch (1976, p. 24), “paradoxically, and rather nobly ... Harrod, a founder of modern growth economics, led the field in pinpointing what growth could not achieve ... he identified the economic wants and not just the cultural or spiritual values that would go unmet by economic growth”.⁷

Regardless of the prospect of economic satiety, Harrod continued to press economic growth at the natural optimal rate as the grand objective of economic policy.

We need growth to mitigate hardships, which abound even in richer countries, and to give citizens fuller opportunities; and, if and when countries become

⁶ “Wealth is liberty, liberty to recreation – liberty to enjoy life – liberty to improve the mind. Wealth is disposable time, and nothing more” (quoted from Robertson [1957-1958-1959] 1963, p. 17).

⁷ There are some striking similarities between Harrod’s American essay and J.M. Keynes’s ([1930] 1963) well-known “Economic possibilities for our grandchildren”. Harrod, however, did not refer to Keynes in that connection. Instead, in the 1961 reprint Harrod ([1958] 1961, p. 7) mentioned J.K. Galbraith’s 1958 *Affluent Society*, published after his essay was written. Apart from Hirsch (1976), Harrod ([1958] 1961) has influenced Linder’s (1970) *Harried Leisure Class*.

rich to the point of satiety, there is still the great challenge of the poverty-stricken famished countries of the world that an over-plus in the rich countries could help to meet. (Harrod 1965, pp. 77-78)

The natural growth rate was regarded as a “sort of optimum”, not in the sense of a “distant ideal”, but rather objective and feasible in the general institutional, political and economic context of the society, in close connection with the achieved “degree of civilization”, as Harrod (1955, p. 358) pointed out. It is not constant in time, since, as in Harrod’s economic dynamics in general, it is governed by determinants operating at a given point of time (Harrod 1963a, p. 406). In principle, according to a “sophisticated theoretical analysis”, it may vary daily due to changes in the rate of growth of active population and technical progress. In practice, one may consider the natural rate as an average over the period of analysis (1955, *ibid*).

Harrod, of course, was not the only economist supporting growth as the goal of economic policy. Evsey Domar (1956, p. 14), in the foreword to his collection of essays, observed that the goals of growth and full employment were not necessarily incompatible, but neither were they identical. Growth was deemed the “healthier objective”, as full employment could coexist with inefficiency and stagnation. According to Domar ([1952] 1957, p. 30), the “optimum allocation of resources does not mean the maximum output under given conditions at a point of time but a maximum achievable rate of growth over time”. The concept of a natural growth rate is only implicit in Domar’s framework though, as discussed by Harrod (1959, pp. 455-56) in his assertion of the close similarities between his and Domar’s approaches to economic dynamics (see also Boianovsky 2015a). Economic growth as a goal of economic policy was the topic of James Tobin’s (1964) presidential address to the American Economic Association. However, differently from both Domar and Harrod, Tobin relied on the neoclassical Solovian adjustment mechanism to argue that, asymptotically, policy makers have no choice over the rate of growth, but can choose only among parallel paths of different levels according to the golden rule. The natural rate is also exogenous in Harrod’s (and Domar’s) framework, but the convergence to the natural optimal path is a matter of economic policy, which affects the determination of the optimum rate of savings.

When introducing the notion of optimal growth rate as an optimum, Harrod (1953, p. 554) recognized that there was some “ambiguity” in his concept in relation

to the optimal distribution of effort in the provision of present and future goods. At first, he thought the distribution determined by savings individuals prefer to perform when fully employed could be regarded as optimal, but acknowledged that the subject needed further clarification. A couple of year after, Harrod (1957a, p. 3) still regarded the optimum natural rate idea ambiguous, as “nothing is stipulated about the behavior of the rate of interest”. It was only in his 1960 “Second essay” that Harrod came up with an answer, as discussed next.

3. Saving, the rate of interest, and Ramsey

Harrod (1960, 1963a) restatement of the natural growth rate as a welfare optimum, and of the role of saving in that framework, should be seen against the background of the distinction between three different growth rates introduced in 1939 and further elaborated in 1948. As it is well-known, Harrod (1939, 1948 chapter 3) distinguished between the *actual* growth rate per unit of time $G = s/C$, the *warranted* rate $G_w = s/C_r$, and the *natural* rate G_n , where s is the fraction of income saved, C is the accretion of capital divided by the increment of goods produced in the same unit of time, and C_r is the requirement for new capital divided by the increment of output to sustain which new capital is required, that is, the required (“accelerator”) capital coefficient. The definition of C_r followed from the assumption that the capital/output ratio is constant because inventions are Harrod-neutral and the rate of interest is given. It is a marginal concept. As Harrod often pointed out, the expression for the actual rate C is necessarily true, that is, a truism or tautology, based on the identity between ex-post investment and ex-post saving. The warranted rate, on the other hand, expresses the equilibrium of steady growth, in the sense that entrepreneurs are satisfied with their production and investment decisions, so that the market for goods is in equilibrium. Harrod (1939, p. 17) called it the “fundamental equation” of economic dynamics.

In order for the warranted rate to be equal to the natural one, the required saving ratio must be such that $s_r = C_r G_n$. When introducing that equation, Harrod (1960, p. 285) stressed that the fraction of income saved s_r becomes a “*desideratum*” along the optimal full-employment growth path. While the natural rate of growth is

(mostly) exogenous in relation to the variables of the equations and “is therefore taken to *require* a specified amount of savings (s_r), the warranted rate of growth is taken to be determined by the actual rate of saving (s)” (p. 286). In the equilibrium (warranted) equation it is assumed that economic agents are free to save the amount they prefer, which decides the equilibrium growth rate.⁸ But, under the assumption that growth is sustained at its potential level, the fraction that agents “collectively have to save” is determined (Harrod 1976, p. 72). Hence, whereas s is an independent variable, s_r is a dependent one.

This assumption of the independence of s is appropriate in its context. Indeed, the fact that the “warranted” rate of growth may not be equal to the “natural” rate depends precisely on the assumption that private motives may not yield the amount of saving that complies nicely with the needs of society; they may generate too much or too little saving. The Keynesian origin of this idea is obvious. (Harrod 1960, p. 279)

The different roles of the saving ratio in Harrod’s framework have not always been appreciated in the literature. In the new chapter on growth theory, added to the 6th edition of his *Economics*, Paul Samuelson (1964, pp. 743-46) got it right. Samuelson made clear the distinction between the required and the actual desired saving ratios in the specification of Harrod’s equations of the natural and warranted growth rates.

The macroeconomic relation between capital accumulation and the natural growth rate in Harrod’s framework, and its change between the 1930s/40s and the 1960/70s, is not straightforward. As pointed out by D.H. Robertson (1961, pp. 14-15), many growth theorists treated technical progress as something that “just happens” and increases output regardless of whether capital is growing or not. For Harrod, on the other hand, technical progress will only bring about economic growth

⁸ A high s means that the equilibrium rate G_w is high, because only with a high rate of growth there will be enough investment to absorb (through the accelerator mechanism) available saving. Whether a high s actually brings about a high growth rate G is a different issue, pertaining to the stability properties of Harrod’s demand-dominated model (see e.g. Hahn and Matthews 1964).

if “additional capital to ‘support’ it is forthcoming on the requisite scale” (ibid).⁹ In Harrod’s (1939, 1948) initial formulation the natural growth rate was the highest rate of output continuously permitted by what he called “fundamental conditions” (the rate of growth of population and the rate of technical progress). “*For* it to be maintained capital must grow at such a rate as to keep the rate of interest constant; but the question of how such a rate of growth of capital was achieved, if it was achieved at all”, did not affect the definition of G_n . This changed in Harrod’s (1960) restatement of the natural growth rate as welfare optimum. In Robertson’s (p. 15) enlightening interpretation, Harrod redefined G_n “as the maximum rate of growth of output which would be compatible” not only with the fundamental conditions of population growth and technical progress, but “with a particular behavior on the part of the community as regards saving” (see also Asimakopulos and Weldon 1965).

In his latter writings Harrod made an attempt to explain saving by rational agents under the double assumption of the law of diminishing marginal utility and absence of net time preference, both borrowed from Ramsey’s (1928) classic contribution. Harrod’s (1960, pp. 278-79; 1963a, p. 404) new approach to the natural rate reflected also his conceding to the neoclassical criticism that he had overlooked the influence of the interest rate in the determination of saving and the capital coefficient. “The difficulty”, however, “is to discover the correct theory of interest” (1963a, p. 404).

Harrod had long been attracted to Ramsey’s approach to optimal capital accumulation (see also Duarte 2009, pp. 171-72). In fact, the two men corresponded extensively in 1929 about details of Ramsey’s model of saving (see Ramsey’s letter of 27 March 1929 to Harrod, reproduced as letter # 158 in Besomi 2003). Harrod ([1936] 1965, pp. 108-09; 1938, p. 404, n.1) endorsed Ramsey’s result that if an individual is not biased in favor of the present – that is, has zero net time preference – he should save at such a pace that his net income rises at such a rate that the marginal utility of consumption falls at a rate equal to the current rate of interest.¹⁰ Harrod’s (1948) chapter two on “the supply of saving” was entirely Ramseyan, but it was only in his 1960 (p. 281) “Second essay” that he combined Ramsey’s 1928 model with his own approach to growth to put forward his second “fundamental equation”, relating

⁹ Cf. Harrod’s (1973, p. 108) remark that saving is necessary to “finance ‘natural’ growth”.

¹⁰ Ramsey’s result had been anticipated by Knut Wicksell (see Boianovsky 1998).

the natural rate of interest and the natural rate of growth: $r_n = \frac{pc G_n}{e}$, where r_n is the natural rate of interest appropriate to a welfare optimum rate of growth, pcG_n is the natural rate of growth per capita and e is the (inverse of the) elasticity of the diminishing marginal utility of income schedule.

Harrod's "supply equation" was derived by rewriting Ramsey's condition as $r = \frac{G(con)}{e}$, where $G(con)$ is the rate of growth of consumption (see also Asimakopulos and Weldon 1963; Wan 1971, p. 22, n. 6). Harrod then replaced $G(con)$ for G on the grounds that consumption and income increase at the same rate in steady growth. Differently from Harrod, Ramsey had assumed constant population. In order to apply the expression to a community (instead of a representative individual as in Ramsey), Harrod assumed a given income distribution, interpreted e as a weighted average of individual elasticities, and expressed consumption in per capita terms. The concept and measurement of e implies, as in Ramsey, cardinal measurement of utility (Harrod 1963a, p. 417; 1973, p. 79). Hence, $r = \frac{pcG}{e}$, which, however, was not yet Harrod's supply equation. The next step was to switch the role of the interest and growth terms, and to replace G for G_n , exogenously determined by population growth and technical progress. Corresponding to the natural or welfare growth rate was Harrod's "natural rate of interest", which led to his supply equation $r_n = \frac{pc G_n}{e}$. As pointed out by Harrod (1960, p. 282), G_n is only "mainly" exogenous, since the capital coefficient C_r is a negative function of the rate of interest. This means that r_n is determined by a system of three simultaneous equations: $G_w = s/C_r$, $r_n = \frac{pc G_n}{e}$, and $C_r = f(r_n)$.

Although Harrod deployed Ramsey's formulation of the saving decision, he did not follow Ramsey in assuming that as capital accumulated the economy would asymptotically approach a condition of maximum utility called "Bliss" at zero marginal productivity of capital and interest rate. In the case of a steadily growing economy it is possible to formulate the optimum rate of saving "without reference to the whole journey to Bliss", as Harrod (1963b, p. 121) observed. In fact, a couple of years later T. Koopmans (1965) would argue that, in an economy with steadily increasing population, the golden rule path – that is, the path that maximizes consumption per capita, with the rate of interest equal to the rate of population growth – takes the place of Ramsey's state of Bliss in determining optimal growth.

Moreover, Harrod (1960, p. 280; 1963a, p. 410; 1966, p. 169) deemed Ramsey's Bliss unsatisfactory for welfare economics, as it involved the "impracticable" comparison of the total utility achieved at "Bliss" with total and marginal utility currently achieved.¹¹ Moreover, Ramsey's concept was considered "theoretically inappropriate" for economic dynamics, as it assumed that the gradient of the path to Bliss is determined only by the rate of saving, whereas in fact it depended on the rate of technical progress, as expressed by Harrod's notion of optimal growth.

I define the optimum rate of saving (equals investment) as that required to implement the maximum growth of production rendered possible by the growth of factors other than capital disposal ... This is in conflict with views that have been much canvassed recently in the theoretical literature. In some of this writings it is implied that the growth of income depends primarily on the extent to which a community is prepared to sacrifice present consumption in favor of future consumption ... Once we recognize that the increase of future income obtainable by a sacrifice of consumption now is a function of the rate at which non-capital factors are growing, it appears that Ramsey's solution lacks a dimension. (Harrod 1963b, pp. 113-14)

Harrod's criticism goes against the widespread view that he (together with Domar) founded the idea, later dubbed "capital fundamentalism", that capital accumulation is the engine of growth (King and Levine 1994; Easterly 2001, chapter 3). Although "capital fundamentalism" may describe parts of development economics and policy based on a mechanical interpretation of the so-called Harrod-Domar model (see Boianovsky 2015b), it is not consistent with Harrod's own views of economic growth and development. Indeed, in his review of *Keynesian Dynamics*, by the American-Japanese economist Kenneth Kurihara (1956), Harrod (1957b, p. 193) criticized Kurihara (p. 211) for suggesting that the major problem facing underdeveloped economies was "increasing capital accumulation". "Is this not a wrong emphasis, not confined to Professor Kurihara?" asked Harrod. Surely, he

¹¹ Writing B for Bliss, x for the current daily rate of saving, c for the current daily rate of consumption, U for its total utility and V for its marginal utility, the so-called "Keynes-Ramsey" rule establishes that the optimal rate of saving is given by $x = \frac{B-U}{V}$ (see Robertson [1957-1958-1959] 1963, p. 252 for a simple derivation). "This does not look very promising from the practical point of view", Robertson (ibid) noted.

claimed, more important limitations came from factors, such as lack of know-how, which are behind the natural rate of growth of per capita output. Harrod (1966, p. 169) would often reject the notion that the growth of output per capita is governed by an increase in the capital-labor ratio. Indeed, “if an attempt were made to get growth in output per head merely by increasing the capital/labor ratio, when no other factors of increase were operating, it is likely that one would run into sharply diminishing returns, and very soon a nil return, from any further rise in the capital/labor ratio” (ibid). At the 1961 Brissago conference he described his argument as a “dynamized version of the law of diminishing returns to one factor” (1963b, p. 114).

It is interesting – and perhaps surprising to many, in view of prevailing accounts of the history of growth economics (see e.g. Easterly 2001, chapters 2 and 3) – to find Harrod in the unlikely position of criticizing Solow, in correspondence of 26 November 1963, for “following Ramsey [and taking] the growth potential to be mainly determined by the rate of investment” instead of technical progress. In a previous letter (August 30 1960) to Solow, Harrod explained that in his 1960 “Second essay” he was “breaking away” from Ramsey’s line of thought. “I now entirely repudiate” the notion that in assessing the optimum rate of saving we must take into account utilities in the state of bliss in the remote future. He would stress in his 1963 presidential address that in his analysis, unlike that of Ramsey, the “optimum rate of saving is shown as governed by determinants operating *at a given point of time* without any reference to the future course of events” (1963a, p. 406).¹²

Solow was not convinced that Harrod (1960) had successfully broken away from Ramsey. In his reply of 23 September 1960, he argued that Harrod’s second fundamental equation assumed that the future values of the rate of interest are “independent of the present and future decisions about saving and capital formation. And this in turn follows only if the marginal productivity of capital is constant”. If the return on capital depends on the stock of accumulated capital, then today’s investment decision influence the terms in which present and future consumption will be exchangeable in next periods, “and the welfare decision reverts to a more complicated Ramseyan form”. Solow concluded that Harrod’s attempt – to apply the

¹² As pointed out by Chakravarty (1962, p. 339, n. 4), Harrod (1960) dealt with a finite economic horizon, but overlooked the question of valuing terminal capital equipment. It worth noting that, contrary to Duarte’s (2009, p. 172) suggestion, Harrod did not brake away from Ramsey’s utilitarian analysis.

new equation for the natural rate to an economy with a variable capital coefficient – failed in the sense that the equation could only be deduced from Ramsey’s saving function if the capital coefficient was fixed (see also Young 1989, p. 184). The matter was related to Graaff’s (1960) objection to Harrod’s (1960) identification of the growth rate of per capita income with the growth rate of per capita consumption. That was only valid under the “restrictive” assumption of a constant capital-output ratio, as Harrod (1963a, p. 405) would acknowledge later. Moreover, Solow’s criticism brought out the contrast between Harrod’s formula of a constant optimal saving ratio and the dominant neoclassical approach to optimal growth. As observed by Henry Wan (1971, p. 22, n. 6), Harrod “grafted the constant saving/income ratio assumption of Keynes onto the optimal saving model of Ramsey. But under what conditions will the optimal saving ratio be constant over time?” The answer is that in an optimal saving model with constant capital/output ratio and constant elasticity of marginal utility e , the optimal output path and the optimal consumption path will grow at the same rate only if $e = 1$, as in the utility function $u = \log c$, a quite restrictive case (ibid).

In his assessment of Harrod’s approach to optimal saving, written before the emergence of the neoclassical literature on optimal growth, Amartya Sen (1961, p. 496) found a “little puzzling” at first Harrod’s claim that a growth rate given by a set of purely objective factors (the natural rate) should be regarded automatically as the normative “welfare optimum”. As pointed out by Sen, Harrod did deploy a utility function, but its main role was to determine what (“natural”) interest rate, as an expression of intertemporal preference¹³, is consistent with the natural welfare optimum rate of growth, not to decide the growth rate itself. Harrod’s natural growth rate, to recapitulate, is the only rate of growth consistent with sustained full employment. Sen (ibid) regarded Harrod’s approach as a “very neat and ingenious method of solving this [optimal] intertemporal problem using value judgments that are sufficiently spread ... to be taken for granted”. Domar (1957, p. 14) had already

¹³ Harrod assumed a particular behavior on the part of the community as regards saving, as observed by Robertson (1961, p. 15). It behaves as it would do if it consisted entirely of individuals who “were conscious indeed of a law of diminishing marginal utility of consumption but free of the regrettable human tendency to regard the present as more important than the future and themselves as more important than their successors” (ibid). See also Harrod (1948, p. 40) oft-quoted remark that pure time preference is a “polite expression for rapacity and the conquest of reason by passion”.

suggested that the preference for maximizing the rate of economic growth is a “value judgment”. Harrod (1963a, pp. 416-20), in what was probably in part a reaction to Sen’s remarks, rejected the view that economic recommendations in general implied some form of value judgments. The “happiness principle” should be enough to warrant the natural growth rate as welfare optimum, according to Harrod. What Sen found unacceptable in Harrod’s solution, though, was the assumption that technical progress and population growth (and therefore the natural growth rate itself) are in the main exogenous variables independent of capital accumulation. Sen contrasted that with Tinbergen’s (1956) discussion of optimal saving – based on a traditional “Harrod-Domar” equation with a given capital-output ratio – and its result that a rise in the saving rate leads to a rise in the growth rate in the same proportion. Tinbergen (1956) fitted well in the postwar economic development literature, which tended to disregard Harrod’s concept of a natural rate of growth (see Little 1982, p. 42), differently from the role it played in Harrod’s own approach to economic policy.

4. Economic dynamics, growth policy and planning

Harrod (1964, p. 905) gave two reasons why he eventually came to regard the concept of the natural growth rate as “more important” than the warranted rate. Firstly, it was “*realistic* in relation to what is *quantitatively* important in determining the system”. Moreover, he anticipated that G_n would be of increasing relevance in economic dynamics. The matter was related to the notion of “model”, as discussed in detail by Harrod (1968) in his contribution to the John Hicks Festschrift. He rejected on that occasion the widespread references to the “Harrod-Domar model”. A “model” is “a formulation that has adjustable parameters”, in the sense of parameters or constants that can be estimated econometrically and therefore falsified (p. 174-75). The first form of Harrod’s dynamic equations, $G = s/C$, is a tautology with no adjustable parameters. The equation for the warranted rate, $G_w = s/C_r$, may be treated as definitional or tautological, in the sense that G_w is *defined* as that rate of growth which, if it took place, would be consistent with “people saving what they desire to save and with additional capital being furnished in accordance with requirements” (p. 186). Finally, the difficulty with the third dynamic equation, $s_r = C_r G_n$, did not lie in

the concept of natural growth, but in “making a statistical forecast” of it. Under the assumption that, from the perspective of economic welfare, output should grow at the greatest possible rate, the equation looks “self-evident”, with no adjustable parameters. However, the equation that really mattered was Harrod’s “supply equation” $r_n = \frac{pc G_n}{e}$, which stated that the welfare optimum natural rate of interest is determined by the prospective growth rate of income per capita divided by the elasticity of the marginal utility of income schedule.

Harrod claimed that the natural rate of interest could be empirically estimated, once measurements of e and pcG_n were made. Econometric investigations of e mentioned by Harrod (1963a, p. 408) indicated a value close to 0.5. Harrod (1976, p. 74) acknowledged that in practice there must be “some haziness” about the rate at which the income of the representative person will grow in the future, but suggested that 5% was a good guess (1973, p. 77). Hence, the estimated value of the natural rate of interest was around 10% for the UK. The upshot was that, differently from Harrod’s other dynamic equations, the set-up as a whole for the natural rates of interest and growth “would become rather model-like” (1968, p. 188), which should provide some rough guidelines for economic (monetary) policy. Accordingly, claimed Harrod (1976, p. 74), banking policy “should be framed so as to cause the interest rate to move to the optimal level ... This maxim does not, in fact, give the banking system much guidance, owing to the uncertainty about what the rate of growth will be. But the criterion does set limits.”

Since his first “Essay”, Harrod (1939, pp. 31-33) had distinguished between two problems of policy: (i) the short-term one of preventing deviations from the warranted steady growth rate and (ii) the long-term one of bringing the warranted rate into equality with the natural rate. In the 1960s and 1970s he focused mostly on the second problem, which could be solved by affecting the rate of saving through fiscal policy and/or the capital coefficient through monetary policy. However, both fiscal and monetary policies have their limits in bringing the economy to its natural growth path. Assuming the propensity to save is weak in relation to the growth potential of the economy, to obtain a full-employment rate of advance the rate of interest should in principle be high enough to encourage such labor intensive methods “as to leave enough savings over to finance a ‘widening’ of production in accordance with the growth potential of the economy” (Harrod 1963c, p. 75). Harrod doubted the rate of

interest could rise so high. If it did not, and if monetary authorities adopted measures to prevent inflation, there would not be enough saving to finance potential growth. More generally, he asked whether there was any “rate of interest sufficiently high to render productive processes sufficiently labor intensive to leave enough savings over for optimum growth” (ibid). If not, compulsory saving (budget surplus) was necessary. However, budget surplus, because of its potential perverse effect on current and expected consumption expenditure, could affect negatively investment demand by firms (Harrod 1973, pp. 118-19).

It was in that context that Harrod (1963c, pp. 77-78; 1964, pp. 914-15; 1973, pp. 119-21) advocated the use of indicative planning in the UK and other industrialized countries, along the lines of the successful French experience since the 1950s (see Estrin and Holmes 1983). The creation of the British National Economic Development Council (NEDC) in 1962, in an attempt to address Britain’s relative economic decline, provided a political context for Harrod’s (1964, p. 915) plea for indicative planning. NEDC added a new dimension to the British welfare state, as seen by Harrod. In a growing economy producers are required to provide for a demand that does not yet exist, and “about which they can have no certainty that it ever will exist” (p. 914). Indicative planning should be used to give entrepreneurs the necessary assurance that their markets will in fact increase over a period of time, based on the forecast of the potential growth rate estimated by economic planners. From that perspective, the natural growth rate could ground demand expectations and make producers “sufficiently adventuresome”, even if there is no compulsion whatever in the plan. If some feasible growth rate is postulated, it may be possible to deduce what the rate of expansion of demand is likely to be in various sectors (Harrod 1963c, p. 77).

If the planning body can evaluate, naturally with some error, the growth potential of the economy, and the likely appropriate rates of growth of different industries, subject to the overall growth potential being realized, will this give entrepreneurs some ground to be more adventuresome than they would be in its absence? ... The industries should be requested to comment, and if some regard the parts of the plan assigned to them as not feasible, the planning body should do a new input-output analysis in the light of the information and present a fresh plan ... Thus in the end the industries should

be able to consider the plan as well based in all its parts. (Harrod 1964, p. 914)

Hence, by fixing demand expectations on the underlying natural rate of growth, Harrod (1963c, p. 77) believed indicative planning would be able to “jack up” the actual and warranted growth rates to this optimal figure (see also Estrin and Holmes, pp. 19-21). Harrod (1964, p. 914) was aware that the expectational effect of planned targets depended on the existence of some “guarantee” by policy makers that monetary and fiscal policy would be deployed to ensure that the economy reaches its growth potential.¹⁴ As he realized, this created a theoretical dilemma. If authorities have the policy instruments to give this guarantee to ensure natural welfare optimum growth, why is indicative planning necessary? On the other hand, if they lack such instruments, how can they give the required guarantee? (ibid) However, even if monetary and fiscal policies are able to ensure a growth of aggregate demand in accordance with the supply potential, they will likely do so at the price of demand inflation. Indicative planning, claimed Harrod (1964, p. 914; 1973, pp. 120-21), may significantly reduce that risk. From that perspective, planning may be useful to “reduce the influence of monetary authorities and prevent their stunting growth by an unduly restrictive policy, actuated by fears of inflation or balance of payments difficulties” (Harrod 1963b, p. 115, n. 1).

Planning in developing countries had a different goal, as discussed by Harrod (1963a, 1963b). It was not so much a matter of reaching the natural growth rate, but changing the natural path itself. That was not the same as indicative planning. Developing countries lacked “enterprise”, in the sense of “pure will power or initiative”, which restricted taking up potential production projects.¹⁵ “By a ‘plan’ a governmental agency, supposed to be more enterprising than the main mass of individuals, takes on the role of supplying the basic will-power” (1963b, p. 115). The main determinant of G_n per capita in developing countries is the maximum rate at

¹⁴ Domar ([1946] 1957, pp. 79-81) had already suggested that a “guaranteed growth of income” as the best way to call forth sufficient investment and achieve the full employment growth path (see Boianovsky 2015a).

¹⁵ This is close to Albert Hirschman’s (1958, pp. 35-40) well-known concept of “ability to invest” as the main restriction on economic development. Harrod did not refer to Hirschman’s *Strategy of Economic Development*, but read it carefully. In correspondence of 1963 with Hirschman, Harrod praised *Strategy* as the “most interesting book that I have read on economics for years” (Adelman 2013, p. 350).

which qualified personnel can be increased. The supplement to previous entrepreneurship through planning may raise that rate and thereby entail an upward inflection in the natural growth curve, accompanied by a higher s_r . Harrod (1963a, p. 410; 1963b, pp. 121-22) asked whether, under those circumstances, consumption per capita must be reduced. He rejected the view of the “stern moralist” that a developing country should reduce consumption in order to build up its capital (1963b, p. 121). According to Harrod, this would have a perverse effect on “incentives” provided for the higher forms of work associated with skilled personnel, which are essential for the growth process.

The problem for the developing countries is how, out of an increasing national product, to provide *both* saving at a higher level (the s_r as increased by the plan) *and* sufficient incentives, involving increasing consumption for the increasing cadres of qualified personnel (1963a, pp. 410-11).

In order to take into account the restriction of the amount of feasible saving caused by the increased incentives, Harrod (p. 411) suggested the concept of “optimum transitional saving” s_{rtr} , which is less than s_r during the economic development breakthrough. However, it might happen that the increase of consumption, essential to give the necessary incentives, was such as to prevent an increase in s_{rtr} . This is the case for foreign aid, since an unaided take-off into sustained growth would be impossible, as discussed in detail by Harrod (1963b).

As often pointed out by Harrod, it is the shortage in the increase of personnel well-adapted to enterprise and business management (as well as the increase of know-how) in developing economies that accounts for low growth, rather than a low s as compared to s_r . If, for those reasons, a high G_n is not feasible, s_r will be low, and s , though probably low in developing countries, may not fall short of s_r . Nevertheless, Harrod (1960, pp. 289-91) discussed in detail as well the case where s is below s_r , that is, $G_w < G_n$. This is a condition of chronic tendency to inflation in mature countries, but not necessarily in developing countries, where capital markets are insufficiently accommodating (see Boianovsky 2015b). If actual growth is below natural growth only because of the shortage of saving, this implies that there is available qualified personnel to implement improved methods of production. In such a case, to obtain “social optimum” it is necessary to raise s towards s_r by a budget

surplus or compulsory levy. Such increase of saving would bring the economy to a “transitional period” in which actual growth is above natural growth, owing to the exploiting of previously underemployed personnel. Once the limited fund of such personnel is taken up, transitional growth is merged into regular natural growth. There are clear limits to the effect of higher saving on the per capita rate of growth, since its “very essence ... is the education by practice and the gradual drawing out of the latent potentialities of personnel” (p. 291). This is a crucial aspect of Harrod’s concept of natural optimum growth, which differed sharply from simple and widespread recipes – often based on a misinterpretation of the so-called Harrod-Domar model – that stressed saving as the key to economic growth.

It is important to avoid over-simplified ideas about the consequences of the mere provision of additional saving. This view might be regarded as pessimistic in that it sets a limit to what can be done by one simple recipe (more saving); but it is optimistic in that it enables us to curb the impulses of those who believe Utopia can be gained solely by the imposition of harsh austerity. (Harrod 1960, p. 291)

“Utopia” in this context means achieving the natural welfare optimum rate of growth and possibly bringing it to a higher level.

5. Concluding remarks

Dynamic welfare economics, in the sense of the extension of welfare economics to intertemporal decisions, became an important area of research after mid 1950s and particularly after the development of optimal growth models in the 1960s. Apparently, Arrow (1951, p. 926) was the first to use the term “dynamic welfare economics”, but it did not gain currency until later (see e.g. Heal 2005). Harrod saw the extension of his concept of natural rate of growth to welfare economics as an important task pertaining to the core of economic theory and policy. From that perspective, Harrod overlapped with some aspects of optimal growth models based on the Solow-Swan neoclassical approach to economic growth. This has led Asimakopulos and Weldon (1965, p. 71) to call Harrod’s (1960, 1963a) set of articles “Harrod II”, as distinguished from “Harrod I” of 1939 and 1948. According to

Asimakopulos and Weldon (ibid), “Harrod II”, Solow (1956) and Swan (1956) were essentially the same model of a system of natural growth. In his later historical treatment of Harrod’s economic dynamics, Asimakopulos (1985, 1986) discussed only “Harrod I”, with no reference at all to Harrod (1960, 1963a). However, although Harrod did shift the focus of his research in the 1960s, the sharp contrast between “Harrod I” and “Harrod II” may be more distracting than revealing. Harrod continued to frame his economic dynamics and policy in terms of differences between his three concepts of growth rates (see Harrod 1973, chapter 7). Indeed, Harrod (1973, pp. 167-68) would criticize “current writings” for not recognizing that there are “two normative growth rates” – the one that enables investment requirements to absorb the saving people want to make, and the one that corresponds to the increase of manpower and technological progress – and that they “may be *entirely different*”.

Harrod believed his concept of optimum saving required to implement the natural growth rate could be instrumental in the formulation of macroeconomic growth policy in the context of the postwar welfare state. Collard (2011, p. 268) has described Harrod’s “Second essay” as a “valiant (and rather neglected) attempt to bring ‘optimality’ back to center stage”, despite the fact that the attempt to marry up Ramsey and the natural rate theories was “not fully worked out”. The relative neglect of Harrod’s analysis of optimal growth, however, can hardly be ascribed to any lack of effort from his part to integrate – if critically – Ramsey’s model with Harrod’s own dynamic framework. Harrod shared Ramsey’s utilitarianism, and used in his calculation of e the notion of a “community utility function” (deployed by Harrod and others in trade theory) as an average of individual utility functions. The argument applied to capitalist and socialist economies alike. Indeed, Harrod (1971, p. 150, 1973, p. 30) criticized Michal Kalecki (1970) for assuming that the choice between present and future consumption is determined by arbitrary government decision in socialist economies instead of (gross) time preference as expressed by the elasticity of the diminishing marginal utility of income. Socialist (and capitalist) economies should disregard pure time preference – but not the law of diminishing marginal utility of income, overlooked by Soviet Union’s “ruthless saving” in its first Five-Year Plan (Harrod 1948, p. 40).

Harrod’s natural growth rate idea fit well with the notion of the limit to productive accumulation of capital imposed by the “absorptive capacity” of investment in developing countries, where cooperative factors other than capital

(such as qualified personnel) tend to be in short supply (see Guillaumont, 1971). It did not square so well with other concepts extensively used at the time by development economists, such as the notion of an endogenous labor force as in W. A. Lewis's unlimited supply of labor model or Marx's industrial reserve army. As pointed out by Stephen Marglin (1984, pp. 77-78), much of Harrod's argument about the dynamic effects of divergences between the warranted and natural growth rates depends on the view that population growth puts a limit to expansion, in contrast with Lewis. There have been attempts by some Harrodian economists to reformulate the natural rate of growth as a partly endogenous variable (Leon-Ledesma and Thirlwall 2002). In fact, Harrod's discussion of the role of incentives may be seen as a first step into that direction. Be as it may, an essential feature of Harrod's concept of optimum saving is the proposition that the maximum rate of increase of qualified workers represents a more important limitation than the supply of capital-disposal in determining the maximum growth rate in developing countries. Harrod (1962, p. 10) expressed his belief, at a conference in Asia, that "if all other factors were known to be present in adequate supply (and if the markets for products were known to be available) there would be seldom any difficulty in obtaining the capital-disposal required". The training and qualification of workers was closely related to the issue of education, the "most important problem in the whole range of development economics". The historical experience of Japan, where compulsory education was introduced in 1868, a few years after the fall of the Shogunate, was a case in point. "It may well be thought that this provision was the most important cause of Japan now having such a long leading in economic development over all other Asian countries" (ibid). This seemed to Harrod an illustration of the applicability of his natural welfare optimum growth framework to different historical episodes.

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