Centro di Ricerche
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"Piero Sraffa"

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Centro Sraffa Working Papers
n. 24

February 2017

ISSN: 2284-2845
Centro Sraffa working papers
[online]

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Abstract

The concept of Harrodian instability is reexamined taking into due consideration the fact that growth occurs through irregular fluctuations. This undermines the cornerstone of Harrodian instability, namely the way in which investment is assumed to react to a degree of utilization differing from its desired level. The methodological consequence of Harrodian instability is reconsidered: the assumption that only theoretical positions in which capacity and demand are perfectly adjusted can be regarded as theoretically acceptable appears to be based on weak foundations. The relevance of the cumulative tendencies toward expansion and recession is greatly reduced. Different ways of addressing these hypothetical phenomena are suggested.

Keywords: Harrodian Instability; Demand-led Growth Theory; Methodology

JEL codes: O40; E12; B41

1. Introduction[1]

The concept of Harrodian instability has had a marked impact on the study of economic growth, unquestionably orienting both mainstream theories and theories of demand-led growth toward the assumption of steady-state paths as a method of analysis.
It has also returned recently to the center of broad theoretical debate in the context of theories that recognize the role of aggregate demand in the growth process, and general dissatisfaction with its rigidity can be detected in the associated literature.

[1] I wish to thank the participants in the seminars held in autumn 2016 at the Centro Sraffa, Roma Tre University, the Department of Economics of the University of Massachusetts – Amherst, and the Department of Economics of the New School for Social Research, New York. The paper has been considerably improved in particular by the comments of Roberto Ciccone, Daniele Girardi, Antonella Palumbo, Daria Pignalosa, Mark Setterfield, Peter Skott, Antonella Stirati, and an anonymous referee. Needless to say, the responsibility for any errors and misconceptions is entirely mine.

Despite the crucial nature and wide-ranging discussion of the concept, its underlying assumptions and theoretical foundations have not been sufficiently scrutinized. The aim of the present paper is to initiate steps in this direction.

In particular, all the theoretical relations involved in the definition of Harrodian instability will be reexamined taking into due consideration the fact that growth occurs through irregular fluctuations.

Section 2 recalls the definition of the concept and section 3 briefly considers both its role in fostering the use of the steady-state method in theories of growth and the way in which this has triggered debate in recent years.

The vision of the interaction between investment and the actual utilization of capacity is grounded on the concept of a *desired* degree of capacity utilization or, in Harrod's terms, a *desired* capital-output ratio. On the basis of the definition of this concept and by taking into due account the fact that growth takes place through irregular fluctuations (section 4), some properties of the relationship between investment and *actual* capacity utilization have already been detected in the literature (section 5). While these properties actually undermine the concept of Harrodian instability, their relevance to the debate on it has been completely disregarded. Moreover, deeper analysis of the concept of the degree of normal utilization reveals a further weakness of the concept. It will be argued that the determination of desired or planned utilization is not independent of the very circumstances that determine higher or lower intensity of growth. The two terms of comparison that generate Harrodian instability are therefore not independent of one another (section 6).

These considerations appear to undermine the cornerstone of Harrodian instability, namely the way in which investment is assumed to react to a degree of utilization differing from its desired level. The last part of the paper (section 8) will seek to show how these results change the terms in which the phenomena described by the concept of Harrodian instability can plausibly take place.

Even though our arguments may not be sufficient to bring about complete abandonment of the concept, they do make it clear that its methodological consequences should be reconsidered. The assumption that *only* theoretical positions in which capacity and demand are perfectly adjusted (steady-state paths or fully adjusted positions) can be regarded as theoretically acceptable appears to be based on weak foundations. Moreover, the relevance of the cumulative tendencies toward expansion and recession is greatly reduced. Still more important, however, is the fact that our arguments suggest ways of addressing this hypothetical phenomenon that appear to differ from those adopted in the literature.

2. The concept of Harrodian instability

Harrod's 'inherent instability' is described in terms of a comparison between the actual and the warranted rate of growth, the latter being «determined by certain "fundamental

conditions"—namely the propensity to save and the state of technology» (Harrod 1939, p. 17). For very simplified hypotheses, the warranted rate of growth is in fact equal to the ratio between the marginal (and average) propensity to save **s** and the capital-output ratio $\boldsymbol{\alpha}$.[2]

That warranted rate determines a 'moving equilibrium' that proves to be highly unstable. Any divergence between the actual, g_a, and the warranted, g_w, rate of growth generates 'centrifugal forces'. Any «departure from equilibrium—instead of being self-righting—will be self-aggravating» (Harrod 1939, p. 22). While $g_a > g_w$ generates a cumulative tendency toward expansion, $g_a < g_w$ generates a cumulative tendency toward recession.

This concept is based on an assumption about the investment behavior of individual firms, namely that they tend to realize a technically given capital/output ratio—the *state of technology*—and that they *react to any divergence* of the *actual* from the *desired* capital/output ratio by reducing or increasing investment respectively when the actual capital/output ratio is higher or lower than the *desired*.

Only when the actual and desired degrees of capacity utilization coincide are firms 'content with what they are doing' (Harrod 1948, p. 81) and the pace of capital accumulation can be regarded as dynamically stable.

3. Harrodian instability, the adoption of steady-state paths and the revival of debate

The examination of Harrodian instability makes it possible to argue that the concept has played a crucial role in causing both mainstream and demand-led growth theories to adopt steady-state paths — along which all the aggregates grow at the same constant rate — as the theoretical positions for the analysis of economic growth.

This instability vanishes in fact only under conditions in which the normal utilization of capacity and desired capital/output ratio are constantly attained. On the assumption of constancy of techniques, the continuous normal utilization of capacity implies that the ratio of capital to output remains constant in time and therefore that the two aggregates grow at the same rate.[3] Only theoretical positions in which capital and output grow at

[2] In the second part of his 1939 paper (from section 12, p. 26, on), Harrod studies the warranted rate for more general hypotheses in which the existence of autonomous components of aggregate demand, **A**, is assumed. In this case, the numerator of the warranted ratio is equal to the average propensity to save expressed as the difference between the marginal propensity to save and the ratio between autonomous components of consumption in income.

[3] If a constant average propensity to save is assumed, the composition of aggregate demand must remain constant and all the aggregates must therefore grow at the same rate.

the same rate are therefore associated with the absence of instability and can be regarded as sufficiently persistent to serve as the object of theoretical analysis.[4]

It is therefore hardly surprising that the persistence of *normal* utilization of capacity (or a normal capital/output ratio) should have been considered a prerequisite for any meaningful theoretical position ever since Harrod's contribution. Moreover, the objects of modern theories of growth have actually been steady-state paths along which output, capital and all the relevant magnitudes grow at the same rate and the capital-output ratio is constant and equal to the desired ratio so as to prevent instability. Along such paths, the economy grows at a rate possessing the properties attached to the warranted rate. Different theories argue the existence of different theoretical mechanisms through which the principles determining the actual rate of growth simultaneously affect either the numerator or the denominator of the warranted rate.

As is known, Solow's theory of growth (followed ever since by all the mainstream theories) overcame the problem of instability by means of marginalist principles that determine the optimal techniques and the capital-output ratio compatible with conditions of full employment (Solow 1956). It is the denominator of the warranted rate that adjusts so as to generate stable dynamic equilibria.

Keynesian theories as a whole take a different approach whereby the rate of growth and accumulation is seen as affecting the numerator of the warranted rate.

The numerator of the warranted rate differs in relation to the assumptions of the model adopted. If it is assumed that there are no autonomous components of demand, it coincides with the marginal propensity to save. Under this assumption, the theories based on the Cambridge Equation[5] envisage an adjustment mechanism of the warranted to the actual rate of growth based on changes in income distribution. The marginal propensity to save of the economy is the weighted average of the propensities of capitalists, s_c, and workers, s_w.

Some analyses in the Classical-Keynesian approach[6] instead assume the existence of autonomous components of demand, in which case the numerator of the warranted rate is equal to the difference between the marginal propensity to save and the share of autonomous demand in income. Changes in this share determine the adjustment of the warranted to the actual rate of growth in analyses based on the Sraffian supermultiplier.

These analyses share the assumption that the rate of growth must be equal to the warranted rate in order to overcome Harrodian instability even though their correspondence is explained by radically different principles.

[4] This position appears to involve transposition of the property of persistence of the long-run positions of the Classical and traditional marginalist theories of value into the study of quantities. For the fallacious nature of this transposition, see Trezzini (2013).

[5] See Kaldor (1956).

[6] See, in particular, Serrano (1995). For the different strands of analysis in this approach, see Trezzini and Palumbo (2016).

Neo-Kaleckian models[7] posit a steady-state rate of growth (and accumulation) simultaneously with a steady-state degree of capacity utilization differing from its normal level.

Criticisms of these steady-state paths as unstable in terms of the traditional definition of Harrodian instability[8] have renewed debate on this concept. Eckhart Hein, Marc Lavoie and Till van Treeck (2011) provide an overview and discussion of the mechanisms put forward in order to overcome the supposed instability of Kaleckian models, most of which involve a tendency of normal utilization to adjust to the actual steady-state degree of utilization.[9] The authors regard all these mechanisms as unsatisfactory, however, and go on in a companion paper of 2012 to review all the arguments put forward by Kaleckians to claim that complete adjustment of actual to normal utilization is not necessary even in the long run. Some simply suggest that a persistent discrepancy between the two is plausible, some question the uniqueness of the normal degree, and some argue that full adjustment can be impeded by the action of different agents pursuing conflicting objectives all of which depend on actual utilization.

Other works (Allain 2013, Dejuàn 2013, Lavoie 2014) attempt to overcome the instability of Kaleckian models—determined by the endogenous determination of the steady-state degree of capacity utilization—by introducing an autonomous component of demand growing at an exogenously determined rate, as in supermultiplier analyses. Both the actual and the warranted rate tend to converge on the rate of growth of autonomous demand.

Harrodian models constitute another line of research connected with the issue of Harrodian instability,[10] which is seen in these analyses as the engine of growth. The elements limiting this instability are studied through the construction of models that offer a *dynamic* alternative to the steady-state assumption involving lags and different elements of reality. The distinction between the short-run and long-run sensitivity of investment to changes in aggregate demand, the simultaneity of the analysis of trend and cycle, and the explicit consideration of monetary policy and finance appear to be the lines along which this approach is currently developing.

The variety of positions on the issue of Harrodian instability among authors who share the general conception of growth as a phenomenon governed by the expansion of demand suggests the need to question the idea at the heart of this debate and its theoretical foundations to a greater extent and in a different way. The present work is clearly connected with this debate and some of its results appear similar to some of those

[7] This approach to the analysis of growth was originated by Rowthorn (1981) and has since developed in many different directions and with different strands of analysis. For a complete and detailed overview, see the special issue of *Metroeconomica* on Kaleckian growth theory published in 2012.

[8] See Committeri (1986), Auerbach and Skott (1988) and Trezzini (2011a).

[9] The tendency of the normal degree of utilization to adjust to the steady-state degree implies the simultaneous tendency of the warranted rate to adjust to the steady-state rate of growth by means of changes in the denominator of the warranted rate.

[10] See Skott (2010 and 2012) for an overview of this approach.

emerging from it. Its basic thrust is, however, a reconsideration of the very basis of the concept of Harrodian instability.

In particular, Harrodian instability is reassessed in the light of the fact that growth occurs through irregular fluctuations in the level of demand and output. This leads us to question the assumptions as regards the investment behavior of firms on which the concept is based and, as a result, to strip it of most of its apparent plausibility.

4. The meaning and the determination of the normal or planned degree of capacity utilization

Despite the centrality of the idea of the desired degree of capacity utilization in both the theory of prices and the theory of accumulation, few studies have provided a clear definition and an analysis of its determination.

The desired degree of utilization has been defined as an element that determines the production technique and hence addressed in terms of the utilization/technique that minimizes the cost of production. Kurz (1986) and Shaikh (2009) follow this approach and study the determination of the normal degree of utilization[11] on the assumption of a given quantity of production. This definition of the degree of capacity utilization therefore appears to be in line with the classical surplus approach to the determination of prices and distribution.

The assumption of a given quantity does not appear particularly appropriate for an analysis of growth that focuses specifically on the changes in the quantities produced. It therefore appears necessary to extend the definition so as to adjust it to the study of accumulation. As a first step, the possibility can be considered of basing the analysis of accumulation on a definition of the planned degree other than the one adopted in the analysis of prices.[12] The possible compatibility of the two definitions and the need for further analysis to ascertain the relations between them will then be discussed briefly.

This different definition of the desired degree of capacity utilization was put forward in the context of the analysis of accumulation by Steindl (1952, pp. 9−14).

In Steindl's view, firms desire to work with substantial margins of spare capacity. Economies generally grow through irregular fluctuations of demand and output. The *indivisibility* and the *durability* of production plants are two technical features that make

[11] Shaikh (2009) quotes Harrod (1952, pp. 150−51), Foss (1963, p. 25), and Shapiro et al. (1989, p. 184) and Winston (1974) as works following the same approach. It is, however, impossible to find anything more in these works than a general statement to the effect that the normal degree must be regarded as associated with the technique that minimizes costs.

[12] The analysis of accumulation and of value and distribution might in fact conceivably be developed separately, as in the modern classical approach, and might also use different methods of analysis as long as they are not inconsistent. In this sense, see Trezzini and Palumbo (2016).

smooth, continuous adjustment of capacity to fluctuations in demand generally impossible.

Entrepreneurs know from experience that the demand for their products tends to fluctuate and that they must be *able to meet comparatively higher levels of demand*. [13] More recently[14], attention has been drawn to the possibility of entrepreneurs wishing to install capacity even in excess of the highest expected peaks. Expectations on peaks level of demand are uncertain forecasts and firms might also desire to meet *unexpected* increases in demand.

The behavior assumed by Steindl is closely connected with competition. Every firm must be equipped to meet higher peaks of demand—both expected and unexpected—in order to avoid losing its market share, to prevent the entrance of potential new competitors, and if possible to take advantage of unexpected peaks of demand so as to increase its market share: «Each of the competing producers wants to take part in any eventual expansion of sales, and not to have it snatched away by new competitors» (Steindl 1952, p. 10).

The indivisibility of production plant can be so important as to force the firm to install a large margin of spare capacity even with respect to peak levels of production.[15]

Once such capacity is installed in relation to peaks, its durability necessarily implies that it will not be fully utilized when demand decreases. It is reasonable to assume that any production plant will experience fluctuations in demand that include booms and slumps over the course of its lifetime, and its utilization will change accordingly.

The degree of utilization that entrepreneurs expect to obtain *on average* over a period of time will therefore certainly be lower than the maximum. This average value is generally called the *desired* or *normal* degree of capacity utilization. In a sense, however, it would be more reasonable to describe it as *planned*. Firms *expect* or *plan* to obtain this degree even though they would be much happier, if it were technically possible and if they had no competitors, to utilize all of their capacity all of the time. What they actual-

[13] Ciccone argues in this connection that, at both the aggregate and the individual firm level, «the size of capacity installed is commensurate with the relative higher levels of demand that entrepreneurs expect to encounter with a certain frequency, during the economic life of their plants» (Ciccone 1986, p. 27). This behavioral assumption, made by Steindl and Ciccone, implies considerable underestimation of the cost of holding spare capacity in the phases of the cycle in which the demand is lower than the expected peak levels. It is possible that an analytical specification of cost functions would lead to the detection of cases in which the costs resulting from spare capacity are greater than those resulting from the firm's inability to meet expected demand peaks. The behavioral rule might therefore be different in many cases. As will be shown, however, a different rule does not significantly alter our arguments. See fn 22.

[14] The possibility of a further margin of spare capacity to meet unexpected peaks has been argued by Dutt (1990 and 2010).

[15] Another argument in favor of the assumption that firms plan to have spare capacity is the following: 'Any producer who sets a new plant knows that for a certain initial period (which we must not imagine too short) he will be able to get only a restricted market, because of the attachment of costumers and all the other well-known factors. He will, nevertheless, chose his capacity so as to leave comfortable room for a greater output, because he hopes to be able to expand his sales later.' Ibid., p.10.

ly *desire* is a higher level of utilization, which is, however, impossible. What they *plan* is to have some spare capacity on average.[16]

Firms expect to obtain a maximum degree of capacity utilization, $\mathbf{u^e_{max}} \leq 100\%$, in connection with one or more peaks in output.[17] They also expect some *troughs* in output during the lifetime of their plant. The degree of capacity utilization in the worst of these troughs is expected to be considerably lower than 100% and equal to $\mathbf{u^e_{min}}$.[18]

If firms expect long booms with plant working for long time near-maximum utilization, the planned degree of capacity utilization, $\mathbf{u^*}$, will be close to $\mathbf{u^e_{max}}$. It will instead be closer to $\mathbf{u^e_{min}}$ if firms expect long slumps with plant working for long periods at its lowest levels.

The *planned* or *desired* degree of capacity utilization will therefore be closer to $\mathbf{u^e_{max}}$ the higher the output levels expected during expansions and the longer the expected expansions and the shorter and less intense the expected slumps. Symmetrically, it will be closer to the expected minimum level the shorter and less intense the expected expansions and the longer and deeper the recessions.[19]

The minimum and maximum expected degrees of capacity utilization are only partially determined by technical conditions (the production method and the durability and indivisibility of plant). They also depend on the height of the expected peaks and the depth of the expected troughs with respect to the expected peaks. The *planned* degree of capacity utilization is even less exclusively determined by technique. In addition to the circumstances determining the maximum and the minimum degrees, it also depends on the length and intensity of the different phases of the expected fluctuations, i.e. on the time pattern of the expected fluctuations in demand.[20]

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[16] Steindl actually uses the term 'planned' instead of 'desired' both for the excess capacity and for the degree of capacity utilization. R. Ciccone suggested the argument used in the text for choosing the term 'planned' in a recent conversation. He also argued that the attribute 'normal' is misleading as well, as this is customarily associated with the level of a magnitude that tends, at least theoretically, to predominate on average over a long period. In the literature on demand-led growth, many authors instead assert the absence of any definite tendency toward the realization of this degree of utilization, even on average, over a long period of time.

[17] The indivisibility of production equipment may be such as to imply maximum expected values of capacity utilization markedly lower than 100% and possibly differing for different peaks.

[18] It is possible for a firm to expect more than one peak and more than one trough over the entire economic lifetime of a production plant. The durability and indivisibility of plant may be such as to entail different values of the expected degree of utilization. Indivisibility may also result in the maximum value of capacity utilization being reached in a boom period that is not a peak of output.

[19] While it has been decided to develop the argument here in term of degrees of capacity utilization, it is important to stress that our reasoning implies symmetrical conclusions for the *normal/planned* capital-output coefficient $\boldsymbol{\alpha^*}$, which will be closer to $\boldsymbol{\alpha_{min}}$ when $\mathbf{u^*}$ tends to be closer to $\mathbf{u^e_{max}}$ and closer to $\boldsymbol{\alpha_{max}}$ when $\mathbf{u^*}$ tends to be closer to $\mathbf{u^e_{min}}$.

[20] If demand grew at a constant rate, technical indivisibility would be a feature of plants capable by itself of determining the economic need for spare capacity, whereas capital durability would not. Since demand grows through fluctuations, both indivisibility and durability are capable alone of determining the economic need for spare capacity.

The definition of the planned degree of capacity utilization deriving from Steindl's work does not necessarily contradict the definition of the planned degree as determined so as to minimize costs.

Cost minimization is defined with respect to a single given quantity by Kurz and Shaikh but with respect to different produced quantities for different periods through the economic life of the indivisible plant by Steindl. Moreover, cost is here implicitly defined so as to include not only technical costs but also the risk of losing the firm's market share.

Given the expected quantities and the indivisibility of productive plants, the implicit comparison is between plants of different dimensions each of which is capable of producing the given quantities at different average planned degrees.

In this sense, the planned degree of capacity utilization minimizes the costs entailed in installing an indivisible plant of a given size with respect to the costs associated with all the other plants of different dimensions that would produce the same expected quantities with different planned degrees of utilization.

In this way, it seems possible to overcome what appears to be a contradiction.[21] On the basis of this definition, we can state that if the actual average utilization turned out to be higher than planned, actual profits would be higher than normal profits (associated with planned utilization). This does not contradict the assumption that the planned utilization is such as to minimize costs/maximize profits.

While a given plant could minimize costs at a planned level with respect to given expected quantities, the same plant could also generate lower average costs and allow higher realized profits if the actual quantities generated an average higher utilization.

The planned degree of utilization should in fact be understood as the one that minimizes costs given the expected produced quantities and therefore only if the actual quantities are those expected. If the actual quantities differ from the expected, however, the average costs might be lower than planned and utilization higher than planned, which would make profits higher than normal possible.

Once correctly analyzed and perhaps developed, Steindl's definition could therefore prove to be an extension of the one based on a single given expected produced quantity.

While Steindl's definition is adopted here, the two definitions, their relations and their mutual compatibility or incompatibility certainly require further examination through general formal models.

[21] This contradiction has been the center of a debate between Kurz and Ciccone.

5. Divergence of the actual from the planned degree of utilization: effects on investment

Taking into due consideration Steindl's definition and the fact that growth occurs through cyclical fluctuations, Ciccone (1986) draws some conclusions that tend to reduce the relevance of the assumption on which Harrodian instability is actually grounded, i.e. that investment reacts in a precise way to *any* divergence of *actual* from *planned* capacity utilization.

The very definition of the planned degree of utilization implies that each firm expects the actual utilization of capacity to vary between relatively high levels, which correspond to production peaks, and relatively low levels, which correspond to troughs, even if its expectations are completely fulfilled.

A firm therefore expects to obtain a degree of utilization that always *differs* from its *planned* level. Being an average magnitude, the *planned* degree is expected to emerge at most over time from a succession of actual values differing from their average. There is thus no reason for the firm to react immediately to any divergence of actual utilization from its planned level.

This appears to suggest that investment cannot be sensitive to *every* divergence of actual from normal utilization. A certain amount of installed capacity can be deemed inadequate, thus generating pressure to invest, only after a period during which a succession of degrees of utilization differing from the expected level has suggested that their average value will be significantly different from the normal one.

It can therefore be argued that the potential effect of actual utilization on investment would tend to be much less immediate and mechanical than is assumed in discussions on Harrodian instability. Investment can at most react to an *average value* of the *actual levels* of capacity utilization. This consideration, which can be found in the literature, unquestionably alters the intensity of the forces determining instability.

This leads us, however, to a further consideration that appears to affect the very nature of these forces. Differences between the *average actual* degree of utilization and the *planned* degree of utilization can occur in many different ways.

Ciccone (1986, p. 28) argues that the actual utilization of capacity can prove to differ from planned utilization «without the size of the capacity being seen as wrong with respect to what entrepreneurs would have found profitable to install».

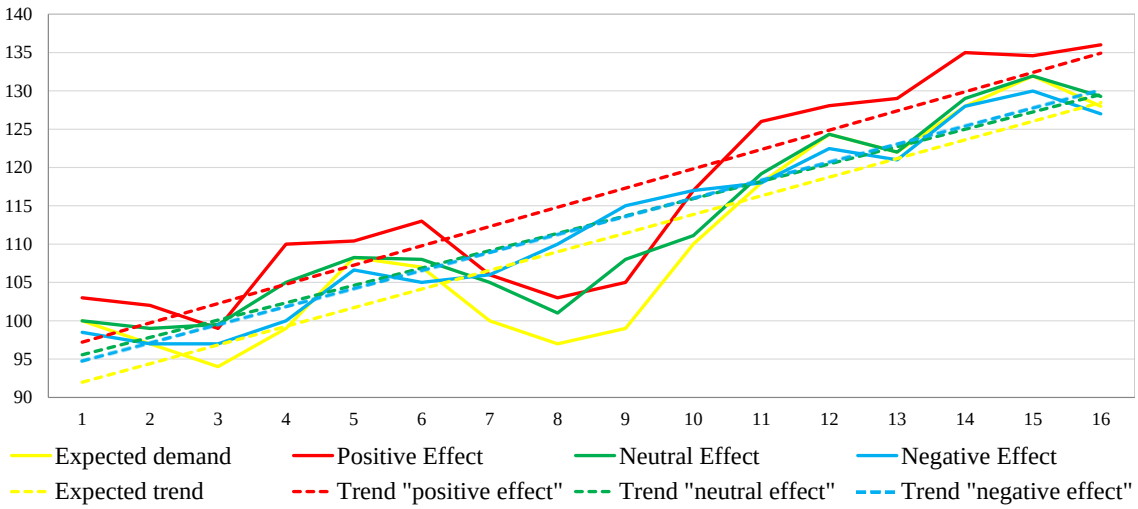
In particular, Ciccone studies different cases in which the highest levels of demand correspond to those for which capacity has been installed. Average utilization is determined in each case by the extent and duration of the demand levels below the peaks. It is therefore possible for more severe and/or frequent decreases in demand to generate actual utilization lower than the expected level, and symmetrically for less severe and/or frequent falls to generate actual utilization higher than the expected level. In these cases, even though the actual utilization of capacity proves to differ from 'normal' utilization, the size of the capacity is probably not seen as 'wrong'. The firm would in fact achieve its production target to meet the expected peaks of demand even if not its average

planned utilization target. Despite overutilization or underutilization, these situations leave entrepreneurs 'content with what they are doing' and investment would be unaffected by utilization differing from normal.

It is possible to represent and generalize Ciccone's insights by means of a numerical example (see Appendix A, Table 1, for the numbers used, and Figure 1).

On the basis of a given expected time pattern of demand fluctuations and taking into account capital indivisibility, a firm installs capacity so as to meet peak levels of production. This time pattern of fluctuations is represented by the yellow line in Figure 1 (the dotted yellow line represents the linear trend of this pattern). On the assumption of a given capital/output ratio corresponding to full utilization and the given properties of indivisibility and durability of capital, it is possible to imagine a desired evolution of productive capacity for a given period.[22] Comparison of the evolution of potential output and of expected output then makes it possible to calculate the degrees of utilization that the investing firm expects to obtain in each period. Their average level is the *planned* degree of capacity utilization. In our numerical example the planned degree is $u^* = 91.19\%$.

Figure 1. Fluctuations and trends in demand



Let us now consider three hypothetical patterns of actual demand, all of which generate actual average utilization that is higher than planned.

- In the first case—called 'Positive effect' and represented by the red lines—utilization is higher than its planned level (in our example $96.1 > 91.19\%$). Overutilization is caused by higher peaks and less severe recessions than expected. This pattern implies that the installed capacity is insufficient with respect to demand. This case probably implies a positive effect on investment.

[22] See Appendix A.

- In the second case—called 'Neutral effect' and represented by the green lines—the peaks are as expected but the recessions are less severe and the expansions more intense. Capacity is overutilized on average with respect to the planned level (93.25 > 91.19) but sufficient to meet demand also during the peaks, and the effect on investment could be nil.

- In the third case—called 'Negative effect' and represented by the blue lines—overutilization (93.1 > 91.19) is determined by lower peaks but less severe recessions and more intense expansions. Capacity proves overabundant and overutilization could have a negative effect on investment.

An average actual degree of utilization *higher* than the planned level would therefore have different effects on investment depending on how it came about.

Symmetrically, in the case of the peaks being higher than expected—and the firm therefore failing to seize profitable opportunities—and the troughs longer and more intense than expected, an average utilization *lower* than the planned level could generate *positive pressure* on investment.

Finally, it is obviously possible for an average actual degree of utilization equal to the planned level to generate negative or positive pressure on investment depending in any case on the specific circumstances in which it occurs.

The conclusion can therefore be drawn that the elasticity of investment with respect to divergences between actual and planned utilization is not only less immediate and intense than assumed in the discussion of Harrodian instability but might also be equal to *zero* or even *opposite in sign* to what is assumed. The same differences between average actual and planned utilization might be the result of different circumstances that drive the inducement to invest in different directions.[23]

These considerations lead to a further point of relevance to our general conclusions: Harrodian instability is caused by the fact that investment which determines the overutilization of capacity also determines further investment designed to adjust existing capacity to actual demand.

Our analysis appears to suggest that what determines a potential positive effect on investment *aimed at adjusting existing capacity* is overutilization due to prolonged pressure on the peak levels of production.

[23] We can now resume the considerations put forward in fn.12. Steindl's hypothesis is that the firms install capacity in relation to expected peaks. Even though more detailed analysis of the possible relevance of the costs of underutilization would lead to a different rule, the arguments put forward above would still hold. The crucial point is in fact that once the dimension of capacity and a corresponding degree of planned utilization have been determined, by any rule, actual fluctuations might determine an actual average utilization other than the planned level in different ways. Many of these can give rise to effects on investments differing from those on which Harrodian instability rests.

The condition capable of triggering the cumulative tendency toward expansion is therefore not just any overutilization but the *persistence* of the actual degree of utilization at levels close to the maximum.[24]

6. The dependence of the planned degree of utilization on expected growth and the interdependence of actual and planned degrees

A significant feature of the planned degree of utilization can be identified on the basis of its definition and due consideration of the fact that growth occurs through irregular fluctuations, namely that this key magnitude is determined by many of *the same circumstances* as determine the *actual* average degree of capacity utilization. The two magnitudes, whose divergence determines Harrodian instability, are not independent of one another. This necessarily vitiates the concept of Harrodian instability.

As stated above, the *planned* degree of capacity utilization tends be higher the longer and/or the higher the expected expansions and the shorter and/or less intense the expected slumps, and to be lower the shorter and less intense the expected expansions and the longer and deeper the expected recessions.

This point has a further crucial impact on the concept of Harrodian instability, as will become clear once it has been connected with another key issue.

Most of the literature studies the determinants of the trend of growth independently of fluctuations. This is tantamount to seeing economic growth as the result of (more or less regular) fluctuations that occur around a trend growing at a rate determined independently of the fluctuations themselves. Though dominant, this assumption is seldom stated explicitly and never explicitly discussed and argued.

An alternative position—present in the Keynesian literature of the 1950s and ’60s and recently revived[25]—sees the growth trend of the economy as born out of cyclical fluctuations and not independent of the way in which these fluctuations actually occur. It can be argued that a period of intense growth, at a high average rate of growth, arises out of longer and/or more intense expansions and/or out of shorter and/or less intense recessions.[26] [27]

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[24] This condition positively affects investment even though it can in principle generate either average overutilization or average utilization equal to or lower than planned.

[25] It is not farfetched to state that this approach—see above all Kaldor (1954) and Kalecki (1968)—has been abandoned as a result of the power of the concept of Harrodian instability and its role in steering theory toward the adoption of the steady-state method. See Trezzini (2013) and Trezzini and Palumbo (2016) for recent attempts at reappraisal.

[26] Unprejudiced observation of the time series of the output of developed countries shows that different average rates of growth in different periods or countries generally arise out of more intense and longer expansions and shorter and milder recessions. It is instead almost impossible to find historical cases in which similar fluctuations have occurred around steeper or flatter trends.

[27] The relevance of this point is limited to non-marginalist theories of output and growth. In marginalist theories, the tendency to full employment makes it possible to select a long-term trend of the

This second and less popular approach to the analysis of growth is adopted here in accordance with the role played in our argument by due consideration of fluctuations in output.

It is possible to argue that if growth is determined by the features of fluctuations then so are expectations about growth. In other words, it is reasonable to assume that expectations of periods of high growth imply expectations of longer and more intense expansions and shorter and less severe recessions. This is in fact the way in which growth generally occurs.

A firm that expects more intense growth of the demand for its product expects *longer* and *more intense expansions* and/or *shorter* and *less severe recessions*. These expectations give rise to a stronger incentive to invest.

A strong incentive to invest is thus determined by *circumstances*—the expectation of longer and more intense expansions and shorter and less severe recessions—*which are at the same time* likely to cause investing firms to expect their new plants to operate, on average over their economic life, close to the maximum value of the degree of utilization. This determines a high *expected* or *planned degree of utilization*.[28]

The implications for the concept of Harrodian instability should now be clear. When a strong incentive to invest generates a buoyant pattern of aggregate demand, the resulting high actual degree of utilization will be compared with a high *planned* degree of utilization that is ultimately determined by the very same causes. The two magnitudes move in the same direction for the same causes.

As the determination of the *planned* utilization of capacity is not independent of the conditions determining growth and accumulation, this *planned* value will tend to accommodate different conditions of growth with the effect of largely neutralizing instability. Even though this accommodation may not be complete, the resulting possible divergence between the average actual and planned degrees will be certainly much smaller than that implicitly assumed in the hypothetical mechanism leading to Harrodian instability.

Divergence between the actual and planned degrees tends to occur more rarely and to be smaller than is assumed in the construction of the concept of instability.[29]

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economy that can correctly be regarded as determined independently of cyclical fluctuations, which can be seen in such theories as random and temporary disturbances of the natural operation of the system.

[28] This effect must be logically distinguished from any influence of *ex post* realized degrees of capacity utilization on the determination of the planned degree, which is widely theorized in Kaleckian models of growth. For a complete overview and discussion of this point see Hein et al. (2011). The influence in these *steady-state growth models* is that of past steady-state actual degrees and it is theorized independently of cyclical fluctuations. This amounts to assuming that investing producers become accustomed to actual conditions of production and realize that higher or lower margins of spare capacity are not desirable. In our argument, actual past and current degrees of capacity utilization have no direct role in determining planned utilization or the relation between the incentive to invest and the planned degree of capacity utilization.

[29] One way of presenting the issue of Harrodian instability is based on the expectations implicit in investment decisions. Harrodian instability can be interpreted as the result of investments based on

7. Individual and aggregate magnitudes

As in the original Harrod's contribution and in all the analyses that discuss the Harrodian instability, our analysis of the sensitivity of investment to actual utilization has been developed at the level of single firm decisions. A direct transposition from the individual to the aggregate level may however be less immediate than it has been assumed in the literature.

Transposition from the individual to the aggregate level of analysis appears to strengthen our conclusions about the difficulties of identifying a general unidirectional relation between investment and the actual degree of capacity utilization.

The conditions determining the planned degree of capacity utilization, i.e. the durability and indivisibility of plant and patterns of expected demand, can differ greatly between firms in the same industry and still more between different industries.

Similarly, the conditions determining an actual average degree of utilization different from planned—i.e. the way in which actual fluctuations differ from those expected, on the basis of which capacity is installed—might differ radically between firms in the same industry and still more between different industries.

The aggregate values of both the *planned* and the *average actual* degree of capacity utilization are in principle the result of the sum of the corresponding sector or firm magnitudes. They are therefore the result of many heterogeneous and potentially conflicting circumstances.

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expectations that prove to be necessarily wrong except in the case of growth at the warranted rate. If firms expect a surge in demand at a rate $g_e > g_w$ and accordingly tend to increase capital and/or investments at the same rate, they will in fact generate overutilization. This can be seen as the effect of an error in expectations, capacity being created for an expected level of demand that fails to materialize. In making investment decisions, firms are unable to predict the effects of the investments themselves on aggregate demand. The result will be a boost to accelerate the pace of accumulation and the growth rate will ultimately tend to be greater than g_e.

An implicit assumption about expectations is found at the basis of this mechanism. A condition that is plausible at the level of the individual firm is uncritically transposed to the aggregate level but with paradoxical results. The expectations of an individual firm about the future demand for its product are certainly independent of the effects on aggregate demand of the investment that the firm itself makes. Aggregate investments are assumed to be determined on the basis of expectations about future aggregate output that will—in any case where $g_e \neq g_w$—prove 'wrong' because of the effects of current investments on current demand, which turn out to be totally unexpected.

This transposition to the aggregate level requires closer scrutiny. It is not necessary to assume rational expectations in order to consider it plausible that, in any given conditions, expectations about the future demand for a single commodity are affected by the current performance of economy, which clearly depends also on current investments. At the aggregate level, it appears plausible to imagine that the effects of current investments on aggregate demand are somehow included in future expectations. It is not our intention to try to develop a theoretical analysis of expectations at individual firm level, their aggregation, and their effects on investment. This is a slippery field of analysis for Keynesian theories, which have already shown their difficulties. It is important to point out, however, that our arguments on the interdependence of the determinants of the incentive to invest, of planned utilization and of actual utilization work to overcome the evident inconsistency of the extension to the aggregate level of an assumption that is only plausible at the individual level.

In the light of this, the comparison of an aggregate *planned* and an aggregate average *actual* degree of utilization appears to be even less meaningful for the determination of aggregate investment than it is in principle at the firm level. At the same time, the assumption that an aggregate degree of capacity utilization has regular and predictable effects on aggregate investment becomes even less tenable.

8. The macroeconomic implications

Let us now examine the macroeconomic implications of our results for Harrodian instability.

Our criticism of the sensitivity of investment to divergences between actual and planned degrees of utilization has led us to attach very limited relevance to the concept of Harrodian instability.

The circumstances in which high investments determine a cumulative pressure toward investment or in which low investments determine a further reduction in investment appear to be neither as strong nor as general as assumed in the literature.

The first consequence of this is the rejection of the main methodological implication of the concept of Harrodian instability. There is no strict logical necessity to ground theoretical analysis on positions—steady-state paths or fully-adjusted positions—characterized by normal utilization. Nor must long-term rates of growth necessarily be seen as warranted rates.[30]

[30] The adoption of fully adjusted positions as the object of theoretical analysis also finds its primary justification in the concept of Harrodian instability. The existence and the complexity of many forces countering the adjustment of capacity to demand is generally recognized in analyses that assume the dependence of accumulation on the expansion of demand. In this connection, see not only Trezzini (1995 and 1998) or Palumbo and Trezzini (2003), who reject the use of such positions, but also Freitas and Serrano (2015) and Pariboni (2015), who instead attach theoretical significance to them. The assumption of the dependence of accumulation on demand expansion leads many of these analyses to adopt fully adjusted theoretical positions, as it is thought that the divergence of actual utilization from its planned level always determines effects on investment of the sign and dimension required to eliminate it. An unstated assumption that the tendency of capacity to adjust perfectly to demand in the theory of accumulation corresponds to the tendency toward a uniform rate of profit in price theory appears to be implicit in this position. For improper extensions of the methods of long-term price theory to the context of theories of quantities, see Trezzini (2013). If there are many circumstances in which the effects of the divergence of actual utilization from its planned level can be nil or even opposite in sign to those assumed in order to assert the existence of Harrodian instability, as our arguments seem to suggest, the primary reason for the need to assume normal utilization as a feature of the theoretical positions appears to be lacking. Not only are there conflicting forces but the major force leading to full adjustment appears to be nonexistent. To continue the comparison, while no one denies the existence of forces that can counteract the tendency toward uniformity of the rate of profit, it is difficult to argue that the effects of a difference in the rates of profit in different sectors can be nil or even opposite in sign to those assumed in order to assert the tendency to the uniformity of the rate of profit. As a result, theoretical positions characterized by uniformity of the rate of profit even in conditions in which this tendency is impeded or even completely blocked remain meaningful.

Our analysis will also prove useful to address the analysis of the circumstances in which phenomena similar to those assumed by Harrodian instability might possibly happen.

It appears appropriate to discuss the possible cumulative tendencies toward expansion and contraction separately.[31]

8.1. The potential cumulative tendency to expansion

Investment higher than 'capacity saving'[32] in one period (or a few) would generate a degree of utilization higher than the planned level. In most cases, however, this is (or can be interpreted as) an event falling within the 'normal' circumstances on the basis of which the existing capacity was installed, i.e. one of the expected periods of overutilization that determine the expected average.

Our first result is that the magnitude potentially capable of affecting the decision to invest is the average degree of capacity utilization. This prompts us to consider as a possible source of instability not so much the effect of a single period of investment as the effects of *a time pattern of investment* that implies a strong dynamic of aggregate demand and therefore determines average utilization at a level higher than planned.

On the basis of the argued interdependence of planned and average actual degrees of utilization, it can be argued that if this phenomenon is not entirely unexpected, it will also generate a proportionally high level of *planned* utilization. The high level of actual average utilization will then be compared with a proportionally high level of planned utilization. As a result, the divergence between actual and planned utilization will be limited or even nonexistent.

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[31] Harrodian instability has frequently been presented as a result of the fact that investments have dual effects of different quantitative relevance. The effects on demand are a multiple (determined by the multiplier) of investments, while the effects on capacity are a fraction (the reciprocal of the product-capital ratio) of the same amount of investments. Investment designed to correct overutilization generates more demand than capacity and the overutilization is self-aggravating. Only an increase in demand at the warranted rate (determined by the multiplier and the capital/output ratio) generates investment with mutually compatible effects on demand and capacity.

This objective fact generates Harrodian instability only if the elasticity of investment to actual utilization possesses the features assumed.

The increase in demand generated by a given investment has to be met not by the capacity created by the investment itself but by the whole existing capacity, old and new. In terms of the different production sectors, investment generally creates capacity in only one sector, whereas its multiplicative effects are spread out over all the sectors of the economy. The increase in aggregate demand is met by existing capacity as a whole and generates a change in utilization of low intensity. This change in utilization, as discussed in the text, has effects on further investment that are very different from those rigidly assumed in studies on Harrodian instability. The elasticity of investment with respect to changes in actual utilization can thus be seen as the very cornerstone of Harrodian instability also when the dual effect of investment is taken into consideration.

[32] 'Capacity saving' is generally understood as the level of saving corresponding to the income generated by the normal utilization of existing capacity. Normal utilization is attained when investment is equal to this level of saving.

It is also possible to consider the case of investments that exceed the level of capacity savings on average and for a considerable period of time so as to generate an average degree of actual utilization higher than the (high) planned degree. As shown, however, this condition may again generate no further incentive to invest if determined by expansions longer than expected and recessions that are milder or less frequent. The productive capacity installed would then in any case meet the actual demand.

The circumstances that would generate a cumulative incentive to invest and an 'explosive' tendency toward expansion would be a time pattern of investments that generates an average level of utilization higher than the planned level as a result of a pattern of aggregate demand that exerts continuous pressure on the maximum peaks of potential capacity. The peaks of demand and output would in most industries be sufficiently close to or even higher than these maximum peaks, which may also include additional plausible margins of excess capacity determined by indivisibility or uncertainty with respect to the maximum expected peaks of demand. These appear to be the only circumstances determining a tendency toward high investment that automatically generate further investment and trigger Harrodian cumulative expansion.

They do not, however, appear to occur very often and are indeed so implausible in historical terms that this case is (unfortunately) no more than a theoretical curiosity.[33]

Theoretical analysis should therefore seek to understand what phenomena do not so much limit the tendency toward cumulative expansion but actually prevent the circumstances generating it from occurring altogether.

It is reasonable to suggest that the expansion of investment is in fact systematically limited by structural elements, in which case the effects on aggregate demand would seldom be such as to generate the conditions leading to the cumulative process. The expansion of investment could be held back by the achievement of full capacity utilization in the sectors that produce capital goods, and this could happen before the effects on aggregate demand bring the actual utilization of aggregate capacity close to its maximum.[34]

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[33] Persistent pressure on maximum capacity does not appear to have ever occurred. The Federal Reserve has estimated the degree of utilization since 1957 on the basis of two surveys, one by the Bureau of Census and one by McGraw Hill. Processed by *tradingeconomics* and available at http://www.tradingeconomics.com/united-states/capacity-utilization, these data show that in US manufacturing between 1967 and 2016, capacity utilization has reached the maximum value of 86.9% in only one quarter (the first of 1967) and a slightly lower value in the last of 1973. The value in all subsequent years has touched 85% in only four peak periods, being lower to a greater or lesser degree in all the other quarters. The average value of utilization is 75% for the period as a whole. While these estimates are certainly very controversial, they also appear the most reliable as regards the source and the country concerned. They appear to confirm that cases in which utilization is close to the maximum for long periods, thus making the occurrence of cumulative tendencies plausible, can hardly be regarded as a real possibility.

[34] The constraint imposed by the full utilization of capacity in the sector of capital goods might certainly be removed, given sufficient time, by investing more in this sector. As argued above, however, the temporal distribution and the intensity of the overutilization are relevant to the generation of the cumulative tendencies toward expansion. The fact that investment expansion is constrained and the same

Moreover, while constant prices have been assumed so far,[35] an extension of the analysis could conceivably show the possibility of a relationship between high actual utilization and inflation, as argued by some Kaleckians. This could perhaps hold the expansion of demand back long before pressure on a potential maximum occurred, e.g. through effects on exports.

An element of a different nature that further reduces the relevance of this hypothetical phenomenon is the fact that the assumption of simultaneity of the effects of investment on demand and on capacity appears to be an oversimplification in need of closer scrutiny.

A 'dynamic' analysis of economic phenomena in terms of their temporal evolution would probably suggest that the effects of investment on demand are spread out over a period of time, brief though it may be, whereas those effects of the same investment on capacity appear far more immediate. The additional demand resulting from the investment could therefore be met through repeated overutilization of existing capacity without generating any pressure on the maximum potential levels of production.[36]

8.2. The potential cumulative tendency to recession

Our considerations also suggest that the hypothetical cumulative pressure toward recession is of limited relevance. The arguments in this case are, however, not completely symmetrical to those regarding expansion. Other economic phenomena must be taken into consideration to explain why persistent underutilization does not generate a cumulative process of recession.

As in the case of expansion, it can be argued that underutilization limited to one or a few periods has no effect on investment at all.

If not entirely unexpected, a stagnant time pattern of investment determining a sluggish demand dynamic tends to determine a low actual degree of utilization, which will, however, be compared with a correspondingly low planned degree.

The circumstances capable in principle of affecting investment are time patterns of investment that determine an average degree of utilization lower than planned over a significant period. As seen above, however, these circumstances may not generate addi-

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ammount of investment is spread over a longer period can therefore be sufficient by itself to prevent the cumulative pressures toward expansion.

[35] An assumption made in accordance with the practice of the classical economists to examine prices and quantities separately. This separation implies the assumption that output and capacity adjust to demand through a process largely independent of the flexibility of relative prices and the distribution variables.

[36] It is ironic that due to the rigidities of the concept of instability, the primary thrust of Harrod's analysis, namely the need for a dynamic economic theory, led to a very poor view of dynamics: the study of conditions in which all the variables can only grow at the same, constant rate of growth and the levels of the magnitudes are not dated. This is not markedly different from a stationary analysis in which the constant and uniform rate of growth is zero.

tional reductions in investment if investments determine longer and more intense recessions but do not imply peaks lower than the highest levels of expected demand (on the basis of which capacity was installed).

The circumstances that would generate 'explosive' cumulative recessionary pressure by causing cumulative reductions in investment are those that determine underutilization through peaks of demand systematically lower than those for which capacity was installed. Such circumstances would generate further reductions in gross investment, lower capital creation and even non-replacement of existing capacity.

Contrary to the symmetrical case, these circumstances do not appear so implausible in either theoretical or empirical terms.

It is, however, certain that not all decreases in investment lead to cumulative recessionary pressures. Some elements appear to operate in reality and stem the cumulative decrease in investment, thus making instability something relevant only in special—albeit not impossible—circumstances.

In times of recession, capacity adjusts to demand not only through the depreciation of existing capital but also through radical reductions in capacity due to bankruptcies and the disappearance of marginal firms.[37] When this happens, it may even prompt firms to invest in order to restructure their operations and absorb part of the demand previously met by those that have gone bankrupt.[38]

The crucial role in halting and often entirely preventing cumulative Harrod-type recessionary pressures is, however, played by the fact that many components of aggregate demand can have a dynamic that is partially independent of the adjustment of capacity to demand.

In long-run analyses, it can be argued that some parts of *each* component of demand can *at times* be independent of the current level of activity and play the role of independent variables in the process of growth and accumulation.[39]

Government spending and *exports* are certainly the components of aggregate demand that play this role most easily. They are largely independent of the current level of income and may even have automatic anti-cyclical components. *Consumer spending* and *investments* can, however, also have components determined independently of actual utilization, current income and the adjustment of capacity to demand. Part of consumption expenditure can be determined by acquired standards of consumption, which tend to resist a decrease in current income, while part of investment expenditure may be determined by the competitive need to introduce technological innovation, which can prove even more urgent in periods of depression than expansion. The existence of such

[37] In this sense, see also Trezzini and Palumbo (2016).

[38] In the case of reductions in investment too, the multiplier effects can of course be spread over a period of time, brief though it may be, while those on capacity appear far more immediate. The decrease in demand arising from the reduction in investment can therefore be absorbed by the repeated underutilization of existing capacity.

[39] In this sense see also Aspromourgos (2013, p. 26).

phenomena can serve either to prevent the cumulative tendency toward recession from starting or to halt the process when it does.[40] It appears possible to argue, for example, that the tendency has been entirely prevented in periods of sustained government expenditure determined by the political objective of full employment. The worldwide crisis of 2008 can instead be interpreted as a case in which the tendency was under way and these forces have acted so as to halt and weakly reverse it.

9. Conclusions

In light of the fact that economic growth occurs through irregular fluctuations, points have been identified that appear to strip the concept of Harrodian instability of much of its relevance.

This element of reality lies at the very root of the fact that firms plan to utilize capacity *on average* at a degree considerably below full utilization, which is therefore crucial in determining the *planned* degree of capacity utilization.

Once the concept of a planned degree of utilization has been correctly understood, the assumption of the elasticity of investment to any divergence between actual and

[40] The role of these components in limiting the cumulative tendencies toward recession has been stated repeatedly and in different ways in the Keynesian literature (see for example Hicks 1950 and, more recently, Fazzari et al. 2013). It has also found considerable space in recent growth models proposed by some authors of the Classical and Keynesian approach and based on the Sraffian supermultiplier, and in some Kaleckian models (Lavoie 2014, pp. 406–10). These analyses share, however, the general concept of Harrodian instability discussed here and its methodological consequences. Moreover, in all of this literature, entire components of aggregate demand are (unhappily) defined as *autonomous* and the analysis of growth is developed on the assumption of an exogenously given rate of growth of this 'autonomous' demand. This approach is justified in Keynesian short-run analysis, as entire components such as exports and government expenditure are independent of current income because they depend in the broad sense on the economy's level of development and institutional features, which can be taken as given in the short run. In long-run analyses, however, the economy's level of development and institutional features are part of the object of the analysis. Exports, for example, depend on the evolution of international demand, the characteristics of the international payment system, and trade regulation, but also on factors of domestic supply and specific policies (which may be related to the level of production) that determine the competitiveness of national production. Government expenditure depends, *inter alia*, on policy choices that may be closely influenced by the level of activity. In this logical framework, it therefore appears more reasonable, as is done here, to take the view that some parts of *each* component of demand can *at times* be independent of the current level of activity and play the role of independent variables.

Garegnani and Trezzini (2010) and Trezzini (2011b) study the role in the growth process of what is generally called 'autonomous consumption' in terms of independent changes in the propensity to consume that can at times play the role of driving growth. The evolution of aggregate consumption is seen as influenced by the process of continuous acquisition of increasing standards of consumption leading to asymmetry of the propensities to consume in the different phases of the cycle. This process is seen as a possible source of endogenous growth, without assuming any exogenously given rate of growth of an autonomous component of consumption. The complex interaction between demand factors, supply factors, and institutional and historical phenomena that drive growth cannot be effectively represented through the hypothesis of an exogenously given rate of growth of a component of aggregate demand.

planned utilization must be reconsidered. As the concept of Harrodian instability is based on this assumption, it appears to lose most if not all of its relevance.

An initial general methodological conclusion can be drawn from this.

Contrary to what has been argued on the basis of Harrodian instability, there is no strict logical necessity to ground theoretical analysis on positions—steady-state paths or fully-adjusted positions—characterized by normal utilization. Nor must long-term rates of growth necessarily be seen as warranted rates.

Theoretical positions or trends characterized by other than normal degrees of capacity utilization can be regarded as stable enough to prove meaningful in the analysis of the long-run tendencies of the economy.

Moreover, these objects of theoretical analysis, growth paths or theoretical positions, do not appear to be studied independently of the irregular fluctuations through which aggregate demand and output vary in time.[41]

The arguments developed here limit the circumstances in which processes similar to those described by Harrodian instability can potentially affect economies. Our analysis has also suggested two promising fields of further theoretical work. One is analysis of the institutional and economic circumstances that make the cumulative process of expansion a far from common phenomenon. The other is analysis of the role—and in particular the correct identification, determination and relative irreversibility—of the components of aggregate demand that limit possible cumulative process of contraction and can serve at same time as a driving force for growth.

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[41] The logical necessity of regarding theoretical positions as characterized by normal utilization appears to be the paradoxical result of a concept based on the assumption that irregular fluctuations of output do not exist and therefore prompting the view that only theoretical positions which assume the irrelevance of cyclical fluctuations are to be taken as relevant. Harrodian instability is in fact based on the assumption that investment is elastic to any divergence of actual from planned utilization, which would be true only if firms expected no fluctuation.

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Appendix A. The effect of actual over-utilization on investments

The first step is the arbitrary construction of a pattern of expected demand. The peaks, randomly distributed over time, have an implicit annual growth rate of 2%. The second is the assumption of a planned pattern of evolution of fixed capital stock. In accordance with common practice in growth models, it is assumed that capital has infinite life. It is further assumed that the capital is constituted by machines with a unit value (measured at normal prices) of P_k (P_k = 40 in the example) and that the product of capital when fully utilized (u=100%) with the corresponding amounts of labor and circulating capital is equal to $\mathbf{P_k\alpha}$. $\mathbf{\alpha = 2}$ is the minimum capital/output ratio corresponding to full utilization.

The level of the stock of capital that the firm plans to install is determined by comparing a theoretical value of capital, $K_t^*=\alpha y_t^e$—which is impossible in most cases due to capital indivisibility—and the existing stock of capital, K_{t-1}. The installation of a further machine with a value of 40 is assumed if the existing capital is not sufficient to produce the expected output. It should be noted that the assumption that firms take investment decisions regarding the size of capacity primarily in order to meet the expected peak demand is further qualified by specifying that this could imply a degree of utilization markedly lower than the technical maximum even during the peaks.

Table 1. Patterns of expected and actual demand, capital and degrees of utilization

Time	D_t^e	K_t^*	K_t	M	u_t^*	D_t Pos.	D_t Neut.	D_t Neg.	u_t^a Pos.	u_t^a Neut.	u_t^a Neg.
1	**100**	**200,00**	**200**	**5**	**100**	**103**	**100**	**98,5**	**103**	**100**	**98,5**
2	97	194,00	200	5	97	102	99	97	102	99	97
3	94	188,00	200	5	94	99	99,5	97	99	99,5	97
4	99	198,00	200	5	99	110	105	100	110	105	100
5	**108,24**	**216,49**	**240**	**6**	**90,2**	**110,41**	**108,24**	**106,62**	**92,01**	**90,2**	**88,85**
6	107	214,00	240	6	89,17	113	108	105	94,17	90	87,5
7	100	200,00	240	6	83,33	106	105	106	88,33	87,5	88,33
8	97	194,00	240	6	80,83	103	101	110	85,83	84,17	91,67
9	99	198,00	240	6	82,5	105	108	115	87,5	90	95,83
10	110	220,00	240	6	91,67	117	111,1	117	97,5	92,58	97,5
11	118	236,00	240	6	98,33	126	119,18	118	105	99,32	98,33
12	**124,34**	**248,67**	**280**	**7**	**88,81**	**128,07**	**124,34**	**122,47**	**91,48**	**88,81**	**87,48**
13	122	244,00	280	7	87,14	129	122	121	92,14	87,14	86,43
14	128	256,00	280	7	91,43	135	129	128	96,43	92,14	91,43
15	**131,95**	**263,90**	**280**	**7**	**94,25**	**134,59**	**131,95**	**129,97**	**96,13**	**94,25**	**92,83**
16	128	256,00	280	7	91,43	136	129,28	127	97,14	92,34	90,71
			Planned u^*		**91,19**			Average u^a	**96,10**	**93,25**	**93,09**

The bold lines represent peak periods.

The second column of table 1 shows the expected levels of demand D_t^e. Three different quantities of capital are calculated in columns 3, 4 and 5. The first is a completely

hypothetical form of perfectly divisible and circulating capital, K_t^*. Its level is determined by the product of the expected level of output and the capital/output ratio corresponding to full utilization of production capacity, $\alpha_{min} = 2$. The second is the value of an indivisible capital, K_t, and the third the number of machines M. Column 6 shows the expected value of capacity utilization calculated for each period, u_t^*. The average value of these variables represents the theoretical *planned* degree of capacity utilization. The planned degree of capacity utilization, $\mathbf{u}^* = 91{,}19\%$, appears in the last row of column 6.

Columns 7, 8 and 9 represent the three different actual patterns of demand and output discussed in the text (with positive, neutral or negative effect on investment), all of which generate a degree of utilization of capacity higher than the planned level.

Columns 10, 11 and 12 show the actual degrees of capacity utilization of the three possible actual patterns of demand. The last row of the table presents the calculated value of the planned degree of utilization and of the average degrees of capacity utilization corresponding to the different patterns of demand.

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