On the (non) empirical content of the convergence debate: Cross country evidence on capacity utilization *

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Abstract

A key feature of the baseline Neo-Kaleckian model is that actual capacity utilisation does not converge to the desired or normal capacity utilisation. This feature contrasts with many other heterodox macroeconomic models employed in the profession, including the Sraffian supermultiplier. We revisit this theoretical debate by clarifying the empirical implications of this absence of convergence in some widely used Neo-Kaleckian models. We demonstrate that the Neo-Kaleckian model with autonomous expenditures is the only model which restricts the time-series behaviour of capacity utilisation, in the sense that it predicts it to be stationary. We then test this empirical implication using univariate unit-root test for quarterly capacity utilisation rates in a set of 22 advanced and underdeveloped countries. The results overwhelmingly accepts this prediction: capacity utilisation rates are found to be stationary for 19 out of the 22 countries. This implies that either modified versions of the Neo-Kaleckian model or other heterodox models - such as the supermultiplier model - should be used as workhorse models when conducting macroeconomic research.

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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 (Rowthorn, 1981; Dutt, 1984, 1987; Taylor, 1985; Amadeo, 1986) predicts that current capacity utilisation can deviate persistently from normal capacity utilisation, some Sraffian, Marxian and Harrodian critics of the Neo-Kaleckian model point out that in the long run it is unfeasible for the firm to deviate permanently from the normal or desired rate of capacity utilisation.

While substantial theoretical arguments have been made on both sides of the debate, the empirical analysis of this important topic has received remarkably little attention, with the exceptions of a few recent contributions (Schoder, 2014; Nikiforos, 2016). The present paper pretends to contribute to filling this gap.

Our first contribution is to clarify what are the empirical implications of some popularly used Kaleckian model for the univarite behavior of capacity utilization. In particular, we show that the baseline Neo-Kaleckian model is devoid of empirical content - in the sense that both capacity utilization and the gap between actual capacity utilization and desired capacity utilization can show either deterministic and/or stochastic trends, or be stationary. The same is also true for the Neo-Kaleckian model where the desired rate is turned into an endogenous variable and adjusts to the actual one - a model formulated by Lavoie (1996; 2004) and which has recently received microfoundations by Nikiforos (2013; 2016). However, the Neo-Kaleckian model with autonomous expenditures, developed by Allain (2015) and Lavoie (2016) both restrict capacity utilization to be stationary process. The same is true of the Sraffian Supermultiplier model of Serrano (1995).

Our second contribution is to test in a rigorous manner the stationarity prediction of the Neo-Kaleckian model with autonomous expenditures and the Sraffian Supermultiplier using quarterly series of capacity utilisation for a set of 22 advanced and developing countries. Because previous studies have only focused on the US and have used filtered or leading indicators, or both (Schoder, 2014; Nikiforos, 2016) to examine the behaviour of capacity utilisation, this widens the scope of previous empirical investigations.

Our main results from both univariate and panel unit root tests overwhelmingly reject the existence of a unit root in aggregate capacity utilisation. Given that we use the most powerful unit root tests available for univariate series, and account for cross-sectional dependence when we pool our series, it's safe to say that the evidence is firmly in line with the 'autonomous component' version of the NK model and with the SM model.

2. The empirical content of the convergence debate

As already mentioned, the absence of convergence between actual capacity utilization and the desired capacity utilization rate is a key feature of the Neo-Kaleckian model. This is not a minor issue, since capacity utilization is the main adjustment variable that clears the goods market in this model, and provides a rationale for claiming that quantity adjustment dominates over price adjustment in response to aggregate demand fluctuations, even in the long run. Despite a large theoretical literature devoted to debating the subject (a recent 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 utilization. By "empirical implications", we mean any form of testable restrictions on the univariate time-series behavior of capacity utilization. This section traces out one family of empirical implications, which concern the trending behaviour of capacity utilization; it should be kept in mind, however, that more sophisticated models could imply other empirical implications. With this caveat in mind, we present some familiar models commonly employed in the literature.

2.1. The baseline Neo-Kaleckian model

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

$$\frac{I_t}{K_t} = \gamma + \gamma_u(u_t - u_n) \tag{1}$$

$$\frac{S_t}{K_t} = \frac{s_\pi \pi u_t}{v} \tag{2}$$

The first equation postulates that the growth rate of investment is a function of γ, which is interpreted as the (constant) growth rate of sales, and the discrepancy between actual capacity utilization (u_t) and the desired or normal rate (u_n). The second equation is the growth rate of savings, which is simply the product of the marginal propensity to save out of profits (s_p) and the profit rate, written as the product of the profit share (π), capacity utilization, and the capital output ratio (v).

An equilibrium is defined as the situation where the goods market clear, which in this context is equivalent to the equality of (1) and (2). If one assumes capacity utilization is the variable that adjusts to clear the goods market, then, the steady growth capacity utilization rate is:

$$u^* = \frac{v(\gamma - \gamma_u u_n)}{s_\pi \pi - \gamma_u v} \tag{3}$$

To derive the steady-growth gap between actual capacity utilization and desired capacity utilization, one merely subtracts normal capacity utilization from both sides of the equation, which gives:

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

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

Does this model put any reduced-form restriction on the univariate beahvior of capacity utilization? To asnwer this question, recall from equation (3) that this model counts with two exogenous variables that drive the observed variation in the utilization rate - the capital-output ratio and the profit share. Thus, the Neo-Kaleckian model merely states that capacity utilization inherits the time series behavior of these two exogenous variables. If both variables are stationary - as they have been in the U.S for much of the post-war period until the 80's - then capacity utilisation will be stationary. If any of these variables feature trends - such as the increase in the profit share that has been observed in many developed and developing countries since the 80's (Barba & Pivetti, 2009; Stirati, 2013; Stockhammer, 2017) - then capacity utilization will feature a downward trend.[1] In short, the baseline version places no restriction whatsoever on the trending behaviour of capacity utilisation, insofar as its determined by the trending behaviour of the exogenous variables.

Evidently, the same is true for the gap between actual and desired utilization, at least if one

[1] 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 utilization. Nevertheless, the point that capacity utilization essentially inherits the time series properties of the profit share and the capital output ratio still remains.

assumes that the normal rate is a constant or stationary process. If the exogenous variables are stationary, then the gap will remain stationary. If any of the exogenous variables posses trends, then this gap will also trend upwards or downwards. As a matter of fact, a positive trend in the profit share will induce an-ever increasing gap between actual and desired capacity utilization - a fact which has not been fully appreciated in the literature.[2]

2.2. The Neo-Kaleckian model with endogenous normal utilization

A common 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, developed by Lavoie (1996, 2004), among others, is based mainly on four equations:

$$\frac{I_t}{K_t} = \gamma + \gamma_u(u_t - u_n) \tag{5}$$

$$\frac{S_t}{K_t} = \frac{s_\pi \pi u_t}{v} \tag{6}$$

$$\dot{u_n} = \mu(u^* - u_n) \tag{7}$$

$$\dot{\gamma} = \rho(g - \gamma) \tag{8}$$

Where $g = \frac{I}{K}$ and γ is the autonomous component of investment (the expected secular rate of accumulation or the expected secular growth rate of sales) (Lavoie, 2004). The last equation can be rewritten in the following way,

$$\dot{\gamma} = \rho[\sigma(u^* - u_n)] \tag{9}$$

If the actual rate of accumulation is greater than the expected rate, then actual capacity will be greater than the 'normal' one, and vice versa. From an empirical standpoint, u will be stationary if and only if the expected rate secular growth of sales does not diverge systematically from the actual rate. Otherwise, actual capacity utilisation might present an increasing

[2]To the best of our knowledge, most Kaleckian responses which accept the divergence argument posit theoretical reasons why a *constant* gap will remain over time in these two variables. We are not aware, however, of theoretical responses which adress the fact that this gap could be ever increasing over time.

stochastic trend[3] if the actual rate of accumulation es greater than the expected rate, and vice versa.[4] Thus, despite solving the divergence present in the baseline Kaleckian model, this extended version still does not restrict the aggregate behavior of capacity utilization.

Finally, we defer to present the Kaleckian model with autonomous expenditures, given that it's structure and empirical implication are fairly similar to those obtained using the Sraffian Supermultiplier. Thus, the next section presents a stochastic version of the Supermultiplier model and traces its empirical implications.

2.3. The Sraffian Supermultiplier

There is no shortage of Post-Keynesian models that generate a stationary capacity utilisation rate.[5] However, as we will show, the supermultiplier model of Serrano (1995) in its current version (Freitas & Serrano, 2015a, 2015b; Serrano & Freitas, 2016) generates a particularly elegant stochastic model. This model[6] is derived from a basic macroeconomic equation, where in equilibrium between aggregate demand and output, which can be represented by the equation below,

$$Y_t = (w + h_t)Y_t + Z_t \tag{10}$$

where Y_t is the current level of aggregate output, w is the given wage share of output, h_t is the marginal propensity to invest of capitalists (or I_t/Y_t) and Z_t is aggregate autonomous consumption. Also $w + h_t$ can be considered the marginal propensity to spend of the economy as a whole.

Given the capital-output ratio $v = K_t/Y_{Kt}$, where Y_{Kt} is the full capacity output and K_t is the level of installed capital stock, then, as usual, we can define capacity utilisation as

[3] Deterministic trends are disregarded because of the lack of economic meaning, but are also plausible from a purely theoretical standpoint.

[4] In recent contributions, Nikiforos (2013,2016) develops microfoundations for this version of the Kaleckian model, where certain assumptions on the cost functions faced by firms guarantee an aggregate equation like (7)

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

[6] In this simple model, it is assumed that the aggregate income is distributed in the form of wages and benefits and that it is mainly determined by historical, political and institutional factors. Added to this, there is only one method of production in use that requires a fixed combination of labour and homogeneous fixed capital that, as a result, generates a single homogeneous output. Natural resources, in this case, are considered abundant, and also constant returns to scale and lack of technical progress are assumed, so the production method does not change. Finally, growth is not constrained by the scarcity of labour force. This assumptions are shared by the canonical Kaleckian model.

$u_t = Y_t/Y_{Kt}$, and its rate of growth as $g_u = g_Y - g_{Kt}$, replacing $g_u = \dot{u}/u_t$ we can say that

$$\dot{u} = u_t(g_t - g_{Kt}) \tag{11}$$

Supposing that $\delta = 0$ and dividing the well-known law of capital accumulation $I_t = \dot{K}$ by K_t we can derive the following equation $\dot{K}/K_t = I_t/K_t = g_{Kt}$, and multiplying and dividing by Y_t and Y_{Kt} (it means that $\frac{I_t}{K_t} = \frac{I_t}{Y_t}\frac{Y_t}{Y_{Kt}}\frac{Y_{Kt}}{K_t}$) we can derive a relationship between capital accumulation, capital-output ratio and utilisation capacity. Under this view, we can arrive to the following reasoning where

$$g_{Kt} = \frac{I_t/Y_t}{v}u_t \tag{12}$$

it means that the rate of capital accumulation is equal to the investment share I_t/Y_t multiplied by the capital-output ratio v and divided by utilisation capacity level u_t.

The marginal propensity to invest, moreover, is endogenous. Changes are explained by forces of competition, what drives the tendency of capacity to adjust to demand. In other words, the tendency of effective utilisation capacity to adjust to its *normal* level. From an economic point of view this can be interpreted following the Professor Steindl (1952); if capacity utilisation is an exogenous and *normal* (or *desired*) position decided by entrepreneurs, it should be guaranteed the existence of sufficiently strong and persistent forces, i.e. competition, that, in the long-run analysis, allows the effective capacity utilisation to return to, or at least to show a tendency towards, its long-run *desired* level. In this sense, the flexible accelerator investment function can be defined as follows,

$$\dot{h}_t = h_t\gamma_u(u_t - u_n) \tag{13}$$

where $\dot{h}$ is the change of investment share of output through time, h_t the investment share of output, γ_u is a parameter between 0 and 1 (in general, a low value), u_t the effective capacity utilisation and u_n the normal one. [7] Taking the time derivatives of Y_t, h_t and Z_t in Equation 1 and dividing both sides by aggregate output level we can say that $g_t = (w+h_t)g_t + \dot{h} + z_t g_Z$. Knowing that $z_t = s - h_t$[8] and introducing Equation 4, finally we can get that

$$g_t = g_Z + \frac{h_t\gamma_u(u_t - u_n)}{s - h_t} \tag{14}$$

[7] Also from Equation 4 and knowing that $I_t/Y_t = h_t$ we can derive the rate of growth of investment $I_t/K_t = g_{It} = g_t + \gamma_u(u_t - u_n)$.

[8] A positive level of autonomous consumption assures an endogenous saving ratio. Moreover, s is given by the exogenous distribution.

Here the rate of growth of aggregate output is driven by autonomous components of effective demand (in this case, autonomous consumption) plus the flexible accelerator investment multiplied by the supermultiplier $1/(s - h_t)$.

To get back on track with the main aim of this paper we have 4 equations and 6 unknowns ($\dot{u}$, u_t, $\dot{h}$, h_t, g_t, g_{Kt}). Replacing Equation (3) and Equation (5) into Equation (2) we have a system of two equations and 4 unknowns ($\dot{u}$, u_t, $\dot{h}$, h_t).

$$\dot{h} = h_t \gamma_u (u_t - u_n) \tag{15}$$

$$\dot{u} = u_t \left(g_Z + \frac{h_t \gamma_u (u_t - u_n)}{s - h_t} - \frac{h_t}{v} u_t\right) \tag{16}$$

In the equilibrium path, we know that $\dot{h} = \dot{u} = 0$ - reaching 2 equations and 2 unknowns -, then $u_t = u_n$ and $g_Z = g_{Kt} = h_t u_t / v$ so we are able to find an expression for the behaviour of the *effective* capacity utilisation rate, u^*:

$$u^* = \frac{v g_Z}{h_t} \tag{17}$$

This will help us to close the presentation of the model in deterministic terms in the next step. Until this moment we have 2 equations ($u_t = u_n$ and $u_t = v g_Z / h_t$) and 2 unknowns (u_t and h_t) so we are able to close the model. But also, here we think that is natural to add a stochastic component in the following way:

$$g_Z = \varepsilon_t \tag{18}$$

where $\varepsilon_t \sim AR(1)$ with a positive constant. In other words, we impose that the growth rate of autonomous consumption is an autoregressive process with mean different from zero.[9] This specification is attractive for a number of reasons; firstly, it allows us to interpret the stochastic parts of the model as aggregate demand shocks, which drive variations (transitory or permanent) in the growth rate of capital. Secondly, it's a fairly general specification in statistical terms, given that g_Z is not imposed to be Gaussian (large shocks can occur from time to time), and allows ARCH or GARCH-type conditional heteroscedasticity. Finally, it will allow to show in a transparent way how the properties of g_Z affect the properties of the utilisation rate. If we log-linearise Equation (7), and replace Equation (8) inside it, we get:

[9] Girardi & Pariboni (2015) found a g_Z between 1,6% and 5,3% for different countries and periods.

$$\log u^* = \log v - \log h + \log \varepsilon_t \tag{19}$$

With this equation in mind, it's clear to see that if ε_t is I(1), then u^* will also be I(1), a random walk. This would imply that a transitory demand shocks, such as an increase in ε_t, would lead to a permanent increase in the utilisation rate, which is what a standard Kaleckian model would imply. However, in our opinion, proponents of the supermultiplier seem to implicitly think that ε_t is I(0), which would in turn implies a stationary u^*, where a transitory demand shock only has transitory effects on the capacity utilisation rate.

At this point, a few remarks are in order. The first one is that g_Z could be generalised to any ARMA(p,q) process without changing the basic fact that u_t inherits the properties of the demand shock. Second, given that our model has two endogenous variables (u_t and h_t), but only one structural shock, this shock cannot be identified yet. However, at this stage, this remains irrelevant to analyse the reduced-form implications of the supermultiplier model. A final remark is that from the Sraffian supermultiplier equilibrium path a balanced growth can be obtained , which implies:

$$g_Z = g_Y = g_C = g_{Kt} \tag{20}$$

Thus, if g_Z is a I(1) variable, as assumed in the baseline Kaleckian model analysed in the following section, then this would imply that the growth rate of output, consumption and capital are also I(1) variables - a result which contradicts massively decades of studies on unit roots since the seminal work of Nelson and Plosser (1982) and Jones (1995). Even more, since the seminal work of King et. al (1987) it has been found that output, consumption and capital all share a stochastic trend, which implies that they are cointegrated. This also implies that the growth rate of all these variables are stationary, and that the balanced growth condition holds in its stochastic version.

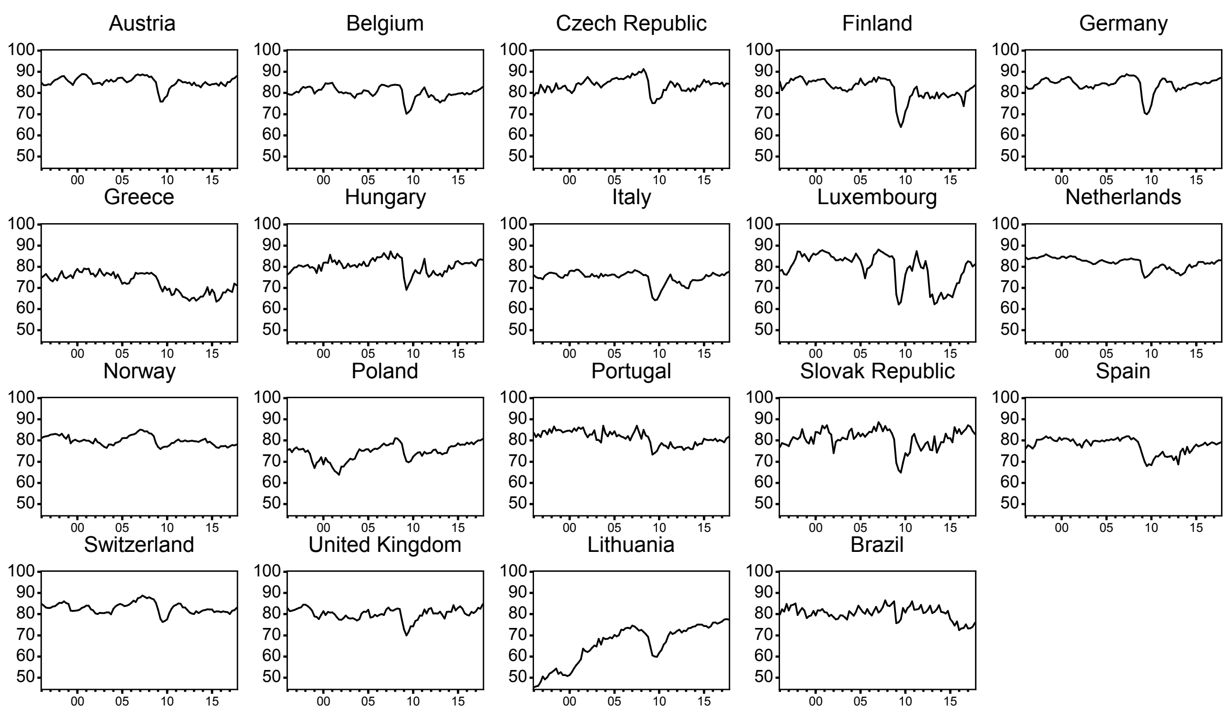
3. Data Sources

In order to test the existence of a unit root in the utilisation rate, we draw data from multiple sources - firstly, we use an OECD database on 19 advanced and semi-industrialised countries to obtain quarterly series on capacity utilisation. Secondly, we draw data from the national statistical agencies of Argentina and Brazil to increase our sample size. All of our data sets are quarterly. Appendix 1 contains details as to how these data are obtained.

Our sample was constructed in the following way. First, we obtained series on capacity utilisation from the OECD's Business Tendency Surveys database (`http://stats.oecd.org`) and national agencies of Argentina (INDEC) and Brazil (BCB). Second, we exclude all series which were constructed in any other units than levels (e.g. some series are constructed asking entrepreneurs whether their utilisation rate is 'above', 'below' or 'around' the normal rate they use, or quite often they have to respond in a 'closed' survey). Third, we remove any seasonal component by applying (X-13ARIMA-SEATS) for the Argentinian case. Fourth, we opt to retain series at quarterly rather than yearly frequencies.

To begin our empirical investigation, we utilise 19 quarterly series as we can see in Figure 1. Given the heterogeneity of their starting dates, we compute 1996Q1 as the starting date for all the countries, in order to compare them visually, until 2017Q4. As it can be seen, the series seem fairly heterogeneous, despite some common features among them, such as strong drop around the global financial crisis.

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



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. These two moments serve as measures of the central tendency and persistence, respectively. Table 1 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 being suggest of 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.

Table 1: Moments of Capacity Utilisation

Country	Mean	Persistence	Time frame
Argentina	71.6%		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
Switzerland	83.6%	0.88	1967Q2-2017Q4
United Kingdom	80.9%	0.87	1985Q1-2017Q4

A final point to take into consideration regards the recent debate on the adequacy of capacity utilisation as built by the FRB - which serves as a mold for most OECD countries' questionnaires - to test the stationarity of capacity utilisation. In a recent paper, Nikiforos (2015) claims that capacity utilisation as constructed by the FED is '...stationary by construction' (p. 2). We have recently commented on our reasons to disregard this claim by said author (Gahn & González, 2018), so we refer to reader to this paper to review the arguments presented there.[10]

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:

$$u_t = \alpha + \sum_{k=j}^{K} \beta_k u_{t-k} + \varepsilon_t \tag{21}$$

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, unlike the Akaike information criteria. Furthermore, it doesn't 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. 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 didn't register a unit root.

After searching for the best AR(p) model, we implement 3 tests: Augmented Dickey-Fuller

[10] The measurement error that Nikiforos claims to be I(1) in the FED series is I(0), and what is measured with error is only the level of the series. Thus, this series is suitable to test the Kaleckian model. Also he does not provide unit root tests for the series he suggests as superior to the FED and all unit root tests we have performed decidedly reject the existence of a unit root on his 3 proposed series, which do not lend support to the Kaleckian model.

(ADF) tests, Phillips-Perron (PP) tests (both with BIC criterion), and Ng-Perron tests (with MAIC criterion). We choose to omit GLS-detrended style tests since these test show serious size distortions in the presence of non-normality (Choi, 2015). All of our series present evidence of non-normality at any conventional significance level, so we opt to choose for tests robust to non-normality. Finally, stationary as the null type tests such as KPSS are not considered, given the serious size distortions that they present when the process under testing is highly persistent (Choi, 2015), as is the case with capacity utilisation.

While it is true that both ADF and PP tests have some power distortions when there is a near-unit root in the AR process, the Ng-Perron test substantially improves the power properties of both tests.

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 poor 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 difficulties to interpret the test if the null is rejected, 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:

$$u_{it} = \alpha_i + \sum_{k=j}^{K} \beta_{ik} u_{i,t-k} + \varepsilon_{it} \tag{22}$$

where the null hypothesis is that all time series are random walks ($H_0 : \beta = 0$) and under the alternative 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. Unfortunately, panel unit root tests have low power and sever size distortions when errors are cross-sectionally correlated (O'Connell, 1998; Maddala & Wu, 1999; Strauss & Yigit, 2003; Banerjee, Marcellino & Osbat (2005); Breitung & Das, 2005; Baltagi & Pesaran, 2007). In case our panel data suffers from cross-sectional dependence, we should go on with the *Second Generation* Unit Root Tests that consider the possibility of Cross-Section Dependence. According to Pesaran (2015), dealing with this Panel's weakness will allow us to analyse the results only in an *informative sense* given that although some techniques have been developed in the recent times, there is still no convenient, simple and robust one to be performed with broad acceptance (Choi, 2015).

On the one hand, when errors are cross-sectionally correlated it is natural to consider SUR or GLS estimation (Choi, 2015). In this sense, we took into account that the test designed by Breitung & Das (2005) is compatible with our data set ($T > N$).[11] These authors, specifically, under a weak error dependence assumption, consider the following autoregressive model,

$$\Delta u_{it} = \alpha_i + \beta_i u_{i,t-k} + \Gamma_i \Delta u_{i,t-k} + \varepsilon_{it} \tag{23}$$

where ε_{it} is a cross-sectionally correlated white noise process. In this case, the *GLS* estimator of β_i is more efficient than the *OLS*.

On the other hand, Pesaran (2007), assuming homogeneous AR processes, works with a cross-section correlated by common factors and performs tests using large T and large N where ε_{iT} from Equation 14 is modified in the following sense

$$\varepsilon_{it} = \gamma_i f_t + \phi_{it} \tag{24}$$

where γ_i is factor-loading coefficient, f_t is the unobserved common factor and ϕ_{it} are idiosyncratic errors. In this case, f_t and ϕ_{it} are white noise processes. Once eliminated the common factor, *First Generation* Unit Root tests can be applied. The main limitation of Pesaran (2007) is that this model imposes homogeneity across cross-sectional units. Finally, the Cross Section Augmented Dickey Fuller (CADF) regression is the next one,

$$\Delta u_{it} = \alpha_i + \beta_i u_{i,t-k} + \Gamma_{0i} \widehat{\Delta u} + \Gamma_{1i} \hat{u} + \varepsilon_{it} \tag{25}$$

where $\widehat{\Delta u}$ is the average of the cross-section difference and $\hat{u}$ is the cross-section average. 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).

[11] It should be noted that the test also has power in the heterogenous case, where the autoregressive coefficients are different across units (Breitung & Das, 2005). Also, we should take into account that this test performs well in the case of weak cross-section dependence.

There exist more tests for unit roots in the common components (i.e. Bai & Ng, 2004; Breitung & Das, 2008; Westerlund & Reese, 2016; among others) but these tests are *likely to require particularly large panels* (Breitung & Pesaran, 2008), are attractive if the number of cross-section units are large compared with the number of time periods (Breitung & Das 2005) and, finally, some authors consider that factor-based methods seem to have considerable limitations, recommending Pesaran (2007) test as a valid factor-based option (Kapetanios, 2007). According to Pesaran, Smith & Yamagata (2013), *if the primary objective of the exercise is to test for unit roots in the observed series, the distinction between the common and idiosyncratic components...is not essential and the panel unit root test can be implemented using the Moon-Perron or Pesaran's set up. The distinction will become relevant if the unit root null hypothesis is not rejected. In that case it would indeed be of interest to investigate further whether the source of the non-stationarity lies with the common factors, the idiosyncratic components, or both.* A similar perspective is adopted by Choi (2015) based on Gengenbach, Palm & Urbain (2009).

Moreover, panel tests for the null of stationary, as we have said previously, have serious size distortions when the null is close to the alternative of a unit root so were discarded; particularly Hadri (2000) perform very poorly in small samples (Pesaran, 2015). For these reasons, we decided to perform Breitung & Das (2005) and Pesaran (2007) tests.

5. Results

5.1. Univariate Results

Our main results for the univariate setting are shown in Table 1. As mentioned before, we select the best AR(p) model with which to conduct our tests using the Hannan-Risannen estimation method. We then use this specifications without deterministic trends to compute the results.

The first two columns report the results of both ADF and PP tests. The statistics shown are p-values. As it can be readily appreciated, both tests allow to reject the null of a unit root at any conventional significance level for 18 out of the 22 countries. Furthermore, for 19 out of 22 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 in-

Table 2: Time Series Unit Root Tests

Country	ADF	PP	N-P
Argentina	0.001	0.001	107
Austria	0.016	0.048	1.5***
Belgium	0.001	0.013	6.1
Brazil	0.095	0.001	6.0
Czech Republic	0.052	0.028	2.6**
Finland	0.010	0.050	1.9**
Germany	0.001	0.001	1.3***
Greece	0.249	0.332	3.9*
Hungary	0.015	0.029	5.5
Indonesia	0.001	0.001	22.1
Ireland	0.001	0.001	24.6
Italy	0.001	0.001	2.6**
Lithuania	0.902	0.838	18.1
Luxembourg	0.019	0.029	1.4***
Netherlands	0.195	0.054	1.6***
Norway	0.015	0.055	14.8
Poland	0.001	0.001	45.8
Portugal	0.072	0.013	3.9*
Slovak Republic	0.015	0.018	10.4
Spain	0.008	0.041	2.8**
Switzerland	0.000	0.002	1.3***
United Kingdom	0.057	0.026	1.4***

Note: *=pval<0.1, **=pval<0.05, ***=pval<0.01

consistency between the baseline Neo-Kaleckian model and the data.

The third column shows the results of Ng-Perron tests. This test improves on the size properties of both ADF and PP tests, conditional on the existence of a large unit root on the MA part of the univariate process. This test presents somewhat mixed evidence, with 12 out of the 22 counties rejecting the unit root hypothesis at the 10% level at least. However, as mentioned, given that the moving average component was far below a negative unit root, our preferred specification relies on both ADF and PP tests.

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 (see Table 3).[12]

Table 3: Cross-Section Dependence Test

Test	Statistic	Prob.
Breusch-Pagan LM	4943.50	0.0001
Pesaran scaled LM	258.06	0.0001
Bias-corrected scaled LM	257.95	0.0001
Pesaran CD	58.09	0.0001

Observations: 1672 (N=19 - T=88)

According to the tests performed, under the lens of the *Second Generation* Unit Root Panel Data techniques, a significant fraction of the cross-section units is stationary (see Table 4), a thesis which is suggested directly by an unprejudiced observation of the facts. Breitung & Das (2005) and Pesaran (2007) reject strongly the null hypothesis that all series contain a unit root and homogeneous non-stationary processes, respectively, in panel data series of capacity utilisation.[13]

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

[13] The Breitung & Das (2005) test was performed with 5 lags according to the AIC criterion - in differences. The Pesaran (2007) lag length criterion was decided according to General to Particular Methodology based on F joint test, following CIPS's designed by Máximo Sangiácomo (Burdisso & Sangiácomo, 2016a, 2016b).

Table 4: Panel Unit Root Tests

Test	Statistic	Prob.
Breitung & Das (2005)	-3.38	0.0004
Pesaran (2007)	-2.91	< 0.01

Observations: 1672 (N=19 - T=88).

6. Conclusion

In the baseline Neo-Kaleckian model, which has rapidly established itself as the workhorse of Post-Keynesian economics, transitory demand shocks have permanent effects on the level of capacity utilisation and on the growth rate of capital accumulation. However, the impossibility of this model to explain a long-run stationary capacity utilisation was recently put deeply under debate at a theoretical level.

Moreover, at an empirical level, besides some recent contributions aforementioned, *the empirical evidence on this* [convergence or gravitation towards a normal rate of utilisation] *is not clear-cut* (Lavoie, 2016) and no wide range research on this topic has been done previously. Our paper is the first one to systematically investigate this claim empirically using a rich cross-country dataset which includes 22 developed and developing countries.

To arrive to our testable reduced form equations we applied, theoretically, stochastic shocks to the neo-Kaleckian and to the supermultiplier growth models. We then proceed to show how the debate empirically boils down to the order of integration of capacity utilisation. The results of both univariate and panel unit root tests overwhelmingly reject the existence of a unit root in the level of capacity utilisation, casting doubt on the usefulness of the Neo-Kaleckian model - at least on its simple and well-known version.

7. Bibliography

Allain, O. (2014). 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. (1986). The role of capacity utilization in long-period analysis. Political Economy, 2(2), 147-160.

Baltagi, B. H., & Hashem Pesaran, M. (2007). Heterogeneity and cross section dependence in panel data models: theory and applications introduction. Journal of Applied Econometrics, 22(2), 229-232.

Banerjee, A., Marcellino, M., & Osbat, C. (2005). Testing for PPP: Should we use panel methods?. Empirical Economics, 30(1), 77-91.

Barba, A., & Pivetti, M. (2008). Rising household debt: Its causes and macroeconomic implicationsa long-period analysis. Cambridge Journal of Economics, 33(1), 113-137.

Breitung, J., & Das, S. (2005). Panel unit root tests under crosssectional dependence. Statistica Neerlandica, 59(4), 414-433.

Breitung, J., & Das, S. (2008). Testing for unit roots in panels with a factor structure. Econometric Theory, 24(1), 88-108.

Breitung, J., & Pesaran, M. H. (2008). Unit roots and cointegration in panels. In The econometrics of panel data (pp. 279-322). Springer, Berlin, Heidelberg.

Burdisso, T., & Sangiacomo, M. (2016). Panel time series: Review of the methodological evolution. Stata Journal, 16(2), 424-442.

Burdisso, T., & Sangicomo, M. (2016). Panel times series. A review of methodological developments. Ensayos Econmicos, 1(74), 105-131.

Choi, I. (2015). Almost all about unit roots: Foundations, developments, and applications. Cambridge University Press.

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

Dumnil, G., & Levy, D. (1995). A Post-Keynesian Long-Term Equilibrium with Equalized Profit Rates? A Rejoinder to Amitava Dutts Synthesis. Review of Radical Political Economics, 27(2), 135-141.

Dumnil, G., & Lvy, D. (1999). Being Keynesian in the short term and classical in the long term: The traverse to classical longterm equilibrium. The Manchester School, 67(6), 684-716.

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.

Fiebiger, B.,& Lavoie, M. (2017). Trend and business cycles with external markets: Noncapacity generating semiautonomous expenditures and effective demand. Metroeconomica.

Freitas, F., & Serrano, F. (2015). Growth, distribution and effective demand: the supermultiplier growth model alternative'. mimeo, IE/UFRJ.

Freitas, F., & Serrano, F. (2015b). 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 C., A. (2018). On the 'utilisation controversy': a comment. mimeo.

Gengenbach, C., Palm, F. C., & Urbain, J. P. (2009). Panel unit root tests in the presence of cross-sectional dependencies: Comparison and implications for modelling. Econometric Reviews, 29(2), 111-145.

Girardi, D., & Pariboni, R. (2015). Autonomous demand and economic growth: some empirical evidence. Centro Sraffa Working Papers, 13.

Hadri, K. (2000). Testing for stationarity in heterogeneous panel data. The Econometrics

Journal, 3(2), 148-161.

Hein, E., Lavoie, M., & van Treeck, T. (2010). 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 rateof capacity utilization in Kaleckian models of distribution and growtha survey. Metroeconomica, 63(1), 139-169.

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

Jones, C. I. (1995). Time series tests of endogenous growth models. The Quarterly Journal of Economics, 110(2), 495-525.

Jones, C. I. (2015). Pareto and Piketty: The macroeconomics of top income and wealth inequality. Journal of Economic Perspectives, 29(1), 29-46.

Kapetanios, G. (2007). Dynamic factor extraction of crosssectional dependence in panel unit root tests. Journal of Applied Econometrics, 22(2), 313-338.

King, R., Plosser, C. I., Stock, J. H., & Watson, M. W. (1987). Stochastic trends and economic fluctuations.

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

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

Maddala, G. S., & Wu, S. (1999). A comparative study of unit root tests with panel data and a new simple test. Oxford Bulletin of Economics and statistics, 61(S1), 631-652.

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. (2015). 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.

O'Connell, P. G. (1998). The overvaluation of purchasing power parity. Journal of international economics, 44(1), 1-19.

Pesaran, M. H. (2007). A simple panel unit root test in the presence of crosssection dependence. Journal of applied econometrics, 22(2), 265-312.

Pesaran, M. H., Smith, L. V., & Yamagata, T. (2013). Panel unit root tests in the presence of a multifactor error structure. Journal of Econometrics, 175(2), 94-115.

Pesaran, M. H. (2015). Time series and panel data econometrics. Oxford University Press.

Piketty, T. (2015). About capital in the twenty-first century. American Economic Review, 105(5), 48-53.

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

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.

Schoder, C. (2017). Estimating Keynesian models of business fluctuations using Bayesian Maximum Likelihood. Review of Keynesian Economics, 5(4), 586-630.

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

Serrano, F., & Freitas, F. (2016). The Sraffian supermultiplier as an alternative closure for heterodox growth theory. European Journal of Economics and Economic Policies, 14(1), 70-91.

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

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.

Stirati, A. (2013). Alternative Closures to Sraffas System: Some Reflections in the Light of the Changes in Functional Income Distribution in the United States. In Sraffa and the Reconstruction of Economic Theory: Volume One (pp. 192-217). Palgrave Macmillan, London.

Stock, J. H., & Watson, M. W. (1998). Business cycle fluctuations in US macroeconomic time series (No. w6528). National Bureau of Economic Research.

Stockhammer, E. (2017). Determinants of the wage share: A panel analysis of advanced and developing economies. British Journal of Industrial Relations, 55(1), 3-33.

Strauss, J., & Yigit, T. (2003). Shortfalls of panel unit root testing. Economics Letters, 81(3), 309-313.

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

Appendix A. Details on data sources

A.1. National Surveys

Firstly, 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 serie 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 possible, including the maintenance necessary, is taken into account.*

- France: *Your company currently operates at % 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 rate is the current one being used your factory capacity rate %(100% utilization of the factory potential corresponds to the point where it does not you can further 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 utilization of capital, near 168 hours per day as possible). The definition is quite similar to US's National Emergency one.

b. Those countries such as Germany, Ireland, Italy, Poland, Slovak, Denmark, Stonia, Croatia, Cyprus, Latvia, Malta, Colombia, Albania, Macedonia and Serbia 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 utilization means a desirable utilisation rate of the company's production equipment (buildings, facilities, machinery, equipment, etc.), and not the maximum utilization.*

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; 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, what is fully related with the aim of this paper. 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 given that we are not keen on defining the level of capacity utilisation, but on its long-run behaviour.