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The "Utilization Controversy": Demand and Utilization in Alternative Theories of Economic Growth and Distribution

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The "Utilization Controversy": Demand and Utilization in Alternative Theories of Economic Growth and Distribution*

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Abstract

This chapter discusses the "utilization controversy," the debate on whether or not demand plays a role in the determination of the rate of utilization in the long run. First, it explains why utilization has a central role in the various theories of growth and distribution. Second, it examines the theory of utilization and explains how the standard model does not recognize a role of demand and outlines recent theoretical advancements that justify an endogenous-to-demand long-run rate of utilization. Finally, it examines different estimates of utilization. It argues that the Federal Reserve measure of utilization, commonly employed in the debate, is inappropriate to capture long-run variations in utilization. Other measures such as the Average Workweek of Capital or the National Emergency Utilization Rate are better suited. These estimates provide empirical support for a utilization rate which is endogenous to demand in the long run.

Keywords: Accumulation; Growth; Distribution; Utilization

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1 Introduction

The late 1970s and the 1980s saw the development of what is today called the (neo-)Kaleckian model of growth and distribution (Krugman and Taylor, 1978; Rowthorn, 1981; Taylor, 1983; Dutt, 1984; Amadeo, 1986; Bhaduri and Marglin, 1990; Kurz, 1990). The model has also been given other names such as Structuralist or Post Keynesian. Names aside, the model is based on two pillars, which constitute a specific closure of the macroeconomic system. On the one hand, there is an autonomous role for investment and aggregate demand along Keynesian/Kaleckian lines. On the other hand, distribution is primarily determined by institutions and social norms, along classical lines. Arguably, this combination is essential to understand the major developments in growth and distribution in most capitalist economies, such as the slowdown in growth in recent decades or the increase in income inequality over the same period. Or to put it differently, if one believes that demand does play a role in the long run, and institutions and social norms do play an important role in the determination of distribution, then the Kaleckian/Structuralist closure is the appropriate one (Nikiforos, 2021a). Another interesting feature of the model is that changes in distribution do not have certain *a priori* effects on the level and growth rate of economic activity.

This choice of closure for demand and distribution implies that the rate of capital utilization becomes an adjusting variable. This feature has been a consistent source of criticism of the model since its inception in the early 1980s, and continues to this day. The criticism goes as follows: firms, when they build and install a plant, determine that a certain rate of utilization maximizes their profits; this is an *ex ante* rate of utilization, often called the normal rate, which according to the critics is exogenous to demand. *Ex post*, after the plant is built, changes in the level of demand faced by the firm will lead to changes in their actual rate of utilization, but this discrepancy cannot continue forever. In the long run, utilization must return to its exogenous-to-demand normal level. It is on these grounds that Committeri (1986, p.170) criticized the early neo-Kaleckian models by Rowthorn (1981) and Amadeo (1986), writing that "there is the possibility [in these models] of utilization being *different* from its normal degree, even in states of equilibrium (and indeed, actual and normal utilization would coincide only by a mere fluke)," while Auerbach and Skott (1988, p. 52) claim—again as a critique of the Kaleckian model—that "it is inconceivable that utilization rates should remain significantly below the desired level for any long period."

However, if utilization is exogenous to demand, something has to give; the closure needs to change and another variable has to become endogenous. See from this point of view, it is not surprising that the criticism of the Kaleckian model originates from scholars with different visions—different closures—of growth and distribution in the long run: classicals (e.g. Duménil and Lévy, 1999), neo-Keynesians (e.g. Auerbach and Skott, 1988; Skott, 2012) and Sraffians (early criticisms include Vianello, 1985; Committeri, 1986; Kurz, 1986).

The Kaleckian response, first articulated by Amadeo (1986), was that in the faces of discrepancies of the actual from the normal rate, it is likely that the normal rate adjusts towards the actual. The resulting model, in addition to the desired properties mentioned in the first paragraph, which carry in the long run, has the property of path-dependence. Short run shocks can have long-run *level and growth* effects. Nevertheless the question remains: if the normal rate is exogenous to demand, why would it adjust towards the actual one? This question has generated some interesting recent theoretical literature that justifies the endogeneity of normal utilization to demand.

Finally, another aspect of the controversy is related to the empirical evidence for or against the endogeneity-to-demand of the long-run rate of utilization. On this level, the criticism of the Kaleckian model is usually justified with the use of the Federal Reserve Board (FRB) measure of utilization, which for long stretches of time was fluctuating around a constant mean. This side of the controversy has also generated a literature which argues that the FRB measure is inappropriate as a measure of long run variations in utilization; other measures such as the Average Workweek of Capital or the National Emergency Utilization Rate should be used for the empirical evaluation of the role of demand. These measures provide evidence in favor of an endogenous-to-demand normal rate of utilization.

The present chapter provides an overview of the three aforementioned aspects of the "utilization controversy." The next section discusses the role of utilization in different approaches to growth and distribution. Section 3 discusses the theory of utilization. It begins with the basic model where demand does not play a role in the determination of normal utilization, and then outlines various theoretical justifications of why changes in demand might affect the normal rate. Section 4 provides an overview of the empirical side of the debate, the different measures of the rate of utilization, and the various studies that have attempted to estimate the effect (or its lack thereof) of demand on utilization in the long run. Section 5 concludes.

2 Utilization, Growth and Distribution

Before moving to the theoretical and empirical aspects of the utilization controversy, it is worth examining what is at stake. We can approach this question with reference to the closure—the direction of macroeconomic causality among different variables—in various theories of growth and distribution. At an abstract level, we can assume a closed economy without a government sector and two classes, workers and capitalists. In such an economy the basic macroeconomic identity that investment is equal to saving can be written as:

$$g^i = [s_w + (s_c - s_w)\pi]u\rho \tag{1}$$

with g^i being the accumulation rate, s_w and s_c the saving rate of workers and capitalists respectively, π the profit share, u the utilization rate, and ρ the potential-output-to-capital-stock ratio. If we further assume that s_w, s_c and ρ are constant (because the saving rate is determined by preferences and norms that do not change over time and there is not much room for factor substitution in the production process), we are left with one equation and three potentially endogenous variables: the accumulation rate (g^i); income distribution (π); and the utilization rate (u). Thus, the choice of how utilization is determined is crucial for how the rate of accumulation and distribution are treated.

If u becomes the endogenous variable (for the one available equation), then g^i and π need to be exogenously determined; if u is exogenous, then either g^i or π must be endogenized.

Starting from the accumulation rate, there are two main approaches for its determination. On the one hand, in classical political economy (and neoclassical economics), accumulation is constrained by available savings, and is therefore endogenous. On the other hand, in Keynesian theory, investment and demand have an autonomous role. Kaldor (1955, 95) called this "hypothesis that investment ... can be treated as an independent variable" the "Keynesian hypothesis."

In turn, when it comes to distribution there are also two main approaches. On the one hand, classical political economy suggests that distribution is mainly determined based on institutions and social norms (thus π is exogenous), while neo-Keynesian and neoclassical theory suggest—for different reasons—that distribution is determined within the economy.

This summary implies different potential approaches to the question of distribution of income and growth—as expressed by the related closures. To begin with, the Kaleckian/Structuralist theory adopts the classical approach to distribution and the Keynesian hypothesis. As a result, both g^i and π are exogenously determined while utilization is endogenous. This is the only model of growth and distribution with endogenous utilization, and is therefore at the center of the controversy. In the short run, the model can be summarized with two equations for investment and saving:

$$g^i = g^i[\gamma, \pi, (u - u_n)] \tag{2}$$

$$g^s = [s_w + (s_c - s_w)\pi]u\rho \tag{3}$$

where where γ is an autonomous term that captures factors such as the "animal spirits" of the entrepreneurs or their expectations about the future growth rate and u_n is the normal rate of utilization: the rate of utilization that maximizes firms' profits or minimizes their unit costs, which is assumed to be constant in the short run. All partial derivatives in both equations are positive. Firms will increase their investment the higher is the expected future growth rate, the higher is profitability, and the bigger is the discrepancy between the actual and the normal rate of utilization. If the rate of utilization is above its normal rate the firms will tend to increase in their investment to achieve the desired normal rate and vice versa.

We can also define the warranted growth rate (γ_w) as the growth rate where actual and normal utilization are equal. Using this definition equation (2) becomes:

$$g^i = g^i[\gamma_w, (u - u_n)] \tag{2'}$$

If profitability did not have any effect on investment, the warranted rate, thus defined, would be equal to γ. Alternatively, if the investment function was linear ($g^i = \gamma + \beta_1 \pi + \beta_2 [u - u_n]$), the warranted growth rate would be equal to γ adjusted for the effect of profitability: $\gamma_w = \gamma + \beta_1 \pi$.

Assuming a classical exogenous distribution of income, the short-run equilibrium rates of utilization and the growth are:

$$u^* = u^*(s_c, s_w, \gamma, \pi) \tag{4}$$

$$g^* = g^*(s_c, s_w, \gamma, \pi) \tag{5}$$

The partial derivative of u^* with respect to the saving propensities are negative (the so-called paradox of thrift), while with respect to π depends on the relative magnitude of the propensities to invest and save out of profits ($\partial g^i / \partial \pi$ and $\partial g^s / \partial \pi$)—this is the well-known distinction between wage- and profit-led growth (Bhaduri and Marglin, 1990). The effects of these changes (in the saving rates and the profit share) on g^* will depend on their magnitude relative to the change in u^*. Finally an increase in γ leads to an increase in both u^* and g^*.

In the medium run, it is assumed that the normal rate of utilization will change in response to discrepancies from the actual rate, as was first suggested by Amadeo (1986). We can write:

$$\dot{u}_n = \mu (u^* - u_n) \tag{6}$$

where μ is a positive constant and the dot stands for the time derivative. Equation (6) suggests that the normal (profit-maximizing) rate of utilization will increase as demand increases and pushes actual utilization above the normal rate, and vice versa. It is this adjustment that lies at the heart of the controversy. Why would changes in demand manifested through changes in actual utilization lead to changes in firm's profit-maximizing utilization rate? (We return to this question in the next section)

The adjustment of normal utilization can be combined with an endogenous adjustment of the warranted growth rate, as was first suggested by Lavoie (1996) and Dutt (1997):

$$\dot{\gamma} = \varphi(g^* - \gamma_w) \tag{7}$$

Overall this—Kaleckian/Structuralist—closure allows for a series of desirable properties for the model: i) demand plays a role in the short and the long run; ii) distribution is primarily determined by institutions and social norms along classical lines; iii) changes in distribution have different effects on economic activity depending on the structural characteristics of the economy; iv) there is path dependence and short-run shocks might persist in the long run.

The Kaleckian/Structuralist model is the only model with an endogenous rate of capacity utilization in the long run. It is instructive to examine the implications of assuming an exogenous utilization in other approaches to growth and distribution. The classical model follows classical political economy in the determination of distribution (exogenous π) and also assumes exogenous utilization, while accumulation is determined by available saving. In terms of equation (1) this implies that g^i is the one endogenous variable. Duménil and Lévy (1999) in an article with the explicit title: "Being Keynesian in the Short Term and Classical in the Long Term" allow for the Kaleckian closure in the short run (as that was described in the previous paragraphs) but argue that in the long run utilization is exogenous and thus they revert to the classical closure. An implication of this choice of closure is that an increase in the profit share always increases the rate of accumulation (the system is thus always profit-led) and demand shocks do not affect the long run growth of the economy unless we allow for endogenous changes in labor productivity (see Tavani and Zamparelli, 2017).

The neo-Keynesian model adopts the Keynesian hypothesis and an exogenous utilization rate, while distribution becomes the main adjusting variable that brings total saving in line with investment (see chapter 3 and Kaldor, 1955; Robinson, 1962). Within this closure it does not make much sense to talk about the effects of changes in distribution on economic activity, as distribution is itself determined by economic activity. A problem of dropping the classical theory of distribution—and the role of institutions and social norms in the determination of income distribution—is that it is hard to make sense of long run variation of distribution. If we take the neo-Keynesian model at face value the increase in the profit share over the last four decades should be mainly due to investment (and other demand injections) increasing faster than saving (and other demand leakages); the institutional change of this period (political changes, weak trade unions, neoliberal policies and institutions etc.) are ignored.

Another approach suggests that normal utilization should be thought of as an interval rather than a specific rate. This allows for long-run variation in utilization in response to demand within the interval along the lines of the Kaleckian/Structuralist closure while outside the interval, the system switches to a closure with exogenous utilization. This idea was proposed by Harrod (1970) and was more recently formalized by Dutt (2010) and Setterfield (2019), who point to a neo-Keynesian closure outside the interval.[1] The endogeneity of utilization within the interval is justified on the basis of fundamental uncertainty: firms operating under conditions of fundamental uncertainty will tolerate a certain discrepancy between realized and expected outcomes. However, uncertainty itself cannot have a large effect on utilization, so the resulting interval of endogenous adjustment is small. Thus, the spirit of this hybrid approach is similar to a closure with exogenous utilization.[2]

[1] In principle, however, one could propose another closure with exogenous utilization-say, the classical one-outside the interval.

[2] For example, Skott (2012, p.116-7) in a paper highlighting the endogenous normal utilization rate as one of the main "shortcomings" of the Kaleckian model, writes that “in an uncertain environment ... firms may have a range of

This is not to say that uncertainty is not important. However, its effects are transmitted through expectations about the future level (or growth or volatility) of aggregate demand or other factors that affect profitability. We thus return to the original question of the controversy do changes in expected future demand affect the choice of normal utilization. For example, imagine an entrepreneur who builds a plant in a state of fundamental uncertainty. Would stronger "animal spirits" or other conventions that make him optimistic about expected demand lead to a higher rate of utilization of their capital or not?

In the neoclassical model the basic unit of analysis is the household and not class. Hence the neoclassical version of equation (1) is $g^i = su\rho$ (where s is the saving rate). The neoclassical closure rests on two main assumptions, that investment decisions are not autonomous (g^i is endogenous) and that there is full employment and utilization of resources (u but also the employment rate are exogenous). This exogeneity of u and the employment rate is guaranteed by an endogenous adjustment of the technique of production (ρ becomes endogenous) and the prices of the factors of production, which also implies that distribution is endogenous as well. The accumulation rate together with the (exogenous) growth rate of the supply of labor determine the supply of the factors of production over the next period. Eventually the system converges to a steady state where growth is fully determined by the exogenous growth rate of the supply of labor, and in more sophisticated models by technical change, which is also exogenous.[3] Like in the case of the neo-Keynesian model, it does not make much sense to talk about the effects of changes in distribution on economic activity, as distribution is fully endogenous. The neoclassical theory of distribution is even more implausible: the stability of the wage share in the early postwar decades is explained by a production

'satisfactory' utilization rates, rather than a sharply defined optimal rate...The Harrodian argument, however, does not require the sharp definition. It is sufficient that the satisfactory range be small (a few percentage points)."

[3]The conclusion of the canonical neoclassical model that that long-run growth is driven by factors exogenous to the economy (population and productivity growth) led to the so-called (neoclassical) endogenous growth theory which posits that factors such as human capital, innovation, and knowledge produce positive spillovers and contribute endogenously to long-run growth (for a textbook discussion and references to the related literature see Barro and Sala-i-Martin [2004]). In terms of closure the endogeneity of long run growth rate implies the exogeneity of another variable depending on the specific version of the endogenous growth model (Tavani and Zamparelli, 2017, section 3.2).

function with an elasticity of substitution equal to one; this elasticity is supposed to have increased in the last four decades leading to an increase in the profit share.

A final closure is proposed by the so-called Sraffian Supermultiplier model which combines the Keynesian hypothesis with the classical theory distribution (as in the Kaleckian/Structuralist approach) but also assumes a constant rate of capacity utilization, a combination that—in terms of equation (1)—makes the model overdetermined. The Supermultiplier model is able to combine exogeneity of π and u with a role for demand by introducing the so-called "autonomous expenditure" (expenditure which is independent of income such as autonomous consumption, residential investment, government expenditure, and exports). Equation (1) is thus transformed into $g^i + g^z = [s_w + (s_c - s_w)\pi]u\rho$, with g^z representing autonomous expenditures over capital stock. g^z is exogenous and drives the system in the long run, while the rate of capital accumulation becomes the necessary endogenous variable. Seen from this point of view, it becomes clear that this is a peculiar Keynesian closure: although demand does play a role, investment is endogenous and is not treated as an independent variable (thus Kaldor's definition of the Keynesian hypothesis in the aforementioned quote does not hold). In the Supermultiplier model, increases in the wage share have a positive *level* effect on long-run output; while the growth rate is exogenously given by the growth rate of autonomous expenditure, and therefore there is no room for path dependence (as in the Kaleckian/Structuralist model). Moreover, the assumption of economic activity being driven by autonomous demand, while investment is endogenous allows only some peculiar types of business cycles (for example Minskyan cycles are incompatible with this approach). It is also questionable whether the "autonomous" categories of spending can be really autonomous from output in the long run (Nikiforos, 2018; Nikiforos et al., 2024).

The preceding discussion highlights the important role that utilization plays in the various theories of distribution and growth, and how an endogenous long-run rate of utilization allows for several desirable characteristics within the Structuralist/Kaleckian framework. At the same time, as was explained with reference to equation (6), the central question remains: why would utilization be endogenous to demand in the long run? Is such an assumption justified? We turn to the theoretical and empirical aspects of this debate in the following two sections.

3 Theoretical Approaches

The main question regarding the long run rate of utilization goes as follows. Imagine a firm, that decides to build a new plant. This decision entails three related aspects: i) what technique of production to use (what combination of the different factors of production); ii) how large the plant should be; and iii) how much the plant should be utilized. If the *expected* demand for the product of the firm *at the time of the investment* is Q, would changes in Q cause changes in the choice of the level of utilization? In other words, most economists would agree that changes in the actual demand for firm's output *ex post,* after the plant is built, will lead to changes in the level of utilization. The disagreement is about what happens *ex ante*, or about the long-run: when the useful life of the plant is over, would the firm—all other things equal—choose a different level of utilization if the expected demand for its product has changed in the meantime?

In the following sections we examine different answers to this question. We start with the standard model where demand does not play a role and then provide an exposition of different models that have provided arguments in favor of an endogenous-to-demand rate of utilization.

3.1 The standard model

The two books that form the foundation of the theory of utilization are *The economics of Capital Utilisation* by Robin Marris (1964) and *Capital Utilization* by Roger Betancourt and Christopher Clague (1981). Both of these books suggest that utilization might be influenced by demand over the cycle but it is determined by supply-side factors in the long run. Kurz (1986), who builds on these works, reaches a similar conclusion in a paper that is situated within the "controversy" discussed here.

The main elements of the argument advanced by these works can be understood with a simple model. Assume that there is only one technique of production available, which requires labor and capital as inputs. Marris (1964) and Betancourt and Clague (1981) extend this analysis to take into account more than one techniques, but the main results do not change.[4] The production of Q, requires a certain amount of capital services (K^s) and labor services (L^s) which are assumed to be proportional to the stock of capital (K) and the number of workers (L). The firm can produce its output with a single-shift system (a workweek of 40 hours) or a double-shift system (a workweek of 80 hours). In the single-shift system, Q is produced with the use of capital (K^1) and labor (L^1).[5] In the double-shift system, the firm is able to produce Q with half of the amount of capital ($K^2 = K^1/2$) utilized twice as much and the same amount of labor divided in two shifts, so that in each shift the firm employs half of the amount of labor compared to the single-shift system: L^{21} in the first shift and L^{22} in the second with $L^{21} = L^{22} = L^2 = L^1/2$.

The firm must pay a utilization differential (α) for employing labor in the second shift, because (for example) this is a shift outside of normal working hours, so that $\frac{w_2}{w_1} = 1 + \alpha$, where w_1 and w_2 are the wage for working in the morning and evening shift and $\alpha > 0$. Finally, the unit cost of capital is r.

Given these specifications, the total cost of production under the single-shift system will be:

$$C^1 = rK^1 + w_1 L^1 \tag{8}$$

while under the double-shift system it will be:

$$C^2 = rK^2 + w_1 L^{21} + w_2 L^{22} = rK^2 + (2+\alpha) w_1 L^2 \tag{9}$$

[4]For a detailed discussion see Nikiforos (2013).

[5]Here, and in what follows the first number in a superscript refers to the system of operation (single or double shift) and the second—if there—to the shift within each system.

The firm will choose the number of shifts and thus the rate of utilization that maximizes its profits—or minimizes its costs. The ratio of the cost of the double-shift system over the cost of the single-shift system is:

$$\Lambda = [\pi + (2+\alpha)\psi]\frac{1}{2} \tag{10}$$

where $\pi = rK^1/(rK^1 + w_1L^1)$ is the share of capital cost and $\psi = 1 - \pi$ is the share of wage cost in the total cost of production under the single-shift system. Thus, the double-shift system will be chosen if $C^2 < C^1$, that is if $\Lambda < 1$.

From equation (10) we can infer three factors that play a role in the choice of the rate of utilization:

(i) $\partial\Lambda/\partial r < 0$ and $\partial\Lambda/\partial w > 0$, which means that the higher is the cost of capital relative to labor, the higher will tend to be the rate of utilization of capital.

(ii) $\partial\Lambda/\partial(K^1/L^1) < 0$, so that the more capital intensive is production, the more the firm will tend to utilize its capital

(iii) $\partial\Lambda/\partial\alpha > 0$, i.e., the larger the utilization differential the more the firm will tend to use a single shift system. The utilization differential extends beyond labor costs into other "rhythmic" variations of production costs. For example, in agriculture a crucial input to production is heat. In the spring and summer months, the cost of heat is zero, but in winter, generating an equivalent amount of heat (e.g., through building a greenhouse) becomes expensive. Consequently, many farmers find it more economically viable to keep their machinery inactive during the winter season.

Overall, these factors are intuitive. The higher is the share of capital cost in production (either because the unit cost of capital is relatively high, or because production is capital intensive) and the lower is the utilization differential, the greater is the incentive of a firm to utilize capital

Two more important—also intuitive—factors not captured in this model but mentioned in the literature are:

(iv) "Rhythmic" variations of demand. The demand for the product of most firms is not uniform over time but varies. This variation can be either due to the nature of the product—think for example of a restaurant that faces demand for its products during lunch and dinner time—or the variations of economic activity over time. Businesses understand that overall economic activity and the demand for their product is subject to fluctuations. To the extent that firms cannot adjust their capital fast enough, their capital is left idle when there is no demand (Winston, 1974; Betancourt and Clague, 1981).

(v) Market structure. As several authors have discussed excess capacity is used as an entry deterrent by the monopolist or oligopolist. (Kaldor, 1935; Chamberlin, 1962; Spence, 1977; Cowling, 1981).

The factors outlined above do not include demand; this absence forms the basis for the criticism of the Kaleckian model. How can an adjustment process like that of equation (6) be justified if demand does not affect the profit-maximizing utilization rate of the firm?

3.2 Conventions

There have been four responses to this criticism. Some authors (Lavoie, 1995, 1996; Lavoie et al., 2004; Hein et al., 2012; Dutt, 1997) have suggested that because of fundamental uncertainty about the future economic conditions the normal utilization rate is to a large extent a convention. As a result, when the actual rate differs from the (conventional) normal rate, conventions change and the normal rate converges to toward the actual along the lines of equation (6). This is related to the idea of normal utilization as an interval discussed in section 2. However, as it was argued there uncertainty itself is unlikely to significantly impact utilization, resulting in a narrow range of endogenous adjustment just because conventions change.

The model outlined above shows that the choice of the rate of utilization rate is similar in nature to the choice of the technique of production; it is therefore hard to see how this choice might be a convention in an economically significant way. One could argue along Keynesian lines that because of fundamental uncertainty expectations about future demand (Q) are indeed based on conventions.

But this brings us to the original question. Why would the conventionally determined Q affect the normal rate of utilization.

3.3 The role of economies of scale

Another justification has been provided by Nikiforos (2013). Think of the model outlined above and additionally assume that there are economies of large scale production in the single-shift system *relative* to the double-shift system (the scale of production in the single shift is by definition larger than the double shift) and that these economies of scale depend on the level of the firm's production. If $\zeta(Q)$ captures these economies of scale the total cost of production under the first system will now be:

$$C^1 = (rK^1 + w_1 L^1)/\zeta(Q) \tag{8'}$$

while it will remain the same in the double-shift system (equation 9). The ratio of the cost of the two systems now becomes:

$$\Lambda = [\pi + (2+\alpha)\psi]\frac{\zeta(Q)}{2} \tag{10'}$$

The factors that affect the choice of the system mentioned above carry over in this version of the model, but in addition, since $\partial\Lambda/\partial Q = [\pi + (2+\alpha)\psi]\frac{\zeta'(Q)}{2} \neq 0$, demand plays a role in the determination of the optimal level of utilization. In particular the firm will tend to increase its rate of utilization (choose the double-shift system of operation over a single-shift system) as the demand for its product increases, if the degree of returns to scale decreases as the scale of production increases ($\partial\Lambda/\partial Q < 0$ if $\zeta'(Q) < 0$). As with the original model, this result can be derived with technology with more than one techniques of production or a production function (Nikiforos, 2013, sections 5.2 and 5.3).

The theory of production justifies that the degree of returns to scale behaves this way because in most cases returns to scale are due to indivisibilities (e.g., Kaldor, 1934; Koopmans, 1957). The economic gains due to indivisibilities—and therefore the related returns to scale—are exhausted as production increases and thus the degree of returns to scale is decreasing. As a result, the utilization rate of the firm will tend to increase as the demand for its product increases.

As with the other factors mentioned above, the main idea here is intuitive. In general, the inputs of production are are not perfectly divisible. Machines do not come in every size. These indivisibilities suggest that some of the factors will be necessarily underutilized and therefore their utilization can only increase when the demand for the product of the firm increases. Essentially, the standard model assumes that machines come in any size, and therefore firms can always adjusts the size of machines to the level of demand.

A detailed discussion of returns to scale and how the related theory of production justifies this behavior of $\zeta(Q)$ with some numerical examples are provided in Nikiforos (2013, section 7; 2023, sections 3, 5). The latter paper (section 4) also shows how these conclusions can be extended to the case of an oligopolist with power to set the price of the product.

A last related question is how this mechanism, in which the level of utilization is a function of the level of demand for the product of the firm, fits with a macro adjustment mechamism like that of (6) which, given the definitions of the actual and warranted growth rates, can be restated as:

$$\dot{u}_n = \mu_1(g^* - \gamma_w) \tag{6'}$$

where μ_1 is a positive constant. In other words, if normal utilization at the firm level is a positive function of the level of demand, why would normal utilization at the macro level respond to deviation of the actual from normal utilization—or equivalently, to deviations of the actual from the warranted growth rate?

Two possible answers have been given. Nikiforos (2016, section 6) suggests that under normal conditions, when actual utilization is at its normal rate and output grows at the warranted rate, an increase in aggregate demand is accommodated by the entry of new firms in the market, so that demand for the output of individual firms—and thus the rate of utilization—increases when the growth rate is above the warranted rate, and vice versa. US data provide some evidence in favor of this hypothesis

Another possible theoretical justification, discussed in Nikiforos (2023, section 6), suggests that when a firm builds a new plant and decides on the profit-maximizing level of utilization, it does not take into account a static level of expected demand per se but rather the flows of expected demand over the useful lifetime of the plant. In other words, the variable Q in the model above is determined by the expected flows and therefore the expected growth rate of demand. Thus if the economy grows at the warranted rate, firms will base their expectation about the future flows of demand on this growth rate. If the growth rate deviates from the warranted growth rate, firms will adjust their expectations about the future flow of demand and thus the normal rate of utilization accordingly.

3.4 Strategic Complementarities

Another argument in favor of an endogenous-to-demand rate of utilization is provided in two related papers by Petach and Tavani (2019) and Franke (2020) who emphasize the role of strategic complementarities in the determination of the optimal utilization rate at the firm level within a game-theoretical framework. The main idea of their models is straightforward. The usual definition of the *net* rate of profit for a firm is:

$$r = \pi u - \delta \tag{11}$$

with r being the net rate of profit, π the profit share, u the utilization rate, and δ the depreciation rate (in this equation we assume that the the potential-output-to-capital-stock ratio is equal to one, as Petach and Tavani implicitly do). Usually, the depreciation rate is assumed to be constant. Petach and Tavani suggest that there is a user cost component which is broader than simple depreciation. They denote this user cost as λ and suggest that it is a function of firm's own utilization (u) rate as well as firm's perceptions of the average utilization rate (denoted $\tilde{u}$), which in turn is assumed to be proxied by the average utilization rate at the macro level.

They also make the relatively standard assumptions that the user cost of the firm increases at an increasing rate with respect to the own rate of utilization ($\partial\lambda/\partial u > 0$ and $\partial^2\lambda/\partial u^2 > 0$). Crucially, they assume that the change in user cost in response to changes in own utilization ($\partial\lambda/\partial u$) is negatively affected by the average utilization rate ($\tilde{u}$) so that $\partial[\partial\lambda/\partial u]\Big/\partial\tilde{u} = \partial^2\lambda/\partial u\partial\tilde{u} < 0$. The intuition behind this assumption is that when the macroeconomy is not doing well the marginal cost of an increase in the firm's rate of utilization is high, because the firm would benefit more from increasing its production when economic activity is better. On the other hand, in a booming economy with high $\tilde{u}$ the increase in own utilization and production can more easily be absorbed.

In order to solve the model analytically, Petach and Tavani assume a specific functional form for the user cost function, which satisfies these conditions: $\lambda(u,\tilde{u}) = \beta u^{1/\beta}\tilde{u}^{-\gamma/\beta}$ with $\beta \in (0,1)$ and $\gamma \in [0, 1-\beta)$. Utilizing state level data for the US economy, they find statistical support for their specification of the user cost function. Using this functional form we can write the equation for the net profit rate as:

$$r = \pi u - \beta u^{1/\beta}\tilde{u}^{-\gamma/\beta} \tag{11'}$$

Equation (11') shows that an increase in utilization affects the net profit rate in two ways. On the one hand, it increases the gross profit rate (πu)—and the higher is π the higher is this increase. On the other hand, it leads to an (accelerating) increase of the user cost (λ)—and the higher is aggregate utilization ($\tilde{u}$), the lower is this increase in the user cost and therefore the decrease in the net profit rate. Therefore, the rate of utilization which maximizes the profit rate of the firm is a positive function of the profit share (π) but also of the aggregate utilization rate ($\tilde{u}$). More precisely, if we use the specific functional form for λ and maximize the profit rate with respect to the rate of utilization in equation (11') we arrive at an optimal level of utilization for the firm:

$$u = \pi^{\beta/(1-\beta)}\tilde{u}^{\gamma/(1-\beta)} \tag{12}$$

This result highlights that aggregate demand and aggregate utilization—and the perceptions of firms about them—matter for the choice of the rate of utilization at the firm level. This result can be understood as a best response function of the firm in a game-theoretic setting. Thus if we consider an economy with many similar firms, it is easy to show that the overall macroeconomic equilibrium, where the utilization rate of the firm is equal to the aggregate utilization rate ($u = \tilde{u}$) is:

$$u = \pi^{\beta/(1-\beta-\gamma)} \tag{13}$$

Petach and Tavani show that this aggregate utilization rate is responsive to demand shocks. For example, fiscal policies can lead to a permanent increase in the rate of utilization.

Franke (2020) follows a similar modeling strategy albeit with slightly different justification and functional forms. More precisely he amends the net profit rate equation (11) with a loss function $l(u)$ and following the same justification as Petach and Tavani (2019) assumes that $l'(u) > 0$ and $l''(u) > 0$. He also proposes a benefit function $b(\tilde{u})$ with $b'(\tilde{u}) > 0$, which captures the effect of aggregate utilization on the profit rate. According to Franke, an improvement in general economic activity improves the profitability of the firm because it allows it to increase its output, sales and utilization and/or sell its current output with lower marketing costs or at higher prices. Based on this reasoning he suggests that the benefit function should enter equation (11) as a coefficient of the gross profit rate. Overall, then, Franke arrives at the equation:

$$r = b(\tilde{u})\pi u - \delta - l(u) \tag{11''}$$

It is not hard to see that this equation has similar properties with respect to π, u, and $\tilde{u}$ as equation (11') above, and therefore Franke reaches conclusions similar to those of Petach and Tavani.

3.5 Output volatility and normal utilization

Another mechanism that endogenizes normal utilization has been suggested by Setterfield and Avritzer (2020). As was mentioned in section 3.1, according to the standard theory of utilization one of the factors that determine the normal rate of utilization is "rhythmic" variations in demand. A firm that faces fluctuations in their demand will face periods when their capital will be left idle. Setterfiled and Avritzer build on this result.

In their model they add two more assumptions, which they justify on theoretical grounds and also with reference to US data for the postwar period. First, they suggest that not only does output volatility affect normal utilization, but also that the higher output volatility is, the lower the normal utilization rate will be. Their argument echoes Steindl (1952, p. 9-14) who suggested that in the presence of uncertainty, the firm will lower its normal rate of utilization as output volatility increases because it desires to be able to maintain its market share in periods of high demand, at the peaks of the fluctuations. We can then write:

$$u_n = g(\sigma_u^2) \tag{14}$$

where σ_u^2 is the variance of actual utilization and $g'(\sigma_u^2) < 0$.

Moreover, Setterfield and Avritzer suggest that periods of crisis witness not only lower level of macroeconomic activity and utilization, but also more macroeconomic volatility—and vice versa. The increase in macroeconomic volatility can be either actual or conventional. This is because, in the presence of fundamental uncertainty, a crisis alters economic perceptions and the conventions underlying economic decisions, fostering expectations of greater macroeconomic volatility in the future. This is another case where uncertainty and conventions can play an important role, not in themselves, but through their effect on expectations about future demand. Overall, then, the variance of utilization increases as actual utilization decreases. Formally:

$$\sigma_u^2 = f(u) \tag{15}$$

with $f'(u) < 0$. By combining equations (14) and (15), it is obvious that the normal rate of utilization becomes a positive function of the actual rate; an increase in the actual rate decreases volatility and increases the normal rate. Thus:

$$u_n = h(u) \tag{16}$$

with $h'(u) > 0$.

Setterfiled and Avritzer also provide an intuitive way to link the adjustment of equation (16) with the adjustment of equation (6). If we rewrite the latter in discrete terms, we get:

$$\begin{gathered} \Delta u_{n,t} = \mu(u_t - u_{n,t-1}) \Longleftrightarrow \\ u_{n,t} - u_{n,t-1} = \mu(u_t - u_{n,t-1}) \Longleftrightarrow \\ u_{n,t} = \mu u_t + (1-\mu)u_{n,t-1} \end{gathered} \tag{17}$$

Given that μ is a parameter and at any point in time $u_{n,t-1}$ is also exogenous, the last equation in (17) can be thought as a special case of (16). This simple and straightforward justification can also be used to link the micro and the macro levels in the model of Nikiforos, presented in section 3.3.

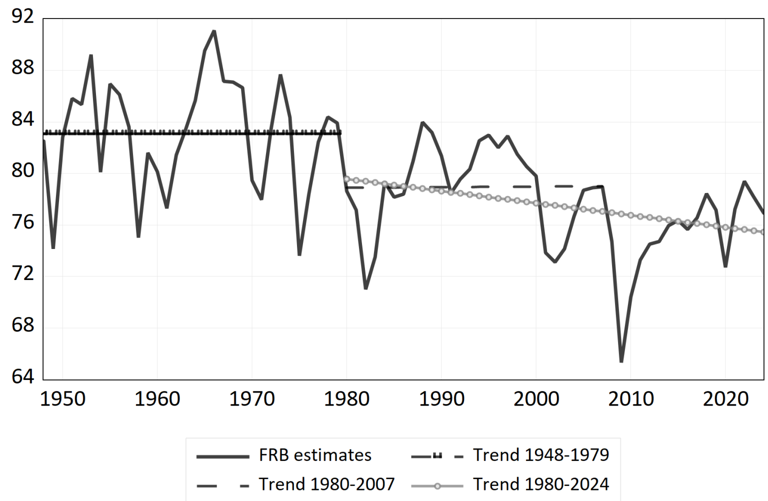
4 Empirical evidence

The other side of the debate is related to empirics. What do the empirical evidence tell us about the normal rate of utilization? In this section we go through several measures of utilization and what they imply about the utilization controversy. Before discussing specific estimates of utilization, an interesting piece of evidence can be found in Marris (1964) and Betancourt and Clague (1981), which, as it was mentioned above, are the two books that form the foundation of the theory of utilization and the basic model outlined in section 3.1. On the second page of the introduction of both books it is mentioned that demand is one of the main reasons that is mentioned by entrepreneurs when they are asked what factors determine their decision on the utilization of their capital. Marris writes: “in business inquiries, one of the commonest reasons given for working shifts or not (as the case may be) relates to *demand* [emphasis added],” while Betancourt and Clague mention: “interviews have shown that when factory managers have been asked why they are operating *only one shift* one of the most frequent answer given is that the firm *would not be able to sell* its product [emphasis added].”

4.1 The Federal Reserve’s Measure of Capacity Utilization

The most commonly-used measured of capacity utilization is the one produced by the Federal Reserve Board (FRB), presented in figure 1. Similar measures of utilization—with similar properties—have been produced by central banks and statistical agencies around the world. As we can see in the figure, the FRB rate of utilization fluctuates around the same level for very long periods of time. In each of the periods 1948–79 and 1980–2007 there is no trend in the data. This stationarity is used as evidence in favor of an exogenous-to-demand rate of utilization in the long-run. (e.g. Skott, 2012, p. 128). Also, it comes as no surprise that if this data is used in a regression, the overall stability of the rate of utilization will lead to insignificant effects of demand shocks on utilization in the long run and the related impulse response functions will converge to zero.

Figure 1: The FRB Measure of Capacity Utilization, 1948-2024



Note: Annual averages calculated from monthly data. Data for 2024 are available up to October.
Alt text: A line graph displaying the Federal Reserve's capacity utilization rates from 1948 to 2024. In each of the periods 1948-1979 and 1980-2007, the rates show consistent oscillations around a relatively stable average (83% for the first and 79% for the second period). In the period 1980-2024, there is a noticeable decline in the long-term average.

However, as it is explained in detail in Nikiforos (2016, section 4.2) and Nikiforos (2021c, section 3) the goal of the FRB series is to measure cyclical fluctuations in economic activity and therefore tends to be stable by construction. This is clear in the methodological notes and the history of the index as published by the FRB itself (Morin and Stevens, 2004; Federal Reserve, 2024a,b).

One way to understand this is by examining its method of construction. The FRB estimates rely on data from the Survey of Plant Capacity (SPC), administered by the US Census Bureau. The SPC asks plant managers to report their "full production capability of their plant—the maximum level of production that this establishment could reasonably expect to attain under normal and realistic operating conditions fully utilizing the machinery and equipment in place." However, the term "normal and realistic conditions," is open to interpretation. Assume a company that faces a certain level of demand. If this company operates consistently under a single-shift (40-hour per week) system for an extended period, these conditions are considered normal and realistic, and the full production capacity will be based on the 40-hour week. Now assume that demand doubles and remains at that level. The firms adds a second shift and the two-shift arrangement becomes the new normal. In this new normal, full production capacity will be based on the 80-hour week. Therefore, the increase in utilization that took place, will not be reflected in a measure such as the FRB which divides actual output over full production capacity.

Several other reports and papers draw similar conclusions.[6] One of the annual revision reports of the capacity and utilization measures produced by the FRB's division of research and statistics mentions that "production indexes, especially at major cyclical peaks provide floors and suggest ceilings in calculating the capacity indexes" (Raddock, 1985, p. 760). A few years later, another note by the same author explains how the FRB adjusted the estimates of utilization based on the McGraw-Hill Survey that was used from 1955 to 1988 and and the US Census Bureau survey that started in 1974 (and is still used today): "In general, simple level adjustment achieved this broad consistency. In some cases, both level and trend adjustments were required because the utilization rates based on the Census survey trend lower over time than those based on the McGraw-Hill/DRI survey" (Raddock, 1990, p. 491). In other words, differences in the levels or trends were just removed manually. Finally, Shapiro (1996, p.91, emphasis added) writes that "the Federal Reserve Board's capacity utilization rate provides a convenient, *detrended* source of data on production. Capacity utilization is the ratio of production to a smooth measure of capacity output. [fn 22]: *Hence the Federal Reserve Board's capacity utilization rate is not a direct measure of capital utilization*."

At the same time, it should be mentioned that in recent years there has been a decline of the FRB measure of utilization. Figure 1 shows that the trend of the period 1980-2024 is significantly negative and the recent pre- and post-pandemic peaks are around the average rate of the period 1980-2007 and significantly below the 1948-79 average. Some of this decrease might be related to methodological changes in the way the estimates are constructed despite the efforts to produce a consistent series (Morin and Stevens, 2004; Bauer and Deily, 1988; Nikiforos, 2016). Bansak et al. (2007) suggest that technical change might have played a role as certain types of capital equipment

[6] A detailed list is provided in Nikiforos (2021c, section 3).

have become cheaper and thus it is less costly to underutilize them. Finally, it seems likely that demand has played a role as well. The decline in utilization is higher in industries that have faced more competition from abroad and experienced a decline in the demand for their product (Nikiforos, 2021c, section 3). In the aforementioned hypothetical scenario, we can think of a plant that runs only one shift, and experiences a drop in demand. In this case the FRB estimate of utilization will decrease. Such a drop in utilization points towards an endogenous-to-demand utilization rate. Nevertheless, despite this possibility, the FRB measure is unable to capture most of the variation in utilization over time. This becomes obvious when it is compared with other measures of utilization.

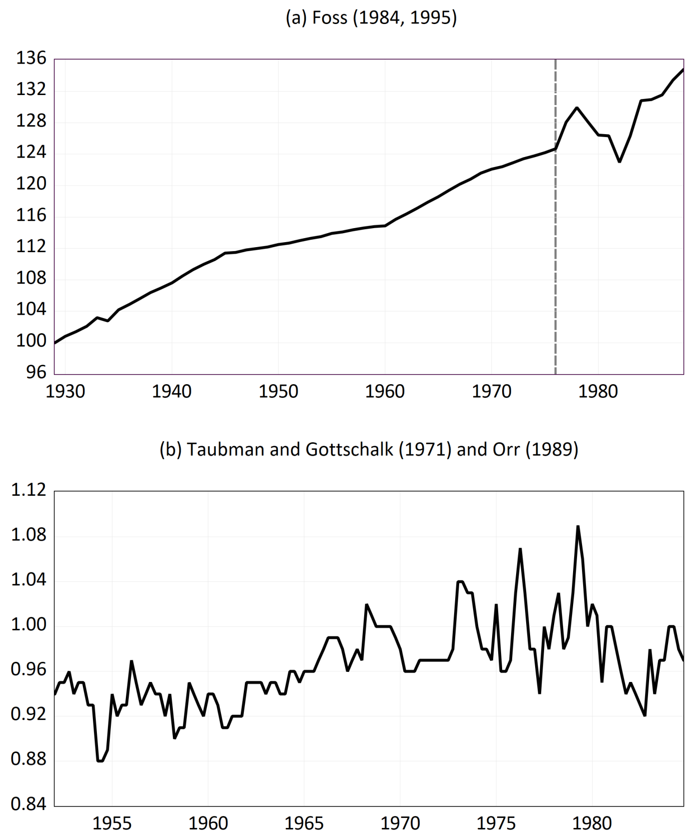
4.2 The Average Workweek of Capital and the National Emergency Utilization Rate

Two other measures of long-run changes of the rate of utilization, which avoid many of the ambiguities of the FRB measure are the Average Workweek of Capital (AWW) and the National Emergency Utilization Rate (NEUR). The AWW, as its name suggests, measures how many hours per week the capital stock is utilized out of the potential 168 hours that a week lasts. Given that this capacity maximum is fixed by definition, it avoids the ambiguities that underlie the capacity measure in the FRB estimate of utilization.

Several studies have attempted to estimate the AWW: i) Foss (1963, 1984, 1995); ii) Orr (1989), who builds on the work of Taubman and Gottschalk (1971); iii) Shapiro (1986); iv) Beaulieu and Mattey (1998); v) Shapiro (1996); and vi) Gorodnichenko and Shapiro (2011). A detailed discussion of the properties of all these estimates is provided in Nikiforos (2016, 2020, 2021c). Figure 2 presents the estimates by Foss (1984, 1995) and Orr (1989) which are the longest series in this literature. These series (and the others not presented here) have a very different trajectory compared to that of the FRB measure. They are not stationary and they show a significant increase in the rate of utilization during the first postwar decades and a slowdown in the years after the mid-1970s.

Given that the US economy boomed in the early postwar period and then entered a period of crisis and lower growth in the mid-1970s this trajectory is consistent with a demand-driven AWW.

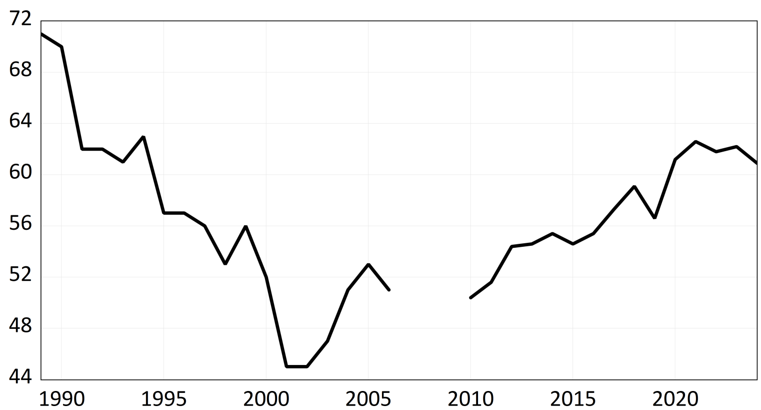
Figure 2: Estimates of the Average Workweek of Capital



Alt text: A graph with two panels depicting estimates of the Average Workweek of Capital (AWW). The upper panel shows the estimates produced by Foss (1984, 1995) for the period 1929-1988; the lower panel shows the estimates produced by Taubman and Gottschalk (1971) and Orr (1989) for the period 1952-1984. Both panels show a significant increase of the AWW until the 1970s, followed by a plateau.

Another relevant measure of long-run utilization is the National Emergency Utilization Rate (NEUR), which is estimated by the US Census Bureau with information of the Census's Survey of Plant Capacity (which is also used for the FRB measure), but is only available for the years after 1989 with a break during the years of the financial crisis (2007–9). Besides asking plant managers about "full production capability" the survey asks for an estimate of their national emergency production, a much less ambiguous measure of capacity. The NEUR is the ratio of actual and national emergency production.

Figure 3: The US Census National Emergency Utilization Rate, 1989-2024



Note: Data for 2024 are available up to the second quarter.
Alt text: A line graph displaying the National Emergency Utilization Rate (NEUR) from 1989 to 2024. The graph shows a notable decline in the 1990s, with subsequent stabilization at a lower level compared to the initial values.

The NEUR is presented in figure 3. Not surprisingly, NEUR is lower than the FRB rate because national emergency production is, by definition, higher than (or equal to) full production capability. At the same time, it is far less stationary compared to the FRB measure. In the 1990s, the NEUR decreased by 26 percentage points, and as of 2024 it was slightly more than 10% below its 1989 level; the FRB rate has decreased by around 5% over the same period. Given that the denominator of the NEUR (emergency production) is higher than the denominator of FRB measure (full production), a change in the numerator (actual production) should have a bigger effect on the latter, which is the opposite of what we observe and confirms the thrust of the critical remarks made in the previous section about the FRB measure.

Finally, it is worth mentioning that the fluctuations of the AWW and the NEUR presented in figures 2 and 3 are significant and are not consistent with the view that long run utilization is conventional and fluctuates within some narrow bounds.

4.3 Should Utilization Be Stationary?

There is, however, a more fundamental reason why a relatively stationary measure of utilization does not capture long run variations of utilization, and therefore, using the stability of the FRB measure as evidence against the role of demand in the determination of the normal rate of utilization is wrong. As was discussed in section 3, the theory of utilization suggests several factors other than demand that that play a role in the determination of the normal rate of utilization: capital intensity, relative prices of labor and capital, rhythmic variations of input prices, rhythmic variations in demand, economies of scale, the degree of monopoly in the market.

A measure of utilization that is stationary in the long run would mean that under a diabolical coincidence all these factors are combined in a way that utilization remains stationary. If one is ready to accept such a coincidence then why would they not include demand as part of it as well? On the other hand, if one does not believe in such a fluke, they should not expect that utilization is stationary in the long run—even if demand does not play a role.

This logical argument has two main implications. First, it shows that the stationarity of the FRB measure over long stretches of time is proof that it is created to measure cyclical fluctuations. Thus, it is an inappropriate measure of normal utilization. Second, it also means that a measure of utilization which is not stationary does not prove that demand plays a role. This is a separate issue, which is discussed in the following section.

4.4 Demand and utilization

The question as to whether or not demand has an effect on utilization in the long run has been explicitly addressed in a number of studies. Some of these use the FRB measure of utilization (or other similar measures from other countries)—and usually within a Vector Autoregressive framework (e.g. Gahn, 2021; Deleidi et al., 2024). Not surprisingly they find that demand does not affect utilization in the long run (the impulse response functions converge to zero) and they therefore conclude that the Kaleckian model is wrong. However, for the reasons outlined previously using the FRB measure of utilization is not appropriate for the examination of long-run variations in utilization. Also, it is evident from a purely econometric point of view that variables with a higher order of integration cannot say much about the long run behavior of stationary variables.

One should then focus on other estimates of utilization. An early attempt was made by Foss (1963), in a work that calculated the AWW using data on power equipment and on electricity consumption, and found that the AWW increased significantly between 1929 and 1955. The study is interesting because Foss was able to isolate industries with negligible technical change over the period of his sample (e.g., the cotton industry), while over the same period of time the cost of labor and overtime pay had increased significantly due to the New Deal changes in the labor market. As was explained in section 3.1, all other thing equal, these increases in the cost of labor and overtime pay–and given that technology did not change—should have resulted in a lower rate of utilization of capital; the opposite of what actually happened. The biggest part of the increase in utilization was recorded during and immediately after the war, which suggests that demand was one of the main factors behind it. Foss also mentions the advances in the "knowledge acquired by management in making more efficient use of machines" as another potential contributing factor.

Another effort to econometrically estimate whether or not demand affects the AWW is made by Nikiforos (2016, section 7). The idea is that if we treat the trend of the AWW as a measure of the normal rate of utilization and the FRB rate as a measure of cyclical fluctuations of utilization (as deviations of the actual from the normal rate) we can estimate equation (6). Nikiforos uses the data from Orr (1989), which is the longest available estimate for the AWW, within an ARDL framework, and finds evidence that changes in the trend of the AWW are related to fluctuations of utilization, as equation (6) suggests.

Finally, Nikiforos (2021b) examines potential explanations for the fall of the NEUR during the period 1989-2019 (figure 3). He finds that most of the factors that the theory of utilization suggests as determinants of normal utilization moved in a direction that would have led to an *increase* in utilization over that period of time. For example, the increase in the profit share, the fall in the relative cost of labor, and the reduction in the shift differentials (α) that took place during this period should have led to an increase in the utilization of capital. The only factors that moved in a direction consistent with a fall in utilization are the decrease in aggregate demand and the increase in industry concentration.

Overall, studies that have used the AWW and the NEUR as estimates of utilization lend empirical support for the role of demand in the determination of utilization rate in the long run.

5 Concluding remarks

This chapter has discussed several aspects of the debate about the long run rate of capacity utilization and whether or not it is endogenous to demand. To begin with, it highlighted the implications of treating utilization as endogenous or exogenous to demand. It also presented the theory of utilization, outlined the various factors that the theory has suggested as the main determinants of the firms' utilization decision, and discussed recent theoretical justifications for a long-run utilization rate that responds to changes in demand. Finally, the chapter examined different estimates of the rate of utilization. It was explained that the FRB measure of utilization, which is commonly used as evidence against an endogenous-to-demand rate of utilization, is inappropriate as a measure of the rate of utilization in the long run. Other estimates such as the Average Workweek of Capital or the National Emergency Utilization Rate are more suitable. Overall, these estimates suggest that demand plays a role in the determination of utilization rate in the long run.

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