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# Estimating normal capacity utilization rates and their tolerable ranges of values: A comment on Setterfield

Florian Botte\*

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## Abstract

Taking the potential instability of the Kaleckian model of growth as his starting point, Setterfield (2017) investigated, *inter alia*, the possibility of taming the Harrodian instability. His investigation used a range of tolerable values, rather than a unique value, for the normal rate of capacity utilization. After illustrating his point theoretically, Setterfield then proposes empirical methods to estimate the normal capacity utilization rate and the corresponding tolerance range. This paper suggests improved methods to estimate the normal rate of capacity utilization and its tolerance range. The proposed alternative solutions offer better consistency with Post-Keynesian behavioral theories, and the presented exploratory narrative based on these suggestions can partly explain the current stagnation.

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# 1 Introduction

One of the main drawbacks of the Kaleckian model of growth and distribution is its potential instability (see Hein *et al.* (2011, 2012) for a survey of these stability problems). Because the utilization rate is the endogenous variable, equality between the normal—or desired—and the long-run equilibrium rate of capacity utilization can only be obtained by chance. This discrepancy between a firm’s objectives and the realized rate of capacity utilization has led some authors to criticize the status of this long-run equilibrium and propose mechanisms that allow equality between these two rates. One of these mechanisms consists in adapting capital stock in the long run in order to bring the equilibrium utilization rate to its normal value. This mechanism is the source of Harrodian instability (Skott, 2010, 2012). Another proposed solution involves adaptive changes to the normal capacity utilization (Lavoie, 1995, 1996; Amadeo, 1986; Dutt, 1997; Lavoie *et al.*, 2004). If firms systematically fail to reach their targets, then they can revise them<sup>1</sup>. In addition, Dallery et van Treeck (2011) explain that firms are subject to *conflict claims* from various groups with different objectives. As a consequence, long-run equilibria are not necessarily fully adjusted, and inequalities between the normal and the actual rate of utilization can last because firms may have to compromise on specific targets that might be incompatible.

Setterfield (2017) makes another suggestion based on Harrod’s original response to the instability of the equilibrium: the well-known *knife edge* critique (Solow, 1956). Harrod (1970) explained that investment reactions to tension in capacity utilization are not as systematic as suggested by the idea of a knife edge. In fact, the instability principle depends on a firm’s reaction time to a discrepancy between the normal and the actual rate of capacity utilization, in addition to taking into account its amplitude and its duration. This means concretely that firms do not systematically change their investment plans when their capacity utilization rates are stressed, that is, firms have tolerable intervals around their normal utilization rate. These tolerance ranges can tame Harrodian instability most of the time.

Setterfield (2017) proposes an empirical estimation of this range of values and of its determinants as well as an estimation of the normal rate of capacity utilization. His main finding is that “the circumstances under which Harrodian instability materializes are relatively rare.” Even though these theoretical propositions are clearly of interest to the debate on Harrodian instability, we herein propose to improve his methods of estimation.

The remainder of the paper is organized as follows: Section 2 explains why the Hodrick–Prescott filter, used by Setterfield (2017) to estimate the

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<sup>1</sup>This demand-induced change in the normal rate of capacity utilization has been extensively criticized by Skott (2012, pp. 117-24), because it lacks consistency and a behavioral foundation.

normal rate of capacity utilization, can be improved and proposes a simple alternative with an economic rationale that is more consistent with Post-Keynesian behavioral theories. Section 3 challenges the method used to estimate the tolerable range of values of capacity utilization rates and proposes a more generalizable way to empirically estimate the range of tolerable values around the normal rate of capacity utilization. Finally, in Section 4, we combine these two propositions and briefly present a narrative that can help explain the current economic stagnation. Our conclusions are presented in Section 5.

## 2 Estimating the normal capacity utilization rate

If we accept the hypothesis that the normal rate of capacity utilization  $u_n$  is a function of past values of the actual rate of capacity utilization  $u$  (Committeri, 1986; Auerbach et Skott, 1988; Lavoie *et al.*, 2004; Skott, 2012), then the Hodrick–Prescott filter is not the most suitable tool. Lavoie *et al.* (2004, p. 139), previously used the Hodrick–Prescott filter as a proxy for the normal rate of capacity utilization:

“...we shall use an established, simple and direct approach for the two Kaleckian equations that consists of applying the HP filter (Hodrick and Prescott, 1980) to  $u_t$ . This procedure allows us to identify an estimate of the permanent component in the series  $u_t$ , which we denote as the series  $u_n$ .”

The problem is that the Hodrick–Prescott filter incorporates past values as well as future values of the utilization rate. As Skott (2012, p. 132), has noted: “It simply smooths the times series, attaching as much weight to future observations as to past.” In the following, quarterly capacity utilization was derived from Federal Economic Reserve data (FRED<sup>2</sup>). For the same period (1990–2007) investigated by Setterfield (2017, p. 21), Figure 1 shows that the Hodrick–Prescott filter is very similar to a moving average. For example, the normal capacity utilization rate for the first quarter of 1997, estimated with the Hodrick–Prescott filter, takes into account values of the actual utilization rate that had not occurred yet. Researchers have access to these values because they analyze the data after the fact, but firms do not know the future when they make decisions. Moreover, the main problem lies in the fact that the Hodrick–Prescott filtered line begins to fall before 1997, although the utilization rate continues to increase until the final quarter of 1997, and the dot-com bubble materializes in the data after 2000. This observation clearly implies that firms have remarkable forecasting abilities and reduce their normal level of productive capacity utilization even before they face a decrease in their actual utilization rate. We believe this is

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<sup>2</sup><https://fred.stlouisfed.org/series/CAPUTLB50001SQ>

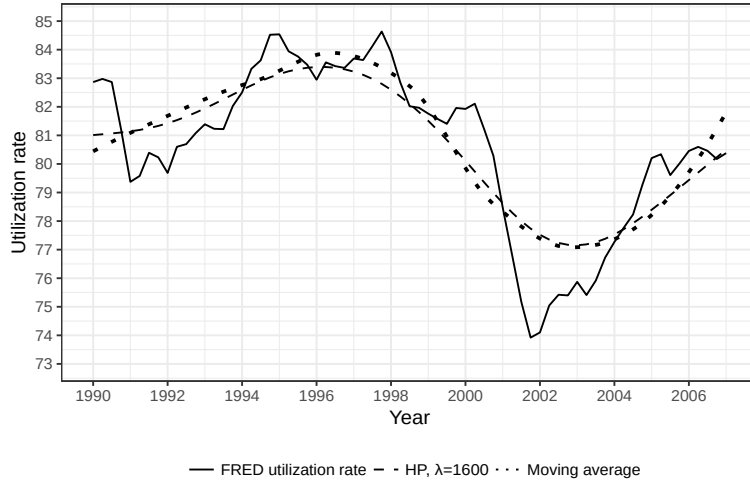


Figure 1: Hodrick–Prescott filter ( $\lambda = 1600$ ) and local regression and utilization rates

not the most appropriate way to describe the behavior of firms immersed in a radically uncertain environment. We therefore propose an alternative mechanism based on a simple adaptive rule:

$$u_{n_t} = \psi \cdot u_{n_{t-1}} + (1 - \psi) \cdot u_{t-1}. \quad (1)$$

By iterating this rule, we can see that  $u_n$  is a weighted average of past values of  $u$  with exponentially decaying weight. If a value remains to be selected for the memory parameter  $\psi$ , then we have the same calibration problem with the smoothing parameter  $\lambda$  of the Hodrick–Prescott filter as illustrated in Figure 2. Figure 3 shows the results of this method for  $\psi = 0.9$ . Following Equation 1, the parameter  $\psi$  is the weight attributed to the normal rate of capacity utilization computed during the previous period  $u_{n_{t-1}}$ , and  $(1 - \psi)$  is the weight imputed to the actual rate of capacity utilization  $u_{t-1}$ . Accordingly, firms revise their normal rate of capacity utilization each quarter by computing a mean of the previous rate of normal capacity utilization with 90% weight and the rate they faced during the previous period with 10% weight. This solution appears to be quite simple and more accurate for our purpose. It does not require firms to possess unrealistic forecasting abilities and is based solely on past data that firms already know. The method is consistent with a radically uncertain economic environment and with procedural rationality *à la* Simon (1976).

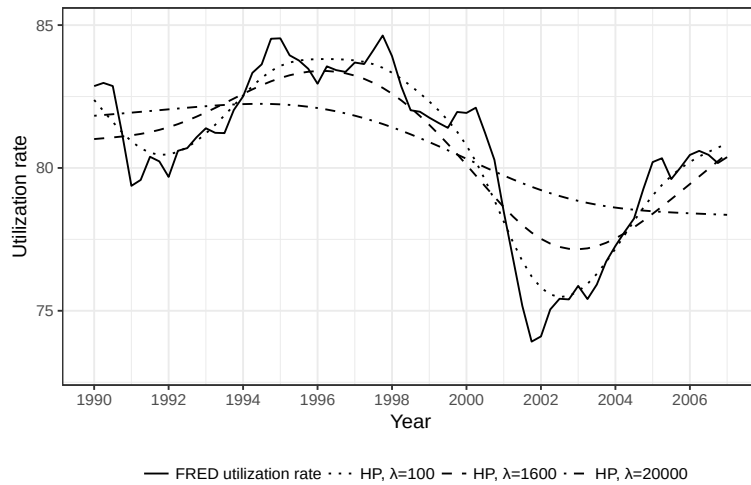


Figure 2: Hodrick–Prescott filter for different values of the smoothing parameter  $\lambda$  and local regression and utilization rates

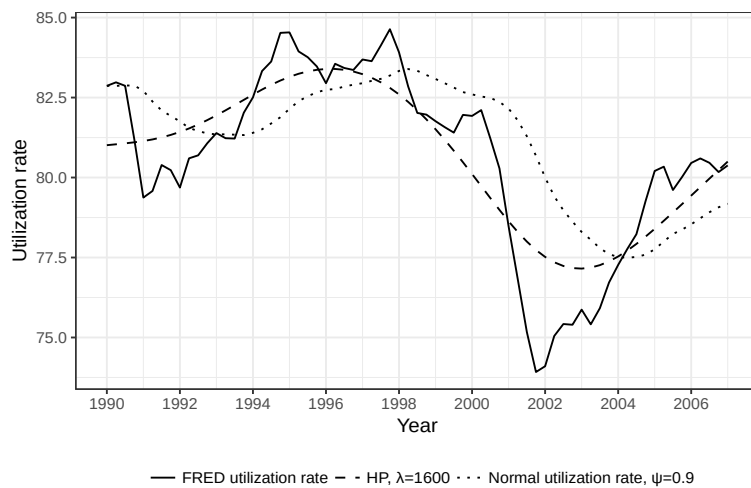


Figure 3: Hodrick–Prescott filter ( $\lambda = 1600$ ), alternative estimation of  $u_n$  ( $\psi = 0.9$ ), and utilization rate

### 3 Estimating a tolerable range of values: a dynamic approach

Setterfield (2017), among others, explains that the range of values of the utilization rate that firms consider normal depends on the level of uncertainty and can be approximated as a function of the standard deviation of  $u$ . Although using the standard deviation of the utilization rate as a proxy

for uncertainty is certainly quite convincing and an interesting approach, applying this method results in the same difficulties as identified for the Hodrick–Prescott filter. Indeed, the standard deviation is computed for the entire considered period (1990–2007). It follows that firms are already anxious in the 1990s about the volatility implied by the dot-com collapse, that is, before the crisis has happened. Moreover, the hypothesis of using the standard deviation of  $u$  computed for the entire studied period makes it difficult to compare different time scales and different periods because the tolerable range will depend largely on the period studied. If he had considered the period 1990–2010, which includes the subprime mortgage crisis, instead of the years 1990–2007, then the range of values would have been much higher for the entire period observed—even in the 1990s.

A possible solution to this problem is to continue to use the standard deviation of utilization rates, but for the  $n$  previous quarters. This means that firms modify their tolerable range of utilization rates according to the volatility of output they experienced in the  $n$  past periods. We can compute a *restlessness indicator*  $c_t$  in the following way:

$$c_t = \phi \cdot \sqrt{\sum_{i=t-n}^{t-1} (u_i - \bar{u})^2}, \quad (2)$$

where  $\bar{u}$  is the average utilization rate during the period  $(t-1, t-n)$ . The *restlessness indicator*  $c_t$  corresponds to the standard deviation of  $u$  during the period  $(t-1, t-n)$  weighted by a factor  $\phi$ . The *restlessness indicator* decreases during phases of tranquility and increases during hard times. Figure 4 presents the results of the *restlessness indicator* for  $\phi = (1, 2, 3)$  ( $\phi = 1$  for the darkest area,  $\phi = 3$  for the lightest) and  $n = 12$ . The figure shows that firms are more cautious after they have experienced high degrees of volatility following a crisis. Consequently, the *restlessness indicator*  $c_t$  is high. Conversely, during phases of tranquility  $c_t$  decreases because volatility is low and firms are more confident.

#### 4 Combining a procedural normal rate of capacity utilization with a dynamically estimated tolerance range: the muddy slump case

Figure 5 shows the results obtained by combining our two proposed parameters—the adaptive normal rate of utilization and the *restlessness indicator* as a proxy for tolerable ranges of values  $u_{n_t} \pm c_t$ , for  $\psi = 0.9$ ,  $\phi = (1, 2, 3)$ , and  $n = 12$ . On the basis of these results, we can propose an exploratory narrative with a Minskian connotation, in which tranquility leads to potential instability (Minsky, 1986). During periods of tranquility, the *restlessness indicator* and the tolerable ranges of utilization decrease because volatility

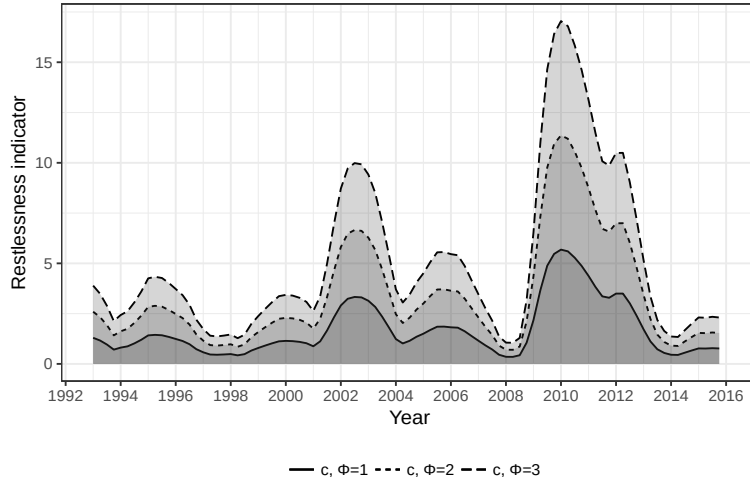


Figure 4: Restlessness indicator for  $n = 12$

is low. Consequently, when a shock occurs (for example, a financial crisis), the risk of the economy falling in a downward spiral of Harrodian instability increases. After a crisis, a high restlessness indicator and large tolerable ranges of utilization are observed, and expectations of growth will presumably be low. Because of the large range of tolerance, a considerable positive shock will be required to improve growth expectations. A consequence of this large range is a potential period of tranquility that will reduce restlessness. This, in turn, can lead to another crisis because even a slight shock can trigger downward Harrodian instability by reducing growth expectations that are already low as a result of the previous crisis. Perhaps this sequence can partly explain the prolonged state of stagnation observed for contemporary economies.

In fact, in accordance with Fazzari *et al.* (2013, p. 17), who states that “The source of secular demand growth is the fundamental upward instability of the dynamics of investment and consumption, as identified decades ago by Harrod,” avoiding the muddy slump case, in which growth expectations are regularly lowered in response to a financial crisis, requires extremely strong fiscal policies during the slump because of the magnitude of the restlessness indicator. The main danger we can derive from these results is the desire to pursue fiscal consolidation during muddy times because the stability corridor is tiny. This policy can lead to downward Harrodian instability, even with moderate fiscal consolidation. We invite the interested reader to observe the results of combining different parameters and time periods by using an application available online<sup>3</sup>.

<sup>3</sup>The application <https://analytics.huma-num.fr/Florian.Botte/Shiny-normal-utilisation-estimation/> is a *Shiny Web App* (Chang *et al.*, 2017)



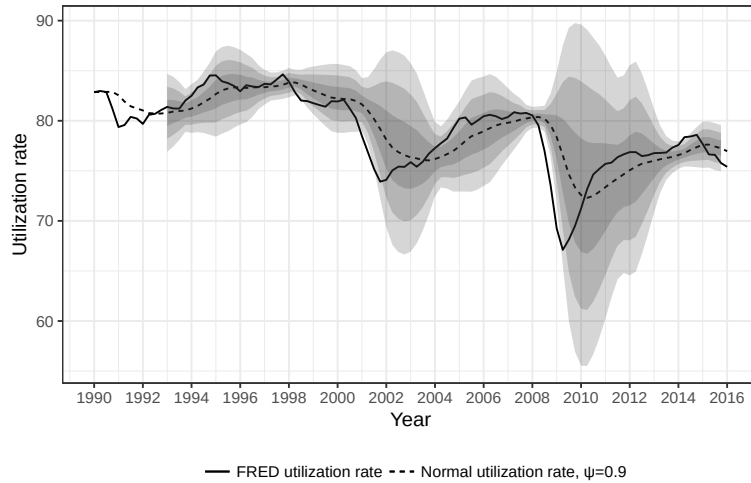


Figure 5: Estimation of the normal capacity utilization rate and its dynamic tolerable range with  $\psi = 0.9$ ,  $\phi = (1, 2, 3)$ , and  $n = 12$

## 5 Conclusion

Our proposed simple method used to estimate the normal utilization rate relies on past values of the actual utilization rate. A restlessness indicator serves as a proxy of the tolerable range of values around the estimated normal rate. Because the proposed method does not require firms to possess unrealistic forecasting abilities, it lacks the problems associated with using the Hodrick–Prescott filter and the standard deviation computed for the entire analyzed period. In addition, the proposed method is more consistent with Post-Keynesian behavioral theories based on procedural rationality in a radically uncertain environment (Lavoie, 2014, pp. 72-95).

Moreover, combining these two suggestions allowed us to present a narrative that can partly explain the current stagnation. The muddy slump case consists of a succession of crises that cumulatively reduce the growth expectations of firms. These crises have a considerable impact on the growth expectations of firms because phases of tranquility, which occur between crises, reduce the size of the stability corridor and increase the risk of a new crisis of potentially greater magnitude. Although these results are evidently preliminary, the strong behavioral foundation and apparent benefits of the proposed approach should encourage further research in this direction.

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coded with *R* (R Core Team, 2016). Data are processed with *dplyr* (Wickham et Francois, 2016), and figures are produced with *ggplot2* (Wickham, 2009).

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