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On the empirical content of the convergence debate: Cross country evidence on growth and capacity utilisation*

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Abstract

In a quarterly unbalanced panel of 24 developed and developing countries, direct survey measures of capacity utilisation rates are stationary, positively correlated with growth in the short run and uncorrelated with growth in the long run. We show how these stylised facts are related to the 'convergence debate', i.e. the inability of actual capacity utilisation to converge to its *normal* or *desired* value in the long-run: In the baseline Neo-Kaleckian model, while trend capacity utilisation is not restricted, it should be positively correlated with growth in the long-run; in contrast, the Sraffian Supermultiplier where capacity utilisation converges to its long-run exogenous value implies utilisation is stationary and uncorrelated with growth in the long-run. Although both models' empirical predictions in the short-run are confirmed, our results reject the baseline Neo-Kaleckian model in favor of the Sraffian Supermultiplier in the long-run .

JEL classification: E11, C22

Keywords: Neo-Kaleckian model, Supermultiplier, Capacity Utilisation, Stationary

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> ... under-utilisation, as well as over-utilisation, of productive capacity is by its very nature a temporary phenomenon.
>
> *F. Vianello, 1985, p.82*

1. Introduction

It would not be an exaggeration to claim that one of most divisive topics among Post Keynesians economists regards the aggregate behaviour of capacity utilisation. While the standard Neo-Kaleckian model predicts that current capacity utilisation can deviate persistently from *normal* capacity utilisation[1], some Sraffian, Marxian and Harrodian critics[2] of the Neo-Kaleckian model point out that in the long run it is unreasonable for the firm to deviate permanently from the *normal* or *desired* rate of capacity utilisation.

Distinguishing whether utilisation converges or not to its long-run value is not a frivolous intellectual exercise; rather, it holds important implications for real-world economic policy. Perhaps the most clear example of this concerns the effects of raising the savings rate or re-distributing income from capitalists to workers; while the Neo-Kaleckian model predicts there will be long-run *growth* effects of such policies, the Sraffian Supermultiplier model predicts these policies will have only long-run *level* effects. It is certainly important to determine whether economic policy has either *level* or *growth* effects, since the benefits of such policies are astonishingly different depending on the model we use. Thus, whilst substantial theoretical arguments have been made on both sides of the debate, the empirical analysis of this important topic, perhaps surprisingly, has received limited attention. The present paper intends to contribute to filling this gap.

Our first contribution is to clarify the confusion about the empirical implications of the textbook Neo-Kaleckian model for the trend behavior of capacity utilisation; in particular, we show that, contrary to what has been claimed in the literature (Nikiforos, 2016, 2018), the Neo-Kaleckian model does not imply that utilisation has a stochastic trend: its trend behavior depends on the trend process of the exogenous variables, namely, the profit share,

[1] An explicit pronunciation of this statement can be found in Amadeo (1986a, 1986b). The standard Neo-Kaleckian model without any notion of *normal* capacity utilisation is presented in Rowthorn (1981), Dutt (1984, 1987), Taylor (1985), among others.

[2] See Duménil & Lévy (1995, 1999) and Shaikh (2009) for Marxian variants; Skott (1989, 2012) for Harrodian variants and Committeri (1986) for an early Sraffian variant.

the savings rate, and the capital-output ratio. Additionally, we show that the Neo-Kaleckian model implies a positive correlation between utilisation and accumulation both in the short and long run. Both of these results hold when we relax the assumption that the *normal* utilisation rate is exogenous - a model made popular by Lavoie (1996, et al. 2004). We contrast these empirical predictions with the ones made by the Sraffian supermultiplier by Freitas and Serrano (2015). In this model, given that steady-state capacity utilisation is an exogenous parameter, utilisation is restricted to be stationary. Additionally, while the model predicts that the short-run correlation between utilisation and growth is positive, in the long run shocks to autonomous demand only affect growth, not capacity utilisation. Thus, these two variables are uncorrelated in the long-run.

Our second contribution is to test empirically the above predictions using cross-country data on growth and utilisation. First, we test the stationarity prediction of the Sraffian Supermultiplier using quarterly series of capacity utilisation for a set of 24 advanced and developing countries. Because previous studies have only focused on the US or have used filtered or leading indicators (Schoder, 2014; Nikiforos, 2016) to examine the behaviour of capacity utilisation, this widens the scope of previous empirical investigations. For the univariate series our testing strategy is based on simple unit root test; and to exploit the cross-country nature of our data, we also build a balanced panel where we perform the Breitung & Das (2005) and Pesaran (2007) tests. Second, we compute both short-run correlations at business cycle frequencies for each country, and we exploit the cross-country dimension of our data set to compute the long-run correlation between average capacity utilisation and the rate of accumulation. To the best of our knowledge, we are the first ones to do so both for a large set of countries.

Our main results from both univariate and panel unit root tests reject the existence of a unit root in aggregate capacity utilisation for a majority of the countries in our data. Additionally, we show that short-run correlations between capacity utilisation and the rate of output growth is positive, while the long-run correlation is nil. Taken together, these stylised facts favour models where actual capacity utilisation converges to the *normal* rate, such as the Sraffian Supermultiplier, over models where the actual utilisation rate fails to converge, such as the baseline Neo-Kaleckian or its extension with endogenous *normal* capacity utilisation. We hope that these stylised facts discipline future model building.

2. The empirical content of the convergence debate

As already mentioned, the absence of convergence between actual and *desired* capacity utilisation is a key feature of the baseline Neo-Kaleckian model. This is not a minor issue since capacity utilisation is not only the adjustment variable that brings equilibrium in the goods market and provides one rationale for claiming that quantity adjustment dominates over price adjustment in the long-run, but it is also crucial for growth theory, since, for instance, its long-run behaviour could define whether permanent shifts in income distribution have a *growth* or *level* effect on output. Despite a large theoretical literature devoted to debating the subject (a survey with Neo-Kaleckian critiques and responses can be found in Hein, Lavoie and van Treeck, 2011; Hein, Lavoie and van Treeck, 2012), there is surprisingly little empirical work concerning this debate. This is due, in part, to the fact that most authors have not explicitly derived the empirical implications of their models for the behaviour of univariate capacity utilisation. By "empirical implications", we mean any form of testable restrictions on the univariate or joint time-series behaviour of capacity utilisation and accumulation.

This section traces two families of empirical implications, which concern the trending behaviour of capacity utilisation, and its co-movement with respect to accumulation. We present some familiar models commonly employed in the literature: the baseline Neo-Kaleckian model, the Neo-Kaleckian model with endogenous 'normal' utilisation and the Sraffian Supermultiplier.

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. All models are written in continuous time; however, $x(t)$ is written as x to avoid cumbersome notation, and $\frac{\delta x(t)}{\delta t}$ is written as $\dot{x}$. These assumptions will carry on to all the models studied in this section. The baseline model can be described by the use of three equations:

$$\frac{I}{K} = \gamma + \gamma_u(u - u_n) \tag{1}$$

$$\frac{S}{K} = s_\pi r \tag{2}$$

$$r = \frac{\pi u}{v} \tag{3}$$

The first equation postulates that the growth rate of capital 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); 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). Finally, the third equation is an 'accounting' equation of the profit rate due to Weisskopf (1979), written as the product of the profit share (π), capacity utilisation, and divided by the capital-output ratio (v).

In this context, goods market equilibrium requires that investment equals savings, which is equivalent to stating that (1) = (2). The baseline model assumes that capacity utilisation is the variables that adjust to bring equilibrium in the goods markets; its steady-growth value is:

$$u^* = \frac{v(\gamma - \gamma_u u_n)}{s_\pi \pi - \gamma_u v} \tag{4}$$

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. We will assume this condition holds both in the baseline model and in the extension explored below. To derive the steady-growth gap between actual and desired capacity utilisation, one merely subtracts *normal* capacity utilisation from both sides of the equation, which gives:

$$u^* - u_n = \frac{v\gamma - u_n s_\pi \pi}{s_\pi \pi - \gamma_u v} \tag{5}$$

Thus, in the steady-growth path, there will generally be a divergence between actual and *desired* capacity utilisation. If, by a fluke, $u_n = v\gamma / s_\pi \pi$, then this divergence equals 0.

Does this model put any reduced-form restriction on the univariate behaviour of capacity utilisation? To answer this question, recall that equation (4) states which exogenous variables drive the observed variation in capacity utilisation. Thus, the Neo-Kaleckian model merely states that capacity utilisation inherits the time series behaviour of these exogenous variables. For instance, if the profit share is stationary - as it has been in the United States for much of the post-war period until the 70's - then capacity utilisation will be stationary *ceteris paribus*.[3] If, on the contrary, this variable features a trend - such as the increase in

[3]In other words, this functional of I(0) variables will be I(0).

the profit share that has been observed in many developed and developing countries since the 70's (Barba & Pivetti, 2009; Stirati, 2013; Stockhammer, 2017) - then capacity utilisation will feature a downward trend.[4] In short, the baseline version places no restriction whatsoever on the trending behaviour of capacity utilisation, insofar as it is determined by the trending behaviour of the exogenous variables.

Despite this absence of empirical implications for the trend behaviour of capacity utilisation, there are implications for the cross-correlation between capacity utilisation and the growth rate of capital or output. To see this, note that the equilibrium growth rate in the baseline model - which is obtained by plugging equation (4) in (3) and the result in (2) - is equal to:

$$g^* = \frac{s_\pi \pi(\gamma - \gamma_u u_n)}{s_\pi \pi - \gamma_u v} \tag{6}$$

Suppose now the economy is driven by shocks to the profit share - that is, by changing the values of π. Whenever π increases capacity utilisation and the growth rate of capital fall. The opposite is true for the capital-output ratio. The main point is that, whatever are the source of business cycle fluctuations - shocks to the profit share, the savings function or the capital output ratio, among others - the correlation between capacity utilisation and the growth rate of capital will be positive. This will hold both contemporaneously in a given country, and on the long run for a cross-section of countries. Perhaps surprisingly, whether this is actually the case has not been documented thoroughly.

2.2. The Neo-Kaleckian model with endogenous 'normal' utilisation

A common response to the absence of convergence between the actual and *desired* rate is to assume that the *normal* rate is an endogenous variable itself, which adjusts to close the gap. However, it has not been asked whether this model brings out new empirical implications. To present the argument, we use a model 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. The model consists of the following equations:

$$\frac{I}{K} = \gamma + \gamma_u(u - u_n) \tag{7}$$

$$\frac{S}{K} = s_\pi \frac{\pi u}{v} \tag{8}$$

[4] In the Bhaduri-Marglin (1990) version of the model, a positive trend on the profit share could imply either a downward or an upward trend on capacity utilisation. Nevertheless, the point that capacity utilisation essentially inherits the time series properties of exogenous variables, e.g. the profit share, still remains.

$$\dot{u_n} = \sigma(u - u_n) \tag{9}$$

$$\dot{\gamma} = \phi(g - \gamma) \tag{10}$$

Thus, the new model adds two differential equations: Equation (9)[5], which states that the *normal* rate of capacity utilisation changes according to the discrepancy between actual and *normal* rate, and equation (10), which states that the expected trend growth of sales increases whenever the actual growth rate of capital is above the secular trend; this equation is usually seen as formalising the principle of Harrodian instability in the baseline Neo-Kaleckian model.

We solve thoroughly the model in Appendix A. Here we present the steady-state values of both *normal* capacity utilisation and the accumulation rate. *Normal* capacity utilisation is equal to:

$$u_n = \frac{C\sigma v}{s_\pi \pi \sigma - \phi v \gamma_u} \tag{11}$$

What are the empirical implications of this model? First, contrary to what has been claimed by Nikiforos (2016, 2018), the stationarity of capacity utilisation series is not a sufficient argument to dismiss the model. To see this, note that from equation (11), if e.g. the profit share or the capital-output ratio are stationary, then the *normal* rate of capacity utilisation will also be stationary. Moreover, if capacity utilisation were stationary, then its statistical long-run value - which would be the average of a stationary series - would be a natural *proxy* for the *normal* utilisation rate.[6]

A second implication corresponds to the cross-correlation between capacity utilisation and the accumulation rate. Note that we can obtain the steady-state accumulation rate, 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:

$$\gamma = \frac{C\sigma s_\pi \pi}{s_\pi \pi \sigma - \phi v \gamma_u} \tag{12}$$

It can be shown - as done originally by Lavoie (1996) - that the paradoxes of thrift and costs hold in this model. Thus, this model retains the predictions from the baseline Neo-Kaleckian model: Upon impact, shocks to the savings rate, the capital-output ratio or the profit share will induce movements in capacity utilisation and the accumulation rate that have the same

[5]There has been a substantial theoretical debate over the economic rationale behind Equation (9); see Skott (2012) for a theoretical critique, Nikiforos (2016) for a defence which stress what assumptions need to be used to derive a specification like (9) and Girardi and Pariboni (2019) for a response.

[6]From a strictly theoretical viewpoint, *normal* utilisation is the expected average utilisation on *newly* installed equipment (Ciccone, 1986).

sign - which means that the short-run correlation between these variables will be positive. However, this result carries over to the long-run correlation between the *normal* utilisation rate and the accumulation rate.

2.3. The Sraffian Supermultiplier

The Sraffian Supermultiplier model of Serrano (1995) in its current version (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.[7] 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,

$$Y = C_w + I + Z \tag{13}$$

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).[8] 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 following way:

$$C_w = \omega Y \tag{14}$$

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), equation (13) can be reduced to the following one:

$$Y = (\omega + h)Y + Z \tag{15}$$

[7] Allain (2015, 2018), Pariboni (2016), Lavoie (2016), 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).

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

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

$$Y = \left(\frac{1}{s_\pi - h}\right) Z \tag{16}$$

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 $g_u = g - g_K$. Replacing $g_u = \dot{u}/u$ we can derive the behaviour through time of the level of capacity utilisation,

$$\dot{u} = u(g - g_K) \tag{17}$$

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[9], we can formulate the growth rate of capital:

$$g_K = \frac{I/Y}{v} u \tag{18}$$

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 inter-capitalist's competition which is what drives the tendency of capacity to adjust to demand. The mechanism is the following one: Given a *planned* or *desired* capacity utilisation which allows the minimisation of *normal* costs, 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 run (ibid., 2015, p. 4), so any increase in u will lead 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,

$$\dot{h} = h\gamma_u(u - u_n) \tag{19}$$

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

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

respect to time, we get the following expression for g:

$$g = g_Z + \frac{h\gamma_u(u - u_n)}{s_\pi - h} \tag{20}$$

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 (18) and equation (20) into equation (17) we arrive at the following system of differential equations:

$$\dot{h} = h\gamma_u(u - u_n) \tag{21}$$

$$\dot{u} = u(g_Z + \frac{h\gamma_u(u - u_n)}{s_\pi - h} - \frac{h}{v}u) \tag{22}$$

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[10] 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. Under these conditions, the multiplicity of results derived from the previous Neo-Kaleckian models are reduced to one. 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 is zero and the causality runs from u to u_n.

To conclude, the empirical implications derived from the Sraffian Supermultiplier are that there must be a positive correlation between g and u in the short run, while in the long run this relationship ceases to exist. Moreover, u gravitates around u_n until its equalisation is fulfilled in the steady state; thus, it might be interpreted as a stationary variable.

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

2.4. A theoretical summary

To summarise our theoretical discussion, Table 1 presents the empirical predictions regarding the trending behaviour of capacity utilisation, and the correlations between capacity utilisation and the rate of accumulation over different time horizons. The main message is the following: Models which achieve convergence between the actual and the *desired* rate by making the former move towards the latter impose stationarity and no correlations between the rate of accumulation and capacity utilisation in the long-run; while models which do not achieve convergence or those that achieve this convergence through movements in the *normal* rate towards the actual rate impose no restriction on the trending behaviour of capacity utilisation, and predict both short-run and long-run positive correlations between utilisation and the rate of accumulation. We now turn to test these empirical implications.

Table 1: Empirical Predictions

Model	Trends in u	$Corr(u, g)$	$Corr(\bar{u}, \bar{g})$
NK baseline	Unrestricted	>0	>0
NK w/ endogenous u_n	Unrestricted	>0	>0
Sraffian Supermultiplier	Stationary	>0	=0

3. Data Sources and Descriptive Statistics

In order to test the predictions of the models discussed above, we will use data on capacity utilisation and the accumulation rate for a cross section of countries. Since data on the accumulation rate are not widely available, we show how we can combine theory and data on output growth to test the relevant predictions. In both of the models discussed above, there is an underlying fixed-coefficients production function which states the following:

$$Y = \min\{\frac{uK}{v}, aL\} \tag{23}$$

Where Y is output, K is capital stock, a is the productivity of labour, v is the inverse of capital productivity, and L is quantity of labour. With this technology, profit-maximising capitalists will employ capital according to:

$$Y = \frac{uK}{v} \tag{24}$$

If we log-difference the above equation, we obtain:

$$g^Y = g^u + g^K - g^v \tag{25}$$

Where, for small variations, g denotes the growth rate of a variable. Given the assumption of no technical progress, $g^v = 0$ at all time. This leaves us with:

$$g^Y = g^u + g^K \tag{26}$$

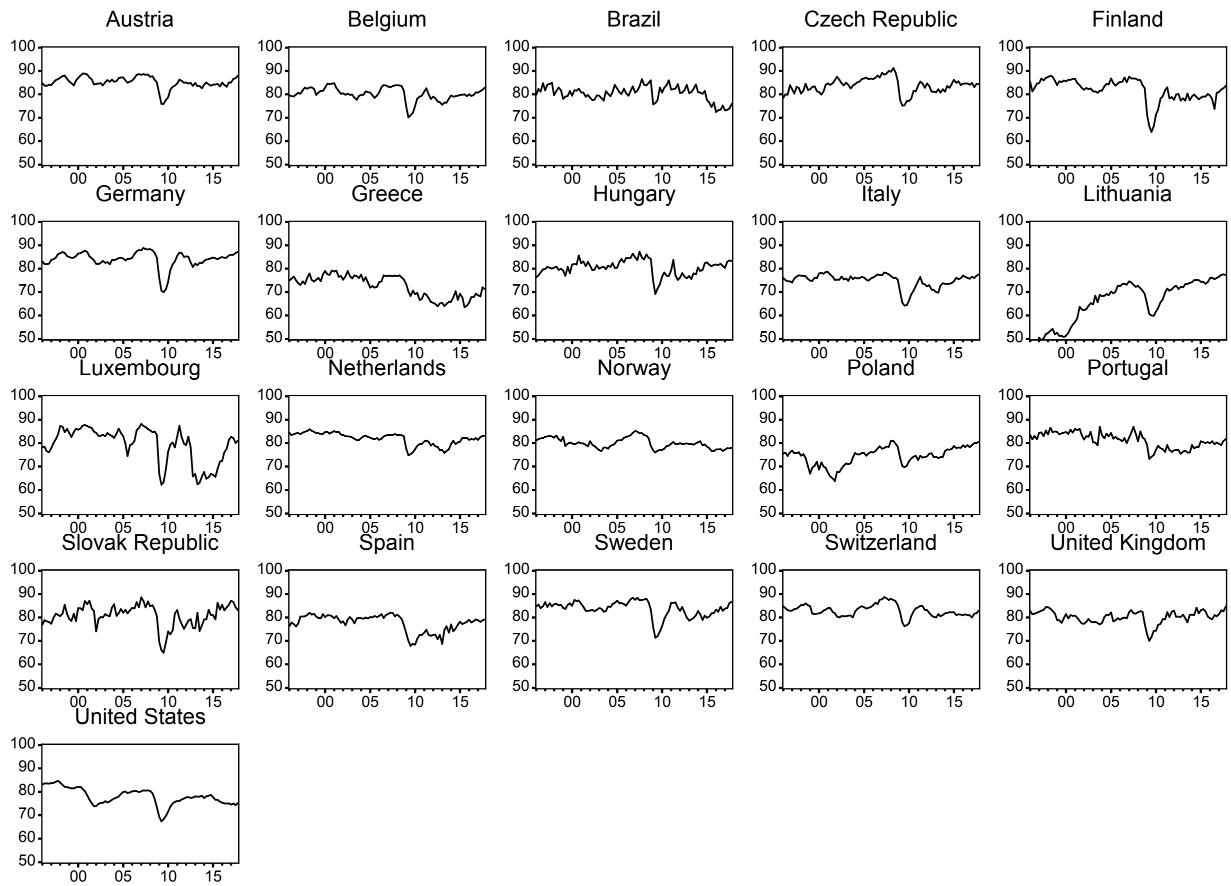
Thus, one way we can compute the growth rate of capital - in the light of our theoretical model - as the residual between output growth and the growth of capacity utilisation. Moreover, if capacity utilisation is stationary - that is, $g^u = 0$ as $t \to \infty$ - then, we can simply use output growth as a substitute for the growth rate of accumulation, at least with regards to the long-run implications of the models. Given the mentioned lack of data on quarterly accumulation rates, we adopt this procedure.

The next question concerns where and how to obtain data for capacity utilisation. This is a controversial issue, since there are multiple ways to compute capacity utilisation. One often used procedure is to use a filtering method to obtain the trend in output, and divide current output by its trend level. Another procedure is to directly ask entrepreneurs for their capacity utilisation level in manufacturing surveys, and then to aggregate these survey responses, as it is done, for example, by the US Census Bureau.

This last procedure has sparked a lively controversy in the recent macroeconomics literature. Nikiforos has recently argued that the FRB data is measured in such a way is 'stationary by construction' (Nikiforos, 2016, p. 2; 2018, p. 7), as such, he disregards this series and proposes alternative series on the workweek of capital. However, as we have noted in a recent comment of his work (Gahn & González, 2019), if one agrees with the author that the FRB is stationary by assumption, then the measurement error must have a unit root. This means that surveys would be collected in such a way that (random) errors taken in each period would permanently affect the series. We argue that this is not a reasonable assumption. Furthermore, we show that there is strong evidence that Nikiforos's additional series are also stationary.

Another comment with regards to these type of measures, noted by Shaikh (1987, 1989, 1992, 2016), is that these surveys take the subjective value answered by plant managers at face value. For instance, it could be the case that entrepreneurs always interpret capacity utilisation over 'normal' output, not over the maximum technically feasible output. With regards to this point, Gahn (2019) claims that the US Census Bureau runs a parallel question which allows to measure maximum technical capacity and that the trend in both time series are quite similar. In other words, while it is probably true that capacity utilisation contains measurement error in levels, it's unreasonable to assume that there is measurement error in growth rates. Overall, we think it is safe to use utilisation measures derived from these surveys to conduct our empirical analysis.

Fig. 1. Panel Data: Capacity Utilisation Rate by Country



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

Both output growth and capacity utilisation were obtained from the OECD's database. Capacity utilisation was obtained from the Business Tendency Surveys[11] and the national agencies of Argentina (INDEC[12]) and Brazil (BCB[13]). We only used capacity utilisation se-

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

[12] https://indec.gob.ar

[13] https://bcb.gov.br

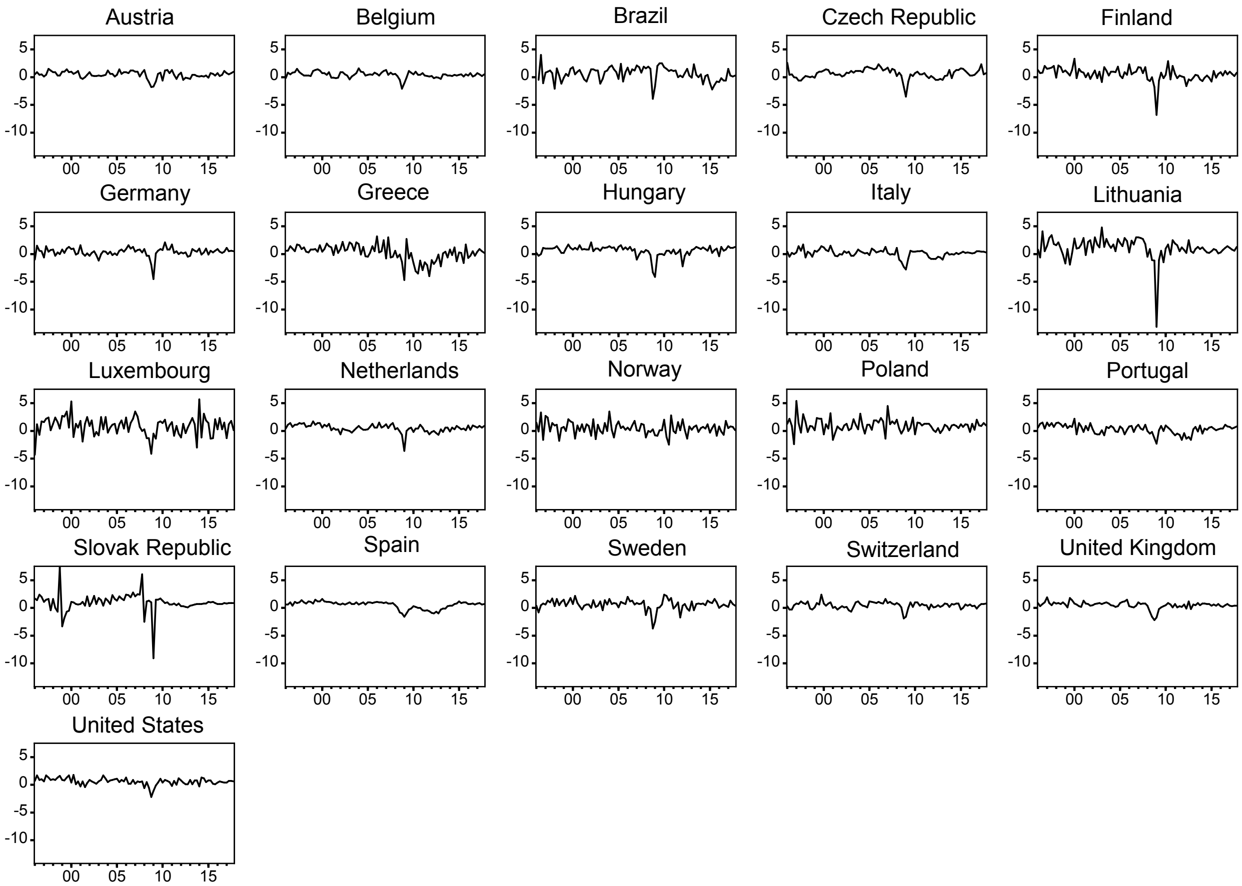
ries which were constructed in levels (e.g. some series are constructed asking entrepreneurs whether their utilisation rate is ‘above’, ‘below’ or ‘around’ the normal rate they use). We removed any seasonal components from the Argentinian case applying X-13ARIMA-SEATS. All the other series had their seasonal components removed. We opt to retain series at quarterly rather than yearly frequencies. This last choice is guided by the fact that we want to distinguish the contemporaneous cross-correlation between the growth rate of output and capacity utilisation and its-long run value in our cross-section of country; given that the contemporaneous correlation is given usually at business cycle frequencies, we choose quarterly data instead of annual data.

Figure 1 plots a balanced panel starting in 1996Q1 and ending in 2017Q4 for 21 quarterly capacity utilisation series (Argentina, Indonesia and Ireland were excluded because of insufficient data). As it can be seen, the series seem fairly heterogeneous, despite some common features among them, such as the strong drop around the global financial crisis. Visual inspection suggest that only Lithuania seems to have a strong upward trend, while Greece seems to have a downward trend after 2009. The other series seem trendless, and vary greatly in their volatility.

Figure 2 plots the growth rate of output for our balanced panel. Visual inspection suggests, as it’s well known, that the growth rate of output tends to be trendless, even in those countries which seem to have a trend in capacity utilisation (such as Lithuania and Greece.) Furthermore, the common dip in the series during the global financial crisis is very evident in the data, which means there is some strong cross-sectional dependence as well. Finally, while the series seems pretty smooth for a number of countries, for quite a few its apparent than the growth rate is highly volatile, even more than capacity utilisation.

To get a further feel of the behaviour of capacity utilisation, we compute moments of interest for each country; namely, the mean and the first-order autocorrelation. Additionally, we compute the start and end date of each series. These two moments serve as measures of the central tendency and persistence, respectively. Table 2 computes these moments. A few results stand out. First, while there is some cross-country dispersion in utilisation rates, the mean of each series seems to fluctuate around 75% and 80%. Secondly, while the series show some degree of persistence, they are far from suggesting a unit root, except in the case of Lithuania, which shows a persistence of 0.99. As a matter of fact, if one takes as a benchmark the data in Stock and Watson (1998), capacity utilisation is less persistent than most other macroeconomic variables in level, except for the unemployment rate; in other

Fig. 2. Panel Data: Growth Rate by Country



Source: own elaboration based on data provided. See appendix C for details.

words, unexpected shocks to capacity utilisation die relatively quickly compared to other macroeconomic series.

4. Estimation Strategy

4.1. Univariate Time Series

In order to test the existence of a unit root in each series, we conduct two classes of unit root tests: univariate and panel-data tests. For our univariate specifications, we search for the best specification of the form:

Table 2: Moments of Capacity Utilisation

Country	Mean	Persistence	Time frame
Argentina	71.6%	0.85	2002Q1-2015Q2
Austria	85.2%	0.88	1996Q1-2017Q4
Belgium	78.9%	0.92	1978Q2-2017Q4
Brazil	80.8%	0.81	1970Q2-2017Q4
Czech Republic	82.4%	0.87	1991Q1-2017Q4
Finland	82.1%	0.88	1991Q1-2017Q4
Germany	84.2%	0.93	1960Q1-2017Q4
Greece	73.7%	0.93	1985Q1-2017Q4
Hungary	78.7%	0.83	1986Q2-2017Q4
Indonesia	72.3%	0.44	2002Q1-2017Q3
Ireland	75.3%	0.61	1985Q1-2008Q2
Italy	75.1%	0.88	1968Q4-2017Q4
Lithuania	63.7%	0.99	1993Q1-2017Q4
Luxembourg	79.8%	0.89	1985Q1-2017Q4
Netherlands	82.0%	0.92	1971Q4-2017Q4
Norway	80.6%	0.91	1978Q1-2017Q4
Poland	73.4%	0.92	1992Q2-2017Q4
Portugal	80.1%	0.88	1977Q1-2017Q4
Slovak Republic	80.2%	0.80	1993Q4-2017Q4
Spain	79.3%	0.92	1965Q2-2017Q4
Sweden	83.6%	0.87	1996Q1-2017Q4
Switzerland	83.6%	0.88	1967Q2-2017Q4
United Kingdom	80.9%	0.87	1985Q1-2017Q4
United States	80.2%	0.94	1967Q1-2017Q4

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

$$u_t = \alpha + \sum_{k=j}^{K} \beta_k u_{t-k} + \varepsilon_t \tag{27}$$

That is, we work with AR(k) models were we seek to determine the order of k before implementing our tests. We choose the Bayesian Information Criteria (BIC) to search for the best model. Our election is justified on the grounds that the BIC is known to be a consistent model selection in this context (Schwarz, 1978), unlike the Akaike information criteria. Furthermore, it does not penalise the number of parameters as much as the Hannan-Queen criteria, and as Choi (2015) documents, truncation the lag order of AR(p) by a low number may cause power problems in unit root tests.

It should be noted that we omit MA components and deterministic trends for our specifications. Linear trends are omitted because the value of capacity utilisation is bounded between 0 and 1; thus, including deterministic trends would imply that on the long run capacity utilisation exceeds any of these bounds. MA components are omitted given that AR approximations are only poorly behaved whenever the MA components have root close to 1. When using Hannan-Risannen (1982) method to search for the best ARMA process, MA components did not register a unit root.[14] After searching for the best AR(p) model, we implement the two most popularly used unit root tests: the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test.

4.2. Panel Time Series

The main reason behind performing unit root tests in Panel data is to gain statistical power and to improve on the power of their univariate counterparts; however, a number of issues which are absent by construction in the univariate setting appear when we consider panel time series, namely, unobserved heterogeneity and cross-sectional dependence; while some problem of the univariate setting persist, such as, bias of the traditional tests, e.g. Dickey Fuller, among others (Pesaran, 2015). For our panel data specifications, we search for the best specification of the form:

$$u_{it} = \alpha_i + \sum_{k=j}^{K} \beta_k u_{i,t-k} + \varepsilon_{it} \tag{28}$$

where the null hypothesis is that all time series are random walks ($H_0 : \beta = 0$) and under the alternative *a significant fraction* of all time series are assumed stationary with $\beta < 0$ for all countries i.

We proceed in the following fashion: first, we will check if our panel suffers from cross-sectional dependence. Panel unit root tests have low power and sever size distortions when errors are cross-sectionally correlated (Choi, 2015). In case our panel data suffers from cross-sectional dependence, we should go on with second generation unit root tests that allow the possibility of cross-section dependence.

We first consider the test designed by Breitung & Das (2005), which is consistent under ($T > N$). It holds power in the case of heterogeneous β_{ik}, and performs well in the case of

[14] Results are available upon request.

weak cross-sectional dependence. These authors, under a weak error dependence assumption, consider the following autoregressive model,

$$\Delta u_{it} = \alpha_i + \beta u_{i,t-k} + \Gamma_i \Delta u_{i,t-k} + \varepsilon_{it} \tag{29}$$

where ε_{it} is a cross-sectionally correlated white noise process. On the other hand, Pesaran (2007), assuming a homogeneous AR processes, works with a cross-section correlated by common factors and performs tests using large T and large N. The main limitation of Pesaran (2007) is that this model imposes homogeneity across cross-sectional units. His Cross Section Augmented Dickey Fuller (CADF) regression equation is the following one:

$$\Delta u_{it} = \alpha_i + \beta_i u_{i,t-k} + \chi_i \Delta \overline{u} + \delta_i \overline{u} + \varepsilon_{it} \tag{30}$$

where $\Delta \overline{u}$ is the average of the cross-section difference and $\overline{u}$ is the cross-section average. Also he proposes a cross-sectional augmented test (CIPS, in Im, Pesaran and Shin, 2003) which is a simple average of the individual CADF tests. The great advantage of this approach is that the cross-sectional correlation is eliminated by simple OLS without estimating factors and factor-loading coefficients as other approaches require (Choi, 2015).

While there is a vast literature on panel unit-root tests, both of the tests mentioned above can be computed by simple OLS regressions and are available in most statistical packages. Thus, these two tests suffice as a robustness check that the majority of our panel possesses or not a unit root component.

4.3. Short and Long-run correlations

We are mainly interested in distinguishing between short-run and long-run correlations between output growth and capacity utilisation. As it should be clear from our theoretical discussion, in Neo-Kaleckian models, irrespective of what causes differences in the equilibrium values of output growth and capacity utilisation, there should be a positive correlation between these two in the long run: countries with higher 'animal spirits', for example, should have higher equilibrium values of utilisation rates and growth rates. According to the Supermultiplier model, however, countries with higher g_Z should have higher growth rate of output, but no higher long-run capacity utilisation; we would expect this correlation to be 0.

A convenient way to summarize short-run correlations is by means of computing $\rho^i_{g_{t-k},u_t}$, that is, the cross-correlation between growth and capacity utilisation in country i, at different time horizons by making g_{t-k} vary. Then, we can graph $\bar{\rho}_{g_{t-k},u_t}$, the average correlation for different time horizons. Besides showing whether this correlation is positive or negative contemporaneously, it will show us whether capacity utilisation leads or lags output-growth - a fact which future Post-Keynesian growth models could aim to match.

There are various methods to compute long-run correlations; however, a very simple one, which exploits the stationarity of two variables, would be to obtain averages of utilisation and growth, $\bar{u}_i, \bar{g}_i$ for each country, and then two compute the cross-country correlation between these two variables, $\bar{\rho}_{\bar{g},\bar{u}}$. If these two variables are stationary, then averaging over the time dimension will give us an estimate of the long-run value of the series. As we will show, the majority of our countries have stationary utilisation, which makes this simple method appealing. As with our panel-data unit-root tests, we will analyse our balanced panel, to make sure that both correlations are being computed over the same n, and over the same years.

5. Results

5.1. Univariate Results

Our main results for the univariate setting are shown in Table 3. As mentioned before, we select the best AR(p) model with which to conduct our tests using the BIC criterion.

The first two columns report the test statistics of both ADF and PP tests. As it can be readily appreciated, both tests allow to reject the null of a unit root at any conventional significance level for 22 out of the 24 countries. Furthermore, for 21 out of 24 the null is rejected at the standard significance level of 5%. Given the usual power concerns regarding unit root tests, we consider this as convincing evidence of the stationarity of capacity utilisation.

5.2. Panel Data Results

As we can see from Figure 1, there are some common cycles between countries and the strong cross-sectional dependence is confirmed by many different tests, which are presented in Table

Table 3: Time Series Unit Root Tests

Country	ADF	PP
Argentina	-7.231***	-6.410***
Austria	-3.390**	-2.913**
Belgium	4.566***	-3.451**
Brazil	-2.719*	-4.921***
Czech Republic	-2.874*	-3.068**
Finland	-3.595***	-2.676*
Germany	-5.105***	-4.091***
Greece	-2.066	-1.881
Hungary	-3.378**	-3.141**
Indonesia	-5.830***	-5.872***
Ireland	-5.733***	-5.615***
Italy	-4.199***	-4.149***
Lithuania	-0.485	-0.769
Luxembourg	-3.309**	-3.101**
Netherlands	-3.129**	-2.864*
Norway	-2.694*	-2.826*
Poland	-7.103***	-6.334***
Portugal	-2.727*	-3.322**
Slovak Republic	-3.306**	-3.306**
Spain	-3.543***	-2.976**
Sweden	-3.299**	-2.896**
Switzerland	-4.608***	-3.905***
United Kingdom	-2.840*	-3.162**
United States	-4.003***	-3.175**

Note: $* = p < 0.1, ** = p < 0.05, *** = pval < 0.01$.

Source: own computations based on data provided in Table 2. 1977Q3 missing value of Brazil was completed with a simple average. Netherland's tests were performed since 1977Q4 because of missing values.

4.[15]

According to the tests performed, *a significant fraction* of the cross-section units is stationary. Breitung & Das (2005) and Pesaran (2007) reject strongly the null hypothesis that a significant fraction of the series contain a unit root and homogeneous non-stationary processes, respectively, in panel data series of capacity utilisation.[16]

[15] Particularly, the Breusch-Pagan LM is valid for N relatively small and T sufficiently large.

[16] The Breitung & Das (2005) with pre-whitening and the Pesaran (2007) CADF tests were performed with 5 lags (maxlag=5) according to the BIC criterion. The Pesaran (2007) CIPS lag length criterion was decided according to General to Particular Methodology based on F joint test (maxlags=5), following CIPS's designed by Máximo Sangiácomo (Burdisso & Sangiácomo, 2016).

Table 4: Cross-Section Dependence Test

Test	Statistic	Prob.
Breusch-Pagan LM	6309.77	0.0001
Pesaran scaled LM	297.63	0.0001
Bias-corrected scaled LM	297.51	0.0001
Pesaran CD	66.75	0.0001

Note: 1848 observations (N=21 - T=88)
Source: own computations based on balanced panel 1996Q1-2017Q4.

Table 5: Panel Unit Root Tests

Test	Statistic	Prob.
Breitung & Das (2005)	-3.50	0.0002
Pesaran (2007) CADF	-2.84	< 0.01
Pesaran (2007) CIPS	-2.97	< 0.01

Note: 1848 observations (N=21 - T=88).
Source: own computations based on balanced panel 1996Q1-2017Q4.

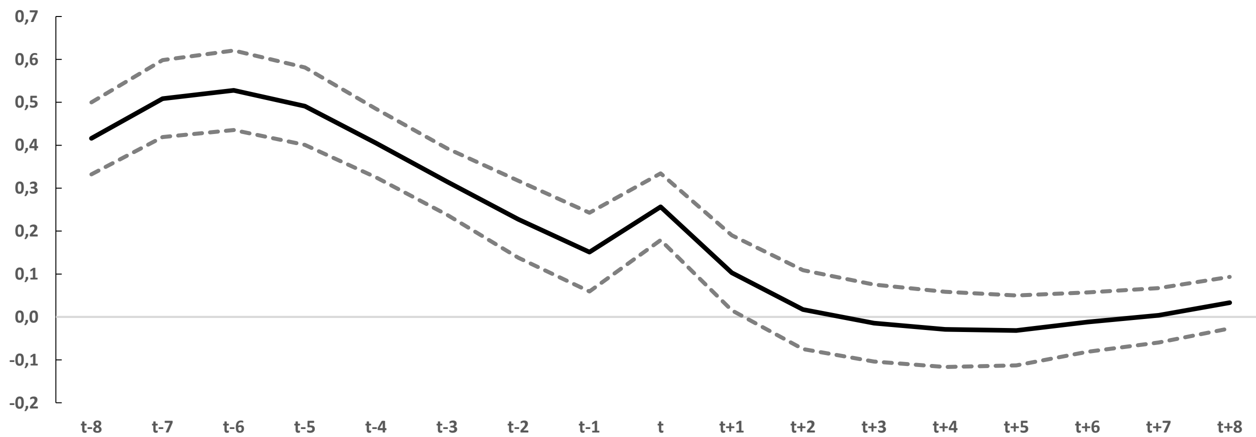
5.3. Cross-Correlations with Output Growth

Finally, we analyse two sets of cross-correlations between output growth and capacity utilisation: contemporaneous and lead-lag correlations over the business cycle, which reflect short-run correlations and long-run correlations between these two variables. To analyse the first set of correlations we use the time-series dimension of the data; to analyse the second, we use the cross-country dimension over the long run.

Note that given the absence of unit roots or deterministic trends established in the previous sections, the second moments of the data, which include the cross-correlations for output growth and capacity utilisation, are well defined. Thus, there is no problem with analysing extensively the cross-correlations at different time horizons, provided we exclude Greece and

Lithuania, which showed evidence of unit roots, from the analysis.[17]

Fig. 3. Average Cross-Correlation between output growth and utilisation



Source: own elaboration from the data provided.

In all the models we have analysed, a demand shock leads to an increase in both capacity utilisation and the growth rate of output in the short run. If we assume fluctuations at business cycle frequencies are driven by these demand shocks, then we would expect a positive correlation between both variables contemporaneously. Figure 3 shows the average cross-correlation for the whole sample, which is simply obtained by averaging the cross-correlations for each country.[18] The pattern that emerges is quite surprising: First, while utilisation is pro-cyclical, as we already noted from Table 8, the peak positive correlation emerges at 6 lags, which implies that capacity utilisation lags the peak of the business cycle by one year and a half. Second, the correlation goes from being strongly positive at all lags to being essentially 0 at all leads, starting with the second lead. Compared to the benchmark in Stock and Watson (1999), capacity utilisation shows a much smaller correlation with output than

[17]While we do not test the existence of trends in output growth, there is a wide consensus in the time series literature that this series does not contain a unit root or deterministic components. See, for example, Nelson and Plosser (1982) for some seminal results. Even if the series contain structural breaks, which are a form of non-stationarity, the second moments are well defined.

[18]Table 8 in Appendix 2 shows the cross-correlations between growth and capacity utilisation at 8 leads and lags for our whole sample.

other macroeconomics time series.[19]

We now turn to compute long-correlations. Dropping Lithuania and Greece from the sample since they showed evidence of non-stationarity, Table 6 reproduces, for the sake of completeness, the average values of capacity utilisation and average growth rates for our balanced panel of 19 countries; while Table 7 shows the point estimate of the correlation coefficient, and the p-values for two hypothesis tests: The first one is that the correlation is positive, while the second one is that the correlation is 0. The results from these hypothesis test reject the Neo-Kaleckian models in favour of the Supermultiplier model, at any conventional significance level.

Table 6: Long-Run Averages of g and u. Balanced Panel, 1996Q1 - 2017Q4

Country	u	g
Austria	0.85	0.46
Belgium	0.80	0.44
Brazil	0.80	0.58
Czech Repulic	0.84	0.64
Finland	0.82	0.54
Germany	0.84	0.37
Hungary	0.80	0.61
Italy	0.75	0.14
Luxembourg	0.79	0.83
Netherlands	0.82	0.50
Norway	0.80	0.50
Poland	0.74	0.98
Portugal	0.81	0.32
Slovak Repulic	0.81	0.97
Spain	0.78	0.54
Sweden	0.84	0.61
Switzerland	0.83	0.47
United Kingdom	0.80	0.53
United States	0.78	0.60

Source: own elaboration based on data provided.

Overall, these patterns of correlations seem to provide stronger support for the Sraffian

[19] These discrepancy in findings is likely due to the fact that Stock and Watson use a measure of detrendend GDP with the HP filter, while we use the first difference of log GDP. Different detrending methods can lead to substantially different results (Canova, 1998); however, we have a strong theoretical reason for using growth rates: the results of all of our analysed models are cast in terms of growth rates of output, not in terms of some bandpass-filtered GDP.

Table 7: Long-run correlation between u and g

$Corr(\bar{u}, \bar{g})$	$H_0 : \rho > 0$	$H_0 : \rho = 0$
-0.24	<0.01	0.25

Supermultiplier model: If demand forces are the central drivers of both business-cycle fluctuations and long-run growth, then the model correctly predicts that a permanent demand shock (say, an increase in the rate of growth of autonomous components) will cause, on impact, a positive correlation between the growth rate of output and capacity utilisation, while in the long-run capacity utilisation will return to its normal level, producing a null-correlation between the latter and the growth rate of output over the fully adjusted position. This is exactly what we find in our data. While the Neo-Kaleckian models analysed here are consistent with the short-run correlations between output and capacity utilisation, they are not consistent with the null correlation between these two variables in our cross-section of countries.

Our long-run cross section analysis presents at least one possible vulnerability: That, independently of the rate of growth of the economy, the composition of output (and it changes through time) might determine the average long-run utilisation rate. For example, an oil-exporting economy might have a higher long-run utilisation, simply because the technical conditions for oil production require 24 hour shifts; and this composition of output might be unrelated to aggregate demand - we appreciate this comment raised by Professor Lavoie. Further research is needed to clarify this point.[20]

6. Conclusion

We have sought to shed light on one of the most heated debates among heterodox macroeconomics: the adjustment or lack thereof between actual and *desired* or *normal* capacity utilisation. We hope to have cleared up confusions with regards to the empirical predictions of two popularly used models: The Neo-Kaleckian model and the Sraffian Supermultiplier. We have shown that the Neo-Kaleckian model predicts no restrictions for the trend behaviour of capacity utilisation, and it predicts that accumulation and utilisation are positively correlated over all time horizons. In contrast, the Sraffian Supermultiplier restricts capacity

[20] A further comment with regards to this results must be done: The questions asked by the national statistical agencies differ among them - see Appendix 3 - and, therefore, there is no homogeneous measure. Our sample is mainly based on countries in groups ‘b’ and ‘d’ of our Appendix and we did not find presence of bias in a particular direction.

utilisation to be stationary, and predicts that while short-run utilisation is positively correlated with growth in the short run, it is uncorrelated with growth in the long-run. Using a cross-country data on utilisation and growth, we have shown that for a majority of countries, utilisation is stationary, it is positively correlated with growth on the short-run and uncorrelated with growth in the long run. Thus, the evidence favours the Sraffian Supermultiplier over the Neo-Kaleckian model.

It should be clear from our paper that our results are model-specific; that is, there might be Neo-Kaleckian models where capacity utilisation is stationary and uncorrelated in the long-run to output growth. As a matter of fact, the recent attempt to build Neo-Kaleckian models with autonomous expenditure (Lavoie, 2016), which we have not analysed in this (long) paper due to space constraints, might be a case in point. Likewise, it is fully possible to build Supermultiplier models where normal capacity utilisation is endogenous and presents a long-run trend; however, we are not aware of any formalisation of such models. Our broader message is that while we expect the prolific theoretical literature on convergence to continue to flourish, this literature should be disciplined by the stylised facts we present. We also hope an empirical literature devoted to testing fully-specified macroeconomic models, even if it is by means of matching simple correlations, to flourish in the future.

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Appendix A. The Neo-Kaleckian model with endogenous 'normal' utilisation

To solve the dynamical system defined by (9) and (10), let us first note we can replace equation (7) inside equation (10), given that $g^* = \frac{I}{K}$. Following Lavoie (1996), this leads to:

$$\dot{\gamma} = \phi\gamma_u(u - u_n) \tag{31}$$

By setting $\dot{u_n} = \dot{\gamma} = 0$, we find that the steady state needs to satisfy:

$$E = \{(u_n, \gamma) | \gamma = \frac{s_\pi \pi}{v} u\} \tag{32}$$

Thus, there is a continuum of equilibria. To pin down the exact equilibrium, we can divide equation (9) by equation (11):

$$\frac{\dot{\gamma}}{\dot{u_n}} = \frac{\phi\gamma_u}{\sigma} \tag{33}$$

Multiplying $\dot{\gamma}$ in both sides, and integrating, we obtain the following equation for γ:

$$\gamma = \frac{\phi\gamma_u}{\sigma} u_n + C \tag{34}$$

Where C is a constant of integration which depends on initial conditions. Substituting this expression into equation (9), we obtain a one-dimensional dynamical system defined by:

$$\dot{u_n} = \frac{\sigma v}{s_\pi \pi - \gamma_u v}[(\phi\gamma_u/\sigma)u_n + C - (s_\pi \pi / v)u_n] \tag{35}$$

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

$$u_n = \frac{C\sigma v}{s_\pi \pi \sigma - \phi v \gamma_u} \tag{36}$$

For the steady state to be positive, we need $s_\pi \pi \sigma > \phi v \gamma_u$ and $C > 0$. Note that the Keynesian stability condition is assumed to hold; thus, the only additional requirement is that $\sigma > \phi$; 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 (9).

To asses whether this steady-state is asymptotically stable, we take the derivative of (35) with respect to itself:

$$\frac{d\dot{u}_n}{du_n} = \frac{\sigma v}{s_\pi \pi - \gamma_u v}[(\phi \gamma_u/\sigma) - (s_\pi \pi/v)] \tag{37}$$

Equation (33) must be negative if the system is to be asymptotically stable. Coincidentally, this only requires that both the Keynesian stability condition holds, and that $\sigma > \phi$, something we have 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.

Appendix B. Further Evidence on Short-Run correlations between utilisation and growth

Table 8: Cross-Correlation coefficients at leads and lags of g_t for balanced panel

Country	t-8	t-7	t-6	t-5	t-4	t-3	t-2	t-1	t	t+1	t+2	t+3	t+4	t+5	t+6	t+7	t+8
Austria	0.49	0.67	0.74	0.64	0.43	0.30	0.18	0.06	0.28	0.06	-0.06	-0.12	-0.23	-0.27	-0.19	-0.14	-0.07
Belgium	0.42	0.65	0.69	0.61	0.45	0.29	0.18	0.06	0.11	-0.12	-0.22	-0.20	-0.16	-0.09	-0.04	-0.02	0.01
Brazil	0.49	0.48	0.43	0.40	0.41	0.28	0.19	0.20	0.22	0.04	0.03	0.01	-0.06	-0.06	0.05	-0.02	0.03
Czech Republic	0.52	0.60	0.63	0.62	0.57	0.49	0.40	0.26	0.34	0.17	0.03	-0.04	-0.05	-0.04	0.00	0.04	0.04
Finland	0.54	0.63	0.61	0.60	0.44	0.37	0.25	0.11	0.37	0.17	0.06	0.01	-0.03	-0.03	0.01	0.05	0.09
Germany	0.44	0.59	0.63	0.55	0.39	0.22	0.08	-0.05	0.17	-0.13	-0.26	-0.33	-0.33	-0.31	-0.24	-0.18	-0.10
Greece	0.54	0.59	0.57	0.61	0.56	0.59	0.64	0.55	0.48	0.39	0.39	0.37	0.32	0.30	0.26	0.18	0.19
Hungary	0.46	0.53	0.50	0.39	0.29	0.28	0.31	0.34	0.24	0.01	-0.09	-0.18	-0.21	-0.21	-0.24	-0.20	-0.19
Italy	0.49	0.65	0.73	0.67	0.55	0.40	0.30	0.15	0.25	0.04	-0.06	-0.10	-0.10	-0.06	0.00	0.10	0.17
Lithuania	0.08	0.11	0.12	0.11	0.07	0.03	-0.02	-0.09	0.01	-0.05	-0.12	-0.13	-0.18	-0.19	-0.18	-0.18	-0.18
Luxembourg	0.13	0.23	0.28	0.27	0.24	0.22	0.10	0.02	0.05	-0.02	-0.09	-0.10	-0.04	-0.12	-0.07	-0.01	0.05
Netherlands	0.62	0.68	0.67	0.61	0.52	0.42	0.39	0.29	0.45	0.26	0.22	0.19	0.16	0.10	0.09	0.11	0.15
Norway	0.16	0.17	0.20	0.23	0.21	0.11	0.14	0.13	0.12	0.09	0.04	-0.01	-0.04	-0.10	-0.06	-0.14	-0.16
Poland	0.11	0.18	0.18	0.13	0.05	0.02	-0.05	-0.14	0.14	0.09	0.01	0.03	0.13	0.05	0.04	0.02	0.07
Portugal	0.49	0.54	0.59	0.58	0.50	0.47	0.40	0.45	0.36	0.33	0.23	0.20	0.21	0.24	0.15	0.23	0.23
Slovak Republic	0.26	0.29	0.27	0.18	0.18	0.10	-0.14	-0.13	0.26	0.08	0.02	0.02	0.00	0.04	0.06	0.01	-0.02
Spain	0.84	0.88	0.88	0.86	0.78	0.69	0.61	0.53	0.73	0.65	0.55	0.47	0.43	0.40	0.38	0.36	0.33
Sweden	0.36	0.51	0.55	0.58	0.47	0.33	0.23	0.12	0.09	-0.15	-0.29	-0.33	-0.32	-0.23	-0.13	-0.06	0.02
Switzerland	0.35	0.55	0.65	0.58	0.46	0.28	0.09	-0.02	0.09	-0.07	-0.13	-0.10	-0.08	-0.08	-0.08	-0.07	-0.02
United Kingdom	0.39	0.52	0.55	0.51	0.40	0.28	0.12	0.02	0.20	0.04	-0.05	-0.05	-0.08	-0.05	-0.09	-0.03	0.02
United States	0.56	0.63	0.62	0.58	0.53	0.45	0.38	0.31	0.43	0.28	0.15	0.09	0.05	0.05	0.03	0.03	0.04
Average	**0.42**	**0.51**	**0.53**	**0.49**	**0.40**	**0.32**	**0.23**	**0.15**	**0.26**	**0.10**	**0.02**	**-0.01**	**-0.03**	**-0.03**	**-0.01**	**0.00**	**0.03**
Std. Dev.	0.19	0.20	0.21	0.20	0.18	0.17	0.20	0.20	0.17	0.19	0.20	0.20	0.19	0.18	0.15	0.14	0.13

Source: own elaboration from the data provided.

Appendix C. Details on data sources

Both output growth and capacity utilisation were obtained from the OECD's database. Capacity utilisation was obtained from the Business Tendency Survey and Consumer Opinion

Surveys[21] and the national agencies of Argentina (INDEC[22]) and Brazil (BCB[23]). However, OECD's database on capacity utilisation includes observations for 40 countries on monthly and quarterly data.[24] Here we present the different questionnaires and our view on this issue:

C.1. Questionnaires

Argentina:

https://www.indec.gob.ar/uploads/informesdeprensa/capacidad_11_15.pdf

https://www.indec.gob.ar/ftp/cuadros/economia/sintesis_metodologica_capacidad_instalada.pdf

https://www.indec.gob.ar/nuevaweb/cuadros/13/metodologia_capacidad_base2004.pdf

https://www.indec.gov.ar/nuevaweb/cuadros/13/metodologia_capacidadinstalada.pdf

Austria:

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.

Brazil:

http://portalibre.fgv.br/lumis/portal/file/fileDownload.jsp?fileId=8A7C82C5557F25F2015626C0585

Czech Republic:

https://ec.europa.eu/info/sites/info/files/questionnaires_cz_indu_cz.pdf

Finland:

https://ec.europa.eu/info/sites/info/files/questionnaires_fi_indu_fi.pdf

Germany:

https://ec.europa.eu/info/sites/info/files/file_import/questionnaires_de_indu_en_0.pdf

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

[22] https://indec.gob.ar. We removed any seasonal components from the Argentinian case applying X-13ARIMA-SEATS.

[23] https://bcb.gov.br

[24] We excluded some of them for different reasons (see next subsection).

Greece:
https://ec.europa.eu/info/sites/info/files/questionnaires_el_indu_el.pdf

Hungary:
https://ec.europa.eu/info/sites/info/files/questionnaires_hu_indu_hu_0.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:
https://ec.europa.eu/info/sites/info/files/boi-eu_industry_questionnaire_2016-2017.pdf

Italy:
https://ec.europa.eu/info/sites/info/files/questionnaires_it_indu_it.pdf

Lithuania:
https://ec.europa.eu/info/sites/info/files/questionnaires_lt_indu_lt.pdf.pdf

Luxembourg:
https://ec.europa.eu/info/sites/info/files/questionnaires_lu_indu_fr.pdf

Netherlands:
https://ec.europa.eu/info/sites/info/files/file_import/questionnaires_nl_indu_serv_reta_en_0.pdf

Norway:
https://www.ssb.no/a/publikasjoner/pdf/nos_d432/nos_d432.pdf

Poland:
https://ec.europa.eu/info/sites/info/files/questionnaires_pl_indu_en.pdf

Portugal:
https://ec.europa.eu/info/sites/info/files/questionnaires_pt_indu_pt.pdf

Slovak Republic:
https://ec.europa.eu/info/sites/info/files/file_import/questionnaires_sk_indu_en_0.pdf

Spain:
https://ec.europa.eu/info/sites/info/files/file_import/questionnaires_es_indu_en_0.pdf

Sweden:
https://ec.europa.eu/info/sites/info/files/questionnaires_se_indu_se.pdf.pdf

Switzerland:
https://ethz.ch/content/dam/ethz/special-interest/dual/kof-dam/documents/FragebogenArchive/imt/inu_en_q.pdf

United Kingdom:
https://ec.europa.eu/info/sites/info/files/questionnaires_uk_indu_en.pdf

United States:
https://www2.census.gov/programs-surveys/qpc/technical-documentation/questionnaires/watermark_form.pdf?#

C.2. Criterion

All the 'national questionnaires' are quite different among them. As far as we noticed from the OCDE database and National Institutes of Statistics, we found that we can classified the surveys questions in, at least, four groups:

a. Those countries such as Argentina, France or Greece that ask:

- Argentina: *Which is the expected level of capacity utilisation for the current month? The time series is built asking for the maximum output capability with the current installed capacity. A technical criterion such as the potential output with the maximum quantity of shifts as possible, including the maintenance necessary, is taken into account.*

- 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 (see US's questionnaire in C.1.).

b. Those countries such as Germany, Ireland, Italy, Poland, Slovak, Denmark, Stonia, Croatia, Cyprus, Latvia, Malta, Colombia, Albania, Macedonia, Serbia and Israel which ask what the OCDE's survey recommends, 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 about normal capacity (Australia), minimizing cost capacity (New Zealand) or allow the 'plant manager' to choose a capacity over 100% (UK, Portugal, Norway). For example,

- Norway: *What capacity utilisation rate does the current production level mean? 50, 50-65, 65-80, 80-95 over 95 as a percentage of full capacity. Full capacity utilisation means a desirable utilisation rate of the company's production equipment (buildings, facilities, machinery, equipment, etc.), and not the maximum utilisation.*

d. Other countries that directly ask just about current capacity utilisation such as Czech Republic, Finland, Hungary, Luxembourg, Netherlands, Spain and Lithuania without further requirements.

In our opinion the 'correct' question about capacity utilisation is given by countries in the 'a' group. If we take into account that for the US's case, the 'Full Capacity' and the 'National Emergency Production Capacity' are, according to the available data from 1989 to 2017, greatly correlated (see Gahn, 2019); we 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. Finally, the last group, also can be included, given that the question is based on current capacity; and although this is subject to plant manager's interpretation, this group can be part of 'b' or 'c', or a mixed of both; again, this is enough justification to include them in our study. This arbitrary classification of course is not error-free, but 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.

C.3. Countries excluded

AUSTRALIA: The question asked is "At what level of capacity utilisation are you working? Above normal/ normal/ below normal".

CHILE: Monthly data.

COLOMBIA: National questionnaire not found.

DENMARK: Judgement on capacity utilisation corresponds to the utilisation rate of premises, equipment, normal weekly hours and financial assets. Data are presented as the balance of "not sufficient" over "more than sufficient" replies; negative data indicate insufficient capacity utilisation.

ESTONIA: National questionnaire not available during the writing process of this article. It is now available in the OECD site.

FRANCE: In October 2016, the French partner institute (INSEE) modified the industry capacity utilisation data (Q13) until October 2004 to correct a break in the series which had been introduced by the questionnaire harmonisation in 2004.

INDIA: The results of this survey reflect the target respondents' assessment for the current quarter and the expectations over the following quarter.'Net responses' are the balance of 'Increase' responses over 'Decrease' responses.

ISRAEL: Monthly data.

JAPAN: The responding enterprises are asked to choose one alternative among three [(+) (=) (-)] as the best descriptor of prevailing conditions, excluding seasonal factors at the time of the survey and three months hence.

LATVIA: National questionnaire not available during the writing process of this article. It is now available in the OECD website.

Mexico: Monthly data.

New Zealand: The question asked in the NZL Quarterly Survey of Business Opinion (QSBO) is the following: "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?" Respondents can select one of five ranges: 0 percent, 1-5 percent, 6-10 percent, 11-20 percent, and over 20 percent. This question has remained unchanged since the beginning of the survey.

Russia: Monthly data. National questionnaire not found.

Slovenia: National questionnaire not available during the writing process of this article. It is now available in the OECD website.

South Africa: The question is 'Is you present level of output below capacity? Yes (+) or No (-)'.

South Korea: Monthly data. The original series are measured as (the rate of positive responses-the rate of negative responses) 100 + 100. The Secretariat then converts the diffusion indices to net balances.

Turkey: Monthly data.