ROMA TRE
UNIVERSITÀ DEGLI STUDI

Ph.D. in Economics

XXXIIIth Cycle

Ph.D. Thesis

Three essays on effective demand and capacity utilisation

Ph.D. candidate: Santiago José Gahn

Advisers: prof. Roberto Ciccone
prof. Riccardo Pariboni

To Albertina, Ítalo and Vera.

‘que ni el interés ni el miedo, el rancor ni la afición, no les hagan torcer del camino de la verdad, cuya madre es la historia’

Acknowledgements

I would like to thank first of all my family for having supported me through all these years. In particular, to my mother, who was instrumental in making me what I am today.

Then I would like to thank my thesis director, Roberto Ciccone, for having embarked on this project and making it come to fruition; for his patience and consistency in discussing various versions of this thesis. Riccardo Pariboni, my co-adviser, was an academic and personal guide, who helped me think so many problems which would have been extremely difficult to solve without his help and accompaniment. Finally, I appreciate the enormous effort made by Daniele Girardi and Ricardo Summa in reading this thesis; they contributed with comments which made this thesis a better piece of work.

To the people in Argentina who encouraged and guided me throughout this process since the Master's degree, particularly Ramiro Álvarez, Ariel Dvoskin, Germán Feldman, Alejandro Fiorito, Guido Ianni and Pablo Lavarello.
To my friends, in Argentina and in Rome.

To Clara, for being so *solare*.

Abstract

For many years, there was an unanswered question among *non-mainstream* scholars: What's the behaviour through time of capacity utilisation after an aggregate demand shock? Following the Classical-Keynesian approach, in this thesis I revise critically the literature on the relationship between output and capacity utilisation and how capacity adjust to the former. After that, I present empirical evidence on the effect of output and capacity utilisation; transitory effects seem to be the rule, rather than the exception. Finally, I try to understand whether it was demand, among many other factors, the main determinant that explains the declining trend in the utilisation of installed capacity in the United States.

Keywords: Growth theory, capacity utilisation Neo-Kaleckian model, Sraffian Supermultiplier
JEL Classification: B50, E11, E22, O41, O47

Contents

List of Figures

List of Tables

1 Preface

1.1 Motivation and Objectives

This thesis is profoundly inspired by what could be considered the Garegnani's project (Moreira & Serrano, 2018; Cesaratto, 2020), born in 'Il problema della domanda effettiva nello sviluppo economico italiano' written by Pierangelo Garegnani in 1962: To provide a basis for a theory of output that might complement the previous revival of the Classical theory by Piero Sraffa in his magnum opus *Production of Commodities by means of commodities* (Sraffa, 1960), following the long-period method (Garegnani, 1976).[1]

As it is well known, most of the Classical authors relied on Say's law in which 'the demand for goods in general is limited only by the production of goods in general' (Garegnani, 1962, pp. 9-10), but not because the latter was a result of the theory but because of the lack of an explicit analysis of output (Mongiovi, 1990). My main motivation is to introduce, within what is called the Classical-Keynesian framework, develop and, in some sense, try to shed some light on three different aspects of *growth* theory: a critique to some recent Neo-Kaleckian contributions, describe empirically the adjustment of capacity to aggregate demand and how this might be incompatible with some Neo-Kaleckian models and, finally, try to explain a declining trend of capacity utilisation in the US economy since 1948.

[1]For a discussion on long-period method see Serrano (1988), Kurz and Salvadori (1995), Ravagnani (2002, 2012), Kurz and Salvadori (2002), D'Orlando (2007, 2012) and Signorino (2001), among others. On the notion of gravitation see the Workshop on *Convergence to Long-Period Positions* held at the Certosa di Pontignano, Siena, 1990.

1.2 Contributions

In the introductory essay, I discuss briefly the ‘Cambridge Equation’, the Neo-Kaleckian and the Sraffian Supermultiplier models, given that are growth models within a non-orthodox framework. After that, I introduce and discuss recent contributions from the Neo-Kaleckian side of the debate that try to continue to support the neo-Kaleckian model as a workhorse of Post-Keynesian models.

Later on, I demonstrate empirically that there is a *persistent* tendency continuously operating towards some exogenous rate of capacity utilisation and why this issue is relevant, given the difficulty to grasp these results for some versions of the Neo-Kaleckian model.

Finally, I discuss another empirical issue, related to the observed declining trend of capacity utilisation in the US economy, after discussing different empirical measures of capacity utilisation and some determinants of *normal* utilisation found in the literature.

Overall, the thesis contribute with three different essays in which I discuss recent Neo-Kaleckian contributions, demonstrate that the baseline Neo-Kaleckian model and most of its amendments are not compatible with the empirical evidence and, finally, try to shed some light on the behaviour of capacity utilisation in the US economy that, recently, has triggered some debates.

1.3 Statement of Originality

This is to certify that to the best of my knowledge, the content of this thesis is my own work. This thesis has not been submitted for any degree or other purposes.

I certify that the intellectual content of this thesis is the product of my own work and that all the assistance received in preparing this thesis and sources have been acknowledged.

1.4 References

Cesaratto, S. (2020). Garegnani, Ackley and the years of high theory at Svimez. In *Economic Growth and Macroeconomic Stabilization Policies in Post-Keynesian Economics*. Edward Elgar Publishing.

D'Orlando, F. (2007). A methodological note on long-period positions. *Contributions to Political Economy, 26*(1), 17-26.

D'Orlando, F. (2012). Reply to Ravagnani. *Review of Political Economy, 24*(1), 145-150.

Garegnani, P. (1962). Il problema della domanda effettiva nello sviluppo economico italiano. Svimez, Rome.

Garegnani, P. (1976). *On a change in the notion of equilibrium in recent work on value and distribution*. Essays in modern capital theory, 25-45.

Garegnani, P. (2002). 23. *Sraffa's price equations: a stationary economy or 'normal positions'?*. Is There Progress in Economics?, 389.

Heinz D. Kurz, & Salvadori, N. (1995). *Theory of Production: A long-period analysis.* Cambridge University Press.

Kurz, H. D., & Salvadori, N. (2002). *22. On the long-period method: a comment on Ravagnani*. Is There Progress in Economics?, 383.

Mongiovi, G. (1990). Notes on Say's Law, Classical Economics and the Theory of Effective Demand. *Contributions to Political Economy, 9*(1), 69-82.

Moreira, V. G., & Serrano, F. (2018). Demanda efetiva no longo prazo e no processo de acumula ção: o debate sraffiano a partir do projeto de Garegnani (1962). *Economia e Sociedade, 27*(2), 463-492.

Ravagnani, F. (2002). *21. Produced quantities and returns in Sraffa's theory of normal prices: textual evidence and analytical issues*. Is There Progress in Economics?, 371.

Ravagnani, F. (2012). The Classical Theory of Normal Prices and the Analysis of Economic Changes: A Comment. *Review of Political Economy, 24*(1), 131-143.

Serrano, F. (1988). *Teoria dos preços de produção e o princípio da demanda efetiva*. Master thesis. Federal University of Rio de Janeiro. Rio de Janeiro, 159.

Signorino, R. (2001). On the Limits to the Long-Period Method in Classical Economics: A note. *Review of Political Economy, 13*(2), 245-251.

Sraffa, P. (1960). *Production of commodities by means of commodities*. Cambridge: Cambridge University Press.

2 Introductory chapter

2.1 Theoretical framework and premises

Since *An Essay in Dynamic Theory* (1939) of Sir Roy Harrod the discussion among growth *models* circulated around the notion of 'Harrodian instability'. How entrepreneurs react to any divergence of the actual from the desired output-capital ratio? The fact that entrepreneurs might react investing (disinvesting) when the output-capital ratio is higher (lower) than the *normal* one might generate an expansion (contraction) by which the *normal* ratio is never attained, what might trigger full (zero) utilisation of capacity. With some degree of arbitrariness, it can be singled out to three alternative proposals - in an *ex-post* reconstruction - in order to solve this issue.

The first model that aims to solve this issue is the *Cambridge Equation* (CE, hereafter) model, in which some highlighted theorists are: Kaldor (1957), Robinson (1962) and Pasinetti (1962). The adjustment is through the distribution of income. The second one is the Neo-Kaleckian model (NK, hereafter) (Del Monte, 1975; Rowthorn, 1981; Dutt, 1984; Taylor, 1983, 1985; Amadeo, 1986a, 1986b; among others) in which utilisation can be different from the *normal* one persistently. Finally, and the most recent one, the Sraffian Supermultiplier (SSM, hereafter) (Monza, 1976; Serrano, 1995; Bortis, 1984, 1997; Dejuán, 2013, 2017; Fazzari et al. 2013; Fazzari, Ferri, and Variato (2020); Serrano, Freitas and Bhering, 2019; Freitas and Christianes, 2020; Serrano, Summa and Moreira, 2020; Mandarino, Dos Santos and Silva, 2020; among others[1]), in which there is a convergence towards a *normal* rate of capacity utilisation with the inclusion of autonomous components

[1] For empirical analysis see Médici, 2015; Girardi and Pariboni, 2016; Braga, 2018; Girardi and Pariboni, 2018; Goes, Moraes and Gallo, 2018; Fiorito, 2018; Gahn and González, 2019; Pérez and Erbina, 2019; Haluska, Braga and Summa, 2020.

of aggregate demand.

This thesis will frame different debates surrounding the role of capacity utilisation under these frameworks. In Chapter 3, I will first discuss theoretically and empirically recent contributions from Neo-Kaleckian authors trying to justify the founding principle of NK models of growth and distribution, i.e. the lack of adjustment of effective capacity utilisation[2] towards the *normal*[3] rate in the long-run. Chapter 4 will be devoted to the empirical study of the adjustment of capacity utilisation to aggregate demand putting in doubt the *baseline* and some *extended* versions of the Neo-Kaleckian model. Finally, in Chapter 5 I will discuss theoretical and empirical determinants of the level of *normal* capacity utilisation and possible causes that might explain the declining trend in capacity utilisation in the United States since 1948.

Because these three essays are interconnected and one of the main issues that will be discussed is the adjustment of capacity to demand, it will be easier for the reader to circumscribe the discussion if I first present different growth models found in the literature from a non-mainstream perspective[4] - the one that will be followed in this thesis.

Some assumptions will be made along this introductory chapter and along the thesis unless otherwise stated. I will assume a closed capitalist economy with no government sector; aggregate income is distributed in wages and profits; the dominant method of production uses a fixed combination of homogeneous labor and homogeneous fixed capital; single output; constant returns to scale and no technical progress; no scarcity of labor.

Finally, a clarification. Each essay shall be written in such a way that it can be read independently of the others. Because of this, many concepts will be repeated, but this is done to expedite reading between essays.

[2]Capacity utilisation is a ratio of the actual level of output (Y) to a maximum level of output, or capacity (Y^*).

[3]Following Ciccone (1986, 1987), *Normal* capacity utilisation is defined as the average *expected* level of utilisation of capacity on newly installed equipment. More in-depth details in the next chapter (especially Appendix A.0).

[4]Part of this was developed briefly in Gahn and González (2019).

2.2 Cambridge Equation model

The elder *CE* model can be summarised in two equations:

$$\frac{I}{K} = \gamma \tag{2.1}$$

$$\frac{S}{K} = \frac{s_\pi \pi u}{v} \tag{2.2}$$

where the first equation postulates that the rate of capital accumulation is a function of γ, which is interpreted as the expected (constant) trend growth rate of sales, autonomous investment or simply 'animal spirits'. With respect to the savings function (Equation 2.2), since only capitalists are assumed to save (a fraction of their income), and workers consume all their income, it follows that savings, normalised by K, is equal to the product of the marginal propensity to save out of profits (s_π) and the profit share (π), capacity utilisation, and divided by the capital-output ratio (v). And it follows that, equating I=S,

$$g = \gamma = \frac{s_\pi \pi u}{v} = s_\pi r \tag{2.3}$$

Assuming a shock to autonomous investment, that expands at an exogenously determined rate $g_I > 0$, and given s_π, $u = u_n$ and v, the burden of the adjustment relies on π. Given it is assumed capacity is *continuously* utilised at its *normal* level, hence any increase in the pace of goods' demand cannot be accommodated through extra production. Therefore, any increase in $g_I = g$ will deliver a process of increment of the level of prices, and given the nominal wage, a reduction of the real wage and an increase on profit. The central proposition derived from this exercise is that a reduction of the real wage rate (or share of wages for that matter) is a *necessary* condition for the economy to achieve a higher rate of growth (Amadeo, 1986b). Thus, there exists a theoretically necessary *a priori* relationship between income distribution and economic growth (Freitas & Serrano, 2015, p. 27).[5]

Another critique was raised by Garegnani and Palumbo (1997, 1998). In those writings, Garegnani claims that,

[5] According to Serrano, output is not demand-led in this model (Serrano, 2015, p. 9; Serrano & Freitas, 2017, p. 10).

> even if . . . the increased investment were to cause a fall in real wages and consumption, such a fall would seem unlikely to last. The shortage of productive capacity causing that fall would not probably last for long, whereas the bargaining position which was reflected in the initial level of the real wage would, if anything, be likely to be strengthened by the increase in labour employment. A rise rather than a fall of the real wage might therefore be expected to accompany an increased incentive to invest and a faster growth.
>
> Garegnani and Palumbo (1997, p. 11; 1998, p. 15)

Another point that can be raised in relation to the *CE* model is that, in the short run there must be a change in the composition of output. Given the *assumption* of workers consuming all their income, a reduction in their real wages will reduce consumption, so part of the existing capacity will be used to produce more capital goods. This is the trade-off between consumption and investment. But after this, in the long-run when that investment matures and it is transformed in productive capacity, there will be too much capital goods for too few consumption; it is a kind of 'over-accumulation' process. To achieve this result, a key *assumption* of the model is a continuously *normal* utilisation of capacity.

Nowadays, few economists still follow the *CE* tradition. The main critique towards this model is that in the long-run output seems to be even more flexible that in the short-run.[6] Because of this, this thesis will focus on the discussion between Neo-Kaleckians and Sraffians, mainly.

2.3 Neo-Kaleckian model

The baseline Neo-Kaleckian model, as presented in textbook form by Lavoie (2014) or Hein (2014), can be summarised in the following two equations:

$$\frac{I}{K} = \gamma + \gamma_u(u - u_n) \tag{2.4}$$

$$\frac{S}{K} = \frac{s_\pi \pi u}{v} \tag{2.5}$$

where γ_u is a parameter, u the effective or actual rate of capacity utilisation and u_n the *normal* one. Equilibrium capacity utilisation is determined equating (Equation 2.4) and (Equation

[6] Many contributions have clarified these issues: See Ciccone (1986), Garegnani (1992, 2013), Bortis (1984, 1993), Serrano & Freitas (2017), among others.

2.5):

$$u^* = \frac{v(\gamma - \gamma_u u_n)}{s_\pi \pi - \gamma_u v} \tag{2.6}$$

Equilibrium growth rate can be obtained replacing u^* in Equation (2.5), hence,

$$g^* = \frac{s_\pi \pi(\gamma - \gamma_u u_n)}{s_\pi \pi - \gamma_u v} \tag{2.7}$$

As it is known (Committeri, 1986; Hein, Lavoie & van Treeck, 2011; Hein, Lavoie & van Treeck, 2012; Lavoie, 2014), the *baseline* Neo-Kaleckian model does not have a built-in mechanism which allows u to converge to u_n in the long run. According to Freitas & Serrano (2015, p. 29) the model is not compatible with the related notions of planned spare capacity and normal (or desired) capacity utilisation rate. Pariboni (2015, p. 14) directly claims that there is an *ad-hoc* abolition of the concept of *normal* degree of capacity utilisation in this model. Thus, in the steady-growth path, there will generally be a divergence between actual and *desired* capacity utilisation.[7] If capitalists tend to close the gap, there might trigger 'Harrodian instability'; given that investment in the short-run is also demand, when they try to increase it to close the gap they finally increase utilization, increasing the gap.[8]

2.3.1 The Neo-Kaleckian model with endogenous 'normal' utilisation

One of the most influential responses to the absence of convergence between the actual and the desired rate is to assume that the *normal* rate is an endogenous variable itself, which adjusts to close the gap. This model, developed by several authors (Amadeo, 1986b; Lavoie, 1995, 1996, 2010; Dutt, 1997, 2010; Lavoie *et al.*, 2004; Hein *et al.*, 2012; among others) is based mainly on four equations:

$$\frac{I}{K} = \gamma + \gamma_u(u - u_n)$$

$$\frac{S}{K} = \frac{s_\pi \pi u}{v}$$

$$\dot{u_n} = \alpha(u^* - u_n) \tag{2.8}$$

$$\dot{\gamma} = \mu(g^* - \gamma) \tag{2.9}$$

[7]If, by a fluke, *normal* capacity utilisation is equal to $u^* = u_n = \frac{v\gamma}{s_\pi \pi}$ then this divergence equals zero.
[8]See Freitas & Serrano (2015) and Cesaratto (2015, p. 164) on this issue.

On the one hand, in Equation 2.8, $\dot{u_n}$ is the behaviour of *normal* capacity through time and depends on the divergence between the level of actual and the level of the *normal* one. On the other hand, in Equation 2.9 g^* is equal to the actual or effective growth rate of aggregate demand and γ is the autonomous component of the investment function (the expected secular rate of accumulation or the expected secular growth rate of sales) (Lavoie *et al.*, 2004). The last equation can be rewritten, replacing Equation 2.4 in Equation 2.9, in the following way,

$$\dot{\gamma} = \mu[\gamma_u(u^* - u_n)] \tag{2.10}$$

Equation 2.10 refers to what Lavoie (2016) calls the 'Harrodian mechanism' and shows how investment - the acceleration of the rate of growth - reacts to divergences between the actual and the *normal* utilisation capacity. Following Lavoie (1996, pp. 139-141), by setting $\dot{u_n} = \dot{\gamma} = 0$, the steady state needs to satisfy:

$$E = \{(u_n, \gamma) | \gamma = \frac{s_\pi \pi}{v} u\} \tag{2.11}$$

Thus, there is a continuum of equilibria. To pin down the exact equilibrium, I can replace (2.6) and (2.7) in (2.8) and (2.9) respectively, and obtain,

$$\dot{u_n} = \alpha(\frac{v\gamma - s_\pi \pi u_n}{s_\pi \pi - \gamma_u v}) \tag{2.12}$$

$$\dot{\gamma} = \mu(\frac{\gamma_u(\gamma v - s_\pi \pi u_n)}{s_\pi \pi - \gamma_u v}) \tag{2.13}$$

These are the behaviour through time of normal utilisation and 'animal spirits' respectively. Dividing Equation (2.13) by Equation (2.12):

$$\frac{\dot{\gamma}}{\dot{u_n}} = \frac{\mu \gamma_u}{\alpha} \tag{2.14}$$

That can be rewritten in the following way,

$$d\gamma = \frac{\mu \gamma_u}{\alpha} du_n \tag{2.15}$$

Integrating, the following equation for γ is obtained,

$$\gamma = \frac{\mu \gamma_u}{\alpha} u_n + C \tag{2.16}$$

Where C is a constant of integration which depends on initial conditions. Substituting this expression into equation (2.12), a one-dimensional dynamical system defined by is obtained:

$$\dot{u_n} = \frac{\alpha v}{s_\pi \pi - \gamma_u v}[(\mu\gamma_u/\alpha)u_n + C - (s_\pi \pi/v)u_n] \tag{2.17}$$

To find the steady-state of this equation, set $\dot{u_n} = 0$. Then, the steady-state is the following one,

$$u_n^* = \frac{C\alpha v}{s_\pi \pi\alpha - \mu v\gamma_u} \tag{2.18}$$

Normal utilisation, then, is determined by initial conditions, the capital-output ratio, the parameter measuring the sensitivity of normal utilisation to changes in the difference between actual and normal utilisation, the propensity to save of capitalists, the income distribution, the sensitivity of the accelerator and the sensitivity of animal spirits to a difference between the expected and actual growth rate. For the steady state to be positive, the model needs $s_\pi \pi\alpha > \mu v\gamma_u$ and $C > 0$. Note that the Keynesian stability condition is assumed to hold; thus, the only additional requirement is that $\alpha > \mu$; in other words, capacity utilisation needs to adjust faster to its long-run value than the rate of capital accumulation. It is crucial to note that the steady-state solution of u_n implies that actual and normal capacity utilisation converge; to see this, note that if $\dot{u_n} = 0$ then $u_n = u$; this can be established trivially by looking at Equation (2.8).

To asses whether this steady-state is asymptotically stable, take the derivative of (2.17) with respect to itself,

$$\frac{d\dot{u_n}}{du_n} = \frac{\alpha v}{s_\pi \pi - \gamma_u v}[(\mu\gamma_u/\alpha) - (s_\pi \pi/v)] \tag{2.19}$$

Equation (2.19) must be negative if the system is to be asymptotically stable. Coincidentally, this only requires that both the Keynesian stability condition holds, and that $\alpha > \mu$, something it was already established in order to guarantee that the steady-state normal capacity utilisation is positive. Given that the equation is linear in u_n, it is also trivial to establish that this steady-state is unique, conditional on the initial condition C.[9]

In relation to the expected rate of sales growth and the fully adjusted rate of accumulation, using (2.5) and (2.18), the equilibrium growth rate is the following one,

$$g^* = \gamma^* = \frac{C\alpha s_\pi \pi}{s_\pi \pi\alpha - \mu v\gamma_u} \tag{2.20}$$

[9]This can be interpreted as a kind of path-dependency, where the initial conditions are important in defining the equilibrium.

where C is a constant of integration. Here again, initial conditions will affect the growth rate, which also depends on the same parameters as capacity utilisation.

2.3.2 The Neo-Kaleckian model with non-capacity creating autonomous expenditures

Recently, based on the Sraffian Supermultiplier developed mainly by Franklin Serrano (Serrano, 1995a, 1995b)[10], some authors (Allain, 2015, 2019; Lavoie, 2016; Nah & Lavoie, 2017; Cynamon & Fazzari, 2017; Fiebiger & Lavoie, 2017; Fiebiger, 2018; among others) have introduced autonomous expenditures, such as exports, capitalists' consumption or government expenditures, in the baseline Neo-Kaleckian model. As a consequence, the model restricts the behaviour of capacity utilisation in the long-run where there is fully adjusted convergence from u to u_n.

Starting from the basic equations described in the previous sections,

$$\frac{I}{K} = \gamma + \gamma_u(u - u_n)$$

$$\frac{S}{K} = \frac{s_\pi \pi u}{v} - z \tag{2.21}$$

$$\frac{\dot{\gamma}}{\gamma} = \mu(g^* - \gamma) \tag{2.22}$$

Here the novelty is that $z = Z/K$ is the variable that represents the autonomous components of aggregate demand divided by the capital stock. This component could embody a diversity of expenditures.[11] In this case, I will follow Lavoie (2016) that introduces an autonomous component of capitalists' consumption out of wealth. This component endogenizes the saving share in output - the average propensity to save (S/Y) in the following sense,

$$\frac{S}{Y} = s_\pi \pi - z\frac{v}{u} \tag{2.23}$$

In line with the previous sections, I can derive the equilibrium value of capacity utilisation from Equation 2.4 and Equation 2.21,

$$u^* = \frac{v(\gamma + z - \gamma_u u_n)}{s_\pi \pi - \gamma_u v} \tag{2.24}$$

[10] This model will be developed in the next section.

[11] See next subsection.

The model includes also an equation *similar* to Equation 2.9 described in the previous section. The combination with Equation 2.4 allows us to formulate the following one,

$$\frac{\dot{\gamma}}{\gamma} = \mu(g-\gamma) = \mu[\gamma_u(u-u_n)] \tag{2.25}$$

Equation 2.25 is similar to Equation 2.10 and it describes the dynamic of the accumulation function, that is chiefly of the flexible accelerator type or Lavoie's 'Harrodian mechanism'. If *normal* capacity utilisation is an exogenous variable decided by entrepreneurs, it should be guaranteed the existence of sufficiently strong and persistent forces, i.e. accumulation, that, in the long-run analysis, allow the effective capacity utilisation to return to, or at least to *show a tendency towards*, its *normal* level. Substracting *normal* capacity from Equation 2.24 I can rearrange in order to obtain the first dynamic equation of the model,

$$\frac{\dot{\gamma}}{\gamma} = \mu\gamma_u[\frac{v(\gamma+z)-s_\pi \pi u_n}{s_\pi \pi - \gamma_u v}] \tag{2.26}$$

The second dynamic equation is obtained from the behaviour of the autonomous components through time,

$$\frac{\dot{z}}{z} = \frac{\dot{Z}}{Z} - \frac{\dot{K}}{K} = g_z - g = g_z - [\gamma + \gamma_u(u-u_n)] \tag{2.27}$$

That replacing, again, $u-u_n$ I can describe the second equation that will take part of the Jacobian matrix.

$$\frac{\dot{z}}{z} = g_z - \gamma - \gamma_u[\frac{v(\gamma+z)-s_\pi \pi u_n}{s_\pi \pi - \gamma_u v}] \tag{2.28}$$

The derivative of Equation (2.28) respect to z is negative as long as the denominator is positive, so it can be claimed that z will converge to an equilibrium value z^* In the equilibrium path where $\dot{\gamma} = 0$ and $\frac{\dot{z}}{z} = 0$ the result $u = u_n$ holds. In the long-run, there is a tendency of u towards its exogenous *normal* value, as a result of the process of investment. Under this new version, the gap between u and u_n in the 'fully adjusted situation' (Vianello, 1985) is zero and the adjustment runs, as I have said, from the former to the latter.

The Jacobian matrix will be formed by Equation (2.26) and Equation (2.28).

$$J = \begin{bmatrix} \frac{\partial \frac{\dot{\gamma}}{\gamma}}{\partial \gamma} & \frac{\partial \frac{\dot{\gamma}}{\gamma}}{\partial z} \\ \frac{\partial \frac{\dot{z}}{z}}{\partial \gamma} & \frac{\partial \frac{\dot{z}}{z}}{\partial z} \end{bmatrix} = \begin{bmatrix} \frac{\mu\gamma_u v}{s_\pi \pi - \gamma_u v} & \frac{\mu\gamma_u v}{s_\pi \pi - \gamma_u v} \\ -(1+\frac{\gamma_u v}{s_\pi \pi - \gamma_u v}) & -\frac{\gamma_u v}{s_\pi \pi - \gamma_u v} \end{bmatrix}$$

To exhibit stability and to converge to an equilibrium, the determinant needs to be positive and the trace needs to be negative.

$$det\ \boldsymbol{J} = \frac{\mu\gamma_u v}{s_\pi\pi - \gamma_u v}$$

$$Tr\ \boldsymbol{J} = -\frac{\gamma_u(1-\mu)v}{s_\pi\pi - \gamma_u v}$$

Whenever the Keynesian stability holds and $\mu > 0$, the determinant is positive and the trace is negative.

2.4 The Sraffian Supermultiplier

The Supermultiplier[12] model of Serrano (1995a and 1995b) in its dynamic version (Freitas & Serrano, 2015; Serrano & Freitas, 2017) generates a particularly elegant adjustment of the effective towards the *normal* utilisation capacity in a context where the Keynesian effective demand principle operates even in the long run.[13] This model is derived from a basic macroeconomic identity, where in equilibrium between aggregate demand and output, which can be represented by the identity below,

$$Y = C_w + I + Z \tag{2.29}$$

where Y is the current level of aggregate output, C_w is the aggregate induced consumption, I is the gross aggregate investment and Z is aggregate autonomous consumption and can be defined as ‘that part of aggregate consumption financed by credit and, therefore, unrelated to the current level of output resulting from firms’ production decisions’ (Freitas & Serrano, 2014, 2015, p. 4).[14] Assuming that the marginal propensity to consume out of wages is equal to one and given the wage share (exogenous distribution in a Classical sense), aggregate

[12]For the historical roots of the term ‘Supermultiplier’ see King (2008).

[13]For a critique of the SSM see Nikiforos (2018) from a *particular* Neo-Kaleckian viewpoint and Skott (2019) from a Harrodian viewpoint. The main critique is that it is hard to claim that the autonomous components are really autonomous.

[14]This component could embody a diversity of expenditures. In Serrano’s thesis (1995b) it is mentioned that ‘the types of expenditure that should be considered autonomous [. . .] include: the consumption of capitalists; the discretionary consumption of richer workers that have some accumulated wealth and access to credit; residential ‘investment’ by households ; firms’ discretionary expenditures (that are sometimes classified as ‘investment’ and sometimes as ‘intermediate consumption’ in official statistics) that do not include the purchase of produced means of production such as consultancy services, research & development, publicity, executive jets, etc.; government expenditures (both consumption and investment); and total exports (both of consumption and of capital goods since the latter do not create capacity within the domestic economy).’ (ibid., pp. 15-16, fn. 9).

induced consumption can be expressed in the following way:

$$C_w = \omega Y \tag{2.30}$$

where ω is the wage share. Furthermore, if I define h as the marginal propensity to invest of capitalists (or the investment share, I/Y), identity (2.29) can be reduced to the following one:

$$Y = (\omega + h)Y + Z \tag{2.31}$$

Thus, $\omega + h$ can be considered the marginal propensity to spend of the economy as a whole. In equilibrium:

$$Y = (\frac{1}{s-h})Z \tag{2.32}$$

where $s = 1 - \omega$. Given the capital-output ratio $v = K/Y_K$, where Y_K is full capacity output and K is the level of installed capital stock, capacity utilisation can be defined as $u = Y/Y_K$, and its rate of growth as $g_u = g - g_K$.[15] Replacing $g_u = \dot{u}/u$ I can derive the behaviour through time of the level of capacity utilisation,

$$\dot{u} = u(g - g_K) \tag{2.33}$$

Whenever the rate of growth of aggregate demand (g) is higher (lesser) than the rate of capital accumulation (g_K), the effective capacity utilisation will increase (decrease). Since v is given, after some algebraic manipulations[16], the rate of capital accumulation by definition:

$$g_K = \frac{I/Y}{v}u \tag{2.34}$$

The above identity states that the rate of capital accumulation is equal to the investment share I/Y divided by the *technical* capital-output ratio v and multiplied by utilisation capacity level u.

The marginal propensity to invest, moreover, is endogenous in the long run. Changes are explained by the tendency of capacity to adjust to demand. The mechanism is the following one: Given a planned capacity utilisation, under free competition, entrepreneurs will try to reach the former in the long-run through changes in the size of capacity - investment or disinvestment process. In this sense, h could be 'provisionally' assumed as given in the short

[15] Since v is given, the rate of growth of capacity-output is equal to the rate of growth of capital accumulation.

[16] Assuming depreciation of capital is zero and dividing the well-known law of capital accumulation $I = \dot{K}$ by K, I can derive that $\dot{K}/K = I/K = g_K$, and multiplying and dividing by Y and Y_K (i.e., $\frac{I}{K} = \frac{I}{Y}\frac{Y}{Y_K}\frac{Y_K}{K}$) I can conclude a specific relationship between capital accumulation, capital-output ratio and utilisation capacity.

run (Freitas & Serrano, 2015, p. 4), so any increase in demand leads to an increase in u; in the long run, h could be considered endogenous, and the flexible accelerator investment function can be defined as follows,

$$\dot{h} = h\gamma_u(u - u_n) \tag{2.35}$$

where $\dot{h}$ is the change of investment share through time, γ_u is a parameter between 0 and 1 (in general, a low value), u_n the *normal* capacity utilisation.[17] Deriving equation (2.31) with respect to time, I get the following expression for g:

$$g = g_Z + \frac{h\gamma_u(u - u_n)}{s - h} \tag{2.36}$$

The rate of growth of aggregate output is driven by autonomous components of effective demand (in this case, autonomous capitalists' consumption) plus a term that takes into account the adjustment of capacity. Replacing equation (2.34) and equation (2.36) into equation (2.33) it is easy to arrive at the following system of dynamic equations:

$$\dot{h} = h\gamma_u(u - u_n)$$

$$\dot{u} = u\left(g_Z + \frac{h\gamma_u(u - u_n)}{s - h} - \frac{h}{v}u\right) \tag{2.37}$$

While in the fully adjusted situation $\dot{h} = \dot{u} = 0$, then $u = u_n$ and $g_Z = g_K = g_I = g^*$. The stability and unique equilibrium of the model is guaranteed by the fact that Jacobian's matrix determinant is positive and its trace is negative,

$$\boldsymbol{J} = \begin{bmatrix} \frac{\partial \dot{h}}{\partial h} & \frac{\partial \dot{h}}{\partial u} \\ \frac{\partial \dot{u}}{\partial h} & \frac{\partial \dot{u}}{\partial u} \end{bmatrix} = \begin{bmatrix} 0 & \frac{\gamma v g_Z}{u_n} \\ -\frac{u_n^2}{v} & \frac{s\gamma u_n}{s - \frac{v}{u_n}g_Z} - \gamma u_n - g_Z \end{bmatrix}$$

$$det\,\boldsymbol{J} = \gamma u_n g_Z$$

$$Tr\,\boldsymbol{J} = \frac{s\gamma u_n}{s - \frac{v}{u_n}g_Z} - \gamma u_n - g_Z$$

[17] Also from equation (2.36) and knowing that $I/Y = h$ I can derive the rate of growth of investment $I/K = g^I = g + \gamma_u(u - u_n)$.

It is assumed that γ, u_n and g_Z are positive values so the determinant is positive. Given a sufficient low value of γ, the Trace is negative.[18]

2.5 Conclusions

In recent years, after the development and rediscoverment of the Sraffian Supermultiplier (Monza, 1976; Bortis, 1979, 1984; Serrano, 1995a, 1995b; Cesaratto, Serrano and Stirati, 2003; Freitas and Dweck, 2013; Dejuán, 2013, 2014, 2017; Freitas & Serrano, 2015, Lavoie, 2017), non-mainstream growth theory has reach a crossroad. In this chapter I only made a brief presentation of the main models that I will discuss and take into account in this thesis. Some recent contributions from the Neo-Kaleckian side of the debate have reborn some debates regarding capacity utilisation. This topic will be discussed along this thesis.

2.6 References

Allain, O. (2015). Tackling the instability of growth: a Kaleckian-Harrodian model with an autonomous expenditure component. *Cambridge Journal of Economics, 39*(5), 1351-1371.

Allain, O. (2019). Demographic growth, Harrodian (in) stability and the supermultiplier. *Cambridge Journal of Economics, 43*(1), 85-106.

Amadeo, E. J. (1986a). Notes on capacity utilisation, distribution and accumulation. *Contributions to Political Economy, 5*(1), 83-94.

Amadeo, E. J. (1986b). The role of capacity utilization in long-period analysis. *Political Economy, 2*(2), 147-160.

Braga, J. de Medeiros (2020). Investment rate, growth, and the accelerator effect in the supermultiplier model: the case of Brazil. *Review of Keynesian Economics, 8*(3), 454-466.

Bortis, H. (1979). Foreing resources and economic development from the early fifties to hte oil-crisis. Éditions Universitaires.

[18] For a detailed analysis of the stability of the model see Freitas and Serrano (2015).

Bortis, H. (1984). Employment in a capitalist economy. *Journal of Post Keynesian Economics, 6*(4), 590-604.

Bortis, H. (1997). Institutions, behaviour and economic theory: a contribution to classical-Keynesian political economy. Cambridge University Press.

Cesaratto, S., Serrano, F., & Stirati, A. (2003). Technical change, effective demand and employment. *Review of political economy, 15*(1), 33-52.

Cesaratto, S. (2015). Neo-Kaleckian and Sraffian controversies on the theory of accumulation. *Review of Political Economy, 27*(2), 154-182.

Ciccone, R. (1986). Accumulation and capacity utilization: some critical considerations on Joan Robinson's theory of distribution. *Political Economy, 2*(1), 17-36.

Ciccone, R. (1987). Accumulation, capacity utilization and distribution: a reply. *Political Economy, 3*(1), 97-111.

Committeri, M. (1986). Some comments on recent contributions on capital accumulation, income distribution and capacity utilization. *Political Economy, 2*(2), 161-186.

Cynamon, B. Z., & Fazzari, S. M. (2017). Household income, demand, and saving: deriving macro data with micro data concepts. *Review of Income and Wealth, 63*(1), 53-69.

Dejuán, Ó. (2013). Normal paths of growth shaped by the supermultiplier. In Sraffa and the Reconstruction of Economic Theory: Volume Two (pp. 139-157). Palgrave Macmillan, London.

Dejuán, Ó. (2014). The supermultiplier as a vertically hyperintegrated sector. Centro Sraffa Working Papers, 4, 1-23.

Dejuán, Ó. (2017). Hidden links in the warranted rate of growth: the supermultiplier way out. *The European Journal of the History of Economic Thought, 24*(2), 369-394.

Del Monte, A. (1975). Grado di monopolio e sviluppo economico. *Rivista internazionale di scienze sociali, 46*(Fasc. 3), 231-263.

Dutt, A. K. (1984). Stagnation, income distribution and monopoly power. *Cambridge Journal of Economics, 8*(1), 25-40.

Dutt, A. K. (1997). Dependence And Hysteresis In Post Keynesian Models. Markets, Unemployment, and Economic Policy, 2, 238.

Dutt, A. K. (2010). Equilibrium, stability and path dependence in post-Keynesian models of economic growth. Production, Distribution and Trade: Alternative Perspectives, 114, 233.

Fazzari, S. M., Ferri, P. E., Greenberg, E. G., & Variato, A. M. (2013). Aggregate demand, instability, and growth. *Review of Keynesian Economics, 1*(1), 1-21.

Fazzari, S. M., Ferri, P., Variato, A. M. (2020). Demand-led growth and accommodating supply. *Cambridge Journal of Economics, 44*(3), 583-605.

Fiorito, A. (2018). Supermultiplicador Clásico y Crecimiento Económico Dirigido por la Demanda en la Argentina. Master Thesis, University of Buenos Aires.

Fiebiger, B., & Lavoie, M. (2019). Trend and business cycles with external markets: Non-capacity generating semi-autonomous expenditures and effective demand. *Metroeconomica, 70*(2), 247-262.

Fiebiger, B. (2018). Semi-autonomous household expenditures as the causa causans of postwar US business cycles: the stability and instability of Luxemburg-type external markets. *Cambridge Journal of Economics*, (1), 155-176.

Freitas, F. N., & Dweck, E. (2013). The pattern of economic growth of the Brazilian economy 1970–2005: a demand-led growth perspective. In Sraffa and the Reconstruction of Economic Theory: Volume Two (pp. 158-191). Palgrave Macmillan, London.

Freitas & Serrano, F. (2014). Growth, Distribution and Effective Demand: the supermultiplier growth model alternative. mimeo.

Freitas, F., & Serrano, F. (2015). Growth rate and level effects, the stability of the adjustment of capacity to demand and the Sraffian supermultiplier. *Review of Political Economy, 27*(3), 258-281.

Freitas, F., & Christianes, R. (2020). A baseline supermultiplier model for the analysis of fiscal policy and government debt. *Review of Keynesian Economics, 8*(3), 313-338.

Gahn, S. J., & González, A. (2019). On the empirical content of the convergence debate: Cross country evidence on growth and capacity utilisation (No. PKWP1922).

Girardi, D., & Pariboni, R. (2016). Long-run effective demand in the US economy: An empirical test of the sraffian supermultiplier model. *Review of Political Economy, 28*(4), 523-544.

Girardi, D., & Pariboni, R. (2020). Autonomous demand and the investment share. *Review of Keynesian Economics, 8*(3), 428-453.

Góes, M. C. B., Moraes, V. D., & Gallo, E. (2018). The Supermultiplier Model and the Role of Autonomous Demand: An Empirical Test for European Countries.

Garegnani, P. (1992). Some notes for an analysis of accumulation. In Beyond the steady state (pp. 47-71). Palgrave Macmillan, London.

Garegnani, P., & Palumbo, A. (1997). Accumulation of capital (No. 0002). Department of Economics, University Roma Tre.

Garegnani, P., & Palumbo, A. (1998). Capital Accumulation. The Elgar Companion to Classical Economics.

Garegnani, P. (2013). Notas para un análisis de la acumulación. Revista Circus.

Haluska, G., Braga, J., & Summa, R. (2019). Growth, Investment Share and the Stability of the Sraffian Supermultiplier Model in the United States Economy (1985-2017).

Harrod, R. F. (1939). An essay in dynamic theory. *The economic journal, 49*(193), 14-33.

Hein, E. (2014). Distribution and growth after Keynes: A Post-Keynesian guide. Edward Elgar Publishing.

Hein, E., Lavoie, M., & van Treeck, T. (2011). Some instability puzzles in Kaleckian models of growth and distribution: a critical survey. *Cambridge Journal of Economics, 35*(3), 587-612.

Hein, E., Lavoie, M., & van Treeck, T. (2012). Harrodian instability and the 'normal rate'of capacity utilization in Kaleckian models of distribution and growth—a survey. *Metroeconomica, 63*(1), 139-169.

Kaldor, N. (1957). A model of economic growth. *The economic journal, 67*(268), 591-624.

King, J. E. (2008). Josef Steindl and the Instability of Capitalism. *Review of Political Economy, 20*(3), 333-340.

Lavoie, M. (1995). The Kaleckian model of growth and distribution and its neo-Ricardian and neo-Marxian critiques. *Cambridge Journal of Economics, 19*(6), 789-818.

Lavoie, M. (1996). Traverse, hysteresis, and normal rates of capacity utilization in Kaleckian models of growth and distribution. *Review of Radical Political Economics, 28*(4), 113-147.

Lavoie, M., Rodriguez, G., & Seccareccia, M. (2004). Similitudes and discrepancies in post-Keynesian and Marxist theories of investment: a theoretical and empirical investigation. *International Review of Applied Economics, 18*(2), 127-149.

Lavoie, M. (2010). Surveying short-run and long-run stability issues with the Kaleckian model of growth. Handbook of alternative theories of economic growth, 132-56.

Lavoie, M. (2014). Post-Keynesian economics: new foundations. Edward Elgar Publishing.

Lavoie, M. (2016). Convergence Towards the Normal Rate of Capacity Utilization in Neo-K aleckian Models: The Role of Non-Capacity Creating Autonomous Expenditures. *Metroeconomica, 67*(1), 172-201.

Lavoie, M. (2017). Prototypes, reality and the growth rate of autonomous consumption expenditures: a rejoinder. *Metroeconomica, 68*(1), 194-199.

Mandarino, G. V., Dos Santos, C. H., & e Silva, A. C. M. (2020). Workers' debt-financed consumption: a supermultiplier stock–flow consistent model. *Review of Keynesian Economics, 8*(3), 339-364.

Médici, F. (2011). Un análisis de cointegración del principio de la demanda efectiva en Argentina (1980-2007). Ensayos Económicos, 61.

Monza, A. (1976). Crecimiento y demanda. *El Trimestre Económico, 43*(169 (1), 107-140.

Nah, W. J., & Lavoie, M. (2017). Long-run convergence in a neo-Kaleckian open-economy model with autonomous export growth. *Journal of Post Keynesian Economics, 40*(2), 223-238.

Nikiforos, M. (2018). Some comments on the Sraffian Supermultiplier approach to growth and distribution. *Journal of Post Keynesian Economics, 41*(4), 659-675.

Pariboni, R. (2015). Autonomous demand and capital accumulation: three essays on heterodox growth theory. Doctoral dissertation.

Passinetti, L. (1962). The Rate of Profit and Income Distribution in Relation to the Rate of Economic Growth. *Review of Economic Studies, 29*(4), 267-79.

Pérez-Montiel, J. A., & Erbina, C. M. (2020). Autonomous expenditures and induced investment: a panel test of the Sraffian supermultiplier model in European countries. *Review of Keynesian Economics, 8*(2), 220-239.

Robinson, J. (1962). A model of accumulation. In Essays in the Theory of Economic Growth (pp. 22-87). Palgrave Macmillan, London.

Rowthorn, B. Demand, real wages and economic growth'(1981). *Thames Papers in Political Economy*, 1-39.

Serrano, F. (1995a). Long period effective demand and the Sraffian supermultiplier. Contributions to Political Economy, 14(1), 67-90.

Serrano, F. (1995b). The Sraffian Supermultiplier. Unpublished Phd Thesis, University of Cambridge, UK.

Serrano, F. (2015). Acumulação de Capital, grau de utilização da capacidade e distribuição nos modelos pós Keynesianos. mimeo.

Serrano, F., & Freitas, F. (2017). The Sraffian supermultiplier as an alternative closure for heterodox growth theory. *European Journal of Economics and Economic Policies: Intervention, 14*(1), 70-91.

Serrano, F., Freitas, F., & Bhering, G. (2019). The Trouble with Harrod: the fundamental instability of the warranted rate in the light of the Sraffian Supermultiplier. *Metroeconomica, 70*(2), 263-287.

Serrano, F., Summa, R., & Moreira, V. G. (2020). Stagnation and unnaturally low interest rates: a simple critique of the amended New Consensus and the Sraffian supermultiplier alternative. *Review of Keynesian Economics, 8*(3), 365-384.

Skott, P. (2019). Autonomous demand, Harrodian instability and the supply side. *Metroeconomica, 70*(2), 233-246.

Taylor, L. (1983). Structuralist macroeconomics: Applicable models for the third world. Basic Books.

Taylor, L. (1985). A stagnationist model of economic growth. *Cambridge Journal of Economics, 9*(4), 383-403.

Vianello, F. (1985). The pace of accumulation. *Political Economy: Studies in the Surplus Approach, 1*(1), 69-87.

3 Some recent Neo-Kaleckian contributions: a critique

3.1 Introduction

It is well known that the convergence (or the lack of) towards *normal* capacity utilisation is one of the most controversial issues within Post-Keynesian tradition. As Hein et al. (2012) recognise, from a Marxian, Sraffian or Classical tradition 'at least in the long run, there ought to be some mechanism bringing back the actual rate of capacity utilization towards some 'normal rate', or to the target rate from the perspective of the firm' (Hein et al., 2012, p. 140) in order to get a Fully Adjusted Situation.[1]

On these grounds, some solutions have been proposed. One solution is related to 'authors trained in a Sraffian, Marxist or Classical tradition, in most models they conceive of desired utilization as a given and fixed magnitude determined in the end by some sort of profit maximization' (Franke, 2020, p. 1); here I might include the Sraffian Supermultiplier (Monza, 1976; Bortis, 1984, 1997; Serrano, 1995; De-Juán, 2005, 2013, 2014, 2017) and the Neo-Kaleckian model with autonomous components (Lavoie, 2016). From the Neo-Kaleckian side, three different proposals have been outlined: First, some Neo-Kaleckian authors treat the rate of *normal* capacity utilisation as an accommodating (endogenous) variable even in the long-run under different economic *rationales* (Lavoie, 1995, 1996; Lavoie et al., 2004; Nikiforos, 2013, 2016; Setterfield & Avritzer, 2020). Second, some present a *corridor* of stability approach (Dutt, 1990; Setterfield, 2019; Franke, 2020), so there is no *single* normal rate of capacity utilisation but a range. Third, capacity utilisation is

[1] Fully Adjusted Situation (FAS, hereafter) is defined in Vianello (1985) as 'situations in which a uniform rate of profits prevails, and the productive capacity installed in each industry is exactly sufficient to produce the quantities that the market absorbs when commodities are sold at their natural prices' (Vianello, 1985, p. 70) or 'productive capacity is normally utilised and a uniform rate of profits prevail' (ibid., p. 71). For a critique of FAS see Chapter 4.

a *free-variable* to solve distributive conflicts (Dallery & van Treeck, 2011).

In the face of these possible solutions, a number of criticisms emerged, which can be summarised in the following papers: Girardi and Pariboni (2019), Fiebiger (2020), Haluska (2020) and Huang (2020). But recently, since there are new contributions from the Neo-Kaleckian side, I will try to find new critical points to these new proposals.

After presenting the baseline Neo-Kaleckian model and its version with endogenous *normal* utilisation, I will discuss these new contributions that, directly or indirectly, deal with the issue of convergence: Nikiforos (2016), Setterfield & Avritzer (2020), Franke (2020) and Petach and Tavani (2019). In my view, the solutions put forward in each case are very specific and do not have the capacity to explain the more general case.

3.2 The Neo-Kaleckian model

3.2.1 The baseline Neo-Kaleckian model

The baseline Neo-Kaleckian model, as presented in textbook form by Lavoie (2014) or Hein (2014), assumes a closed economy with no government sector, no technical progress, no depreciation of the capital stock, a fixed-coefficient production technology, an infinitely elastic labour supply and no workers' savings. I will assume a one-good-economy. These assumptions will carry on to all the models studied in this thesis. The baseline model can be described by the use of two equations,

$$\frac{I}{K} = \gamma + \gamma_u(u - u_n) \tag{3.1}$$

$$\frac{S}{K} = s_\pi \frac{\pi u}{v} \tag{3.2}$$

The first equation postulates that the rate of accumulation is a function of γ, which is interpreted as the expected trend growth rate of sales or simply 'animal spirits', and the discrepancy between actual capacity utilisation (u) and the desired or normal rate (u_n)[2]; γ_u is a parameter. The second one is the saving equation, which is simply the product of the marginal propensity to save out of profits (s_π) and the profit rate (r), the latter written as the

[2] It must be clarified that in the original versions of the baseline Neo-Kaleckian model, the notion of *normal* utilisation is not discussed: Rowthorn (1981), Dutt (1984, 1987), Taylor (1985), among others. As far as I know, the first author that introduce this notion in a Neo-Kaleckian framework is Amadeo (1986a, 1986b, 1987). For a definition of *normal* utilisation, see Appendix A.0 p. 58 of this thesis.

product of the profit share (π), capacity utilisation, and the inverse of the capital-output ratio (v).

In equilibrium, $I = S$ which is equivalent to stating that (3.1) = (3.2). The baseline model assumes that capacity utilisation is the variable that adjust to bring equilibrium in the goods markets; its steady-growth value is:

$$u^* = \frac{v(\gamma - \gamma_u u_n)}{s_\pi \pi - \gamma_u v} \tag{3.3}$$

It is usually *assumed* that the Keynesian stability condition holds; this condition states that $s_\pi \pi > \gamma_u v$, intuitively, it means that the slope of the savings function is bigger than the slope of the investment function. I will *assume* this condition holds both in the baseline model and in the extension explored below. The equilibrium growth rate[3] in the baseline model - which is obtained by plugging equation (3.3) in (3.2) - is equal to:

$$g^* = \frac{s_\pi \pi(\gamma - \gamma_u u_n)}{s_\pi \pi - \gamma_u v} \tag{3.4}$$

This model allows for the upraising of the paradoxes of thrift and costs. The paradox of thrift implies that higher savings rates lead to reduced output (Keynes, 1936) and accumulation, broadly speaking, a higher propensity to save (s) reduces the size of the multiplier what diminishes the *level* of output. The paradox of costs implies that higher real wages lead to higher profit rates (Kalecki, 2016; Rowthorn, 1981) and also operates through the multiplier.

3.2.2 Closing the gap: Neo-Kaleckian model with endogenous *normal* utilisation

A response to the absence of convergence between the actual and the desired rate is to assume that the normal rate is an *endogenous* variable itself, which adjusts to close the gap. This model was developed by Lavoie (1996, pp. 138-142), but models with a similar structure can be found in Amadeo (1986a, 1986b) and Dutt (1997), among others. Following Lavoie's model, it consists of the next equations:

$$\frac{I}{K} = \gamma + \gamma_u(u - u_n) \tag{3.5}$$

[3]The equilibrium growth rate could be defined as the rate of growth compatible with an equalization of savings and investment per unit of capital.

$$\frac{S}{K} = s_\pi \frac{\pi u}{v} \tag{3.6}$$

$$\dot{u_n} = \sigma(u - u_n) \tag{3.7}$$

$$\dot{\gamma} = \phi(g - \gamma) \tag{3.8}$$

Thus, the new model adds two differential equations: Equation (3.7), which states that the *normal* rate of capacity utilisation changes according to the discrepancy between the actual and normal rate, and equation Equation (3.8), which states that the expected trend growth of sales increases whenever the actual growth rate of capital is above the secular trend. Here I present the steady-state values of both normal capacity utilisation and the accumulation rate. *Normal* capacity utilisation is equal to:

$$u_n = \frac{C\sigma v}{s_\pi \pi \sigma - \phi v \gamma_u} \tag{3.9}$$

where C is a constant of integration. Note that the steady-state accumulation rate can be obtained, which will be equal to γ, by simply substituting the steady-state normal utilisation rate in the differential equation for the accumulation rate. This gives,

$$\gamma = \frac{C\sigma s_\pi \pi}{s_\pi \pi \sigma - \phi v \gamma_u} \tag{3.10}$$

where C is again a constant of integration. In this case, even a convergence between u and u_n allows for the paradox of thrift and the paradox of costs to hold. If u is allowed to vary then a simple change in one parameter leads to a permanent change in u, u_n will follow.

The fact that *normal* utilisation changes with the difference between *normal* and effective utilisation is not profoundly justified. See Appendix A.0 for Some clarifications on the definition of *normal* utilisation.

3.3 Some recent Neo-Kaleckian contributions: a critique

Recently some authors have worked within a Neo-Kaleckian theoretical framework to justify that normal utilisation follows the effective one, and not the other way around. Among the authors who could fit into these classification I will discuss the writings of Nikiforos (2016), Franke (2020), Petach and Tavani (2019) and Setterfield and Avritzer (2020).

Nikiforos presents a micro model from which the normal level of utilisation is associated to a single level of production, therefore each change in the level of product will generate, under particular returns to scale, a change in the normal level; an increase in the growth rate, not expected, triggers an increase in the level of production at the firm level, which makes the method of production change (i.e. the normal utilisation). Therefore, the effective level of utilisation determines the normal level.

In Setterfield and Avritzer (2020), the mechanism is different, the level of growth of the economy, by changing the level of output and the level of effective utilisation will generate particular expectations in entrepreneurs and this leads to a change in normal utilisation. They associate a higher level of utilisation with lower aggregate volatility and therefore lower normal utilisation. Thus, normal utilisation is also modified by recent experience of effective utilisation of capacity.

Finally, Franke (2020) as well as Petach and Tavani (2019) differentiate, in similar ways, the aggregate utilisation from the normal utilisation at the firm level. By means of a special mechanism, the aggregate utilisation modifies the cost function of the firms, and therefore, they choose to change the level of normal utilization. This is how the normal utilization follows the actual aggregated utilization.

Since all these developments contain elements that can be discussed in depth, the aim of this chapter is to discuss these 4 papers and the different mechanisms they present.

3.3.1 A cost-minimizing Neo-Kaleckian model with returns to scale

In a recent contribution, Michalis Nikiforos (2011a, 2011b, 2013, 2016) analyses theoretically possible determinants of the *normal* level of capacity utilisation at a firm level. Based on Kurz (1986) and Betancourt & Clague (1981), he studies returns to scale as a driver of the *normal* level of capacity as a result of *indivisibilities* of plant and equipment, finally he closes the Neo-Kaleckian model in a very particular way, making possible that 'it is the desired level of utilization that converges towards the actual rate and not the other way around' (Nikiforos, 2013, p. 515) under an *objective* - cost-minimising - framework. According to this author, the *normal* or *desired* utilisation is determined under the cost-minimising principle and there is no reason to change this desired rate unless the underlying reasons associated with the cost-minimisation problem change (ibid., p. 2). As I have recently shown in the introductory chapter, some recent developments imply that it is the desired rate of utilisation that adjusts to the actual rate and not the other way around. According to

Nikiforos (2016), although this argument presented by many authors (Lavoie, 1995; Lavoie, 1996; Lavoie et al. 2004; among others) is formally correct, it lacks a coherent economic rationale and it is unjustified; the Neo-Kaleckian side does not explain why the desired rate of utilisation behaves in the way it is described in equation (3.7) and some authors claim that this is a *convention*. Broadly speaking, Nikiforos' research question is: Why would a deviation of the actual utilisation from the desired rate induce the entrepreneurs to revise their desired rate? (ibid., p. 7).

The theoretical argument by which the *normal* level of capacity utilisation might become *endogenous* in the long run is based on the notion of returns to scale. These returns to scale are a result of *indivisibilites* present in the productive capacity: the firm[4] 'will tend to utilize its capital more - adopt a double shift system - as the demand for its output grows, if the rate of the returns to scale decreases' (ibid., p. 516). Nikiforos claims are set into two different strands: an empirical and a theoretical side. First, although he starts from a micro theoretical level, I will focus on the theoretical macroeconomic one and its interactions between the macro and the firm level.

In the macro sphere, following a Neo-Kaleckian model with endogenous *normal* utilisation as described above,

$$\frac{I}{K} = \gamma + \gamma_u(u - u_n)$$

$$\frac{S}{K} = \frac{s_\pi \pi u}{v}$$

$$\dot{u_n} = \alpha(u^* - u_n)$$

$$\dot{\gamma} = \mu(g - \gamma)$$

He includes the following equation, to fill the gap between the firm-level and the macro model,

$$\dot{Q} = \kappa(g - \gamma) \tag{3.11}$$

where Q is the demand for the product of the firm g is the effective and γ the expected rate of accumulation. And then he derives the following one,

$$\dot{u_n} = \varsigma(g - \gamma) \tag{3.12}$$

[4] The author states that the lack of an economic rationale of the Neo-Kaleckian model has its origin at the firm level (ibid., p. 15).

Equation (3.11) implies that whenever the effective rate of accumulation is higher (lower) than the expected one, there will be a positive (negative) change in the *level* of output produced by the firm and, therefore, in the *normal* rate of capacity utilisation [Equation (3.12)]. This equation is derived from his micro-model (Nikiforos, 2013). After some manipulations of equation (3.11) it is easy to arrive to,

$$\dot{u_n} = \alpha(u^* - u_n)$$

validating the Neo-Kaleckian adjustment with endogenous *normal* utilisation of capacity.

What's the effect of a change in the level of output on capacity utilisation? Let us start at a firm level. Given *indivisibilities* on productive capacity, a change in Q will trigger a change on u_n. Nikiforos claims that,

$$u_n = f(Q)$$

from his 'micro' model (Nikiforos, 2013).[5] For each different *level* of demand for the product of the firm, the firm will perform a different *level* of normal utilisation: 'Every entrepreneur when she takes a decision about the technique of production or the level of utilisation that is best suited for her firm has in mind a *certain level* of demand for the product of the firm.' (Nikiforos, 2016, p. 15, fn. 21, emphasis added in *italics*). So given each u_n - that is part of the method of production - can only produce a particular level of demand, each shift in demand at a firm level will push a change of method, it means a shift of the wage-profit frontier[6]. The step-by-step explanation is the following one: Given indivisibilities at a firm level, an increase in the level of demand will allow the firm to switch to another method of production that was not cost-minimizing before. This method allows the firm, *supposedly*, to produce at lower average (and marginal) cost and higher normal rate of capacity utilisation (see Figure 3.3. and 3.4.).

Nikiforos' view was criticized on many fronts by many authos (Girardi and Pariboni, 2019; Fiebiger, 2020 and Haluska, 2020; Huang, 2020). Here I will take some of these critics and I will develop other furtherly.

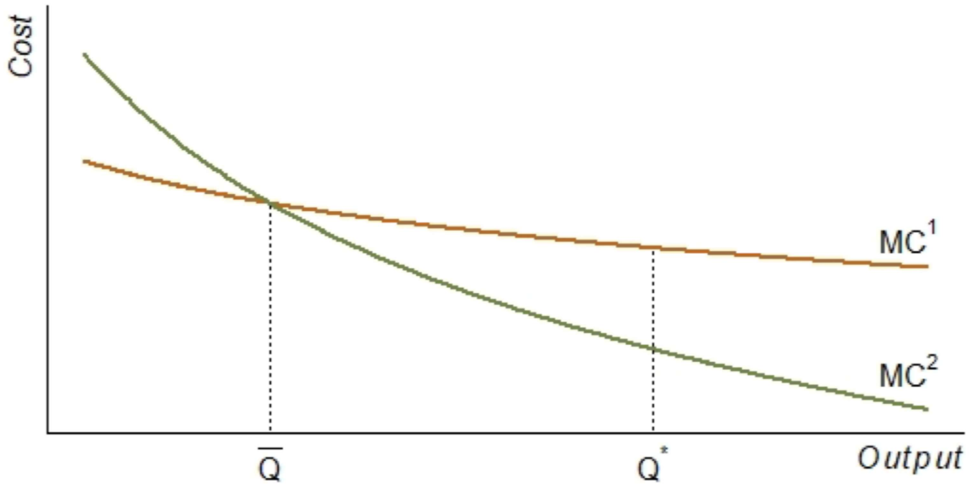
That there are increasing returns to scale at the firm and aggregate level is possible and theoretically logical.[7] It is also logical that an increase in output leads to a review of available

[5]See Girardi & Pariboni (2019) for a critique of the 'micro' model and Nikiforos (2020) for a reply.

[6]This is explicitly recognised by the author in Nikiforos (2020, p. 16-17, fn. 6)

[7]Girardi & Pariboni (2019) claim 'the cost functions do not actually imply increasing returns to scale according to the conventional definition' (ibid., p. 2). Actually, the double-shift system displays *constant*

Figure 3.1 Marginal costs and output



Source: Nikiforos, 2020, p. 20.

production methods, especially when investing in new installed capital that contains the dominant technique. In case these new methods imply a higher level of normal utilisation will *allow for* a higher level of normal rate of profit.[8] What seems difficult to accept is that this mechanism can be generalized to all industries. In fact, while some industries might present an increasing trend of normal capacity utilisation through time, others do not and the overall effect could be uncertain. This is hard to compatibilize with Nikiforos' view at the aggregate.[9]

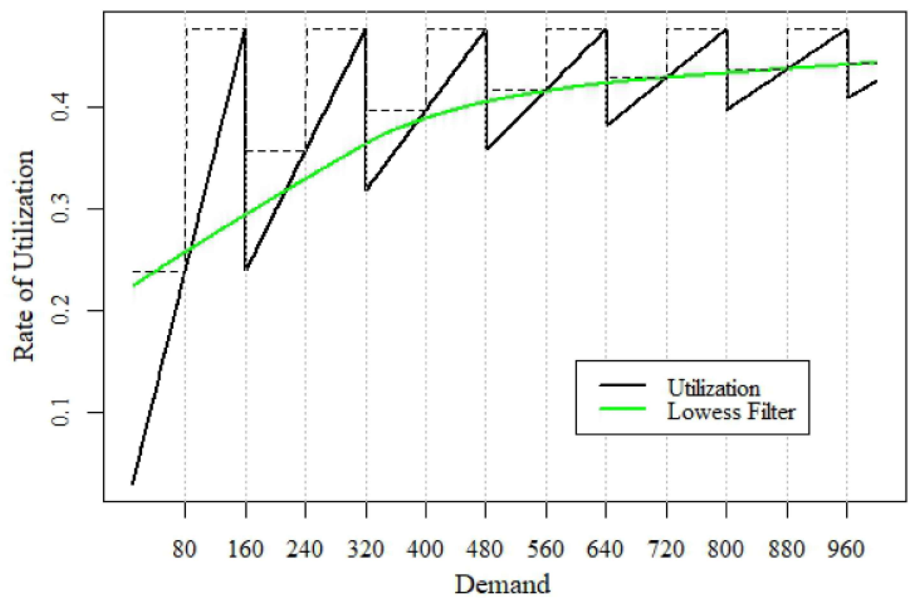
If I retrace my steps and return to the theoretical macroeconomic development of Nikiforos, I overlooked the idea of differentiating expected and unexpected changes in demand. It is important to note that when the expected growth equals the effective one, the firm decides not to increase its productive capacity, and that the increase in aggregate productive capacity occurs through the incorporation of new firms (of the same size) into the market. It is

returns to scale and the single-shift system displays *decreasing* returns to scale (ibid., p. 9). Nikiforos (2020) claims that they did not interpret correctly his model. Although I am not discussing this issue here, I was not able to find a decreasing average cost in the first shift of Nikiforos' model at a firm level, model developed in Nikiforos (2013).

[8]Given the capital stock, a change in the level of demand - and utilisation - will allow the firm to increase the ratio P/K. Therefore, if the level of demand is smoothly increasing - as it seems to be in the capitalist system the last decades - there will be a tendency to increase the level of utilisation and, as a result, the rate of profits. But this has a *natural* limit that it is a physical limit for the installed capital.

[9]The normal rate of return, in this case, would be determined by the level of product, in a scheme very similar to that of the Cambridge equation. In short, the distribution of income would be endogenous. One of the essential points of the Neo-Kaleckian model, which is the exogenous distribution of income, would also be lost.

Figure 3.2 Demand and capacity utilisation



Source: Nikiforos, 2020, p. 25.

difficult to understand that the expected market growth is, for example, 5% and the firm does not increase its productive capacity by 5%. It is worth asking, who is expecting the 5% market growth if not the firms? Expectations are formed at a firm level (these are subjective), therefore in a peculiar way, when the expectations are realized and the firm expect to grow at 5%, and therefore, increase the productive capacity to 5%, it could happen that the firm ends up producing the same - given that the product level does not change at the level of the firm in equilibrium - with a larger capacity, that is, with a lower utilisation of the installed capacity. Otherwise, the expectation of a rate of growth equal to a 5% will not generate any consequence at a firm level and therefore the notion of 'expectation' looses its meaning. The point is that the expectations (which are at firm level) do not generate the expected results at firm level - which is the increase in installed capacity when the expected level of demand is higher. For the model to close as Nikiforos claims, it is necessary that the growth in steady-state be completely absorbed by new firms that instantly create productive capacity, an assumption that seems a bit restrictive for an accumulation theory.

On the other hand, the firm faced with an increase in demand equal to that expected does not increase its effective utilisation of capacity to dispute the market share[10] of the new firms that enter. Somehow the model is based on the partial denial of the principle of competition. When the expected and effective rate of growth are equal, firms do not compete, they do not even increase their level of production[11]; when the expected and effective rate of growth are different, firms compete to increase their market share or, at least, to maintain it.

In a response to some of these critiques, Nikiforos (2020) claims that 'what matters for investment is not the current or expected level of demand per se, but rather expected flows of demand over the lifetime of the invested capital'. From this, the author suggests that the important variable to decide the rate of utilisation is the growth rate of demand and not the *level*. However, these are not exclusive, in fact as I said before, the productive capacity that is chosen at the time of installing capital is for different levels of expected demand throughout the life cycle of the capital stock. That each of these levels implies a different normal price level to money wages is possible, but that it necessarily implies a higher normal profit for the whole system seems too restrictive. In fact, in Nikiforos' view, if the economy grows at the warranted rate one would be under 'normal conditions' (Nikiforos, 2020, p. 3) and outside of that, the economy would be out of equilibrium. However, when firms are out of equilibrium they do not try to return to the previous equilibrium, but when they leave the equilibrium, the data that determined the previous equilibrium changes, and therefore, the equilibrium itself. In short, there are two different equilibrium here. The first is persistent when the economy grows at the expected rate. The second is also persistent and occurs when the economy does not grow at the expected rate. Beyond the criticisms made above, I think it is possible to find another explanation for Nikiforos' idea. Starting from normal utilisation at an expected growth rate, in the face of an unexpected change in the level of demand, the adjustment of productive capacity occurs both through an increase in the level of utilisation (and size of the firm)[12] and through the incorporation of new firms. This allows the economy as a whole to adjust the productive capacity in order to regain a certain balance between the level of output

[10]Precisely, Haluska (2020) claims that according to Nikiforos firms do not growth on steady state, this hypothesis implies that the real economy presents some sort of deconcentration process in production, converging to a situation similar to perfect competition, where each individual producer is insignificant compared to the size of its market. Actually the market share of the firm tends to zero in equilibrium.

[11]According to Girardi and Pariboni (2019) one way to rationalise this is that the creation of new firms, already having the size of the average existing firm, is given at a rate equal to gamma; but there is no economic justification for this, particularly it might not be compatible with increasing returns to scale.

[12]Empirically, Girardi & Pariboni (2019) presents evidence on an increasing size of the the average firm in the US economy since 1992, so part of the adjustment is through the size of the firms and not only through the quantities of firms, as Nikiforos claims.

and the capital stock.

The usefulness of theoretical equilibrium positions is that they make it possible to predict the direction of adjustment. In the case of Nikiforos (2013, 2016, 2020) an increase in production levels at the firm level - regardless of what triggers this increase in production levels - increases the level of equilibrium utilisation because the data of the problem - that first was taken as given - changes in a particular way. Thus, there would not appear to be theoretical equilibrium positions that allow an adjustment towards that position; simply the new effective position will be the new *normal* position. With the same level of arbitrariness, one could build models where normal utilisation decreases *pari passu* with the level of demand.

Finally, it seems to be that in the case of Nikiforos, there would be no room for the role of fluctuations in demand.[13] If entrepreneurs calculate the productive capacity for different levels of expected demand, and even plan not only the level of productive capacity they install but also simultaneously the intensity (hours and speed) of use for each different level of expected demand the notion of normal utilisation, which is the average expected in the new installed capital, will be calculated and planned already taking into account the use of one, two and three shifts, and even inventories; provided it is profitable to do so. This is done so as not to lose market share. No one denies that there is - in fact, it is highly probable that it will happen as I showed before - potential increasing returns to scale (IRTS), so the average cost of production diminishes until the maximum capacity utilisation is reached, and this does not necessarily implies a change in the equilibrium position. When the level of demand is persistently higher than expected and with the prospect of it remaining so over time, so that even with three shifts the utilisation is not sufficient, the accumulated inventories are not enough, and the prospects of market growth are maintained, the firms will necessarily have to increase the productive capacity. However, the notion of equilibrium does not *need* to be transformed, even in the presence of increasing returns to scale. This is because firms do not minimize costs at one point in time - because if this were the case, they would generally operate only to cover the troughs of demand at maximum utilisation in the presence of IRTS - but plan to maximize profits over several cycles, particularly when fixed capital is taken into account.[14]

[13] For an analysis of fluctuations in demand under a Kaleckian framework see Kalecki (1954, p. 131).

[14] See Buzzell, Gale & Sultan (1975) on the close connection between market share and the return on investmnet (ROI).

The response to the research question of why entrepreneurs would change the normal rate of capacity utilisation with a change in the effective one seems to be answered by Nikiforos in a very restrictive way, therefore it seems to be not a general case.

3.3.2 Another Neo-Kaleckian model with hysteresis in the normal rate of utilisation

As I have explained previously, the hysteresis mechanism of the Neo-Kaleckian model [Equation (3.7)] has been severely criticized, these criticisms focusing on its alleged lack of behavioural foundations - particularly, Skott (2012). The aim of Setterfield and Avritzer (2020) is to present an empirically-grounded behavioural foundation for hysteresis in the normal rate of capacity utilisation.

According to these authors, the volatility of the macroeconomic environment, as captured by the variance of the rate of effective capacity utilisation, plays a crucial role in linking changes in the normal rate of capacity utilisation to changes in the actual rate (Setterfield and Avritzer, 2020, p. 2). The model, although they clarify it is only a linear approximation, can be reduced to the following equations,

$$g^K = \frac{I}{K} = \gamma + \gamma_u(u - u_n) \tag{3.13}$$

$$g^S = \frac{S}{K} = s_\pi \pi u \tag{3.14}$$

$$\sigma_u^2 = f(u),\ f' < 0 \tag{3.15}$$

$$u_n = g(\sigma_u^2),\ g' < 0 \tag{3.16}$$

$$u_n = h(u),\ h' > 0 \tag{3.17}$$

where the first two equations (3.13 and 3.14) correspond to the standard Neo-Kaleckian model, σ_u^2 is actual volatility of effective utilisation as a negative function of the level of effective u in Equation (3.15). Equation (3.16) expresses the negative relationship between macroeconomic volatility - captured by the volatility of effective rate of capacity utilisation - and the *normal* rate of utilisation because ‘firms maintain a conventional degree of excess capacity to insulate themselves against losses of market share arising from unforeseen variations in product demand in an environment of fundamental uncertainty’ (ibid., p. 16) and, finally, Equation (3.17) summarize both previous equations.

In this model, it is clear that the positive relationship between u and u_n, from the last equation, has a Neo-Kaleckian 'normal-to-actual' flavour, and this model actually is an attempt to reinstate or justify the hysteresis mechanism. The 'economic rationale' behind the last three equations is that

> long-term growth dynamics are characterized by long and slow builds, embedded in historically-specific institutional frameworks, during which intervals confidence and animal spirits improve gradually. These long booms are punctuated (and thus brought to an end) by sudden and severe crises that simultaneously fracture the institutional framework on which the previous upswing was based and give rise to sudden and potentially persistent diminutions of confidence and animal spirits
>
> Setterfield & Avritzer, (2020, p. 12),

> crises that, by definition, are associated with a deterioration of macroeconomic performance are also associated with greater macroeconomic volatility, whereas periods of boom are also periods of macroeconomic tranquility
>
> Setterfield & Avritzer, (2020, p. 16),

Therefore, a low level of effective utilisation is associated with higher macroeconomic volatility and vice-versa. This argument is based, supposedly, on an empirical basis. From a theoretical point of view, the observation of Setterfield & Avritzer, relating macroeconomic volatility to levels of *normal* utilisation is interesting and it is a line of research that needs to be deepened. However, there might be some issues that could be put under debate.

While I agree with Skott (2012) and with Setterfield and Avritzer (2020) that the *normal* rate of capacity utilisation is potentially time-varying, Equation (3.16), by construction, gets rid off of the possibility of having an economy that performs high levels of utilisation with high macroeconomic volatility (high σ_u^2). In principle, there is no economic justification to avoid this case.[15] In line with the authors, from a theoretical point of view, one might expect that high volatility of expected output should be associated with lower levels of *normal* utilisation. Although it is not a general and necessary relationship, for more volatile output, in case entrepreneurs would like to feed peaks of demand, they might install a larger size of capacity; therefore more volatility might be associated with lower levels of normal utilisation.[16]

[15] Setterfield and Avritzer (2020) present empirical evidence to explain this ad-hoc relationship, that I will discuss later.

[16] One point I consider relevant but for the authors it would seem not to be so much is that a lower level of *normal* utilisation of installed capacity would imply *necessarily*, a lower *normal* rate of profit - given the

From an empirical standpoint, the history of the US - the country the authors try to explain - does not seem to be validated in this case (see Haluska, Summa and Serrano, 2021). Great volatility during the 1940s and 1950s is associated with high rates of growth and high levels of effective utilisation, while the period of the 'Great Moderation' is linked to low rates of growth, lower volatility and lower rates of capacity utilisation. Their empirical evidence contrast with the consensus in the literature that the Great Moderation implies less macroeconomic volatility (Arias, Hansen & Ohanian, 2007; Blanchard & Simon, 2001; Kim, Nelson & Piger, 2004), and in turn, it is a stylized fact that this has temporarily coincided with a lower level of utilisation.

3.3.3 A Neo-Kaleckian model with a corridor of utilisation

Franke tries to build a bridge between Sraffian and Kaleckian views on utilisation at a *firm* level. Starting from a Sraffian or Marxian perspective that assumes the existence of a unique desired rate of utilisation, he makes the latter dependent on the *effective* profit share and *effective* aggregate utilisation, for a *given capital stock*. This is an important difference from the other works analyzed, since the adjustment is not through the capital stock. The paper presents what could be considered some conclusions suggested from some Sraffians such as a fully adjusted situation in the long-run and a weak pressure on firms to close the utilisation gap. However, I will present some possible liabilities that might weaken the approach.

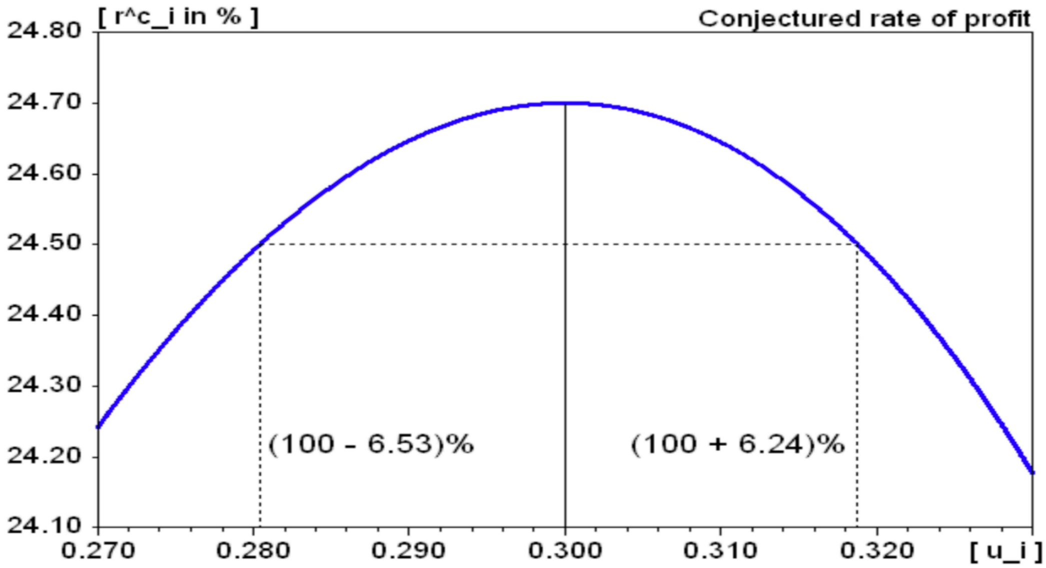
Main Franke's motivation is related to the fact that the relationship between the level of capacity utilisation and the firm's rate of profit should be represented through a non-linear relationship (see Figure 3.3).[17] Inspired by Kurz (1986), the author states that there must be a kind of threshold by which the rate of profits starts to diminish while capacity utilisation increases because of overtime work or night shifts that are more expensive for the firms or simply higher maintenance costs of capital stock.

Franke, then, attempts to conciliate this non-linearity with profit maximisation. The author states that when considering its future revenues under *expected* variations of its utilisation u_i,

real wage. This is a change of at least, the method of production, that one that Setterfield (2019) claimed as impossible given a Leontieff production function. Following this reasoning, at least part of the distribution become endogenous to volatility.

[17]This non-linear profit function is reminiscent of Kurz (1993, p. 76; 1994, p. 477), where he claims that 'The fact that, for any given feasible level of the wage rate, the profit rate is first an increasing and, from a certain point onwards, a decreasing function of the degree of utilisation can be explained in terms of factors such as the empirically observed utilisation-specific profile of labour productivity and wage premia to be paid outside ordinary working hours and days' (ibid., p. 411). Similar point are raised in Lavoie (1992, p. 144) and Arestis et al. (2012).

Figure 3.3 Non-linear relationship between r and u.



Source: Franke's elaboration (p. 13).

the firm cannot expect the profit rate to obey the simple relationship expressed in the current rate of profit ($r_i = \frac{\pi u_i}{v}$) (ibid., p. 7)[18], but she will maximise profits based on these *expected* variations of utilisation.[19] The rate of profits that results from these *expected* variations of utilisation is named by Franke the *conjectured* rate of profits: 'This rate is concerned with the question what, given the present capital equipment, would be the profits under hypothetical variations of a firm's utilization rate u_i' (ibid., p. 7). So in order to formalise this issue, he builds a *conjectural* rate of profits in which anticipated losses are subtracted from the profit identity: A loss function $\ell = \ell(u_i)$ that is increasing in the firm's utilisation rate at an increasing rate ($\ell'(u_i) > 0$ and $\ell''(u_i) > 0$) for all $u_i < 1$.

[18]Where r_i is the rate of profits, π is the profit share, u_i is the level of capacity utilisation at a firm level, and v is the capital-output ratio.

[19]This argument seems to be similar to Ciccone's view within his debate with Heinz Kurz in the '80s. According to Ciccone, the definition of long-period positions must include *real* variations in the level of output. See Ciccone (1986, 1987) and Kurz (1986) for a reply and a rejoinder. However, under Professor Ciccone's view this *normal* rate of profit is calculated for newly installed equipment and not necessarily for the capital stock already installed as in Franke's analysis. Moreover, the *expected* rate of profits in Ciccone (1987) is not affected by *effective* level of capacity utilisation nor in the recent past. In this line of reasoning, the long period position takes time to manifest itself and cannot be associated with each effective one.

A firm's benefit function $b = b(u)$ with $b'(u) > 0$[20] is also imposed: The idea is that the firm has expectations about the general state of aggregate demand and, 'even if the firm does not change utilisation, she can moderate its marketing activities and/or sell its current flow of output at higher prices' (ibid., p. 8). Given the profit share, the expectations can be captured by multiplying the profit rate *identity* by a 'benefit' factor larger than one (ibid., p. 8). The general state of expected demand is *proxied* by the actual aggregate utilisation rate u and, following this line, the firm's profit rate is multiplied by a function that increases in expected demand and therefore in u. Finally, the firm maximises the following *conjectured* profit rate,

$$r_i^c = \frac{b(u)\pi u_i}{v} - \delta - \ell(u_i) \tag{3.18}$$

and she obtains a maximum one whenever

$$\frac{\delta r_i^c}{\delta u_i} = \frac{b(u)\pi}{v} - \ell'(u_i) = 0 \tag{3.19}$$

The second derivative is assumed to be negative ($r_i^{c\prime\prime}(u_i) = -\ell''(u_i) < 0$) to ensure a unique solution. According to Franke, 'as it depends on aggregate utilization and the uniform profit share, this rate [capacity utilisation] is the same for all firms.' (ibid., p. 8) so $u^{d_i} = u^d(u, \pi)$. Applying the Implicit Function Theorem Franke derives two results: First, desired utilisation increases (decreases) if actual utilisation increases (decreases). Second, desired utilisation increases (decreases) if the profit share increases (decreases). The explanation is that a rise in aggregate utilisation (or the profit share) raises the conjectured marginal profits and later the value of u_i. Instead of an abstract theoretical formulation, Franke introduces a concrete and arbitrary specification for the benefit and loss functions as follows,

$$\ell(u_i) = \theta_{\ell u} u_i^{\lambda} - \theta_{\ell o} \tag{3.20}$$

$$b(u) = \theta_{bu} u^{\beta} \tag{3.21}$$

Where $\lambda > 1$, $\lambda - 1 > \beta > 0$, $\theta_{\ell u}$, θ_{bu} and $\theta_{\ell o}$ are all positive parameters. The solution, in which the actual and conjectured profit rates coincide ($b(u^o) = 1$ and $\ell(u^o) = 0$), brings a closed form for desired utilisation in which $u = u^d$ like the following form,

$$u^d = u^d(u, \pi) = \left(\frac{\theta_{bu}}{v\lambda\theta_{\ell u}}\right)^{\frac{1}{\lambda-1}} \pi^{\frac{1}{\lambda-1}} u^{\frac{\beta}{\lambda-1}} \tag{3.22}$$

[20] In this case u is the aggregate rate of capacity utilisation.

The author also derives that $\frac{\delta u^d}{\delta u} > 0$, analytically,

$$\frac{\delta u^d}{\delta u} = \frac{\beta}{\lambda - 1}(\frac{\theta_{bu}}{v\lambda\theta_{\ell u}})^{\frac{1}{\lambda-1}}\pi^{\frac{1}{\lambda-1}}u^{\frac{\beta-\lambda+1}{\lambda-1}} > 0 \tag{3.23}$$

Implying that even in the long-run there is a positive relationship between the general state of expected demand and the level of desired capacity utilisation.[21] By assumption, in the previous equation, $\beta - \lambda + 1$ is negative, therefore, $\lambda - 1 > \beta > 0$.[22] The latter seems to be not arbitrarily chosen but based on empirical evidence from Petach and Tavani (2019).[23]. The mechanism seems to be simple: a rise in aggregate utilisation raises the conjectured marginal profits, and therefore, as the latter are decreasing in the firm's utilisation, the value of u_i where this function cuts the zero line.

Franke's try to conciliate Sraffian and Neo-Kaleckian frameworks but some arguments can be discussed. In this section I will present some points that may be debatable. Something that must be clarified before the analysis is that Franke starts his analysis from the level of a single firm (p. 4) given the capital stock and then he claims that the *desired* utilisation, 'as it depends on aggregate utilization and the uniform profit share, this rate is the same for all firms' implicitly claiming that there is a *representative* firm. I will clarify this point whenever necessary.

Franke starts modifying an *identity*

$$r_i = \frac{\pi u_i}{v} - \delta \tag{3.24}$$

that's true for all possible values of its variables. The incorporation of a loss function in the latter *identity*, as follows,

$$r_i^c = \frac{b(u)\pi u_i}{v} - \delta - \ell(u_i) \tag{3.25}$$

is justified by the fact that

[21] Up to this point, it could be interpreted that there are two aggregate utilisations. It is difficult to understand when the aggregate could be different from normal, if the firms in each moment use the capacity at the normal level.

[22] It must be clarified that λ and β represent the elasticity of the loss function and the benefit function to the level of capacity utilisation, at a firm level and and at an aggregate level respectively.

[23] This paper an its interrelated empirical foundations are discussed later.

> in an environment of imperfect competition (which we presume) . . . If . . . the firm considers increasing its production, it may well have to reduce the price somewhat in order to sell the additional output . . . the firm might also anticipate higher wages that it would have to pay . . . higher sales might require higher marketing efforts for the firm or taking other measures to acquire additional costumers . . . A straightforward way to take them [these effects] into account is a *conjectured* rate of profit r_i^c, in which these anticipated losses are subtracted from (2) [see previous equation].
>
> Franke, 2019, p. 7

Therefore three motivations are mentioned. The first one is a reduction in prices in case of an increase in production; the second one higher real wages and the third one marketing efforts. In short, a change in the 'data' determining the level of utilisation that is cost-minimizing, will change the cost-minimizing-desired level of utilisation. The enterprise always decide how much to produce and the decisions is looking only at costs of production.[24]

In relation to the first argument, why the firm is producing more before the effective demand is increased? Which is the *primum movens* for more output? One might be pushed to claim that the firm wants to increase its market share, but the capacity to reduce prices or marketing activities is in *relation* to other firms[25]; but this is, at the same time, incompatible with the idea that all firms behave the same. If a firm is increasing its market share, there must be another one loosing it. Second, if we consider asymmetries between firms, this argument may suffer from a fallacy of composition, it is not clear why other firms will not respond in the same way if they do not want to lose market share.

The second argument, related to an increase in real wages, could be formalised directly taking into account a - i.e. non linear - change in the *profit share*[26] with a change in utilisation

[24]There is no explanation in Franke about why the loss function might even be negative for low levels of utilisation - even when utilisation is zero, and the profit rate should be equal to $-\delta$, it is not clear why the parameter $\theta_{\ell o}$ is still positive.

[25]It is not clear why Franke starts with a particular level of prices and then firms are able to reduce it. How is the level of prices determined initially? Which are the determinants of this particular level? The differentiation between effective and normal prices seem to be not present in his analysis and this might be a source of problems. Starting from a position in which *normal* prices and *desired* utilisation hold, a reduction of *effective* prices of all firms will deliver in a lower *effective* profit rate and higher *effective* real wages for the firm (and why not?) the aggregate. But the main question remains, why the firm did not choose the 'new' level of prices first? Under Franke's analysis there is no obstacle for a tendency of the level of prices to go to zero.

[26]This possible effect is recognised by the author in Footnote 12 (p. 7). He claims that 'In order to streamline the results, it will, however, be convenient to treat the profit share h as a predetermined variable, which is exogenously given in the following discussion, and assume that possible effects on the firm's product wages

different from *desired*.

$$\frac{\partial \pi}{\partial u} = \begin{cases} < 0, & \text{if } \mid u > u_n \mid \\ > 0, & \text{if } \mid u < u_n \mid \end{cases} \tag{3.26}$$

Two questions remain open: why the firm has to be forced to increase real wages when might introduce new capital stock? The firm has chosen a particular size of capacity previously, based on profit maximization; if the firm is profit maximizing and now she has to feed additional demand, the natural reaction is to increase the size (level) of capacity *pari passu* the level of demand to get the profit maximizing relationship between output and capacity. Even if this is not necessary, what about the entry of new firms? If the firm does not increase capacity, after a *process of adjustment* there will be new firms in the market. One might respond that both take time, and no one can disagree on this, the point is that, if this is the case, it can be recognised that this is part of the cyclical behaviour of utilisation, and not the long-run. However, this position seems to be against the *cyclical* behaviour of the profit share that could be observed empirically at least for the case of the US economy (see Figure 3.4., p. 55 in this thesis).

The last argument for the loss function is that it is based on the possibility that higher sales is associated with higher marketing efforts or taking other measures to acquire additional customers.[27] This cannot be denied, but the point is, why a firm would be keen on increasing marketing efforts if this imply a lower profit rate? One might claim that this is a way to increase its market share but, therefore, why the profit rate calculated for the capital stock previously did not take into account this possibility? And finally, why other firms cannot respond in the same way neutralising this behaviour?

On the other hand, the benefit function might not be exempt of critiques. The author claims that during a general improvement in the general state of aggregate demand, even if the firm does not change its utilisation, the firm could moderate its marketing activities and/or sell its current flow of output at higher prices. Three comments might be done on this. First, if the firm does not change its utilisation, there might be other firms (new or existing ones) doing that and getting a greater market share (in case it is not a representative firm). Therefore, there will be no space to moderate marketing activities or sell the output at higher prices - it will loose market share or go bankrupt. Second, there is no reason to suppose that other firms will not do the same. Third, in case this is a representative firm, how the aggregate

and labour productivity are all captured by the loss function'. Departing from a firm level analysis, it is a pity that the author takes as given something that is changing at a firm level.

[27] A clarification here is that these higher marketing efforts are an income of someone else, in the model here this is not mentioned.

utilisation can change if the representative firm does not change its utilisation?

Franke recognises that an increasing function, like $b'(u) > 0$, amounts to *assuming* that the threat of new entry is of secondary importance and that this is, in the end, an *empirical* issue. It seems that he is denying the principle of competition based on some empirical evidence - based on Petach and Tavani (2019). But is this empirical evidence really implying that the threat of entrance is of minor importance? It seems that it is just a very strong *assumption*. But what it is more important is that he is not taking into account the threat of *existing* firms.

Finally, Franke's choice is to fully reinstate the baseline Neo-Kaleckian model simply claiming a weak incentive for firms to react to a possible utilisation gap. Although, it is not clear how this utilisation gap first appears, through this strand of analysis he restores the idea of a 'corridor of stability' supported by many authors (Lavoie, 1992; Dutt, 1990; Dutt, 2010; Parrinello, 2014; Setterfield, 2019) from which Harrodian instability is being excluded. His conclusions are that 'deviations of actual from desired utilization may appear rather inessential to the firms and, therefore, may well persist even over long periods of time, or vanish only extremely slowly' (ibid., p. 4). However, as he recognises, the maximization of profits is possible only at a unique level of utilisation, equal to the *normal* rate and, therefore, the range is not profit maximising. In fact, in Franke seems to present a continuous *normal* utilisation without the possibility of being outside this position.

3.3.4 Capacity utilisation in a General Equilibrium framework

In a recently published paper Luke Petach and Daniele Tavani (2019) present an elegant version of a model with spare capacity in a general equilibrium framework.[28] The model seems to be quite innovative and it is definitely an interesting attempt towards an explanation of accumulation of capital with spare capacity and also seems to allow for the equality between effective and 'desired' utilisation in the long run. Their main motivation is that the accumulation of capital under spare productive capacity - and productive equipment - could be a critique to 'Keynesian and Kaleckian growth theories'[29] and also that if endogeneity of capacity utilisation does not hold, then Keynesian paradoxes are confined only to the short-run analysis.

[28]The authors assume Say's law.

[29]The authors here include the criticism of Auerbach and Skott (1988) and Skott (2010, 2012) given to the 'new normal' Neo-Kaleckian equation where the 'normal' rate of utilisation is endogenous.

After an interesting and complete review of the literature, the authors claim that as firms do not act in isolation they ‘wait and see’ what other firms do when choosing about how much to utilise their plants. The incumbent firm’s beliefs about the state of the economy are not only based on incumbent’s expected sales but also on expectations on the utilisation rate of other firms (ibid., p. 204). The latter is, according to Petach and Tavani’s model, a proxy of *expected* aggregate level of economic activity (ibid., p. 203). Finally, the authors present empirical estimations in which effective utilisation at a sectoral level is explained by aggregate utilisation and distribution.

The authors consider a closed economy without government. Their analysis starts at a price taker’s *representative* firm level. The production function is a Leontieff one in which $Y = min\{uK, AL\}$ where Y is firm’s output, u_n is the *normal* level of capacity utilisation, K is capital stock, L is the quantity of labour and A is labour productivity. That the latter is constant and no technical change are assumed. Analytically, the authors introduce an adjustment cost function in which,

$$\lambda(u_i, \tilde{u}) = \beta u_i^{\frac{1}{\beta}} \tilde{u}^{\frac{-\gamma}{\beta}} \tag{3.27}$$

where u_i is the level of capacity utilisation of the firm i, $\tilde{u}$ is the aggregate level of capacity utilisation that captures firm i’s expectations about the utilisation chosen by other firms (ibid., p. 207). $\beta \in$ (0,1) and $\gamma \in$ [0, 1-β) are parameters. γ captures the importance of a firm’s beliefs about economic activity on its own choices. They *assume* that $\lambda_u > 0$ and $\lambda_{uu} > 0$ meaning costs increase with higher level of firm i’s capacity utilisation at an increasing rate: ‘an increase in the utilisation rate of installed capacity increases its absolute wear and tear’ (ibid., p. 205). They also *assume* that $\lambda_{u\tilde{u}} < 0$ therefore firm i’s marginal cost decreases with other firms’ utilisation. Although not mentioned by the authors, $\lambda_{\tilde{u}} \leq 0$[30] meaning that firm i’s costs decrease (increase) with other firms’ higher (lower) level of capacity utilisation by construction, with strict inequality if $\gamma \neq 0$. This ‘neglected assumption’ will be treated later during this essay.

Two dynamic optimizations of a ‘typical capitalist household’ in order to maximize consumption through time are presented by the authors. The first one is the ‘Equilibrium’ one and the second one is called ‘Socially-Coordinated’ outcome. I will describe them in the Appendix A.1. and A.2.. In the following paragraphs I will analyze their results.

[30]The derivative is the following one: $\partial\lambda(u, \tilde{u})/\partial\tilde{u} = -\gamma u^{\frac{1}{\beta}} \tilde{u}^{\frac{-\gamma-\beta}{\beta}}$

The reasoning behind λ (see Equation 3.27) is that an increase in u increases absolute wear and tear of fixed capital. Analogously, an increase in $\tilde{u}$ could be thought as if it decreases absolute wear and tear of fixed capital. This is algebraically sound as I have shown in the previous paragraphs (see also the Appendix) but, which is the economic rationale that is behind this *assumption*? How a higher level of utilisation at an aggregate level might diminish cost of the individual firm? It is quite difficult to rationalise - under the assumptions given - the idea that aggregate capacity utilisation has a negative impact on incumbent firm's cost, that at the same time it is a representative firm and, therefore, *she* is the aggregate economy.

Let us assume in principle that these 'externalities' exist and that the firms are sufficiently small enough that their individual utilisation does not change the aggregate one, but the firm is not a representative one.[31] The second step is to understand the adjustment mechanism. Under this model, if aggregate utilisation increases, incumbent's wear and tear fixed capital is lower, modifying a parameter of the productive process, therefore it could be considered as if it were similar to a change on the method of production[32] - given these are the determinants of *normal* utilisation. It seems to be that aggregate level of capacity utilisation changes the method of production for the firm, the cost minimising one and therefore the level of 'normal' capacity utilisation. It is through this mechanism by which, any higher (lower) level of aggregate capacity utilisation is accommodated later with a higher (lower) *normal* level of capacity utilisation at the firm level. The question that follows this process is, why capitalists are choosing now a new level of utilisation that minimises costs and not previously with the possibility of extra-profits? They did not chose it because this method of production was not the cheapest one. It seems that for different levels of aggregate capacity utilisation or different levels of expected aggregate demand new methods of production become cheaper than before.

Although it is true that a different level of effective demand might change the cost-minimizing methods of production it might be possible that this drives a change on the level of *normal* utilisation. However, the mechanism explained by Petach and Tavani is difficult to grasp. The key assumption to arrive to this result is that aggregate utilisation impacts negatively and mechanically on firm's wear and tear of fixed capital, and this is done by *assumption*.

[31]The authors claim that 'one could imagine a more complex setting characterized by a continuum of firms with varying technology in which each firm's choice of utilisation depends on expectations about the average utilisation of firms with similar technology. In equilibrium, *each* type of technology would have a different associated *level* of average utilization.' (ibid., p. 207, fn. 6).

[32]The fact that wear and tear does not appear directly in the Leontieff production function and then appears modifying costs of production is a little bit vague.

In case the model represents a representative firm (ibid., pp. 205-207), the firm's level of utilisation and the aggregate utilisation are the same in each instant of time, so it is difficult to claim how one might impact the other if both are the same variable.

Introducing effective demand

Given that the authors many times mention that their results 'would be reinforced by the inclusion of independent investment behaviour' (ibid., p. 205, p. 207) I introduce this 'cost minimisation problem' into a baseline Neo-Kaleckian model. In this sub-section I will try to achieve similar results by taking into account Petach and Tavani's assumptions as valid. There could be another way to introduce this discussion directly from a profit maximisation problem and it is the following one. I know that,

$$r = \pi u - \lambda[u, \tilde{u}] \tag{3.28}$$

where r is the effective rate of profits at firm level, π is the profit share at firm level, u is the effective rate of capacity utilisation at the firm level and $\tilde{u}$ is the aggregate level of capacity utilisation. Replacing,

$$r = \pi u - \beta u^{\frac{1}{\beta}} \tilde{u}^{\frac{-\gamma}{\beta}} \tag{3.29}$$

To maximise profits, firms choose the level of utilisation rate that give them the maximum rate of profits,

$$\frac{\delta r}{\delta u} = \pi - u^{\frac{1-\beta}{\beta}} \tilde{u}^{\frac{-\gamma}{\beta}} = 0 \tag{3.30}$$

I can derive from the previous maximisation, a desired level of capacity utilisation at the firm level,

$$u^n = \pi^{\frac{\beta}{1-\beta}} \tilde{u}^{\frac{\gamma}{1-\beta}} \tag{3.31}$$

This result is the same obtained in Petacha and Tavani's analysis (ibid., p. 207). Now, I am able to introduce Petach and Tavani's results in a standard Neo-Kaleckian model.[33]

$$\frac{I}{K} = \alpha + \gamma_u (u - \pi^{\frac{\beta}{1-\beta}} \tilde{u}^{\frac{\gamma}{1-\beta}}) \tag{3.32}$$

$$\frac{S}{K} = s_\pi \pi u \tag{3.33}$$

[33] I can do this if every firm has the same normal degree and hence the normal degree at the firm level is the normal degree at the whole economy level.

In the goods market equilibrium, also,

$$\frac{I}{K} = \frac{S}{K} \tag{3.34}$$

Being I and S net investment and net savings, respectively.[34] Up to this point I have 3 equations and 4 unknowns (I, S, u and $\tilde{u}$), so in order to close the system I impose the following,

$$u = \tilde{u} \tag{3.35}$$

This is not an arbitrary assumption, given the notion of *representative* firm that is present in the paper.[35] Finally I have 4 equations and 4 unknowns so I can solve the system.

$$\alpha + \gamma_u u - \gamma_u \pi^{\frac{\beta}{1-\beta}} u^{\frac{\gamma}{1-\beta}} - s_\pi \pi u = 0 \tag{3.36}$$

To analyse the impact of a change in a variable on the level of capacity utilisation, I could introduce the Implicit Function Theorem,

$$\frac{\delta u}{\delta \pi} = -\frac{\frac{\delta F}{\delta \pi}}{\frac{\delta F}{\delta u}} = -\frac{-\frac{\beta}{1-\beta}\gamma_u \pi^{\frac{2\beta-1}{1-\beta}} u^{\frac{\gamma}{1-\beta}} - s_\pi u}{\gamma_u - \gamma_u \pi^{\frac{\beta}{1-\beta}} \frac{\gamma}{1-\beta} u^{\frac{\gamma+\beta-1}{1-\beta}} - s_\pi \pi} > 0 \tag{3.37}$$

Following the authors' empirical evidence, the expected sign would be a positive one. In order to get that sign, given that the numerator as a whole is negative, plus the negative sign before the fraction, it is safe to claim that the whole numerator is positive. If I expect a positive sign for the whole derivative, then the denominator must be positive.

$$\gamma_u - \gamma_u \pi^{\frac{\beta}{1-\beta}} \frac{\gamma}{1-\beta} u^{\frac{\gamma+\beta-1}{1-\beta}} - s\pi > 0 \tag{3.38}$$

Reordering, the denominator is greater than zero, if and only if,

$$-\gamma_u \pi^{\frac{\beta}{1-\beta}} \frac{\gamma}{1-\beta} u^{\frac{\gamma+\beta-1}{1-\beta}} > s\pi - \gamma_u \tag{3.39}$$

In case the Keynesian stability (Lavoie, 2014; Allain, 2015) holds (RHS>0), the result is that a negative number must be greater than a positive one what is an absurd. Therefore, the Keynesian stability hypothesis cannot hold if the sign of the derivative as a whole is positive. This incompatibility between this determination of the 'normal' rate of utilisation

[34] Net investment and net savings allow me to avoid the introduction of depreciation.

[35] In fact, if all the firms realized the desired rate of utilisation there is no difference between aggregate utilisation and desired utilisation. This is a problem in Petach and Tavani's analysis as I have claimed before.

and a Neo-Kaleckian demand-led model also holds after the incorporation of autonomous components of aggregate demand (See Appendix A.3.).[36] This result can be interesting and legitimate as long as premises mentioned above are taken into account. Petach and Tavani's model seems to be incompatible with these Neo-Kaleckian premises.

Empirical evidence: an alternative explanation

Using detailed Bureau of Economic Analysis state-by-industry data for the United States the authors test their hypothesis about the impact of aggregate utilisation in firm's utilisation. With a logarithmic transformation of the 'Best Response' function as it follows,

$$\ln u = \frac{\beta}{(1-\beta)}\ln(1-\omega) + \frac{\gamma}{(1-\beta)}\ln\tilde{u} \tag{3.40}$$

They test the following equation,

$$\ln u_{i,jt} = \beta_1 \ln(1-\omega_{i,jt}) + \beta_2 \ln u_{-i,jt} + \xi_{ij} + \phi_t + \varepsilon_{ijt} \tag{3.41}$$

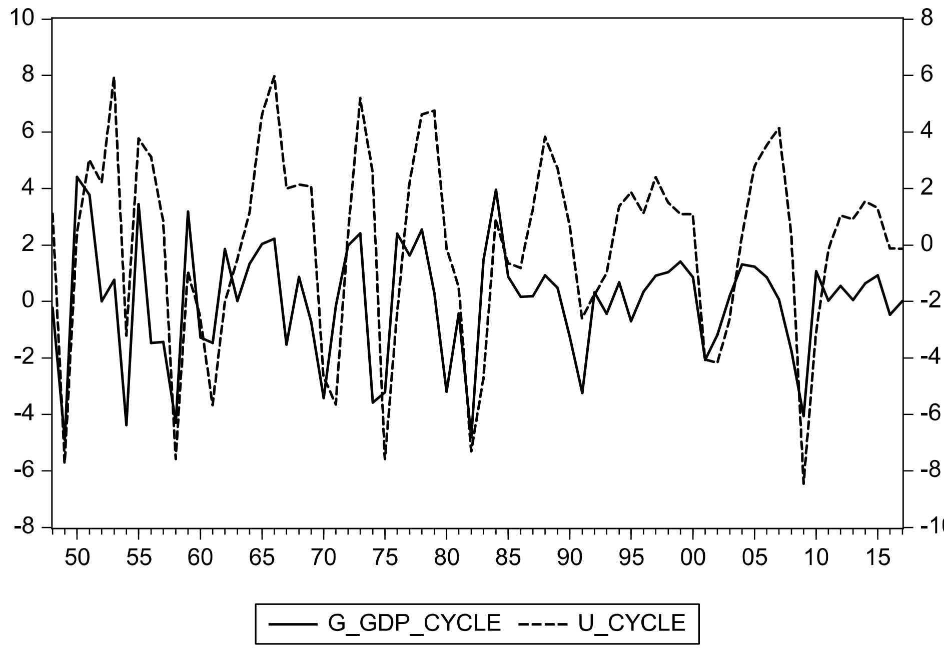
where $u_{i,jt}$ is capacity utilisation in region i, in sector j, at time t, $\omega_{i,jt}$ is the region-industry specific labor share, $u_{-i,jt}$ is capacity utilisation in all other regions of the economy for the same sector, ξ_{ij}, ϕ_t and ε_{ijt} are a region-industry specific fixed-effect, a time-specific fixed effect and an idiosyncratic error term respectively. Broadly speaking, the *level* of utilisation of sector j in region i is explained by the profit share of sector j in region i and the *level* of utilisation of sector j in all regions different from i. Although the results that Petach and Tavani present in their paper are overwhelmingly coherent with their hypothesis, I will present an alternative explanation for those considered stylised facts of the literature: If $u_{-i,jt}$ stands as a proxy of the expectations on economic activity level then $u_{-i,jt}$ drives $u_{i,jt}$ from a demand-led approach and this could explain the statistical significance of the regression. The relationship, although our data is built in a macroeconomic approach with different sources, can be clearly observed in Figure 3.6.[37]

The second relationship that must be explained is the positive one between the level of capacity utilisation and the profit share, and this is more intuitive. In the upper phase of the cycle, when utilisation is above what could be considered its *normal* level, the effective rate

[36] For the sake of simplicity, I will not introduce the 'Socially Coordinated case' result in a baseline Neo-Kaleckian model but it is easy to arrive at the same conclusions. Exactly the same happens in a Neo-Kaleckian model with endogenous utilisation in a way that $\dot{u} = \mu(\tilde{u} - u)$.

[37] $GDPC1-PCH$ - Real Gross Domestic Product, Percent Change, Annual, Seasonally Adjusted Annual Rate. $CAPUTLB00004SQ$ - Capacity Utilization: Manufacturing, Percent of Capacity, Annual, Seasonally Adjusted. Both series detrended with HP filter (λ=100). Source: https://fred.stlouisfed.org/

Figure 3.4 Detrended GDP growth rate and detrended level of capacity utilisation - U.S. (1948-2017)



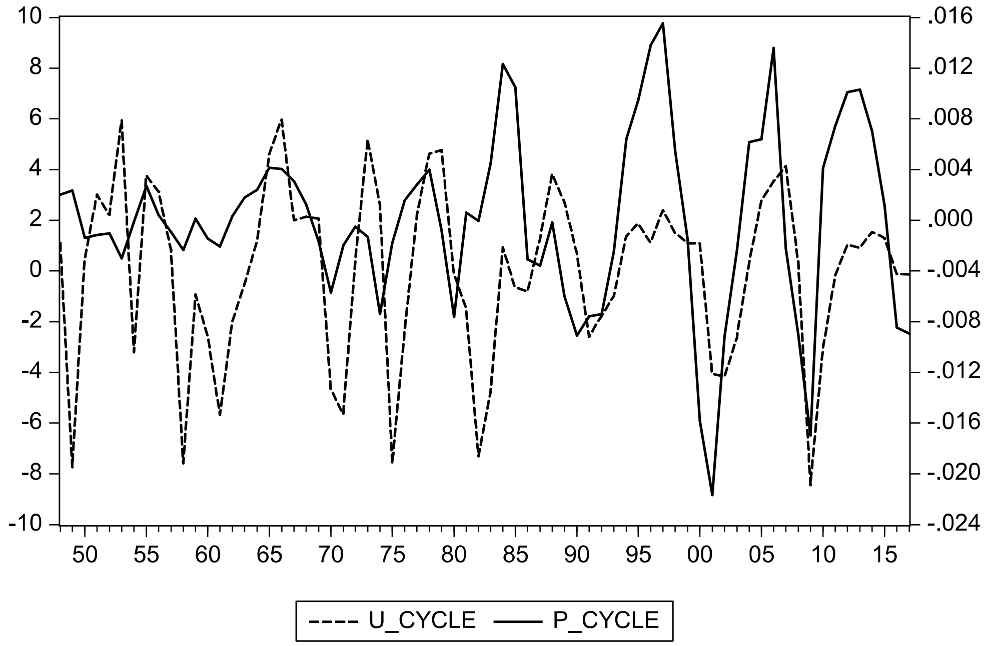
Source: own elaboration based on the data provided.

of profits increases - see Figure 3.5.[38] This fact is also considered in Puty (2005, 2018) at a sectoral level for the U.S. economy. Added to this, the effective wage share $\omega = \frac{w}{Y}$ presents a counter cyclical behavior (Petach , 2020, Figure 2).

In order to explain the stylised facts that I have shown above, I will follow a Classical-Keynesian view. Let us assume that there is a change on a level of autonomous aggregate demand, this might deliver a process of growth by which effective utilisation is *persistently* above its *normal* level in the short-run. This fact *endogeneize* short-run distribution; in particular, short-run wage and profit shares. When utilisation is higher-than-normal is a stylized fact that the profit share is greater than the *normal* one - procyclical - and the wage share is countercyclical. The increase in the profit share, in general, is a result of

[38] $A466RD3Q052SBEA$ - Profit per unit of real gross value added of nonfinancial corporate business: Corporate profits after tax with IVA and CCAdj (unit profits from current production), Dollars, Annual, Seasonally Adjusted. $CAPUTLB00004SQ$ - Capacity Utilization: Manufacturing, Percent of Capacity, Annual, Seasonally Adjusted. Both series detrended with HP filter (λ=100). Source: https://fred.stlouisfed.org/

Figure 3.5 Detrended profits and detrended level of capacity utilisation - U.S. (1948-2017)



Source: own elaboration based on the data provided.

indivisibilities in fixed capital and, when effective utilisation increases, fixed capital's cost diminishes. This opens the door for a higher effective profit-share.

3.3.5 Appendix A.0.: Some clarifications on the definition of *normal* utilisation

The mechanism above mentioned in Equation (3.7), and the different 'microeconomic foundations' (Amadeo, 1986; Lavoie, 1995, 1996; Dutt, 1997; Lavoie, Rodriguez, & Seccareccia, 2004) were based on a conventional grounds, receiving various critiques on many grounds by Skott (2012, 2019), Cesaratto (2015), Nikiforos (2013, 2016), Shaikh (2016), Girardi & Pariboni (2019), Fiebiger (2020) and Haluska (2020). The common line of reasoning is that it is not explained in the Neo-Kaleckian literature by which mechanism the new effective utilisation will be the new *normal* one and still logically compatible with a profit-maximizing method of production and competition. More recently, other attempts have been made to revitalize the u_n to u argument, but based on different grounds. Four proposals can be singled out: Nikiforos (2013, 2016), Setterfield & Avritzer (2020), Franke (2020) and Petach and Tavani (2019) will be analyzed later.

But first I would like to present the economic rationale behind the pricing equations of the Neo-Kaleckian model. While analysing different pricing-strategies of firms, Marc Lavoie (2014) claims that the target-return pricing theory is not so different to what he calls the 'canonical version of Sraffian prices of production' in which

> it is assumed that best-practice technological coefficients are calculated at standard levels of capacity utilization, and the rates of profit imposed upon fixed capital (or variable capital) are assumed to be uniform across industries. This rate of profit is thus the *normal* rate of profit, and output corresponds to the *normal* rate of utilization of capacity, each plant or segment of plant being operated at its optimal engineer-rated capacity. This is quite similar to the target-return view: standard or normal output, that is the *normal* rate of utilization, helps to determine unit costs and the mark-up; the latter also depends on the *normal* rate of profit that corporations wish to obtain in the long run on their investments and capital. The target rate of return thus plays a similar role to that of the uniform rate of profit in prices of production.
>
> Lavoie, 2014, p. 176, , emphasis added in *italics*

From this analysis, and taking into consideration that, for *simplicity*, steady-state growth models are built under the assumptions described in the previous sections and therefore can thus only be consistent if there exists some mechanism leading the model to a fully adjusted position it is impossible to allow an adjustment process of *normal* capacity utilisation like Equation (3.7) without impacting the *normal* rate of profits *mechanically*.[39] Therefore, defining

$$r_n = \frac{u_n \pi}{v} \tag{3.42}$$

as the rate of profit which entrepreneurs expect to realise on their *new investment* if future realised rates of capacity utilisation turn out to be equal to their normal value (Lavoie, 1996),

[39] It must be clarified that this is valid only under Fully Adjusted Situations, which is the method used when working on growth *models*. It is clear along Lavoie's book that 'pricing is linked with investment decisions' (Lavoie, 1992, p. 137); thus, it is possible to claim that under Lavoie's definition, it is not *necessary* that the whole capital stock is normally utilized to have a *normal* rate of profit, but only on investment. This said, in Lavoie's view a Fully Adjusted Situation is not *necessary*, it is just a matter of *simplicity*. Lavoie (1992, p. 120) seems to clarify that old capital stock might allow for different quasi-rents, but 'to be able to make any sort of progress when dealing with complex issues', for *simplification*, he assumes that this will not be the case. I completely agree with Lavoie's view on this: accumulation theory is out of the 'core' (Garegnani, 1984) so the relations that this theory wants to explain are very complex to be formalised. However, since the method for studying growth theory is one in which relationships are formalized, I believe it is important to conduct the analysis on these basis, even though the relationships that are imposed do not always require the same degree of necessity as they do within the 'core'.

an equation like the following one is a *necessary* result of (3.7).[40],

$$\dot{r_n} = \phi(r^* - r_n) \tag{3.43}$$

As Lavoie defines *normal* utilisation, 'it is assumed that each segment of a plant is operated at its optimal level, as defined by the engineers, under the standard requirements of cost minimization [...] in normal conditions some of the segments will not be running [...] to face an uncertain future [...] and they are a deterrent to entry' (Lavoie, 1996, p. 120). Tracing his definition, previously in his well-known book of 1992, he claims that 'The normal rate of utilization of capacity is also called the load factor on the capacity of the standard ratio. It is defined as the percentage of total practical capacity at which the firm can expect to operate on the average over the business cycle (Eichner, 1976, p. 62). The rate of utilization at which the firm is planning to function in the coming period is the *expected* rate' (Lavoie, 1992, p. 122). According to Lavoie, firms will *not* be producing at levels of output where average total cost is increasing because of indivisibilities, because excess capacity is a deterrent to entry, random seasonal fluctuations, among other factors. Therefore, it is not possible to claim that according to Lavoie the choice of normal utilisation is just a matter of 'cost-minimizing' technique.

If the definition implies *strict* cost minimization, capacity utilisation is able to reach full capacity (Skott, 2012; Girardi & Pariboni, 2019; Gahn & González, 2019) and there is no clue to say that full capacity will not be the *normal* one. The reasoning is quite simple: If I assume that entrepreneurs are able to decide their own investment and, therefore, the size of their own capacity, they are able to choose their own rate of capacity utilisation. If this reasoning is correct, then they will choose the rate of capacity utilisation that minimise their cost, and given Equation (3.42) this implies choosing capacity utilisation at its 100%. Once achieved 100% of capacity utilisation, it is difficult to think why entrepreneurs will produce

[40]In 1996, Lavoie develops three different mechanisms of adjustment by which realized and normal rates of capacity utilisation are equated, along with the realised and normal rate of profits and/or along with the expected and effective rate of growth. There are three adjustment mechanisms, through prices, through prices and investment or only through investment. However, as I recently claimed those are not alternatives, whether the model introduces and adjustment like (3.7), implicitly or explicitly is introducing an equation like (3.43), in case the FAS is defined as in Vianello (1985) in which *normal* prices prevail for the whole capital stock.

at a lower level with lower profits.[41] [42] This phenomenon does not to seem to be compatible with the empirical evidence, in which the observable rates of aggregate capacity utilisation among countries hardly surpasses 80%.

Another way to interpret this issue is that the *cost-minimising* capacity utilisation is not 100% but lower, e.g. 80%. This is the vision held by Kurz (1993, 1994),

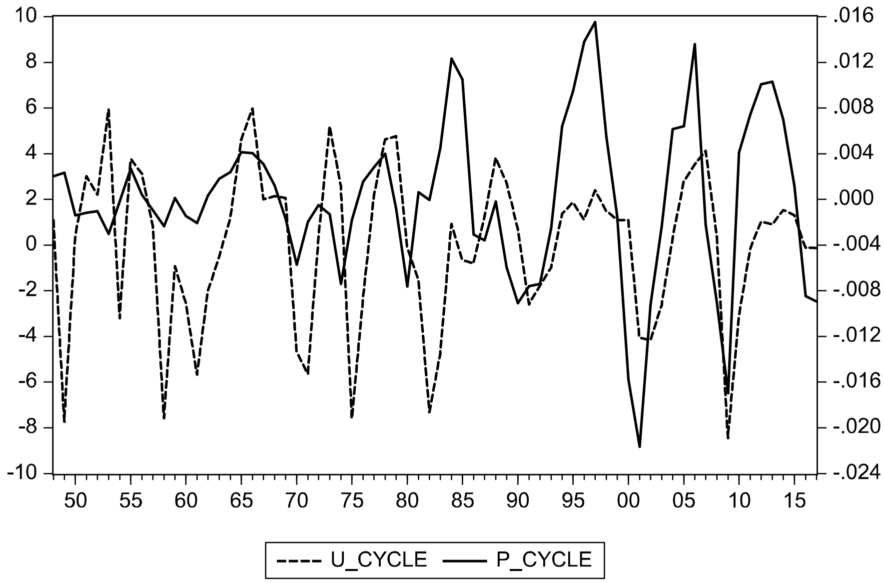
> The fact that, for any given feasible level of the wage rate, the profit rate is first an increasing and, from a certain point onwards, a decreasing function of the degree of utilization can be explained in terms of factors such as the empirically observed utilization-specific profile of labour productivity and wage premia to be paid outside ordinary working hours and days [...] first, cost-minimizing firms are generally not interested in realizing the technically maximum degree of utilization, $u = 1$, because it would not be profitable.
>
> Kurz, 1994, p. 411

This vision might be compatible with the empirical evidence on the levels of capacity utilisation around 80%. According to Kurz, there is a threshold by which the *effective* rate of profits starts to diminish while utilisation is increasing. There are many arguments to believe that this might be the case: higher real wages paid in overtime hours, lower productivity in night-shifts, greater depreciation of the capital stock when capital is used more intensively. Lavoie agrees on this issue but he claims that this is the segment between *Full Capacity* and *Theoretical Full Capacity*, and the firm will try not to operate in this segment because of increasing total average cost.

[41] This argument was claimed by Hein et al. (2011, pp. 592-593), Cesaratto (2015, pp. 163-1634), Setterfield (2019, p. 452) and Setterfield & Avritzer (2020, p. 4) , however these authors rise this issue as part of the Harrodian instability analysis. Here I claim that, given entrepreneurs are able to decide the level (and intensity) of utilisation, there is a tendency towards full capacity utilisation and to the maximum rate of profits. Park (1995, pp. 302-304) claims that in a two-sectors baseline -Kaleckian model one of the solutions for the over-determination is to discard mark-up pricing, in the sense that mark-up rates would be deprived of the exogeneity of their own in the long period. According to White, in these models, the rate of profit might then be regarded as demand-determined (2006, p. 157).

[42] Amadeo (1986b, p. 9) recognises this in the case of the baseline Neo-Kaleckian model. He claims that the 'possibility of capacity utilisation being different from its planned degree in the long run has an important implication for theories of distribution and accumulation: the inverse relations between the rate of profit and the real wage, on the one hand, and the rate of growth and consumption per head, on the other, do not necessarily hold. In this case, to higher wage rates there corresponds higher degrees of capacity utilisation and, thus, higher rates of profit up to the point where the economy reaches a situation of full utilisation of capacity.'

Figure 3.6 Detrended profits per unit of output of non financial corporations corporate profit share and detrended level of capacity utilisation - U.S. (1948-2017)



Source: own elaboration based on the data provided.

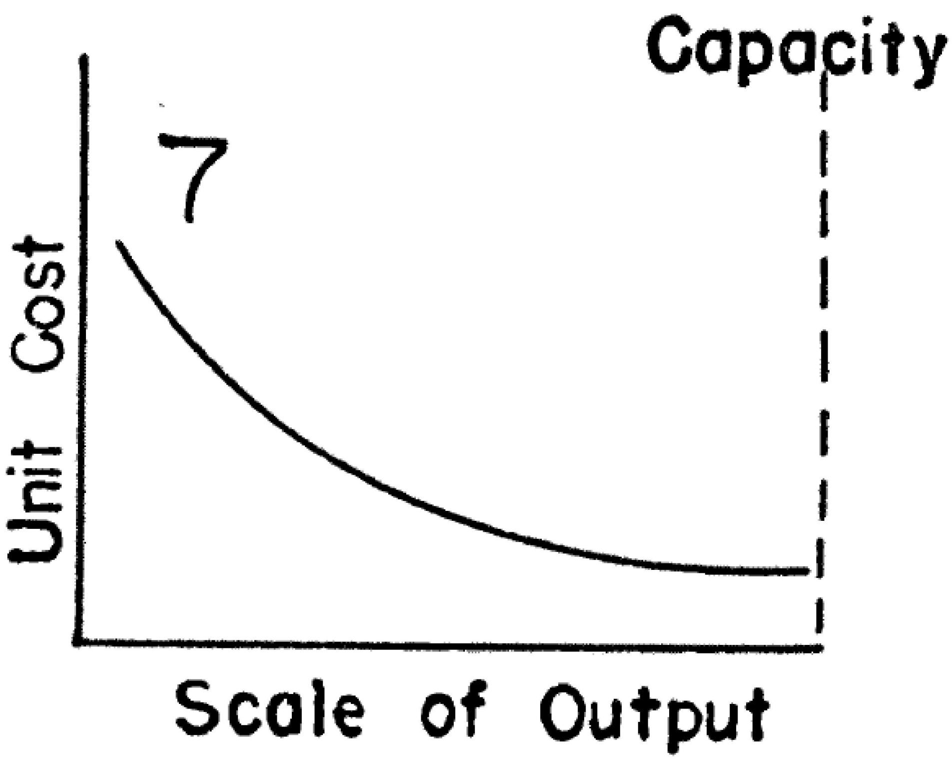
The relationship between the rate of growth of the economy and the effective rate of profits seems to be positive all along the economic cycle (see Figure 3.6).[43] And this has a reason, why entrepreneurs should increase their utilisation if the rate of profits (even the effective one) is lower? Of course they might increase production to not loose market share, but even under this circumstance entrepreneurs could have foreseen that too and have chosen an even greater capacity previously. It seems that the system is even more flexible that what some authors expect and *higher-than-normal* utilisation might imply *higher-than-normal* rate of profit. Lavoie agrees on the pro-ciclicality of profits (Lavoie, 1992, p. 144).

Up to this point, the definition of *normal* capacity utilisation under a broad Post-Keynesian framework is still open. On the one hand, if it is an exogenous *normal* cost-minimising technique, then there should be a tendency towards it. Given that fluctuations are, in general, not taken into account (Kurz, 1986) in steady-state models, then this should be the maximum rate as derived from equation (3.42), but this is not compatible with the empirical evidence. On the other hand, if the cost-minimising technique is not the maximum rate of capacity

[43] In this case the Figure shows the relationship between the detrended profit share and the detrended capacity utilisation. The point is that we are able to show that there is not *necessarily* a positive relationship between *higher-than-trend* capacity utilisation and the wage share.

utilisation but a lower-than-maximum, then there should be a threshold observable in empirical evidence and that could lead to a non-linear formulation of equation (3.42) as Kurz suggests (1993, 1994); however empirical facts do not seem to support this view either (see Figure 3.6).[44] Until now, both definitions of cost-minimising could be considered as definitions in a *narrow* sense.

Figure 3.7 Shape of the average cost curve according to plant managers



Source: Eiteman & Guthrie (1952, p. 835).

When fluctuations (and strategic decisions) are introduced to calculate the *normal* rate of profits on newly installed equipment with an average expected rate of capacity utilisation for the duration of the capital stock - or *normal* rate of capacity utilisation - then the latter could be defined as *normal* capacity utilisation in a *broad sense*. This definition is not cost-minimising, but profit maximising: it takes fluctuations into account.

[44]On similar results see the survey of Lee (1986) and the writings of Puty (2005).

Marris (1964) stressed that the individual businessman, when considering a *new investment*, must make a *decision* regarding the use of his fixed capital under what she expects to be his normal operating conditions. At any given time normal conditions may not prevail, since fluctuations in demand may cause firms to alter their plant hours by adding or dropping shifts. But these are cyclical rather than long-run considerations. When a business contemplates building a new factory and is faced with a decision regarding capital requirements, it can plan to use a given stock of capital intensively (say, two shifts) or a larger stock less intensively (say, one shift). The decision regarding shifts is no less an aspect of the firm's capital requirements than is the size of the stock itself. Shifts and changes in shifts are a dimension of capital and cannot be ignored in analyzing the growth of capital and the growth of output over time (Foss, 1981, p. 36). However, the fact of incorporating the notion of shifts does not change the *definition* of *normal* utilisation of capacity. *Normal* utilisation as an average expected rate of capacity utilisation for the duration of the capital stock on the newly installed equipment is the notion of *normal* utilisation suggested by Ciccone (1986, 1987)[45] and the one I will follow from now on. This notion, however, it is important for the determination of *normal* prices.

As soon as the argument shifts into a discussion on the theory of quantities, as the level of abstraction is lower because it is outside the 'core' (Garegnani, 1984), the relationships prescribed could stop being general enough: Processes of accumulation imply usually changes in the population's living standards, changing consumption patterns, demand fluctuations, product composition, among other factors that are complex to formalize. Given this clarification, I will discuss models in abstract terms where I will assume the existence of a single good and fixed capital following Serrano (1995). The normal rate of capacity utilisation, throughout this thesis, will be presented as a characteristic, an element, that is part of the

[45] Lavoie (1992, p. 144) seems to agree on this definition when he claims that 'In contrast to orthodox theory, profits necessarily increase when the output of the firm increases, provided the firm stays beneath full capacity'; according to him 'cost-minimization and excess capacities are not incompatible' (Lavoie, 1992, p. 328). Shaikh (2007) follows a similar view. According to Shaikh (2009, p. 6), 'the output corresponding to normal capacity utilization may include some desired level of capacity reserves needed to meet demand fluctuations and to survive against competitors, so that the normal competitive level of capacity utilization may be somewhat below the exact 'ideal' point'. Lee (1999) follows a similar view and claims that Kalecki's arguments regarding the constancy of the average direct cost curve was influenced by Piero Sraffa's observations on the lack of changes in the ratio of prices to costs with changes in output below full capacity utilisation (Lee, 1999, p. 147). From a practical standpoint, see Lanzillotti (1958) on pricing to achieve a target return on *investment* 'assuming standard volume to be the long-run average rate of plant utilization' (ibid., p. 923) for American companies. On the notion of *normal* utilisation as a standard volume at a firm level see Lanzillotti (1958, p. 923, fn. 5 and p. 929; 1959) for the case of twenty industrial corporations or Johnson (1978) and Clifton (1983) for the case of General Motors during the 1920s. For a different and surprising view, in which effective utilisation changes, what here is intended as, *normal* prices see Brierley et al. (2006). On an often revision of *practical* capacity by managers see Bragg (2007, p. 248).

dominant method of production. Therefore, a change in *normal* utilisation will be associated with a change in the method of production.[46] Having presented the problems that this thesis will face, in the this chapter I will present different models that can be considered within the Neo-Kaleckian literature where I will critically analyse the adjustment of productive capacity to aggregate demand.

3.3.6 Appendix A.1.: Equilibrium case

Given $\tilde{u}$, the firms chooses $\{c(t), u(t)\}_{t\in[s,\infty)}$ with a discount rate $\rho > 0$. To maximize

$$\int_s^\infty e^{-\rho(t-s)} \ln c(t) \cdot dt$$

Subject to

$$\dot{K} = (1-\omega)u(t)K(t) - c(t) - \lambda[u(t);\tilde{u}]K(t)$$

$$K(s) \equiv K_s > 0$$

$$\lim_{t\to\infty} e^{-\rho(t-s)} K(t) \geq 0$$

The Hamiltonian is:

$$\mathcal{H} = \ln c + \mu[(1-\omega)uK - c - \lambda(u;\tilde{u})K]$$

First Order Conditions

$$\frac{\partial \mathcal{H}}{\partial c} : \frac{1}{c} - \mu = 0$$

$$\frac{\partial \mathcal{H}}{\partial c_{t+1}} : \frac{1+\rho}{c_{t+1}} - \mu_{t+1} = 0$$

$$\frac{\partial \mathcal{H}}{\partial u} : 1 - \omega - \lambda_u(u;\tilde{u}) = 0$$

$$\frac{\partial \mathcal{H}}{\partial K} : \mu[(1-\omega)u - \lambda(u;\tilde{u})] = \rho\mu - \dot{\mu}$$

$$\lim_{t\to\infty} e^{-\rho t} \mu(t) k(t) = 0$$

From the First Order Conditions two equations can be derived,

$$u(\omega;\tilde{u}) = (1-\omega)^{\frac{\beta}{1-\beta}} \tilde{u}^{\frac{\gamma}{1-\beta}} \tag{3.44}$$

[46] The expected average degree of capacity utilisation enters quantitatively into the unit coefficients of fixed capital. Therefore, the amount of fixed capital per unit of output depends on *normal* utilisation. This is a tangible manifestation of the expected average utilisation on newly installed equipment. See Trezzini and Pignalosa (2021) on this issue.

$$g^c = \frac{\dot{c}}{c} = (1-\omega)^{\frac{1}{1-\beta}} \tilde{u}^{\frac{\gamma}{1-\beta}} - \rho \tag{3.45}$$

The results are that the level of utilisation is a decreasing function of the wage share while increasing in aggregate utilisation and that the rate of growth of consumption depends on distribution and on aggregate capacity utilisation: Desired level of capacity utilisation is 'a moving target' (ibid., p. 207). Up to this point we have just two equations and four unknowns (u, g_c, ω and $\tilde{u}$). In order to close the model, the authors explain that 'firms best-respond to other firms' choices, in Cournot-Nash fashion . . . requires that $u = \tilde{u}$' (ibid., p. 207); this new equation will leave us with two equations and three unknowns (u, g_c and ω). The system of equations for the 'Equilibrium' case is the following one,

$$u_E(\omega) = (1-\omega)^{\frac{\beta}{1-\beta-\gamma}} \tag{3.46}$$

$$g^c_E = \frac{\dot{c}}{c} = (1-\beta)(1-\omega)^{\frac{1-\gamma}{1-\beta-\gamma}} - \rho \tag{3.47}$$

The authors present two alternative closures: a Pasinetti/Kaldor exogenous supply of labour or a Classical/Kaleckian distributive closure. I will choose the second one given that it is not our aim to discuss the alternative closures of this paper. Finally, given $\omega = \hat{\omega}$, we have a system with two equations and two unknowns so it is fully determined.

3.3.7 Appendix A.2.: Socially-Coordinated case

In this outcome, given $u = \tilde{u}$ at all times, she chooses $\{c(t), u(t)\}_{t\in[s,\infty)}$ with a discount rate $\rho > 0$. To maximize

$$\int_s^\infty e^{-\rho(t-s)} \ln c(t) \cdot dt$$

Subject to

$$\dot{K} = (1-\omega)u(t)K(t) - c(t) - \lambda[u(t)]K(t)$$

$$K(s) \equiv K_s > 0$$

$$\lim_{t\to\infty} e^{-\rho(t-s)} K(t) \geq 0$$

The Hamiltonian is:

$$\mathcal{H} = \ln c + \mu[(1-\omega)uK - c - \lambda(u)K]$$

First Order Conditions

$$\frac{\partial \mathcal{H}}{\partial c} : \frac{1}{c} - \mu = 0$$

$$\frac{\partial \mathcal{H}}{\partial c_{t+1}} : \frac{1+\rho}{c_{t+1}} - \mu_{t+1} = 0$$

$$\frac{\partial \mathcal{H}}{\partial u}: 1-\omega-\lambda_u(u)=0$$

$$\frac{\partial \mathcal{H}}{\partial K}: \mu[(1-\omega)u-\lambda(u)]=\rho\mu-\dot{\mu}$$

$$\lim_{t\to\infty} e^{-\rho t}\mu(t)k(t)=0$$

From the First Order Conditions and before some steps two equations can be derived,

$$u_{SC}(\omega)=\frac{(1-\omega)}{1-\gamma}^{\frac{\beta}{1-\beta-\gamma}} \tag{3.48}$$

$$g^c_{SC}=\frac{\dot{c}}{c}=(1-\gamma-\beta)(\frac{(1-\omega)}{1-\gamma})^{\frac{1-\gamma}{1-\beta-\gamma}}-\rho \tag{3.49}$$

In the 'Socially-Coordinated' case, the result implies that the level of utilisation and the rate of growth of consumption only depends on distribution. The closure is the same as before, I have two equations with three unknowns and a Pasinetti/Kaldor closure or a Classical/Kaleckian are proposed. One distinction that must be done is that the level of utilisation and the rate of growth under the 'Socially-Coordinated' outcome are higher than in the 'Equilibrium' result if and only if $\gamma > 0$, otherwise are the same.

3.3.8 Appendix A.3.: Introducing the 'Equilibrium case' result in a Neo-Kaleckian model with autonomous components

$$g^I=\frac{I_t}{K_t}=\alpha+\gamma_u(u_t-\pi^{\frac{\beta}{1-\beta}}\tilde{u}^{\frac{\gamma}{1-\beta}})$$

$$g^S=\frac{S_t}{K_t}=s_\pi \pi u_t-\frac{Z}{K}$$

In the goods market equilibrium, also,

$$g^I=g^S$$

Up to this point I have 3 equations and 4 unknowns (g^I, g^S, u and $\tilde{u}$), so in order to close the system I impose the following,

$$u=\tilde{u}$$

Finally I have 4 equations and 4 unknowns so I can solve the system.

$$\alpha + \gamma_u u_t - \gamma_u \pi^{\frac{\beta}{1-\beta}} u^{\frac{\gamma}{1-\beta}} - s_\pi \pi u_t + \frac{Z}{K} = 0$$

To analyse the impact of a change in a parameter on the level of capacity utilisation, I could introduce the Implicit Function Theorem,

$$\frac{\delta u}{\delta \pi} = -\frac{\frac{\delta F}{\delta \pi}}{\frac{\delta F}{\delta u}} = -\frac{-\frac{\beta}{1-\beta}\gamma_u \pi^{\frac{2\beta-1}{1-\beta}} u^{\frac{\gamma}{1-\beta}} - s_\pi u}{\gamma_u - \gamma_u \pi^{\frac{\beta}{1-\beta}} \frac{\gamma}{1-\beta} u^{\frac{\gamma+\beta-1}{1-\beta}} - s_\pi \pi} > 0$$

As it can be seen, the same result holds even with the introduction of autonomous components.

3.4 Conclusion

Through this essay, I have presented many alternatives that try to justify the non-convergence towards *normal* utilisation or the latter's endogeneity in Neo-Kaleckian models. However, all of them present different theoretical and empirical shortcomings that should be addressed in order to substantiate their claims. Here, a critique from a Classical-Keynesian viewpoint was presented.

Nikiforos presents a micro model from which the normal level of utilisation is associated to a single level of production, therefore each change in the level of output will generate, under particular returns to scale, a change in u_n; an increase in the growth rate, not expected, triggers an increase in the level of production at the firm level, which makes the method of production change (i.e. the *normal* utilisation). Therefore, the effective level of utilisation determines the normal level. However, the mechanism described by the author seems to be very restrictive and not general enough.

In Setterfield and Avritzer (2020), the mechanism is different, the level of growth of the economy, by changing the level of output and the level of effective utilisation will generate particular entrepreneurs' expectations and this leads to a change in normal utilisation. They associate a higher level of utilisation with lower aggregate volatility and therefore lower normal utilisation. Thus, normal utilisation is also modified by recent experience of effective utilisation of capacity. Again, the mechanism described by the authors seems to be very restrictive and not general enough.

Finally, Franke (2020) as well as Petach and Tavani (2019) differentiate, in similar ways, the aggregate utilisation from the normal utilisation at the firm level. By means of a special mechanism, the aggregate utilisation modifies the cost function of the firms, and therefore, they choose to change the level of normal utilisation. This is how the normal utilisation follows the actual aggregate utilisation. However, the whole model depends on one assumption that has not been sufficiently justified. Moreover, this result is not compatible with the baseline and extended versions of the Neo-Kaleckian model.

In this essay I presented these 4 models and analyzed them thoroughly. I did not find a valid and general answer that could justify the idea through which the normal utilisation of the installed capacity is modified by the effective levels of capacity utilisation. In general, in growth models, normal utilisation is taken as given, not because it cannot change but because it is a simplification in modelling[47]. Including mechanisms that allow normal utilisation to change is highly propositional. The problem arises when these mechanisms are not general enough and are simply a way of justifying the mechanism of the Neo-Kaleckian models analysed here.

3.5 References

Allain, O. (2015). Tackling the instability of growth: a Kaleckian-Harrodian model with an autonomous expenditure component. *Cambridge Journal of Economics, 39*(5), 1351-1371.

Amadeo, E. J. (1986a). Notes on capacity utilisation, distribution and accumulation. *Contributions to Political Economy, 5*(1), 83-94.

Amadeo, E. J. (1986b). The role of capacity utilization in long-period analysis. *Political Economy, 2*(2), 147-160.

Amadeo, E. (1987). Expectations in a steady state model of capacity utilization. *Political Economy, 3*(1), 75–89.

Arias, A., Hansen, G. D., & Ohanian, L. E. (2007). Why have business cycle fluctuations become less volatile?. *Economic theory, 32*(1), 43-58.

[47]The fact that one variable is considered exogenous does not mean that it cannot change, but that it is relatively persistent; for the theoretical method to be useful it is enough that the speed of change of the endogenous variables is of a higher order than the rate of change of the exogenous magnitudes; the given variables may then be assumed to be fixed for the purpose of explaining the long-period position, even though they may change slowly over time (Dvoskin and Lazzarini 2013, p. 118).

Arestis, P., González, A. R., Dejuń, Ó. (2012). Private productive investment in Spain and the United States. *Análise Econmica, 30*(58).

Auerbach, P., & Skott, P. (1988). Concentration, competition and distribution-a critique of theories of monopoly capital. *International Review of Applied Economics*, 2(1), 42-61.

Betancourt, R. P., & Clague, C. (1981). *Capital Utilization: A theoretical and Empirical Analysis.* Cambridge University Press.

Blanchard, O., & Simon, J. (2001). The long and large decline in US output volatility. *Brookings papers on economic activity, 2001*(1), 135-174.

Bortis, H. (1984). Employment in a capitalist economy. *Journal of Post Keynesian Economics, 6*(4), 590-604.

Bortis, H. (1997). Institutions, behaviour and economic theory: a contribution to classical-Keynesian political economy. Cambridge University Press.

Bragg, M. (2007). Steven. Financial Analysis, A Controller's Guide. Second edition, Canada: John Wiley & Sons.

Brierley, J. A., Cowton, C. J., & Drury, C. (2006). A note on the importance of product costs in decision-making. Advances in management accounting, 15, 249-265.

Buzzell, R. D., Gale, B. T., & Sultan, R. G. (1975). Market share-a key to profitability. Harvard business review, 53(1), 97-106.

Ciccone, R. (1986). Accumulation and capacity utilization: some critical considerations on Joan Robinson's theory of distribution. *Political Economy, 2*(1), 17-36.

Ciccone, R. (1987). Accumulation, capacity utilization and distribution: a reply. *Political Economy, 3*(1), 97-111.

Clifton, J. A. (1983). Administered prices in the context of capitalist development. *Contributions to Political Economy, 2*(1), 23-38.

Dejuán, O. (2005). Paths of accumulation and growth: towards a Keynesian long-period theory of output. *Review of Political Economy, 17*(2), 231-252.

Dejuán, Ó. (2013). Normal paths of growth shaped by the supermultiplier. In Sraffa and the Reconstruction of Economic Theory: Volume Two (pp. 139-157). Palgrave Macmillan, London.

Dejuán, Ó. (2014). The supermultiplier as a vertically hyperintegrated sector. Centro Sraffa Working Papers, 4, 1-23.

Dejuán, Ó. (2017). Hidden links in the warranted rate of growth: the supermultiplier way out. *The European Journal of the History of Economic Thought, 24*(2), 369-394.

Dutt, A. K. (1984). Stagnation, income distribution and monopoly power. *Cambridge Journal of Economics, 8*(1), 25-40.

Dutt, A. K. (1987). Alternative closures again: a comment on 'Growth, distribution and inflation'. *Cambridge Journal of Economics, 11*(1), 75-82.

Dutt, A. K. (1990). Growth, distribution and uneven development. Cambridge University Press.

Dutt, A. K. (1997). Dependence And Hysteresis In Post Keynesian Models. *Markets, Unemployment, and Economic Policy, 2*, 238.

Dutt, A. K. (2010). Equilibrium, stability and path dependence in post-Keynesian models of economic growth. In *Production, Distribution and Trade: Alternative Perspectives*, 114, 233.

Dvoskin, A., & Lazzarini, A. (2013). On Walras's concept of equilibrium. *Review of Political Economy, 25*(1), 117-138.

Eichner, A. (1976). *The Megacorp and Oligopoly*. Cambridge University Press.

Eiteman, W. J., & Guthrie, G. E. (1952). The shape of the average cost curve. *The American Economic Review, 42*(5), 832-838.

Fiebiger, B. (2020). Some observations on endogeneity in the normal rate of capacity utilisation. *Review of Keynesian Economics, 8*(3), 385-406.

Foss, M. F. (1981). *Changes in the Workweek of Fixed Capital: US Manufacturing, 1929 to 1976 (Vol. 309)*. American Enterprise Institute Press.

Franke, R. (2020). An attempt at a reconciliation of the Sraffian and Kaleckian views on desired utilization. *European Journal of Economics and Economic Policies: Intervention, 17*(1), 61-77.

Gahn, S. J., & González, A. (2019). On the empirical content of the convergence debate: Cross country evidence on growth and capacity utilisation (No. PKWP1922).

Garegnani, P. (1984). Value and distribution in the classical economists and Marx. *Oxford economic papers, 36*(2), 291-325.

Girardi, D., & Pariboni, R. (2019). Normal utilization as the adjusting variable in Neo-Kaleckian growth models: A critique. *Metroeconomica, 70*(2), 341-358.

Haluska, G. (2020). A critical evaluation of some Kaleckian proposals to deal with the issue of convergence towards normal capacity utilization. *Review of Keynesian Economics, 8*(3), 407-427.

Haluska, G.; Summa, R. and Serrano, F. (2021). The degree of utilization and the slow adjustment of capacity to demand: reflections on the US Economy from the perspective of the Sraffian Supermultiplier. *IE-UFRJ Discussion Paper*.

Hein, E., Lavoie, M., & van Treeck, T. (2011). Some instability puzzles in Kaleckian models of growth and distribution: a critical survey. *Cambridge Journal of Economics, 35*(3), 587-612.

Hein, E., Lavoie, M., & van Treeck, T. (2012). Harrodian instability and the 'normal rate'of capacity utilization in Kaleckian models of distribution and growth—a survey. *Metroeconomica, 63*(1), 139-169.

Hein, E. (2014). *Distribution and growth after Keynes: A Post-Keynesian guide*. Edward Elgar Publishing.

Huang, B. (2020). Normal utilization rate in the Sraffa framework. *Metroeconomica, 71*(4), 767-780.

Johnson, H. T. (1978). Management accounting in an early multidivisional organization: General Motors in the 1920s. *Business History Review, 52*(4), 490-517.

Kalecki, M. (1954). Theory of Economic Dynamics London. George Allen.

Kalecki, M. (2016). Studies in the theory of business cycles: 1933-1939. Routledge.

Keynes, J. M. (2018 [1936]). The general theory of employment, interest, and money. Springer.

Kim, C. J., Nelson, C. R., & Piger, J. (2004). The less-volatile US economy: a Bayesian investigation of timing, breadth, and potential explanations. *Journal of Business Economic Statistics, 22*(1), 80-93.

Kurz, H. D. (1986). Normal positions and capital utilization. *Political Economy, 2*(1), 37-54.

Kurz, H. D. (1994). Growth and distribution. *Review of Political Economy, 6*(4), 393-420.

Kurz, H. D. (1993). Accumulation et demande effective: quelques notes. *Cahiers d'économie politique/Papers in Political Economy*, 59-82.

Lanzillotti, R. F. (1958). Pricing objectives in large companies. *The American Economic Review, 48*(5), 921-940.

Lanzillotti, R. F. (1959). Pricing objectives in large companies: Reply. *The American Economic Review, 49*(4), 679-687.

Lavoie, M. (1992). Foundations of post-Keynesian economic analysis. Books.

Lavoie, M. (1995). The Kaleckian model of growth and distribution and its neo-Ricardian and neo-Marxian critiques. *Cambridge Journal of Economics, 19*(6), 789-818.

Lavoie, M. (1996). Traverse, hysteresis, and normal rates of capacity utilization in Kaleckian models of growth and distribution. *Review of Radical Political Economics, 28*(4), 113-147.

Lavoie, M., Rodriguez, G., & Seccareccia, M. (2004). Similitudes and discrepancies in post-Keynesian and Marxist theories of investment: a theoretical and empirical investigation. International *Review of Applied Economics, 18*(2), 127-149.

Lavoie, M. (2014). *Post-Keynesian economics: new foundations.* Edward Elgar Publishing.

Lavoie, M. (2016). Convergence Towards the Normal Rate of Capacity Utilization in Neo-Kaleckian Models: The Role of Non-Capacity Creating Autonomous Expenditures. *Metroeconomica, 67*(1), 172-201.

Lee, F. (1986). Post Keynesian View of Average Direct Costs a Critical Evaluation of the Theory and the Empirical Evidence. *Journal of Post Keynesian Economics, 8*(3), 400-424.

Lee, F. S. (1999). *Post Keynesian price theory*. Cambridge University Press.

Marris, R. (1964). The economics of capital utilisation (No. 10). Cambridge University Press.

Monza, A. (1976). Crecimiento y demanda. *El Trimestre Económico, 43*(169 (1), 107-140.

Nikiforos, M. (2011a). On the desired rate of capacity utilization. *The New School for Social Research, Working Paper*, (16).

Nikiforos, M. (2011b). The Kaleckian model in the long run: Economies of Scale as a source for Hysteresis. mimeo.

Nikiforos, M. (2013). The (normal) rate of capacity utilization at the firm level. *Metroeconomica, 64*(3), 513-538.

Nikiforos, M. (2016). On the 'utilisation controversy': a theoretical and empirical discussion of the Kaleckian model of growth and distribution. *Cambridge Journal of Economics, 40*(2), 437-467.

Nikiforos, M. (2020). Notes on the Accumulation and Utilization of Capital: Some Theoretical Issues. Levy Economics Institute, Working Papers, (952).

Park, M. S. (1995). A Note on the 'Kalecki-Steindl' Steady-State Approach to Growth and Income Distribution. *The Manchester School of Economic Social Studies, 63*(3), 297-310.

Parrinello, S. (2014). A search for distinctive features of demand-led growth models. *PSL Quaterly Review, 67*(270), 309-342.

Petach, L., & Tavani, D. (2019). No one is alone: Strategic complementarities, capacity utilization, growth, and distribution. *Structural Change and Economic Dynamics, 50*, 203-215.

Petach, L. (2020). Distribution and capacity utilization in the United States: evidence from state-level data. *Review of Keynesian Economics, 8*(2), 240-267.

Puty, C. C. B. (2005). Cost Curves and Capacity Utilization in the US Manufacturing, 1958-1996. In Seminar programs. São Paulo Department of Economics. Universidade Federal do Pará.

Puty, C. A. C. B. (2018). Sectoral Mark-ups in US Manufacturing. *Structural Change and Economic Dynamics.*

Rowthorn, B. (1981). *Demand, real wages and economic growth.* North East London Polytechnic.

Serrano, F. L. (1995). The sraffian supermultiplier. Unpublished PhD thesis.

Shaikh, A. (2007). A proposed synthesis of Classical and Keynesian growth. The New School for Social Research, Working Paper, (5).

Shaikh, A. (2009). Economic policy in a growth context: a classical synthesis of Keynes and Harrod. *Metroeconomica, 60*(3), 455-494.

Shaikh, A. (2016). *Capitalism: Competition, conflict, crises.* Oxford University Press.

Skott, P. 2010. 'Growth, Instability and Cycles: Harrodian and Kaleckian models of accumulation and income distribution.' In M. Setterfield, Ed., *Handbook of Alternative Theories of Economic Growth*. London, UK: Edward Elgar.

Skott, P. (2012). Theoretical and empirical shortcomings of the Kaleckian investment function. *Metroeconomica, 63*(1), 109-138.

Skott, P. (2019). Autonomous demand, Harrodian instability and the supply side. *Metroeconomica, 70*(2), 233-246.

Setterfield, M. (2019). Long-run variation in capacity utilization in the presence of a fixed normal rate. *Cambridge Journal of Economics, 43*(2), 443-463.

Setterfield, M., & David Avritzer, J. (2020). Hysteresis in the normal rate of capacity utilization: A behavioral explanation. *Metroeconomica, 71*(4), 898-919.

Taylor, L. (1985). A stagnationist model of economic growth. *Cambridge Journal of Economics, 9*(4), 383-403.

Trezzini, A., & Pignalosa, D. (2021). The Normal Degree of Capacity Utilization: The History of a Controversial Concept (No. CSWP49). Centro di Ricerche e Documentazione " Piero Sraffa".

Vianello, F. (1985). The pace of accumulation. *Political Economy: Studies in the Surplus Approach, 1*(1), 69-87.

4 On the adjustment of capacity to aggregate demand

4.1 Introduction

Although there is a general agreement by which productive capacity adjusts to effective demand and not the other way around among Post-Keynesian scholars (Garegnani, 1992; Arestis, 1996), it is not clear at all how this adjustment is achieved regarding capacity utilization - *direction* and *speed* of adjustment.

The main critiques to the Neo-Kaleckian model and its extended version are resumed in Fagundes and Freitas (2017). The most important ones are that they cannot generate a tendency towards normal capacity utilisation and they do not imply a positive relationship between the rate of output growth and the investment-output ratio.

In this chapter, I tackle this very first issue - presented in Fagundes and Freitas (2017) - by investigating the relationship between the *level* of output and the ensuing utilisation of existing capacity. I will discuss the behaviour through time of capacity utilisation after an output shock, from an exclusively empirical standpoint.

4.2 Sraffian and Neo-Kaleckian controversies on capacity utilisation

4.2.1 FAS and Sraffian responses

It could be claimed that the analytical debate between Sraffians and Neo-Kaleckians authors on the convergence towards *normal* capacity utilisation - and its flexibility - started during the 1980s in many interventions published in *Political Economy: Studies in the Surplus Approach*. The philosopher's stone had been discovered by Fernando Vianello (1985): He developed, under a Classical-Keynesian framework (a latter-day term), the notion of Fully Adjusted Situations (FAS, hereafter) 'situations in which a uniform rate of profits prevails, and the productive capacity installed in each industry is exactly sufficient to produce the quantities that the market absorbs when commodities are sold at their natural prices' (Vianello, 1985, p. 70). During the process of adjustment from one FAS to another one with a higher level of output, Vianello claims that 'a temporary over-utilisation of productive capacity is require in order to bridge the gap between the moment in which normal utilisation turns out to be insufficient to meet the demand, and the moment in which productive capacity has fully adjusted' (Vianello, 1985, p. 72). As a conclusion, changes in the level of real output do not involve permanent changes in the degree of utilisation of productive capacity but rather changes in the productive capacity installed.[1] Despite his very first intuitions, Vianello did not develop an analytical model able to explain the whole process of adjustment from changes in output to changes in capacity; something that has been done many years later.

The notion of FAS, after Vianello (1985), was severely criticized on theoretical grounds by Sraffians and Neo-Kaleckians. The critique from Sraffian grounds was related to the fact that the FAS were such a particular case of the long-period positions and could not be general enough (Ciccone, 1986; Committeri, 1986) or suffered from the lack of an 'objective' determination (Kurz, 1986).

First, Ciccone did not agree with the idea that 'normal' utilisation should be founded on the rigidity of the degree of capacity in the long-period (Ciccone, 1986, p. 23, fn. 23). In this sense long-period utilisation of capacity is modified in response to variations in demand (Ciccone, 1986, p. 17), for instance, if the average-to-peak relation changes. In the long-period's notion of Ciccone, there 'is evidently room for the fluctuations in quantities and prices and the disappointments of expectations that occur in reality' (ibid, p. 23). The definition of *normal* utilisation refers to 'the degree of utilisation of capacity that is relevant for long-period prices seems to be that expected for newly installed capacity, which need not necessarily coincide with the degree of utilisation actually realised with the existing stock of capacity' (ibid, p. 24). Within the long-period actual utilisation can turn out to be different from *normal* utilisation without the size of the capacity being seen as 'wrong' with respect to what entrepreneurs would have found profitable to install (ibid, p. 28). In this sense,

[1]By productive capacity I mean the productive equipment (mostly fixed capital goods) in existence, together with that part of the workforce which is required to operate it (Garegnani, 1992, p. 65, fn. 3).

Ciccone's view is in line with the *flexibility* of production coefficients presented in Wicksteed, Marshall, Walras and Wicksell (Stigler, 1939, p. 305), nowadays it could be seen as a *range* of effective utilisation and not a precise *unique* value of effective output-capital relationship in which the producers 'will be content with what they are doing'. Therefore, *normal* utilisation 'can no longer be determined with reference to a single level of output' [Ciccone, 1987, p. 100; based on Marris (1964, p. 95)]. Given that *normal* capacity utilisation is that one expected on average for newly installed capacity, the latter is characterized by the existence of margins within which deviations with respect to that average do not necessarily resolve into undesired excesses or deficiencies (Ciccone, 1986, p. 29). In short, although not explicitly claimed, Ciccone supports the idea by which a range of effective utilisation might not trigger entrepreneurs' responses (Ciccone, 1987, p. 106) because that range was deliberately taken into account when new capacity was installed.[2] Although their profound critiques to the FAS, the tendency of capacity to adjust to output was not even denied by these scholars (Ciccone, 1986; Garegnani, 1992; Park, 1997; Trezzini, 1995; Trezzini, 1998).[3]

The second critical comment on Vianello's position was written by Marco Committeri. In his view,

> Vianello does not seem to provide a substantial contribution towards an understanding of how a long-period theory of output could be shaped in Sraffa's theory: in particular, the basic difficulty seems to lie in the fact that Sraffa's production prices are viewed as anchored to situations like FAS, which by their very nature are devoid of any practical relevance for the study of long-run tendencies.
>
> Commiteri, 1986, p. 178.

According to Committeri (1986, p. 177), FAS were conceived as *terminal points* of a complex adjustment process, *to be attained at some specific moment of time*, such a process, is left unspecified, as well as the time span required for the economy to pass from one FAS to another; therefore, nothing can be concluded about the actual pace of accumulation during this *within* period. Committeri then claims that unless the system were thought to oscillate around a trend line of steady growth, FAS could not be taken to represent the *average* rate of

[2]Under different theoretical frameworks, the idea of a range of inaction for the firms was developed by Dutt (1990), Lavoie (1992), Dutt (2010), Parrinello (2014) and Setterfield (2019, 2020). Setterfield (2020) and Botte (2020) tried also to calculate empirically this range.

[3]In general, the critiques are related to the fact that the process of adjustment of capacity to output is not mechanical and, given that it is full of contingencies, it is by far complex enough to be formalised. See Trezzini (2012), Trezzini (2013), Trezzini and Palumbo (2016) and Trezzini (2017) on this view and Moreira & Serrano (2019) for a response.

accumulation. To conclude, Committeri's view is that FAS might allow to understand the growth process at a *precise moment of time*, and not a long-run *trend*.

The third remark was made by Kurz who claims that, although Vianello shares the idea that there is an implicit notion of *normal* capacity utilisation in Sraffa's analysis, it remains unclear how this *normal* degree is determined (Kurz, 1986, p. 51; Kurz, 1990b, p. 397). For Kurz, Vianello's notion of *normal* utilisation is not based on cost-minimising and because of this has the disadvantage of lacking an 'objective' determination.

Through time, the position of Fernando Vianello becomes the Second Sraffian Position and those that are critical of FAS became the First Sraffian Position, a classification borrowed from Professor Cesaratto (2015). In fact, Vianello finally changed his position in favour of a *non-complete* adjustment (Vianello, 1989, p. 188, fn. 17), in line with the First Sraffian Position.[4]

4.2.2 The Neo-Kaleckian reaction: First generation

The notion of FAS in which effective utilisation capacity adjusts perfectly towards the *normal* rate, given that capacity is what adjusts in the long run, was difficult to process for some Neo-Kaleckian scholars. The Neo-Kaleckian model was under attack on at least one ground: Is there a *tendency* to produce under (exogenous - given technique) *normal* conditions constantly operating? If the answer is yes, therefore the baseline Neo-Kaleckian model, in which effective and normal utilisation might coincide only by a fluke, was lacking economic rationale. The model developed by Amadeo, following the Neo-Kaleckian tradition (Del Monte, 1975; Rowthorn, 1981; Taylor, 1983, 1985; Dutt, 1984), consisted on two equations (own notation),

$$\frac{I}{K} = \gamma + \gamma_u(u - u_n) \tag{4.1}$$

$$\frac{S}{K} = s_\pi \frac{\pi u}{v} \tag{4.2}$$

The first equation postulates that the growth rate of accumulation is a function of γ, which is interpreted as the expected trend growth rate of sales or simply 'animal spirits', and the discrepancy between actual capacity utilisation (u_t) and the desired or normal rate (u_n)[5]; γ_u

[4] See Serrano and Moreira (2018) on this.

[5] It must be clarified that in the original versions of the baseline Neo-Kaleckian model, the notion of *normal* utilisation is not discussed: Rowthorn (1981), Dutt (1984, 1987), Taylor (1985), among others. As far as I know, the first author that introduce this notion in a Neo-Kaleckian framework is Amadeo (1986a, 1986b, 1987).

is a parameter. The second one is the saving equation, which is simply the product of the marginal propensity to save out of profits (s_π) and the profit rate (r), the latter written as the product of the profit share (π), capacity utilisation, and the inverse of the capital-output ratio (v). As I have previously said, in equilibrium, given that investment equals savings,

$$u^* = \frac{v(\gamma - \gamma_u u_n)}{s_\pi \pi - \gamma_u v} \tag{4.3}$$

It is easy to see under the blind eye that u will be equal to u_n by a fluke, if and only if, $\frac{\alpha - \pi u_n}{\pi - \beta} = 0$. Any increase in aggregate demand will be accommodated with a persistent change in the level of capacity utilisation; moreover, u could be at any level between 0 and 1.

Let us suppose that starting from a FAS in which $u = u_n$ there is an exogenous *positive* (negative) change in the level of capitalists' savings s_π, the level of effective capacity utilisation will decrease (increase) *una tantum* and there is no mechanism that ensures a return towards its *normal* level. Analytically,

$$\frac{\partial u}{\partial s_\pi} = -\frac{v\pi(\gamma - \gamma_u u_n)}{(s_\pi \pi \sigma - \phi v \gamma_u)^2} < 0$$

under this circumstance, the economic rationale of the model is undermined: If that particular *level* of *normal* utilisation is chosen in order to minimize costs in the long-run, why capitalists would have no incentive to achieve that level in the FAS? Rephrasing, why capitalists would have no incentive to *tend* toward that particular level that was chosen previously when capacity was installed?[6]

On the other hand, the model implies relevant implications in terms of distribution and growth. In the case of Amadeo's model, given that propensity to consume is greater for workers, an exogenous increase in the wage rate (a decrease in π) implies a higher level of capacity utilisation which is associated with a higher rate of profits and a higher rate of growth. Given that there is no mechanism that equalises u and u_n, a change on distribution generates a persistent *growth effect* on output.

[6] Again, it must be clarified that in these models, the technique of production is assumed as given.

4.2.3 The Neo-Kaleckian reaction: Second generation

From the Neo-Kaleckian side, Amadeo (1986a) presented a model in which the effective capacity utilisation could equalise its *normal* one in the long-run (ibid., p. 148 and p. 155), but reverting the usual adjustment: He introduced the idea by which the *normal* could adjust to the *effective*, endogenising the *normal* rate: 'one may argue that if the equilibrium degree is systematically different from the planned degree of utilization, entrepreneurs will eventually revise their plans, thus altering the planned degree' (Amadeo, 1986a, p. 155) but he did not assert any rational mechanism of adjustment, leaving the effective (and the *normal*) level of capacity utilisation as a variable free to present a value between 0 and 1 (see Skott, 2012). This second version with endogenous utilisation of capacity was developed in Lavoie (1992, 1995, 1996, 2010), Lavoie et al. (2004) and Cassetti (2006), among others. Based on the phrase of Amadeo, the system of equations now consists on,

$$\frac{I}{K} = \gamma + \gamma_u(u - u_n)$$

$$\frac{S}{K} = s_\pi \frac{\pi u}{v}$$

$$\dot{u_n} = \sigma(u - u_n)$$

$$\dot{\gamma} = \phi(g - \gamma)$$

This model is profoundly formalized by Lavoie in the abovementioned papers. The main conclusions are that, first, a change in 'animal spirits' (γ), the propensity to save (s_π) or the profit share (π) deliver a *growth* effect on output and a *persistent* effect on the *level* of capacity utilisation. In this case, *normal* capacity utilisation is equal to:

$$u_n = \frac{C\sigma v}{s_\pi \pi \sigma - \phi v \gamma_u}$$

where C is a constant of integration. therefore, as an example, a change in s_π delivers a *persistent* effect on capacity utilisation,

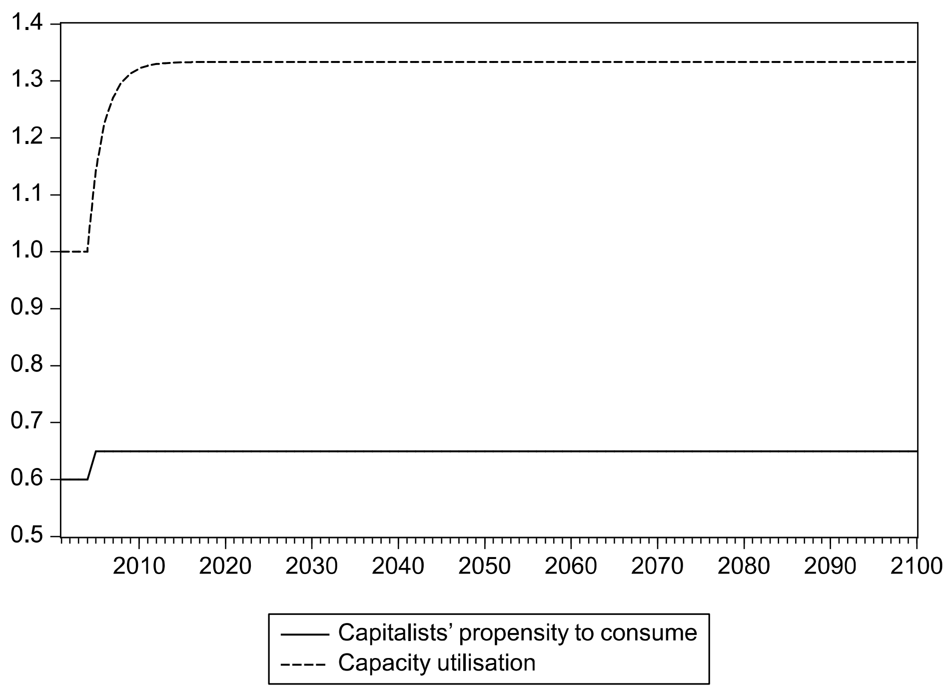
$$\frac{\partial u_n}{\partial s_\pi} = -\frac{C\sigma^2 \pi v}{(s_\pi \pi \sigma - \phi v \gamma_u)^2} < 0$$

where C is a constant of integration. The difference with the baseline Neo-Kaleckian model is that here, not only the *effective* rate of capacity utilisation is changing but also its *normal* level. Secondly, the model includes a FAS in which $u = u_n$; however, the mechanism that allows the equalization between the effective and the normal utilisation in the long run reverses the original logical causality of Vianello (1985) and follows the crystal-clear causality of Amadeo (1986).

4.2.4 A graphical representation

In this subsection I will present graphically, how the aggregate - effective and *normal* - capacity utilisation behaves in response to aggregate demand shocks in the baseline and extended versions of the Neo-Kaleckian model. Based on a simulation code[7] on the baseline and extended versions of the Neo-Kaleckian model I demonstrate graphically, as I have done previously analytically, that a change in the propensity to save of capitalists (or a change in capitalists' propensity to consume) has *persistent* effects on the level of capacity utilisation in these models.

Figure 4.1 Propensity to consume and capacity utilisation in a baseline Neo-Kaleckian model



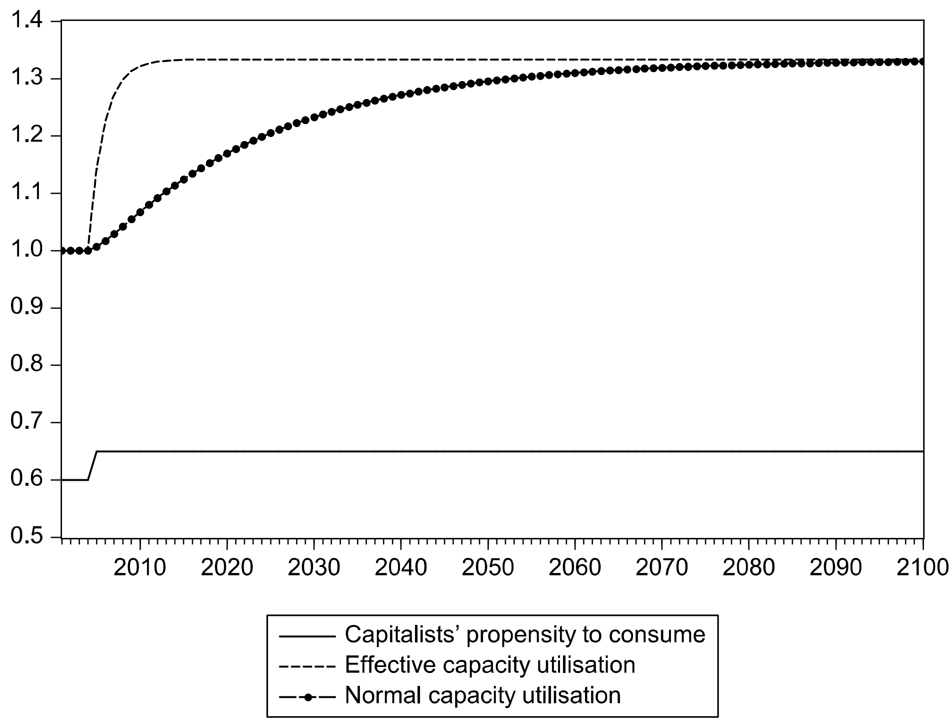
Source: own elaboration based on simulations.

As it can be seen from Figure (4.1), a persistent change in the propensity to consume of capitalists (from 0.6 to 0.65) results in a persistent change in the level of effective capacity

[7] I would like to thank Mg. Guido Ianni for sharing his baseline code and for fruitful discussions on this topic.

utilisation, remaining the *normal* rate ($= 1$) unaltered. On the other hand, from Figure (4.2) it

Figure 4.2 Propensity to consume and capacity utilisation in a extended Neo-Kaleckian model



Source: own elaboration based on simulations.

can be observed that a persistent change in the propensity to consume of capitalists generates a persistent change in the level of effective capacity utilisation, but also in the *normal* rate in the long-run.

4.3 On the empirical evidence

4.3.1 Literature review

There are few attempts in the empirical literature to analyse the interaction between aggregate demand growth (or levels) and capacity utilisation and the latter's behavior through time.

On the one hand, from a traditional perspective, for instance, Nadiri and Rosen (1969) is the paper which is the closest one to the exercise performed here. The authors try to estimate the impact on capacity utilisation of a shift in demand and find that utilisation rates - hours per man and capacity utilisation - 'immediately overshoot their ultimate values in the first or second and monotonically decline to their equilibrium values as the stock adjustments proceed' (ibid., p. 465) and conclude that these 'comparisons show that the primary roles of variations in utilization rates, and to a lesser extent employment variations, serve to maintain output levels while capital stock is slowly adjusting.' (ibid., p. 466).

Shapiro (1989, p. 193), on a critical paper to the Federal Reserve Board's measures of capacity utilisation, presents OLS regressions of the growth rate of capacity utilisation (ΔCU) on a constant and the growth rate of industrial production (ΔIP) for various industries; the growth rate in production explains virtually all of the month-to-month changes in utilisation. Finn (1995) introduces only a correlation between capacity utilisation and cyclical per-capita industrial production equal to 0.82. Driver (2000) shows how aggregate utilisation capacity, as a proxy of economic cycle, impacts positively on firm's utilisation. Bansak, Morin & Starr (2007), while analysing empirically potential determinants of capacity utilisation level, include growth rate of industrial production index (δIP), the investment-capital ratio (I/K) and the standard deviation of industrial production index to capture effects on utilisation of output growth, investment level, and output volatility, respectively; to accommodate the panel aspect of the data they ran their model using both fixed and random effects and, after that, Generalized Method of Moments (GMM) estimator proposed by Arellano and Bond (1991); the rate of growth of industrial production impacts positively on capacity utilisation in all their estimates in the short-run but the GMM estimations.

On the other hand, from a Neo-Kaleckian and/or Sraffian perspective, Schoder (2012a), who analyses both aggregate data and sectoral panel data through state-space modeling approach and the Kalman filter, rejects the null hypotheses of no endogenous adjustments of capacity utilisation. Moreover, Schoder (2012b, 2014b) using Cointegrated Vector Auto-Regression analysis, provide evidence that production capacities adjust endogenously to current output in the long run for the US manufacturing sector. He also finds that capacity adjusts very slowly (Schoder, 2012b, p.7). Finally, Nikiforos (2016) presents evidence, as Kennedy (1998, p. 177), Driver and Shepherd (2005, p. 136), Braga (2006, p. 56) and Schoder (2012b), on the stationarity of FRB's measures on capacity utilisation but he severely criticises the construction of this time series; after that, he develops a theoretical model in which normal capacity utilisation at a micro and macro level is endogenous and he presents some empirical evidence using AutoRegressive Distributive Lag methodology as a proof of his claim.[8]

In this essay, I will try to assess the impact of a change in the *level* of output on the *level* of capacity utilisation. Although there was a lively theoretical debate on the notion of FAS, no empirical tests were performed on this. For this reason, my empirical results will try to size not only the *direction* but the *speed* of adjustment of the *level* of capacity utilisation to a persistent *level* shock of aggregate demand. It should be noticed that I am limiting my attention to Neo-Kaleckian and the Sraffian Supermultiplier because of their current relevance in growth and accumulation debates.

4.3.2 Data

The econometric analysis carried out in this essay is based on quarterly data provided by the OECD[9] on GDP[10] and capacity utilisation[11] In order to assess the effects of shocks to gross domestic product on the degree of capacity utilisation and to provide a robust and clear picture of this phenomenon, I will run one time series regression for each of the 34 countries of the dataset. I will make use of the GDP (Y); given the Keynesian perspective that informs this work, I believe that changes in output levels are due mainly to aggregate demand shocks. All time-series considered are seasonally adjusted and their time span are different. All considered variables are transformed in logarithmic form.

4.3.3 Methods and identification strategy

I use a structural VAR (SVAR) methodology to estimate these models. In particular, a reduced-form VAR(p), shown in Equation (4.4), has to be estimated:

$$y_t = c + \sum_{i=1}^{p} A_i y_{t-p} + \epsilon_t \tag{4.4}$$

where y_t is the $kx1$ vector of considered variables (GDP and Utilisation), c is the constant term, A_i is the kxk matrix of reduced-form coefficients and ϵ_t is a $kx1$ vector composed by the error terms. The lag P of the VAR will be calculated through the Akaike Information

[8] For a theoretical and empirical critique of Nikiforos' approach see Girardi and Pariboni (2019), Gahn and González (2020) and Chapter 5 of this thesis. For stationarity in capacity utilisation in other countries see Gahn and González (2019) and Gallo (2019).

[9] https://stats.oecd.org/

[10] Expenditure approach. Measure VPVOBARSA: US dollars, volume estimates, fixed PPPs, OECD reference year, annual levels, seasonally adjusted.

[11] Business Tendency Surveys. See Appendix A for an analysis of Surveys.

Table 4.1 Time frame by country

Australia	1996Q1-2018Q4
Austria	1996Q1-2018Q4
Belgium	1978Q2-2018Q4
Brazil	1980Q1-2018Q4
Colombia	1981Q1-2018Q4
Czech Republic	1991Q1-2018Q4
Denmark	1987Q1-2018Q4
Estonia	1993Q2-2018Q4
Finland	1991Q1-2014Q4
France	1976Q1-2018Q4
Germany	1960Q1-2018Q4
Greece	1985Q1-2018Q4
Hungary	1986Q2-2018Q4
India	2000Q2-2018Q4
Indonesia	2002Q1-2018Q4
Ireland	1985Q1-2018Q4
Italy	1968Q4-2018Q4
Japan	1974Q2-2018Q4
Latvia	1993Q2-2018Q4
Lithuania	1993Q1-2018Q4
Luxembourg	1985Q1-2018Q4
Netherlands	1971Q4-2018Q4
New Zealand	1961Q2-2018Q4
Norway	1987Q1-2018Q4
Poland	1992Q2-2018Q4
Portugal	1977Q1-2018Q4
Slovak Republic	1993Q4-2018Q4
Slovenia	1995Q2-2018Q4
South Africa	1986Q1-2018Q4
Spain	1965Q2-2018Q4
Sweden	1995Q3-2018Q4
Switzerland	1967Q2-2018Q4
United Kingdom	1985Q1-2018Q4
United States	1967Q1-2018Q4

Source: own elaboration based on data provided. See Appendix A for details.

Criterion (AIC). I will also check the stationarity of the *VAR(p)* by assessing whether the inverse roots of the characteristic polynomial lie inside the unit circle. In order to obtain a *SVAR*, an identification strategy has to be imposed on the reduced-form *VAR(p)* (Equation

4.4). More precisely, a *SVAR(p)* can be represented as follows in Equation (4.5):

$$B_0 y_t = c + \sum_{i=1}^{p} B_i y_{t-p} + \omega_t \tag{4.5}$$

where B_0 represents the matrix of contemporaneous relationships between the k variables in y_t, B_i is the kxk matrix of autoregressive slope coefficients, and ω_t is the vector of serially uncorrelated structural shocks (Kilian and Lütkepohl, 2017). Once zero short run restrictions are imposed on B_0 and the *SVAR* is estimated, impulse response functions (IRFs) are calculated for a period of 60 quarters. Standard errors will be estimated through the Monte Carlo methods (1000 repetitions) and IRFs will be reported with a two-standard error bound, namely a 95% confidence interval.

It should be noticed that I did not introduce linear trends in the equations and regressions performed. Although linear trends on capacity utilisation *might* capture the process of technical progress or other determinants of the level of capacity utilisation, these determinants are not explicitly developed in the abovementioned models and therefore I stick to them. Moreover, these might not be linear and might also depend on aggregate demand. Added to this, following Nelson and Plosser (1982) there is no reason to introduce linear trends on output, given it is not a trend-reverting process, but a unit-root process.

In all considered models, a Cholesky factorisation is assumed and variables able to capture changes in output levels (Y) are ordered first, whereas the degree of capacity utilisation (U) is ordered as the last variable. In other words, I am assuming that changes in the level of output-GDP affect the degree of capacity utilisation within the quarter, while exogenous changes in the degree of capacity – whatever its origin – does not influence output within the quarter.

The reader might wonder why I use a combination I(1) and I(0) variables. This is still an ongoing debate in econometrics. Since the work of Sims, Stock and Watson (1990) it is clear that IRF can be done with a combination of variables with different order of integration. Sims (2013) gives an example in which differentiating the data does not change his IRF's results. Where one's principal concern is in obtaining impulse response function confidence intervals with good coverage Ashley and Verbrugge (2009) found that VAR in levels and lag-augmented VAR estimation methods perform adequately, at least for rather large samples, but that the differenced estimation models (i.e., the VAR in differences and error correction models) are problematic. In the end, SVAR models can be applied to a mix of I(0) and I(1) variables, without producing any spurious regression (Sims, 2013, pp. 21-22; Kilian and Lütkepohl, 2017, pp. 41 and 287). According to Kilian and Lütkepohl (2017, p. 287), SVAR models based on short-run restrictions are valid regardless of the order of integration of the variables. Therefore, Impulse Response Functions remain valid.

In Section 4.3.4 I will report the impulse response functions (IRFs) related to the effect produced by output level shocks on the degree of capacity utilisation (U).

4.3.4 Results

The first results concern the lag selection and the stability of the estimated *VAR* models. Our findings on the lag selection are reported in Appendix B (Table 4.2) and show that the optimum lags according to *AIC* criterion varies between 1 and 6 lags (maxlag=8). When I look at the stability of the estimated VAR models, the unit circle shows that estimated VAR are stationary and stable. Findings are reported in Appendix C (Figure 4.36).[12] Finally, almost all models are found to be stationary and stable. Specifically, Y has a unit root in almost all countries excepted Germany, Italy, Japan and Luxembourg. By contrast, U is stationary variable in almost all countries excepted in Czech Republic, Greece, India, Latvia, Lithuania, South Africa and Spain. The unit root tests are reported in Appendix D (Table 4.3). However, these exceptions do not change our results.

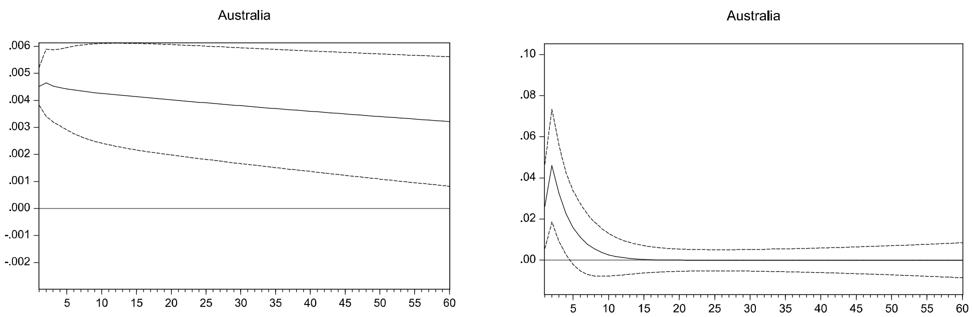
The econometric methodology considered allow me to isolate exogenous shocks to output levels that are approximated by Y. In the figures below, I report the effects of these shocks on the degree of capacity utilisation U by country. I report the the impulse response functions (IRFs) estimations without deterministic trend as well as by considering all the timespan.

As shown in left column of Figure 4.3 , shocks to output-GDP are usually accompanied by a persistent dynamic, which implies that an initial increase in the *level* of output builds up over time, stabilizing on a non-zero level. In this way, I am able to detect the effect of a *permanent* change of output level on the *level* of capacity utilisation. Specifically, when I look at the effects of these income's permanent shocks on U in right column of Figure 4.3, impulse response functions show that U tends to increase as soon as activity increases but it starts to converge to its pre-shock level approximately 5 quarters after shocks occur, namely after that U reaches its peak effect. The response of U converges to zero after roughly 10-20

[12] Whenever the estimates did not pass the autocorrelation or normality tests of residuals, the lags were increased without changing the results - the direction of the adjustment. However, here are the results without the increase in lags.

quarters and stabilises at that level in the long term.[13] The process of stabilization of U to its pre-shock level is similar in almost all considered models, ceteris paribus. However, some exceptions should be mentioned: Estonia, Indonesia and South Africa.[14]

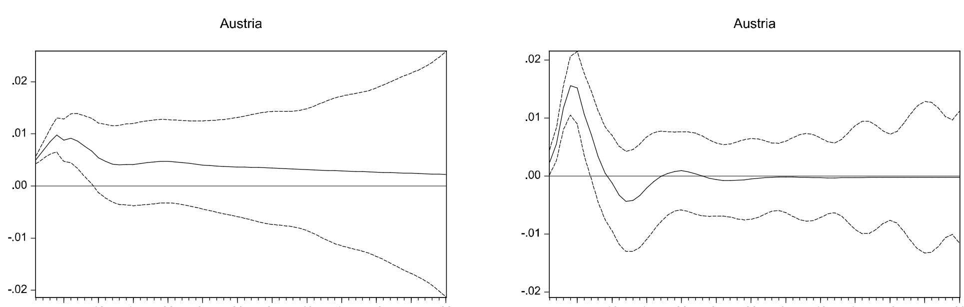
Figure 4.3 Response to Structural VAR Innovations $\pm$ 2 S.E. - Output (LHS) and utilisation (RHS) level

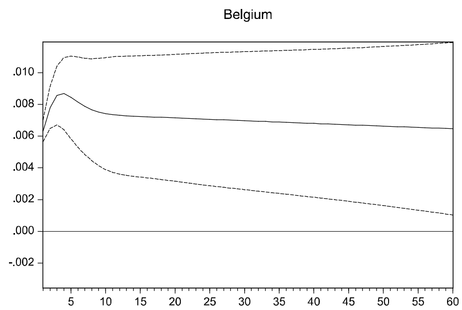


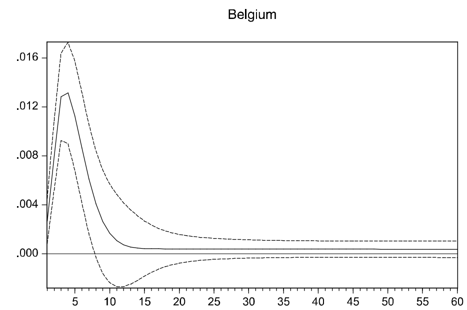
These exceptions might be related to the data-generating process given that in the case of Estonia the first observation of capacity utilisation (1993Q2) starts at a very low value of 52.5; the average level of utilisation was reached starting the 2000s; but this is a similar case to that one of Lithuania, which responses are 'well-behaved' in some sense. However, during the crisis of 2009, Lithuania's capacity utilisation was reduced 10 p.p. while Estonia's one 30 p.p. The data generation process, therefore, is quite volatile and this issue might explain this case. Indonesia is the country with less number of observations (n=68) so that might obstacle a correct analysis. Finally, South Africa is similar to Estonia in the sense that there is a fall of approximately 30 p.p. from the initial period until 2002 when utilisation reaches

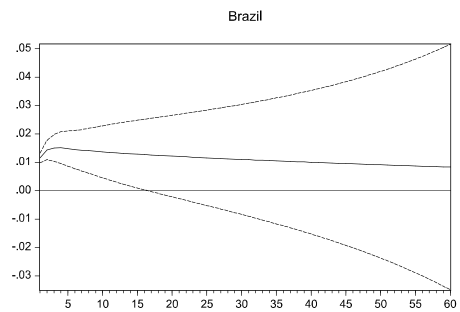
[13]This result can be related with the literature of slow adjustment of capital stock, e.g. Fazzari, Ferri and Variato (2020) and Haluska, Braga and Summa (2021).

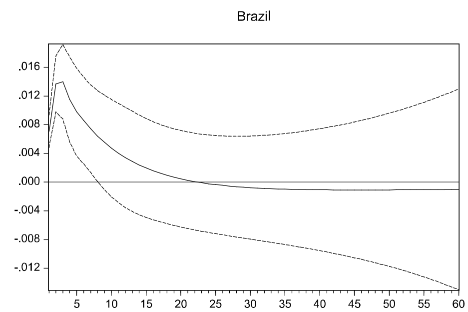
[14]Following a stimulating suggestion with a colleague I complemented my analysis with (1) a panel analysis 1996Q1-2018Q4 (Pedroni, 2013) and (2) an analysis employing local projections (Jordá, 2005, 2009). Results were robust and no substantial difference was found. I present some of this results in Appendix E.

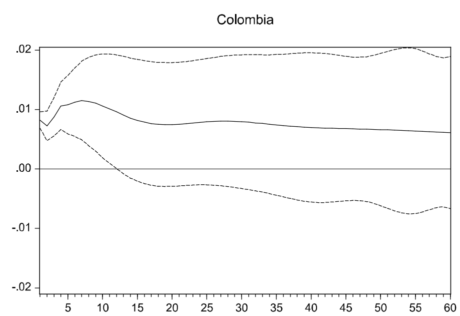


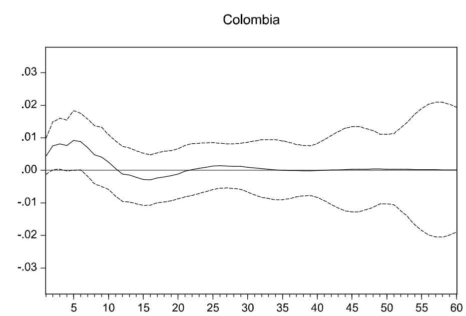

Belgium
.010
.008
.006
.004
.002
.000
-.002
5 10 15 20 25 30 35 40 45 50 55 60

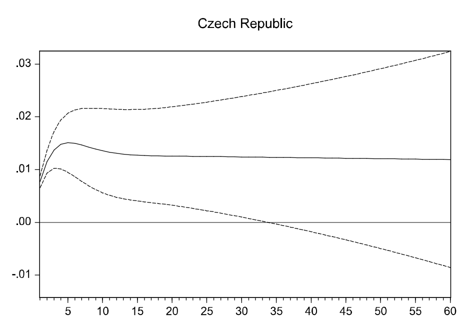

Belgium
.016
.012
.008
.004
.000
5 10 15 20 25 30 35 40 45 50 55 60

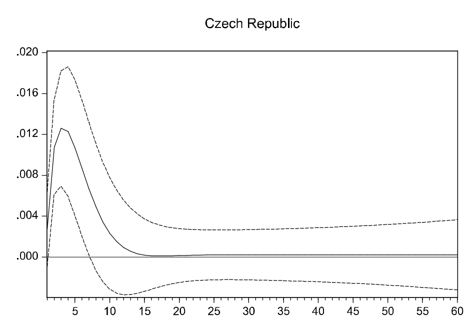

Brazil
.05
.04
.03
.02
.01
.00
-.01
-.02
-.03
5 10 15 20 25 30 35 40 45 50 55 60

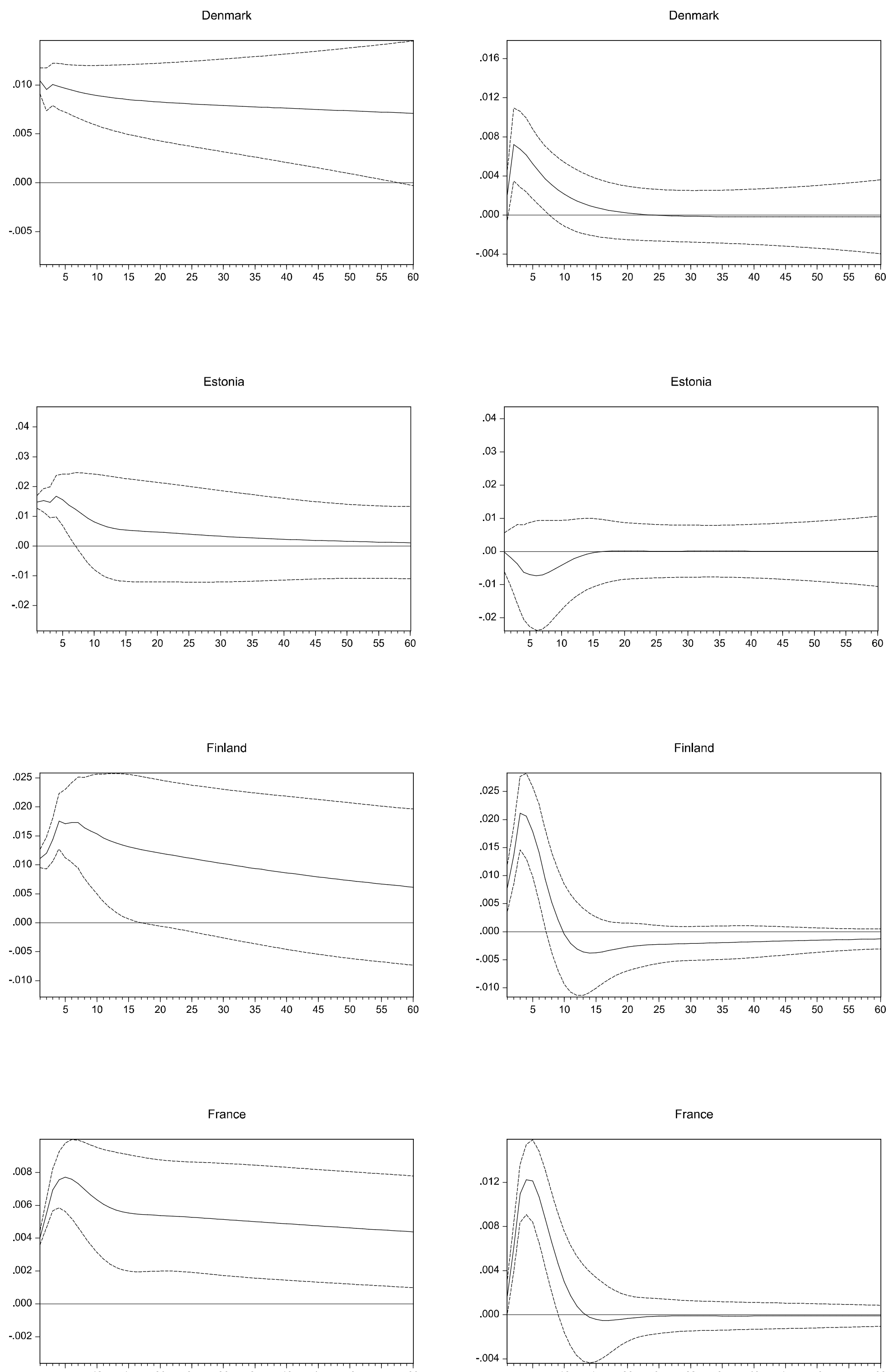

Brazil
.016
.012
.008
.004
.000
-.004
-.008
-.012
5 10 15 20 25 30 35 40 45 50 55 60

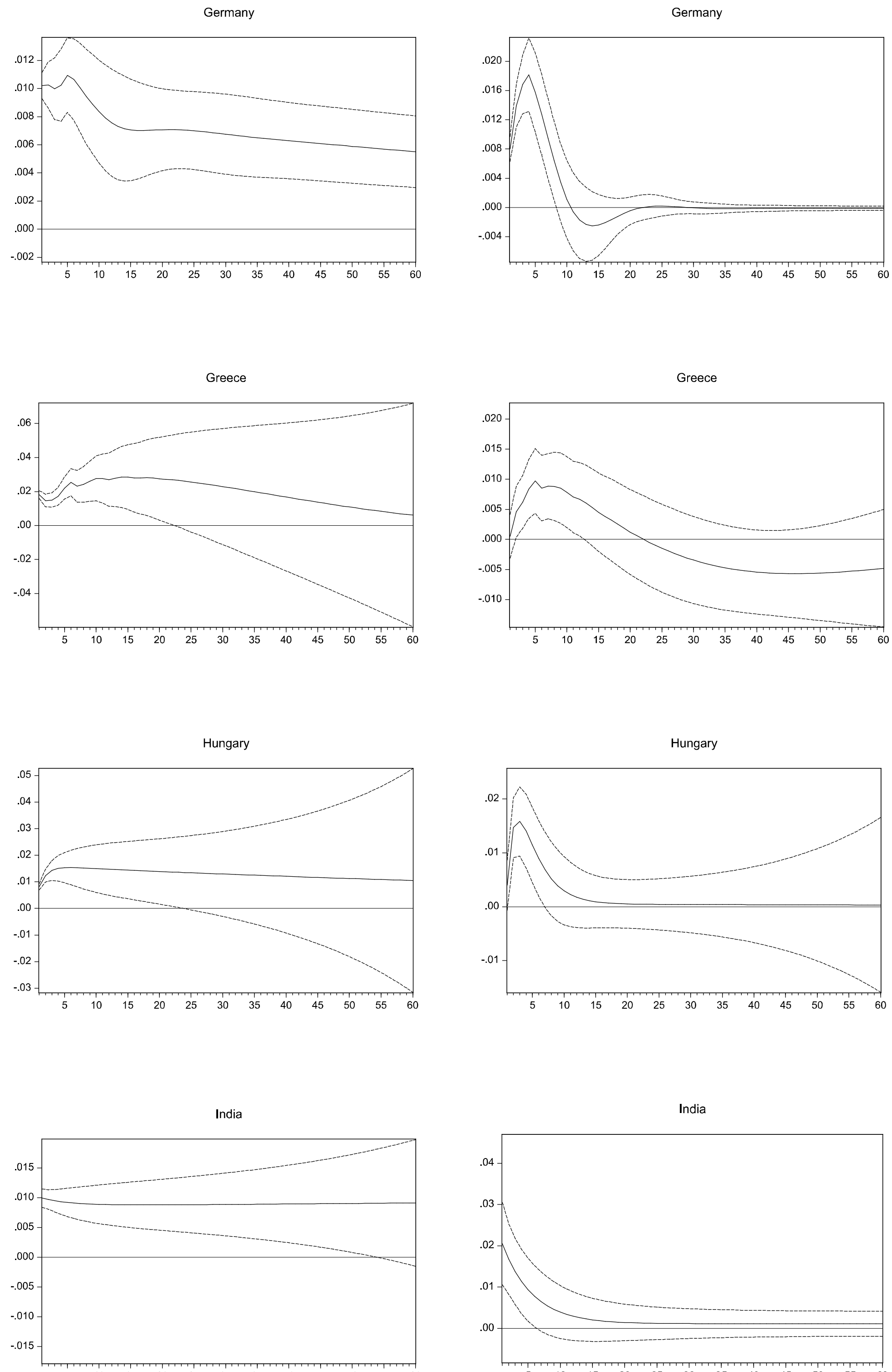

Colombia
.02
.01
.00
-.01
-.02
5 10 15 20 25 30 35 40 45 50 55 60

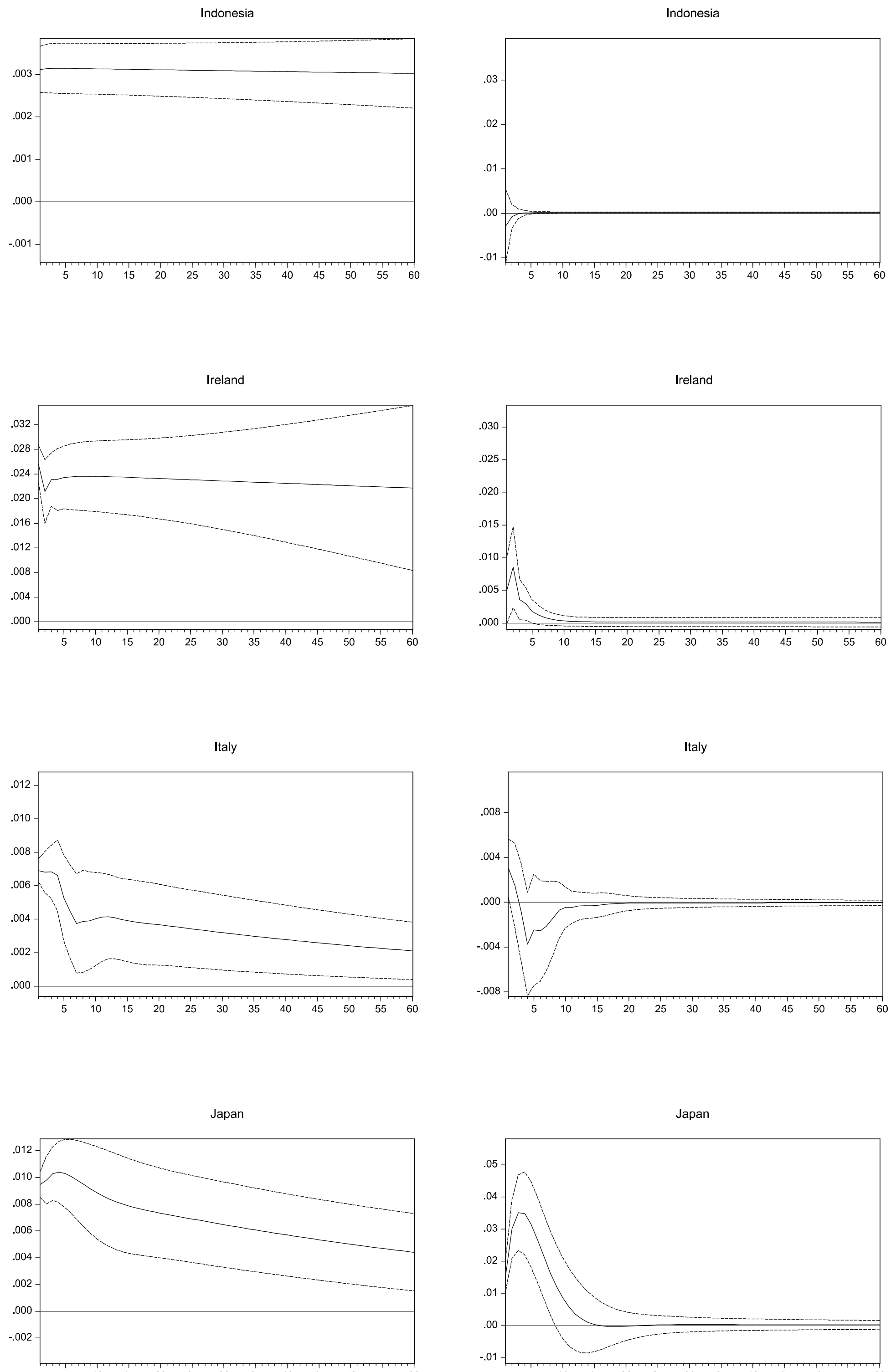

Colombia
.03
.02
.01
.00
-.01
-.02
-.03
5 10 15 20 25 30 35 40 45 50 55 60

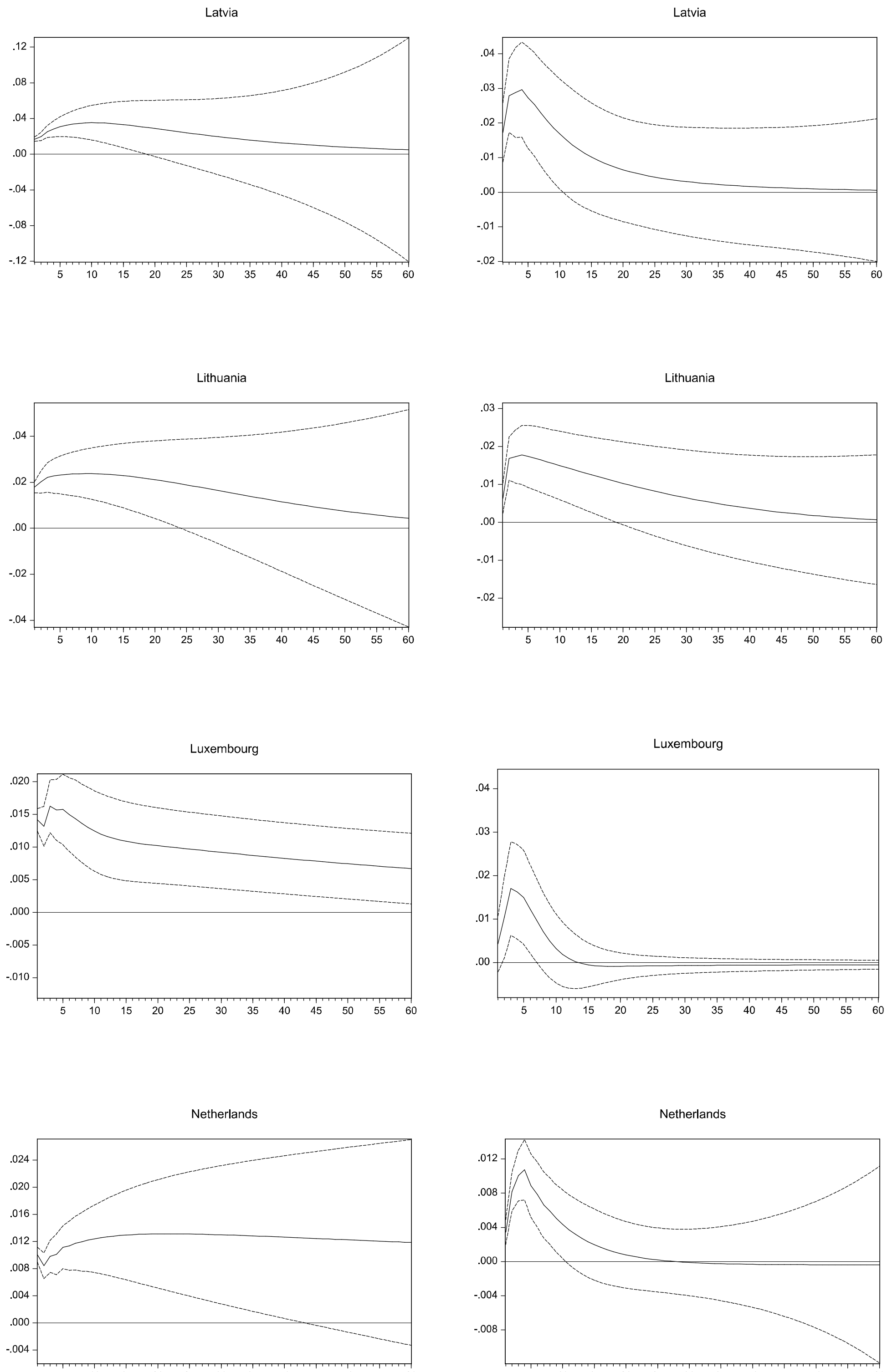

Czech Republic
.03
.02
.01
.00
-.01
5 10 15 20 25 30 35 40 45 50 55 60

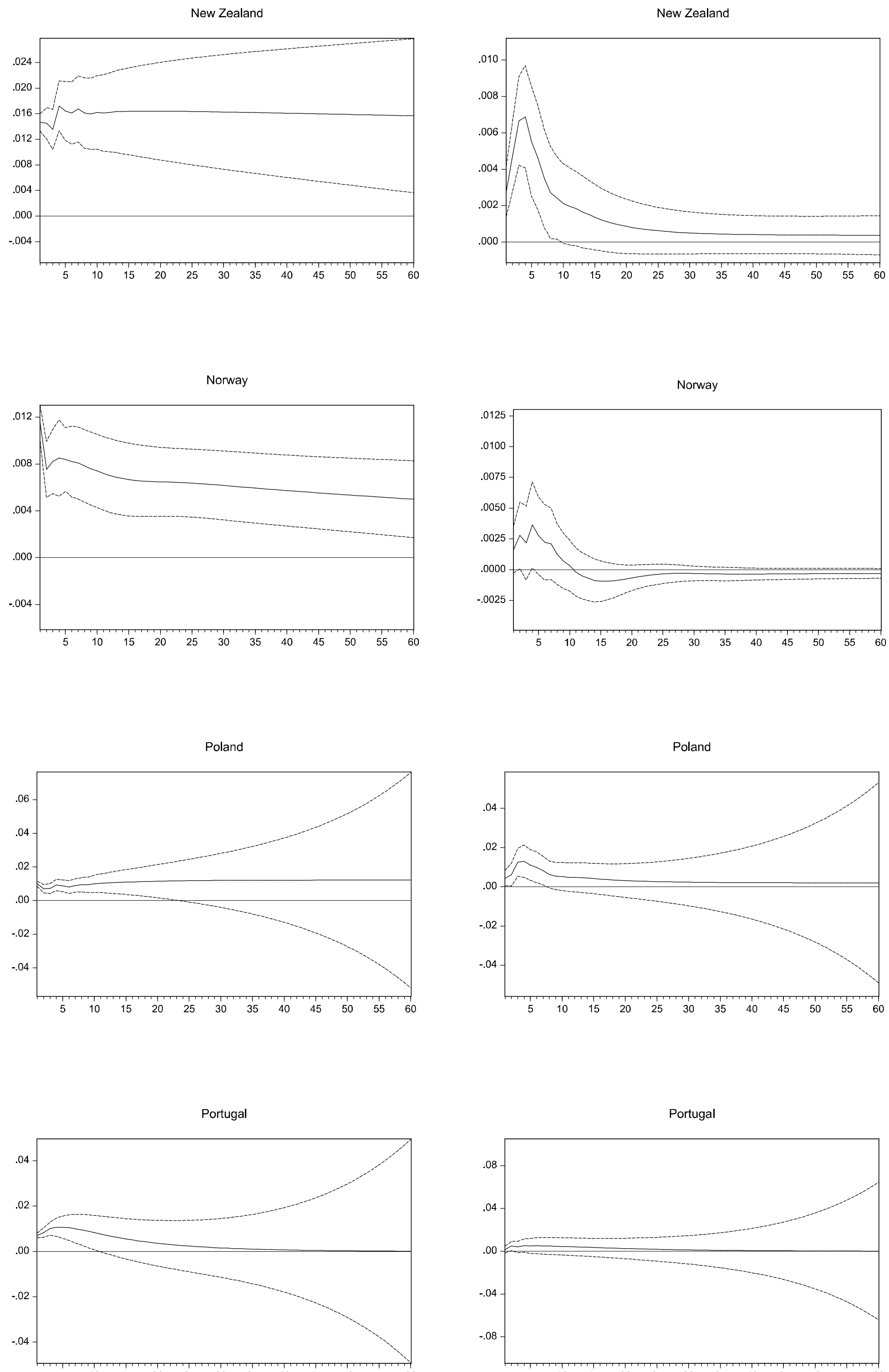

Czech Republic
.020
.016
.012
.008
.004
.000
5 10 15 20 25 30 35 40 45 50 55 60

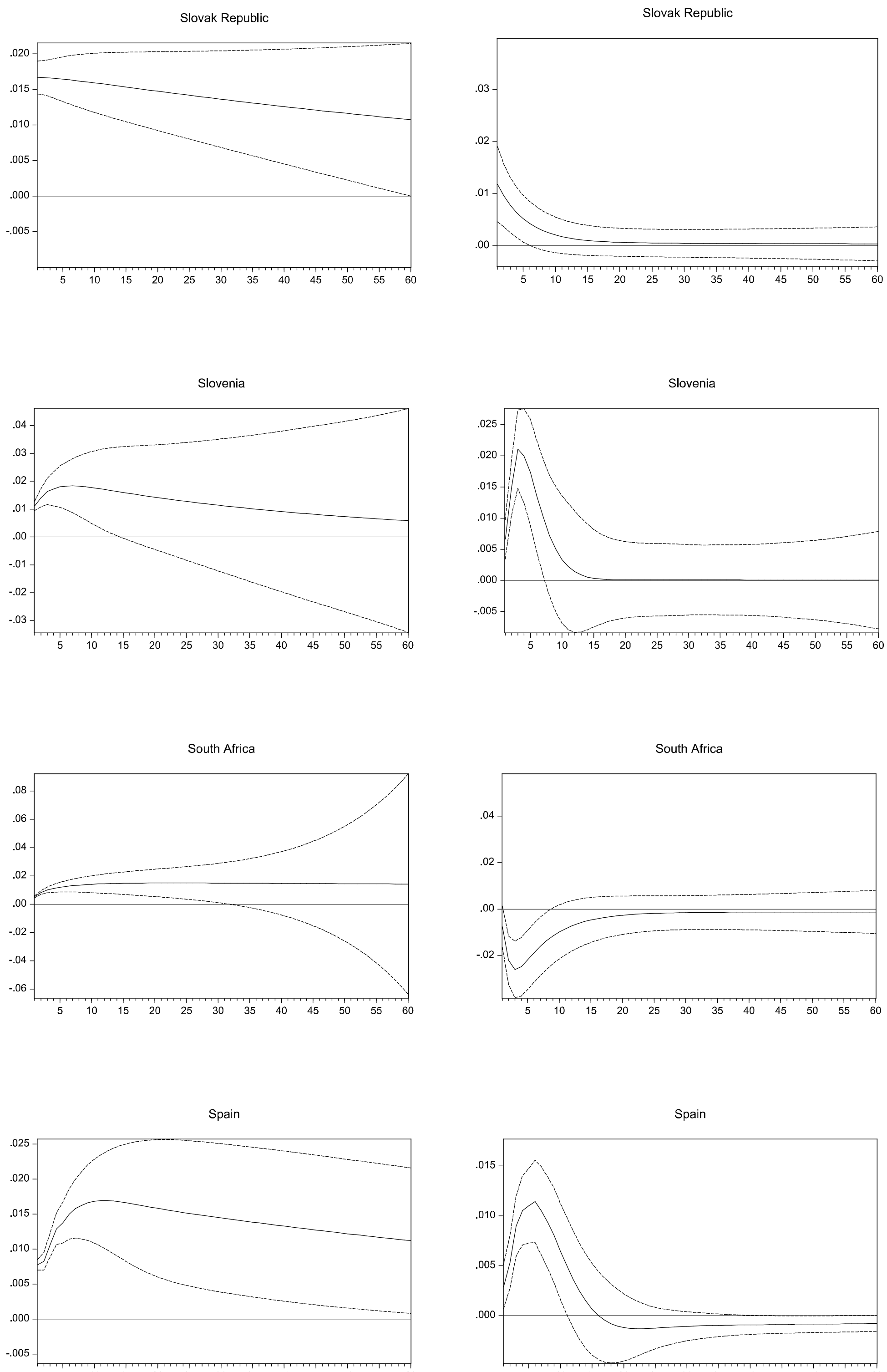

Denmark
Denmark
Estonia
Estonia
Finland
Finland
France
France

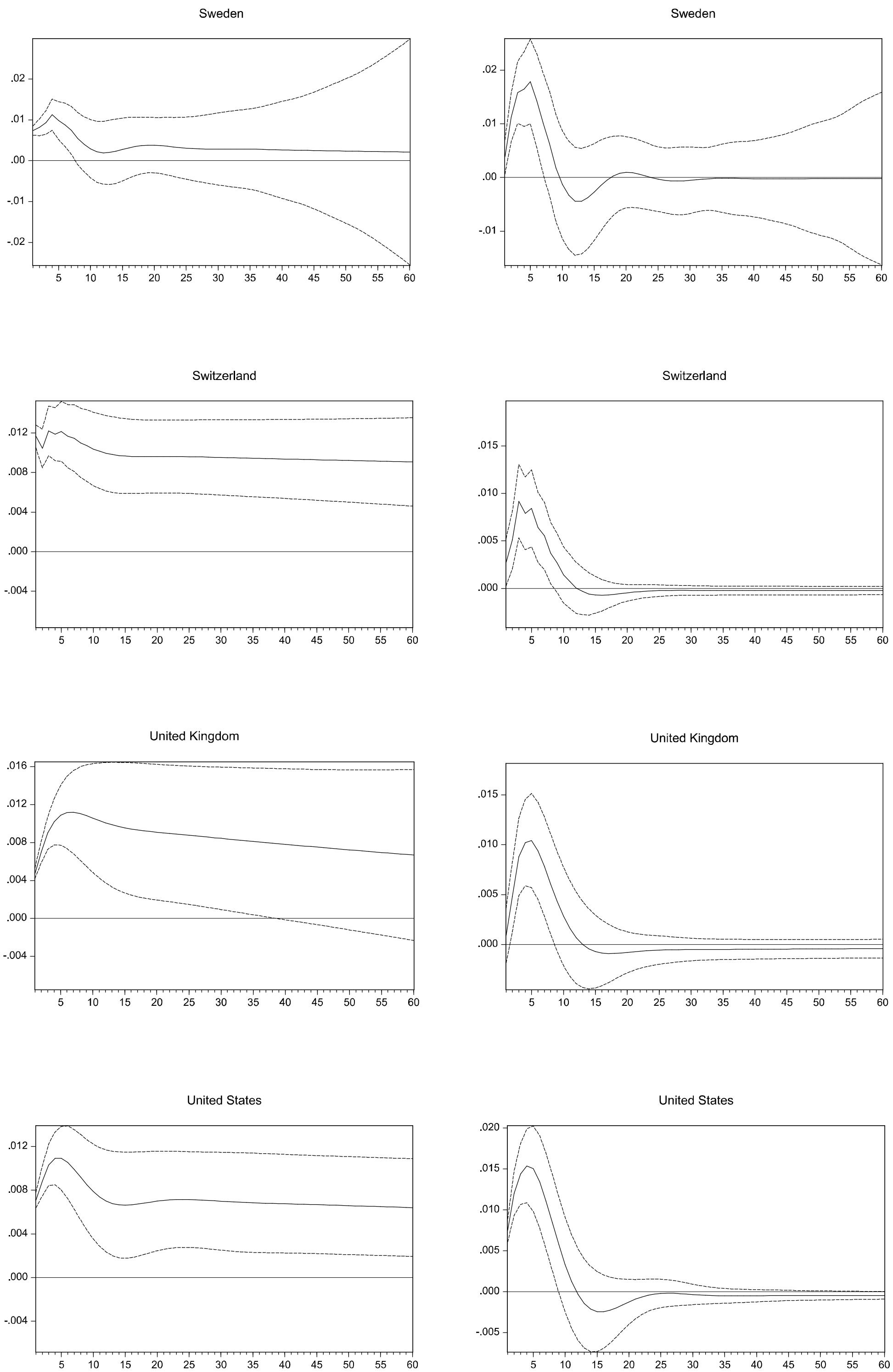

Germany
.012
.010
.008
.006
.004
.002
.000
-.002
5 10 15 20 25 30 35 40 45 50 55 60
Germany
.020
.016
.012
.008
.004
.000
-.004
5 10 15 20 25 30 35 40 45 50 55 60
Greece
.06
.04
.02
.00
-.02
-.04
5 10 15 20 25 30 35 40 45 50 55 60
Greece
.020
.015
.010
.005
.000
-.005
-.010
5 10 15 20 25 30 35 40 45 50 55 60
Hungary
.05
.04
.03
.02
.01
.00
-.01
-.02
-.03
5 10 15 20 25 30 35 40 45 50 55 60
Hungary
.02
.01
.00
-.01
5 10 15 20 25 30 35 40 45 50 55 60
India
.015
.010
.005
.000
-.005
-.010
-.015
5 10 15 20 25 30 35 40 45 50 55 60
India
.04
.03
.02
.01
.00
5 10 15 20 25 30 35 40 45 50 55 60


Indonesia
.003
.002
.001
.000
-.001
Indonesia
.03
.02
.01
.00
-.01
Ireland
.032
.028
.024
.020
.016
.012
.008
.004
.000
Ireland
.030
.025
.020
.015
.010
.005
.000
Italy
.012
.010
.008
.006
.004
.002
.000
Italy
.008
.004
.000
-.004
-.008
Japan
.012
.010
.008
.006
.004
.002
.000
-.002
Japan
.05
.04
.03
.02
.01
.00
-.01
5 10 15 20 25 30 35 40 45 50 55 60


Latvia
Latvia
Lithuania
Lithuania
Luxembourg
Luxembourg
Netherlands
Netherlands


New Zealand
.024
.020
.016
.012
.008
.004
.000
-.004
5 10 15 20 25 30 35 40 45 50 55 60
New Zealand
.010
.008
.006
.004
.002
.000
5 10 15 20 25 30 35 40 45 50 55 60
Norway
.012
.008
.004
.000
-.004
5 10 15 20 25 30 35 40 45 50 55 60
Norway
.0125
.0100
.0075
.0050
.0025
.0000
-.0025
5 10 15 20 25 30 35 40 45 50 55 60
Poland
.06
.04
.02
.00
-.02
-.04
5 10 15 20 25 30 35 40 45 50 55 60
Poland
.04
.02
.00
-.02
-.04
5 10 15 20 25 30 35 40 45 50 55 60
Portugal
.04
.02
.00
-.02
-.04
5 10 15 20 25 30 35 40 45 50 55 60
Portugal
.08
.04
.00
-.04
-.08
5 10 15 20 25 30 35 40 45 50 55 60


Slovak Republic
Slovak Republic
Slovenia
Slovenia
South Africa
South Africa
Spain
Spain



Source: own elaboration.

53% (2002Q4), and during the crisis (2008Q1-2009Q2) utilisation increases 15 p.p. what could be suspect as counter intuitive.

4.4 Autonomous demand as an alternative explanation?

In contrast to the conclusions I drew in the previous sub-sections (4.2.2, 4.2.3 and 4.2.4), it can be said that the non-persistent nature of the effects on capacity utilisation of demand shocks is consistent with an alternative class of models. I refer here, in particular, to autonomous demand-led growth models, in which capacity adjusts to demand in the long run. Models of this type include the Sraffian supermultiplier (see, for example, Monza, 1976; Bortis, 1984; Serrano, 1995a, 1995b; Cesaratto et al., 2003; De Juán, 2013, 2014; Freitas and Serrano, 2015) and the amended versions of the Neo-Kaleckian model I mentioned in sub-section 2.3.2. What happens, in these theoretical constructions, after, say, a permanent increase in autonomous demand? To answer, it is useful to briefly recall the basic structure of the model. The Sraffian Supermultiplier model (Serrano, 1995a, 1995b; Freitas & Serrano, 2015; Serrano & Freitas, 2017) generates a particularly elegant adjustment of effective utilisation towards the *normal* utilisation in a context where the Keynesian effective demand principle operates even in the long run.[15] This model is derived from a basic macroeconomic equation, where in equilibrium between aggregate demand and output, which can be represented by the equation below,

$$Y = C_w + I + Z \tag{4.6}$$

Where Y is the current level of aggregate output, C_w is the aggregate induced consumption, I is the gross aggregate investment and Z is aggregate autonomous consumption and can be defined as 'that part of aggregate consumption financed by credit and, therefore, unrelated to the current level of output resulting from firms' production decisions' (Freitas & Serrano, 2015, 2016, p. 4).[16] Assuming that the marginal propensity to consume out of wages is equal to one and given the wage share, aggregate induced consumption can be expressed in the

[15] Allain (2013, 2015, 2019), Pariboni (2016), Lavoie (2016), Nah and Lavoie (2017), among others, have introduced autonomous expenditures such as exports, capitalists' consumption, government expenditures or population growth in different versions of the Neo-Kaleckian model achieving similar results. For a critique of the SSM see Nikiforos (2018) and Skott (2019).

[16] This component could embody a diversity of expenditures. In Serrano's thesis (1995) it is mentioned that 'the types of expenditure that should be considered autonomous (...) include: the consumption of capitalists; the discretionary consumption of richer workers that have some accumulated wealth and access to credit; residential 'investment' by households ; firms' discretionary expenditures (that are sometimes classified as 'investment' and sometimes as 'intermediate consumption' in official statistics) that do not include the purchase of produced means of production such as consultancy services, research & development, publicity, executive jets, etc.; government expenditures (both consumption and investment); and total exports (both of consumption

following way:

$$C_w = \omega Y \tag{4.7}$$

Where ω is the wage share. Furthermore, if we define h as the marginal propensity to invest of capitalists (or the investment share, I/Y[17]), equation (13) can be reduced to the following one:

$$Y = (\omega + h)Y + Z \tag{4.8}$$

Thus, $\omega + h$ can be considered the marginal propensity to spend of the economy as a whole. In equilibrium:

$$Y = \left(\frac{1}{s_\pi - h}\right) Z \tag{4.9}$$

Given the capital-output ratio $v = K/Y_K$, where Y_K is full capacity output and K is the level of installed capital stock, capacity utilisation can be defined as $u = Y/Y_K$, and its rate of growth as $g_u = g - g_K$.[18] Replacing $g_u = \dot{u}/u$ we can derive the behaviour through time of the level of capacity utilisation,

$$\dot{u} = u(g - g_K) \tag{4.10}$$

Whenever the rate of growth of aggregate demand (g) is higher (lesser) than the rate of capital accumulation (g_K), the effective capacity utilisation will increase (decrease). In the short run, a divergence might occur and implies a positive relationship between the level of u and g. Since v is given, after some algebraic manipulations[19], I can formulate the growth rate of capital:

$$g_K = \frac{I/Y}{v} u \tag{4.11}$$

The above identity states that the rate of capital accumulation is equal to the investment share I/Y divided by the capital-output ratio v and multiplied by utilisation capacity level u. The marginal propensity to invest, moreover, is endogenous in the long run. Changes are explained by the tendency of capacity to adjust to demand. The mechanism is the following one: Given a *planned* capacity utilisation which allows the maximization of profits, under free competition, entrepreneurs will tend to reach the former in the long-run through changes in the size of capacity - investment or disinvestment process. In this sense, h could be 'provisionally' assumed as given in the short run (ibid., 2015, p. 4), so any increase in u will

and of capital goods since the latter do not create capacity within the domestic economy).' (ibid., 1995, pp. 15-16, fn. 9).

[17] I assume that the marginal propensity to invest of capitalists is equal to the investment share.

[18] Since v is given, the rate of growth of capacity-output is equal to the rate of growth of capital accumulation.

[19] Assuming depreciation of capital is zero and dividing the identity of capital accumulation $I = \dot{K}$ by K, I can derive that $\dot{K}/K = I/K = g_K$, and multiplying and dividing by Y and Y_K (i.e., $\frac{I}{K} = \frac{I}{Y}\frac{Y}{Y_K}\frac{Y_K}{K}$) I can conclude a specific relationship between capital accumulation, capital-output ratio and utilisation capacity.

lead to an increase in g_K; in the long run, h could be considered endogenous, and the flexible accelerator investment function can be defined as follows,

$$\dot{h} = h\gamma_u(u - u_n) \tag{4.12}$$

where $\dot{h}$ is the change of investment share through time, γ_u is a parameter between 0 and 1 (in general, a low value), u_n the *normal* capacity utilisation. Deriving equation (16) with respect to time, we get the following expression for g:

$$g = g_Z + \frac{h\gamma_u(u - u_n)}{s_\pi - h} \tag{4.13}$$

The rate of growth of aggregate output is driven by autonomous components of effective demand (in this case, autonomous consumption) plus a term that takes into account the adjustment of capacity. Replacing equation (4.11) and equation (4.13) into equation (4.10) we arrive at the following system of differential equations:

$$\dot{h} = h\gamma_u(u - u_n) \tag{4.14}$$

$$\dot{u} = u(g_Z + \frac{h\gamma_u(u - u_n)}{s_\pi - h} - \frac{h}{v}u) \tag{4.15}$$

While in the fully adjusted situation $\dot{h} = \dot{u} = 0$, then $u = u_n$ and $g_Z = g_K = g^* = hu_n/v$. Given that u_n is independent of growth at this stage of the analysis and could be considered a parameter, there is no relationship at all between g^* and u in the fully adjusted situation. The rate of growth of aggregate demand has no impact on the level of capacity utilisation in the long run.

Starting from a fully adjusted situation, let us assume that there is a positive and permanent shock to g_Z. At first, whenever we introduce a shock[20] to g_Z, this will be accommodated by an increase in u in the short run, but in the long run, as a result of the accelerator mechanism (h), capacity will adjust and u will return to u_n.[21]

In the long-run, there must be a tendency of u towards its exogenous value u_n as a result of the process of investment or disinvestment. Effective utilisation rates are prone to be mean reverting (Serrano, 2007, p. 13, fn. 18). Hence, the gap between u and u_n in stationary state

[20]See Freitas & Serrano (2015) for a discussion on the stability conditions of the equilibrium.

[21]For empirical evidence on growth and the investment share see Blomström et al., 1996; Girardi and Pariboni, 2020.

is zero. The incentive to utilise productive capacity at a 'normal' level induces firms to adjust the scale of capacity to the levels of output that the market can absorb (Ciccone, 2012).

These kind of models could also be interpreted through the lens of Lippi's analysis of Vianello (Lippi, 2010). Lippi assumes that (i) no change occurs in income distribution, (ii) producers adjust production and investment using the fully adjusted ratios as their targets, (iii) the disturbances which displace the system from full adjustment average to zero, then, he concludes that on average the rate of growth is that of the fully adjusted position and the latter does not imply that the system grows around any steady growth path.

4.5 Conclusion

For many years, there was an unanswered question among Post-Keynesian scholars: What's the behaviour through time of capacity utilisation after an aggregate demand shock?[22] Is this effect temporary or persistent in nature? On the one hand, under a (baseline and extended) Neo-Kaleckian framework, there should be a persistent effect on capacity utilisation to an aggregate demand shock. On the other hand, some Classical-Keynesian scholars are inclined to emphasise a continuous tendency towards *normal* utilisation, so that discrepancies between the latter and actual utilisation, which might ensue from unexpected demand shocks, are confined to the short run.

With this essay, I try to shed some light on the issue by adopting a Structural VAR methodology. This is particularly appropriate because it allow me to show the dynamic effect of an income's permanent shock on the degree of capacity utilisation. My findings, based on

[22] A clarification is needed here. In this essay I am analysing the level of output and the level of utilisation of installed capacity. Some readers may wonder why, if I am presenting growth models, I work with variables in levels. First, I believe that a good growth model should also be able to explain what happens in the face of changes in output levels. Second, within growth models, there is a way to identify changes in output levels (e.g. a distributional change in the SSM or in Neo-Kaleckian models). Finally, there are econometric limitations. While the level of output is usually an I(1) variable, so that analysing an output shock allows me to analyse a *persistent* change in the level of output, the output growth rate is a stationary I(0) variable. A shock to the output growth rate only allows me to analyse *transitory* changes in the output growth rate - which is equivalent to a persistent change in the level of output. While the result is the same, some authors might argue that the Neo-Kaleckian model can accommodate transitory changes in the output growth rate with convergence to a pre-shock capacity utilisation. This would imply, for example, that the growth rate is 3%, then rises to 4% one period, and then falls back to 3%. It is also a way of explaining the change in the level of output with a convergence to a pre-shock utilisation. However, in this explanation there is a trick, the model needs to suffer from two shocks in order to accommodate the convergence to pre-shock utilisation, the growth rate must increase and then it must decrease. While the results with the output level are the same, and can also be accommodated by some forced Neo-Kaleckian interpretation, presenting the results in output levels makes the distinction clear to the reader.

national quarterly data for 34 countries, suggest that the nature of the effects on capacity utilisation of shocks to the level of economic activity is merely *transitory*. I also analysed alternative (demand-led) growth models on the basis of their ability to reproduce the stylised facts that emerge from this empirical analysis, concluding that autonomous demand-led models cum convergence towards *normal* utilisation perform better in this respect.

I am fully aware that a simple empirical exercise cannot suffice to settle such a complex issue. I am also aware that nothing in my analysis points, strictly speaking, to a convergence towards equilibria with *normal* utilisation, because the latter is an unobserved variable. With the support of sound theory, however, I can interpret along these lines the fact that capacity utilisation tends towards its pre-shock level, given due time.

4.6 References

Allain, O. (2013). Tackling the instability of growth: A Kaleckian model with autonomous demand expenditures. Documents de travail du Centre d'Economie de la Sorbonne.

Allain, O. (2015). Tackling the instability of growth: a Kaleckian-Harrodian model with an autonomous expenditure component. *Cambridge Journal of Economics, 39*(5), 1351–1371.

Allain, O. (2019). Demographic growth, Harrodian (in) stability and the supermultiplier. *Cambridge Journal of Economics, 43*(1), 85-106.

Amadeo, E. J. (1986a). The role of capacity utilization in long-period analysis. *Political Economy, 2*(2), 147–160.

Amadeo, E. J. (1986b). Notes on capacity utilisation, distribution and accumulation. *Contributions to Political Economy, 5*(1), 83–94.

Amadeo, E. (1987). Expectations in a steady state model of capacity utilization. *Political Economy, 3*(1), 75–89.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The review of economic studies, 58*(2), 277-297.

Arestis, P. (1996). Post-Keynesian economics: towards coherence. *Cambridge Journal of Economics, 20*(1), 111-135.

Ashley, R. A., & Verbrugge, R. J. (2009). To difference or not to difference: a Monte Carlo investigation of inference in vector autoregression models. *International Journal of Data Analysis Techniques and Strategies, 1*(3), 242-274.

Bansak, C., Morin, N. and Starr, M. (2007). Technology, capital spending, and capacity utilization. *Economic Inquiry, 45*(3), 631–645.

Bortis, H. (1984). Employment in a capitalist economy. *Journal of Post Keynesian Economics, 6*(4), 590-604.

Botte, F. (2020). Estimating normal rates of capacity utilisation and their tolerable ranges: a comment on Mark Setterfield. *Cambridge Journal of Economics, 44*(2), 475-482.

Blomström, M., Lipsey, R. E., & Zejan, M. (1996). Is Fixed Investment the Key to Economic Growth?. *The Quarterly Journal of Economics, 111*(1), 269-276.

Braga, J. M. (2006). Raiz unitária, histerese e inércia: A controvérsia sobre a NAIRU na economia norte-americana nos anos 1990 (Doctoral dissertation, Federal University of Rio de Janeiro).

Cassetti, M. (2006). A note on the long-run behaviour of Kaleckian models. *Review of Political Economy, 18*(4), 497-508.

Cesaratto, S., Serrano, F., & Stirati, A. (2003). Technical change, effective demand and employment. *Review of political economy, 15*(1), 33-52.

Cesaratto, S. (2015). Neo-Kaleckian and Sraffian controversies on the theory of accumulation. *Review of Political Economy, 27*(2), 154–182.

Ciccone, R. (1986). Accumulation and capacity utilization: some critical considerations on Joan Robinson's theory of distribution. *Political Economy, 2*(1), 17–36.

Ciccone, R. (1987). Accumulation, capacity utilization and distribution: a reply. *Political Economy, 3*(1), 97–111.

Ciccone, R. (2012). Pierangelo Garegnani: Rebuilding Economic Theory. *PSL Quarterly Review, 65*(262), 311-331.

Committeri, M. (1986). Some comments on recent contributions on capital accumulation, income distribution and capacity utilization. *Political Economy, 2*(2), 161-186.

Dejuán, Ó. (2013). Normal paths of growth shaped by the supermultiplier. In Sraffa and the Reconstruction of Economic Theory: Volume Two (pp. 139-157). Palgrave Macmillan, London.

Dejuán, O. (2014). The supermultiplier as a vertically hyperintegrated sector. Centro Sraffa Working Papers, 4, 1-23.

Del Monte, A. (1975). Grado di monopolio e sviluppo economico. *Rivista internazionale di scienze sociali, 46*(3), 231–263.

Driver, C. (2000). Capacity utilisation and excess capacity: theory, evidence, and policy. *Review of Industrial Organization, 16*(1), 69–87.

Driver, C., & Shepherd, D. (2005). Capacity utilization and corporate restructuring. A comparative study of the US, UK and other European countries. *Cambridge Journal of Economics, 29*, 119-140.

Dutt, A. K. (1984). Stagnation, income distribution and monopoly power. *Cambridge Journal of Economics, 8*(1), 25–40.

Dult, A. K. (1987). Competition, monopoly power and the uniform rate of profit. *Review of Radical Political Economics, 19*(4), 55-72.

Dutt, A. K. (1990). *Growth, distribution and uneven development.* Cambridge: Cambridge University Press.

Dutt, A. K. (2010). *Equilibrium, stability and path dependence in post-Keynesian models of economic growth*. Production, Distribution and Trade: Alternative Perspectives, 114, 233.

Fagundes, L., & Freitas, F. (2017). The Role of Autonomous Non-Capacity Creating Expenditures in Recent Kaleckian Growth Models: An Assessment from the Perspective of the Sraffian Supermultiplier Model. *Mimeo.*

Fazzari, S. M., Ferri, P., & Variato, A. M. (2020). Demand-led growth and accommodating supply. *Cambridge Journal of Economics, 44*(3), 583-605.

Finn, M. G. (1995). Is 'High' Capacity Utilization Inflationary?. *FRB Richmond Economic Quarterly, 81*(1), 1-16.

Freitas, F. and Serrano, F. (2015). Growth rate and level effects, the stability of the adjustment of capacity to demand and the Sraffian supermultiplier. *Review of Political Economy, 27*(3), 258–281.

Gahn, S. J., & González, A. (2020). On the 'utilisation controversy': a comment. Cambridge Journal of Economics, 44(3), 703-707.

Gahn, S. J., González, A. (2019b). On the empirical content of the convergence debate: Cross country evidence on growth and capacity utilisation. *Post Keynesian Economic Society Working Paper No. 1922*.

Gallo, E. (2019). Investment, autonomous demand and long run capacity utilization: An empirical test for the Euro Area. *Working Paper No. 116.2019. Berlin School of Economics and Law, Institute for International Political Economy (IPE).*

Garegnani, P. (1992). *Some notes for an analysis of accumulation*. In Halevi, J., Laibman, D., Nell, E.J. (eds.), Beyond the Steady State. Basingstoke: Palgrave Macmillan, pp. 47–71.

Girardi, D. and Pariboni, R. (2019). Normal utilization as the adjusting variable in Neo-Kaleckian growth models: a critique. *Metroeconomica, 70*(2), 341–358.

Girardi, D., & Pariboni, R. (2020). Autonomous demand and the investment share. *Review of Keynesian Economics, 8*(3), 428-453.

Haluska, G., Braga, J., & Summa, R. (2020). Growth, investment share and the stability of the Sraffian Supermultiplier model in the US economy (1985–2017). *Metroeconomica*.

Jordà, Ò. (2005). Estimation and inference of impulse responses by local projections. *American Economic Review, 95*(1), 161-182.

Jordà, Ò. (2009). Simultaneous confidence regions for impulse responses. *The Review of Economics and Statistics, 91*(3), 629-647.

Kennedy, J. E. (1998). An analysis of time-series estimates of capacity utilization. *Journal of Macroeconomics, 20*(1), 169-187.

Kilian, L. and Lütkepohl, H. (2017). *Structural vector autoregressive analysis*. Cambridge: Cambridge University Press.

Kurz, H. D. (1986). Normal positions and capital utilization. *Political Economy, 2*(1), 37-54.

Kurz, H. D. (1990). *Accumulation, distribution and the 'Keynesian hypothesis'*. In 'Essays on Piero Sraffa'. London: Routledge.

Lavoie, M. (1992). *Foundations of post-Keynesian economic analysis*. Books.

Lavoie, M. (1995). The Kaleckian model of growth and distribution and its neo-Ricardian and neo-Marxian critiques. *Cambridge Journal of Economics, 19*(6), 789-818.

Lavoie, M. (1996). Traverse, hysteresis, and normal rates of capacity utilization in Kaleckian models of growth and distribution. *Review of Radical Political Economics, 28*(4), 113-147.

Lavoie, M. (2010). Surveying short-run and long-run stability issues with the Kaleckian model of growth. *Handbook of alternative theories of economic growth,* 132-56.

Lavoie, M. (2016). Convergence towards the normal rate of capacity utilization in Neo-Kaleckian models: the role of non-capacity creating autonomous expenditures.

Metroeconomica, 67(1), 172–201.

Lavoie, M., Rodriguez, G. and Seccareccia, M. (2004). Similitudes and discrepancies in post-Keynesian and Marxist theories of investment: a theoretical and empirical investigation. *International Review of Applied Economics, 18*(2), 127–149.

Lippi, M. (2010). Fully Adjusted Situations, Trend Stationary and Difference Stationary Processes: On 'The Pace of Accumulation'. In 'Il ritorno dell'economia politica. Saggi in ricordo di Fernando Vianello' (pp. 71-77). Bonifati, G. and Simonazzi, A. editors. Meridiana Libri.

Lütkepohl, H. (2005). New introduction to multiple time series analysis. Berlin: Springer.

Marris, R. (1964). *The Economics of Capital Utilization: A Report on Multiple-Shift*. Work.

Monza, A. (1976). Crecimiento y demanda. *El Trimestre Económico, 43* (169(1)), 107-140.

Moreira, V. G., & Serrano, F. (2018). Demanda efetiva no longo prazo e no processo de acumulaç ão: o debate sraffiano a partir do projeto de Garegnani (1962). *Economia e Sociedade, 27*(2), 463-492.

Moreira, V. G., & Serrano, F. (2019). O debate envolvendo o efeito acelerador na controvérsia sobre o modelo do supermultiplicador sraffiano. *Revista de Economia Contempornea, 23*(3).

Nadiri, M. I., & Rosen, S. (1969). Interrelated factor demand functions. *The American Economic Review, 59*(4), 457-471.

Nah, W. J., & Lavoie, M. (2017). Long-run convergence in a neo-Kaleckian open-economy model with autonomous export growth. *Journal of Post Keynesian Economics, 40*(2), 223-238.

Nelson, C. R., & Plosser, C. R. (1982). Trends and random walks in macroeconmic time series: some evidence and implications. *Journal of monetary economics, 10*(2), 139-162.

Nikiforos, M. (2016). On the 'utilisation controversy': a theoretical and empirical discussion of the Kaleckian model of growth and distribution. *Cambridge Journal of Economics, 40*(2), 437–467.

Nikiforos, M. (2018). Some comments on the Sraffian Supermultiplier approach to growth and distribution. *Journal of Post Keynesian Economics, 41*(4), 659-675.

Pariboni, R. (2016). Autonomous demand and the Marglin–Bhaduri model: a critical note. *Review of Keynesian Economics, 4*(4), 409-428.

Park, M. S. (1997). Normal values and average values. *Metroeconomica, 48*(2), 188-199.

Parrinello, S. (2014). A search for distinctive features of demand-led growth models. *PSL Quaterly Review, 67*(270), 309-342.

Pedroni, P. (2013). Structural Panel VARs. *Econometrics, 1*(2), 180-206.

Plagborg-Møller, M., & Wolf, C. K. (2019). Local projections and VARs estimate the same impulse responses. Unpublished paper: Department of Economics, Princeton University, 1.

Rowthorn, B. (1981). Demand, real wages and economic growth. *Thames Papers in Political Economy, Autumn, TP/PPE/81/3*, 1–39.

Schoder, C. (2012a). Hysteresis in the Kaleckian growth model: a Bayesian analysis for the US manufacturing sector from 1984 to 2007. *Metroeconomica, 63*(3), 542–568.

Schoder, C. (2012b). Effective demand, exogenous normal utilization and endogenous capacity in the long run. Evidence from a CVAR analysis for the US (No. 103). IMK Working Paper.

Schoder, C. (2014). Effective demand, exogenous normal utilization and endogenous capacity in the long run: evidence from a cointegrated vector autoregression analysis for the USA. *Metroeconomica, 65*(2), 298–320.

Serrano, F. (1995a). Long period effective demand and the Sraffian supermultiplier. *Contributions to Political Economy, 14*(1), 67–90.

Serrano, F. L. (1995b). The Sraffian supermultiplier (Doctoral dissertation, University of Cambridge).

Serrano, F. (2007). Histéresis, dinámica inflacionaria y el supermultiplicador sraffiano. Seminarios Sraffianos, UNLU-Grupo Luján. Colección Teoría Económica, Edicionones Cooperativas.

Serrano, F., & Freitas, F. (2017). The Sraffian supermultiplier as an alternative closure for heterodox growth theory. *European Journal of Economics and Economic Policies: Intervention, 14*(1), 70-91.

Setterfield, M. (2019). Long-run variation in capacity utilization in the presence of a fixed normal rate. *Cambridge Journal of Economics, 43*(2), 443–463.

Setterfield, M. (2020). Tolerable ranges of variation in the rate of capacity utilisation and corridor instability: a reply to Florian Botte. *Cambridge Journal of Economics, 44*(2), 483-488.

Shapiro, M. D. (1989). Assessing the Federal Reserve's measures of capacity and utilization. *Brookings Papers on Economic Activity, 20*(1), 181–242.

Sims, C. A., Stock, J. H., & Watson, M. W. (1990). Inference in linear time series models with some unit roots. *Econometrica: Journal of the Econometric Society*, 113-144.

Sims, E. (2013). *Graduate Macro Theory II: Notes on Time Series*. Rap. tech., University of Notre Dame, https://www3.nd.edu/~esims1/time_series_notes_sp13.pdf

Skott, P. (2012). Theoretical and empirical shortcomings of the Kaleckian investment function. *Metroeconomica, 63*(1), 109–138.

Skott, P. (2019). Autonomous demand, Harrodian instability and the supply side. *Metroeconomica, 70*(2), 233-246.

Stigler, G. (1939). Production and distribution in the short run. *Journal of Political Economy, 47*(3), 305-327.

Taylor, L. (1983). *Structuralist macroeconomics: applicable models for the third world*. New York: Basic Books.

Taylor, L. (1985). A stagnationist model of economic growth. *Cambridge Journal of Economics, 9*(4), 383–403.

Trezzini, A. (1995). Capacity utilisation in the long run and the autonomous components of aggregate demand. *Contributions to political economy, 14*(1), 33-66.

Trezzini, A. (1998). *Some notes on Long-Run capacity utilisation, steady state and induced investment* (No. 0010). Department of Economics-University Roma Tre.

Trezzini, A. (2012). *Steady state and the analysis of long-run tendencies: the case of neo-Kaleckian models*. In Sraffa and Modern Economics Volume II (pp. 138-160). Routledge.

Trezzini, A. (2013). *The meaning of output trends in the analysis of growth.* In Sraffa and the Reconstruction of Economic Theory: Volume Two (pp. 68-91). Palgrave Macmillan, London.

Trezzini, A., & Palumbo, A. (2016). The theory of output in the modern classical approach: main principles and controversial issues. *Review of Keynesian Economics, 4*(4), 503-522.

Trezzini, A. (2017). Harrodian instability: a misleading concept. *Centro Sraffa Working Papers, 24*, 1-27.

Vianello, F. (1985). The pace of accumulation. *Political Economy: Studies in the Surplus Approach, 1*(1), 69–87.

Vianello, F. (1989). Effective demand and the rate of profits: some thoughts on Marx, Kalecki and Sraffa. *In Kalecki's Relevance Today* (pp. 164-190). Palgrave Macmillan, London.

4.7 Appendix A: Details on data sources

Both output level and capacity utilisation were obtained from the OECD's database. Capacity utilisation was obtained from the Business Tendency Survey and Consumer Opinion

Surveys[23]. However, OECD's database on capacity utilisation includes observations for 40 countries on monthly and quarterly data.[24] Here I present the different questionnaires and my view on this issue:

4.7.1 Appendix A.1.: National Questionnaires

AUSTRALIA:

Figure 4.4 Australia's Questionnaire

2. At what level of capacity utilisation are you working?

	Net balance	Above Normal	Normal	Below Normal
	-5	13	69	18

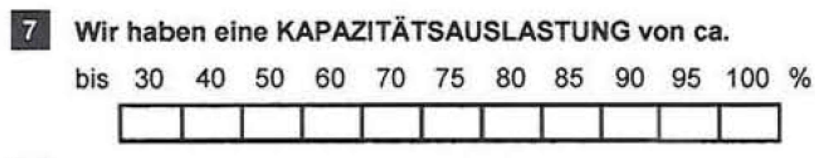
Source: https://www.australianchamber.com.au/publications/australian-chamber-westpac-survey-of-industrial-trends-june2019/.

[23]https://stats.oecd.org. Depending on the country's survey it could be a survey for all industries or only for manufacturing industries.

[24]I excluded those countries that present only monthly data.

AUSTRIA:

Figure 4.5 Austria's Questionnaire



7 Wir haben eine KAPAZITÄTSAUSLASTUNG von ca.

bis 30 40 50 60 70 75 80 85 90 95 100 %

Source:
https://ec.europa.eu/info/sites/info/files/file_import/questionnaires_at_busi_en_0.pdf.

BELGIUM: Lambert, J. P. (1988). *Disequilibrium macroeconomic models: theory and estimation of rationing models using business survey data.* CUP Archive. Page 22. and also https://ec.europa.eu/info/sites/info/files/questionnaires_be_indu_fr.pdf

BRAZIL: http://portalibre.fgv.br/lumis/portal/file/fileDownload.jsp?fileId=8A7C82C5557F25F2015626C0585D118C

COLOMBIA:

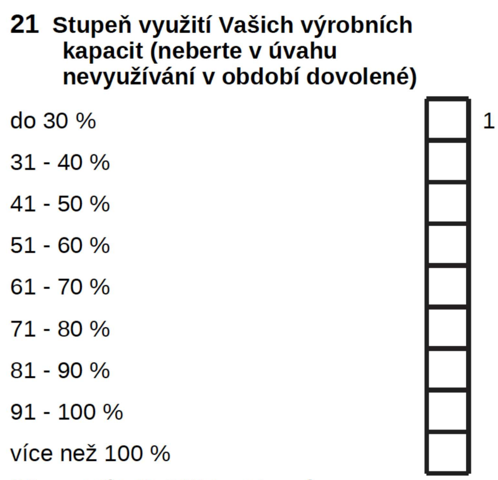
Figure 4.6 Colombia's Questionnaire

9. Cuál es su nivel actual de utilización de capacidad (en porcentaje de utilización de capacidad normal): _______

Source: https://ideas.repec.org/p/ecr/col027/4770.html.

CZECH REPUBLIC:

Figure 4.7 Czech Republic's Questionnaire



21 Stupeň využití Vašich výrobních kapacit (neberte v úvahu nevyužívání v období dovolené)

do 30 % 1
31 - 40 %
41 - 50 %
51 - 60 %
61 - 70 %
71 - 80 %
81 - 90 %
91 - 100 %
více než 100 %

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_cz_indu_cz.pdf.

DENMARK:

Figure 4.8 Denmark's Questionnaire

Kapacitetsudnyttelse i pct. skønnes til .... pct. af fuld kapacitet

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_dk_busi_dk.pdf.

ESTONIA:

Figure 4.9 Estonia's Questionnaire

K13 Tootmisvõimsuste rakendatuse tase praegu

(% kõikidest tootmisvõimsustest) ....%

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_ee_indu_ee.pdf.

FINLAND:

Figure 4.10 Finland's Questionnaire

17. Kapasiteetin käyttöaste %

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_fi_indu_fi.pdf.

FRANCE:

Figure 4.11 France's Questionnaire

2. Goulots et utilisation des capacités de production

- Si vous receviez plus de commandes, pourriez-vous produire davantage, avec vos moyens actuels ? OUI ☐ NON ☐

Si OUI quel pourrait être l'accroissement de votre production avec le matériel dont vous disposez et **sans que vous ayez besoin d'embaucher du personnel supplémentaire ?** .... environ .... %

- Pourriez-vous produire davantage encore **en embauchant du personnel supplémentaire ?** .... OUI ☐ NON ☐

- Votre entreprise fonctionne actuellement à .... % de ses capacités disponibles.

Il s'agit du ratio (en %) de votre production actuelle sur la production maximale que vous pourriez obtenir en embauchant éventuellement du personnel supplémentaire.

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_fr_indu_fr.pdf.

GERMANY:

Figure 4.12 Germany's Questionnaire

B) Die **Ausnutzung** unserer **Anlagen** zur Herstellung von XY (betriebsübliche Vollausnutzung=100%) beträgt **gegenwärtig** bis ..... %

30	40	50	60	70	75	80	85	90	95	100	**mehr als 100% und zwar:**

Source:
https://ec.europa.eu/info/sites/info/files/file_import/questionnaires_de_indu_en_0.pdf.

GREECE:

Figure 4.13 Greece's Questionnaire

3. Σε τι ποσοστό περίπου χρησιμοποιείται την τρέχουσα περίοδο αυτή το **εργοστασιακό σας δυναμικό** Ποσοστό %

(100% χρησιμοποίηση του εργοστασιακού δυναμικού αντιστοιχεί στο σημείο εκείνο στο οποίο δεν μπορείτε να αυξήσετε περαιτέρω την παραγωγή σας αυξάνοντας την απασχόληση με περισσότερες βάρδιες ή υπερωρίες **αλλά πρέπει να επεκτείνετε το εργοστασιακό σας δυναμικό- μηχανές εγκαταστάσεις**).

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_el_indu_el.pdf.

HUNGARY:

Figure 4.14 Hungary's Questionnaire

13. A meghatározó kapacitásaik jelenlegi kihasználtsága: ***............ %.***

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_hu_indu_hu_0.pdf.

INDIA:

Figure 4.15 India's Questionnaire

Sr. Number	Product		Unit (Capacity / Production)	Installed Capacity	Quantity Produced	Capacity Utilised (%)	Value of Production (₹ Lakhs)
	Name	NIC 2008 Code (5 digits)		April-June 2019 Quarter	April-June 2019 Quarter	April-June 2019 Quarter	April-June 2019 Quarter

Source: https://rbidocs.rbi.org.in/rdocs/Forms/PDFs/OBICUSRD4704102019.pdf.

INDONESIA:

Tosetto, E., & Gyomai, G. (2009). Current status of business tendency survey and consumer survey harmonisation in non-EU OECD countries. OECD enhanced engagement economies and OECD accession countries. Unpublished paper delivered at an EU-OECD workshop on Business and Consumer Surveys, November, Brussels.

IRELAND:

Figure 4.16 Ireland's Questionnaire

Q.16 At about what capacity is your company currently operating (as a percentage of full capacity)?

The company is currently operating at ___ % of full capacity (MAX 100)

Source:
https://ec.europa.eu/info/sites/info/files/boi-eu_industry_questionnaire_2016-2017.pdf.

ITALY:

Figure 4.17 Italy's Questionnaire

D.35 Rispetto all'utilizzazione massima qual è stato percentualmente il grado di utilizzo degli impianti nel corso del trimestre?

il ________________% (senza decimali)

(inserire valori percentuali compresi tra 20 e 100)

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_it_indu_it.pdf.

JAPAN:

Figure 4.18 Japan's Questionnaire

(6) Production Capacity of Your Enterprise
1.Excessive capacity 2.Adequate 3.Insufficient capacity

Source: https://www.boj.or.jp/en/statistics/outline/exp/tk/data/survey03.pdf.

LATVIA:

Figure 4.19 Latvia's Questionnaire

15. Uzņēmums pašlaik izmanto ☐ % no pilnas jaudas.

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_lv_indu_lv.pdf.

LITHUANIA:

Figure 4.20 Lithuania's Questionnaire

13. Kaip šiuo metu panaudojamas Jūsų įmonės gamybinis pajėgumas?

mažiau kaip 30 %	31–40 %	41–50 %	51–60 %	61–70 %	71–80 %	81–90 %	91–100 %	daugiau kaip 100 %
☐	☐	☐	☐	☐	☐	☐	☐	☐

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_lt_indu_lt.pdf.pdf.

LUXEMBOURG:

Figure 4.21 Luxembourg's Questionnaire

13. Degré d'utilisation de la capacité de production

La capacité de production de l'entreprise est actuellement utilisée à concurrence de: ☐ %

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_lu_indu_fr.pdf.

NETHERLANDS:

Figure 4.22 Netherlands's Questionnaire

De bezetting/benutting van onze beschikbare productiecapaciteit bedraagt momenteel ca.	………………… %

Source: https://ec.europa.eu/info/sites/info/files/file_import/questionnaires_nl_indu_serv_reta_en_0.pdf.

NEW ZEALAND:

Figure 4.23 New Zealand's Questionnaire

Excluding seasonal factors, by how much is it currently practicable for you to increase your production from your existing plant and equipment without raising unit costs?

Source: https://www.rbnz.govt.nz/-/media/ReserveBank/Files/Publications/Bulletins/2004/2004sept67-3hodgetts.pdf.

NORWAY:

Figure 4.24 Norway's Questionnaire

	Under 50 %	50 - 65 %	65 - 80 %	80 - 95 %	Over 95 %
12. Hvilken kapasitetsutnyttingsgrad innebærer nåværende produksjonsnivå ?	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

Source: https://www.ssb.no/a/publikasjoner/pdf/nos_d432/nos_d432.pdf.

POLAND:

Figure 4.25 Poland's Questionnaire

21.	**Jaki procent posiadanych pełnych mocy produkcyjnych Państwa przedsiębiorstwa jest obecnie wykorzystywany:**	☐☐☐,☐ %

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_pl_indu_en.pdf.

PORTUGAL:

Figure 4.26 Portugal's Questionnaire

13. No último trimestre a vossa capacidade de produção utilizada foi aproximadamente de:

B1300 |_|_|_|%

(É possível um estabelecimento laborar a mais de 100% da sua capacidade desde que o equipamento e/ou pessoal empregado trabalhem a um ritmo superior ao considerado normal)

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_pt_indu_pt.pdf.

SLOVAK REPUBLIC:

Figure 4.27 Slovak Republic's Questionnaire

13. Aká je súčasná úroveň využitia výrobných kapacít vo Vašej firme (v % plnej kapacity)?

do 30	31 - 40	41 - 50	51 - 60	61 - 70	71 - 80	81 - 90	91 - 100	nad 100	
○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	13

Source:
https://ec.europa.eu/info/sites/info/files/file_import/questionnaires_sk_indu_en_0.pdf.

SLOVENIA:

Figure 4.28 Slovenia's Questionnaire

D4 **Ali je sedanja stopnja izkoriščenosti vaših zmogljivosti - tehnično-tehnoloških, človeških virov in podobno:**

- ☐ 1 Pod 30 %
- ☐ 2 Od 31 do 40 %
- ☐ 3 Od 41 do 50 %
- ☐ 4 Od 51 do 60 %
- ☐ 5 Od 61 do 70 %
- ☐ 6 Od 71 do 80 %
- ☐ 7 Od 81 do 90 %
- ☐ 8 Od 91 do 100 %
- ☐ 9 Več kot 100 % (nadure, dodatne izmene…)

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_si_indu_si.pdf.

SOUTH AFRICA:

Figure 4.29 South Africa's Questionnaire

12 Is your present level of output below capacity? (i.e. are you working below a satisfactory full rate of operation)	Yes	No
	☐	☐

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_si_indu_si.pdf.

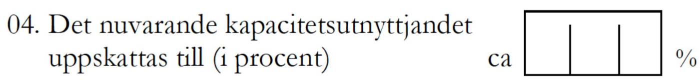
Spain:

Figure 4.30 Spain's Questionnaire

Source:
https://ec.europa.eu/info/sites/info/files/file_import/questionnaires_es_indu_en_0.pdf.

Sweden:

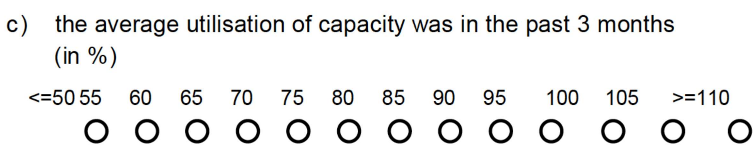
Figure 4.31 Sweden's Questionnaire



Source: https://ec.europa.eu/info/sites/info/files/questionnaires_se_indu_se.pdf.pdf.

Switzerland:

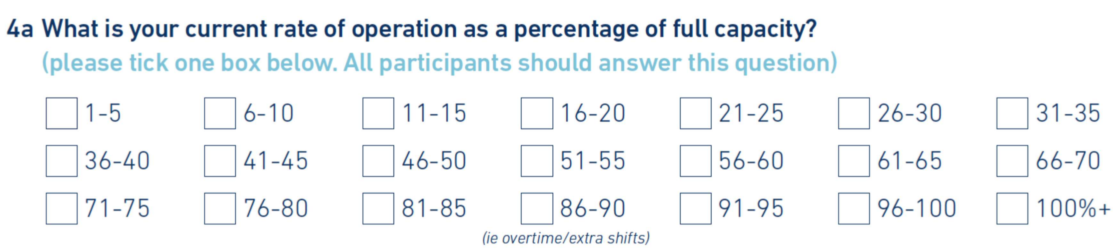
Figure 4.32 Switzerland's Questionnaire



Source: https://ethz.ch/content/dam/ethz/special-interest/dual/kof-dam/documents/FragebogenArchive/imt/inu_en_q.pdf.

United Kingdom:

Figure 4.33 United Kingdom's Questionnaire



Source: https://ec.europa.eu/info/sites/info/files/questionnaires_uk_indu_en.pdf.

UNITED STATES:

Figure 4.34 United States' Questionnaire


C. Divide your **actual production** estimate by your **full production estimate**. Multiply this ratio by 100 to get a percentage. . . . .

Capacity Utilization

%

Source: https://www2.census.gov/programs-surveys/qpc/technical-documentation/questionnaires/watermark_form.pdf?#.

4.7.2 Appendix A.2.: Criterion

As it can be seen in the previous section, all the 'national questionnaires' are quite different among them. As far as I noticed from the OCDE database and National Institutes of Statistics, I found that we can classified the survey's questions in, at least, four groups:

a. Those countries such as France or Greece that ask:

- FRANCE: *Your company currently operates at X% of its available capacity. This is the ratio (in %) of your current production to the maximum production you could get by hiring possibly additional staff.*
- GREECE: *At what current rate is used your factory capacity %?. (100% utilisation corresponds to the point where you cannot increase your production by increasing employment with more shifts or overtime, but you need to expand your factory-capacity facilities).*

So these surveys explicitly explain to the 'plant managers' which is the definition of 'full capacity' (as many shifts as possible, plenty technical utilisation of capital, near 168 hours per day as possible). The definition is quite similar to US's National Emergency one[25].

b. Those countries such as Denmark, Estonia, Germany, Ireland, Italy, Latvia, Poland, Slovak Republic and the United States which ask what the OCDE's survey recommends[26], which is:

- OCDE: *At what capacity is your company currently operating (as a percentage of full capacity)?*

In this case, there is no explicit explanation of 'full capacity'.

c. Other countries that directly ask just a net balance (Australia, Belgium, Japan, South Africa), minimizing cost capacity (New Zealand)[27] or allow the 'plant manager' to choose a capacity over 100% (Eslovenia, Portugal, Lithuania, United Kingdom) or in terms of normal capacity (Colombia).[28]

d. Other countries that directly ask just about current capacity utilisation such as Austria, Brazil, Czech Republic, Finland, Hungary, India, Indonesia, Luxembourg, Netherlands, Norway, Spain, Sweden and Switzerland (past three months) without further requirements.

[25] See my lasy essay on the National Emergency Rate of capacity utilisation for the US economy.

[26] Also these countries not included in our dataset: Albania, Croatia, Cyprus, Israel, Macedonia, Malta and Serbia.

[27] In this case, it is not useful for my purpose here, but anyway it was included in the dataset.

[28] In this case, it is not useful for my purpose here, but anyway it was included in the dataset.

In my opinion the 'correct' question about capacity utilisation is given by countries in the 'a' group. If I take into account that for the US's case, the 'Full Utilization Rate' and the 'National Emergency Rate' are, according to the available data from 1989 to 2017, greatly correlated (see my last essay in this thesis); I think that this is enough justification to include the 'b' group. Moreover, the group 'c' also can be included, just because they ask explicitly about the behaviour of the effective capacity in relation to the 'normal' or 'desired' capacity utilisation.[29] Finally, the last group, also can be included, given that the question is based on current effective capacity; and although this is subject to plant manager's interpretation, this group can be part of 'a', 'b' or 'c', or a mixed of them; again, this is enough justification to include them in this study.

This arbitrary classification of course is not error-free, but with Alejandro González in a previous article (Gahn and González, 2019) using a reduced version of this dataset, we did not find a particular relationship between capacity utilisation levels within these groups; so, at least from our analysis there is no clue to expect an ex-ante spurious correlation by how the questionnaires are built. Moreover, a survey-based study of this type is conditional to data availability.

4.7.3 Appendix A.3.: Countries excluded

CHILE: Monthly data.
ISRAEL: Monthly data.
MEXICO: Monthly data.
RUSSIA: Monthly data.
SOUTH KOREA: Monthly data.
TURKEY: Monthly data.

[29] Here it must be noticed that, in terms of the models discussed above, the *normal* might be changing with the level of output, so it is not enough evidence, as in the other groups, to reject or not the theoretical models.

4.8 Appendix B: Lag selection criteria

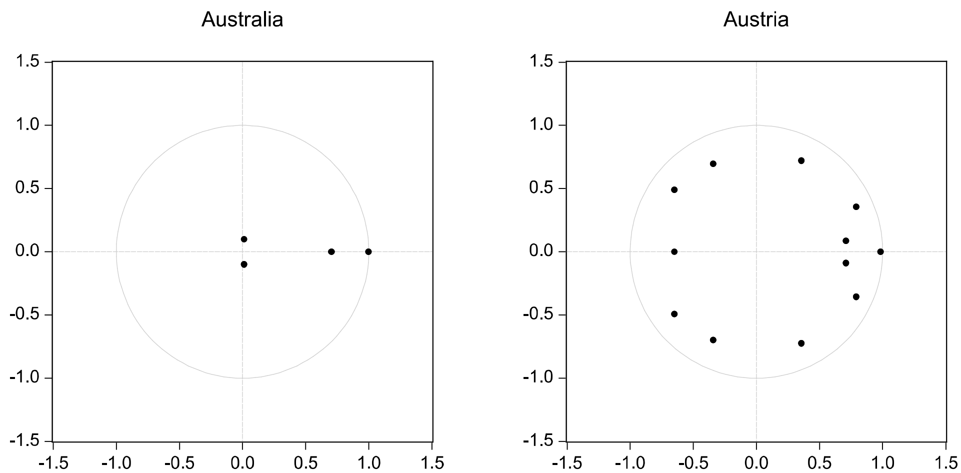
Table 4.2 Lag selection by country

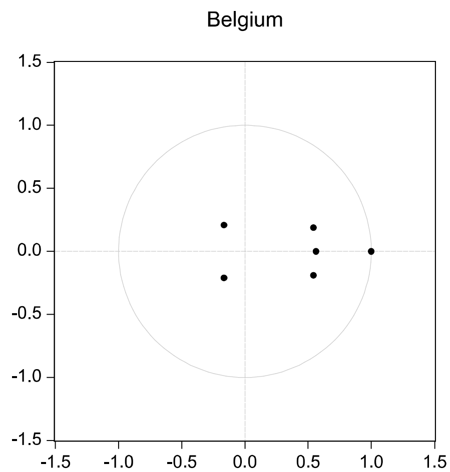
Country	AIC lags	Value
Australia	2	-9.805
Austria	6	-13.865
Belgium	3	-13.494
Brazil	3	-12.667
Colombia	5	-11.162
Czech Republic	2	-12.633
Denmark	2	-11.880
Estonia	4	-9.768
Finland	4	-10.920
France	3	-14.455
Germany	4	-12.312
Greece	6	-9.976
Hungary	2	-11.397
India	1	-9.937
Indonesia	1	-12.518
Ireland	2	-8.609
Italy	5	-12.410
Japan	2	-10.638
Latvia	3	-8.878
Lithuania	2	-10.220
Luxembourg	3	-9.423
Netherlands	4	-13.311
New Zealand	5	-11.836
Norway	4	-12.233
Poland	4	-11.486
Portugal	3	-12.378
Slovak Republic	1	-9.056
Slovenia	3	-11.586
South Africa	2	-10.619
Spain	4	-12.381
Sweden	5	-12.427
Switzerland	3	-11.420
United Kingdom	3	-13.167
United States	4	-13.674

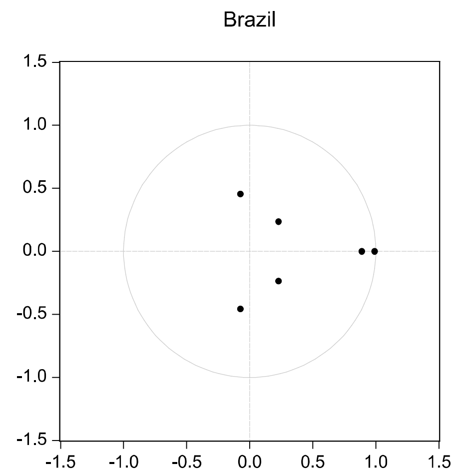
Source: own elaboration based on data provided.

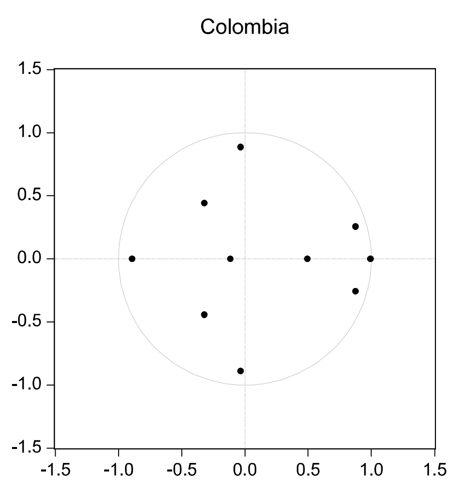
4.9 Appendix C: Stability

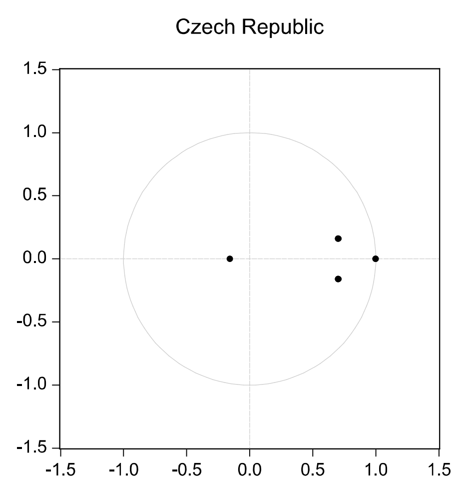
Figure 4.35 Inverse Roots of AR Characteristic Polynomial

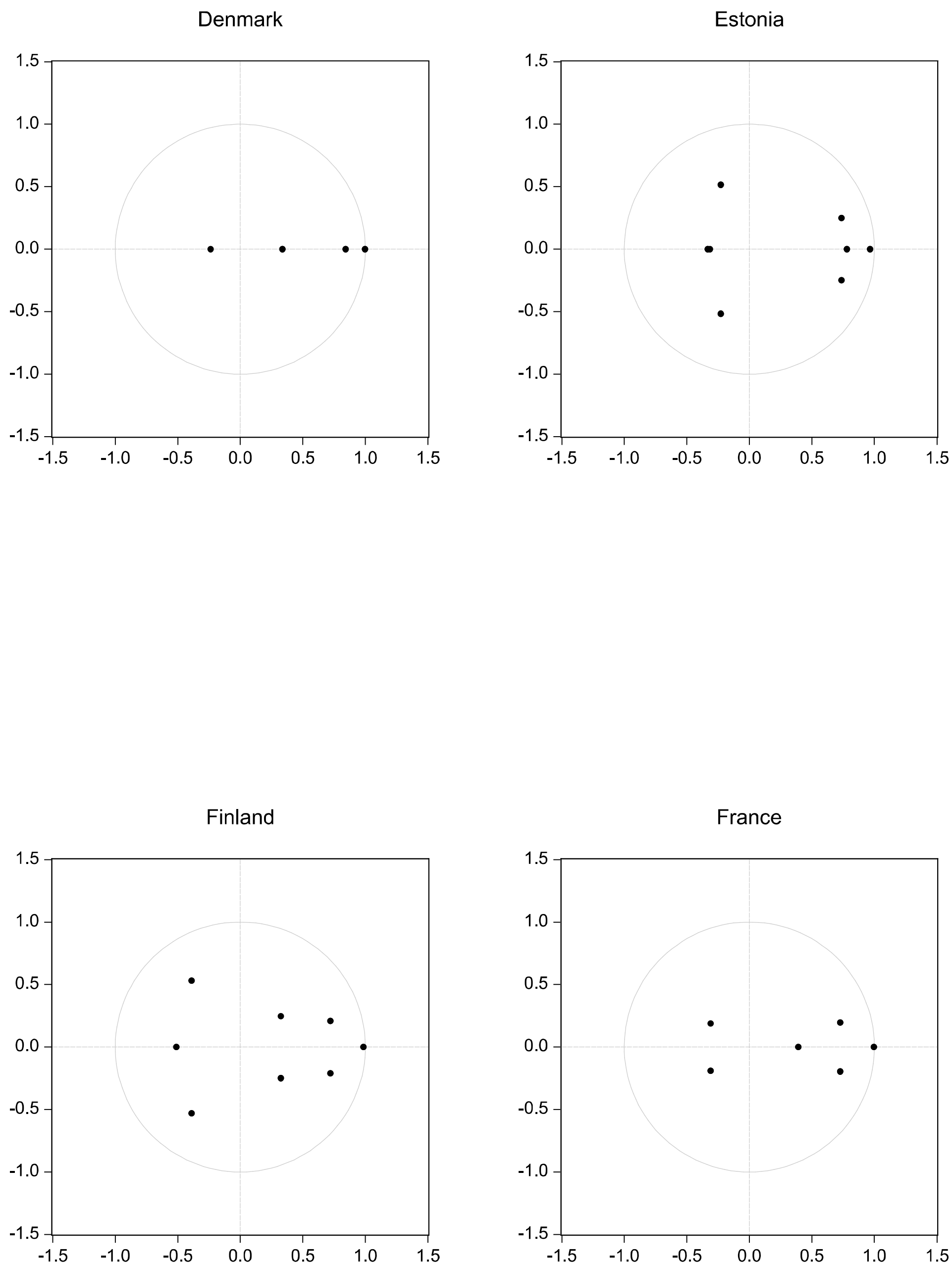


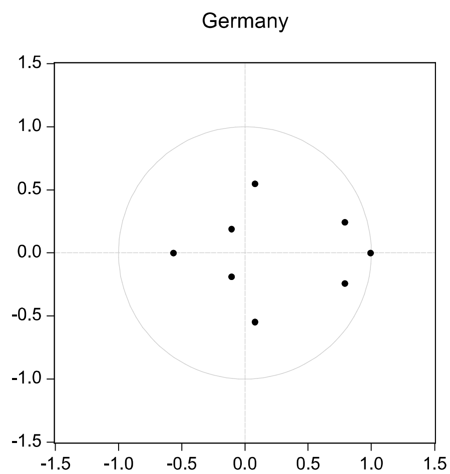

Belgium
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

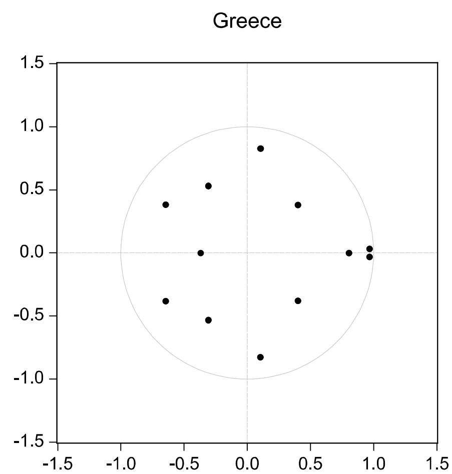

Brazil
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

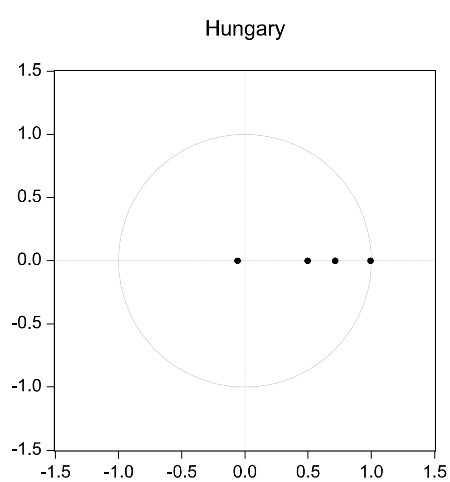

Colombia
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

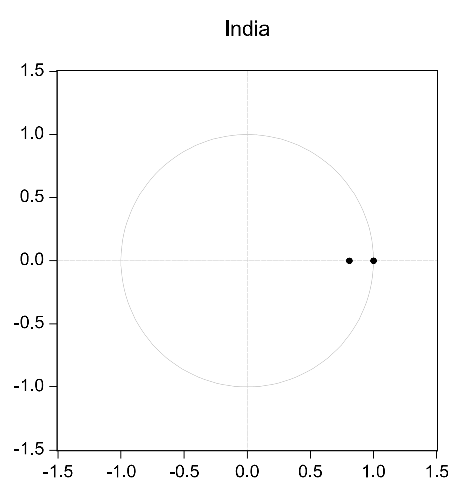

Czech Republic
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

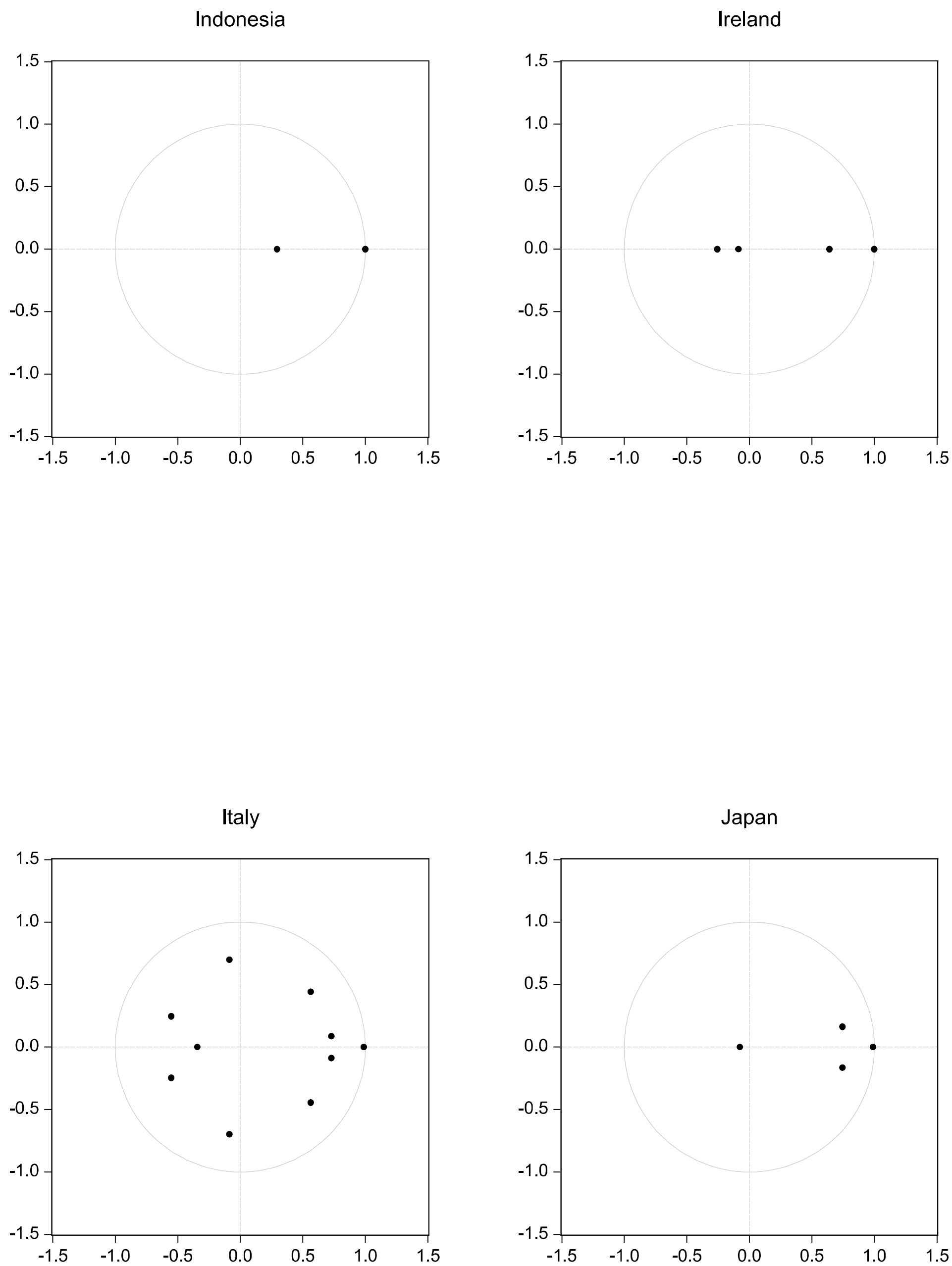

Denmark
Estonia
Finland
France
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

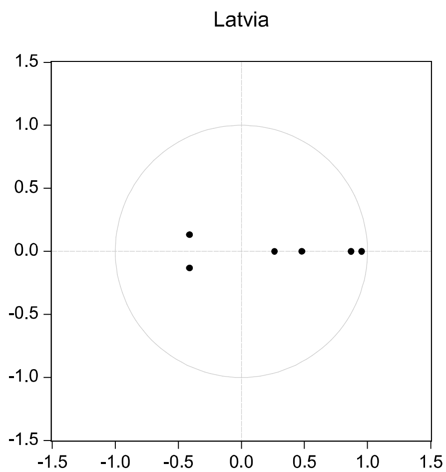

Germany
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

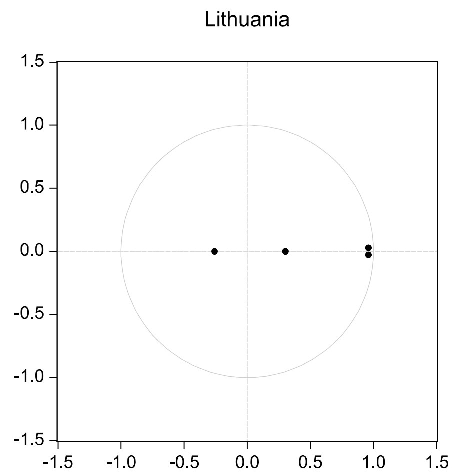

Greece
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

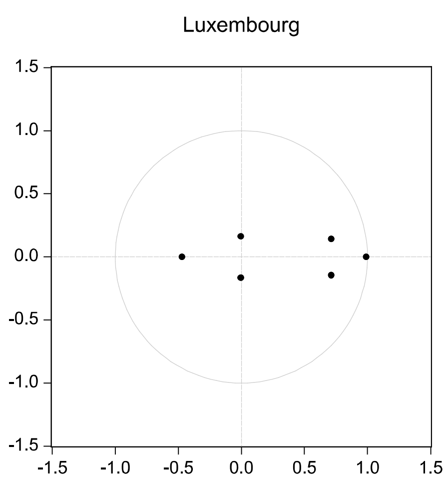

Hungary
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

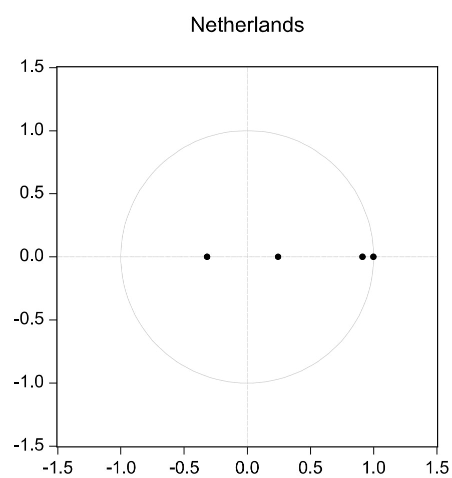

India
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

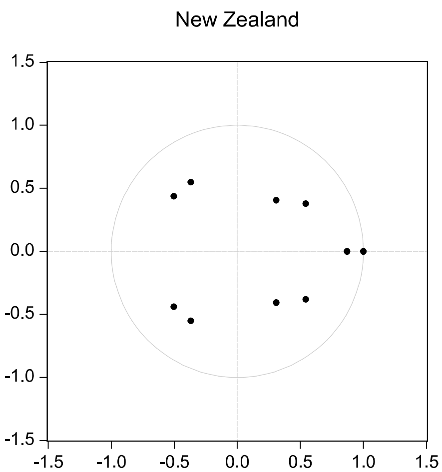

Indonesia
Ireland
Italy
Japan
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

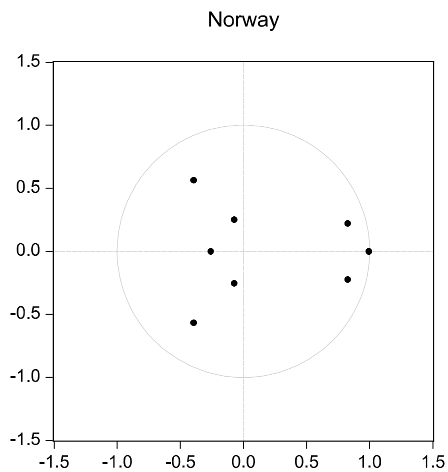

Latvia
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

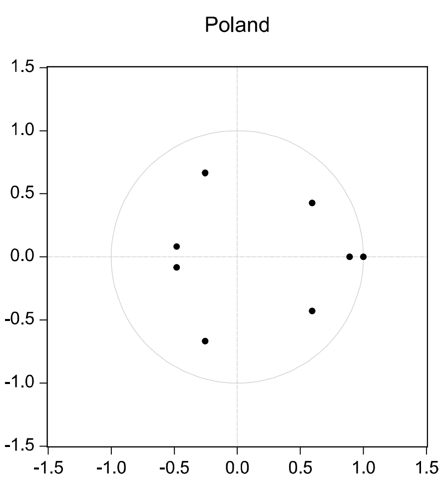

Lithuania
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

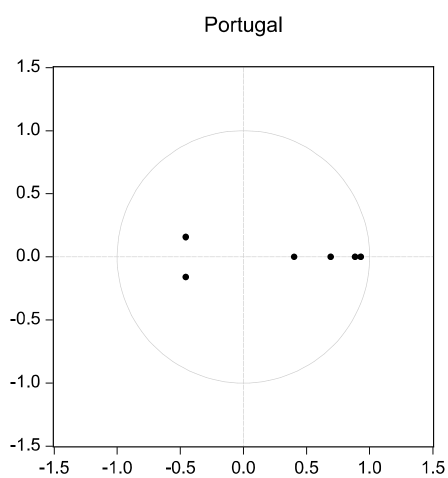

Luxembourg
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

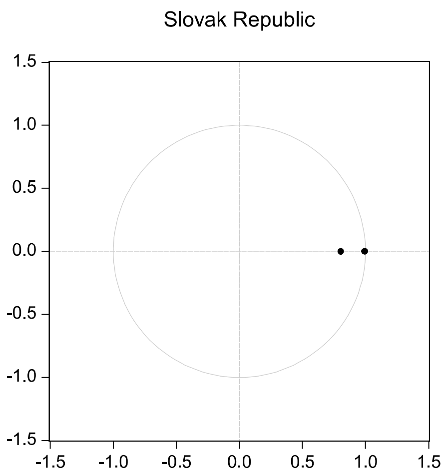

Netherlands
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

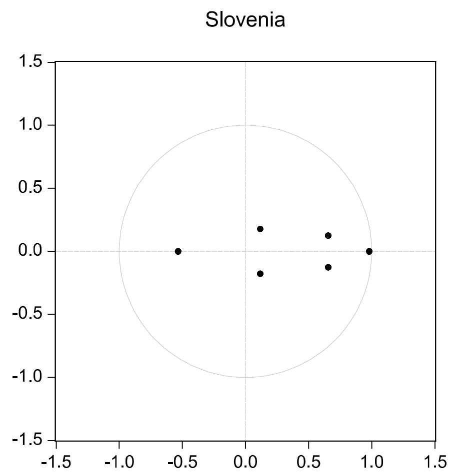

New Zealand
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

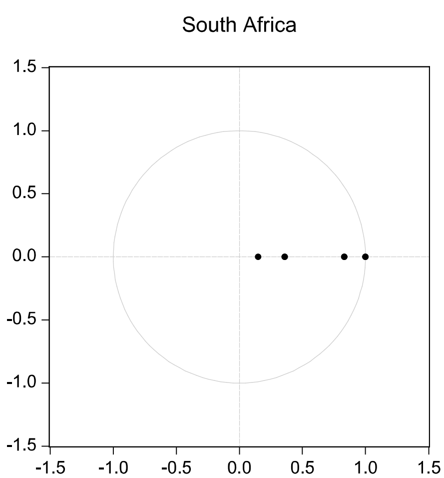

Norway
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

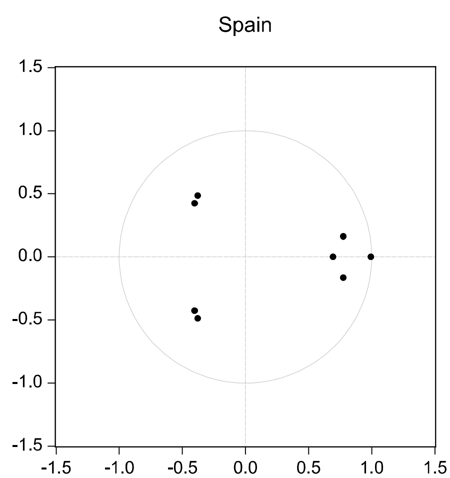

Poland
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5

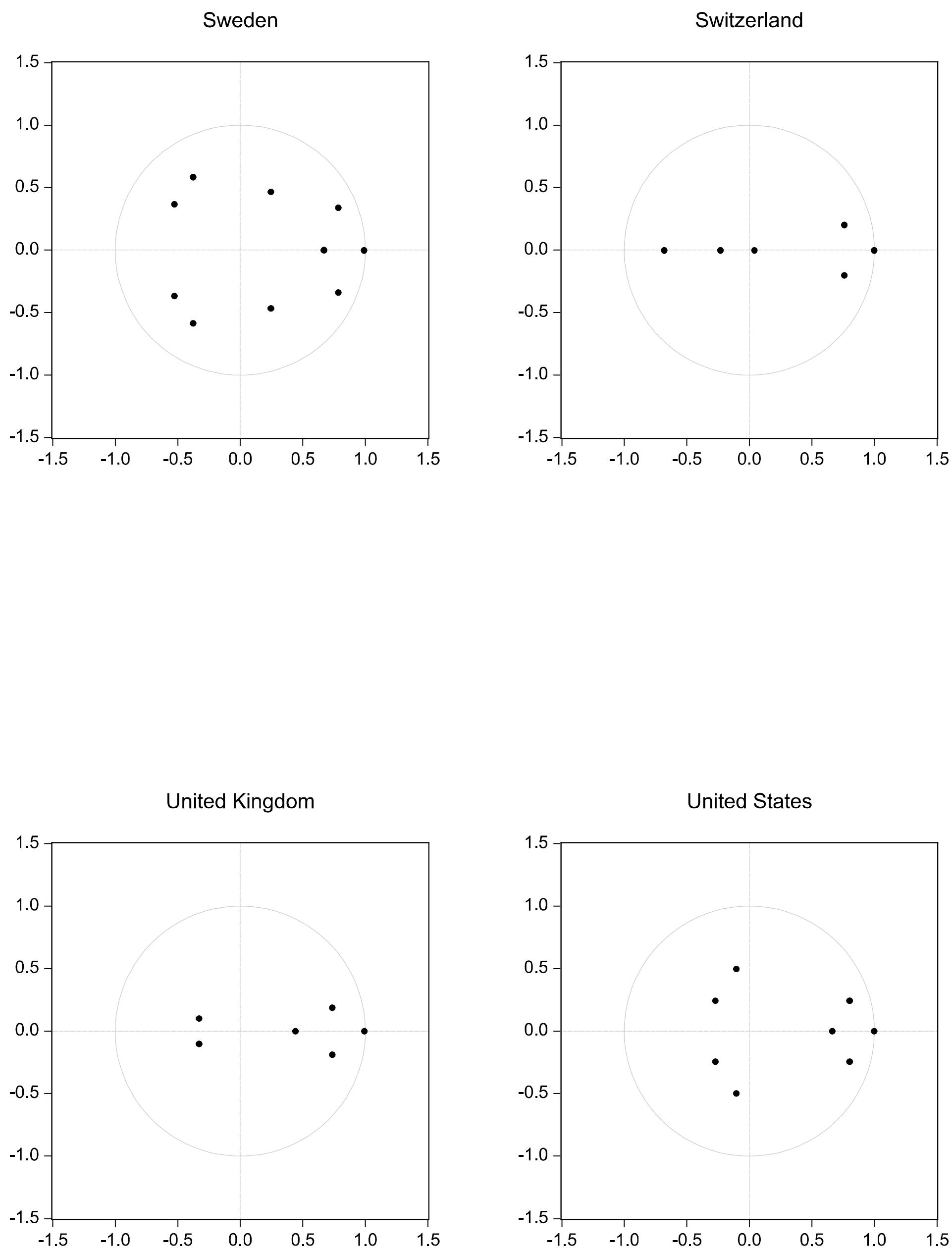

Portugal
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5


Slovak Republic
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5


Slovenia
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5


South Africa
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5


Spain
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-1.5 -1.0 -0.5 0.0 0.5 1.0 1.5



Source: own elaboration.

4.10 Appendix D: Unit Root Tests

Table 4.3 Time Series Unit Root Tests

Country	Utilization	Output-GDP
Australia	-4.052***	-2.391
Austria	-3.858***	-1.355
Belgium	4.698***	-1.117
Brazil	-2.958**	-1.577
Colombia	-2.733*	-0.733
Czech Republic	-2.156	-0.414
Denmark	-3.660***	-1.433
Estonia	-3.080**	-1.861
Finland	-3.658***	-1.939
France	-4.300***	-1.797
Germany	-5.902***	-3.793***
Greece	-1.778	-1.607
Hungary	-3.156**	-0.701
India	-2.272	0.363
Indonesia	-4.043**	-0.579
Ireland	-5.918***	-0.670
Italy	-4.214***	-3.921**
Japan	-4.426***	-4.920***
Latvia	-2.348	-1.350
Lithuania	-1.335	-1.536
Luxembourg	-3.378**	-2.588*
Netherlands	-3.391**	-0.917
New Zealand	-3.028**	-0.109
Norway	-3.501***	-1.373
Poland	-6.776***	-1.305
Portugal	-2.763*	-2.349
Slovak Republic	-3.214**	-1.366
Slovenia	-3.157**	-1.507
South Africa	-2.173	-0.161
Spain	-2.115	-1.253
Sweden	-3.719**	-1.601
Switzerland	-3.381**	-0.411
United Kingdom	-3.998***	-1.698
United States	-3.054**	-1.318

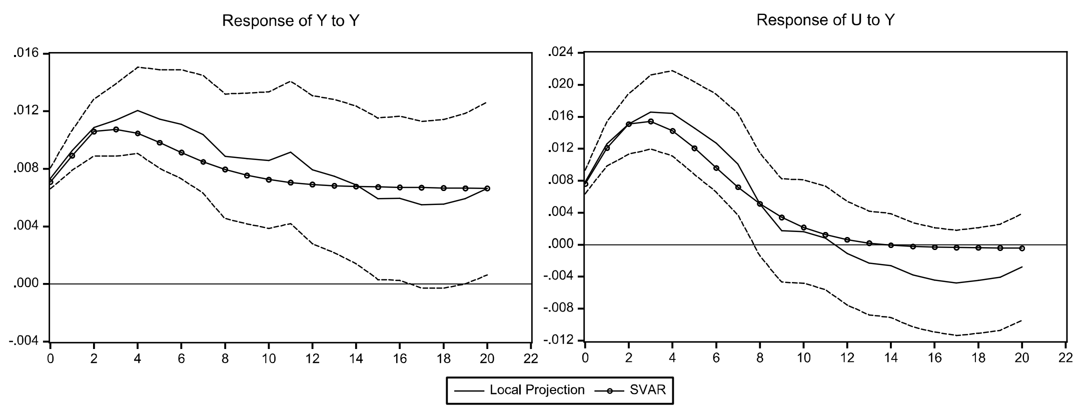
Note: $* = p < 0.1, ** = p < 0.05, *** = pval < 0.01$.

Source: own computations based on data provided in Appendix A in logarithms. ADF test for unit root in level with intercept; following Akaike Information Criterion (maxlags=11).

4.11 Appendix E: Local Projections and Panel Data

When the underlying data generating process (DGP) cannot be well approximated by a VAR(p) process, IRFs derived from the model will be biased and misleading. Jordà (2005) introduced an alternative method for computing IRFs based on local projections that do not require specification and estimation of the unknown true multivariate dynamic system itself. In addition to marginal error bands, Jordà (2009) introduced two new sets of bands to represent uncertainty about the shape of the impulse response and to examine the individual significance of coefficients in a given trajectory. The methodology I have followed is Jordà (2009). Here I show the case of the US economy with local projections and their comparison with the VAR analysis to demonstrate that there is no difference at all between local projections (solid lines) and VAR's results (crossed lines). Other countries' results are available upon request.

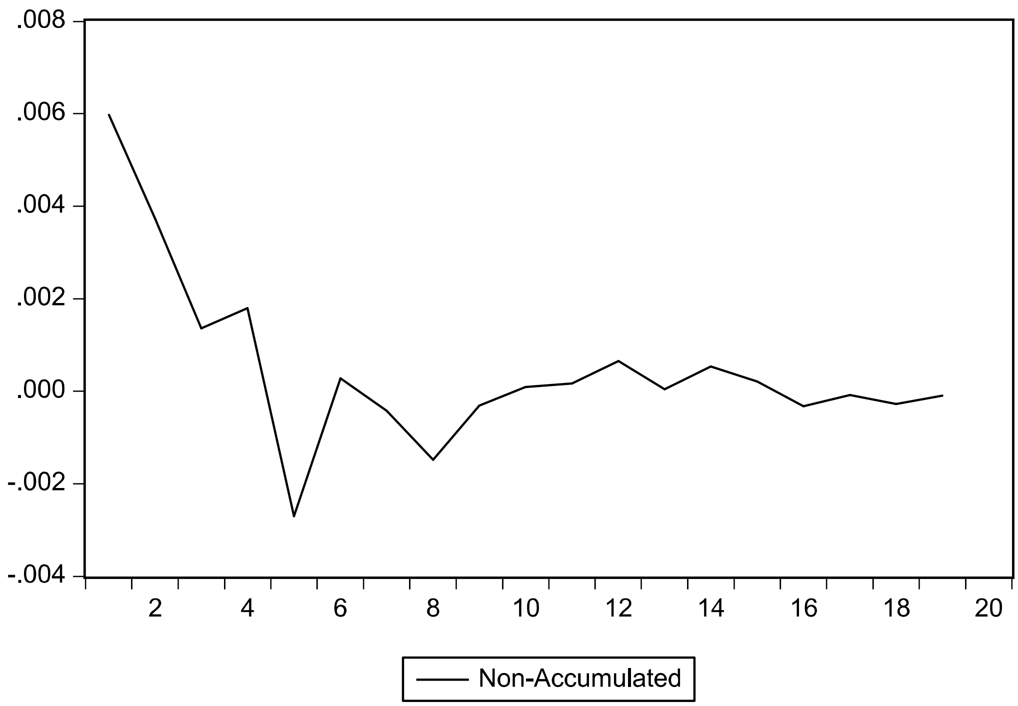
Figure 4.36 IRFs of output and capacity utilisation: US economy



Note: LHS IRF of output to output. RHS IRF of utilisation to output. **Source:** own elaboration.

Given the similarities of the results (see Plagborg-Møller, M., & Wolf, C. K., 2019), I found not so useful to include these graphs in this essay. For the panel data analysis, I took a balanced panel 1996Q1-2018Q4. I followed Pedroni (2013) methodology to perform a Structural VAR analysis. I have found, again, transitory effects of output on capacity utilization even with a panel dataset.

Figure 4.37 Response of capacity utilisation to an output shock: Panel Data



Source: own elaboration.

5 Towards an explanation of a declining trend in capacity utilisation in the US economy

5.1 Introduction

Recently during the revival of the 'utilisation controversy' (Nikiforos, 2013, 2016, 2018, 2020; Fiebiger, 2020; Girardi & Pariboni, 2019; Gahn & González, 2019; Gahn & González, 2020), many authors have mentioned the possibility of a declining trend in the level of capacity utilisation since the 1970s for the US economy. The discussion might be divided into two different spheres: Firstly, from an empirical perspective - whether there is (or not) a declining trend in capacity utilisation and its alternative measures - and secondly, the causes of the latter trend, should it exist. In this essay, I will try to clarify both. The aim of this essay is to identify whether such a declining trend in capacity utilisation exists in the US economy and its possible causes.

Different conclusions on whether there is a declining trend or not depend on which sources are used. On the one hand, Skott and Zipperer (2012), Duménil and Lévy (2012, 2014), Kiefer and Rada (2014), Blecker (2016), Setterfield (2019), Pierce and Wisniewksi (2018), Fiebiger (2020), Nersisyan and Wray (2019), Setterfield and Avritzer (2020), Bitros (2020) and Haluska, Summa and Serrano (2021) agree that there is a declining trend in capacity utilisation in the US: Evidence of their views may be sourced from Federal Reserve Board (FRB, hereafter) estimates. On the other hand, Shaikh (1987, 1989, 1992, 1999, 2016) and Nikiforos (2016, 2018, 2020) disagree with this, based on a measurement error argument, as the FRB estimates do not correctly capture the true value of capacity utilisation. Following these lines, I will analyse empirically the FRB time series and discuss alternative measures of capacity utilisation. After that, I will investigate some possible determinants of *normal* utilisation and, then, I will present some empirical evidence that might help us in order to explain the existence of this trend. Some conclusions will be drawn.

5.2 Alternative measures of capacity utilisation for the US economy

There is one thing undeniable for those working on empirical evidence, there is always a possibility of measurement error in data, so all the empirical results must be taken into account with caution. Related to this, according to some authors, in the case of the FRB time series a lot of revisions have been made to the capacity utilisation series[1] in order to provide a better fit between data and reality however, at least in the past a lack of transparency was present in the building of the series (Shapiro, 1989; Shaikh, 2016, p. 823). In this section I will try to analyse empirically capacity utilisation measures for the US economy. If the FRB measure is taken as a valid[2] measurement of capacity utilisation, a statistically significant decreasing trend could be found.[3] A negative trend in the whole period (1948Q1-2017Q4) as can be seen in Figure 1, confirming what have been commented in the previous section.

According to the Board of Governors of the Federal Reserve System[4]. (Corrado and Mattey, 1997, p. 153; Corrado et al., 1997, p. 80; Gilbert et al., 2000 and private communication), initially a survey of firms by McGraw-Hill, which started in the mid-1950s, was the primary determinant of the level of utilisation in manufacturing. The US Census Bureau survey - analysed later - was started in the mid-1970s and became the only source of utilisation rate data in the late 1980s, when the McGraw-Hill survey was discontinued. The rates from the McGraw-Hill survey are currently the basis for the earlier years of the published FRB rates, but they tend to be higher than those from the Census survey (the two surveys overlapped for 14 years). A *level adjustment is applied* to estimates for more recent years in order to maintain consistency with the historical levels based on the earlier survey. Moreover, the *level* difference between the McGraw-Hill rates and the Census rates may come from differences in their samples. McGraw-Hill was a *firm-level* survey, whereas Census did a *plant-level* survey. Finally, FRB estimates industry capacity using a regression model[5] relating survey-based capacity to measures of capital input and measures of the average age of the industry's capital stock. The final capacity indexes - denominator of FRB's capacity utilisation - for a year are derived from the fitted values of these regressions (Raddock, 1996).

[1] Raddock, 1990, 1993, 1995, 1996; Corrado et al., 1997; Corrado et al., 1999; Gilbert et al., 2000; Doyle, 2000; Corrado, 2001, 2003; Corrado et al., 2001; Morin, 2003; Stevens, 2003

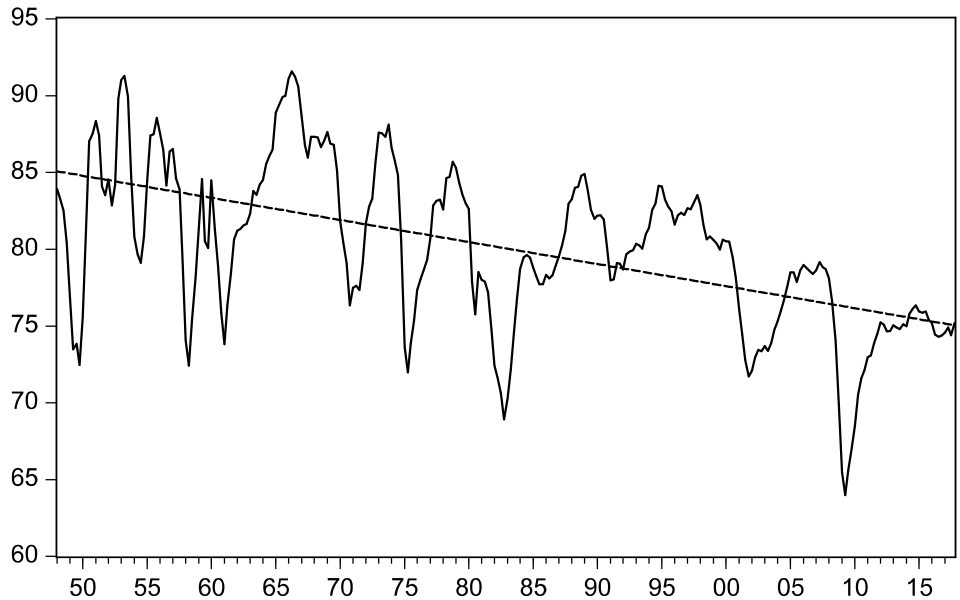
[2] Board of Governors of the Federal Reserve System (US), Capacity Utilization: Manufacturing [CAPUTLB00004SQ], quarterly, seasonally adjusted, retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CAPUTLB00004SQ

[3] Confirmed using the usual tests on Unit Roots (ADF, DF-GLS, PP, KPSS, ERS-PO, Ng-Perron).

[4] Source:https://www.federalreserve.gov/Releases/g17/Meth/MethCap.htm and https://www.federalreserve.gov/pubs/Bulletin/2000/0300secnd.pdf

[5] They also calculate rates of depreciation. See Mohr and Gilbert (1996).

Figure 5.1 Federal Reserve Board Utilisation Rate (1948Q1 – 2017Q4)



Note: Utilisation rate (solid line) - Trend (dot line).

The fact that the FRB makes use of multiple surveys to build on the whole period from 1948 to the present and estimates capacity using a regression model (Kennedy, 1998, p. 172; Morin and Stevens, 2004) whose step-by-step results are not publicly published has raised some doubts on its reliability. These critiques will be analysed in the next subsection. Something that must be clarified is that I am not keen in precisely measuring nor understanding which is the level of capacity utilisation but its behaviour through time. In this sense, I will try to make a robustness check with some alternative series.

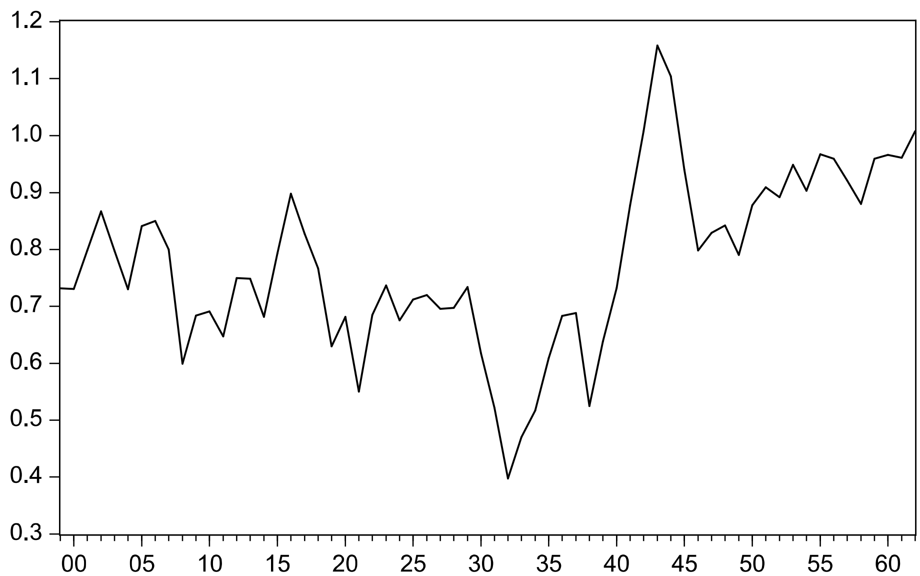
5.2.1 Electric Motors Index

Murray Foss (1963) developed an alternative measure related to the statistics on horsepower of electric motors in place.[6] He built a proxy of capacity utilisation with a theoretical maximum of production of energy by equipment in place and actual production of energy. However, the main limitations, among others, were: First, the assumption that there was no change in the technical efficiency of motors over the period under consideration (ibid., p. 13); second, that the increased use of measuring, metering and control instruments, which have grown more rapidly than machinery generally in that period (ibid., p. 14) has been ignored and, third, that is difficult to determine the

[6] The first historical reference could be Flux (1913).

change in the utilisation rate of machinery powered by sources other than electric motors. Besides this weaknesses of the approach, he was the first one introducing this alternative measures. Jorgenson and Griliches (1967), Heathfield (1972), Kim and Kwon (1973), Morawetz (1976), Bosworth (1985), Bosworth and Westaway (1985), Anxo and Sterner (1994), Bosworth and Cette (1995), Burnside, Eichenbaum, and Rebelo (1995) and Basu (1996) extended this field of research.

Figure 5.2 Electric Index - Shaikh (1992)



Note: own elaboration based on Shaikh (1992, p. 192). Period 1899-1963 annual data.

In more recent works, according to Bosworth and Westaway (1984), the degree of utilisation is constructed as the ratio of actual electricity consumed, L, to maximum possible consumption, L_M, based on the installed rated wattage of machinery. In practice, measures of L_M are not available annually by industry and are approximated by comparing the rated wattage to the stock of plant and machinery. Nowadays, there exists a major obstacle to the forward extension of this series: namely, that the data on the installed capacity of electric motors, which is crucial to the construction of the series, was dropped after the 1963 Census (Shaikh, 2016, p. 824). In Figure 5.2 we show the Foss' time series reconstructed by Shaikh (1992).[7]

[7]See the Appendix 5.7.1., Table 5.1., in which I show Unit Root tests for this time series. Results are mix.

5.2.2 The Average Workweek of Capital

The US Census Bureau reports a variety of measures of capacity utilisation from the 'Quarterly Survey of Plant Capacity Utilisation' previously called 'Survey of Plant Capacity' (SPC). One of these series is the 'Average Plant hours per week in operation' (APW-SPC hereafter), that is the quantity of hours that plants has been operating during a week. According to the Census, this time series has been estimated since 1974[8] and are publicly available[9] since the publication of the database by Gorodnichenko & Shapiro (2011).

From this time series, originally introduced by Murray Foss in an Appendix of his 1963's article, Foss (1984), Shapiro (1986), Orr (1989), Mayshar & Solon (1993), Shapiro (1996), Mattey & Strongin (1997), Beaulieu & Mattey (1998) and Gorodnichenko & Shapiro (2011) proceed to provide alternative measures of utilisation, which are based on the average workweek of capital.[10] The series constructed by these authors try to measure the Average Workweek of Capital (AWC hereafter). Given that the precise AWC is hardly ever measured in surveys, these authors propose to derive estimates of this measure by assuming that the workweek of capital is fixed for different shift systems that the firm might adopt. The precise equation for this measure is the following:

$$AWC = \frac{(H(E1-E2)+80(E2-E3)+120(E3))}{E1}$$

Where AWC 'is the average workweek of capital (in hours), H is the average weekly hours worked by production workers on the first shift, and E1, E2, and E3 are the number of production workers employed on the first, second and third shifts, respectively' (Orr, 1989, p. 89). Thus, the series goes between 0 and 120 hours of the average workweek of capital.

At a very first sight, all the measurements of AWW seems to show an increasing trend on capacity utilisation (see Figures 5.3 to 5.9), contrary to the Federal Reserve Utilisation Rate shown previously.[11] Some empirical test were run in the Appendix A (Table 5.2) to confirm or deny this

[8] https://www.census.gov/ces/dataproducts/economicdata.html

[9] The public availability of the data is not a minor issue. In most of the cases, this data is confidential.

[10] The estimates of Taubman & Gottschalk (1971), Shapiro (1986), Orr (1989) and Mayshar & Solon (1993) are based on data from the Area Wage Survey (AWS). Estimates of Beaulieu & Mattey (1998) and Gorodnichenko & Shapiro (2011) derived from SPC data (and the Annual Survey - Census of Manufactures for assigning plants to industries) (Fiebiger, 2020). According to Shapiro (1986, p. 213) the U.S. Bureau of the Census in 1929 collected and again since 1973 collects information directly on the work week of capital; these data were too infrequent and not collected over a long enough continuous time span to be useful so this is the reason why the shiftwork is a *proxy*. The full data is presented in Gorodnichenko & Shapiro (2011) and here named Census Bureau 2017. For the case of UK see Bosworth, Dawkings and Westaway (1981), Bosworth and Westaway (1984) and Ingram and Sloane (1985).

[11] Anxo and Sterner (1994, pp. 71-72) find that although the share of shiftworking increases, capital operating time remains stable for the case of Swedish manufacturing. For the case of the US it slightly increases for the period 1957-1984 like in Orr (1989). They find also that it slightly decreases in France, Norway and Sweden, almost remaining stable.

Figure 5.3 Foss (1984)

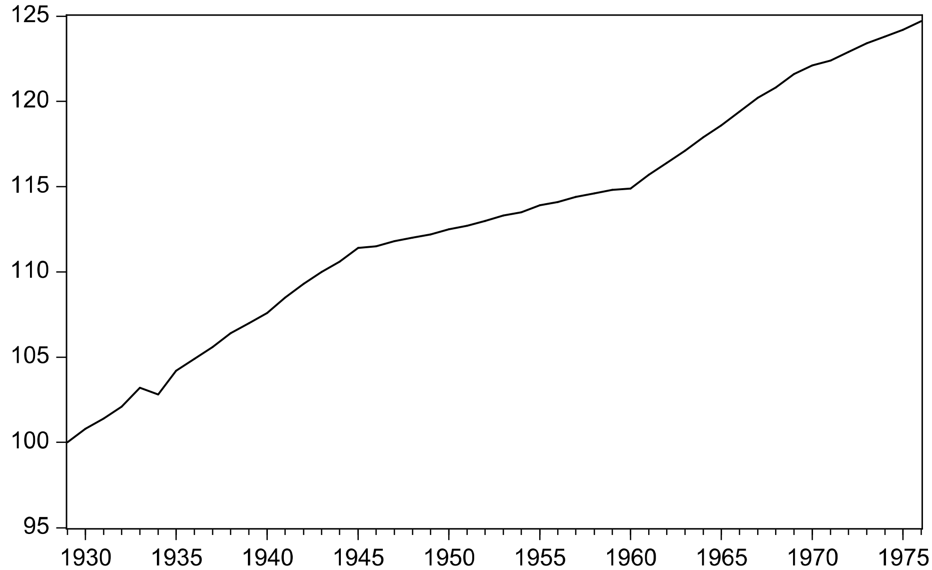


Figure 5.4 Shapiro (1986)

claim. The conclusion is that results are mixed. Older time series - except Foss (1984) - tends to reject a stochastic trend (Shapiro, 1986; Orr, 1989; Mayshar & Solon, 1993; Bulieau & Mattey, 1998)

Figure 5.5 Orr (1989)

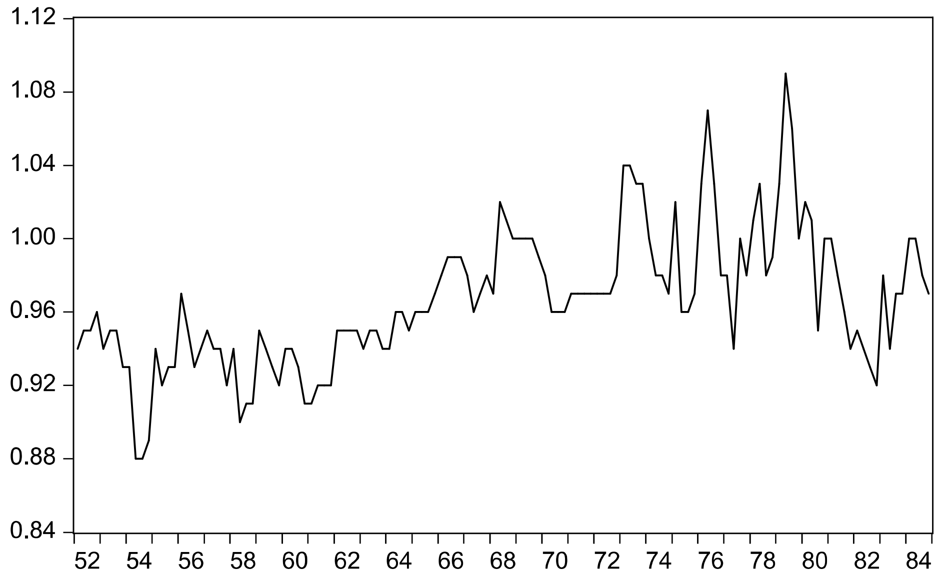


Figure 5.6 Mayshar and Solon (1993)

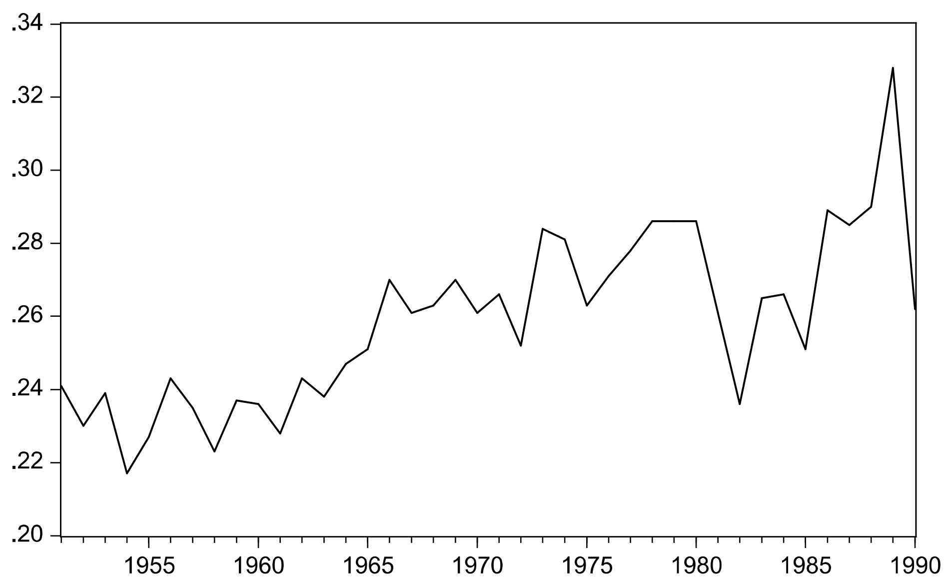


Figure 5.7 Bulieau and Mattey (1998)

while recent ones tend to accept an increasing stochastic trend (Gorodnichenko & Shapiro, 2011; Census Bureau 2017).[12]

Besides the mixed results of the empirical evidence, what cannot be denied is that this indirect measure of capacity utilisation could be subject to severely critiques. In relation to the AWC, according to Foss (1963) this series embraces some limitations that should be mention. First, they do not take into account the speed of operation of machines[13]; second, it is probably not appropriate to assume that machine hours by shift would be proportional to employment by shift and, third, that all machines on the first shift represent total machines available (Foss, 1963, p. 16). The article suggested, also, that increasing use of multiple shifts (McMenamin, 2007), a trend toward continuously operated industries as a result of technological change, and more efficient use of machinery were some of the influences underlying the rise in relative utilisation. Added to this, Foss admits that this measure could be influenced by many factors, i.e. learning-by-doing process, knowledge acquired by management in making more efficient use of machines, relative reduction in ‘downtime’ for equipment repairs, introduction of continuous-automatic operation in which machines tend to be used with a high degree of intensity (Foss, 1981a, p. 29), change in product mix toward industries in which continuous operation are important (usually, paper, chemicals, petroleum, and primary metal) (Foss, 1981a, p. 35,

[12]Similar exercise performed in Nikiforos (2020).

[13]Bresnahan and Ramey (1994, p. 603) finds that even in automotive assembly plants the line speed can be adjusted.

Figure 5.8 Gorodnichenko and Shapiro (2011)

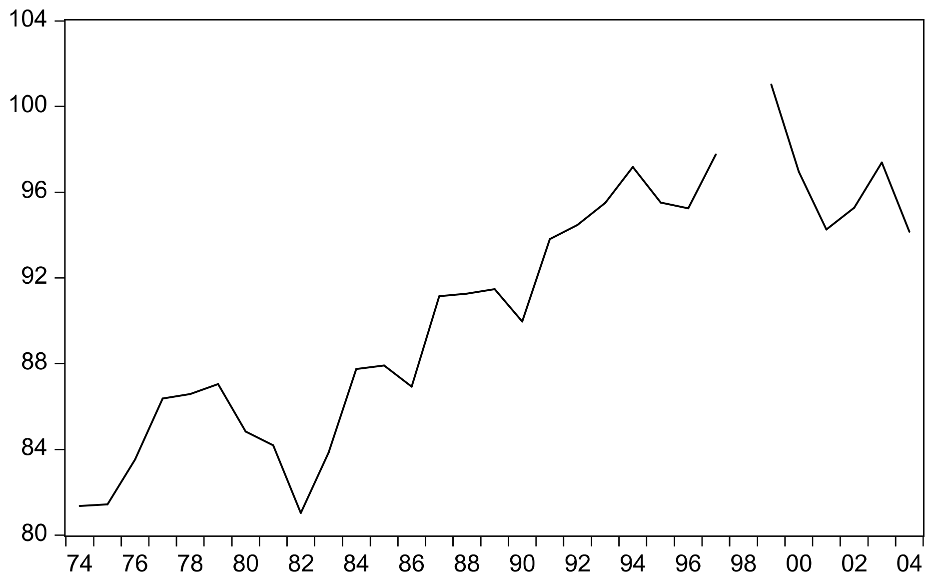
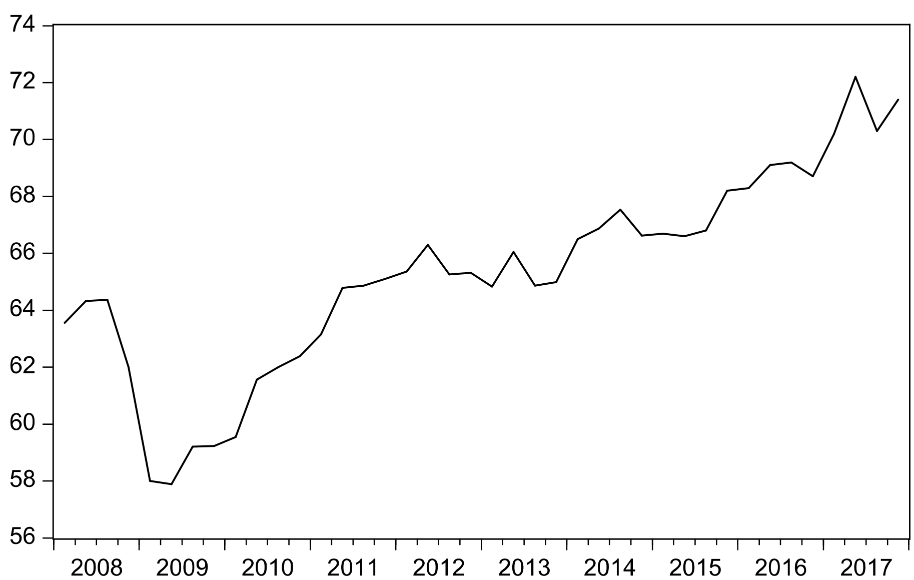
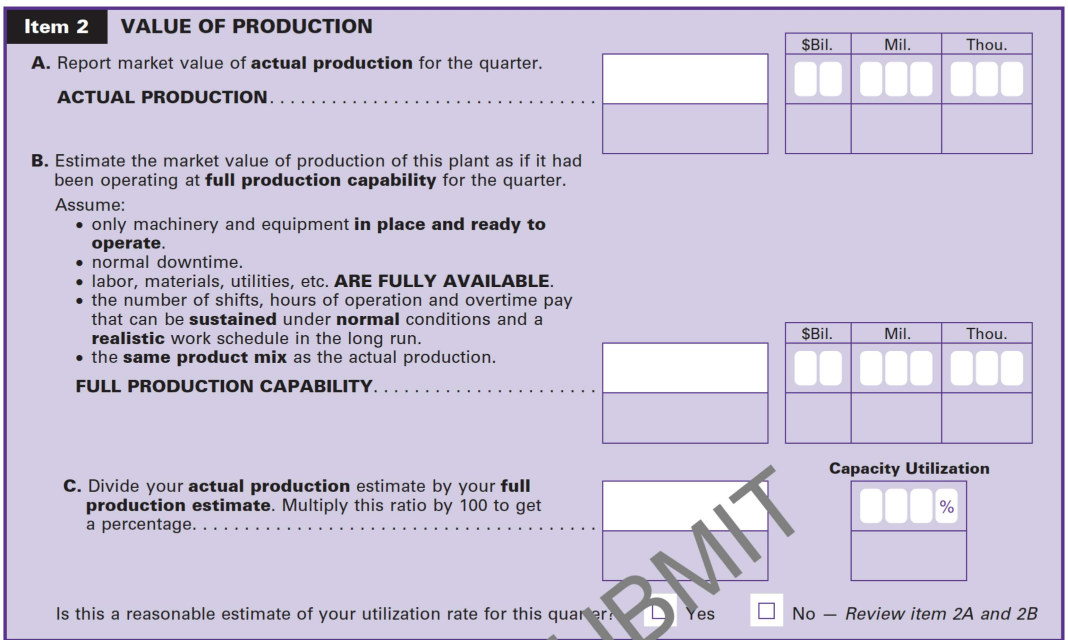


Figure 5.9 Census (2017)



p. 39), change in wage differentials for late shifts (ibid., p. 42), changes in relative importance of single-plant firms (Foss, 1981a, p. 29, p. 40), among others (Foss, 1981a, p. 60). Broadly speaking, technical change, changes on distribution or changes in the composition of output. It should be noticed that an increasing trend is in strict contrast with the findings of Creamer (1954) on capital-output ratios for the period 1880-1948 and those estimates of Hickman (1964). Recently, Fiebiger (2020) found that the behaviour through time of AWC hardly follows aggregate demand and he claims that it might not be used interchangeably with capacity utilisation, however it cannot be denied that part of the *temporary* adjustment of production is through more shifts of production (Mattey and Strongin, 1997). To conclude, AWC is hardly a 'pure' measure of capacity utilisation. In order to find another response I will analyse different capacity utilisation measures in the next section.

Figure 5.10 Quarterly Survey of Plant Capacity - Full Utilisation Rate



Item 2 **VALUE OF PRODUCTION**

A. Report market value of **actual production** for the quarter.

ACTUAL PRODUCTION . . . . $Bil. | Mil. | Thou.

B. Estimate the market value of production of this plant as if it had been operating at **full production capability** for the quarter.

Assume:

- only machinery and equipment **in place and ready to operate**.
- normal downtime.
- labor, materials, utilities, etc. **ARE FULLY AVAILABLE**.
- the number of shifts, hours of operation and overtime pay that can be **sustained** under **normal** conditions and a **realistic** work schedule in the long run.
- the **same product mix** as the actual production.

FULL PRODUCTION CAPABILITY . . . . $Bil. | Mil. | Thou.

C. Divide your **actual production** estimate by your **full production estimate**. Multiply this ratio by 100 to get a percentage. . . . . **Capacity Utilization** %

Is this a reasonable estimate of your utilization rate for this quarter? ☐ Yes ☐ No — *Review item 2A and 2B*

Source: Quarterly Survey of Plant Capacity (p. 2).

5.2.3 Full Utilisation Rate

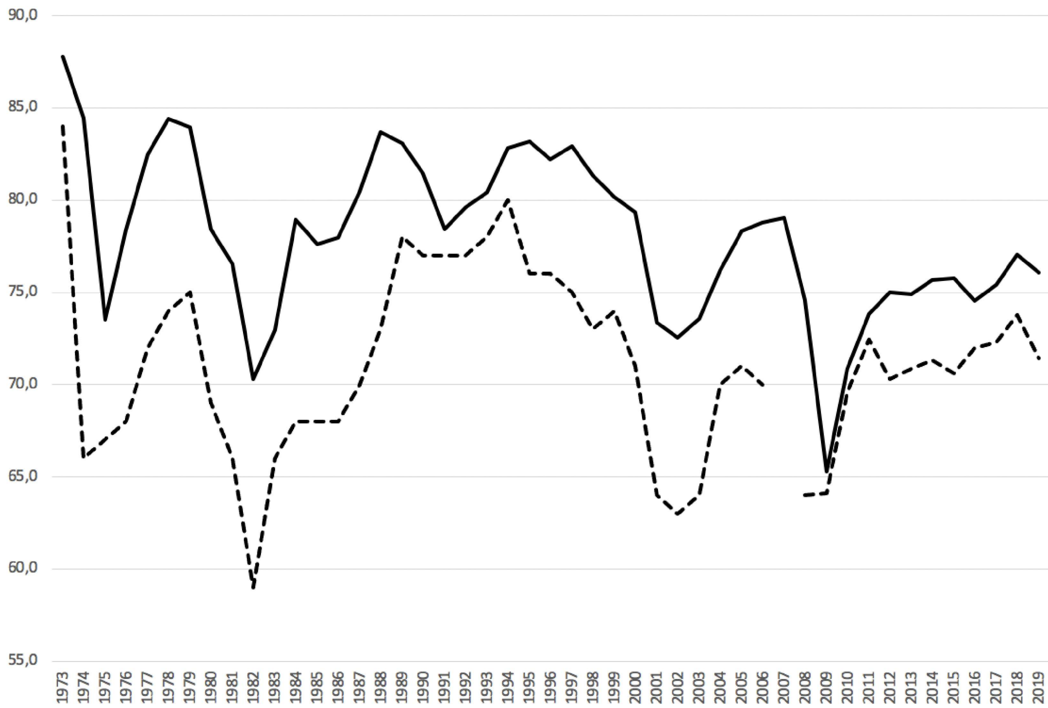
Another time series calculated by the Census Bureau since 1974 is the Full Utilisation Rate (FUR, hereafter)[14] - which serves as a basis for the construction of FRB's measure. It is a comparison of actual production and 'full production capability'. In this case the plant managers have to 'report market value of actual production for the quarter' (for the numerator) and 'estimate the market value of production of this plant as if it had been operating at full production capability for the quarter' (for the denominator) (Survey, US Census Bureau[15]): For the latter, they have to assume only machinery

[14]Publicly available since 1973 https://babel.hathitrust.org/cgi/pt?id=pst.000031321952&view=1up&seq=1

[15]https://www2.census.gov/programs-surveys/qpc/technical-documentation/questionnaires/watermark_form.pdf?#

and equipment in place and ready to operate, normal downtime, that labour, materials, utilities, etc. are fully available, the number of shifts, hours of operation and overtime pay that can be sustained under normal conditions and a realistic work schedule in the long run, as well as the same product mix as the actual production (see Figure 5.10)[16].

Figure 5.11 Federal Reserve Board and Full Utilisation Rate (1973 - 2019)



Note: Federal Reserve Board Capacity Utilisation (solid line) – Full Utilisation Rate (dot line). Source: Board of Governors of the Federal Reserve System (US), Capacity Utilization: Total Industry [TCU], retrieved from FRED, Federal Reserve Bank of St. Louis for the FRB rate and Current industrial reports. U.S. Department of Commerce, Bureau of the Census for the FUR rate. Practical rate until 1988 and Full Production rate after. See Doyle (2000) for compatibility. I would like to thank PhD Devika Dutt for her help while looking for sources for this graph.

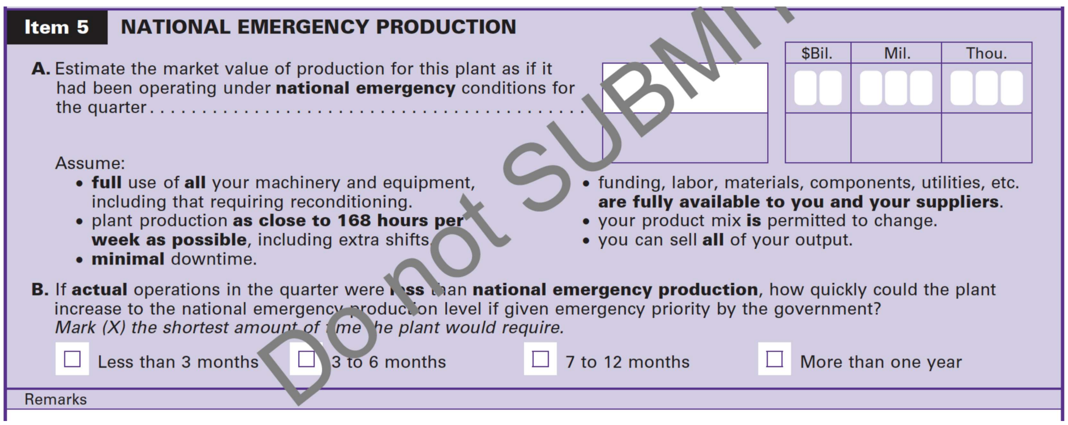
As it can be seen in the next Figure (5.11), FUR closely tracks FRB's estimate. The fact that plant managers have to assume equipment *in place*, ready to operate, *normal* downtime and a *realistic* work schedule might cast some doubts about the reliability of these estimates, simply because this measure of installed capacity utilisation does not include 100% of productive capacity in the denominator.

[16]The question of the survey has been changing through time (see Doyle, 2000; Morin and Stevens, 2004; Nikiforos, 2016; Fiebiger, 2020 on this issue.)

5.2.4 National Emergency Rate

The Census also presents another measure of utilisation, called the National Emergency Rate (NER), again a ratio between actual production and 'national emergency production'. Here the plant manager must 'estimate the market value of production for this plant, as if it had been operating under national emergency conditions for the quarter' (for the denominator) (Survey, US Census Bureau[17]): They also have to assume *full* use of *all* their machinery and equipment, *including that requiring reconditioning, plant production as close to 168 hours per week as possible, including extra shifts, minimal* downtime, supposing that funding, labour, materials, components, utilities, etc. are fully available to them and their suppliers, their product mix is permitted to change and finally, that they can sell all of their output (see Figure 5.13).

Figure 5.12 Quarterly Survey of Plant Capacity - National Emergency Utilisation Rate



Item 5 NATIONAL EMERGENCY PRODUCTION

	$Bil.	Mil.	Thou.
A. Estimate the market value of production for this plant as if it had been operating under **national emergency** conditions for the quarter			

Assume:
- **full** use of **all** your machinery and equipment, including that requiring reconditioning.
- plant production **as close to 168 hours per week as possible**, including extra shifts.
- **minimal** downtime.
- funding, labor, materials, components, utilities, etc. **are fully available to you and your suppliers**.
- your product mix **is** permitted to change.
- you can sell **all** of your output.

B. If **actual** operations in the quarter were **less than national emergency production**, how quickly could the plant increase to the national emergency production level if given emergency priority by the government?
Mark (X) the shortest amount of time the plant would require.

☐ Less than 3 months ☐ 3 to 6 months ☐ 7 to 12 months ☐ More than one year

Remarks

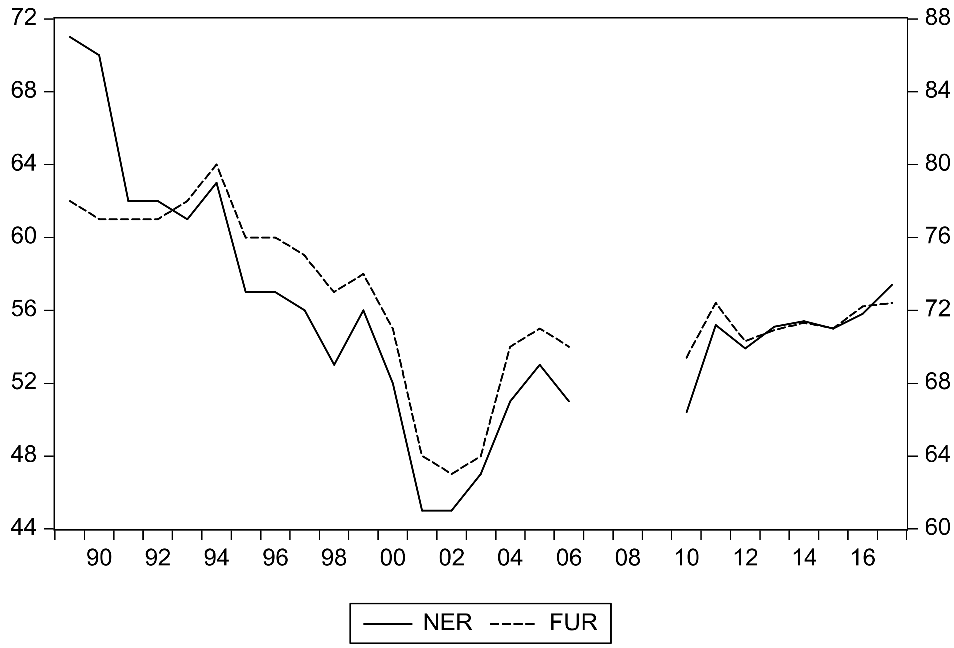
Source: Quarterly Survey of Plant Capacity (p. 3).

5.2.5 Comparing the Federal Reserve Board and the Census Bureau time series

The FUR could represent an 'economic' estimate of capacity utilisation, while the NER is similar to the 'engineer' concept. The difference has to lie in the denominators of these two indexes, there is scope for 'economic' considerations in the FUR, while the NER is just, plain and simple, the production you can technically achieve by operating machines at full speed. The NER database is publicly available at an aggregate level and for more than 500 industries from 1989Q4 to 2006Q4 - only for the last quarter of each year and for 93 industries from 2010Q1 to 2017Q4 - quarterly - not seasonally adjusted, therefore, in the first stage, I will try to compare visually this aggregate time series with the aggregate FUR in order to see if there is any compatibility.

[17] https://www2.census.gov/programs-surveys/qpc/technical-documentation/questionnaires/watermark_form.pdf?#

Figure 5.13 Full Utilisation and National Emergency Rates (1989Q4–2017Q4)

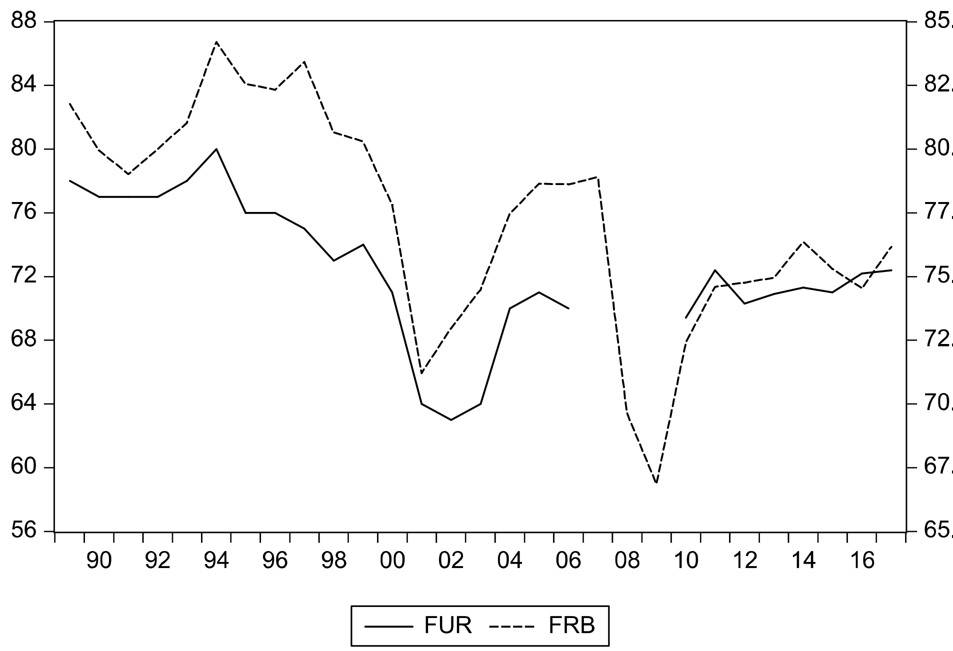


Note: NER (left axis) - FUR (right axis). Only last quarter. 2007, 2008 and 2009 values are missing. Source: own elaboration.

In Figure 5.13, the aggregate NER and the aggregate FUR, directly retrieved from the US Census Bureau Survey, are shown; hence without any adjustment performed by the Federal Reserve Board (FRB). Even considering the missing values for 2007, 2008 and 2009, it can be seen that the pattern of both variables is quite similar. Few comments should be made regarding this. Firstly, it is clear that, as previously stated, the pattern is similar and what is different is the level of the variables: The NER is at any time lower, as might be expected, given the denominator is the maximum that can be technically produced. Secondly, if we consider that the NER is the closest variable to the measurement of 'engineering' utilisation capacity and given that FUR's behaviour through time is very similar, then it could also validate the idea that the latter could be a proxy of the correct 'economic' measure of capacity utilisation, at least to analyse its behaviour through time, if not its level. The fact that the FUR estimates follow the NER estimates - as can be seen in Figure 5.13 - is proof that what can be considered for some authors an 'ambiguous' question asked by the Census - although without being error-free as any survey-based method - it is not necessarily the case with regard to plant managers.

As I have mentioned previously, the FRB makes some adjustments to the US Census Bureau's FUR, so I must also compare these variables. Unfortunately, the FRB time series is seasonally adjusted by default while the FUR is not; therefore, I applied X-13ARIMA Seats seasonal adjustment for the period 2010Q1-2017Q4. As it can be seen from Figure 5.14, the behaviour of both series through time is not the same but quite similar. The level of the FRB's measure might be greater, as expected, because of the adjustment of the FRB in relation to McGraw-Hill's estimates (see 5.2). At least from a simple visual analysis[18] it could be inaccurate to claim that the adjustment made by the FRB radically changes the behaviour through time of the Census Bureau time series.

Figure 5.14 Full Utilisation and Federal Reserve Board Utilisation Rates and (1989Q4-2017Q4)



Note: FUR (left axis) - FRB (right axis). Only last quarter, seasonal adjusted since 2010. 2007, 2008 and 2009 values are missing for FUR.

5.2.6 Main critiques to FRB measures

Shaikh's critique

Professor Shaikh (2016) assures, based on Hertzberg et al. (1974), Schnader (1984), Shaikh (1987b) and Shapiro (1989), that

[18]See the Appendix B for the econometric evidence.

> a second group of capacity measures tries to get around this problem by relying on economic surveys of operating rates, as in those by the Bureau of Economic Analysis (BEA) and the Bureau of the Census. Here, firms are typically asked to indicate their current operating rate (i.e., their current rate of utilization of capacity). The difficulty with such surveys is that they do not specify any explicit definition of what is meant by "capacity", so that the respondents are free to choose between various measures of capacity, and the analysts who use this data are free to interpret them in manners consistent with their own theoretical premises.
>
> Shaikh, 2016, p. 823

Bosworth and Westaway raised a similar argument:

> It seems quite likely for example that a particular plant may report that it is operating at full capacity even when working on a single shift basis, while another plant might report working at less than full capacity even when it is on a continuous four or five crew, three shift system
>
> Bosworth and Westaway, 1984, p. 317

Problems related to surveys have been greatly acknowledged by De Leeuw (1979). In my view, Shaikh's argument could hardly be a concern for a survey's analysis: Firstly, according to Phillips (1963, p. 284), while referring to McGraw-Hill estimates '(...) companies set their own definitions' and 'follow a commonsense definition of capacity, such as maximum output under normal work schedules'. Added to Phillips' view, in my view this could be hardly a concern for survey's analysis: Once fixed the criteria to define capacity by the plant manager at a very first time, even right or wrong, in any case if it is assumed that she will respond coherently using the same method of estimation through time, the error measurement of the time series remains only at the level of this time series. I think this is not a too strong and implausible assumption that could be done if working on surveys rather than in estimates of capital stock is preferred.

Based on this argument, Professor Shaik (1987a, 1987b, 1992, 1999, 2016) estimates another alternative measure of capacity utilisation. In 1987a and 1987b he divides the Federal Reserve Board index of industrial production by a new series on capital stock, being the latter built from a McGraw-Hill survey on gross investment and corrected to get a net investment measure (see Figure 5.15). Later, as a robustness check, he compares this outcome with Foss' (1963) electric motors index and he concludes that the series tracks precisely Foss' estimates.[19]

[19]For robustness purposes a comment can be done here. His series from 1987a and 1987b are far from stationary and present an increasing stochastic trend (see Table 5.3. in Appendix 5.7.3). However, the author, given that he does not present results on Unit Roots, does not introduce the discussion on a possible increasing or declining trend.

Figure 5.15 Shaikh (1987a, 1987b)

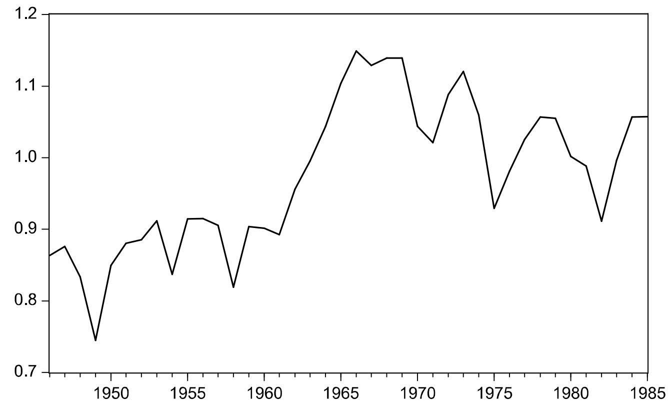


Figure 5.16 Shaikh (1992)

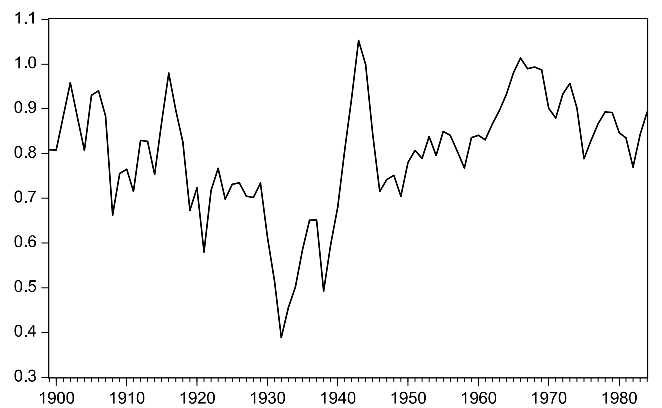


Figure 5.17 Shaikh (2016)

In 1992 he estimates another alternative measure of capacity utilisation (1992, p. 182) from 1899 to 1984 based directly on Foss' (1963) electric motor utilisation index (see Figure 5.16). He recalculates this series for the whole period. He modified it to incorporate Foss's data on the slow change in the trend of normal work shift (Foss, 1984), adjusting capacity with Foss's (1981a) AWC index - it means that AWC is not a measure of capacity utilisation but a determinant of the *normal* one.[20] Professor Thio, in Shaikh's 1992 article, has heavily criticised this measure given that it is based on an indirect measure of the ratio of the use of electricity for electric motors and the energy use of these motors at full capacity. Something that was recognised by Foss (1963). Thio claims that 'even if such measure could be completely correct, there may be reasons why it shows a long-run trend quite apart from changes in the utilisation rate, such as gradual development of techniques to apply machines to appropriate size, or learning on the basis of experience how to integrate electrical machinery in the production process' (Thio, 1992, pp. 197-198).

In his last book Shaikh (2016) criticises the estimates of the FRB as I have commented above. His new alternative series on capacity utilisation (2016, p. 822) – that are similar – based on estimations of output, capital stocks and an arbitrary assumption of linear technical progress as suggested in Moudud & Shaikh (2004), is not stationary (ibid., p. 824) (see Figure 5.17 and Table 5.3. in Appendix 5.7.3.). The determinants of this non-stationarity remain open and are unexplored by the author. At a theoretical level, however, he supports the idea that these time series must be stationary given that *normal* rate operates as a Classical centre of gravitation, in line with his 1992 paper.[21] The problem with the estimates of capital stocks is mainly that include also current or historical prices, so it is not only an estimate of physical capital.

To sum up, although Professor Shaikh's measures on capacity utilisation are an innovative way to approach the construction of alternative series, the relationship between the National Emergency Rate, the Full Utilisation Rate and the FRB rate might allow us, through a simple visual analysis, to consider that the FRB's measure, although with serious limitations, might still be valid as a measure of capacity utilisation.

Nikiforos' critique

Nikiforos (2016, 2018, 2019b), on the Federal Reserve Board estimates, claims that 'it becomes obvious that the rate of capacity utilisation tends to gravitate around a constant rate over a prolonged period of time' (2016, pp. 9-10) and therefore this is difficult to conciliate with an endogenous utilisation rate (2016, p. 9), a natural result of some versions of the Neo-Kaleckian model. However,

[20] Although the author does not present this result, his series of 1992 is stationary (see Table 5.3 in Appendix 5.7.3) and the incorporation of AWC only shifts the level of the series.

[21] It must be clarified that a centre of gravitation does not need to be stationary.

he states that the FRB measurement is 'stationary by construction' (2016, p. 2), putting in doubt the FRB's estimates. Furthermore, even taking into account the data's possible measurement error, he recognises also the possibility of a declining trend that 'can be attributed to a change of the structural characteristics behind the desired rate of utilisation' (2016, p. 9); his argument is based partially on Spence (1977) and Dixit (1980) in which higher concentration implies lower utilisation as a barrier to entry. The latter argument is a logical theoretical possibility.

The main argument rests in the fact that, the FRB's utilisation measure is based on the Survey of Plant Capacity, conducted by the US Census Bureau, in which the Census asks plant managers for 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' (Nikiforos 2016, p. 10). Due to the 'ambiguous' way in which this particular question of the survey might be designed, the author states, 'In that sense the FRB utilization index is a proxy for the deviation of u^* [effective utilization] from u_d [desired utilization] and gives us no information about u_d itself.' (Nikiforos 2016, p. 11). In a similar fashion, some authors in the past have already claimed, that, in some surveys plant managers [respondents in the McGraw-Hill utilisation survey] 'find' capacity when output rises sharply, and 'lose' it when output slackens (Perry 1973, p. 711; Rost 1983, p. 521; Morin and Stevens, 2004, p. 16).

Finally, motivated by Morin and Stevens (2004) it seems to be that Nikiforos' main explanation is related to 'changes in the sources of the data and the way the series are constructed'; therefore it is a problem of measurement (design of surveys and revisions made by the FRB). With the latter argument he recognises a declining trend in the data but only as a consequence of how the data was built – measurement error. It is true that all the macroeconomic time series suffer from error measurement. However, it is quite difficult to explain this declining trend just because of 'the sources of the data and the way the series are constructed' (Nikiforos, 2016, p. 9) given that this trend is also followed by the NER. Nikiforos also introduces an alternative measure - AWC, previoulsy analyzed - and he claims that 'a solution to this problem is to examine the behaviour of the average workweek of capital (AWC), where the full capacity is defined as $24x7 = 168$ hours per week'. Under my view, there is no need for an alternative - an indirect - measure like AWC, if the analysis can rely on the NER which is a direct measure of 'engineer' capacity utilisation. First, AWC does not take into account the speed of operation (Nikiforos, 2016, p. 11, fn. 14), NER does. Second, it only applies to capital in use (Taubman & Gottschalk, 1971), among other critiques mentioned in the previous section.

5.2.7 Is there a declining trend in capacity utilisation in the US economy?

Although all the measures shown above have their own shortcomings[22], based on the evidence shown above, it is difficult to claim that the Electric Motors Index or the Average Workweek of Capital can be better measures of effective capacity utilisation than the surveys done by the Census Bureau. Of course, much more evidence must be analyzed for this purpose, based on the material discussed so fare as a preliminary conclusion I am able to claim that, at least for survey's analysis, the long-run trend in the FRB rates largely reflects the results of the Census Bureau's annual Survey of Plant Capacity (SPC) (Morin and Stevens, 2004, p. 47, fn. 2) and private communication with the Federal Reserve Board, there is a declining trend in effective capacity utilisation for the US economy since 1989.

After this I will try, first, to make an exhaustive revision of literature on the determinants of the normal rate of capacity in order to find possible explanations to our results and second to analyse some empirical evidence that could explain this issue.

5.3 Determinants of ‘normal’ level of capacity utilisation

One might argue that a declining trend in capacity utilisation could be explained in two different ways. Keeping in mind that u_n is an unobservable variable[23], the effective rate of capacity utilisation is changing through time, and therefore, no evidence at all in relation to the *normal* one. A corollary of this interpretation is that - because the process of adjustment is slow - a series of subsequent shocks has hindered a full convergence to u_n.

On the other hand, if a declining trend of capacity utilisation for so many years is observed, one might suspect that the *normal* rate is changing. Therefore, some determinants of the *normal* rate have been changing through time and the *normal* rate is that one suffering a declining trend; but given it is *unobservable* I should look for in its determinants to find a plausible answer.

There are many factors that determine the level of ‘normal’ capacity utilisation in the literature. In this section, I will try to introduce the main determinants through a theoretical literature review.

[22]There is specific literature on difficulties to measure capacity and capacity utilisation: De Leeuw (1962), Klein et. al (1973), Cremeans (1978), Christiano (1981), Rost (1982), Bosworth and Westaway (1984), among others.

[23]The *normal* rate of capacity utilisation is an observable variable at a firm level, in particular periods of time under particular conditions. It is the average expected rate of capacity utilisation on newly installed equipment. This can be found at a firm level within firms that produce with the dominant technique and get a normal rate of profit.

5.3.1 Expected demand fluctuations

Stigler's (1939) is, of course, the classic analysis of rationally building flexibility into a plant, ex ante, in anticipation of demand fluctuations even though it means sacrificing the lowest achievable unit cost (Winston, 1974b).

Marris presents particular attention to the effect of expected fluctuations in maximum output (1964, p. 80). According to him, the firm will probably wish to be able to meet at least a *reasonable* proportion of the peak orders without unduly long delays in delivery (ibid., p. 95) and that the output for which the plant is designed is based on some guess as to the average expected sales during its lifetime. According to the author,

> the firm is able to attach a 'probability of occurrence' so the complete set of such estimates would represent a probability-distribution of expected demand and could be described by familiar statistical concepts: the most probable, or expected average level, is the 'mathematical expectation'; the variability, or spread around the average, can be measured by the *coefficient of variation*, i.e. by the standard deviation divided by the mean. A low coefficient of variation implies that demand is expected to be rather stable, and that only a relatively small proportion of total output is expected to occur under extreme conditions; a high coefficient implies unstable demand and relatively higher probabilities of experiencing extremes
>
> Marris, 1964, pp. 96-97

Nevertheless, Marris seems to be keen on analysing the relationship between average-to-peak ratio of demand and he claims that the greater the coefficient of variation the lower 'normal' utilisation should be.

According to Steindl (1952, p. 10) the existence of an ample margin is what allows the trade cycle to operate as it does, so planned utilisation already takes into account the business cycle fluctuations. Output fluctuations (stochastic demand fluctuations), with their consequent adjustment costs and uncertainty, are also important aspects of the investment decision according to Betancourt and Clague (1981, p. 59).

Del Monte (1975) claims that,

> A first reason [for desired excess capacity] is the existence of fluctuations in demand where the producer always leaves spare capacity margins to take advantage of the expansion and not to allow other competitors to take over its incremental market share. Evidently, in an expanding economy, where demand has developed quite regularly, the margins that the entrepreneur wishes to maintain will be lower than in an economy that has shown wider fluctuations in demand
>
> Del Monte, 1975, p. 244, own translation

According to Ciccone, one of the main determinants of the level of *normal* capacity utilisation consists in ‘the fluctuations which, in a market economy, generally characterize demand, and hence, more or less closely, production’ (Ciccone, 1986, p. 26; 1990, p. 420). As firms do not want to loose market share (Steindl, 1952, p.8, p.10; Marris, 1964, p.95; Del Monte, 1975, p.244; Ciccone, 1986, p.27; Palumbo and Trezzini, 2003, p.111; Skott, 2012, p.116; De Juán, 2013, p.114) under the pressure of competition they will adapt the ‘normal’ utilisation, defined as the expected realized average utilisation on investment, to *breadth* and *frequency* of demand levels. In this sense, i.e. ‘normal’ utilisation will be lower, the larger are the *breadth* and *frequency* of the expected falls in production with respect to the peaks for which capacity is adequate’ (Ciccone, 1986, p. 27, 1990, p. 421, emphasis in *italics* added.). Committeri (1987, p. 93) also claims that potential output will be kept in line with the *expected* peaks of demand. Similar results in which the size of capacity differently to different fluctuations can be found in Manne (1961) and Giglio (1970). Kurz also agrees that fluctuations might be a source of mismatch between demand and productive capacity (1992, p.79) although he thinks that there are other mechanisms that give flexibility to the system (old capital stock and inventories, among others).

Skott (2012) and Ryoo & Skott (2017) also agree that ‘desired’ utilisation might change or deviate from unity: ‘Changes (. . .) in the volatility of demand, for instance, could affect desired utilization rates’. Recently, Setterfield and Avritzer (2020) claim that the *normal* rate of utilisation depends negatively on the volatility of effective rate of capacity utilisation.

5.3.2 Rate of growth

According to Huang (2020), the determination of a cost-minimizing technique is independent of demand if one of the following assumptions holds: (a) all machines always work with constant efficiencies (e.g., Roncaglia, 1978; Sraffa, 1960); (b) old machines are not transferable, nor jointly utilized (Baldone, 1980; Schefold, 1980; Varri, 1980; Kurz & Salvadori, 1994); (c) old machines are not allowed to be jointly utilized and the efficiencies of transferable machines are independent of the sectors in which the machines are used (Salvadori, 1999). The model provided by Kurz and Salvadori (1995, Chapter 7, Section 7) is in line with the first assumption. If the above assumptions are not satisfied (e.g., if joint utilisation of machines is allowed), then the normal utilisation rate is generally not independent of demand.

5.3.3 Technical change

Maxwell (1977), while describing one of the most important enterprises related to the siderurgic industry in Argentina claimed that, ‘A very similar story applies to the Rosario plant’s billet mill. This was originally installed in 1950 with a production capacity of 50,000 tons per year, however this capacity has been raised by successive technical changes so that the Billet mill’s capacity today is over 160,000 tons per year. This has been achieved ‘without any profound variations, simply by improving equipment, channel design, reheating furnaces, etc.’ and it is also claimed that the Rosario plant’s billet mill is today ‘more productive than some of the more modern primary rolling mills in Argentina which have twice the horsepower of the Rosario Billet mill and involved five to ten times as much investment’. (Maxwell, 1977, p. 25).

Bansak, Morin and Starr (2007) claim that flexible manufacturing makes it easier to ramp production up and down and this may encourage firms to install a broader margin of excess capacity—that is, to operate at lower average utilisation—in order to be able to handle upswings in demand. Such a strategy would be favored by declining prices of high-tech capital[24], which make excess capacity cheap (ibid., p. 632). But because automated design and modular units make capacity expansion faster and cheaper, firms may prefer to operate at higher average utilisation, expecting to be able to boost capacity should demand turn out to be strong. These are two offseting forces.

Shaikh (2009) also claims that the *normal* utilisation might change in the long-run due to changes in capital intensity of production (2009, p. 461). Nikiforos (2019, p.7) agrees.

5.3.4 Relative prices

No one will deny that the choice of the level of ‘normal’ utilisation is a cost-minimising choice. According to Kurz (1986; 1992, p.78), it is analogous to what could be considered a *choice of technique*. According to him, if fluctuations are *not* taken into account, it could be demonstrated that the level of utilisation chosen depends exclusively on distribution and technology.[25]

Skott (1989, 2016), Ryoo & Skott (2017) and Skott & Ryoo (2017) also claim that the output-capital ratio might depend on the ‘cost of finance’.

[24]Levy (1995) finds an accelerated depreciation of producer durable goods and equipment since newer and more advanced technology makes older equipment obsolete. Duménil and Lévy (2016) show that the share of investment in information technologies in total investment in equipment and software increased from 5% to 55% in the last 60 years.

[25]For a neoclassical view with similar results see Mann (1984).

> The costs of excess capacity are increasing in the cost of finance, and the desired utilization rate will, therefore, depend positively on the real interest rate.
>
> Ryoo & Skott, 2017, p. 506

Marris (1964) also introduce relative prices as a determinant *assuming* given output.

5.3.5 Barrier to entry and intensity of competition

Building excess capacity to deter entrance of competitors is one of the mechanism present in the literature that determines normal capacity utilisation. This idea was first delivered by Spence (1977) who claims that entry is deterred in an industry when existing firms have enough capacity to make a new entrant unprofitable.[26] Steindl coincides in this aspect. According to Del Monte (1975), 'In oligopoly, on the other hand, where the existence of a few large companies prevents price competition, the degree of monopoly is higher and growth with large unused production capacity is logically consistent.' (ibid, p. 244). From a Harrodian perspective, Skott (2012, p. 116) and Ryoo & Skott (2017) a firm 'may want to hold excess capacity to deter entry' and 'changes in the degree of product market competition (...) could affect desired utilization rates.'

5.3.6 Indivisibilities

Del Monte assures that 'Another reason is the inability to increase production capacity as the market grows. The reasons that prevent this are the indivisibility of plant and equipment. It is part of company policy to build plants by anticipating future demand.' (1975, p. 244).

Ciccone (1986, 1990) also argues that the 'expectation of a growth in demand, together with the economic indivisibility that may characterize fixed capital, already constitutes an evident reason why it may be profitable to install a capacity greater than the peaks expected for the most immediate future' (ibid., p. 31; 1990, p. 424). Ryoo & Skott (2017) also agree that excess capacity may exist simply as a result of indivisibilities of investment (non-convexities in adjustment costs) (ibid., p. 116). In this sense, expectations of excess capacity's idleness is chosen deliberately by entrepreneurs.

5.3.7 Institutional and managerial bottlenecks

When a firm decides that it needs more capital services than it already has, it has two options. Acquire additional physical capital or use its current capital more intensively (Shapiro, 1986). According to Foss (1984, p. 5; 1985, p. 4) 'the number of hours per week a business establishment is ordinarily open and operating is an aspect of a firm's investment decision' as such the Average Workweek of

[26]See Wilson (1992) for a review.

Capital is one of the aspects of *normal* capacity utilisation.

According to Skott 'Managerial constraints or other bottlenecks (...) may make it difficult or costly to expand capacity at a rapid pace, and the desired utilization rate, consequently, may depend, *inter alia*, on the rate of accumulation.' (Skott, 2012, p. 116). Marris raises a similar point (1964, p. 92).

Foss (1981a, p.44) also claims that there might be managerial constraints in which the size of establishments is small. These are industries in which owners may provide a significant share of total labor input or may constitute the only managerial input available to the firm. The owner may feel that his presence is always needed and may balk at working the long hours required for, say, two shifts, preferring leisure over additional income.

According to Winston and McCoy (1974), these cost rhythms mean that 'it is often optimal to 'overbuild' the capital stock in order to produce only during periods of low input costs and avoid operation during periods of high costs' (ibid., p. 419). When this is true, the degree of 'overbuilding' -consequently the capital- labour and capital output ratios and the level of utilisation-becomes an economic variable determined by relative factor prices, by the rhythm of the input prices and by the elasticity of factor service substitution.

5.3.8 Physical composition of the output and age distribution of fixed capital

The composition of output is also another determinant of aggregate *normal* utilisation of capacity. There exists industries, known as *continuous* industries, such as paper, chemicals, petroleum, and primary metal, that operates at higher rates than average rates of capacity utilisation. This implies that countries in which these kind of industries explain a great part of their output will naturally present higher levels of *normal* utilisation rates. This argument was presented by Garegnani & Palumbo (1997 and 1998[27]),

> Clearly y would normally depend on the physical composition of the output, and on the age distribution of fixed capital.
>
> Garegnani & Palumbo, 1997, p. 4, fn. 6.

In case capital goods industries operate with lower *normal* levels of capacity utilisation, episodes of higher growth rates (and higher levels of investment Share) might be associated with lower levels of

[27] Here Garegnani talks about the relationship Y/K assuming *normal* utilisation. So it might be interpreted that he is talking about v instead of Y/Y^*, the latter being the relevant variable for us now. But given he assumes *technical conditions of production* as given in a previous paragraph, Garegnani is clearly talking about Y/Y^*.

normal utilisation by composition effect.[28]

Moreover, when dealing with existing capital stock, and not only *newly* installed equipment, the age distribution of the existing fixed capital should be taken into account.

5.3.9 Inventories buffers

Inventories' stocks are part of the investment plan of a firm. Depending on its profitability, it might be convenient to reduce or increase the *normal* quantity of inventories as a percentage of output.[29] The reduction of inventories implies a reduction of one of the buffers that the companies have to respond to demand fluctuations, this might also reduce the level of capacity utilisation in order to compensate for expected fluctuations.[30]

5.3.10 A summing up

Up to now, I found nine determinants of the *normal* level of capacity utilisation: demand fluctuations, rate of growth, technical change, relative prices, barrier to entry, indivisibilities, Institutional and managerial bottlenecks, physical composition of output and age distribution of fixed capital and inventories.

It is not possible to perform a proper, straightforward and complete empirical analysis, given data availability and also the fact that several possible determinants of u_n are hardly measurable. Given this, I will use a mixed strategy, based on findings of the related literature and on a simple empirical exercise. In the next section, after a literature review, I will try to introduce an empirical model that takes into account some of this determinants in order to explain a decreasing trend in capacity utilisation in the US economy.

5.4 Causes of a declining trend in capacity utilisation: An empirical assessment

5.4.1 Literature review

Using the estimates of the Federal Reserve Board that, at those years was based mainly on the Mc-Graw Hill estimates, Nadiri and Rosen (1969) try to asses the impact on capacity utilisation of a

[28] Thanks Ricardo Summa that brought this comment during the revision of this thesis.

[29] There is a longstanding evidence that inventories are pro-cyclical (Zarnowitz, 1985; Kashyap and Wilcox, 1993).

[30] It is clear that if the level of output is given remaining invariant the capital stock, a reduction of inventories should increase the level of capacity utilisation.

shift in the demand function and find that utilisation rates, hours per man and capacity utilisation 'immediately overshoot their ultimate values in the first or second period and monotonically decline to their equilibrium values as the stock adjustments proceed' (ibid., p. 465) and conclude that these 'comparisons show that the primary roles of variations in utilization rates, and to a lesser extent employment variations, serve to maintain output levels while capital stock is slowly adjusting.' (ibid., p. 466). Moreover, they find that there are essentially no long run relative factor price effects on utilisation rates, their coefficients being negative, but very close to zero; there is a positive relative factor price effect on capital stock, however, long run output effects on capital stock are four times as great as that of relative prices. Finally, the impact of output on long-run utilisation is positive but small and they claim that small this may be a manifestation of the residual nature of the measurement of this variable (ibid., pp. 467-468). Boileau and Normandin (1999) find that capacity utilisation is much more correlated with the cyclical component of output than with output growth.

Foss (1963, 1981a, 1981b, 1984, 1985, 1997) analyses the impact of many variables, not on capacity utilisation, but on the Average Workweek of Capital. First, he introduces an analysis for the year 1976. The independent variables analyzed for the year 1976 were (1) capital intensity, measured by the ratio of kilowatt-hours to man-hours, (2) percentage of value added accounted for by single-unit companies (SUVA), (3) percentage of employment accounted for by women, (4) continuousness, (5) percentage of production workers unionized, and (6) capacity utilisation. (Foss, 1981a, p. 45). In his regression, the variables (1), (2) and (4) are statistically significant. For the year 1929, the same variables explains its results. Then he tried to explain changes between 1929 and 1976. The independent variables were absolute changes over the same time period in (1) capital intensity, as measured by the ratio of kilowatt-hours to man-hours, (2) the proportion of value added accounted for by single-unit companies, (3) the share of women in total employment, and (4) continuousness. The final independent variable measures the length of the labor workweek in 1929 in excess of forty hours (5). The coefficients on variables for capital intensity, single-unit value added, continuousness, and labor workweek have the correct signs, and all are significant at the .05 level. The coefficient for the share of women in total employment is significant at the .10 level. There was some uncertainty about the sign of this coefficient. The negative suggests that the rise in the women's share of employment has had the effect of holding down weekly plant hours (Foss, 1981a, p. 48). Foss (1984, p. 69) present another estimation in which the Average Weekly Plant hours is explained by a constant and two independent variables, the capital-labor ratio with labor adjusted for unemployment and the wage differential. With a simple OLS estimation, the capital-labor ratio impacts positively on utilisation and the wage differential negatively.

Both Esposito and Esposito (1974) and Caves, Jarrett, and Loucks (1979) generate results which indicate that partial oligopolies experience higher levels of excess capacity than either tight oligopolies or atomistic industries. Esposito and Esposito (1986) find ambiguous evidence on the impact of concentration on the level of capacity utilisation; the empirical results based on the more comprehensive Census sample support the hypothesis that partial oligopolies experience higher levels of excess capacity than tight oligopolies or atomistic industries, however, the results using the Federal Reserve sample of material input industries do not support this hypothesis. Lieberman (1987) finds that incumbents rarely built excess capacity pre-emptively in an effort to deter entry. Driver (2000) using Arellano and Bond methodology with Instrumental Variables finds that using PIMS database at a firm level, the share of the market and the concentration index are significant explaining a change on the level of capacity utilisation.

Lieberman (1989) estimates the determinants of industry capacity utilisation in 40 chemical product industries over a period of roughly two decades following different models of capacity expansion (Manne, Newsboy and the Whitt-Luss model). He finds that the investment economy of scale parameter is not statistically significant. The results reveal a significant but relatively small positive link between growth and capacity utilisation. All of the models predict a negative relation between capacity utilisation and demand variability. General macroeconomic fluctuations, as recorded by the FRB index, account for about 22% of the overall variance in capacity utilisation observed in the data sample. There is also a positive link between capital intensity and capacity utilisation. He finds also that the number of firms do not affect the average level of utilisation, the results suggest that industry capacity utilisation is not strongly affected by the number of producers. The study also shows the absence of a strong relation between capacity utilisation and the average number of plants per firm. The differential plant cost model implies a negative relation between capacity utilisation and the extent of variation in plant sizes and this is also confirmed by the data.

Basnak et al. (2007) find significant negative effects of technological change [high-tech equipment as a share of total investment and the share of high-tech equipment in the capital stock] on utilisation for a panel (fixed, random effects and Arellano-Bond procedure) of 111 industries during the period 1974-2000 for the US economy. The control for lagged output growth, lagged ratio of investment to capital [as a *proxy* of investment level], lagged standard-deviation of industrial output [as a *proxy* of volatility], change in average age of capital equipment excluding high tech, change in average age of the high-tech capital equipment, ratio of capital to labor [capital intensity], some measure or set of measures of high-tech capital or investment and, finally, some dummies (for the years 1989 and 1995 where the surveys changed). However, they recognise this is a short-run effect, because of the stationary nature of sectoral capacity utilisation rates (ibid., pp. 638-639).

Van Biesebroeck (2003) finds that autoassembly plants using lean manufacturing methods have lower fixed and variable costs of adding shifts, compared to plants using traditional methods. The lower variable cost of operating a shift for the lean technology and the increasing returns to shifts both cause lean producers to operate at a higher level of capacity utilisation (ibid., p. 192).

Pierce & Wisniewski (2018) analyzes this declining trend in capacity utilisation in the US economy. They discarded some explanations. They examined the role of changes in value added on industry weighting by recalculating the aggregate manufacturing utilization rate holding each industry's value added weight fixed at its 1972 level and the found that the decline in capacity utilisation is not the result of shifts in industry weighting, so it is not a consequence of a change in the composition of output. They also estimated linear trend terms for 64 individual manufacturing industries over the period from 1972 to 2016. The estimated trends indicate that declines in utilisation rates are widespread across U.S. manufacturing industries, with 86 percent of industries exhibiting a downward trend over the period. Long-term declines in utilisation rates are widespread, but magnitudes vary substantially across industries; this means that some industries did not suffer from this declining trend. Finally, they calculated utilisation rates for the set of establishments that appear in every year of the SPC from 1979 to 1999, which we refer to as 'continuous reporters'. These establishments are a selected sample, and thus not representative of the manufacturing sector as a whole. In addition to being particularly long-lived, they are large, with fewer than 300 continuous reporters accounting for approximately 6 percent of the manufacturing sector based on SPC sample weights. Nonetheless, because we can observe the continuous reporters over a long period of time, they provide a novel look at how capacity utilisation has evolved within establishments. They concluded that capacity utilisation declines are present within continuing establishments, so this declining trend is not solely the result of entry and exit of firms.

Nikiforos (2016) follows Foss and claims that the AWW of capital was raising since 1929. Based on this argument, the author argues that there is an increasing trend of *normal* capacity utilisation driven by aggregate demand. Furthermore, Fiebiger (2020) finds that capacity utilisation closely tracks the rate of growth of value added in the US economy, at a sectoral level trying to support the thesis that normal utilisation could also be endogenous.

Haluska, Summa and Serrano (2021) found no reason to claim that this decline in actual utilisation can be explained by a general reduction in the *normal* rates of capacity utilisation. They analyze empirically the average-to-peak demand in order to claim this, following the theoretical developments of Ciccone (1986, 1987).

In the next section, I will try to analysis the causes of a declining trend in capacity utilisation in the US economy.

5.4.2 Data

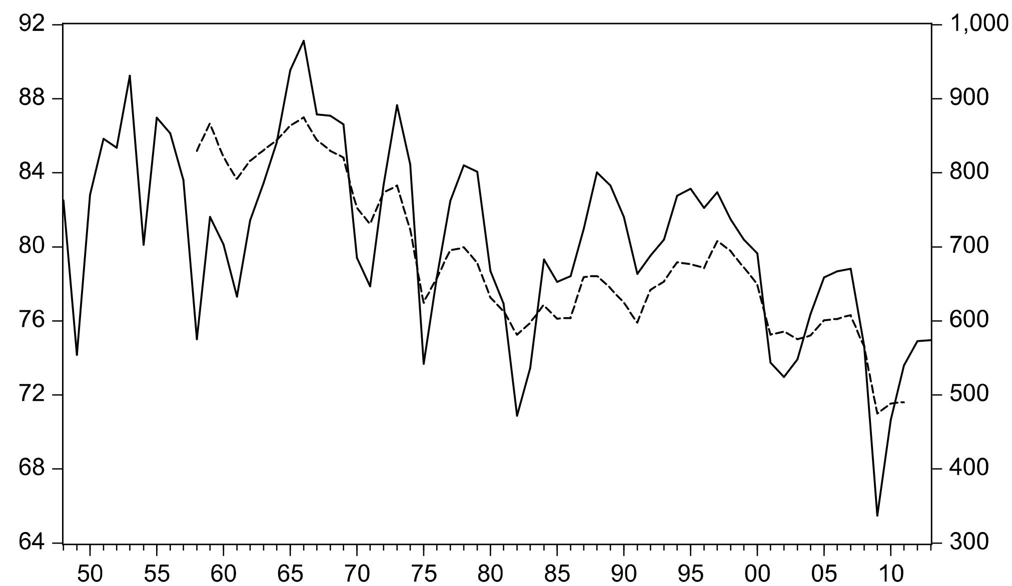
The database I am using it is a joint effort between the National Bureau of Economic Research (NBER) and U.S. Census Bureau's Center for Economic Studies (CES) [31], containing annual

[31] It is publicly available and it can be downloaded here: http://data.nber.org/data/nberces.html

industry-level data from 1958-2011 on output, employment, payroll and other input costs, investment, capital stocks, TFP, and various industry-specific price indexes. Because of the change from SIC to NAICS industry definitions in 1997, the database is provided in two versions: one with 459 four-digit 1987 SIC industries and the other with 473 six-digit 1997 NAICS industries. In this case, I will be performing different test to the NAICS-database. The number of observations for this dataset is 25542 at an industry level (473 x 53).

This dataset cointains a number of relevant variables such as value added (vadd), real capital stock (cap), shipments (vship), investment deflator (piinv), shipments deflator (piship), production workers' wages (prodw), payroll, quantity of workers (emp), quantity of production workers (prode), quantity of hours worked by production workers (prodh) that will allow me to build a relevant panel data to analyze capacity utilisation at an industry level. Based on this database, I built an aggregate relationship between output and capital stocks, weighted by industries' share of capital stock by year.

Figure 5.18 NBER (1958-2011) and FRB (1948-2013)



Source: own elaboration based on NBER-CES and Federal Reserve Board (CUMFNS).

As it can be seen from Figure 5.18., the relationship output-capital stock of the NBER-CES database closely tracks the Manufacturing (SIC)[32] time series of the Federal Reserve Board. Therefore, this Y/K relationship might be also a good *proxy* for capacity utilisation.[33] I built another time series such

[32]https://fred.stlouisfed.org/series/CUMFNS

[33]Clearly the source of the declining trend in installed capacity utilisation is included in this Y/K ratio.

us: real value added (rva), real value of shipments (rvs)[34], wage share (production workers' wages divided value added), technique (real capital stock divided quantity of hours worked by production workers). I will perform a Structural VAR analysis to understand the relationship between capacity utilisation (Y/K), technique (K/L), distribution (W/Y) and output (real value of shipments). The idea is to find out whether income distribution or production techniques have an impact on the utilisation of installed capacity, controlling for output levels. Given the ability of the panel data to empower the results obtained, I will use this database instead of aggregate time series. Given almost all the determinants of *normal* utilisation in the last subsection are non-observable variables, or at least they are not present in this database (expected fluctuations, barrier to entry, indivisibilities, bottlenecks, age distribution of fixed capital), I will try to explain the level of capacity utilisation (real value added/real capital stock) with the level of real shipments, technique and distribution. The fact that the model will suffer from omitted variables is present and, unfortunately, will not be solved. Although the analysis is partial, it still shed some light on the influence on u of, at least, some of its determinants: in this case, output, distribution and technique.

5.4.3 Methods and identification strategy

Given I have a panel of 473 industries I will apply a Panel SVAR methodology, following closely Pedroni (2013) which takes into account responses to both idiosyncratic and common structural shocks, while permitting full cross member heterogeneity of the response dynamics (Pedroni, 2013, p. 180). The advantage of this methodology is that takes into account substantial heterogeneity present across the individual industries of the panel and cross-sectional dependence that is likely to arise from the fact that individual industries of the panel are responding not only to their own member-specific idiosyncratic shocks, but also to shocks that are common across industries of the panel (Pedroni, 2013, p. 181). The methodology is in line with the traditional time series structural VAR literature, such as Bernanke (1986), Blanchard and Quah (1989), Blanchard and Watson (1986), Clarida and Gali (1994) and Sims (1986), among others.

The key to my estimation and identification method will be the assumption that a model representation exists that builds upon structural shocks that can be decomposed into both common and idiosyncratic structural shocks, which are mutually orthogonal (Pedroni, 2013, p. 182). I will consider a panel composed of $i = 1, \ldots, N$ individual industries, each of which consists of an $Mx1$ vector of observed endogenous variables, y_{it}, for $y_{m,it}$ with $m = 1, \ldots, M$. The panel is strongly balanced. To accommodate fixed effects and to simplify the notation, the methodology considers the $Mx1$ vector of demeaned data $z_{it} = (z_{1,it}, \ldots, z_{M,it})'$, where $z_{it} = y_{it} - \bar{y}_i$, with $\bar{y}_{m,it} = T^{-1} \sum_{t=1}^{Ti} y_{m,it} \, \forall \, i, m$.

Driving the temporal variations in these data are the unobserved structural shocks. I consider a $Mx1$ vector of composite white noise shocks $\epsilon_{m,it}, m = 1, \ldots, M, \epsilon_{m,it} = (\epsilon_{1,it}, \ldots, \epsilon_{M,it})'$ for each

[34] I took the real value of shipments to avoid multicollinearity with real value added.

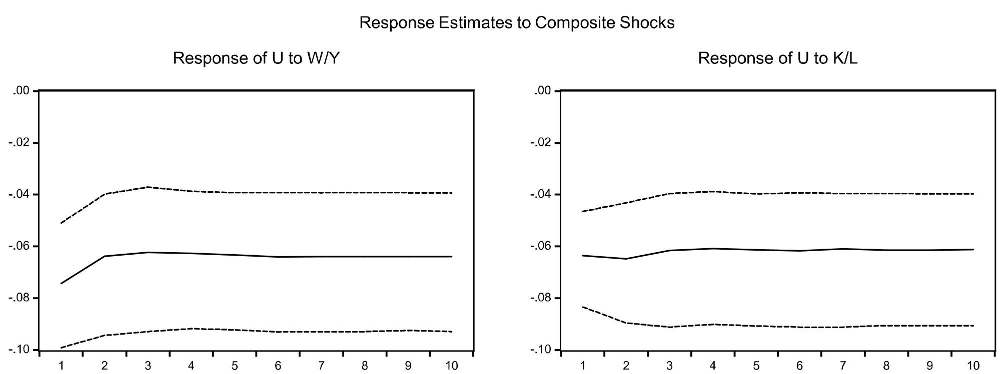
industry, i, of the panel. These composite shocks are distributed independently over time, but may be cross-sectionally-dependent. Also, I consider a common factor representation for this dependence, such that $\epsilon_{m,it} = \lambda_{m,it}\bar{\epsilon}_{m,t} + \tilde{\epsilon}_{m,it} \forall i, t, m$ where the two categories of mutually orthogonal structural shocks, $\tilde{\epsilon}_{m,it}$ and $\bar{\epsilon}_{m,t}$, $m = 1, \ldots, M$ represent, respectively, the induistry-specific idiosyncratic white noise structural shocks and the common white noise structural shocks shared by all industries of the panel, and $\lambda_{m,i}$ are the industry-specific loading coefficients for the common shocks.

In keeping with the Structural VAR literature, the structural shocks are assumed to be orthogonal[35] with respect to each other for each type, so that the various $m = 1, \ldots, M$ idiosyncratic shocks are mutually orthogonal to one another, as are the various common shocks to one another. Furthermore, in keeping with the structural VAR literature, the variances of these unobserved shocks are taken to be arbitrarily normalizable. These restrictions are analogous to those made in the time series structural VAR literature and are a natural extension of those restrictions as applied to the panel setting (Pedroni, 2013, p. 183).

5.4.4 Results

The results can be divided into idiosyncratic - that are specific to each sector - the common ones and the composites. In the latter, the idiosyncratic and the common are combined. I will present the composite results only in aggregate terms because my interest is on the aggregate utilisation of installed capacity (see Appendix C for the idiosyncratic and common ones).

Figure 5.19 Composite shocks

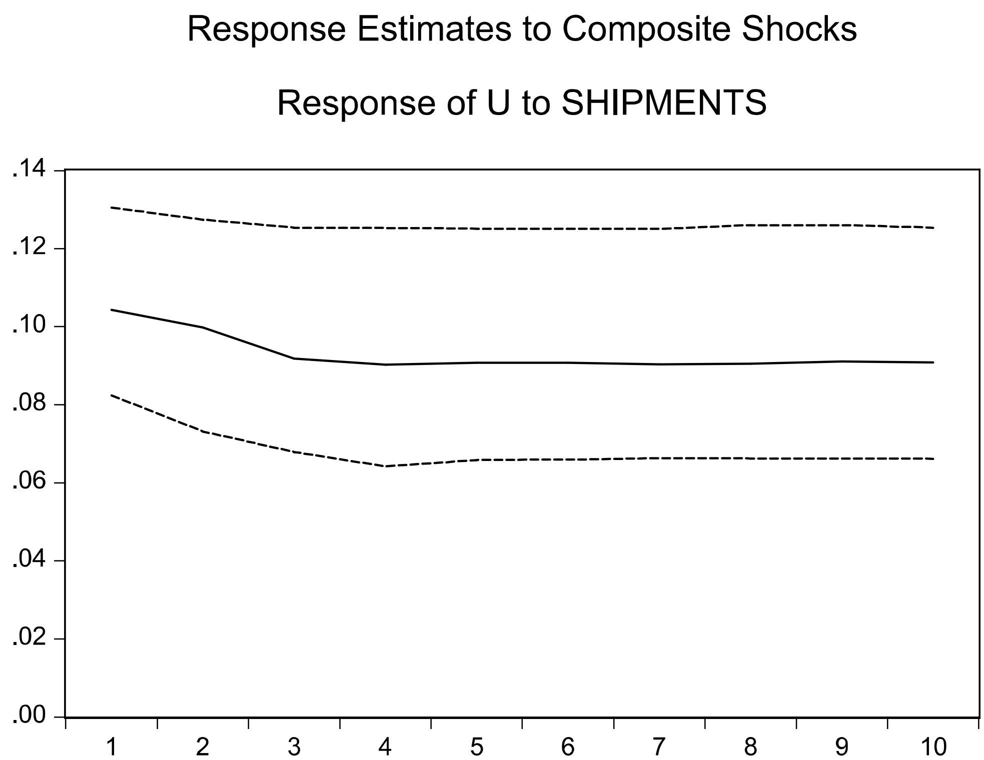


Source: own elaboration based on NBER-CES.

[35]When we perform impulse–response analysis, we ask the question, ‘What is the effect of a shock to one equation, holding all other shocks constant?’ To analyze that impulse, we need to keep other shocks fixed (Schenck, 2016).

In the two columns of Figure 5.19 I can see the impacts of distribution (W/Y) and technique (K/L) on capacity utilisation. These are composite shocks. On the LHS of the Figure it can be seen the impact of a positive shock to distribution on capacity utilisation. On the RHS of the Figure, the impact of a positive shock to technique on capacity utilisation. Both have a negative impact. It must be clarified that the results presented here are accumulated. In this sense, when the graph shows that a variable becomes stationary after a particular period, this implies that the effect is null afterwards. In fact, what it can observed is that both a (positive) change of technique and a (positive) change on income distribution generate transitory effects on capacity utilisation. However, these transient shocks take a certain amount of time to adjust, which in the case of composite plots can take up to four years.

Figure 5.20 Output and capacity utilisation - Composite shocks



Source: own elaboration based on NBER-CES.

As it can be seen from the graphs a positive change on distribution (payroll share on output) impacts negatively on capacity utilisation, but this is a transitory effect. After four years, this effect disappears. The negative effect could be explained by the fact that the wage share might be capturing partially a change of productivity; in fact something similar occurs with a positive change of technique (a positive change of real capital stock per workers' hour), the impact is negative and after five years this change is completely absorbed. Because of technical issues, it was impossible to run the four variables - utilisation, distribution, technique and output - contemporaneously. For a robustness check I introduce real value added of shipments with distribution and utilisation, and, separately, with technique and utilisation. The results hold. Here I show also the impact of a change in output on the level of capacity utilisation. As it can be seen in Figure 5.20., the response estimate to a composite shock is positive but transitory and it is completely absorbed after 5 years, in line with my results shown in the previous essay.

Using this novel database for the U.S. economy, for the time span under analysis, it seems possible to argue that changes in distribution or technique - as defined here - have not exerted a permanent and persistent effect on u at an aggregate level, but only transiently. Therefore, the causes of the declining trend in the installed capacity utilisation rate may have to be sought in other determinants.[36]

[36]In the Appendix D also introduced an analysis on the impact of inventories, the composition of investment (between plant and equipment) and investment in equipment on the utilisation of installed capacity. These last two results could be promising as these impacts would appear to be negative and persistent on installed capacity utilisation.

5.5 Conclusion

During this essay, I demonstrated that there is a declining trend in US' effective capacity utilisation. After that I have presented several possible candidates to explain this declining trend although this declining trend is difficult to explain empirically. One of the possibilities is that the declining, but positive, rate of growth of aggregate demand, plus the decreasing wage share have been operating negatively on the effective capacity utilisation and its adjustment process towards the *normal* rate is by far very slow. Given the convergence towards a pre-shock utilisation seems to take like 4-7 years, given everything else (see Chapter 4 of this thesis), it can be claimed that during this adjustment process, many new aggregate demand's shocks can perform new growth paths during the traverse. In a nutshell, it is an equilibrium concept that it is constantly operating but never realized. Other explanation possible is that the *normal* rate is changing itself.

Given *normal* utilisation is difficult to measure, I attempted to explain this declining trend of the observable (effective) capacity utilisation. Although much more research must be done on this issue, following Pedroni (2013), it means, applying a Panel Structural VAR model for a novel database that includes 473 industries from 1958-2011, I did not find *persistent* effects of technology, distribution and aggregate demand on *effective* capacity utilisation. In case the *normal* rate is changing, these results suggest that its causes should be looked for in other determinants.

5.6 References

Anxo, D., & Sterner, T. (1994). Using electricity data to measure capital utilization. *Energy economics, 16*(1), 63-74.

Baldone, S. (1980). Fixed capital in Sraffa's theoretical scheme. In L. L. Pasinetti (Ed.), *Essays on the theory of joint production* (pp. 88–137). London, UK: Macmillan.

Bansak, C., Morin, N., & Starr, M. (2007). Technology, capital spending, and capacity utilization. *Economic Inquiry, 45*(3), 631-645.

Basu, S. (1996). Procyclical productivity: increasing returns or cyclical utilization?. *The Quarterly Journal of Economics, 111*(3), 719-751.

Beaulieu, J. J., & Mattey, J. (1998). The workweek of capital and capital utilization in manufacturing. *Journal of Productivity Analysis, 10*(2), 199-223.

Bernanke, B. S. (1986). Alternative explanations of the money-income correlation (No. w1842). *National Bureau of Economic Research*.

Betancourt, R. P., & Clague, C. (1981). Capital Utilization: A theoretical and Empirical Analysis. Cambridge University Press.

Bitros, G. C. (2020). Demand adjusted capital input and potential output in the context of US economic growth. *The Journal of Economic Asymmetries, 21*, e00140.

Blanchard, O. J., & Watson, M. W. (1986). Are business cycles all alike?. In The American business cycle: Continuity and change (pp. 123-180). University of Chicago Press.

Blanchard O, J., & Quah, D. (1989). The dynamic effects of aggregate demand and supply disturbances. *American Economic Review*, 19, 655-73.

Blanchard, O., & Simon, J. (2001). The long and large decline in US output volatility. *Brookings papers on economic activity, 2001*(1), 135-174.

Blecker, R. (2016). Wage-led versus profit-led demand regimes: the long and the short of it. *Review of Keynesian Economics, 4*(4), 373-390.

Boileau, M., & Normandin, M. (1999). Capacity utilization and the dynamics of business cycle fluctuations (No. 92). CREFE, Université du Québec à Montréal.

Bosworth, D. (1985). Fuel based measures of capital utilisation. *Scottish Journal of Political Economy, 32*(1), 20-38.

Bosworth, D. R., Dawkins, P. J. V., & Westaway, T. J. T. (1981). The causes of shiftworking in Great Britain. In *Microeconomic Analysis* (Vol. 361, No. 385, pp. 361-385). Routledge in association with GSE Research.

Bosworth, D., & Westaway, A. J. (1985). *The theory and measurement of capital utilisation and its role in modelling investment*. In Industrial Investment in Europe: Economic Theory and Measurement (pp. 291-317). Springer, Dordrecht.

Bosworth, D., & Cette, G. (1995). Capital operating time: measurement issues. In *Work Patterns and Capital Utilisation* (pp. 89-120). Springer, Dordrecht.

Bresnahan, T. F., & Ramey, V. A. (1994). Output fluctuations at the plant level. *The Quarterly Journal of Economics, 109*(3), 593-624.

Burnside, C., Eichenbaum, M., & Rebelo, S. (1995). Capital utilization and returns to scale. *NBER Macroeconomics Annual, 10*, 67-110.

Cavaliere, G., & Xu, F. (2014). Testing for unit roots in bounded time series. *Journal of Econometrics, 178*, 259-272.

Caves, R. E., Jarrett, J. P., & Loucks, M. K. (1979). Competitive conditions and the firm's buffer stocks: An exploratory analysis. *The Review of Economics and Statistics*, 485-496.

Christiano, L. J. (1981). A Survey of Measures of Capacity Utilization. *IMF Staff Papers, 28*(1), 144.

Ciccone, R. (1986). Accumulation and capacity utilization: some critical considerations on Joan Robinson's theory of distribution. *Political Economy, 2*(1), 17-36.

Ciccone, R. (1990). Accumulation and capacity utilization: Some critical consideration on Joan Robinson's theory of distribution. *Essays on Piero Sraffa: Critical Perspectives on the Revival of Classical Theory*, Unwin Hyman, Boston.

Clarida, R., & Gali, J. (1994, December). Sources of real exchange-rate fluctuations: How important are nominal shocks?. In Carnegie-Rochester conference series on public policy (Vol. 41, pp. 1-56). North-Holland.

Committeri, M. (1986). Some comments on recent contributions on capital accumulation, income distribution and capacity utilization. *Political Economy, 2*(2), 161-186.

Committeri, M. (1987). Capacity utilization, distribution and accumulation: a rejoinder to Amadeo. *Political Economy, 3*(1), 91-95.

Corrado, C. (2001). Industrial production and capacity utilization: the 2000 annual revision. Fed. Res. Bull., 87, 132.

Corrado, C. (2003). Industrial production and capacity utilization: The 2002 historical and annual revision. Fed. Res. Bull., 89, 151.

Corrado, C., & Mattey, J. (1997). Capacity utilization. *Journal of Economic Perspectives, 11*(1), 151-167.

Corrado, C., Gilbert, C., Raddock, R., & Kudon, C. (1997). Industrial production and capacity utilization: historical revision and recent developments. *Fed. Res. Bull., 83*, 67.

Corrado, M. D., Doyle, M., Estevao, M., Fennell, G., Krug, M., Lanoue, M., ... & Tranum, D. (2001). Industrial Production and Capacity Utilization: Recent Developments and the 1999 Revision. Ratio, 145, 155.

Creamer, D. (1954). Capital and Output Trends in Manufacturing Industries 1800-1948. *NBER Occasional Papers*, (41).

Cremeans, J. E. (1978). Capacity Utilization Rates—What Do They Really Mean?. *Business Economics*, 41-46.

De Juán, Ó. (2013). Normal paths of growth shaped by the supermultiplier. In Sraffa and the Reconstruction of Economic Theory: Volume Two (pp. 139-157). Palgrave Macmillan, London.

Del Monte, A. (1975). Grado di monopolio e sviluppo economico. *Rivista internazionale di scienze sociali, 46*(Fasc. 3), 231-263.

De Leeuw, F. (1962). The demand for capital goods by manufacturers: a study of quarterly time series. *Econometrica: Journal of the Econometric Society*, 407-423.

De Leeuw, F. (1979). Why capacity utilization estimates differ. *Survey Current Business*, 59, 45-56.

Dixit, A. (1980). The role of investment in entry-deterrence. *The Economic Journal, 90*(357), 95-106.

Doyle, M. P. (2000). *The 1989 Change in the Definition of Capacity: A Plant-Level Perspective*. US Census Bureau, Center for Economic Studies.

Driver, C. (2000). Capacity utilisation and excess capacity: Theory, evidence, and policy. *Review of Industrial Organization, 16*(1), 69-87.

Duménil, G., & Lévy, D. (2012). Being Post-Keynesian in the Medium Term and Classical-Marxian in the Long Term?. mimeo.

Duménil, G., & Lévy, D. (2014). A reply to Amitava Dutt: the role of aggregate demand in the long run. *Cambridge journal of economics, 38*(5), 1285-1292.

Duménil, G., & Lévy, D. (2016). Technology and distribution in managerial capitalism: The chain of historical trajectories à la Marx and Countertendential traverses. *Science Society, 80*(4), 530-549.

Esposito, F. F., & Esposito, L. (1974). Excess capacity and market structure. *The Review of Economics and Statistics*, 188-194.

Esposito, F. F., & Esposito, L. (1986). Excess Capacity and Market Structure in US Manufacturing: New Evidence. *Quarterly Journal of Business and Economics*, 3-14.

Fiebiger, B. (2020). Some observations on endogeneity in the normal rate of capacity utilisation. *Review of Keynesian Economics, 8*(3), 385-406.

Flux, A. W. (1913). Gleanings from the census of production report. *Journal of the Royal Statistical Society, 76*(6), 557-598.

Foss, M. F. (1963). The utilization of capital equipment: postwar compared with prewar. *Survey of Current Business, 43*(6), 8-16.

Foss, M. F. (1981a). *Changes in the Workweek of Fixed Capital: US Manufacturing, 1929 to 1976* (Vol. 309). American Enterprise Institute Press. ISO 690.

Foss, M. F. (1981b). Long-run changes in the workweek of fixed capital. *The American Economic Review, 71*(2), 58-63.

Foss, M. F. (1984). *Changing Utilization of Fixed Capital: An Element in Long-Term Growth.* American Enterprise Institute for Public Policy Research - Business Economics - 128 pp.

Foss, M. F. (1985). Changing utilization of fixed capital: an element in long-term growth. *Monthly Lab. Rev., 108*, 3.

Foss, M. F. (1997). *Shiftwork, capital hours and productivity change*. Springer Science Business Media.

Gahn, S. J., & González, A. (2020). On the 'utilisation controversy': a comment. *Cambridge Journal of Economics, 44*(3), 703-707.

Gahn, S. J., & González, A. (2019). On the empirical content of the convergence debate: Cross country evidence on growth and capacity utilisation. Post Keynesian Economic Society Working Paper 1922.

Garegnani, P., & Palumbo, A. (1997). Accumulation of capital (No. 0002). Department of Economics. Roma Tre University.

Garegnani, P., & Palumbo, A. (1998). Capital Accumulation. The Elgar Companion to Classical Economics.

Giglio, R. J. (1970). Stochastic capacity models. *Management Science, 17*(3), 174-184.

Gilbert, C., Morin, N., & Raddock, R. (2000). Industrial Production and Capacity Utilization: Recent Developments and the 1999 Revision. Fed. Res. Bull., 86, 188.

Girardi, D., & Pariboni, R. (2019). Normal utilization as the adjusting variable in Neo-Kaleckian growth models: A critique. *Metroeconomica, 70*(2), 341-358.

Gorodnichenko, Y., & Shapiro, M. D. (2011). Using the survey of plant capacity to measure capital utilization. *US Census Bureau Center for Economic Studies Paper No. CES-WP-11-19*.

Griliches, Z., & Jorgenson, D. W. (1967). The explanation of productivity change. *Review of Economic Studies, 34*(3), 249-283.

Haluska, G.; Summa, R. and Serrano, F. (2021). The degree of utilization and the slow adjustment of capacity to demand: reflections on the US Economy from the perspective of the Sraffian Supermultiplier. *IE-UFRJ Discussion Paper*.

Heathfield, D. F. (1972). The measurement of capital usage using electricity consumption data for the UK. *Journal of the Royal Statistical Society: Series A (General), 135*(2), 208-220.

Hertzberg, M. R., Jacobs, A. I., & Trevathan, J. E. (1974). The Utilization of manufacturing capacity, 1965-73. *Survey of current business, 54*, 47-57.

Hickman, B. G. (1964). On a new method of capacity estimation. *Journal of the American Statistical Association, 59*(306), 529-549.

Huang, B. (2020). Normal utilization rate in the Sraffa framework. *Metroeconomica, 71*(4), 767-780.

Ingram, A. H., & Sloane, P. J. (1985). Shiftwork and Socio-Economic Policy. *International Journal of Manpower*.

Kashyap, A. K., & Wilcox, D. W. (1993). Production and Inventory Control at the General Motors Corporation During the 1920's and 1930's. *The American Economic Review*, 383-401.

Kennedy, J. E. (1998). An analysis of time-series estimates of capacity utilization. *Journal of Macroeconomics, 20*(1), 169-187.

Kiefer, D., & Rada, C. (2014). Profit maximising goes global: the race to the bottom. *Cambridge Journal of Economics, 39*(5), 1333-1350.

Kim, Y. C., & Kwon, J. K. (1973). Capital Utilization in Korean Manufacturing, 1962-71: Its Level, Trend, and Structure. Korea Industrial Development Research Institute.

Klein, L. R., Long, V., Greenspan, A., Greenwald, D., Edmonson, N., & Perry, G. (1973). Capacity utilization: concept, measurement, and recent estimates. *Brookings Papers on Economic Activity, 1973*(3), 743-763.

Kurz, H. D. (1986). Normal positions and capital utilization. *Political Economy, 2(*1), 37-54.

Kurz, H. D. (1992). *Accumulation, effective demand and income distribution*. In Beyond the Steady State (pp. 73-95). Palgrave Macmillan, London.

Kurz, H. D., & Salvadori, N. (1994). Choice of technique in a model with fixed capital. *European Journal of Political Economy*, 10, 545–569.

Kurz, H. D., & Salvadori, N. (1995). *Theory of production. A long-period analysis*. Cambridge, UK: Cambridge University Press.

Levy, D. (1995). Capital Stock Depreciation, Tax Rules, and Composition of Aggregate Investment. *Journal of Economic and Social Measurement, 21*(1), 45-65.

Lieberman, M. B. (1987). Excess capacity as a barrier to entry: An empirical appraisal. *The Journal of Industrial Economics*, 607-627.

Lieberman, M. B. (1989). Capacity utilization: Theoretical models and empirical tests. *European Journal of Operational Research, 40*(2), 155-168.

Manne, A. S. (1961). Capacity expansion and probabilistic growth. *Econometrica: Journal of the Econometric Society*, 632-649.

Marris, R. (1964). The economics of capital utilisation (No. 10). *CUP Archive*.

Maxwell, P. (1977). Learning and technical change in the steelplant of Acindar S.A. in Rosario, Argentina.

Mann, B. S. (1984). Capital heterogeneity, capital utilization, and the demand for shiftworkers. *Canadian Journal of Economics*, 450-470.

Mayshar, J., & Solon, G. (1993). Shift work and the business cycle. *The American Economic Review, 83*(2), 224-228.

McMenamin, T. M. (2007). A time to work: recent trends in shift work and flexible schedules. *Monthly Lab. Rev., 130*, 3.

Mohr, M. F., & Gilbert, C. E. (1996). Capital Stock Estimates for Manufacturing Industries: Methods and Data. *Board of Governors of the Federal Reserve System*.

Morawetz, D. (1976). The electricity measure of capital utilization. *World Development, 4*(8), 643-653.

Morin, N. J. (2003). NAICS and the 2002 historical revision of industrial production, capacity, and capacity utilization. In 2003 Proceedings of the American statistical association.

Morin, N., & Stevens, J. (2004): Estimating capacity utilization from survey data, Finance and Economics Discussion Paper No. 2004–49, Board of Governors of the Federal Reserve System.

Nadiri, M. I., & Rosen, S. (1969). Interrelated factor demand functions. *The American Economic Review, 59*(4), 457-471.

Nersisyan, Y., & Wray, L. R. (2019). How to Pay for the Green New Deal. *Levy Economics Institute, Working Papers Series, 931*.

Nikiforos, M. (2013). The (normal) rate of capacity utilization at the firm level. *Metroeconomica, 64*(3), 513-538.

Nikiforos, M. (2016). On the ‘utilisation controversy’: a theoretical and empirical discussion of the Kaleckian model of growth and distribution. *Cambridge journal of economics,* (2), 437-467.

Nikiforos, M. (2018). Some comments on the Sraffian Supermultiplier approach to growth and distribution. *Journal of Post Keynesian Economics, 41*(4), 659-675.

Nikiforos, M. (2019) Notes on the Accumulation and Utilization of Capital: Some Empirical Issues. *Levy Economics Institute Working Paper Series*.

Nikiforos, M. (2020). On the ‘utilisation controversy’: a rejoinder and some comments. *Cambridge Journal of Economics, 44*(3), 709-722.

Orr, J. A. (1989). The average workweek of capital in manufacturing, 1952–1984. *Journal of the American Statistical Association, 84*(405), 88-94.

Palumbo, A., & Trezzini, A. (2003). Growth without normal capacity utilization. *European Journal of the History of Economic Thought, 10*(1), 109-135.

Pedroni, P. (2013). Structural Panel VARs. *Econometrics, 1*(2), 180-206.

Perry, G. L. (1973). Capacity in manufacturing. *Brookings Papers on Economic Activity, 1973*(3), 701-742.

Phillips, A. (1963). An appraisal of measures of capacity. *The American Economic Review, 53*(2), 275-292.

Pierce, J. R., & Wisniewski, E. (2018). Some Characteristics of the Decline in Manufacturing Capacity Utilization (No. 2018-03-01). Board of Governors of the Federal Reserve System (US).

Raddock, R. D. (1990). Recent developments in industrial capacity and utilization. Fed. Res. Bull., 76, 411.

Raddock, R. D. (1993). Industrial production, capacity, and capacity utilization since 1987. Fed. Res. Bull., 79, 590.

Raddock, R. D. (1995). Industrial production and capacity utilization: a revision. Fed. Res. Bull., 81, 16.

Raddock, R. D. (1996). A Revision to Industrial Production and Capacity Utilization, 1991-95. Fed. Res. Bull., 82, 16.

Roncaglia, A. (1978). *Sraffa and the Theory of Prices*. New York: Wiley.

Rost, R. F. (1982). Capacity-Neutral Investments and Capacity Measurement in Manufacturing. *The Journal of Industrial Economics*, 391-403.

Rost, R. F. (1983). New Federal Reserve Measures of Capacity and Capacity Utilization. *Federal Reserve Bulletin, 69*, 515-521.

Ryoo, S., & Skott, P. (2017). Fiscal and monetary policy rules in an unstable economy. *Metroeconomica, 68*(3), 500-548.

Salvadori, N. (1999). Transferable machines with uniform efficiency paths. In G. Mongiovi & F. Petri (Eds.), *Value, distribution and capital. Essays in honour of Pierangelo Garegnani* (pp. 270–285). London and New York: Routledge.

Schefold, B. (1980). Fixed capital as a joint product and the analysis of accumulation with different forms of technical progress. In L. L. Pasinetti (Ed.), *Essays on the theory of joint production* (pp. 138–217). London, UK: Macmillan.

Schenck, D. (2016). Structural vector autoregression models. *The STATA Blog, 20*.

Schnader, M. H. 1984. 'Capacity Utilization' The Handbook of Economic and Financial Measures, Frank J. Fabozzi & Harry I. Greenfield, eds. Illinois: Dow-Jones Irwin.

Setterfield, M. (2019). Long-run variation in capacity utilization in the presence of a fixed normal rate. *Cambridge Journal of Economics, 43*(2), 443-463.

Setterfield, M., & David Avritzer, J. (2020). Hysteresis in the normal rate of capacity utilization: A behavioral explanation. *Metroeconomica, 71*(4), 898-919.

Shaikh, A. (1987). The falling rate of profit and the economic crisis in the US. The Imperiled Economy, Book I, *Macroeconomics from a Left Perspective*, 115-126.

Shaikh, A. (1989). The current economic crisis: Causes and implications. ATC.

Shaikh, A. (1992). The falling rate of profit as the cause of long waves: Theory and empirical evidence. *In New findings in long-wave research* (pp. 174-202). Palgrave Macmillan, London.

Shaikh, A. (1999). Explaining the global economic crisis. *Historical materialism, 5*(1), 103-144.

Shaikh, A. (2009). Economic policy in a growth context: a classical synthesis of Keynes and Harrod. *Metroeconomica, 60*(3), 455-494.

Shaikh, A. (2016). *Capitalism: Competition, conflict, crises.* Oxford University Press.

Shaikh, A., & Moudud, J. (2004). Measuring capacity utilization in OECD countries: A cointegration method (Working Paper no. 415). *The Levy Economics Institute of Bard College Working Paper Series*.

Shapiro, M. D. (1986). Capital utilization and capital accumulation: Theory and evidence. *Journal of Applied Econometrics, 1*(3), 211-234.

Shapiro, M. D. (1989). Assessing the Federal Reserve's Measures of Capacity and Utilization. *Brookings Papers on Economic Activity, 20*(1), 181-242.

Shapiro, M. D. (1996). Macroeconomic Implications of Variation in the Workweek of Capital. Brookings Papers on Economic Activity, 27(2), 79-134.

Sims, C. A. (1986). Are forecasting models usable for policy analysis?. *Quarterly Review*, 2-16.

Skott, P. (1989). Effective demand, class struggle and cyclical growth. *International Economic Review*, 231-247.

Skott, P. (2012). Theoretical and empirical shortcomings of the Kaleckian investment function. *Metroeconomica, 63*(1), 109-138.

Skott, P. (2016). Aggregate demand, functional finance, and secular stagnation. *European Journal of Economics and Economic Policies: Intervention, 13*(2), 172-188.

Skott, P., & Zipperer, B. (2012). An empirical evaluation of three post-Keynesian models. *European Journal of Economics and Economic Policies: Intervention, 9*(2), 277-308.

Skott, P., & Ryoo, S. (2017). Functional finance and intergenerational distribution in neoclassical and Keynesian OLG models. *Review of Keynesian Economics, 5*(1), 112-134.

Spence, A. M. (1977). Entry, capacity, investment and oligopolistic pricing. *The Bell Journal of Economics*, 534-544.

Sraffa, P. (1960). *Production of commodities by means of commodities*. Cambridge: Cambridge University Press.

Steindl, J. (1952). Maturity and Stagnation in American Capitalism, Basil Blackwell, Oxford.

Stevens, J. J. (2003). Overhauling industrial production: The 2002 historical and annual revision. In Proceedings of the American Statistical Association.

Stigler, G. (1939). Production and distribution in the short run. *Journal of Political Economy, 47*(3), 305-327.

Strongin, S., & Mattey, J. P. (1997). Factor utilization and margins for adjusting output: evidence from manufacturing plants. *Economic Review*, 3-17.

Taubman, P., & Gottschalk, P. (1971). The average workweek of capital in manufacturing. *Journal of the American Statistical Association, 66*(335), 448-455.

Van Biesebroeck, J. (2003). Productivity dynamics with technology choice: An application to automobile assembly. *The Review of Economic Studies, 70*(1), 167-198.

Varri, P. (1980). Prices, rate of profit and life of machines in Sraffa's fixed capital model. In L. L. Pasinetti (Ed.), *Essays on the theory of joint production* (pp. 55–87). London, UK: Macmillan.

Wilson, R. (1992). Strategic models of entry deterrence. *Handbook of game theory with economic applications*, 1, 305-329.

Winston, G. C., & McCoy, T. O. (1974). Investment and the optimal idleness of capital. *The Review of Economic Studies, 41*(3), 419-428.

Zarnowitz, V. (1985). Recent Work on Business Cycles in Historical Perspective: A Review of Theories and Evidence. *Journal of Economic Literature, 23*(2), 523-580.

5.7 Appendix A: Unit Root Tests

5.7.1 Electric Motors Index

Table 5.1 Time Series Unit Root Tests

Time series	ADF	DF-GLS	PP	KPSS	ERS-PO	NP
Electric Index (Shaikh, 1992)	-2.181	-2.198**	-2.298	0.388**	3.086*	3.075**

Note: *=pval<0.1, **=pval<0.05, ***=pval<0.01.

Source: own computations (in logarithms) based on data provided. SIC criterion, max-lag between 3 and 12, Bartlett Kernel spectral estimation method and Newey-West Bandwidth. AR Spectral OLS for ERS-PO. AR GLS-detrended for NP.

5.7.2 Average Workweek of Capital

Table 5.2 Time Series Unit Root Tests

Time series	ADF	DF-GLS	PP	KPSS	ERS-PO	NP
Foss (1984)	-1.803	0.452	-1.685	0.891***	1630.2	20.731
Shapiro (1986)	-3.886***	-3.907***	-3.907***	0.240	0.982***	0.998***
Orr (1989)	-3.900***	-3.452***	-3.806***	0.909***	1.383***	1.252***
Mayshar & Solon (1993)	-2.623*	-2.494**	-2.508	0.651**	2.964**	2.672**
Beaulieu & Mattey (1998)	-2.203	-2.255**	-2.217	0.256	3.762*	3.949*
Gorodnichenko & Shapiro (2011)	-2.052	-0.823	-2.063	0.684**	20.025	16.056
Census Bureau	-0.419	-0.399	-0.419	0.655**	15.687	14.642

Note: *=pval<0.1, **=pval<0.05, ***=pval<0.01.

Source: own computations (in logarithms) based on data provided. SIC criterion, max-lag between 3 and 12, Bartlett Kernel spectral estimation method and Newey-West Bandwidth. AR Spectral OLS for ERS-PO. AR GLS-detrended for NP. Year 1998 is missing in Gorodnichenko & Shapiro (2011).

5.7.3 Shaikh's alternative measure

Table 5.3 Time Series Unit Root Tests

Time series	ADF	DF-GLS	PP	KPSS	ERS-PO	NP
Shaikh (1987)	-1.877	-1.604	-1.723	0.504**	6.836	5.396
Shaikh (1992)	-2.708*	-2.714***	-2.861*	0.330	1.945**	1.985**
Shaikh (2016)	-2.145	-1.920*	-2.071	0.321	3.690*	3.263**

Note: *=pval<0.1, **=pval<0.05, ***=pval<0.01.

Source: own computations (in logarithms) based on data provided. SIC criterion, max-lag between 3 and 12, Bartlett Kernel spectral estimation method and Newey-West Bandwidth. AR Spectral OLS for ERS-PO. AR GLS-detrended for NP.

5.8 Appendix B: Statistical evidence and data sources

5.8.1 Declining trend in capacity utilisation?

In this Appendix I perform two tests (Augmented Dickey-Fuller and Phillips Perron using Schwarz Information Criterion) to show that there is a declining trend in capacity utilisation in the FRB time series for the period 1948Q1-2017Q4. For *simplicity*, I perform tests which include a constant and a linear trend in the effective, Hodrick-Prescott filtered (λ=1600) and Hamilton filtered series. I also *assume* that bounds are sufficiently far away so conventional unit root methods behave according to the standard asymptotic theory.[37]

Table 5.4 Time Series Unit Root Tests

	FRB		**FRB-Hodrick Prescott**		**FRB-Hamilton**	
	ADF	PP	ADF	PP	ADF	PP
t-Stat	-4.43***	-3.72***	-2.55	-3.06	-5.30***	-3.98**
Trend	Yes***	Yes*	Yes**	Yes***	Yes***	Yes**

Note: *=pval<0.1, **=pval<0.05, ***=pval<0.01.

Source: own computations based on data provided.

As I said, for *simplicity*, I have included a linear trend. From an economic point of view this does not necessarily make sense, given that, a linear trend implies that the level of utilisation, sooner or later, will reach an upper or lower bound. Following this reasoning, the inclusion of breakpoints, as Nikiforos (2016) has done in his article, might be an advantage over the linear-trend *assumption*.[38]

5.8.2 Comparing NER, FUR and FRB time series

I have two sub-samples. One for the period 1989Q4-2006Q4 (only last quarter, not seasonally adjusted) and another one for the period 2010Q1-2017Q4 (quarterly, seasonally adjusted).[39] First, I present a correlation matrix for all the variables in both sub-samples.

The correlation coefficient is a measure that determines the degree of association of two variables' movements. A correlation coefficient above .70 typically signals a strong positive correlation. As I can see from Table 2, correlations are between 0.701 and 0.928. Higher, on average, for the 2nd period.

On the one hand, as I can see in Table 3, a unit root process without deterministic trend cannot be discarded for variables in the first sub-sample. On the other hand, I can reject the presence of a unit

[37]If bounds were not sufficiently far away, the analysis must consider this issue (see Cavaliere & Xu, 2014).
[38]Thanks to Alejandro González who raised this issue.
[39]See Section 5.8.3. for data description.

Table 5.5 Correlation matrix

Period		NER	FUR	FRB
1989Q4-2006Q4	NER	1	0.887	0.701
	FUR	0.887	1	0.902
	FRB	0.701	0.902	1
2010Q1-2017Q4	NER	1	0.909	0.928
	FUR	0.909	1	0.894
	FRB	0.928	0.894	1

Source: own computations based on data provided.

root without deterministic trend for each variable of the sub-sample 2010Q1-2017Q4. This will arise some complications while analysing the following time series: Even taking into account that probably I will loose important information, I will differentiate the data for the first sub-sample.[40]

Table 5.6 Unit root tests without trends in sub-samples

Period		ADF	PP
1989Q4-2006Q4	NER	-2.02	-2.14
	FUR	-1.20	-1.20
	FRB	-1.47	-1.60
2010Q1-2017Q4	NER	-3.35**	-3.79***
	FUR	-4.62***	-4.62***
	FRB	-6.27***	-6.01***

Source: own computations based on data provided - SIC criterion.

Comparing NER and FUR time series

Here I will compare the Full Utilisation Rate (FUR) and the National Emergency Rate (NER) at an aggregate level for the period 1989Q4-2006Q4 (only last quarter, not s.a.) and 2010Q1-2017Q4 (quarterly, s.a.). To avoid spurious regression, I introduce distributive lags under Schwarz criterion (SIC). The equation tested consists on,

$$NER_t = \alpha + \gamma_1 NER_{t-1} + \cdots + \gamma_n NER_{t-n} + \beta_1 FUR_t + \cdots + \beta_n FUR_{t-n} + \epsilon \quad (5.1)$$

[40]These tests were performed without deterministic trends in order to be useful for all the Appendix. Cointegration analysis was discarded because of the small number of observations.

After a simple OLS regression[41], that takes the form of an ARDL model, I run a Wald test in which we test for our null hypothesis in which $\beta_1 = 0$. If I reject that $\beta_1 = 0$ then I cannot reject the possibility of *FUR* and *NER* being *similar* time series. For a robustness check, I run another Wald test in which $\beta_1 = 1$, it means that I check if these time series are equal, with a different *level* (α). Results presented in Table 5.5. As it can be seen there, I reject in all cases that $\beta_1 = 0$ and I cannot reject that $\beta_1 = 1$.

Table 5.7 Wald Test - NER and FUR comparison

Period	H_0	Aggregate
1989Q4-2006Q4	$\beta_1 = 0$	12.76***
	$\beta_1 = 1$	0.40
2010Q1-2017Q4	$\beta_1 = 0$	6.31***
	$\beta_1 = 1$	-0.30

Note: *=pval<0.1, **=pval<0.05, ***=pval<0.01.

Source: own computations based on data provided.

Comparing FRB and FUR time series

In this subsection, I will compare the Federal Reserve Board Utilisation Rate (FRB) and the Full Utilisation Rate (FUR) at an aggregate level for the period 1989Q4-2006Q4[42] and for 2010Q1-2017Q4 (quarterly, s.a.). Following the same methodology explained previously, results are presented in Table 5.6.

Table 5.8 Wald Test - FRB and FUR comparison

Period	H_0	Aggregate
1989Q4-2006Q4	$\beta_1 = 0$	6.49***
	$\beta_1 = 1$	0.56
2010Q1-2017Q4	$\beta_1 = 0$	2.95***
	$\beta_1 = 1$	-0.49

Note: *=pval<0.1, **=pval<0.05, ***=pval<0.01.

Source: own computations based on data provided.

[41] Given I cannot reject the presence of a unit root process, for the first sub-sample I differentiate the data so the equation to be tested is

$$\Delta NER_t = \gamma_1 \Delta NER_{t-1} + \cdots + \gamma_n \Delta NER_{t-n} + \beta_1 \Delta FUR_t + \cdots + \beta_n \Delta FUR_{t-n} + \epsilon \tag{5.2}$$

The same procedure will follow for all the Appendix.

[42] FUR: only last quarter, not s.a.; FRB: only last quarter, s.a.

In this case, I also reject that $\beta_1 = 0$ in my two sub-samples. Moreover, I cannot reject that $\beta_1 = 1$ for both sub-samples.

Comparing NER and FRB time series

Finally I will compare the National Emergency Rate (NER) and the Federal Reserve Board Utilisation Rate (FRB) of capacity utilisation at an aggregate level for the period 1989Q4-2006Q4[43] and for 2010Q1-2017Q4 (quarterly, s.a.). Following the same methodology explained previously, results presented in Table 5.7. In this case, I also reject that $\beta_1 = 0$ in my two sub-samples and I cannot reject that $\beta_1 = 1$.

Table 5.9 Wald Test - NER and FRB comparison

Period	H_0	Aggregate
1989Q4-2006Q4	$\beta_1 = 0$	4.92***
	$\beta_1 = 1$	-1.18
2010Q1-2017Q4	$\beta_1 = 0$	2.90***
	$\beta_1 = 1$	0.38

Note: *=pval<0.1, **=pval<0.05, ***=pval<0.01.

Source: own computations based on data provided.

5.8.3 Data Sources

- FRB Capacity Utilization 1948 - 2017. Board of Governors of the Federal Reserve System (US), Capacity Utilization: Manufacturing [CAPUTLB00004SQ], quarterly, seasonally adjusted, retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CAPUTLB00004SQ. For Graph 1 and Appendix A.1.

- FRB Capacity Utilization 1972 - 2017. Board of Governors of the Federal Reserve System (US), Capacity Utilization: Manufacturing (NAICS) [MCUMFN], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/MCUMFN, for aggregate comparisons.

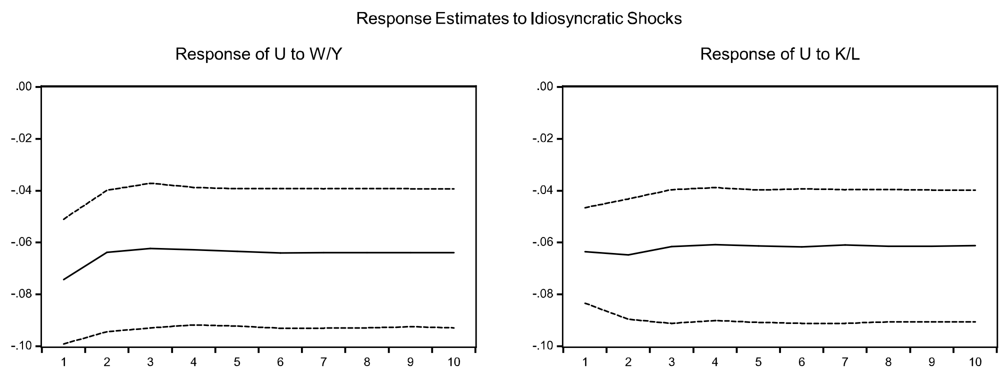
- Full Utilization Rate (FUR) and National Emergency Rate (NER) 1989Q4-2006Q4, only last quarter, aggregate, Census Bureau (US), Quarterly Survey of Plant Capacity Utilization (QPC), https://www.census.gov/programs-surveys/qpc/data/tables.html.

[43]NER: only last quarter, not s.a.; FRB: only last quarter, s.a.

- Full Utilization Rate (FUR) and National Emergency Rate (NER) 2010Q1-2017Q4 (quarterly) aggregate, Census Buurvey of Plant Capacity Utilization (QPC), https://www.census.gov/programs-surveys/qpc/data/tables.html.

5.9 Appendix C: Idiosyncratic and common shocks.

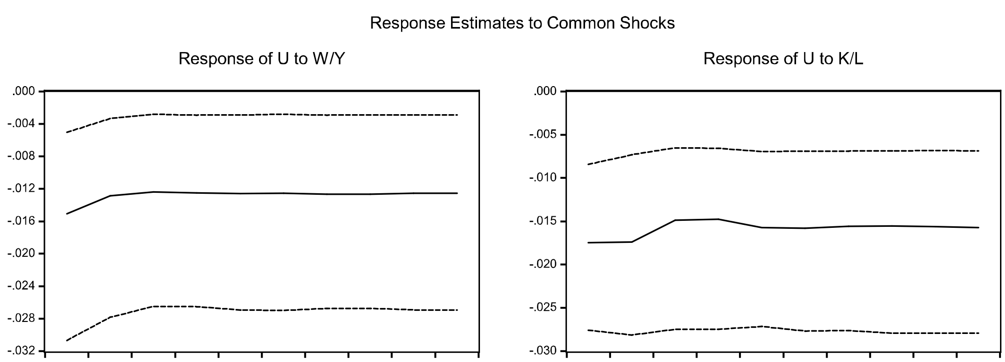
Figure 5.21 Idiosyncratic shocks



Source: own elaboration based on NBER-CES.

In the two columns of Figure 5.21 and 5.22 I can see the impacts of distribution and technique on capacity utilisation. These are idiosyncratic and common shocks respectively. On the LHS it can be seen the impacts of distribution on utilisation. On the RHS it is shown the impacts of technique on utilisation. These results are similar to the one shown in the main text (Composite Shocks).

Figure 5.22 Common shocks

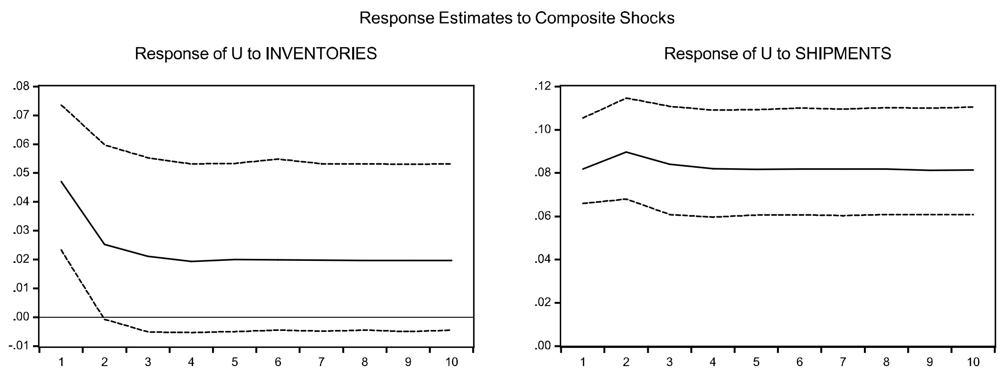


Source: own elaboration based on NBER-CES.

5.10 Appendix D: Inventories and composition of investment.

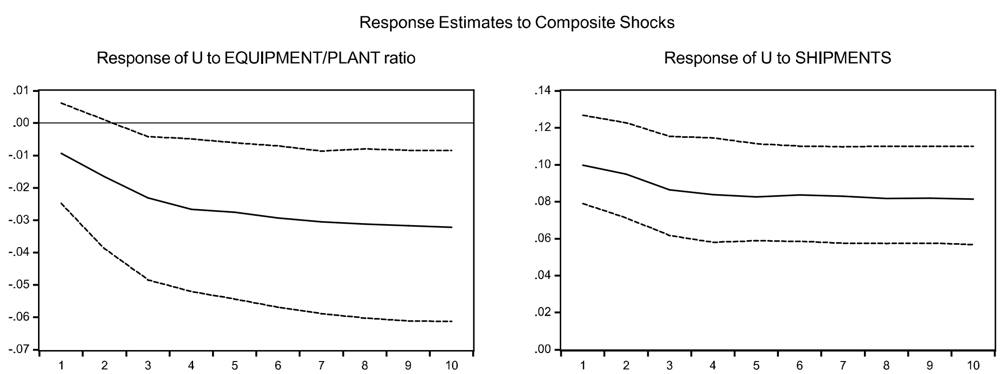
I also performed tests for other variables: inventories, composition of investment (Equipment/Plant ratio) and equipment. Here I present these results (only composite).

Figure 5.23 Composite shocks



Source: own elaboration based on NBER-CES.

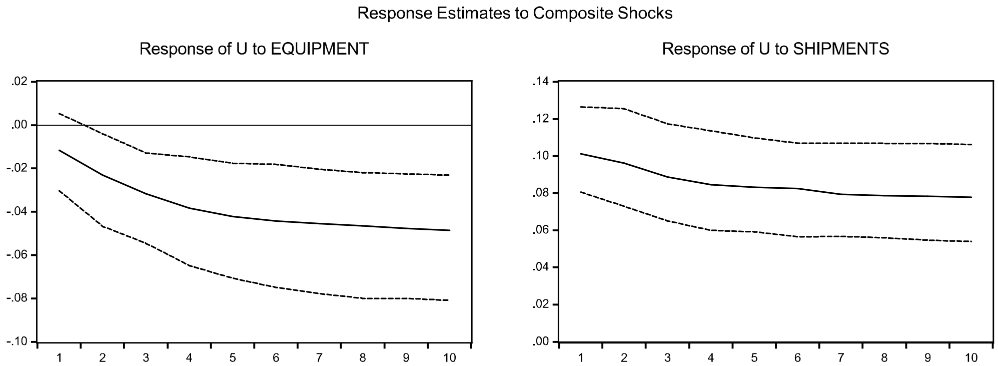
Figure 5.24 Composite shocks



Source: own elaboration based on NBER-CES.

In relation to inventories (see Figure 5.23), the impact is positive and therefore does not explain the phenomenon of the declining trend of capacity utilisation. What is striking is that the composition of investment (equipment/plant ratio) (see Figure 5.24), and also investment in equipment (see Figure 5.25 - first column), have a negative and persistent effect on capacity utilisation. While these are partial results, one possible hypothesis is that the advance of industrial automation, given the exponential

Figure 5.25 Composite shocks



Source: own elaboration based on NBER-CES.

growth in equipment capacity has strongly increased capacity and thus decreased utilisation. However, this effect would only be observed in the United States and not in other countries, so this declining trend remains an enigma. Overall, I found transitory effects in almost all variables.

f

Conclusions

For many years, there was an unanswered question among *non-mainstream* scholars: What's the behaviour through time of capacity utilization after an aggregate demand shock? Following the Classical-Keynesian approach, in this thesis I revise critically the literature on the relationship between output and capacity utilization at an aggregate level.

Following recent Neo-Kaleckian literature, I did not find consistent theoretical elements that would allow to state that the level of demand affects the previously planned utilization by entrepreneurs. In the first essay, I revised critically the arguments developed in Nikiforos (2016), Setterfield and Avritzer (2020), Franke (2020) and Petach and Tavani (2019).

After that, I present empirical evidence on the transitory effect of output on capacity utilization in my second essay. These results suggest that models with autonomous components and an adjustment towards normal exogenous utilization are consistent with the empirical evidence.

Finally, in the last essay, I analyzed a declining trend of capacity utilization in the United States. According to my results, it is possible to rule out technical change, distribution and output level as explanations for this phenomenon.