Activity levels and the flexibility of capacity utilisation in the US economy

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(Very preliminary draft. Please do not quote nor circulate it)

A key feature of the baseline Neo-Kaleckian model is that the equilibrium degree of capacity utilisation can permanently diverge from the desired or normal one. Within this framework, this also implies that, if a shock hits the economy, the degree of capacity utilisation is permanently affected. In this article, we frame this discussion in terms of the relationship between the level of economic activity and the ensuing utilisation of the existing capacity. In order to assess the effect of the former on the latter and to provide a robust and clear picture of this phenomenon, we estimate three different models, based on monthly data provided by the Federal Reserve Bank of St. Louis. In the first one, we consider the industrial production index and utilisation; in the second model, following the suggestion of Blanchard and Quah (1989) and Pagan and Pesaran (2008), we identify the demand shock through the unemployment rate. Finally, in the third model we employ the level of employment for the identification of the shock. Structural VAR methodology is used to estimate the three models. After having presented our empirical results, which point to an exclusively temporary nature of the effects of shocks to the activity level on capacity utilisation, we verify their compatibility with the Neo-Kaleckian model and other theoretical constructions, with the purpose of assessing which one fares better in terms of consistency with the econometric evidence. We conclude that, while the main results of the Neo-Kaleckian model cannot be reconciled with the postulated no long-run effects of demand shocks on capacity utilisation, on the other hand alternative models – such as those in the line of the Sraffian Supermultiplier – seem to provide a more appropriate analytical tool for the analysis of the demand-capacity utilisation relationship.

Keywords: Capacity Utilization, Normal Rate of Utilization, Neo-Kaleckian model, Economic Growth

JEL Codes: B50, E11, E12, E22

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1. Introduction

From some recent (and not so recent) contributions it is easy to recognize that there is no general agreement on the whole process of adjustment of capacity to output. Although there is an accordance on the direction of the adjustment from the latter to the former in non-orthodox literature - following the Keynesian Hypothesis - there are still some open discussions that needs profound clarification. One of these aspects is the process of adjustment of capacity (and also the adjustment of the *level* of utilisation) to aggregate demand.

After introducing a brief discussion, among Sraffian and Neo-Kaleckian authors, on the notion of Fully Adjusted Situations, the main objective of this paper is to perform an empirical exercise to analyse the response of the *level* of capacity utilisation to a change in the *level* of output. Given our results are robust even under different specifications, we will analyse the compatibility of the latter with some widely-known growth models. Although we are conscious that good theory cannot be replaced by an empirical exercise; the former should not be built outside *stylized facts*. Particularly, we will try to convince the reader that our results are difficult to grasp for at least three – out of four - different versions of the Neo-Kaleckian model: The *endogeneity* of the *level* of capacity utilisation is putted under a ferrous examination.

2. Sraffian and Neo-Kaleckian controversies on capacity utilisation

2.1. FAS and the Sraffian response

It could be claimed that the analytical debate between Sraffians and Kaleckians authors on the *flexibility* and *convergenc*e towards *normal* capacity utilization started during the '80s in many interventions published in *Political Economy: Studies in the Surplus Approach*. The philosopher's stone had been discovered by Fernando Vianello (1985): He developed, under a Classical-Keynesian framework (a latter-day term), the notion of Fully Adjusted Situations (FAS, hereafter) ``situations in which a uniform rate of profits prevails, and the productive capacity installed in each industry is exactly sufficient to produce the quantities that the market absorbs when commodities are sold at their natural prices'' (Vianello, 1985, pp. 70). During the process of adjustment from one FAS to another one with a higher level of output, Vianello claims that ``a temporary over-utilisation of productive capacity is require in order to bridge the gap between the moment in which *normal* utilization turns out to be insufficient to meet the demand, and the moment in which *productive capacity* has fully adjusted'' (Vianello, 1985, p. 72, emphasis added in *italics*). As a conclusion, changes in the level of real output do not involve changes in the *normal* degree of utilisation of productive capacity but rather changes in the *productive capacity* installed.[4] Despite his very first intuitions, Vianello did not develop an analytical model able to explain the whole process of adjustment from changes in output to changes in capacity; something that would be done many years later.

The notion of FAS, after Vianello (1985), was severely criticized on theoretical grounds by Sraffians and Neo-Kaleckians. The critique from Sraffian grounds was related to the fact that the FAS were such a particular case of the long-period positions and could not be general enough (Ciccone, 1986; Committeri, 1986). On the one hand, Committeri claimed that the process of adjustment was left unspecified and could not be taken to represent the *average* rate of accumulation, then a FAS was

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

devoid of any practical relevance for the study of long-run tendencies (ibid., pp. 177-178). On the other hand, Ciccone argued that Vianello's argument was itself founded on the *rigidity* of the degree of utilisation of capacity in the long period and the idea by which it must necessarily be considered as given did not appear well-founded (ibid., p. 24).[5] Although their profound critiques, the *tendency* of capacity to adjust to output was not even denied by these scholars (Ciccone, 1986; Garegnani, 1992; Park, 1997; Trezzini, 1995; Trezzini, 1998c).[6]

From the Neo-Kaleckian side, Amadeo (1986a) presented a model in which, even under a FAS, the effective capacity utilisation could differ from the *normal* one, neglecting any tendency by which the former could adjust towards the latter; added to this, he introduced the idea by which the latter could adjust to the former, endogenising the *normal* rate: ``one may argue that if the equilibrium degree is systematically different from the planned degree of utilization, entrepreneurs will eventually revise their plans, thus altering the planned degree'' (Amadeo, 1986a, p. 155) but he did not assert any rational mechanism of adjustment, leaving the effective (and the *normal*) level of capacity utilisation as a *free* variable. The Neo-Kaleckian model have been suffering from different modifications since the '80s. In the next subsection, we will present four generations of Neo-Kaleckian models and their implications on aggregate demand growth and *levels* of capacity utilisation.

2.2.1. The Neo-Kaleckian reaction: First generation

The notion of FAS in which effective utilisation capacity adjusts perfectly *towards* the *normal* rate, given that capacity is what adjusts in the long run, was difficult to process for some Neo-Kaleckian scholars. The Neo-Kaleckian model was under attack on at least one ground. The argument was clear: First, is there a *tendency* to produce under (exogenous) *normal* conditions constantly operating? If the answer is yes, therefore the baseline Neo-Kaleckian model, in which effective and *normal* utilization might coincide only by a fluke, was lacking economic rationale. In fact, the response given by Edward J. Amadeo (1986) had as its main objective the critical discussion of Vianello (1985) and Ciccone (1986), given that both works, following the Classical-Keynesian tradition (Garegnani, 1962), denied the existence of a tradeoff between accumulation and distribution in the long-run. The model developed by Amadeo, following the Neo-Kaleckian tradition (Rowthorn, 1981; Taylor, 1983; Dutt, 1984), consisted on two equations (own notation),

$$g^s = \pi u$$

$$g^i = \alpha + \beta(u - u_n)$$

where g^s is savings normalized by capital stock, π is the profit share and u is the level of effective capacity utilisation. On the other hand, g^i is the rate of capital accumulation, α stands or ``animal spirits'', β measures the speed of adjustment of investment to changes in capacity utilisation and

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[5] Through time, the position of Fernando Vianello becomes the Second Sraffian Position and those that are critical of FAS became the First Sraffian Position, a classification borrowed from Professor Cesaratto (2015). In fact, Vianello finally changed his position in favour of a *non-complet*e adjustment (Vianello, 1989), in line with the First Sraffian Position. See Serrano and Moreira (2018) on this.

[6] In general, the critiques are related to the fact that the process of adjustment of capacity to output is not mechanical and, given that it is full of contingencies, it is by far complex enough to be formalised. See Trezzini (2011a), Trezzini (2013), Trezzini and Palumbo (2016) and Trezzini (2017) on this view.

u_n is the `normal' level of capacity utilisation. As we have previously said, in equilibrium, given that investment equals savings,

$$u = \frac{\alpha - \beta u_n}{\pi - \beta}$$

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

Let us suppose that we start from a FAS in which $u = u_n$ and there is an exogenous positive change in the *level* of *animal spirits* α, the level of effective capacity utilisation will increase *una tantum* and there is no mechanism that ensures a return towards the normal level. Under this circumstance, the economic rationale of the model is undermined: If that particular level of *normal* utilisation is chosen in order to minimize costs in the long-run, why capitalists would have no incentive to achieve that level in the FAS? Rephrasing, why capitalists would have no incentive to *tend* toward that particular level that was chosen previously?

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

2.2.2. Second generation

The baseline model suffered from many modifications. The first one, based also on Amadeo (1986), was developed in Lavoie (1992, 1995, 1996), Lavoie et al. (2004), Cassetti (2006) and Hein et al. (2012), among others. Based on the phrase of Amadeo (see 2.1.), the system of equations now consists on,

$$g^s = \pi u$$

$$g^i = \alpha + \beta(u - u_n)$$

$$\dot{\alpha} = \psi(g^* - \alpha)$$

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

This model is profoundly formalized by Lavoie in the abovementioned papers. The main conclusions are that, first, it still maintains a relationship between distribution's *levels* and *growth* effects, and secondly the model includes a FAS in which $u = u_n$. However, the mechanism that allows the equalization between the effective and the normal utilisation in the long run reverses the original logical causality of Vianello (1985) and follows the crystal-clear causality of Amadeo (1986).

2.2.3. Third generation

After the appearance of the introduction of `autonomous componentes' of aggregate demand in the non-orthodox literature, some authors (Allain, 2015; Pariboni, 2015; Lavoie, 2016) have introduced autonomous components of aggregate demand in a standard Neo-Kaleckian model, that consists on the following equations,

$$g^s = \pi u - \frac{Z}{K}$$

$$g^i = \alpha + \beta(u - u_n)$$

This model implies a similar behavior of that of the Sraffian Supermultiplier (Monza, 1976; Bortis, 1979, 1983; Serrano, 1995, among others) that we will analyse later.

2.2.4. Fourth generation

Recently, some authors (e.g., Nah and Lavoie, 2018) have introduced autonomous components with and adjustment in the last version of the model presented here as it follows,[7]

$$g^s = \pi u - \frac{Z}{K}$$

$$g^i = \alpha + \beta(u - u_n)$$

$$\dot{\alpha} = \psi(g^* - \alpha)$$

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

$$\dot{z} = g_z - g^*$$

In this version, the mechanism that allows the equalization between the effective and the *normal* utilisation in the long run remains being the reverse. The point is that the introduction of and ad-hoc FAS or a combination of an ad-hoc FAS with autonomous components is not a sufficient condition to have a tendency from effective utilisation towards a *normal* rate.

It should be noticed that, although in this contribution we limited ourselves to discuss the Neo-Kaleckian and Sraffian controversies on capacity utilisation, our findings are by far compatible with a wide range of models.

2.2.5. The Sraffian Supermultiplier

Although some scholars are still reluctant to it, the Sraffian Supermultiplier is, step by step, situating itself as a workhorse of Post-Keynesian economics. The model was originally developed by Serrano

[7] Here we are presenting our version.

(1995a, 1995b), following Garegnani's (1962) Sraffian Project (Serrano and Moreira, 2018). The authors have recently developed the whole dynamics of the model (Serrano and Freitas; Freitas and Serrano, 2017; Serrano, Freitas and Behring) recovering the FAS developed by Vianello (1985), not only in the logical sphere as some Neo-Kaleckian models recently shown do, but also taking care of the causalities between effective and *normal*[8] [9]utilisation and of the *level* effects of changes on distribution.

3. On the empirical evidence

Not surprisingly, there are fewer attempts in the empirical literature to analyse the interaction between aggregate demand *growth* (or *levels*) and capacity utilisation and the latter's behavior through time. On the one hand, from a traditional perspective, for instance, Shapiro (1989, p. 193), on a critical paper to the FRB's measures of capacity utilisation, presents OLS regressions of the *growth rate* of capacity utilisation (ΔCU) on a constant and the *growth rate* of industrial production (ΔIP) for various industries; the *growth* rate in production explains virtually all of the month-to-month changes in utilisation. Finn (1995) introduces only a correlation between capacity utilization and cyclical per-capita industrial production equal to 0.82. Driver (2000) shows how aggregate utilisation capacity, as a *proxy* of economic cycle, impacts positively on firm's utilisation. Bansak, Morin & Starr (2007), while analysing empirically potential determinants of capacity utilisation level, include *growth rate* of industrial production index (ΔIP), the investment-capital ratio (I/K) and the standard deviation of industrial production index to capture effects on utilisation of *output growth*, investment *level*, and output volatility, respectively; to accommodate the panel aspect of the data they ran their model using both fixed and random effects and, after that, GMM estimator proposed by Arellano and Bond (1991); the rate of growth of industrial production impacts positively on capacity utilisation in all their estimates but the GMM estimations.

On the other hand, from a Neo-Kaleckian and/or Sraffian perspective, Schoder (2012), who analyses both aggregate data and sectoral panel data through state-space modeling approach and the Kalman filter, rejects the null hypotheses of no endogenous adjustments of capacity utilisation. Moreover, Schoder (2014) using Cointegrated Vector Auto-Regression analysis, provide evidence that production capacities adjust endogenously to current output in the long run for the US manufacturing sector. Finally, Nikiforos (2015) presents evidence, as Braga (2006), on the stationarity of FRB's measures on capacity utilisation but he severely criticises the construction of this time series; after that, he develops a theoretical model in which normal capacity utilisation at a micro and macro level is endogenous and he presents some empirical evidence using ARDL methodology as a proof of his claim.[10]

In this paper, we will try to assess the impact of a *level* of output on the *level* of capacity utilisation. First, although there was a lively theoretical debate on the notion of FAS, no tests were performed on this. Second, as we mentioned above, some empirical evidence has been developed on the

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[8] On the notion of *normal* utilisation as a *standard volume* at a firm level see Lanzillotti (1958, p. 923, fn. 5 and p. 929; 1959) for the case of twenty industrial corporations or Johnson (1978) for the case of General Motors in the '20s. [This cite should not be here, but I think that the idea of "standard volume" will help us to say that we have some convergence towards "something".]

[9] It must be noticed that our independent variable – output – was only adjusted by seasonal fluctuations, therefore, the data appears to include also the phenomenon of *irregular* fluctuations of aggregate demand and output.

[10] For a theoretical and empirical critique of Nikiforos' approach see Girardi and Pariboni (2019) and Gahn and González (forthcoming). For stationarity in capacity utilisation in other countries see Gahn and González (2018) and Gallo (2019).

relationship between output and utilisation, but any of it is explicitly treating this issue in *levels*. For these reasons, our empirical results will try to show the possibility of a concrete Fully Adjusted Situation explicitly sizing not only the *direction* but the *speed* of adjustment of the *level* of capacity utilisation to a persistent *level* shock of aggregate demand, in other words, implicitly the *direction* and the *speed* of adjustment of productive capacity's *level* to an aggregate demand's *level* shock. Broadly speaking, we will introduce an empirical assessment of the *direction* and *speed* of adjustment from a FAS to another one.

4. Data, methods and the identification strategy

4.1. Data

The econometric analysis carried out in this paper is based on monthly data provided by the Federal Reserve Bank of St. Louis (FRED) and concerns US countries. We make use of the industrial production index (Y), the total number of employees (E), the unemployment rates (Un) and the degree of capacity utilisation (U). All time series considered are seasonally adjusted and start from January 1948 and end in February 2019. All considered variables – excluding Un – are transformed in logarithm form. All the considered variables are summarised in Appendix A.

In order to assess the effect of economic activity on the degree of capacity utilization and to provide a robust and clear picture of this phenomenon, we will estimate three different models. In the first one, we will consider Y and U where the industrial production index Y will allow us to determine a demand shock (Fry and Pagan, 2011); in the second model (Model 2), following the suggestion of Blanchard and Quah (1989) and Pagan and Pesaran (2008), the demand shock will be identified through the use of the unemployment rate (Un). Finally, in the third model (Model 3), we will employ the level employment (E) for the identification of a demand shock. In the present paper, the following three models will be estimated:

Model 1: $\mathrm{Y} - \mathrm{U}$

Model 2: $\mathrm{E} - \mathrm{U}$

Model 3: $\mathrm{Un} - \mathrm{U}$

3.2. Methods and the identification strategy

In this paper, structural VAR (SVAR) methodology is used to estimate Model 1 to 3. To estimate a SVAR model, a reduced-form VAR(p), shown in equation (3), has to be estimated:

$$y_t = c + \sum_{i=1}^{p} A_i\, y_{t-p} + u_t \quad (3)$$

where y_t is the $k\ x\ 1$ vector of considered variables, c is the constant term, A_i is the $k\ x\ k$ matrix of reduced-form coefficients and $\mathrm{u_t}$ is a $k\ x\ 1$ vector composed by the error terms. The lag P of the VAR will be calculated through the Akaike Information Criterion (AIC). We will also check the stationarity of the VAR(p) by assessing whether the *inverse* roots of the characteristic polynomial lie inside the unit circle. Furthermore, all considered VAR and SVAR models will be estimated both with and without the deterministic trend.

In order to obtain a SVAR, an identification strategy has to be imposed to the reduced-form VAR(p) (equation 3). More precisely, a SVAR(p) can be represented as follows in equation (4):

$$B_0 y_t = c + \sum_{i=1}^{p} B_i\, y_{t-p} + w_t \ (4)$$

where B_0 represents the matrix of contemporaneous relationships between the k variables in y_t, $\mathrm{B_i}$ is the $k\ x\ k$ matrix of autoregressive slope coefficients, and w_t is the vector of serially uncorrelated structural shocks (Kilian and Lütkepohl, 2017).[11] Once zero short-run restrictions are imposed in $\mathrm{B_0}$ and the SVAR is estimated, impulse response functions (IRFs) are calculated. Standard errors will be estimated through the Monte Carlo methods (1000 repetitions) and IRFs will be reported with two-standard error bound, namely a 95% confidence interval.

In all considered models (from Model 1 to 3), a Cholesky factorisation is assumed and variables able to capture demand shocks (Y, E, and Un) are ordered first, whereas the degree of capacity utilization (U) is ordered as the last variable. In other words, we are assuming that changes in the level of demand affect the degree of capacity utilisation within the monthly observation, while exogenous changes in the degree of capacity (e.g., technical progress) do influence neither output nor employment within the month.

In summary, we will estimate three models where variables are ordered as follows: (i) $[\mathrm{Y_t}, \mathrm{U_t}]$ (Model 1); $[\mathrm{E_t}, \mathrm{U_t}]$ (Model 2); and $[\mathrm{Un_t}, \mathrm{U_t}]$ (Model 3); In sections 4, we will report the impulse response functions (IRFs) related to the effect produced by demand shocks on the degree of capacity utilization U. Additionally, in order to assess the feasible process of convergence toward a normal degree of capacity, we will estimate the 'cumulate effect' (Spilimbergo et al., 2009), namely the ratio between the response of U to alternative impulses, namely the alternative measures employed for the identification of a demand shock. This will allow us to show the average dynamics of the degree of capacity utilization U determined by a permanent unit change in the level of demand.[12]

5. Findings

The first results concern the lag selection, the coefficients of the deterministic trend, and the stability of the estimated VAR models. Our findings on the lag selection are reported in Appendix B (Table B1) and show that the optimum Lags are: 12 in Model 1; 6 in Model 2; and 12 in Model 3. The coefficients of the deterministic trend are reported in Appendix C (Table C1). Findings show that the deterministic trend is significant, at least in one of the equations of the estimated VAR models, in Models 2 and 3. Conversely, the deterministic trend is found to be not significant in Model 1. When we look at the stability of the estimated VAR models, the unit circle shows that estimated VAR are stationary and stable. Findings are reported in Appendix D. Finally, despite estimated models are found to be stationary and stable, Model 1 and 2 are also estimated by using the first differences of Y and E. Specifically, Y and E have a unit-root and the first differences allow us to have I(0) variables. On the contrary, Un and U are stationary variables and will be used at levels without using the first difference operator. The unit root tests are reported in appendix E (Table E1) while findings of Models with I(0) variables are reported in appendix F.

The considered models allow us to isolate exogenous demand shocks which are approximated by: Y in Model 1; E in Model 2; and Un in Model 3. In the Figures below, we report the effect of demand shocks on the degree of capacity utilization U. We report both the estimations with and

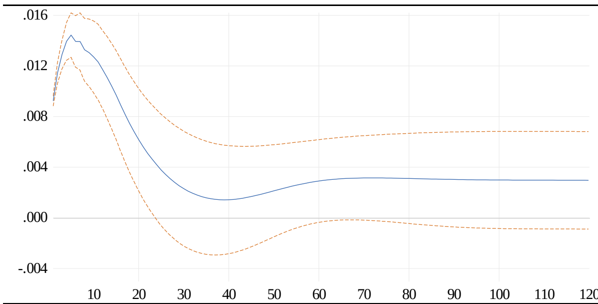
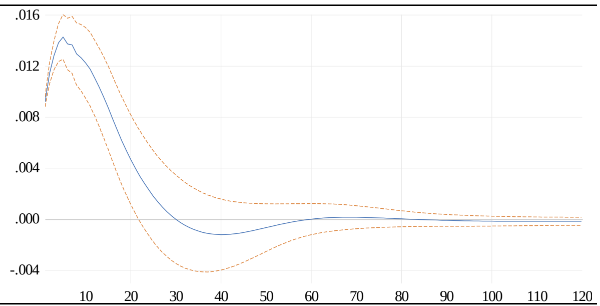
[11] The covariance matrix of structural errors is normalised: $\mathbb{E}(\mathrm{w_t w_t'}) = \sum_{\mathrm{w}} = \mathrm{I_K}$ (Lütkepohl, 2005).

[12] It is worthy to clarify the difference between the IRFs and the so-called 'cumulative effect'. The IRFs shows the dynamic effect at some horizon of the response variable after to an initial shock which can accompanied by a persistent dynamic over time. The 'cumulative effect' represents the response of U to a permanent unitary change in the level of demand (Spilimbergo et al., 2009).

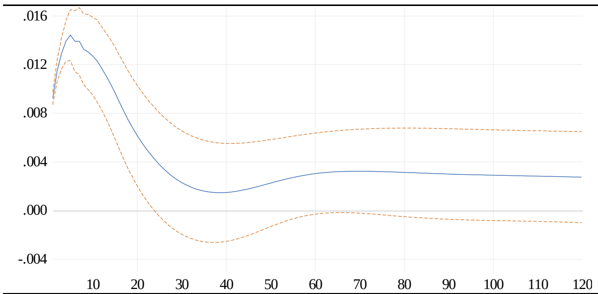
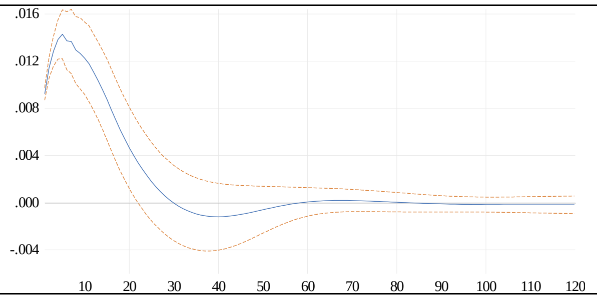
without the determinist trend as well as by considering both the all timespan (i.e., 1948:01-2019:02 period) and the pre-crisis period (i.e., 1948:01-2007:12 period). In this paper, we report both the impulse response functions (IRFs) as well as the 'cumulative effect' produced by a demand shock on degree of capacity utilization.

As shows in the left quadrants of Figures 1 to 3 (with and without trend and for all considered samples), demand shocks are usually accompanied by a persistent dynamic, which implies that an initial increase in demand builds up over time, stabilizing on a non-zero level. In this way, we are able to detect the effect of a permanent change the level of demand on the level of the degree of capacity utilization U. Specifically, when we look at the effect of permanent demand shocks on U in the right quadrants of Figure 1 to 3, IRFs show that U tends to increase as soon as demand increase but it tends to converge to zero approximately after 30 months that the demand shock occurs. Additionally, U stabilises at zero in the long period, namely after sixty months. The process of stabilization of U to zero is similar in all considered models. The inclusion of the trend in all models – which could capture technical progress as well as the increase in the population – do not alter the final picture: permanent demand shocks produce transitory effects on the degree of capacity utilization U.

Model 1 – Without trend (1948-2019)

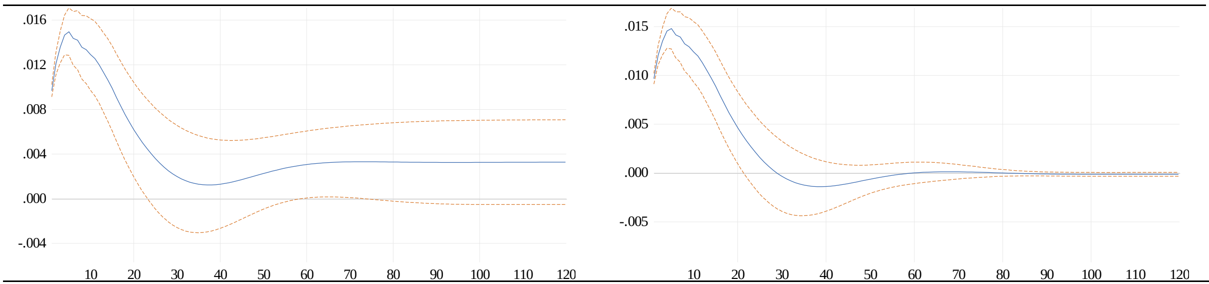
Y → Y	Y → U
	

Model 1 – With trend (1948-2019)

Y → Y	Y → U
	

Model 1 – Without trend (1948-2007)

Y → Y	Y → U



Model 1 – With trend (1948-2007)	
Y → Y	Y → U

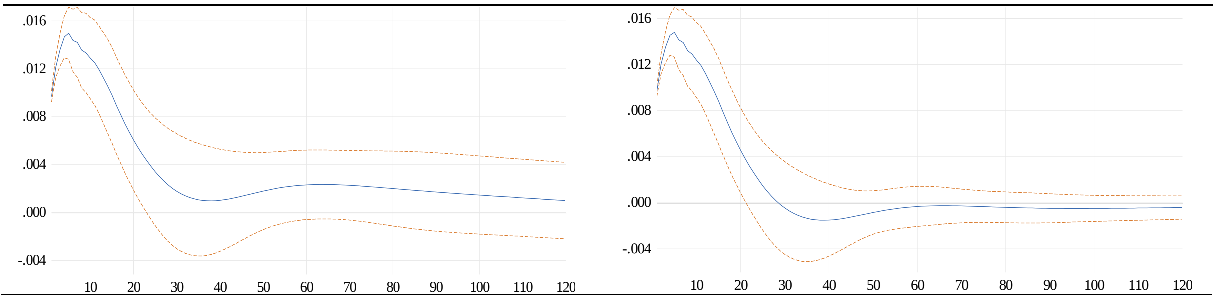
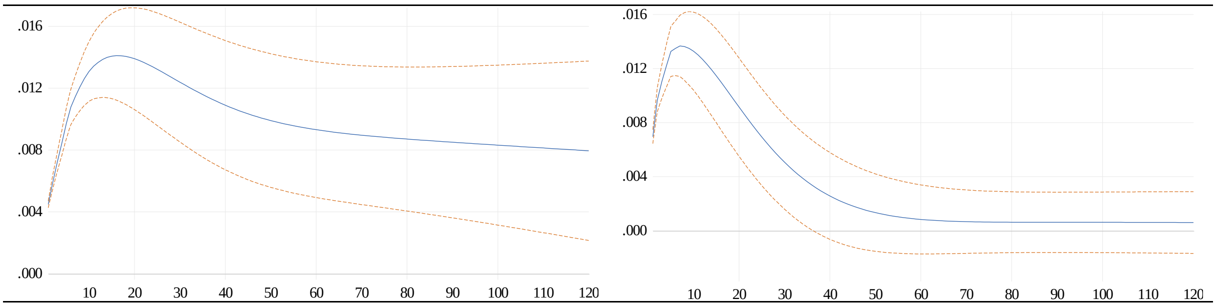
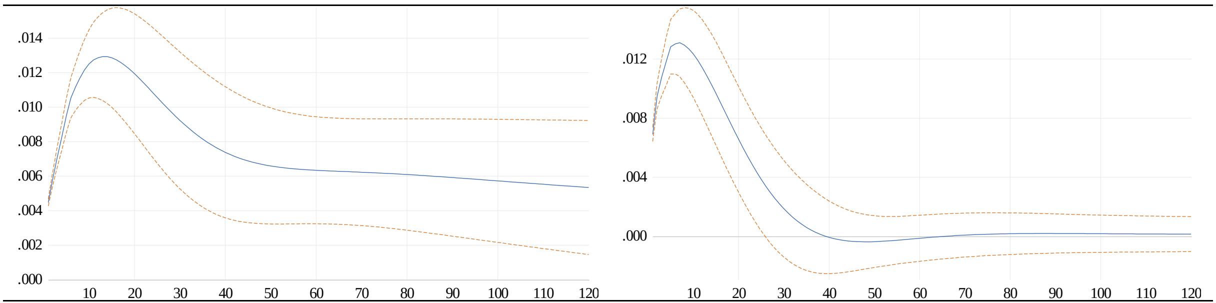


Figure 1. Non-accumulated Impulse Response Functions (IRFs) – Model 1. Y: demand shock, left quadrant. U: response of the degree of capacity utilization, right quadrant. Identification based on zero restrictions Cholesky factorisation. Solid lines are point estimates and dotted lines are the computed error bands. 95% confidence interval bands estimated through a Monte Carlo procedure (1000 repetitions).

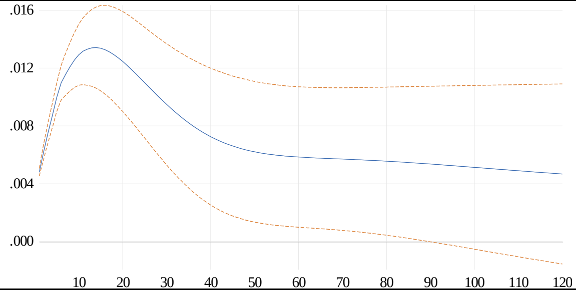
Model 2 – Without trend (1948-2019)	
E → E	E → U

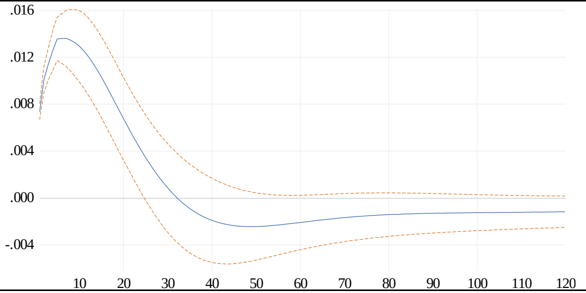


Model 2 – With trend (1948-2019)	
E → E	E → U



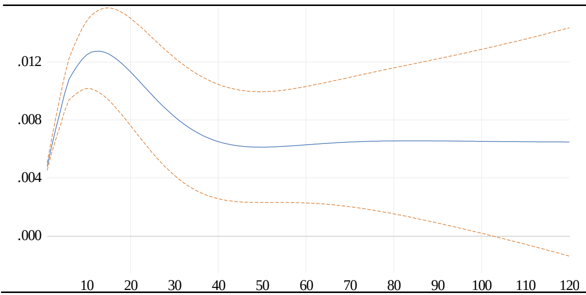
Model 2 – Without trend (1948-2007)	
E → E	E → U





Model 2 – With trend (1948-2007)

E → E | E → U



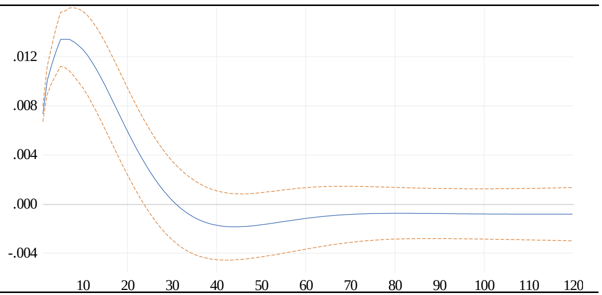
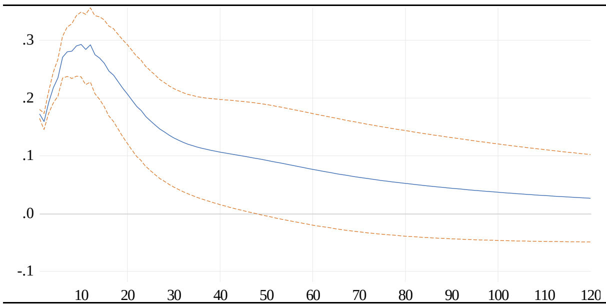
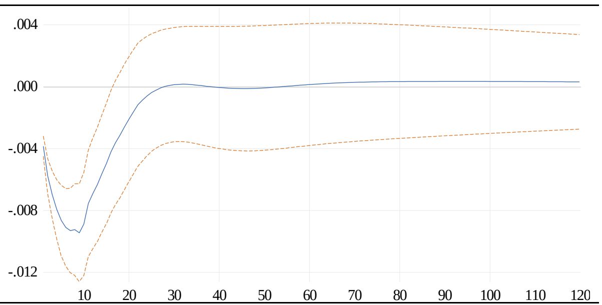


Figure 2. Non-accumulated Impulse Response Functions (IRFs) – Model 2. E: demand shock, left quadrant. U: response of the degree of capacity utilization, right quadrant. Identification based on zero restrictions Cholesky factorisation. Solid lines are point estimates and dotted lines are the computed error bands. 95% confidence interval bands estimated through a Monte Carlo procedure (1000 repetitions).

Model 3 – Without trend (1948-2019)

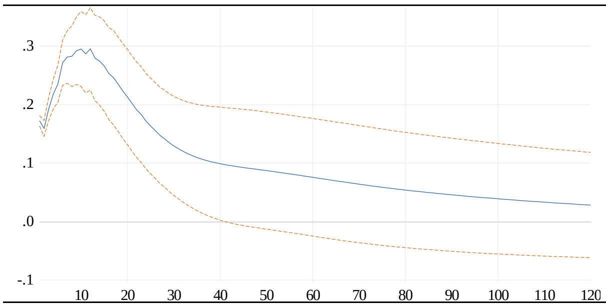
Un → Un | Un → U

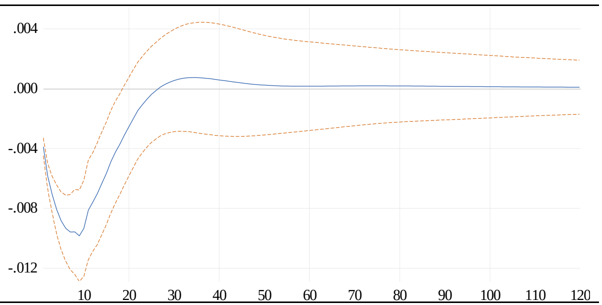




Model 3 – With trend (1948-2019)

Un → Un | Un → U





Model 3 – Without trend (1948-2007)

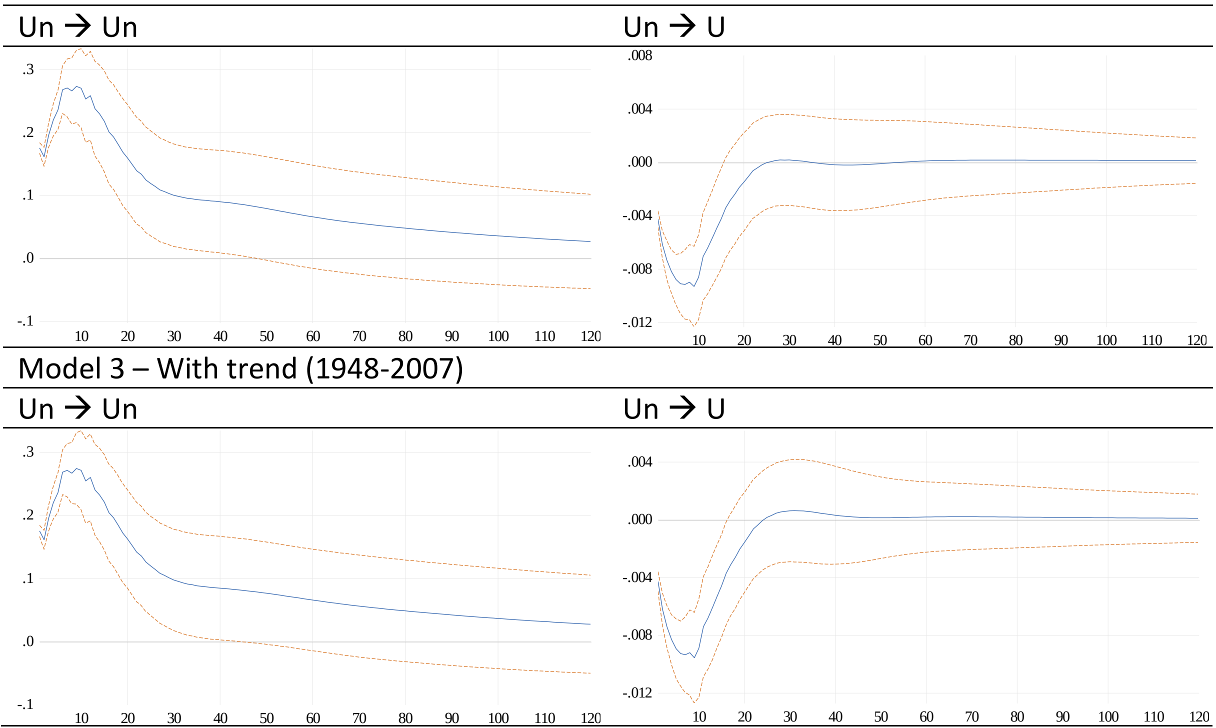
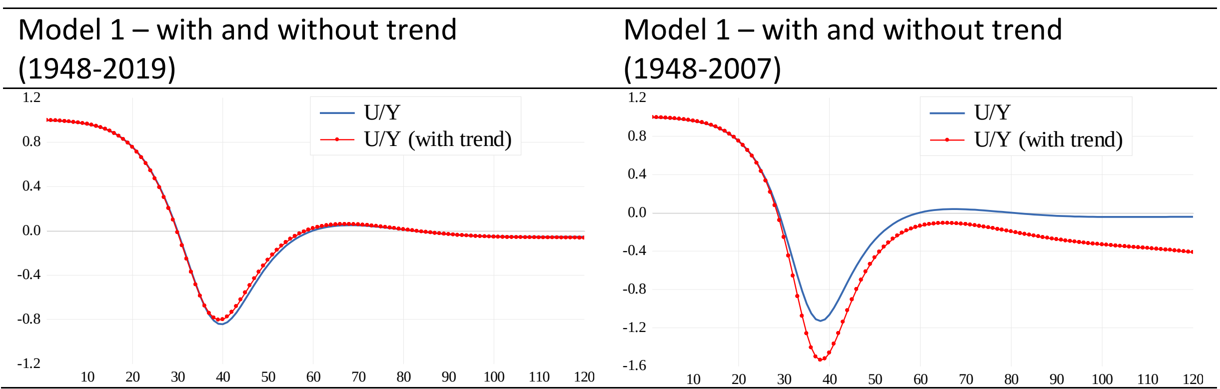


Figure 3. Non-accumulated Impulse Response Functions (IRFs) – Model 3. Un: demand shock, left quadrant. U: response of the degree of capacity utilization, right quadrant. Identification based on zero restrictions Cholesky factorisation. Solid lines are point estimates and dotted lines are the computed error bands. 95% confidence interval bands estimated through a Monte Carlo procedure (1000 repetitions).

Finally, we show in Figure 4 the 'cumulative effect' produced by a unitary permanent increase in the level of demand. This represents the response of U per unit of demand and it is calculated as the ratio between the level of U and the level of demand, with the latter approximated in each model by a different variable (Y, E and Un) (Spilimbergo et al., 2009). Findings show a clear picture: a unitary permanent demand shock produces transitory effects on the degree of capacity utilisation which returns to zero after roughly 30 months. Furthermore, as shown in Figure 4, our results are robust to different model specification, namely to different timespans as well as to the inclusion of the deterministic trend. Additionally, as shown in Appendix F (in Models 1F and 2F), even when ΔY and ΔE are considered, IRFs (Figures F1 and F2) as well as the 'cumulative effect' (Figure F3) show that a permanent increase in the level of demand produces a transitory effect on the level of the degree of capacity utilisation.



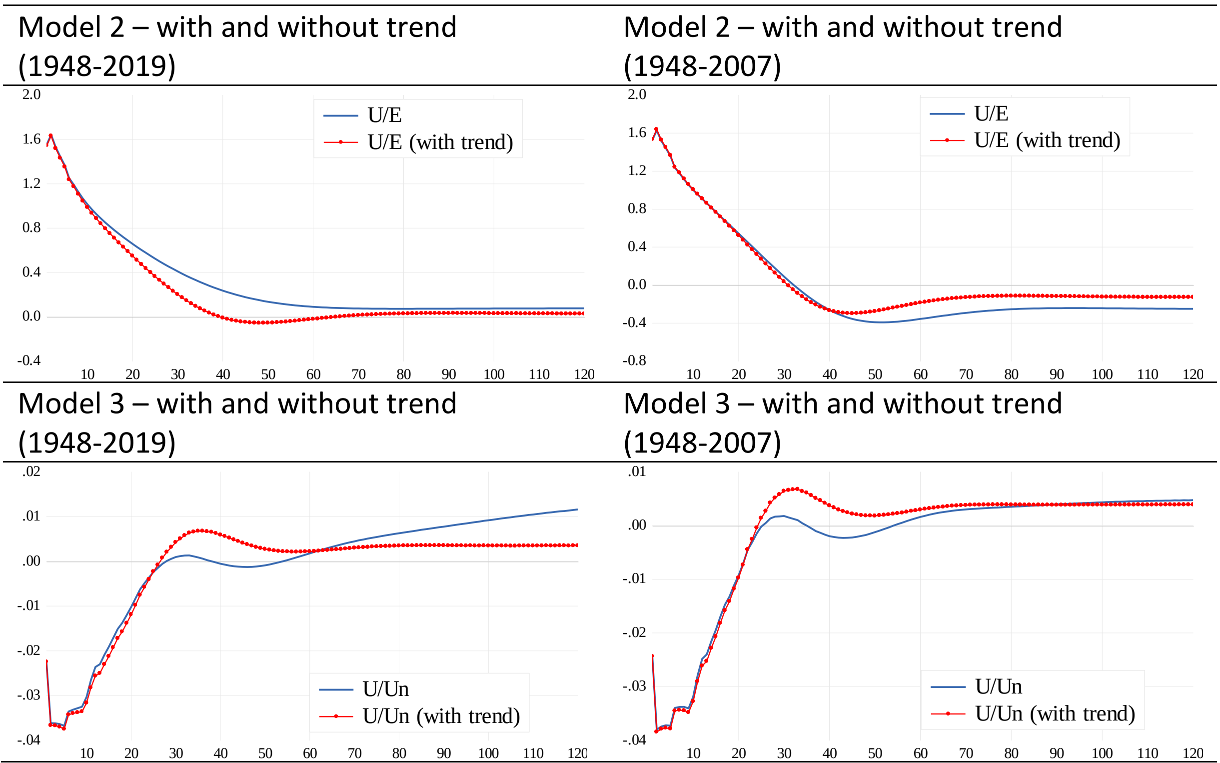


Figure 4. Cumulative effects, Model 1 to 3. Blu line model without trend and red line model with trend.

6. Discussion

After having presented our empirical results, we want to assess the compatibility of our findings with alternative macroeconomic models. Within the non-mainstream theoretical corpus, we can broadly - and to some extent arbitrarily - identify two classes of models, based on the role attributed to the degree of capacity utilisation. In the first one, which can be identified with models in the Kaleckian tradition, the *actual* degree of capacity utilisation is the variable tasked to accommodate any shock to the exogenous parameters of the model. In the second, which can be associated - albeit not exclusively – with Supermultiplier-like models, exogenous shocks displace the economy from the equilibrium position, characterized by a degree of capacity utilisation equal to the normal, exogenous one. However, such discrepancies are only temporary, since a tendency for the actual degree of capacity utilisation to return to the *normal* degree is always at work.

6.1 The Neo-Kaleckian growth model

As is well-known, the Neo-Kaleckian growth model is directly built and designed in *growth* terms. However, it is still possible to investigate the consequences of a permanent shock to the *level* of demand. Starting from the baseline version of the model (Amadeo, 1986) and assuming that the initial position of the economy coincides with normal utilisation, we can for example imagine an exogenous change, say a decrease, in the aggregate propensity to save. This, at first, will cause an increase in the level of consumption and, consequently, in the *level* of demand. In the short-run, with a given productive capacity, this amounts to an increase in the (actual) degree of capacity utilisation. However, this new level of u persists over time, since entrepreneurs are assumed to not even try to restore normal utilisation, and in this way exerts a permanent effect also on the economy's rate of growth. Moreover, the rate of accumulation and the rate of output growth are assumed to be coincident. Hence the numerator and the denominator of u evolve in parallel after the exogenous shock. This implies that the short-run outcome of a level shock - in this case a change in the propensity to save - that is a variation in *u*, extends its effects also to the long-run, the time horizon usually referred to when economic growth is studied. More importantly, even if they wanted and tried to do that, they would not be able to accomplish it. If they reacted to a (positive) discrepancy between realized and target utilisation in the way implied by a standard accelerator-mechanism, i.e. by speeding up accumulation, they would only obtain to displace the economy further away from the position characterized by normal utilisation.

Summarising, it can be concluded that the predictions of the baseline Neo-Kaleckian model are at odds with our empirical findings, since a permanent level shock is assumed to have, within the logic of this theoretical construction, permanent effects on the degree of capacity utilisation.

A similar line of reasoning can be applied to some more recent updates, which add a peculiar twist to the insights of the baseline model, consisting in making the normal degree of capacity utilisation the adjusting variable itself[13] (see e.g. Lavoie et al, 2004 and Nikiforos, 2016). Having in mind the previous discussion of the effects of a decrease in the propensity to save in the baseline model, the main novelty here consists in the fact that the after-shock new level of *u* is considered the new target by the firms involved in production. On the one hand, this implies that, at face value, one cannot any longer talk about a discrepancy between the realized and the target degree of capacity utilisation. On the other hand, however, this also implies that this version of the Neo-Kaleckian model as well cannot be reconciled with our empirical findings, since a permanent change in the degree of utilisation ensues from the level shock.

[13] See Girardi and Pariboni (2019) for a critique.