Domar, Expectations, and Growth Stabilization

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Abstract. Evsey Domar put forward in a couple of articles in the 1940s a "guaranteed income growth proposal." For the first time in macroeconomics, economic policy was supposed to work merely through the impact of its announcement on expectations. He claimed that optimistic expectations of income growth would be created by credible announcement to use government spending to bring the economy to its required growth rate. Confident expectations generated by government's assurance of future growth would induce private investment decisions in a scale that would bring about the required growth rate and by that justify the expectations, without putting the guarantee to test. This paper presents a detailed treatment of Domar's stabilization plan in the context of his growth model, together with discussion of similar ideas put forward by Roy Harrod and of critical reactions by Alvin Hansen.

Key words. Domar, expectations, guaranteed growth, stabilization policy

JEL classification. B22, B31, E61

Suppose now that it were possible for the government (presumably) to guarantee that income would actually grow at this [required] rate for some time to come. Would not this guarantee, if taken seriously by the business public, call forth sufficient investment and thus *make* income grow at the required rate? This is full employment by magic! (Domar [1948a] 1957; italics in the original)

1. Growth models and policy

Evsey Domar's path-breaking contributions to economic growth modeling, like Roy Harrod's, aimed at providing a set of concepts instrumental for the formulation of full-employment growth stabilization policies. Domar's 1940s growth models were explicitly policy-oriented. As a member of the circle of influence of his Harvard thesis supervisor, the leading American Keynesian Alvin Hansen, Domar presented, in the spring of 1944, a first version of his well-known paper on the burden of public debt and economic growth (Domar [1944] 1957) at the famous Fiscal Policy Seminar Hansen conducted at Harvard together with John Williams (Salant 1976: 19). Between February 1943 and June 1946 Domar worked at the Federal Reserve Board in Washington, as assistant to Hansen (who was special advisor to the Fed during the war) on maters of fiscal policy (see Domar 1992: 120-22). Paul Samuelson (undated) aptly described Domar's appointment at the Fed as "Poet in Residence." Domar would submit in March 1947 his PhD thesis, formed by four essays on growth (Domar 1947b; see Boianovsky 2017a).

Upon his arrival in Washington in 1943, Domar suggested to Hansen the organization at the Board of seminars on macroeconomic policy, along the lines of the Harvard Fiscal Policy seminars. The Fed seminar series were inaugurated in great style by John M. Keynes, who happened to be in Washington in the fall of 1943 for preliminary talks on the Bretton Woods Agreements (Domar 1996: 184-85).[1]

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[1] The sources on Keynes's lecture are the recollections given in interviews by Domar, Hansen, Richard Musgrave, Paul Samuelson and Abba Lerner to Colander and Landreth (1996). Keynes strongly and unexpectedly criticized Lerner's notion of

In a footnote to his *Econometrica* growth essay, Domar ([1946] 1957: 70, n. 1) referred to the seminars he and Hansen put together at the Washington Fed from 1943-46 as the "Little Seminar", attended mostly by young economists – he listed P. Baran, L. Metzler, R. Musgrave, J. Duesenberry and T. Scitovsky, among others – working in DC at the time. The only other reference to the "Little Seminar" may be found in Samuelson's (undated) mention of "Washington's wartime Little Seminar", which gathered "the cream of the cream" of American economists. Another policy-oriented paper, written by Domar jointly with Richard Musgrave, on the effects of taxation on risk-taking and investment (Domar and Musgrave 1944), was probably presented at the Little Seminar. One may presume that, when Domar presented his 1946 growth model at the Fed, he discussed the policy implications of that model, set forth in the last section (IV) as the climax of the paper.

Although not listed by Domar ([1946] 1957: 70, n. 1), Thomas Schelling – who in 1947 would put Harrod (1939) and Domar ([1946] 1957; [1947a] 1957) together in the same broad "Harrod-Domar" model, as he named it – probably attended the Little Seminar. Schelling worked in 1944-45 at the Fiscal Division of the U.S. Bureau of the Budget, from where he used to "keep track" of what was going on at the Treasury, the Fed and other wartime agencies (Schelling 2009: 396). Moreover, Schelling partially overlapped with Domar at Harvard, where he was a PhD student and teaching assistant to Hansen, G. Haberler and E. Chamberlin from 1946-48. Schelling (1947) provided the first discussion of Harrod's (1939) dynamics in an American journal, upon learning about that article from Domar's ([1947a] 1957: 92, n.) footnote added in proofs-correction stage.

Domar's ([1946] 1957: 79-81) section IV was titled "Guaranteed Growth of Income". It featured prominently in Schelling (1947), but it has been only occasionally discussed ever since. Domar ([1948a] 1957: 118-20) would come back to his guaranteed growth plan in his discussion of alternative growth stabilization policies. He also presented it as a policy conclusion in papers produced during his 1947-48 period at the University of Chicago and the Cowles Commission (Domar 1947e, 1948c, 1949a). Apart from Schelling, Ernest Stern (1949: 1161), R.G.D. Allen (1956: 68) and Daniel Hamberg (1956: 148, n.) briefly mentioned Domar's plan in different contexts, without challenging its main tenets (see Domar 1949b). Robert

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functional finance on the occasion (see Aspromourgos 2014 and references cited therein).

Eisner (1953) critically discussed its microeconomic features. After a long interval, Walt Rostow (1990: 333-34) and particularly Robert Solow (2006: 136-37) would address again aspects of Domar's scheme. More importantly, Harrod (1963a, b; 1964; 1973) eventually advocated growth stabilization along lines similar to Domar's proposal, without referring to Domar though.

What makes Domar's guaranteed growth proposal particularly interesting is that, for the first time in macroeconomics, economic policy was supposed to work merely through the impact of its announcement on expectations. Upon establishing that the required growth rate of both investment and income that keeps the economy on its full-employment growth path is given by $\alpha\sigma$ – where α is the marginal (= average) propensity to save and σ is the potential social average productivity of investment – Domar ([1946] 1957: 79-80) asked whether the argument could be reversed: "suppose income is guaranteed to grow at the $\alpha\sigma$ rate; will that call forth sufficient investment to generate the needed income?"

Domar claimed that optimistic expectations of income growth would be created by a credible announcement to use government spending to bring the economy to its required growth rate. However, in equilibrium such deficits would not actually be necessary. Under certain conditions, confident expectations generated by government's assurance of future growth would induce private investment decisions in a scale that would bring about the required growth rate and by that justify the expectations, without putting the guarantee to test. The role of economic policy in Domar's plan was, therefore, to create appropriate expectations: "*Thus a mere guarantee of a rise in income* (if taken seriously by the investors) *will actually generate enough investment and income to make the guarantee good without resorting to a government deficit*" (Domar [1946] 1957: 80; italics in the original).[2]

As indicated in the epigraph above, Domar saw his policy proposal as a new approach to macroeconomic stabilization. It was based on the notion that the economic depression was a "vast psychological phenomenon" caused by insufficient

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[2] Domar also expressed the required growth rate as αs, where s is the ratio between potential output and capital, both in average and marginal terms. As discussed in section 2 below, he assumed that s is usually higher than σ, since the latter discounts the effects of misdirected or unviable investment on capacity at the aggregate or social level. Whereas $\alpha\sigma$ designated the rate of growth required to preserve full employment of *labour*, αs indicated the rate needed for full utilization of *capital* (Domar [1948a] 1957: 114, n. 9).

investment demand (Domar [1948a] 1957), which should be approached by tackling the expectation formation mechanism. Domar first discussed expectations in his 1944 article with Musgrave about portfolio decision. Schelling (1947) and LSE economist Roy Allen (1956) did not treat Domar's guaranteed growth scheme as just a policy corollary of his theoretical model, but as part of the model structure itself.

After establishing how the required growth rate depended on the productivity of investment σ, Domar, according to Allen (1956: 68), deployed in section IV an "alternative approach". This featured an investment demand function – absent from Domar's basic growth model – of the accelerator type. Given a certain rate of growth, the question now was whether sufficient investment would be induced to keep the economy on that growth path. That was the case only if the rate of growth is the required or warranted rate. Likewise, Schelling's (1947:864, 870) interest in Domar's guaranteed growth proposal came from what he perceived as key similarities between that notion and Harrod's warranted growth rate.

Hansen never discussed Domar's guaranteed growth proposal in print. He did refer implicitly to it in a few passages, only to dismiss the whole idea for its apparent neglect of what he called "autonomous" or "spontaneous" investment – determined by technical progress, discovery of new territories and natural resources, and population growth – as opposed to investment "induced" by increases in demand. In correspondence with Domar in 1948, Hansen rejected the guaranteed growth plan on those grounds. An investigation of Domar's proposal and its historical context, by bringing to the fore the roles of expectations and other determinants of investment demand in his growth stabilization approach, may shed new light on how it compares to other contemporary Keynesian views of dynamics and stabilization policy, particularly by Hansen and Harrod.

Domar advanced his proposal during the post-war American setting of debates over aggregate demand forecasts and planning for full-employment (see Jones 1972). This differed from the inception, around that period, of planning techniques in underdeveloped countries, which adapted and applied the "Harrod-Domar" model out of its original context. It was also distinct from socialist economic planning models deployed in Russia since the late 1920s, despite their similarities with features of Domar's growth model (see Baran 1952; Domar 1957, chapter 9 on "A Soviet model of growth"; Boianovsky 2018).

Harrod's (1963a, b; 1964; 1973) tacit endorsement of Domar's proposal was related to ideas and policies on economic planning in developed countries. The creation of the British National Economic Development Council in 1962 – with its attempt to launch indicative planning along the lines of the successful French experience – provided a political context for Harrod's (1964: 914) plea for growth stabilization as the declared policy goal. The theoretical side of Harrod's (1964) support of indicative planning was his new proposition that the economy will expand along the warranted growth path only if entrepreneurs *expect* grow at that $G_w = s/C_r$ rate, where *s* is the marginal propensity to save and C_r is the induced investment coefficient. This may be seen as the final stage in Harrod's search for a formulation of equilibrium investment behaviour leading to warranted growth. Whereas Harrod's contribution to indicative planning and its relation to his notions of natural and warranted growth rates have been duly noticed (e.g. Standford 1970; Estrin and Holmes 1983; Wood 2000), Domar's ([1946] 1957; [1948a] 1957) close concept of guaranteed growth has received only scanty attention so far.

2. Domar's guaranteed income growth proposal

In a lecture delivered at Oxford University in February 1953 as part of a series on growth econimics, Domar (1953b) asked whether guaranteed growth policy was "possible." The answer varied according to the reasons given for the divergences of the actual from the required rate. Domar's ([1956] 1956; [1947a] 1957) formula for the required growth rate established conditions for the smooth working of the economy without excessive capital accumulation. His model indicated that the (temporary) multiplier demand effects of investment variations $\Delta Y = \Delta I(1/\alpha)$ would match the corresponding (permanent) capacity supply effects of capital stock changes $I\sigma$ (or Is) if the economy grew at a certain rate $\alpha\sigma$ (or αs) through time (see note 2 above; Boianovsky 2017a).[3] "Economic stabilization will become a special case of the problem of economic growth", Domar ([1952] 1957: 34) claimed.

According to Domar, convergence to the required rate is prevented by wrong market signals that produce instability through the multiplier mechanism. If the actual

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[3] *Y* stands for income and *I* for investment.

growth rate is too low, entrepreneurs react to excess capacity by reducing investment, which increases excess capacity and unemployment even more (and vice-versa if the actual rate is too high). "It is quite paradoxical", Domar ([1952] 1957: 31) stated, that, "with a given propensity to save, to eliminate idle capital, more capital should be built, and to avoid a capital shortage, investment should be reduced" (cf. Schelling 1947: 865-66; Domar 1949a: 311). Growth stabilization policy along Domar's proposal should be able to coordinate producers' expectations and avoid disappointment.

However, the design and feasiblity of stabilization policies depended on alternative hypotheses used to explain departures of actual from required growth. It was generally agreed that the economic upswing featured rapid capital accumulation, but the question remained: "does capital accumulation as such", because of its effects on investment opportunities, "bring prosperity to an end?" (Domar 1947e: 1; 1948c: 98). That question, and the "problem of capital accumulation" as a whole, only made sense under the assumption that the possibilities of capital deepening were limited, that is, that the capital-output ratio was relative stable, at least in the short-run. Domar endorsed that notion, which was central to several other Keynesian (or Marxian) economists – he mentioned Kalecki, Kaldor, Sweezy, Hansen and Harrod – but opposed to by F. Knight's (1944) argument of absence of diminishing returns to capital accumulation (see Domar [1948a] 1957: 109-10; Boianovsky 2017a: 419-20).[4]

Domar shared the view that capital over-accumulation is caused by failure of income to grow at some required rate, but parted company with that group in his answer to the question posed above. He ascribed to them the view that the failure of the economy to grow at the required rate was due to the *inability* of income so to grow. The required rate *could not* be physically achieved or sustained, since, as the economy approached its full-employment ceiling, the consequent fall of induced investment would bring about a reduction of actual growth rate in the downswing through the accelerator mechanism.

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[4] Domar (1949a: 311) considered as well a third alternative – a "slowly declining rate of profit" resulting from diminishing returns to capital under a neoclassical production function (of the kind Solow [1956] deployed). However, such a slow decline would hardly have depression effects over business cycles spans, he claimed. Unlike Knight (1944), both the Leontief and the neoclassical production functions satisfy the Inada condition that marginal capital productivity tends to zero as the capital/labor ratio approaches infinity (Barro and Sala-i-Martin 1995: 39 n. and 47).

That argument, as Domar ([1948a] 1957) observed, became dominant in the 1940s as the prevailing explanation of the business cycle upper turning point. It was further elaborated in John Hicks' (1950, chapter 8) and Richard Goodwin's (1951) models of self-contained perpetual non-linear oscillations (see Hamberg 1956: 279-93). Its origins went back to ideas put forward by Harrod (1936: 165) and Gottfried Haberler (1937: 318-19), independently of Keynesian macroeconomics. Haberler regarded it a case of over-investment or "maladjustment in the structure of production", distinct from the Hayekian meaning usually associated to that phrase (see Boianovsky and Trautwein 2006).

Domar ([1948a] 1957: 121) provided passages from Kaldor (1938: 651-53) and Hansen (1947: 177-78) to document his interpretation, which, he claimed, applied as well to Harrod (1939, 1948). Those authors perceived "over-accumulation" as the result of excessive propensity to save in relation to the capital requirements decided by technological progress and the growth of the labour force – in Harrod's terms, an excess of G_w over the "natural" growth rate G_n. It is an attempt to save and invest too much, since capital accumulates at a faster rate than can be utilized by the economy at full employment, for lack of complementary factors (Domar [1946] 1957: 81; [1947a] 1957: 96).

The economic policy measures associated to that view, consisted of reducing the propensity to save α, and/or reducing s by developing industries with large capital expenses per unit of output of the economy – that is, a reduction in Domar's required rate αs (Domar [1947a] 1957: 96; [1948a] 1957: 118; 1949a: 312). Kaldor (1938) provided an early clear statement.[5] Kaldor's (1938: 655) policy advice, as Domar noticed, was to take measures to bring down saving and stimulate the propensity to consume in order to make the consumption-goods industry operate at full-capacity, while keeping the output of investment-goods within a certain "moderate level."

If that diagnosis of the slump was correct, Domar's guaranteed growth proposal could not apply or be implemented, as the required rate was beyond reach.

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[5] "Sooner or later the point is reached where all the available labour is absorbed in production. Even if the installation of additional equipment goes on still further, current production cannot be increased much further … Thus excess capacity in equipment will make its appearance, which in turn will lead to a breakdown in the demand for investment … It is this factor that is ultimately responsible for that 'temporary exhaustion of investment opportunities' with which several economists explain the breakdown of the boom …" (Kaldor 1938: 651-53). See also Kaldor (1940).

Such majority view led to "a most interesting and startling, but not equally substantiated as yet, conclusion, that labour becomes unemployed because it is short" (Domar 1953a: 560). In a footnote Domar (1953a: 560, n. 4) agreed that growth economics "abounds in paradoxes." It was true that "capital is unutilized because not enough new capital is constructed." But, he queried, "Is this true in regard to labour?" Under Domar's assumption that the required growth rate *could* be achieved, the propensity to save was excessive in relation to the volume of investment as determined by "existing institutional conditions", not in relation to the growth potential of the economy (Domar [1948a] 1957: 118).

During his brief Chicago period, Domar (1947e, 1948c, 1949a) drafted versions of a paper about the upper turning point, presented at the September 1947 meetings of the Econometric Society in Washington and published in *Econometrica* (Domar 1949a). The paper was based on his original 1946 growth model, but with two differences.

He deployed the notion of a "maximum rate of growth", reflecting his reading in 1947 of Harrod's (1939) concept of a natural growth rate G_n, governed by population growth plus technical progress (the rate of increase of the labour force in efficiency units).[6] Such concept was not part of Domar's ([1946] 1957; [1947a] 1957) original model, which tried to incorporate labour supply effects by distinguishing between the productivity of investment in a specific project (s) and the productivity of aggregate investment (σ). The later was influenced by misdirection of investment and shifts of labor from current to new projects, leading to what Domar ([1946] 1957a: 79) called "junking" of capital, defined as the untimely loss of capital value due to inability to sell products from certain old capital assets (see Wan 1971: 25-26).

As Domar (1957: 7) later recalled, that suggested distinction reflected his attempt to accommodate the role of labour in a model that treated output as function of capital only. In his Cowles paper and in his 1948 *AER* piece Domar essentially abandoned his distinction between s and σ, assuming instead that population growth and technical progress would provide enough labour to work new projects without affecting old ones. The introduction of labour as another factor in the production

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6 In a letter to Dennis Robertson of 25 November 1953, Domar (1953c) recalled how he in 1947 accidentally "ran into" Harrod (1939). The next year he became acquainted with Harrod's (1948) book.

function – as Solow (1956) did later – seemed in the 1940s to render the model too complex (Domar 1957: 7-8).

Domar's Cowles Foundation paper, unlike his 1946-47 growth model, featured an investment function, since his focus shifted momentarily to business cycles, taking as a starting point the growth rate that investment (and income) must follow in equilibrium. It fitted aspects of the Cowles 1940s approach to macroeconomics, with its treatment of disequilibrium as the result of over-determined model systems (see Boianovsky 2002). Assuming a saving function $S = \alpha Y$ and a productivity function $P = Ks$, where P is productive capacity, and using the definition $dK/dt = I$, the solution along the path $dY/dt = dP/dt$ takes the forms $I = I_0 \ e^{\alpha st}$ and $Y = Y_0 \ e^{\alpha st}$. Over-determination comes about if an output ceiling and an investment function are added to the model, which opens two breakdown (or disequilibria) possibilities.

$P = Ks$ only for $\alpha s \leq r$, where r is the maximum potential growth rate (Domar 1949a: 310). If investment demand is inserted, of the generic form $I = G(Y, E)$, where E stands for "exogenous causes," it may differ from the equilibrium solution $I = I_0 \ e^{\alpha st}$. When the actual growth rate of investment is below αs, over-accumulation of capital takes place, in the sense that $\frac{dY/dt}{dK/dt} < s$ (Domar 1947e: 3). Alternatively, the economy may be unable to reach the required rate αs because it exceeds the maximum achievable rate r, which brings out the second breakdown possibility. Defining $\sigma = dP/dK$, then $\sigma < s$. Domar (1949a: 311) next rewrote investment demand as $I = \theta \ (Y, E, \gamma)$, where $\gamma = s - \sigma$ and $\theta_\gamma < 0$. Both breakdown cases bring about increases in γ, which reduces profitability and depresses growth, with further increases in excess capacity and a cumulative disequilibrium movement.

If, as Domar believed, the maximum growth rate restriction were not effective, economic policy should encourage private investment, though measures such as low interest rates, incentive taxation, liberal loss effects for income tax purposes (see Domar and Musgrave 1944), and "guaranteed growth of income as a method of creating investment opportunities", an "extremely interesting case" (Domar 1949a: 312; 1947e: 4).

In his first presentation of guaranteed growth, Domar ([1946] 1957) had argued that government assurance that income will grow at the $\alpha\sigma$ rate would bring about enough investment to generate that growth rate only if there was no misdirected

investment ($\sigma = s$, in the 1946 notation). In that case, starting from an equilibrium position, equilibrium will be maintained by the (credible) policy announcement: an expected increase of $Y\alpha\sigma$ induces investment flow $Y\alpha$, which matches the amount of saving made at that income level.

In the 1946 framework, guaranteed growth does not work when σ is significantly below s and the junking process is fully operative – another way to say that the required rate is above the maximum growth rate, although entrepreneurs were unaware of it when they made their decisions. The mere guarantee will fail, as it cannot make capital owners discard old assets in the amount $I(s - \sigma)$. They will invest $Y\alpha\sigma/s$, instead of $Y\alpha$ as in the first case (Domar [1946] 1957: 77-80; see also Solow 2006: 136). Domar doubted a serious difference between s and σ was typical of the American economy. Domar ([1948a] 1957; 1949a) eventually focused on the required rate αs (instead of $\alpha\sigma$) and on the distinction between biding and no biding potential growth constraint cases, with the same policy conclusions as in 1946.

If agents are willing to save some fraction of their income, and the required growth rate can be achieved, "why not concentrate our efforts to make this growth potential real?", instead of reducing the propensity to save, asked Domar ([1948a] 1957: 119). The depression becomes simply a "vast psychological phenomenon", an idea that "takes your breath away" (Domar ([1948a] 1957: 119; 1953b, sixth lecture). Domar perceived the psychological explanation of the downswing as minority taste, together with its corollary that it is possible to "talk ourselves into prosperity" by influencing expectations.[7]

Domar did recognize an approach broadly similar to his own in a couple of contemporary contributions. Indeed, Domar's guaranteed growth proposal – which, he claimed, was able to produce "full employment by magic" – resulted not just from working out the implications of the theoretical growth model, but from reading ideas as those put forward by John Pierson (1944, 1947) and Leo Barnes (1948), concerning the influence of demand expectations on investment and their bearing on economic policy (Domar [1948a] 1957: 119).

Pierson's (1944, 1947) proposal – that government's commitment to underwrite private consumer expenditure, by "insuring" the anticipated level of

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[7] See Hamberg (1956: 300-07), who put Domar in the companion of some other economists who also explained the upper turning point by entrepreneurs' lack of confidence that the boom would continue.

consumption, should be able to stimulate private investment – attracted some critical attention at the time (see e.g. Sweezy 1944; Hansen 1947, chapter 17). Domar ([1948a] 1957: 119, n. 18) saw points in common with his own proposal, but criticized Pierson for stressing government's assurance of future consumption *level* instead of its growth *rate*. What really caught Domar's ([1948a] 1957: 119) attention was Barnes' (1948) "most interesting" and "highly suggestive" account of how optimistic economic forecasts, advanced in 1945 by the Council of Economic Development (CED) in the pamphlet *American industry looks ahead* and other publications, persuaded American industry into the boom experienced in 1945-47. That episode indicated to Domar ([1948a] 1957: 119) that the "magic sometimes works."

Leo Barnes' *JPE* article was based on his 1948 New School for Social Research PhD thesis titled "An experiment that failed: an analysis of economic forecasting in American reconversion, 1945-1946". Barnes (1948) described how the emergence of CED during wartime changed the postwar expectations of businessmen, from a generally pessimistic outlook to widespread optimism. The shift in the expectations regime contributed significantly to the 1945-47 postwar boom, against the predictions of many economists of downturn after the war (see Ballow 1967 for a survey).[8]

The CED carried out market-research projects indicating to businessmen that the optimism about their own markets was shared by most others, so that "the sum of all these expectations could make the full-production blueprints of government planners a reality" after the end of the war (Barnes, 1948: 161). Barnes showed that CED's optimistic forecasts were right for the wrong reasons; they were based on some mistaken estimates and data – as Domar ([1948a] 1957: 119) put it, "by making a few (undoubtedly unintentional) errors" the CED "managed to 'persuade industry

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[8] The CED was formed in Chicago in 1942 by the U.S. Department of Commerce, and it became the most influential business planning group in postwar period, with its blend of leading names from both business and academia. It was the foremost representative of "American corporate liberalism" after the war, a "progressive" business group that developed its own version of "commercial" Keynesianism (Collins 1981; Whitham 2013). Paul Hoffman, president of the Studebaker Corporation, was its first director (Hoffman 1945). Samuelson (1948a: vi) described it as a "middle-of-the-road business group that initiates fundamental research in economic policy", and expected that his new textbook should help students to "read critically the important reports of that group."

into prosperity'". Barnes (1948: 165) concluded that the CED deserved credit for "pulling the American business community up by its psychological bootstraps", a genuine case of "wishful thinking helping make it so."

Domar's proposal differed from Pierson (1944, 1947) or Barnes (1948) as it was based on a growth model supposedly believed by producers and policy makers alike, once estimates were made of the maximum growth rate and of α and s in order to figure out the required rate αs. By 1947-48, the question was whether postwar prosperity and accelerated capital formation could and would continue (Domar ([1948a) 1957: 109). That depended on stabilization policy and assurance that past depressions – with their "profound influence" on business frame of mind – would not recur, an effect that would come about if "businessmen could confidently expect a growing economy" (119).

Confidence on guaranteed growth rested on policy makers' reputation. "It is realized, of course", acknowledged Domar ([1948a] 1957: 120), that "optimistic expectations cannot be created by a mere act of Congress." In order to earn credibility, the government should be able to stabilize the economy on its own for a few years through conventional macroeconomic policies. After that stage, confidence could be placed on assured growth, based on the expectations effect only. Government faced the "paradox of bold action" (Domar 1953b, sixth lecture). If, out of fear of fiscal deficit, it acts hesitantly, "business expectations are therefore low", with little impact on investment; hence, a large deficit may actually become necessary to reach the required growth rate. Alternatively, "a bold announcement of government objectives accompanied by a determination to carry them out may call forth sufficient investment to make a deficit unnecessary" (Domar [1948a] 1957: 120; cf. Domar [1946] 1957: 80 for a related passage, quoted above). A related "paradox" may be found in Harrod's (1964) support of guaranteed growth, as discussed next.

3. Harrod's tacit endorsement and the warranted rate

Schelling's (1947) merging of Harrod's (1939) and Domar's ([1946] 1957; [1947a] 1957) "fundamental" growth equations into a broad "Harrod-Domar" model, followed by many, did not raise complaints from Harrod or Domar, who accepted that the similarities were more significant than the differences. Harrod (1959) provided a careful discussion of Domar's "dynamic economics", formulated, as he noted, independently of his own. Domar's comments on Harrod were scattered through brief remarks in some papers (Domar [1948a] 1957; [1952] 1957; 1953a; 1955a), in his Oxford lectures (Domar 1953b) and in a letter to Hansen about Harrod (1964) (Domar 1965).[9]

Schelling (1947) offered an interpretation of Harrod in the light of Domar, with emphasis on the existence and equilibrium properties of the warranted rate, as a rate that will be maintained along a line of steady advance at a given point of time (see Halsmayer and Hoover 2016, section 3). He was aware of Harrod's instability principle and Domar's capital paradoxes, but those were secondary to his goal. Schelling wrote other macroeconomic pieces around that time, including his PhD dissertation (Schelling 1951), but would soon give up macroeconomics and shift to investigations of conflict and bargain behaviour.[10]

Schelling (1947: 864) found Domar's ([1946] 1957) policy conclusion – that if businessmen can be made to expect output to grow at the required rate $\alpha\sigma$, investment will respond to this expectation as to make that rate effective, justifying the expectations – as "very similar" to Harrod's (1939) result concerning what growth rate tends to "maintain itself". Schelling, however, disputed Harrod's (1939: 16) claim that his "warranted rate" was self-justifying, in the sense that, if entrepreneurs are currently satisfied with their production plans, the rate of growth will remain the same in next periods.

Schelling (1947: 868-70) was the first of a line of authors (e.g. Alexander 1950; Asimakopulos 1985, 1986; Eltis 1987) who charged Harrod for leaving

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[9] Domar and Harrod possibly met when the former visited Oxford in 1953, but there are no records of that.

[10] Ayson (2004: 15) has suggested that Schelling's (1947) concern with stability and distinction between self-aggravating and self-maintenance was relevant for his later strategic thinking.

undefined equilibrium investment behaviour that leads to expansion at the required rate. Schelling raised two objections to the notion that a growth rate $\alpha\sigma$, if achieved, would tend to maintain itself in the future. First, firms make investment decisions through a decentralized process characterized by uncertainty. An individual entrepreneur will project current growth rate into the future only if he believes other investors will do the same. But there is no reason to expect entrepreneurs to act that way; Harrod, taxed Schelling (1947: 870), failed in attempting to attach "motivational significance" to the warranted growth rate.

Domar's ([1946] 1957) notion of guaranteed growth of income – introduced by Domar after presenting his model of the growth rate the economy *must* follow in equilibrium – provided a sounder basis for the warranted rate concept.

> Domar's view is more cautious. He characterizes the [required] rate as that rate of growth which, if independently guaranteed (by the government) will tend to be maintained by private investment. He here avoids [Harrod's] assumption of firms projecting the current rate of growth into the future. *Instead he supplies them with foreknowledge of that future expansion.* Confidence in the power of fiscal policy is all that is required. No firm need rely on the actions of other firms in sustaining future investment; it can go ahead and plan on a larger demand. (Schelling 1947: 870-71; italics added)

Domar's guaranteed growth was seen not just as a policy implication of the model, but a way to give foundation, through information and foresight, to expectation processes associated to a self-maintaining equilibrium growth rate.[11]

However, Shelling (1947: 871) remarked, uncertainty was not entirely eliminated by Domar's aggregative scheme. Although expectation of expanded *aggregate* demand is assured, there remains microeconomic uncertainty about its division into market shares, and the impact of shifts in preferences and technology on individual firms. Eisner (1953), who wrote a PhD dissertation on growth and business cycles under Domar's supervision at Johns Hopkins in the early 1950s, critically assessed Domar's proposal along those lines. Eisner (1953: 171) found it "thought provoking and enlightening", but criticized it for overlooking that, even if

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[11] Hamberg (1956: 148, n. 1) too interpreted Domar's guaranteed growth as "a variation of Harrod's definition of G_w" through the effect of growth guarantee on expectations.

entrepreneurs had full confidence in the assurance of *national* income growth at the required rate, they would be less certain about increase of demand in each industry. Hence, for an anticipated increase in aggregate output $Ya\sigma$, total investment generated was bound to be less than the equilibrium level $Y\alpha$, charged Eisner.

The micro/macro uncertainty problem posed difficulties for Harrod's notion of the warranted rate as a trend-line, as Alexander (1950) pointed out. By resorting to a "representative entrepreneur", Harrod (1951) dodged instead of solved the matter (Asimakopulos 1985: 627-28). Harrod's approach to expectations was complex. He kept uncertainty and expectations (together with time lags) apart from the core argument of his 1936 *Trade Cycle*, and from his 1939 notion of dynamics as the study of rates of changes of variables.[12] This came out in Harrod's correspondence with Keynes, who criticized the irrelevance of expectations in drafts of the 1939 "Essay", which did not change in the published version (Besomi 1999, chapters 4 and 6).[13] Harrod's fundamental equations were not based on an *ex-ante* investment function, but on the *ex-post* relation between investment and ouput variation in the same current period, rendered by his term "justified investment" (see Asimakopulos 1986: 282).

Harrod (1959) did not mention Domar's guaranteed growth proposal, despite reproducing a passage from section IV of Domar ([1946] 1956) (Harrod 1959: 458). In that passage Domar ([1946] 1956: 81) claimed that the American economy had often suffered from the failure of income to growth at the required rate $\alpha\sigma$ (due to insufficient investment demand), not from an excess of s over σ (provoked by exceeding the growth potential). Harrod (1959: 458; italics in the original) disagreed; in his opinion there were "not two separate phenomena here, but one phenomenon. In my view it is the excess of s over σ that *causes* the [actual growth rate] to fall below $\alpha\sigma$." Harrod (1959) probably omitted references to Domar's guaranteed proposal due to disagreement over the upper turning point.

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[12] Hart's ([1940] 1951: viii) assessment, that "anticipations play no significant role in the ambitious dynamics of R.F. Harrod", was not an exception. Samuelson's (1948b) survey of dynamics focused on the applications of differential equations to "process analysis" – introduced by Domar ([1946] 1957, sections II and III) – with no discussion of expectations (see Baumol 1951, part 3; Boianovsky 2020a).

[13] Harrod (1939: 27), because of Keynes' complaint, mentioned the "state of confidence", but that played no role in his stability analysis of the instantaneous warranted rate.

Harrod's views about the upper turning differed from Domar's (Harrod 1939: 30-33; 1948: 87-89).[14] Upon expressing Domar's equations in terms of his own growth model – with $\alpha\sigma$, αs equivalent to G_n and G_w respectively – Harrod (1959: 457) suggested that Domar's ([1946] 1957) discussion of the effects of "junking", caused by $s > \sigma$, was close to his own analysis of the depressive of $G_w > G_n$. Both caused the actual rate G to fall below G_n and G_w, and then to depart progressively downwards from G_w along the lines of the "instability principle."

Domar ([1946] 1957: 81; [1948a] 1957: 117) had claimed that if the prosperity ends because aggregate output *cannot* grow fast enough to prevent over-accumulation, one should observe labour shortage and accelerating inflation, which did not happen in the turning points of 1907, 1929 and 1937. Harrod (1959: 460-61) reacted by repeating his 1948 (89-89) remark that, even if the end of the boom is caused by an excess of G_w over G_n, the turning point may happen before reaching the ceiling, due to frictions in transferring labour and other resources as unemployment declines.

More importantly, Harrod (1959) added a new argument, involving entrepreneurs' forecast of the maximum possible increase in demand. That was a first step in his revision of the G_w concept, completed in 1964. Harrod (1959) assumed that entrepreneurs' demand expectations were influenced by their (correct) prognosis of G_n, leading to a fall in orders in anticipation of the ceiling point, *before* it was reached.[15] However, as Harrod (1959: 463) acknowledged, that argument was not new: "Domar anticipates this point." Domar ([1948a] 1957: 117) had observed that "it is possible to argue that had those prosperities lasted another year or two, such a [full employment] situation would have arisen, and that this was foreseen by the entrepreneurs who reduced their commitments in advance." Evidence was insufficient to decide among alternative hypotheses, Domar (ibid) suggested, which raised Harrod's (1959: 464) reproach that it was unreasonable to dismiss in "so cavalier a

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[14] "[I]f G_w exceeds G_n, then G must lie below G_w for most of the time, since the average value of G over a period cannot exceed that of G_n. Therefore in such circumstances we must expect the economy to be prevailing depressed." (Harrod 1948: 88).

[15] "The natural rate being below the warranted rate … would thus have served to push the actual rate below either, *before* any labour shortage had begun to be felt … the insufficient rate of increase of demand sustainable indefinitely cast its shadow backwards" (Harrod 1959: 463).

way the hypothesis that the entrepreneurs did what they ought to have done on a correct prognosis."

Harrod (1959: 464) saw the influence of G_n on anticipations as a partial "concession" to Baumol's (1951: 53-54) point that distinct expectation formation mechanisms – e.g. the notion that entrepreneurs believed in the return to some long-run "normalcy" – would lead to different results in Harrod's model. Harrod (ibid), however, stuck to his viewpoint that production and investment decisions were dominated by the influence of "current experience", instead of "fixed and rigid views about the future." This may be seen as implicit criticism of Domar's guaranteed growth proposal, with its notion of expectations grounded on future economic policy. Harrod would change his mind a couple of years after his 1959 assessment.

Harrod's 1964 article on stabilization – based on a lecture delivered at the University of Pennsylvania, under Sydney Weintraub's invitation – does not make for easy reading. Hansen (1965) was puzzled a "good bit" by it, asking Domar to throw some "light" on Harrod's discussion about the ability of macroeconomic policies to bring the economy to its potential growth line $G_n = G_w = G$ without causing other imbalances. Harrod's (1964) goal was to state the case for indicative planning in a market economy. Indicative planning – adopted by France in the postwar period and seriously considered for a while in the U.K. in the 1960s – provided in his view a better stabilization strategy to tackle the effects of uncertainty on entrepreneurs' behaviour. Harrod (1964) was the last instalment of a set of papers – started with his 1960 "Second Essay" – on the concept of optimal saving rate as the variable associated to G_n, now reinterpreted as optimum welfare growth (see Boianovsky 2017b).[16]

Harrod (1964: 907) acknowledged "doubts" (907) about his previous depiction of the representative entrepreneur's behaviour. Moreover, he did not push his previous hypothesis that downswings are caused by an excess of G_w over G_n. If the behavioural "parameters" are such that the representative entrepreneur does not

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[16] The notion of optimal saving is implicit in Domar's ([1947a] 1957: 97) expression $\alpha = r/\sigma$, where α is the propensity to save required to bringing the economy to its full employment growth path r. His model established an equilibrium relation between three variables, which could be closed in three different ways (Boianovsky 2017a: 422). In his Oxford notes about guaranteed growth, Domar (1953b) wrote: "Inverse case: given r and v [the capital-output ratio], what α is needed? – the British case." It is not clear why Domar associated the optimum saving problem to Great Britain.

increase orders in full proportion to national income growth, the G_w concept, as well as the use of monetary and fiscal policies to implement optimal saving consistent with G_n, must be modified or given up. Harrod's change reflected acceptance of criticism voiced by Schelling, Alexander and others.

> [T]he majority of entrepreneurs are subject to great uncertainties, not only, or chiefly in regard to the future growth path of the economy … but also in regard to the likely growth of their own industries and their chances of maintaining or increasing their shares of their markets ... (Harrod 1964: 907)

In a growing economy, entrepreneurs have to provide for a demand that does not exist as yet, and about which "they can have no certainty that it ever will exist." They may not be "sufficiently adventuresome" to bring the economy to warranted growth – or to the natural growth rate under usual macroeconomic policies. This may change if a planning body evaluates G_n and takes it as a target rate, through interactive process with the industrial sectors, described as "indicative planning." Entrepreneurs will not, however, follow such "indications", unless they are accompanied by some "*guarantee* by the authorities that they will use normal policies to ensure that overall the economy achieves its growth potential" (Harrod 1964: 914; italics added).

That was close to Domar's guaranteed growth proposal, with no references though. Harrod was aware of Domar's "paradox of bold action", expressed as a "dilemma." If government can give such a guarantee, it must have the policy instruments to ensure G_n, which seems to render indicative planning superfluous. If it lacks such tools, the "all important guarantee" cannot be given. The upshot was that the mere guarantee (if credible) should be enough, as in Domar.

> Thus [the authorities] *are* in a position honourably to give the guarantee. If the indicative planning and the guarantee suffice to stimulate the entrepreneurs to advance at the required rate, then the authorities will not, in the event, have to use other prods … (Harrod 1964: 914; italics in the original)

As Harrod (1963b: 674) put it, "give entrepreneurs the sure (or probable) prospect of expanding markets, and they will do the job of supplying them." Policy makers' commitment to implement growth policy at the targeted required rate

(estimated as 4%) would give entrepreneurs assurance that demand would grow enough to "justify investment" in the various sectors, so that "the whole growth rate could be jacked up" (Harrod 1963a: 77). Harrod (1973: 219-21) kept supporting indicative planning as a more "sophisticated" approach to stabilization (see Estrin and Holmes 1983: 19-21).

Harrod's (1964) discussion of indicative planning entailed a new requirement to define growth at the warranted rate s/C_r (in Harrod's notation). It was not enough to assume that, if investment *ex post* is justified, the representative entrepreneur will in the next period increase output in the same proportion as in this period (Harrod 1951). It is necessary to assume as well that he will expand at the exact rate s/C_r, when he is satisfied with his capital stock. This requires an expectation that the demand for his product will grow at that precise rate G_w = s/C_r. As Walter Eltis (1987: 599) pointed out, Harrod (1964) eventually realized that the requirement for growth along the warranted equilibrium rate line is that entrepreneurs *expect* growth at that rate.[17]

Amartya Sen (1970: 11-13) has put forward a reinterpretation of Harrod's warranted rate along those lines: if businessmen expect a rate of growth G_e equal to the warranted rate G_w, then their expectations will be fulfilled and they will continue to advance on that growth line. The economy will expand along the warranted rate only if G_e = s/C_r. Disregarding Harrod's (1964) indicative planning or Domar's ([1946] 1957) guaranteed growth – which Sen did not mention – such growth equilibrium will only happen by accident. If businessmen do not expect growth at the warranted rate, the actual growth rate will move away from equilibrium, according to Harrod's instability principle: if G_e > G_w, then G > G_e, with the well-known instability results. Sen's reformulation has been often deployed (Jones 1975: 55-58; Fazzari 1985: 68-70; Harcourt 2006: 104-6; Howitt 2006: 1618-20; Eltis 1987 suggested a similar interpretation, independently of Sen 1970). That is consistent with

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[17] Eltis' reading reflected his double experience as Harrod's Oxford student in the early 1960s and member of the National Economic Development Council in 1963-64 – see Backhouse and Middleton (2000: 300), Eltis (1963) and, on the short history of NEDC, Wood (2000). Eltis (1987), however, did not connect Harrod's (1964) new G_w approach to indicative planning.

Harrod's (1964) expectational approach to growth, but not with his better-known statements of the model (Harrod 1939, 1948).[18]

Domar did not react in print to Harrod (1964). By then, he had shifted his agenda to comparative economic systems, economic history and applied economic growth. However, his evaluation was expressed in reply to Hansen's (1965) letter asking for clarification of Harrod's (1964) complex argument. Domar (1965) grasped the essence of Harrod's (1964) discussion and the changes he introduced in the treatment of the warranted rate: "It seems to me that Harrod has finally come to grips with a major problem in his model: the distinction between the capital coefficient or the capital-output ratio on one hand, and the reaction of investors to a rise in income, or the acceleration coefficient on the other" (Domar 1965).

Domar distinguished between the capital-output ratio v, determined by technology, and the fraction of v which investors are willing to invest in response to a given rise in income (ψ). Evidently, $v = 1/s$, in Domar's (1946] 1957) notation. As noted by Domar, Harrod (1964) assumed $\psi < 1$. The required growth rate is then given by $\alpha/\psi v$, instead of α/v. As Domar (1965) explained to Hansen, "because investors are sluggish in their reactions to a rise in income, income must grow faster to call forth the necessary investment." This is not an equilibrium situation, since the ratio between capital and income will approach ψv rather than the correct fraction v, with an ensuing shortage of capital. Moreover, inflation will take place if $\alpha/\psi v > G_n$. In order to "avoid inflation, Harrod suggests other method (planning) to induce the investors to behave correctly", Domar noted.[19] That was Harrod's indicative planning, which arose from the notion that investors may not, out of uncertainty, invest in proportion to income increase. Likewise, Domar's guaranteed growth proposal, with its reversal of the logic of his growth equation, represented a suggested policy

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[18] See Besomi's (1999: 203) criticism of Sen's (1970) formulation for its "over-emphasis" on expectations in Harrod's (1939, 1948) thought.

[19] Domar (1955a: 251, n. 6) expressed in print the distinction between the capital-output ratio as a quantitative ratio in his model, and as a "psychological response" in Harrod's (1939). Harrod (1959: 421) argued instead that both his and Domar's equations assume that investment is "properly utilized" or "justified" (that is, *ex-post*). Indeed, G_w can only be an equilibrium rate if the accelerator coefficient is equal to the incremental capital-output ratio, not just a psychological or behavioural coefficient (Hamberg 1971: 10-11; Boianovsky 2017a: 421). Domar (1953b, lecture 6) noted how he "parted company" with Harrod and Hicks concerning the accelerator and the capital coefficient.

solution to growth stabilization under perverse expectations of demand expansion. Domar (1965) refrained from referring to his own guaranteed growth scheme, probably because Hansen had rejected it in the past.

4. Hansen's criticism and investment decisions

In the opening acknowledgements of his collection, Domar (1957: vii) expressed his "personal debt" to Hansen as "teacher, supervisor and friend." He recounted how he was puzzled, at Hansen's 1941-42 Harvard class, by a diagram in Hansen (1941: 272) about the effects of a constant flow of investment on constant (instead of rising) national income, which provided the starting-point for Domar ([1944] 1957) and, by that, led to his other growth articles. Hansen did influence Domar, but not through supervision or comments on his papers. Domar (undated: 1-2) recalled how he in early 1947 mailed his PhD thesis to Hansen, and, after waiting for several weeks, called him over the phone: "'Thesis', said he, 'what thesis?' I explained. 'Wait a moment, let me find it.' I heard the sound of an envelope torn open. 'Fine', he said, 'fine, send it in.' And that was all the supervision I was to get." J.A. Schumpeter, another member of Domar's thesis committee, did not read the thesis either. When the committee met, "Schumpeter turned to Hansen: 'Instead of talking about the thesis, why don't we ask the candidate to tell us about his current work.' His suggestion was accepted at once" (ibid).

Domar's (1947b) thesis – formed by 4 chapters corresponding to 3 published articles (his 1944, 1947a and 1948b essays), plus a section on Sweezy's (1942) underconsumptionism included in Domar 1948a – did not mention guaranteed growth. In a letter of 14 October 1948 to Domar (held in the Hansen Papers, Harvard), probably reacting to a preliminary version of Domar ([1948a] 1957), published as the leading article in the *AER* December 1948 issue, Hansen disputed the proposition that an assured rise in national income would itself call forth enough investment to achieve the desired growth target. As reported by T. Rosenof (1997: 123), Hansen sustained in the letter that Domar's proposal "undervalued the essential role of autonomous investment based on exogenous stimuli such as technological progress and population expansion."

A few years later, while discussing the 1936-39 recession – an episode that played an important role in his 1939 secular stagnation hypothesis – Hansen remarked: "If, somehow, income could have been raised, this in itself would have *induced* the investments required for the efficient employment of [labour supply]. But induced investment *follows* an increase in income; only autonomous investment can lead the way" (Hansen 1951: 486; italics in the original). This looked like a criticism of Domar's guaranteed growth, along the lines of the 1948 letter. Hansen (1951: 486, n. 17) appended a footnote to that passage stating that the significance of the "capital coefficient" and the role of the "acceleration process" in a growing economy were stressed in Domar's (1946 and 1947a) articles, which implied that Domar disregarded the role of autonomous investment in the growth process.[20] That was consistent with Hansen's (1952: 82-83) assessment that "recent work on dynamic economics has been in large measure sterile", which he ascribed to overall concern with "endogenous factors" and neglect of the role of autonomous factors as providers of external impulses and sources of changes in the responsive mechanism. Harrod (1948, 1951) was Hansen's (1952) explicit target, but the criticism seemed to be aimed at Domar as well.

Hansen's (1951: 486) point that induced investment can only follow, never lead, an increase in income, indicated that he did not consider the effects on investment of an *expected* income growth in the next period. Just like Harrod (1936, 1939), Samuelson (1939) and others, Hansen applied the acceleration principle to the impact on investment of *actual* income changes in the same period. Domar (1948b: 42, n. 14), in his essay contributed to the Hansen Festschrift, distinguished between "induced" and "speculative" investment, brought about by actual and anticipated rises in income respectively.[21] The latter was relevant for the guaranteed growth plan.

Surely, Hansen (1951: 138-41; 338-40) did take into account the general influence of expectations on investment demand, but such expectations were supposed to be grounded on "real factors" determining the volume of capital

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[20] In his critical reaction to Pierson's (1946) proposal of underwriting consumer expenditures – a proposal well-received by Domar (section 2 above) – Hansen (1947: 200) referred to "recent" views that a "program of full employment would itself tend to stabilize fully the rate of private investment." While granting that this could avoid *induced* falls in investment, Hansen stressed "active compensatory programs" of public investment to offset fluctuations in private autonomous investment.

[21] Domar (1948b) corresponded to chapter 3 (titled "The nature of the investment process") of his 1947b thesis. Domar (1947d) is an abstract of that chapter.

requirements, such as changes in technology (capital deepening) and population growth (capital widening). He called Keynes (1936) to task for stressing "psychological" aspects of investment and taking for granted "real" or "objective" features (Hansen 1946: 184). From Hansen's (1951: 141) perspective, "real factors underlie the volatile swings in expectations which in the short run determine the investment demand schedule". The same approach is found in Goodwin's (1951) chapter on econometric business cycle modelling, inserted in Hansen's (1951) book. Goodwin (1951: 442; 453-54) dealt with the "thorny question of expectations" by assuming that businessmen act "as if the future is known on the basis of current experience", which enabled him to elaborate models of oscillations with no role for "irrational" shifts of pessimism and optimism he associated to Keynes. That was far from Domar's ([1948a] 1957 expectational interpretation of the depression and the guaranteed growth proposal.

Domar ([1948a] 1957: 121) included Hansen in the group of authors who believed the upper turning point was caused by an excess of the equilibrium growth rate over the potential rate, which rendered guaranteed growth policy unfeasible. He quoted from a enlightening passage in Hansen's 1947 book, about the tendency for investment to outrun in boom periods the requirements of technical progress and population growth, called temporary "saturation" of investment opportunities. The "amount of investment needed to maintain full employment has historically far exceeded the amount needed for growth and progress", agued Hansen (1947: 177). As mentioned in sections 2 and 3 above, Domar disputed that view, shared by Kaldor (1938) and Harrod (1939). Only in boom years had the amount of investment been adequate to provide for full employment, but "this amount of investment could not be maintained continuously without exceeding by far the requirements of growth and progress", claimed Hansen (1947: 178). Such abrupt end of investment, amplified by the acceleration mechanism, was the "essential cause of depressions and unemployment," concluded Hansen (ibid). As investment catches up with the requirements of growth and technical progress, the boom "dies a natural death" (Hansen 1951: 496).

If the "growth and progress" factors, and the values of the multiplier and of the accelerator coefficient, are weak, the economy is set for "secular stagnation," with stillborn recoveries and recurring depressions caused by an excess of the secular propensity to save over the long-run maintainable rate of investment (Hansen 1939;

Backhouse and Boianovsky 2016). Hansen (1947: 178) consistently rejected attempts to "artificially" increase investment "beyond the requirements of growth and progress." Instead, Hansen (1941, part IV) supported policies aiming at reducing the long-run propensity to save and increasing capital-intensive technical progress, as Domar ([1948a: 1957) observed.[22] This belief – that the saving rate was so high that its full utilization would lead to capital over-accumulation in relation to labour – formed, according to Domar (1953a: 560), "the basis of Harrod's distinction between the natural and the warranted rates of growth" and was "at least a partial basis of Hansen's theory of stagnation." However, Domar (ibid) charged, that belief was supported "by little, if any, empirical information."

Despite Hansen's criticism, Domar's guaranteed growth proposal did not neglect autonomous investment. That distinction was not part of Domar's growth model, which did not feature an investment demand function – expect for the notion that investment was exogenously given and independent of other variables – but a marginal capital coefficient expressing the overall productivity of investment. The investment demand function, however, was relevant for guaranteed growth policy, which dealt with economic fluctuations and actual (not just required) investment. Indeed, Domar's ([1946] 1957: 80; see also Domar [1948a] 1957: 112, 120 n. 21) starting point was that the actual rate of autonomous (or "spontaneous") investment was insufficient to bring about full employment, and some amount of "induced" investment was therefore necessary, with reference to Hansen (1941). Since autonomous investment provides part of the required capital stock, the accelerator is smaller than the marginal capital coefficient (cf. Hansen 1951: 482).[23]

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[22] Despite similarities in their frameworks, Hansen (1952: 78) criticized Harrod for assuming that technical progress and population growth "directly caused" increase in income (Harrod's G_n). Hansen claimed that technical progress decided both the rate of autonomous investment and the accelerator coefficient. Investment was not induced by income growth, but the other way around, with population growth determining the full employment ceiling. Autonomous investment was described as the "physical embodiment of technical change" (Hansen 1952: 81). That was distinct from "Harrod neutral" technical progress, necessary for the G_n concept. Domar tended to follow Hansen in assuming embodied technical progress (see Boianovsky 2017a).

[23] This is distinct from differences between the accelerator and the capital coefficient for "psychological" reasons, mentioned at the end of section 3 above. Harrod (1939: 26-27) showed how the introduction of autonomous (or long-term) investment could be accommodated in his growth equations, without significantly affecting the working

As the working of the guaranteed growth plan was not affected by spontaneous investment (except for the initial conditions), Domar ([1946] 1957: 80), in order to "simplify" the argument, assumed it was close to nil. Domar ([1948a] 1957: 120, n. 21; 1953b, sixth lecture) recognized that a system with induced investment only was very unstable, lacking stabilizers such as technical progress to account for lower turning points (cf. Domar [1952] 1957: 31). If exogenous factors à la Schumpeter played a decisive role in the investment function, past capital accumulation would have little effect on average profitability, with some firms expanding at the expense of others as a lasting dynamic influence on booms, which Domar ([1948a] 1957: 118; 1949a: 312) disputed. He acknowledged that if the rise in income is accompanied by shifts in preferences, new products and aggressive competition, required investment might be created spontaneously, with no need for guaranteed growth policy (see also Solow 2006: 137).[24] Yet, the assurance of a high and rising income was defended as one of the "best methods for encouraging investment" (Domar [1946] 1957: 81).

Domar's (1948b) essay paid homage to Hansen by discussing the investment process from the perspective of the distinction between spontaneous – undertaken in response to *changes*, such as technical progress – and induced types of investment. He also followed Hansen by dismissing the influence of the interest rate, except for very long durable investments (1948b: 34). However, Domar ([1948a] 1957: 117) often stressed a single common element in investment decisions, associated to the fact that the "most simple and obvious purpose of investment" was the expansion of capacity in order to produce more goods. But there was no assurance that demand would increase in future periods. Investment in anticipation of a rising demand was "essentially speculative." It played an important role in the 19th century and up to the 1920s. In the 1940s, however, businessmen would hardly invest substantially in anticipation of a growing demand, unless they received a "positive guarantee from the government" (Domar 1948b: 42-43). Even if demand did expand, in the absence of

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of the model, which raised Hansen's (1952) criticism (see also Allen 1956: 65-66; Asimakopulos 1986: 280-81). Domar (1949a), as discussed in section 2, suggested a general function $I = \theta (Y, E, \gamma)$, where E captured technical progress and other autonomous factors.

[24] Harrod's (1963a: 77) case for indicative planning was similarly based on the lack of "large Schumpeterian innovations or other important incitements to new investment."

some form of "central planning" and "assurance" that income would continue to rise, firms would rather "wait and see" whether it was temporary. They would expand capacity if the rise in income could "with reasonable precision, be foretold in advance", but that was unlikely in a market economy (Domar 1948b: 47-48).[25]

The main obstacle to investment was the risk of capital loss coming from building new capital assets – the microeconomic side of the aggregative effects of capacity increase examined in Domar's growth model. Whereas competition for labour and raw materials was not usually a serious issue, the "struggle for markets" was a real one (Domar 1948b: 50). Every new piece of investment competes with other productive investments, causing potential losses for owners of old capital assets. Such potential losses will not materialize, and may turn into gains, if new investment raises national income to a higher level, so that "there is enough room for everyone" and new capital assets can find a market "without pushing older ones out", along the equilibrium growth path (Domar 1948b: 51). That was "how the country grew" before 1929, but firms could no longer that this easing rise in income for granted, especially after the Great Depression of the 1930s.

As Domar (ibid) pointed out, firms typically assume that national income is independent of their own (and their close competitors') actions, leading to limited investment (and attempts to prevent rival investments), in order to avoid capital losses caused by excess capacity. This may bring new aggregate investment to a halt, especially if monopolistic markets prevail, with perverse effects on income growth – cf. Domar ([1946] 1957: 79; [1947a] 1957: 100) on junking.[26] However, if businessmen took into account the effect of each other's actions, such coordination problem could be solved by business representatives "sitting around a table", so that prospective investments are "placed on a platter and passed around" as participants discuss their sectorial output and input effects (Domar 1948b: 52). In Domar's metaphor, participants at the table would not anymore treat national income as

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[25] Joan Robinson (1952: 51) probably had that passage in mind in her remark that according to Domar "a failure of confidence, or a mere tendency of capitalists to wait and see what the others will do, brings investment to a halt."

[26] Again, Robinson (1952: 47) accurately ascribed to Domar the notion that continuous investment in his growth model required a sort of "collective faith." Each entrepreneur finds it worthwhile to invest at the appropriate rate "provided that all the others do so, and so long as each believes that the others will continue, he continues himself."

independent of their actions, as "each of them would realize his dependence on all the rest."

That provided a disaggregated perspective on guaranteed growth proposal, even closer to indicative planning, as the result of interaction between government and industrial sectors.[27] It was reminiscent of aspects of the balanced growth approach developed at the time by P. Rosenstein-Rodan and R. Nurkse, as firms create markets for each other's products through coordinated expansion and ensuing income growth under unexploited economies of scale. Indeed, that was how Eltis (1963: 40) interpreted the notion that the mere statement of a target growth rate would allow that target to be realized, if output expansion by each industry needed to implement the target was worked out and advertised.

Domar's ([1946] 1957; 1948b) concept of investment risk as the possibility of capital losses came from his 1944 classic joint paper with Musgrave about the effects of taxation on risk-taking and investment decisions (see part II on the "Rationale of investment behaviour"). Domar and Musgrave (1944) advanced a new model for analysing investment behaviour and portfolio selection. They replaced variance by risk of loss as a dispersion parameter avoided by the investor, with "risk" defined as the sum of anticipated negative incomes weighted by their probabilities. "Gain" was the sum of anticipated positive incomes also weighted by probabilities, and "yield" the mean portfolio return when all possible returns were considered (the mathematical expectation). The investor's decision between alternative assets was, for the first time, discussed graphically in terms of preference maps with the utility of a probability distribution determined by its risk and yield. The diagram compared the "investor's advantage of obtaining income and the disadvantage of jeopardizing his wealth" (Domar and Musgrave 1944: 402). The degree of uncertainty – in the sense of anticipations when the probability distribution is not known exactly – was difficult to express in workable terms; it was supposed to influence upwards the rate of return required by the investor (Domar and Musgrave 1944: 395).[28] Guaranteed growth, as a

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[27] As Harrod (1963b: 674; italics in the original) put it in his discussion of indicative planning, "if only a *sufficient number* of entrepreneurs take a robust view [on the future] they will each be justified, but not if too few do so."

[28] As pointed out by Shackle (1949: 119-25), that was close to his own framework, with the probability distribution split into positive and negative parts. Shackle interpreted Domar and Musgrave's notion of probability not as an objective function

way to encourage investment by affecting expectations of gains and risks, should be read against this background. That differed from the secondary role of expectations in Hansen's framework.

5. Forward looking

Domar (1966: 6), in his John R. Commons Lecture, observed how the achievement of macroeconomic equilibrium through the adoption of some form of macroeconomic planning in many Western economies, led by the French experience with indicative planning, had contributed to avoiding mass unemployment and high inflation since the end of World War II. According to Angus Maddison (1976), macroeconomic policy contributed to economic growth during the so-called "Golden age of capitalism" mainly through the announcement of a credible commitment to ensure full-employment rather than through the actual implementation of active policies. That was close to Domar's concept of guaranteed growth. Expectation-adjusting indicative planning, designed under the assumption that output growth is demand-constrained, was seen as an uncertainty-reducing device to make missing information available to economic agents' decision-making (Estrin and Holmes 1990; Cardim de Carvalho 2019). Harrod's (1964, 1973) neglect – probably caused by his concern with British contemporary debates on planning and growth – to refer to Domar in that connection helps to explain why the guaranteed growth proposal has never been mentioned by indicative planning authors.

Interestingly enough, social scientist Robert Merton (1948) advanced his well-known notion of "self-fulfilling prophecies" – defined as a "false definition of the situation evoking a new behaviour which makes the originally false conception come true" – around the same time as Domar's discussion of growth and expectations. Merton's concept fitted Barnes' (1948) interpretation of the postwar boom as "wishful thinking helping making it so," but not Domar's guaranteed growth scheme, based on a supposedly accurate model trusted by policy makers.

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but as plausibility-estimates, compatible with his notion of "surprise", despite Domar and Musgrave's (1944: 394) criticism of that notion.

Domar (1952: 454) noted that the increasing complexity of the economy and expansion of government activities had led to replacement of "common sense" by "explicit mathematical models" in policy-making. Indeed, Domar was in the 1940s at the forefront of modelling as the dominant way to argue in economics, which distinguished his generation from the previous represented by Hansen and others (see also Boianovsky 2017a). His growth stabilization plan assumed that businessmen formed forward-looking expectations, with some knowledge of the dynamic structure of the economy.[29] Hence, an announced policy change, if credible, would influence entrepreneurs' expectations and, through their reactions, modify the way the economy advanced. That differed from later rational expectations concept, which, by assuming that all information necessary for expectations formation is efficiently transmitted, renders assured growth (or indicative planning) superfluous (see Estrin and Holmes 1983: 25-26).

Growth expectations have played a role in some recent macroeconomic models, through the demand effects of forecasts of the evolution of productivity and potential output (see Blanchard, Lorenzoni and L'Huillier 2017; Benigno and Fornaro 2017). Downward revisions of forecasts of future growth rates (sometimes coming from official documents) bring about decreases in the present value of income, leading to reductions in current aggregate consumption, which affects investment negatively. Assuming some nominal price rigidities, temporary increases in the unemployment rate will take place. The argument has focused on lapses from the optimal growth path as the expectation of potential output expansion is revised, that is, downward shifts of G_n due to productivity shocks. Discrepancies between actual, warranted (or required) and the (given) natural rates, conspicuous in both Domar and Harrod, are not part of such models. Economic policy recommendations, especially near the zero lower bound trap, are geared to implement subsidies to investment in innovation (see Benigno and Fornaro 2017).

Domar ([1944] 1957: 57-61) did consider a scenario based on the "heroic assumption" that aggregate demand is always sufficient to maintain income growth at its maximum rate determined by productivity forces. The matter of "long-run expansion" had received little attention in view of the challenging problem of making full use of capacity, Domar noticed. The main source of long-run economic growth

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[29] Like most economists at the time, Domar did not refer to workers' expectations, studied for the first time by D.G. Champernowne in the 1930s (Boianovsky 2020b).

was technological progress, which offset diminishing returns from insufficient increase of labour force and natural resources (60). The "mere assurance of an adequate effective demand" was not enough to stimulate innovations in market structures increasingly dominated by large corporations and monopolies. It was in that context that Domar ([1944] 1957: 60-61) suggested "large-scale government participation in industrial and scientific research" as a major factor in long-run growth. That was not far from modern policy recommendations mentioned above, but in another theoretical framework altogether (see also Boianovsky 2018).[30]

Under full employment long-run growth, the notion of constant labour/capital ratio did not seem acceptable to Domar (1953a: 561; 1955b: 223), who observed that it was a "simplification" that should be used "with care", especially over long periods. His theoretical objection – apart from the empirical one mentioned in section 2 above – to the Haberler-Harrod-Kaldor-Hansen-Hicks view of the upper turning point as the result of labour shortage, was that a higher propensity to save not only required a higher rate of growth for full capacity utilization but "by creating more capital it also reduces the labour coefficient and thus releases labour to achieve … this faster growth" (Domar 1953a: 561). Bertil Ohlin had advanced a similar objection at the 1936 meeting of experts about the first draft of Haberler (1937) (Boianovsky and Trautwein 2006: 68). In his anticipation of the neoclassical growth model, Tobin (1955: 107) would raise the same point concerning the long-run adjustment of the input coefficient to labour supply growth. However, as Domar (1961) clarified, a neoclassical production function (e.g. Cobb-Douglas), of the kind Solow (1956) assumed, did not remove Harrod-Domar instability. As long as excess capacity, caused by growth below the required rate, affected investment demand, an "element of instability is introduced", which was the motivation behind Domar's growth stabilization plan (see also Boianovsky 2017a: 424-25).

Domar's guaranteed growth proposal aimed at reducing macroeconomic risks faced by entrepreneurs, associated to changes in aggregate demand, not risks of a microeconomic sort caused by the competition process. His take on the microeconomics of economic growth – unnoticeable in his aggregative growth model,

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[30] "[N]either technology, nor of course saving, guarantee a rise in income. What they do is to place in our hands the *power* and ability to achieve a growing income … Depending on our economic policy, [they can] result in frustration and unemployment" (Domar [1947a] 1957: 108).

except in part for the notion of junking of capital assets – was essentially Schumpeterian. Domar (1992: 120) regarded Schumpeter as one of his great teachers, together with Jacob Viner (at Chicago) and Nikolai Ustrialov (at Harbin, Russia). As Domar ([947a] 1957: 96) put it, "the struggle for markets and the replacement of weaker (or older) firms and industries for stronger (or newer) ones is the essence of progress in a capitalist society." Such "aggressive competition" could not take place in a absolutely "safe" environment, with no risks of capital losses. Schumpeterian creative destruction is clear in Domar's (1948b: 53) perception of economic growth as a "cruel and destructive" process accompanied by increasing standards of living. Attempts to "tame it", without at the same time introducing some form of "economic planning," would result in unemployment and insecurity, instead of stability (ibid). Schelling's (1947) and Eisner's (1953) criticism – that Domar's guaranteed growth proposal disregarded market shares and other microeconomic uncertainties – missed the target.

Domar's ([1946] 1957) question concerning the policy implications of reversing his growth equation was "very interesting" indeed (Solow 2006: 136), and yet Schelling and Eisner were among the few contemporaries who paid close attention to Domar's plan and its implications for expectations formation. Reviews of his 1957 collection by Frank Hahn (1958) and Ingvar Svennilson (1958) ignored it, despite the fact that both revewers had done theoretical work on expectations in macroeconomics – in Svennilson's case, as member of the venerable Swedish neo-Wicksellian tradition. The whole literature on indicative planning, including Harrod (1964), failed to mention Domar's scheme either, despite several similarities. Year later, Rostow (1990: 333-34) briefly described the historical and theoretical contexts of Domar's growth stabilization plan, but inaccurately stated that Domar proposed "heroic compensatory measures of public policy" to increase the growth rate, in contradiction with Domar's point that higher government spending would not be necessary after all if the announced policy were credible. Solow (2006: 136-37) provided an enlightening concise treatment, but refrained from discussing its links with Harrod's warranted rate and expectations formation in general.

By the end of his 1948 *AER* article, Domar ([1948a] 1957: 125) defended his interpretation of the problem of capital accumulation, and its implications for stabilization policy, as a "narrow path" between two extremes: those who believed there was no accumulation problem at all but only a "wide road to continued

prosperity" (e.g. F. Knight) and those who held that "this road is closed altogether" (e.g. A. Hansen). As Domar (1957: 8, 14) claimed, against what he saw as a long economic tradition stressing a tendency to the stationary state or secular stagnation, there existed an equilibrium growth rate, which, if achieved, would keep the economy away from that trend. Such a rate was "not beyond our physical possibilities" (ibid), reachable through the expectational mechanism of the guaranteed growth proposal, which belonged to the core of Domar's growth economics agenda.

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