On the adjustment of capacity utilisation to aggregate demand: revisiting an old Sraffian critique to the Neo-Kaleckian model*

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May 31, 2021

Abstract

For many years, there was an unanswered theoretical question among Post-Keynesian scholars: What's the behaviour through time of capacity utilisation after an aggregate demand shock? Under a (baseline and extended) Neo-Kaleckian framework, there should be a persistent effect on capacity utilisation to a shock like this one. On the other hand, Classical-Keynesian scholars are inclined to emphasise a continuous tendency towards *normal* utilisation. I tried to shed some light on this issue by adopting a Panel Structural VAR, time series SVAR and Local Projections. My findings, based on national quarterly data for 34 countries, suggests that the nature of the effects on effective capacity utilisation of shocks to the level of economic activity is merely *transitory*.

JEL classification: B50, E11, E22, O41, O47.

Keywords: Capacity Utilisation, Growth, Income Distribution, Neo-Kaleckian model, Sraffian Supermultiplier, Structural VAR analysis, Local Projections.

*Research for this article began while the author was Visiting Scholar at the National University of San Martín under the supervision of Ariel Dvoskin and conducted, partially, at the University of Cambridge under the supervision of Philip Arestis. The author would like to thank Roberto Ciccone, Riccardo Pariboni and Matteo "Bam-Bam" Deleidi for their helpful and constructive comments that greatly contributed to improving the final version of the paper. He would also like to thank Ramiro Álvarez and Guido Ianni for insightful discussions. Finally, the author would like to thank the anonymous referee and Prof. D'Maris Coffman who made extremely pertinent suggestions to improve this work. Remaining errors are author's sole responsibility.

1. Introduction

Although there is a general agreement by which productive capacity adjusts to effective demand and not the other way around among Post-Keynesians (Garegnani, 1992; Arestis, 1996), there is no consensus at all how this adjustment is achieved regarding capacity utilisation - *direction* and *speed* of adjustment.

The main critiques to the Neo-Kaleckian model and its extended version are resumed in Fagundes and Freitas (2017). The most important ones are that they cannot generate a tendency towards normal capacity utilisation and they do not imply a positive relationship between the rate of output growth and the investment-output ratio. In this paper, I will try to tackle the first issue by investigating the relationship between the *level* of output and the *level* of *effective* capacity utilisation, therefore I will show the behaviour through time of capacity utilisation after an output shock from an exclusively empirical standpoint. Before that, I will discuss some implications for the Neo-Kaleckian growth model.

The structure of the paper is as follows: Section 2 describes some controversies surrounding the notion of Fully Adjusted Positions and capacity utilisation from a Sraffian and Neo-Kaleckian viewpoint. In Section 3 I present, after a brief literature review on the impact of output on capacity utilisation, the data used, methods, identification strategy and results. In Section 4, based on the Sraffian Supermultiplier, I present my interpretation to some results shown in Section 3. Some conclusions will close.

2. Sraffian and Neo-Kaleckian controversies on capacity utilisation

2.1. FAS and Sraffian responses

It could be claimed that the analytical debate between Sraffians and Neo-Kaleckians authors on the convergence towards *normal* capacity utilisation started during the 1980s in many interventions published in *Political Economy: Studies in the Surplus Approach*. The philosopher's stone had been discovered by Fernando Vianello (1985): He developed, under a Classical-Keynesian framework (a latter-day term), the notion of Fully Adjusted Situations (FAS, hereafter) 'situations in which a uniform rate of profits prevails, and the productive capacity installed in each industry is exactly sufficient to produce the quantities that the market absorbs when commodities are sold at their natural prices' (Vianello, 1985, p. 70).

During the process of adjustment from one FAS to another one with a higher level of output, Vianello claims that 'a temporary over-utilisation of productive capacity is require in order to bridge the gap between the moment in which normal utilization turns out to be insufficient to meet the demand, and the moment in which productive capacity has fully adjusted' (Vianello, 1985, p. 72). As a conclusion, changes in the level of real output do not involve permanent changes in the degree of utilisation of productive capacity but rather changes in the productive capacity installed.[1] Despite his very first intuitions, Vianello did not develop an analytical model able to explain the whole process of adjustment from changes in output to changes in capacity; something that has been done many years later.

The notion of FAS, after Vianello (1985), was severely criticized on theoretical grounds by Sraffians and Neo-Kaleckians. From a Sraffian viewpoint, Ciccone suggested that *normal* utilisation refers to the degree of utilisation of capacity that is relevant for long-period prices and seems to be that expected for newly installed capacity, which need not necessarily coincide with the degree of utilisation actually realised with the existing stock of capacity (Ciccone, 1986, p. 24). Committeri (1987, p. 177) claimed that FAS were conceived as *terminal points* of a complex adjustment process, *to be attained at some specific moment of time*, but such a process, was left unspecified, as well as the time span required for the economy to pass from one FAS to another, therefore, nothing could be concluded about the actual pace of accumulation during this *within* period. The third remark was made by Kurz who claimed that it was unclear how this *normal* degree was determined (Kurz, 1986, p. 51; Kurz, 1990, p. 397) and it lacked of an 'objective' determination: The criterion of cost-minimisation played no role in Vianello's notion of *normal* utilisation.

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). Vianello finally changed his position in favour of a *non-complete* adjustment (Vianello, 1989, p. 188, fn. 17), in line with the First Sraffian Position.[2] Although these profound critiques to the FAS, the tendency of capacity to adjust to output was not even denied by these scholars (Ciccone, 1986; Garegnani, 1992; Park, 1997; Trezzini, 1995; Trezzini, 1998).[3]

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

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

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

2.2. The Neo-Kaleckian reaction: First generation

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

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

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

The first equation postulates that the growth rate of accumulation is a function of γ, which is interpreted as the expected trend growth rate of sales or simply 'animal spirits', and the discrepancy between actual capacity utilisation (u) and the desired or normal rate (u_n)[4]; γ_u is a parameter. The second one is the saving equation, which is simply the product of the marginal propensity to save out of profits (s_π) and the profit rate (r), the latter written as the product of the profit share (π), capacity utilisation, and the inverse of the capital-output ratio (v). In equilibrium, given that investment equals savings,

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

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

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

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

towards its *normal* level. Analytically,

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

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

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

2.3. The Neo-Kaleckian reaction: Second generation

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

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

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

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

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

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

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

therefore, as an example, a change in s_π delivers a *persistent* effect on capacity utilisation,

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

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

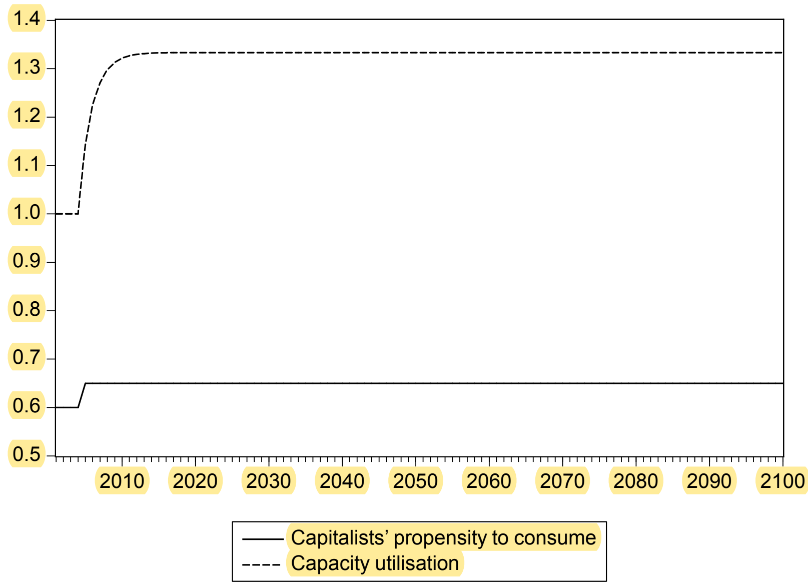
2.4. A graphical representation

In this subsection I will present graphically how aggregate - effective and *normal* - capacity utilisation behaves in response to aggregate demand shocks in the baseline and extended versions of the Neo-Kaleckian model. Based on a simulation code[5] on the baseline and extended versions of the Neo-Kaleckian model I demonstrate graphically, as I have done previously analytically, that a change in the propensity to save of capitalists (or a change in capitalists' propensity to consume) has *persistent* effects on the level of capacity utilisation in these models.

As it can be seen from Figure 1, a persistent change in the propensity to consume of capitalists (from 0.6 to 0.65) results in a persistent change in the level of effective capacity utilisation, remaining the *normal* rate (= 1) unaltered. On the other hand, from Figure 2 it can be observed that a persistent change in the propensity to consume of capitalists generates a persistent change in the level of effective capacity utilisation, but also in the *normal* rate in the long-run.

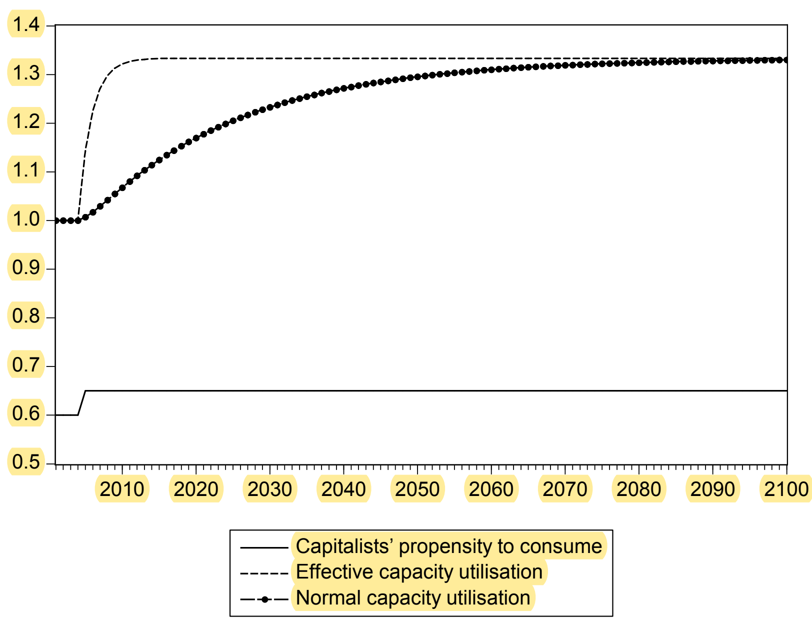
[5] I would like to thank Mg. Guido Ianni for sharing his baseline code and for fruitful discussions on this topic.

Fig. 1. Propensity to consume and capacity utilisation in a baseline Neo-Kaleckian model



Source: own elaboration based on simulations.

Fig. 2. Propensity to consume and capacity utilisation in an extended Neo-Kaleckian model



Source: own elaboration based on simulations.

3. On the empirical evidence

3.1. Literature review

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

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

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 utilisation and cyclical per-capita industrial production equal to 0.82. Driver (2000) shows how aggregate utilisation capacity, as a proxy of economic cycle, impacts positively on firm's utilisation. Bansak, Morin & Starr (2007), while analysing empirically potential determinants of capacity utilisation level, include growth rate of industrial production index (δIP), the investment-capital ratio (I/K) and the standard deviation of industrial production index to capture effects on utilisation of output growth, investment level, and output volatility, respectively; to accommodate the panel aspect of the data they ran their model using both fixed and random effects and, after that, 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 (2012a), who analyses both aggregate data and sectoral panel data through state-space modeling approach and the Kalman filter, rejects the null hypotheses of no endogenous adjustments of capacity utilisation. Moreover, Schoder (2012b, 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. He also finds that capacity adjusts very slowly (Schoder, 2012b, p.7). Finally, Nikiforos (2016) presents evidence, as Kennedy (1998, p. 177), Driver and Shepherd (2005, p. 136), Braga (2006, p. 56) and Schoder (2012b), on the stationarity of FRB's measures on capacity utilisation but he severely criticises the construction of this time series; after that, he develops a theoretical model in which normal capacity utilisation at a micro and macro level is endogenous and he presents some empirical evidence using ARDL methodology as a proof of his claim.[6]

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

3.2. Data

The econometric analysis carried out in this paper is based on quarterly data provided by the OECD[7] on GDP[8] and capacity utilisation.[9] In order to assess the effects of shocks to gross domestic product on the degree of capacity utilisation and to provide a robust and clear picture of this phenomenon, I will run panel - a balanced panel - and time series regression for each of the 34 countries of the dataset. I will make use of the GDP (Y); given the Keynesian perspective that informs this work, I believe that changes in output-GDP levels are due mainly to aggregate demand shocks - autonomous components shocks. All time-series considered are seasonally adjusted and their time span are different (see Table 1). All considered variables are transformed in logarithmic form.

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

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

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

[9] Business Tendency Surveys. I think that surveys are useful for this analysis, especially if you look at the question asked by the surveyors to the plant manager, for example in France and Greece. See Appendix A for an analysis of Surveys.

Table 1: Time frame by country

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

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

3.3. Methods and identification strategy

Following a reviewers' suggestion, to simplify the presentation of the results I will first present here the panel data analysis while the time series Structural VAR as well as the Local Projections analysis for each country are reported in Appendix B. Therefore, in this section, I will apply a Panel SVAR methodology, following closely Pedroni (2013) which takes into account responses to both idiosyncratic and common structural shocks, while permitting full cross member heterogeneity of the response dynamics (Pedroni, 2013, p. 180). The advantage of this methodology is that takes into account substantial heterogeneity present across the individual industries of the panel and cross-sectional dependence that is likely to arise from the fact that individual industries of the panel are responding not only to their own member-specific idiosyncratic shocks, but also to shocks that are common across countries of the panel (Pedroni, 2013, p. 181). The methodology is in line with the traditional time series Structural VAR literature, such as Bernanke (1986), Blanchard and Quah (1989), Blanchard and Watson (2007), Clarida and Gali (1994) and Sims (1986), among others.

The key to my estimation and identification method will be the assumption that a model representation exists that builds upon structural shocks that can be decomposed into both common and idiosyncratic structural shocks, which are mutually orthogonal (Pedroni, 2013, p. 182). I will consider a panel composed of $i = 1, \ldots, N$ individual countries, each of which consists of an $Mx1$ vector of observed endogenous variables (in this case output and capacity utilisation), y_{it}, for $y_{m,it}$ with $m = 1, \ldots, M$. The panel is strongly balanced (1996Q1 - 2018Q4). To accommodate fixed effects and to simplify the notation, the methodology considers the $Mx1$ vector of demeaned data $z_{it} = (z_{1,it}, \ldots, z_{M,it})'$, where $z_{it} = y_{it} - \bar{y}_i$, with $\bar{y}_{m,it} = T^{-1} \sum_{t=1}^{Ti} y_{m,it} \, \forall \, i, m$.

Driving the temporal variations in these data are the unobserved structural shocks. I consider an $Mx1$ vector of composite white noise shocks $\epsilon_{m,it}, m = 1, \ldots, M, \epsilon_{m,it} = (\epsilon_{1,it}, \ldots, \epsilon_{M,it})'$ for each country, i, of the panel. These composite shocks are distributed independently over time, but may be cross-sectionally-dependent. Also, I consider a common factor representation for this dependence, such that $\epsilon_{m,it} = \lambda_{m,it}\bar{\epsilon}_{m,t} + \tilde{\epsilon}_{m,it} \forall i, t, m$ where the two categories of mutually orthogonal structural shocks, $\tilde{\epsilon}_{m,it}$ and $\bar{\epsilon}_{m,t}$, $m = 1, \ldots, M$ represent, respectively, the country-specific idiosyncratic white noise structural shocks and the common white noise structural shocks shared by all countries of the panel, and $\lambda_{m,i}$ are the country-specific loading coefficients for the common shocks.

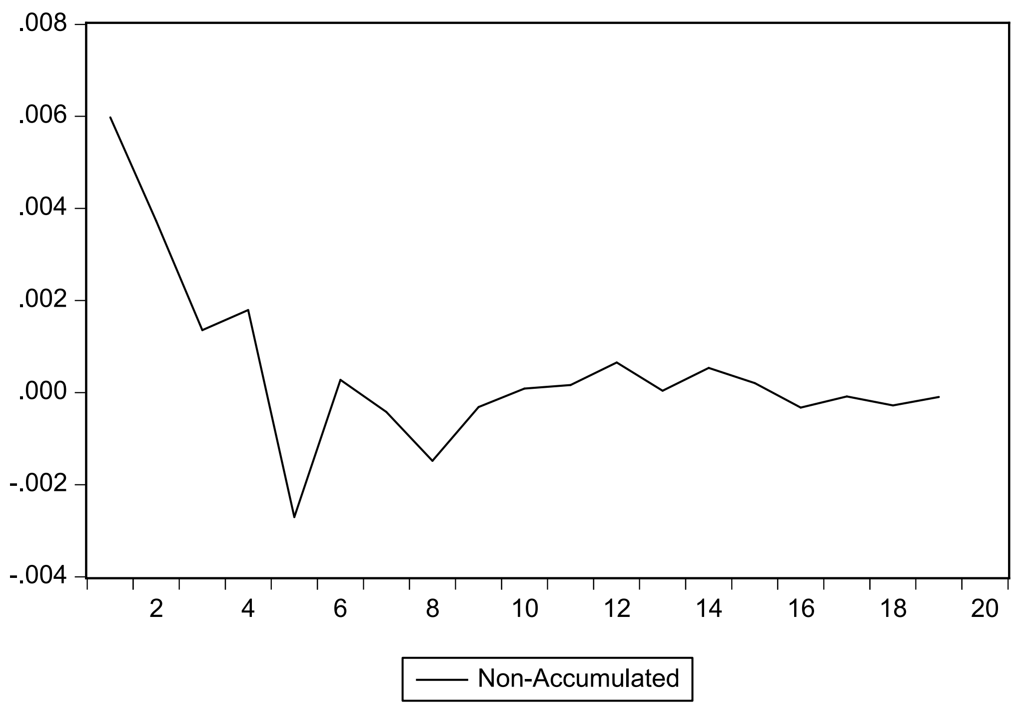
In keeping with the Structural VAR literature, the structural shocks are assumed to be orthogonal with respect to each other for each type, so that the various $m = 1, \ldots, M$ idiosyncratic shocks are mutually orthogonal to one another, as are the various common shocks to one another. Furthermore, the variances of these unobserved shocks are taken to be arbitrarily normalizable. These restrictions are analogous to those made in the time series

Structural VAR literature and are a natural extension of those restrictions as applied to the panel setting (Pedroni, 2013, p. 183).

3.4. Results

In the Panel SVAR, changes in output levels (Y) are ordered first, whereas the degree of capacity utilisation (U) is ordered as the last variable. In other words, I am assuming that changes in the level of output affect the degree of capacity utilisation within the quarter, while exogenous changes in the degree of capacity – whatever its origin – does not influence output within the quarter. Through a short-run (recursive) identification with a maximum number of 5 lags, using a General to Specific lag length criteria, the results can be divided into idiosyncratic - that are specific to each country - the common ones - common among different countries - and the composites. In the latter, the idiosyncratic and the common ones are combined. Here I will present the non-accumulated effects of output on capacity utilisation (only the composite results, while the idiosyncratic and the common ones - all of them accumulated responses - are reported in Appendix F).

Fig. 3. IRFs of Utilisation to Output shock - Accumulated and Non-Accumulated



Source: own elaboration based on data provided.

The non-accumulated impulse response function is the one that allows us to perceive what is the impact of a change in the *level* of output on the *level* of utilisation. As it can be seen in this last figure, the impact is transitory and fades over time. The impact of output on utilisation is positive and this effect disappears after, approximately, ten years. For a robustness check I introduced the Time Series Structural VAR and Local Projection analysis in Appendix B. Time series results are similar on average, and each country has its own particularities which are being analysed there.

4. Autonomous demand as an alternative explanation?

In contrast to the conclusions I drew in the previous sub-sections (2.2, 2.3 and 2.4), it can be said that the non-persistent nature of the effects on capacity utilisation of demand shocks is consistent with demand-led growth models that incorporate autonomous components of aggregate demand, in which capacity adjusts to demand in the long run.[10] Autonomous because they are 'unrelated to the current level of output resulting from firms' production decisions' (Freitas and Serrano, 2015, p. 4).[11] Here I can include the Sraffian supermultiplier (Monza, 1976; Bortis, 1984; Serrano, 1995a, 1995b; Cesaratto et al., 2003; De Juán, 2013, 2014; Freitas and Serrano, 2015; Serrano and Freitas, 2017)[12] and a recent amended versions of the Neo-Kaleckian model with autonomous components (Allain, 2013, 2015, 2019; Pariboni, 2015, 2016; Lavoie, 2016; Nah and Lavoie, 2017; Dutt, 2019, 2020).

Starting from a fully adjusted situation, let us assume that there is a positive and permanent shock to an autonomous component, this will be accommodated by an increase in capacity utilisation in the short run, but in the long run, as a result of the accelerator mechanism,

[10] Actually, these results are compatible with the 3-equation model (Blanchard, 2017), Harrodian (Skott, 1989) and other Marxian models (Duménil and Lévy, 1999). However, here I decided to present the Sraffian Supermultiplier as the main alternative to the Neo-Kaleckian model given that the 'old' critique was mainly Sraffian and, secondly, because as far as I understand, it is the only model that is able to introduce effective demand *even* in the long-run in which utilisation converges to its *normal* rate.

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

[12] For a critique of the Sraffian Supermultiplier see Nikiforos (2018) and Skott (2019).

the investment share will adjust and u will return to its pre-shock level.[13] In the long-run, there must be a tendency of effective utilisation towards its exogenous value 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). The incentive to utilise productive capacity at a 'normal' level induces firms to adjust the scale of capacity to the levels of output that the market can absorb (Ciccone, 2012, p. 325).

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

5. Conclusion

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

With this paper, I tried to shed some light on the issue by adopting a Panel Structural VAR, time series SVAR and Local Projections analysis. These are particularly appropriate because they allowed me to show the dynamic effect of an income's permanent shock on the degree of capacity utilisation. My findings, based on national quarterly data for 34 countries, suggests that the nature of the effects on capacity utilisation of shocks to the level of economic activity is merely *transitory*. I also analysed alternative (demand-led) growth models on the basis of their ability to reproduce the stylised facts that emerge from this empirical analysis, concluding that autonomous demand-led models that includes convergence towards

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

exogenous *normal* utilisation perform better in this respect.

A simple empirical exercise cannot replace theoretical thinking. Nothing in my analysis points to a convergence towards equilibrium with *normal* utilisation. However, the fact that in most countries, after an output shock, utilisation returns to its previous level suggests that a revision of the Neo-Kaleckian baseline and extended model might be useful for economic theory and praxis, since in principle these models would be incompatible with the empirical evidence presented in this paper.

6. References

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Appendix A. Details on data sources

Both output level and capacity utilisation were obtained from the OECD's database. Capacity utilisation was obtained from the Business Tendency Survey and Consumer Opinion Surveys[14]. However, OECD's database on capacity utilisation includes observations for 40 countries on monthly and quarterly data.[15] Here I present the different questionnaires and my view on this issue:

[14] `https://stats.oecd.org`

[15] I excluded those countries that present only monthly data.

A.1. National Questionnaires

Australia:

Fig. 4. Australia's Questionnaire

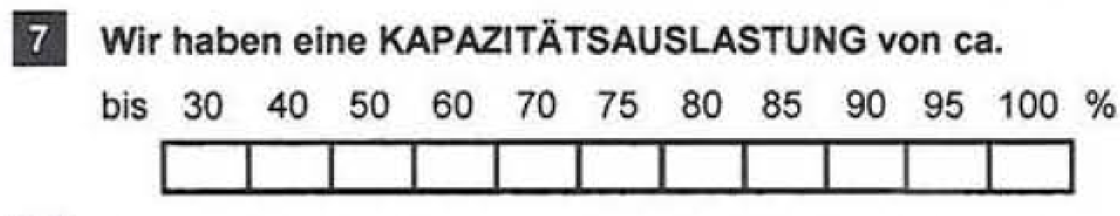
2. At what level of capacity utilisation are you working?

Net balance	Above Normal	Normal	Below Normal
-5	13	69	18

Source: `https://www.australianchamber.com.au/publications/australian-chamber-westpac-survey-of-industrial-trends-june2019/`.

Austria:

Fig. 5. Austria's Questionnaire


7 Wir haben eine KAPAZITÄTSAUSLASTUNG von ca.

bis 30 40 50 60 70 75 80 85 90 95 100 %

Source: https://ec.europa.eu/info/sites/info/files/file_import/questionnaires_at_busi_en_0.pdf.

Belgium: Lambert, J. P. (1988). *Disequilibrium macroeconomic models: theory and estimation of rationing models using business survey data.* CUP Archive. Page 22. and also https://ec.europa.eu/info/sites/info/files/questionnaires_be_indu_fr.pdf

Brazil: http://portalibre.fgv.br/lumis/portal/file/fileDownload.jsp?fileId=8A7C82C5557F25F2015626C0585D118C

Colombia:

Fig. 6. Colombia's Questionnaire

9. Cuál es su nivel actual de utilización de capacidad (en porcentaje de utilización de capacidad normal): _______

Source: https://ideas.repec.org/p/ecr/col027/4770.html.

Czech Republic:

Fig. 7. Czech Republic's Questionnaire

21 Stupeň využití Vašich výrobních kapacit (neberte v úvahu nevyužívání v období dovolené)

do 30 %	☐	1
31 - 40 %	☐	
41 - 50 %	☐	
51 - 60 %	☐	
61 - 70 %	☐	
71 - 80 %	☐	
81 - 90 %	☐	
91 - 100 %	☐	
více než 100 %	☐	

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

Denmark:

Fig. 8. Denmark's Questionnaire

Kapacitetsudnyttelse i pct. skønnes til .... pct. af fuld kapacitet

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_dk_busi_dk.pdf.

Estonia:

Fig. 9. Estonia's Questionnaire

K13 Tootmisvõimsuste rakendatuse tase praegu

(% kõikidest tootmisvõimsustest) ....%

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_ee_indu_ee.pdf.

Finland:

Fig. 10. Finland's Questionnaire

17. Kapasiteetin käyttöaste %

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

France:

Fig. 11. France's Questionnaire

2. Goulots et utilisation des capacités de production

- Si vous receviez plus de commandes, pourriez-vous produire davantage, avec vos moyens actuels ? OUI ☐ NON ☐

Si OUI quel pourrait être l'accroissement de votre production avec le matériel dont vous disposez et **sans que vous ayez besoin d'embaucher du personnel supplémentaire ?** .... environ .... %

- Pourriez-vous produire davantage encore **en embauchant du personnel supplémentaire ?** .... OUI ☐ NON ☐

- Votre entreprise fonctionne actuellement à .... % de ses capacités disponibles.

***Il s'agit du ratio (en %) de votre production actuelle sur la production maximale que vous pourriez obtenir en embauchant éventuellement du personnel supplémentaire*.**

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_fr_indu_fr.pdf.

Germany:

Fig. 12. Germany's Questionnaire

B) Die **Ausnutzung** unserer **Anlagen** zur Herstellung von XY (betriebsübliche Vollausnutzung=100%) beträgt **gegenwärtig** bis ..... %

30 40 50 60 70 75 80 85 90 95 100 **mehr als 100% und zwar:**

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

Greece:

Fig. 13. Greece's Questionnaire

3. Σε τι ποσοστό περίπου χρησιμοποιείται την τρέχουσα περίοδο αυτή το **εργοστασιακό σας δυναμικό** Ποσοστό %

(100% χρησιμοποίηση του εργοστασιακού δυναμικού αντιστοιχεί στο σημείο εκείνο στο οποίο δεν μπορείτε να αυξήσετε περαιτέρω την παραγωγή σας αυξάνοντας την απασχόληση με περισσότερες βάρδιες ή υπερωρίες **αλλά πρέπει να επεκτείνετε το εργοστασιακό σας δυναμικό- μηχανές εγκαταστάσεις**).

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

Hungary:

Fig. 14. Hungary's Questionnaire

13. A meghatározó kapacitásaik jelenlegi kihasználtsága: ***............. %.***

Source:
https://ec.europa.eu/info/sites/info/files/questionnaires_hu_indu_hu_0.pdf.

India:

Fig. 15. India's Questionnaire

Sr. Number	Product		Unit (Capacity / Production)	Installed Capacity	Quantity Produced	Capacity Utilised (%)	Value of Production (₹ Lakhs)
	Name	NIC 2008 Code (5 digits)		April-June 2019 Quarter	April-June 2019 Quarter	April-June 2019 Quarter	April-June 2019 Quarter

Source: `https://rbidocs.rbi.org.in/rdocs/Forms/PDFs/OBICUSRD4704102019.pdf`.

Indonesia:

Tosetto, E., & Gyomai, G. (2009). Current status of business tendency survey and consumer survey harmonisation in non-EU OECD countries. OECD enhanced engagement economies and OECD accession countries. Unpublished paper delivered at an EU-OECD workshop on Business and Consumer Surveys, November, Brussels.

Ireland:

Fig. 16. Ireland's Questionnaire

Q.16 At about what capacity is your company currently operating (as a percentage of full capacity)?

The company is currently operating at ___ % of full capacity (MAX 100)

Source: `https://ec.europa.eu/info/sites/info/files/boi-eu_industry_questionnaire_2016-2017.pdf`.

Italy:

Fig. 17. Italy's Questionnaire

D.35 Rispetto all'utilizzazione massima qual è stato percentualmente il grado di utilizzo degli impianti nel corso del trimestre?

il ________________% (senza decimali)

(inserire valori percentuali compresi tra 20 e 100)

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

Japan:

Fig. 18. Japan's Questionnaire

(6) Production Capacity of Your Enterprise
1.Excessive capacity 2.Adequate 3.Insufficient capacity

Source: https://www.boj.or.jp/en/statistics/outline/exp/tk/data/survey03.pdf.

Latvia:

Fig. 19. Latvia's Questionnaire

15. Uzņēmums pašlaik izmanto ☐ % no pilnas jaudas.

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_lv_indu_lv.pdf.

Lithuania:

Fig. 20. Lithuania's Questionnaire

13. Kaip šiuo metu panaudojamas Jūsų įmonės gamybinis pajėgumas?

mažiau kaip 30 %	31–40 %	41–50 %	51–60 %	61–70 %	71–80 %	81–90 %	91–100 %	daugiau kaip 100 %
☐	☐	☐	☐	☐	☐	☐	☐	☐

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

Luxembourg:

Fig. 21. Luxembourg's Questionnaire

13. Degré d'utilisation de la capacité de production

La capacité de production de l'entreprise est actuellement utilisée à concurrence de: ☐ %

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

Netherlands:

Fig. 22. Netherlands's Questionnaire

De bezetting/benutting van onze beschikbare productiecapaciteit bedraagt momenteel ca.	………………… %

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

New Zealand:

Fig. 23. New Zealand's Questionnaire

Excluding seasonal factors, by how much is it currently practicable for you to increase your production from your existing plant and equipment without raising unit costs?

Source: https://www.rbnz.govt.nz/-/media/ReserveBank/Files/Publications/Bulletins/2004/2004sept67-3hodgetts.pdf.

Norway:

Fig. 24. Norway's Questionnaire

	Under 50 %	50 - 65 %	65 - 80 %	80 - 95 %	Over 95 %
12. Hvilken kapasitetsutnyttingsgrad innebærer nåværende produksjonsnivå ?	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

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

Poland:

Fig. 25. Poland's Questionnaire

21.	**Jaki procent posiadanych pełnych mocy produkcyjnych Państwa przedsiębiorstwa jest obecnie wykorzystywany:**	☐☐☐,☐ %

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

Portugal:

Fig. 26. Portugal's Questionnaire

13. No último trimestre a vossa capacidade de produção utilizada foi aproximadamente de:

B1300 |_|_|_|%

(É possivel um estabelecimento laborar a mais de 100% da sua capacidade desde que o equipamento e/ou pessoal empregado trabalhem a um ritmo superior ao considerado normal)

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

Slovak Republic:

Fig. 27. Slovak Republic's Questionnaire

13. Aká je súčasná úroveň využitia výrobných kapacít vo Vašej firme (v % plnej kapacity)?

do 30	31 - 40	41 - 50	51 - 60	61 - 70	71 - 80	81 - 90	91 - 100	nad 100	
○ 1	○ 2	○ 3	○ 4	○ 5	○ 6	○ 7	○ 8	○ 9	13

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

Slovenia:

Fig. 28. Slovenia's Questionnaire

D4 **Ali je sedanja stopnja izkoriščenosti vaših zmogljivosti - tehnično-tehnoloških, človeških virov in podobno:**

- ☐ 1 Pod 30 %
- ☐ 2 Od 31 do 40 %
- ☐ 3 Od 41 do 50 %
- ☐ 4 Od 51 do 60 %
- ☐ 5 Od 61 do 70 %
- ☐ 6 Od 71 do 80 %
- ☐ 7 Od 81 do 90 %
- ☐ 8 Od 91 do 100 %
- ☐ 9 Več kot 100 % (nadure, dodatne izmene…)

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_si_indu_si.pdf.

South Africa:

Fig. 29. South Africa's Questionnaire

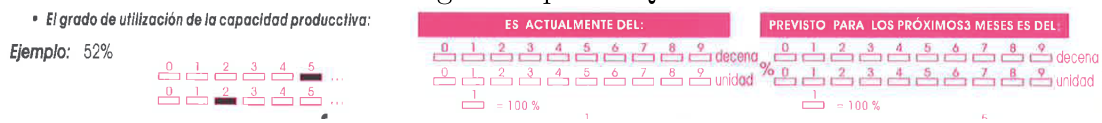
12 Is your present level of output below capacity? (i.e. are you working below a satisfactory full rate of operation)

Yes	No
☐	☐

Source: https://ec.europa.eu/info/sites/info/files/questionnaires_si_indu_si.pdf.

SPAIN:

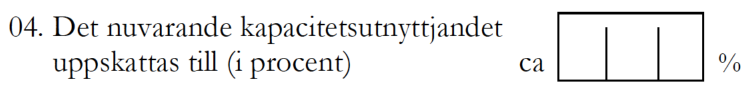
Fig. 30. Spain's Questionnaire



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

SWEDEN:

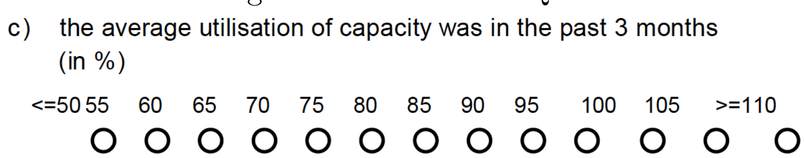
Fig. 31. Sweden's Questionnaire



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

SWITZERLAND:

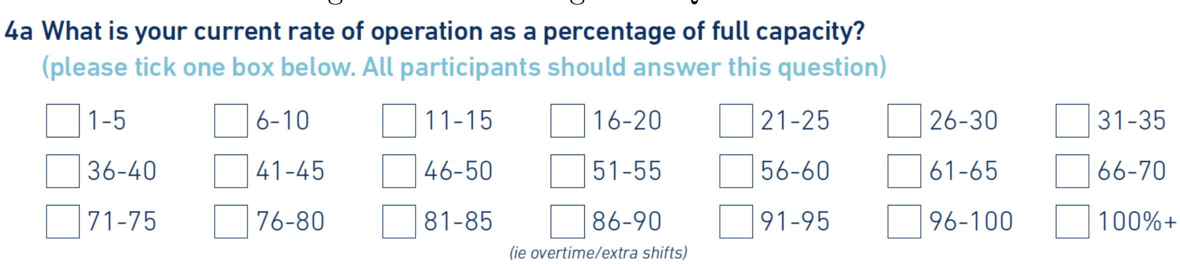
Fig. 32. Switzerland's Questionnaire



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

UNITED KINGDOM:

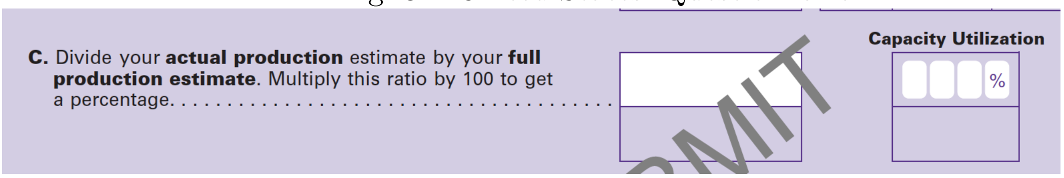
Fig. 33. United Kingdom's Questionnaire



Source: `https://ec.europa.eu/info/sites/info/files/questionnaires_uk_indu_en.pdf`.

United States:

Fig. 34. United States' Questionnaire


C. Divide your **actual production** estimate by your **full production estimate**. Multiply this ratio by 100 to get a percentage. . . . .

Capacity Utilization

%

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

A.2. Criterion

As it can be seen in the previous section, all the 'national questionnaires' are quite different among them. As far as we noticed from the OECD database and National Institutes of Statistics, with Alejandro González in a previous article (Gahn and González, 2019) we found that we can classify the survey's questions in, at least, four groups:

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

- France: *Your company currently operates at X% of its available capacity. This is the ratio (in %) of your current production to the maximum production you could get by hiring possibly additional staff.*

- Greece: *At what current rate is used your factory capacity %?. (100% utilisation corresponds to the point where you cannot increase your production by increasing employment with more shifts or overtime, but you need to expand your factory-capacity facilities).*

So these surveys explicitly explain to the 'plant managers' which is the definition of 'full capacity' (as many shifts as possible, plenty technical utilisation of capital, near 168 hours per day as possible). The definition is quite similar to US's National Emergency one[16].

b. Those countries such as Denmark, Estonia, Germany, Ireland, Italy, Latvia, Poland, Slovak Republic and the United States which ask what the OCDE's survey recommends[17], which is:

- OCDE: *At what capacity is your company currently operating (as a percentage of full capacity)?*

[16] See Gahn (2020) on the National Emergency Rate of capacity utilisation for the US economy.
[17] Also these countries not included in our dataset: Albania, Croatia, Cyprus, Israel, Macedonia, Malta and Serbia.

In this case, there is no explicit explanation of 'full capacity'.

c. Other countries that directly ask just a net balance (Australia, Belgium, Japan, South Africa), minimizing cost capacity (New Zealand)[18] or allow the 'plant manager' to choose a capacity over 100% (Eslovenia, Portugal, Lithuania, United Kingdom) or in terms of normal capacity (Colombia).[19]

d. Other countries that directly ask just about current capacity utilisation such as Austria, Brazil, Czech Republic, Finland, Hungary, India, Indonesia, Luxembourg, Netherlands, Norway, Spain, Sweden and Switzerland (past three months) without further requirements.

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 Utilization Rate' and the 'National Emergency Rate' are, according to the available data from 1989 to 2017, greatly correlated (Gahn, 2020); 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 effective capacity; and although this is subject to plant manager's interpretation, this group can be part of 'a', 'b' or 'c', or a mixed of them; again, this is enough justification to include them in our study.

A.3. Countries excluded

Chile: Monthly data.
Israel: Monthly data.
Mexico: Monthly data.
Russia: Monthly data.
South Korea: Monthly data.
Turkey: Monthly data.

[18] In this case, it is not useful for my purpose here, but anyway it was included in the dataset.
[19] In this case, it is not useful for my purpose here, but anyway it was included in the dataset.

Appendix B. Time Series Structural VAR and Local Projections

For a robustness check, I use a structural VAR (SVAR) methodology to estimate abovementioned models. In particular, a reduced-form VAR(p), shown in Equation (4), has to be estimated:

$$y_t = c + \sum_{i=1}^{p} A_i y_{t-p} + \epsilon_t \tag{4}$$

where y_t is the $kx1$ vector of considered variables (level of output and level of capacity utilisation), c is the constant term, A_i is the kxk matrix of reduced-form coefficients and ϵ_t is a $kx1$ vector composed by the error terms. The lag P of the VAR will be calculated through the Akaike Information Criterion (AIC). I will also check the stationarity of the *VAR(p)* by assessing whether the inverse roots of the characteristic polynomial lie inside the unit circle. In order to obtain a *SVAR*, an identification strategy has to be imposed on the reduced-form *VAR(p)* (Equation 4). More precisely, a *SVAR(p)* can be represented as follows in Equation (5):

$$B_0 y_t = c + \sum_{i=1}^{p} B_i y_{t-p} + \omega_t \tag{5}$$

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

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

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

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

Finally, following a stimulating suggestion of an anonymous reviewer I complement my analysis with another one including local projections (Jordà, 2005, 2009).[20] Results are robust and no substantial difference is found as it can be seen in the next subsection.

B.1. Results

The first results concern the lag selection and the stability of the estimated *VAR* models. My findings on the lag selection are reported in Appendix C (Table 2) and show that the optimum lags according to *AIC* criterion varies between 1 and 6 lags (maxlag=8). When I look at the stability of the estimated VAR models, the unit circle shows that estimated VAR are stationary and stable. Findings are reported in Appendix D (Figure 70).[21] Finally, Y has a unit root in almost all countries excepted Germany, Italy, Japan and Luxembourg. By contrast, U is stationary variable in almost all countries excepted in Czech Republic, Greece, India, Latvia, Lithuania, South Africa and Spain. The unit root tests are reported in Appendix E (Table 3). However, these exceptions

[20] When the underlying data generating process (DGP) cannot be well approximated by a VAR(p) process, IRFs derived from the model will be biased and misleading. Jordà (2005) introduced an alternative method for computing IRFs based on local projections that do not require specification and estimation of the unknown true multivariate dynamic system itself. In addition to marginal error bands, Jordà (2009) introduced two new sets of bands to represent uncertainty about the shape of the impulse response and to examine the individual significance of coefficients in a given trajectory. The methodology I have followed is Jordà (2009). I performed these test using the Corrected AIC for lag length selection.

[21] Whenever the estimates did not pass the autocorrelation or normality tests of residuals, the lags were increased without changing the results - the direction of the adjustment. Although in many cases bands do not converge, the direction of the adjustment is clear. However, here are the results without the increase in lags following the criteria above mentioned.

do not change my results.

The models considered allow me to isolate exogenous shocks to output levels that are approximated by Y. In the figures below, I report the effects of these shocks on the degree of capacity utilisation U by country. As I said, I report the impulse response functions (IRFs) estimations without deterministic trend as well as by considering all the timespan. As shown in left column of Figure 36-69, shocks to output are usually accompanied by a persistent dynamic, which implies that an initial increase in the *level* of output builds up over time, stabilizing on a non-zero level. In this way, I am able to detect the effect of a *permanent* change of output level on the *level* of capacity utilisation. Specifically, when I look at the effects of these income's permanent shocks on U in right column of Figure 36-69, impulse response functions show that U tends to increase as soon as activity increases but it starts to converge to its pre-shock level approximately 5 quarters after shocks occur, namely after that U reaches its peak effect. The response of U converges to zero after roughly 10-20 quarters and stabilises at that level in the long term. The process of stabilization of U to its pre-shock level is similar in almost all considered models, ceteris paribus. However, some exceptions should be mentioned: Estonia, Indonesia and South Africa.

These exceptions might be related to the data-generating process given that in the case of Estonia the first observation of capacity utilisation (1993Q2) starts at a very low value of 52.5; the average level of utilisation was reached starting the 2000s; but this is a similar case to that one of Lithuania, which responses are 'well-behaved' in some sense. However, during the crisis of 2009, Lithuania's capacity utilisation was reduced 10 p.p. while Estonia's one 30 p.p. The data generation process, therefore, is quite volatile and this issue might explain this case. Indonesia is the country with less number of observations (n=68) so that might obstacle a correct analysis. Finally, South Africa's data is similar to Estonia in the sense that there is a fall of approximately 30 p.p. from the initial period until 2002 when utilisation reaches 53% (2002Q4), and during the crisis (2008Q1-2009Q2) utilisation increases 15 p.p. what could be suspect as counter intuitive.

Fig. 35. Output and capacity utilisation shocks - Australia

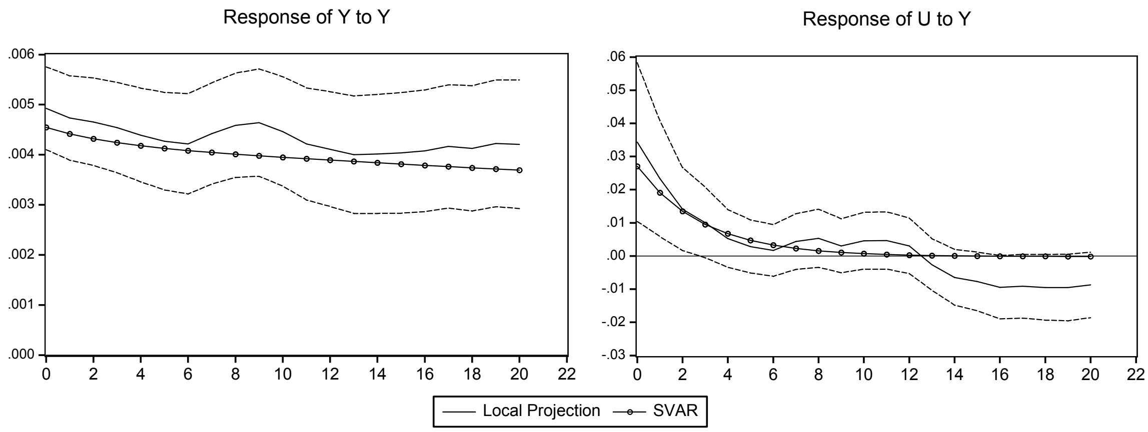


Fig. 36. Output and capacity utilisation shocks - Austria

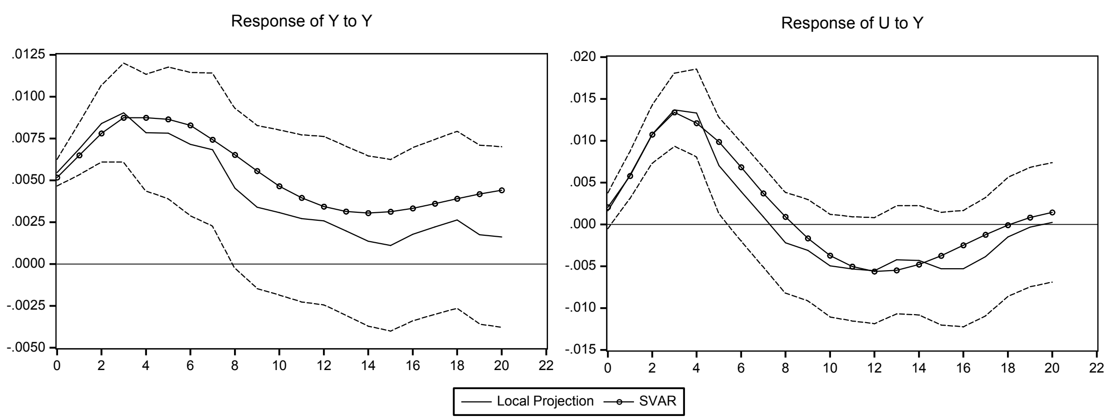


Fig. 37. Output and capacity utilisation shocks - Belgium

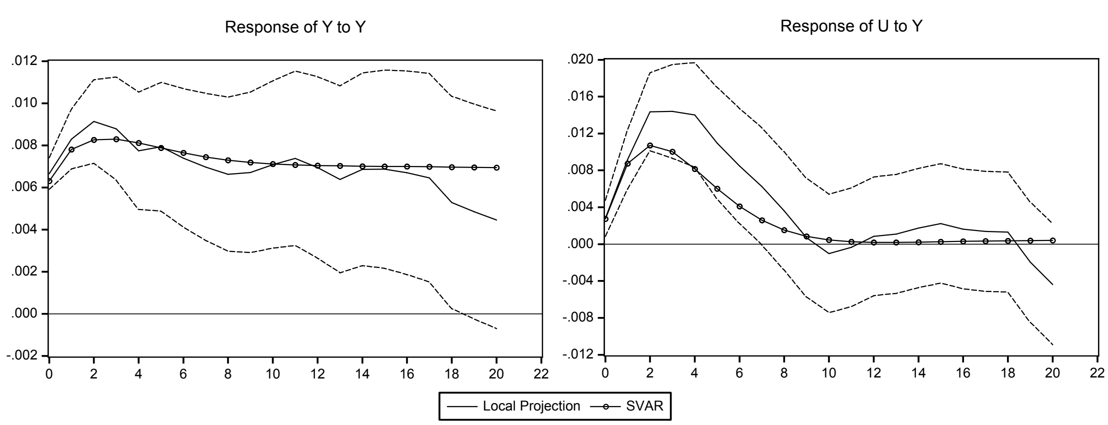


Fig. 38. Output and capacity utilisation shocks - Brazil

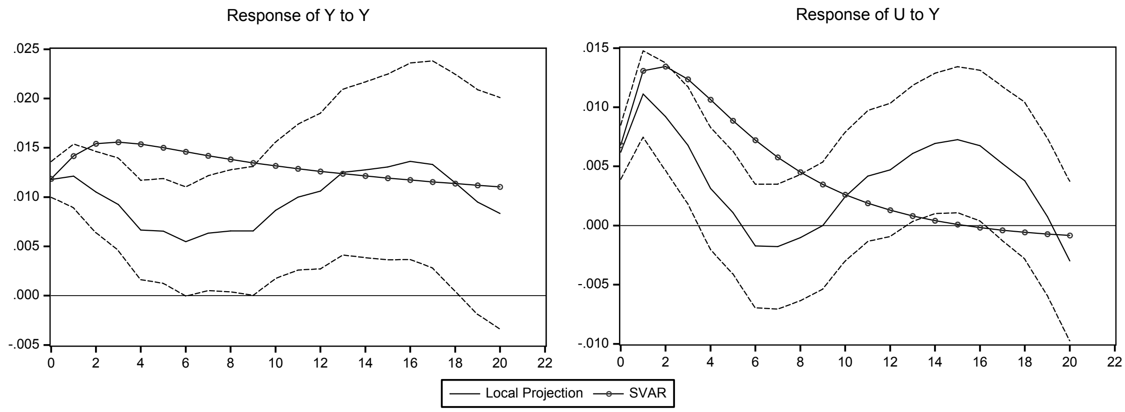


Fig. 39. Output and capacity utilisation shocks - Colombia

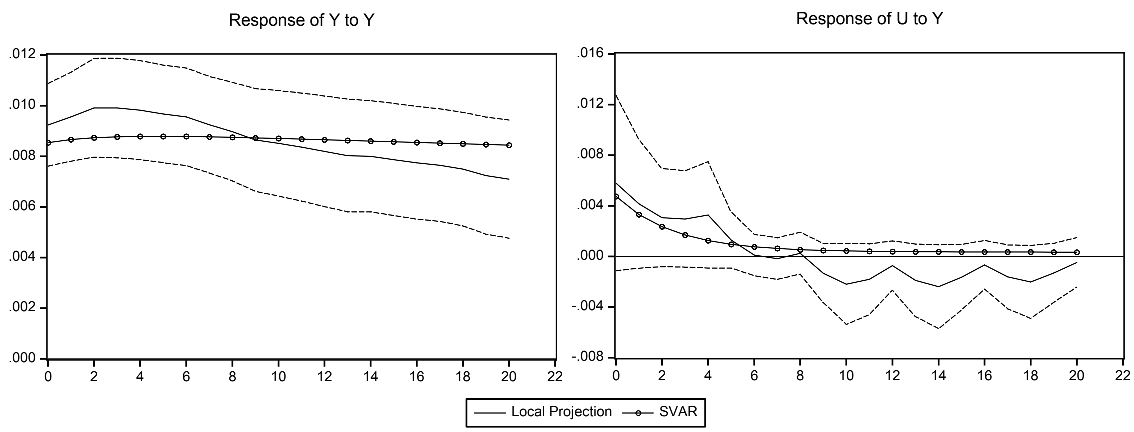


Fig. 40. Output and capacity utilisation shocks - Czech Republic

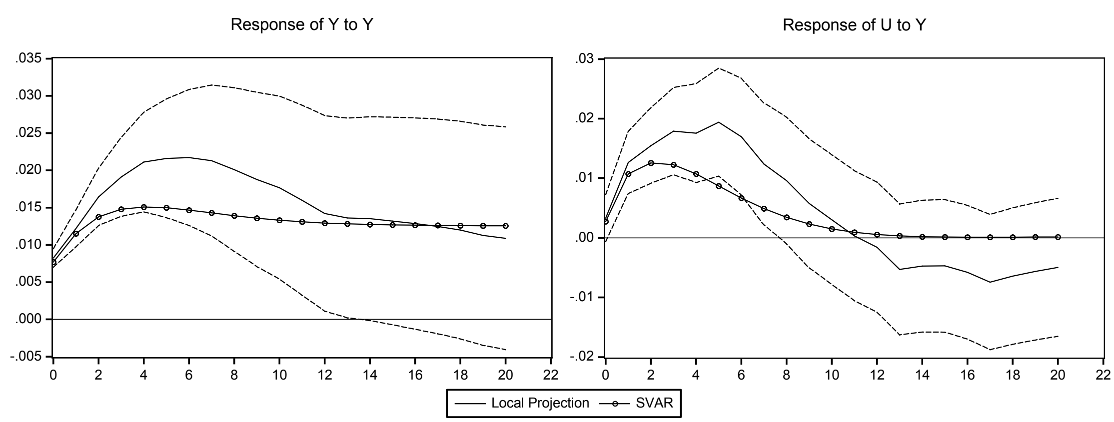


Fig. 41. Output and capacity utilisation shocks - Denmark

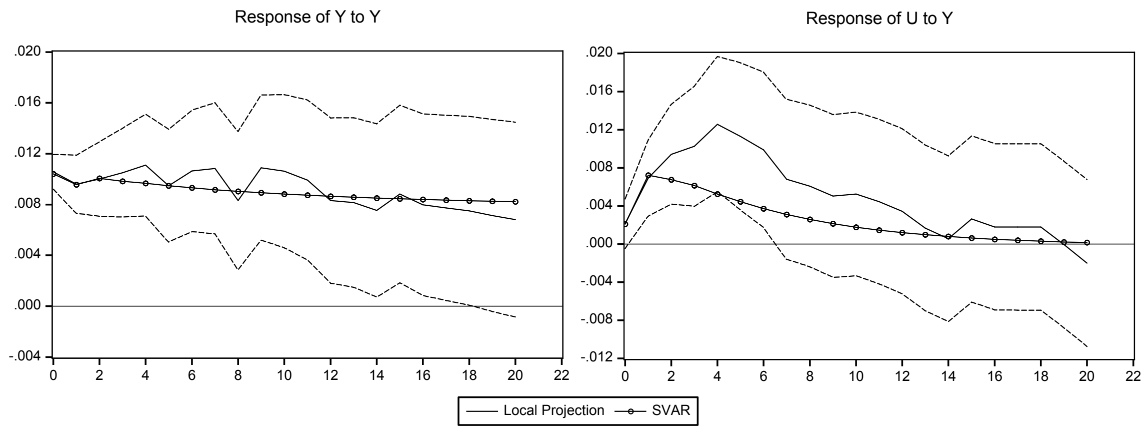


Fig. 42. Output and capacity utilisation shocks - Estonia

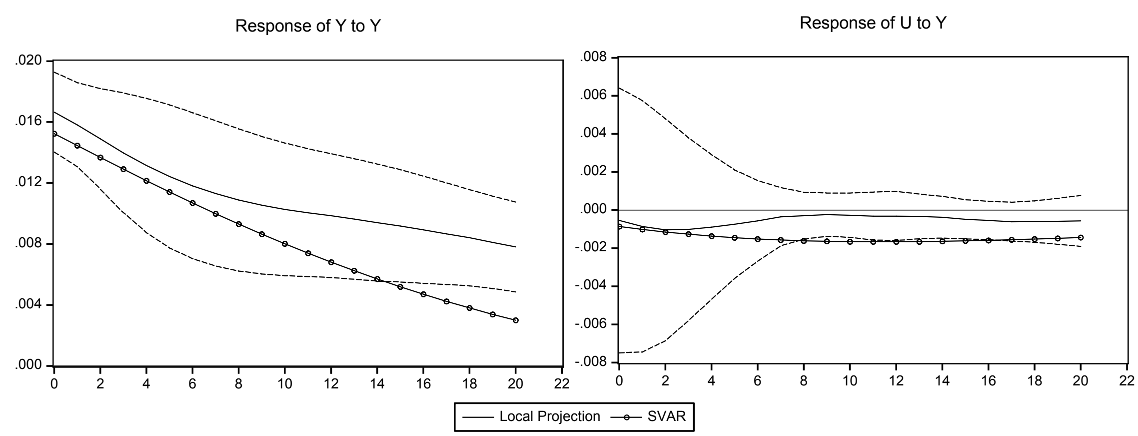


Fig. 43. Output and capacity utilisation shocks - Finland

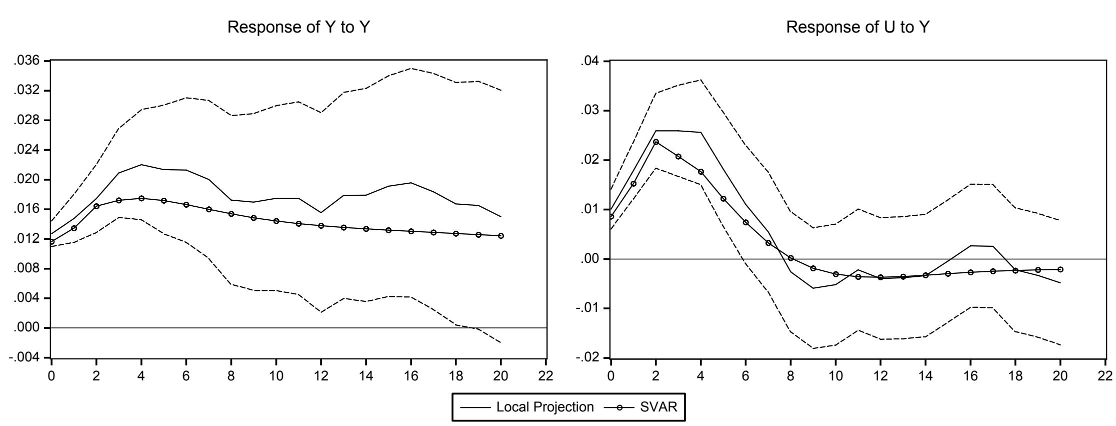


Fig. 44. Output and capacity utilisation shocks - France

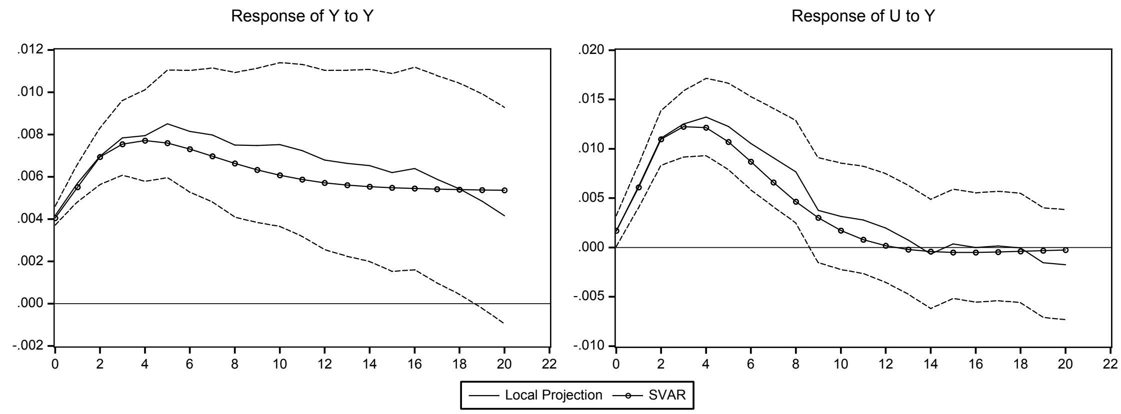


Fig. 45. Output and capacity utilisation shocks - Germany

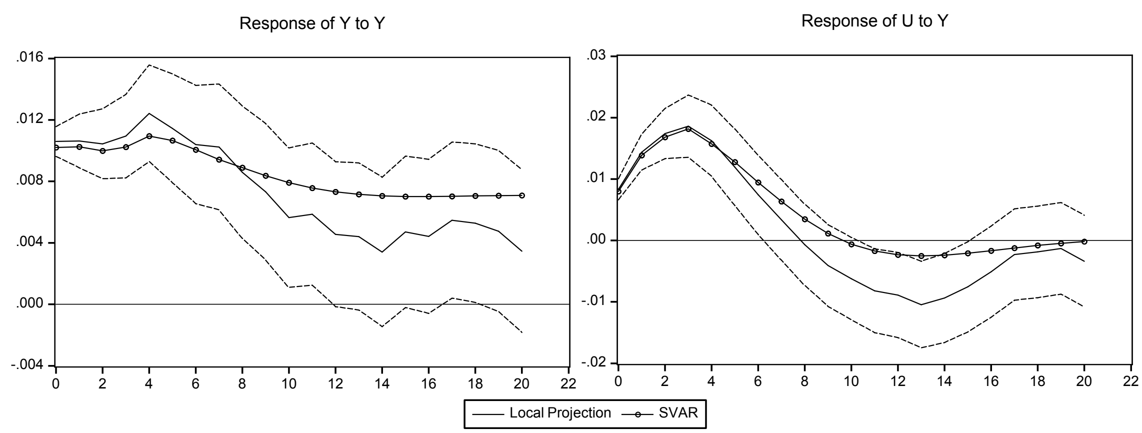


Fig. 46. Output and capacity utilisation shocks - Greece

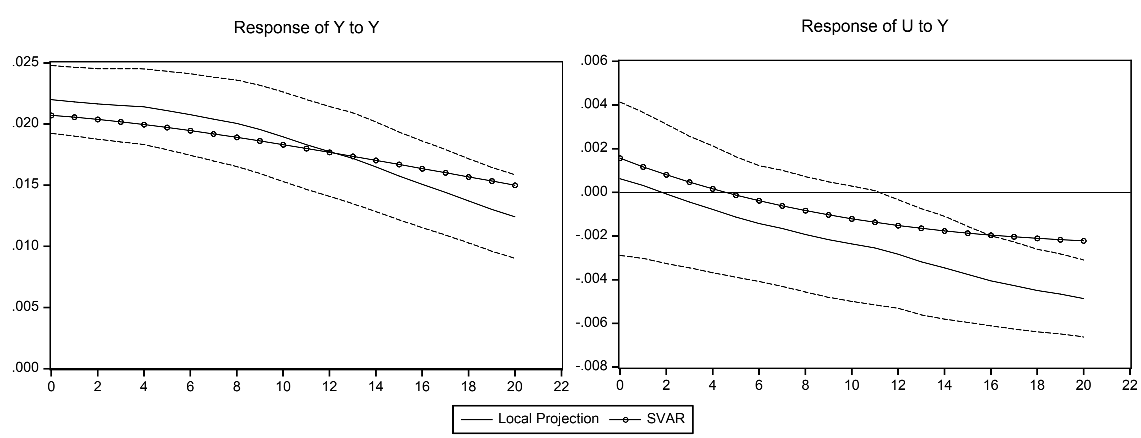


Fig. 47. Output and capacity utilisation shocks - Hungary

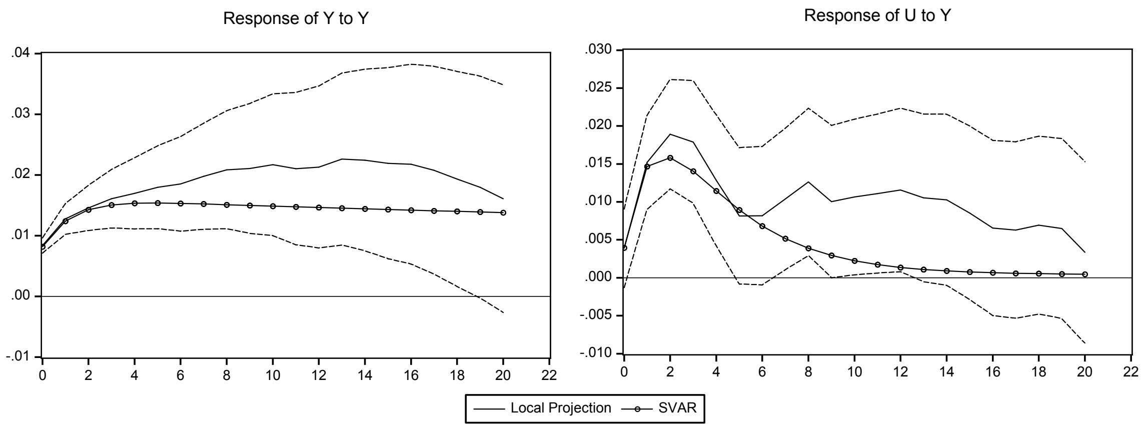


Fig. 48. Output and capacity utilisation shocks - India

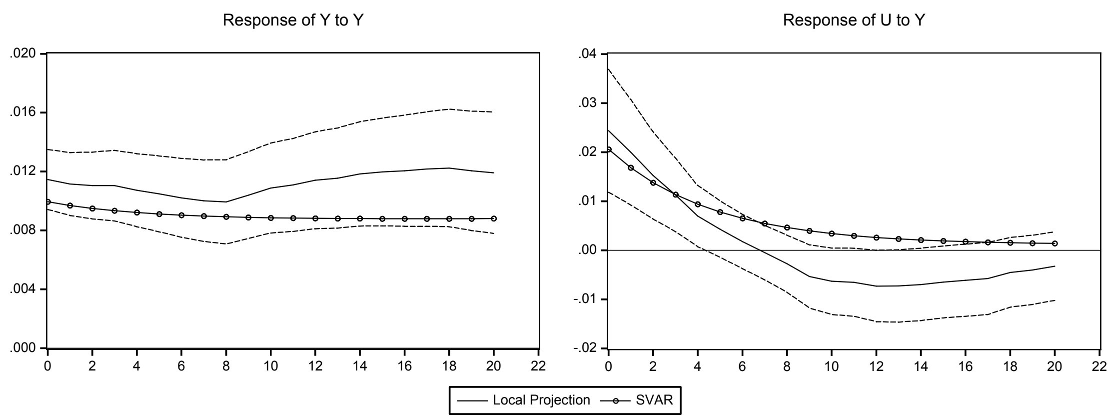


Fig. 49. Output and capacity utilisation shocks - Indonesia

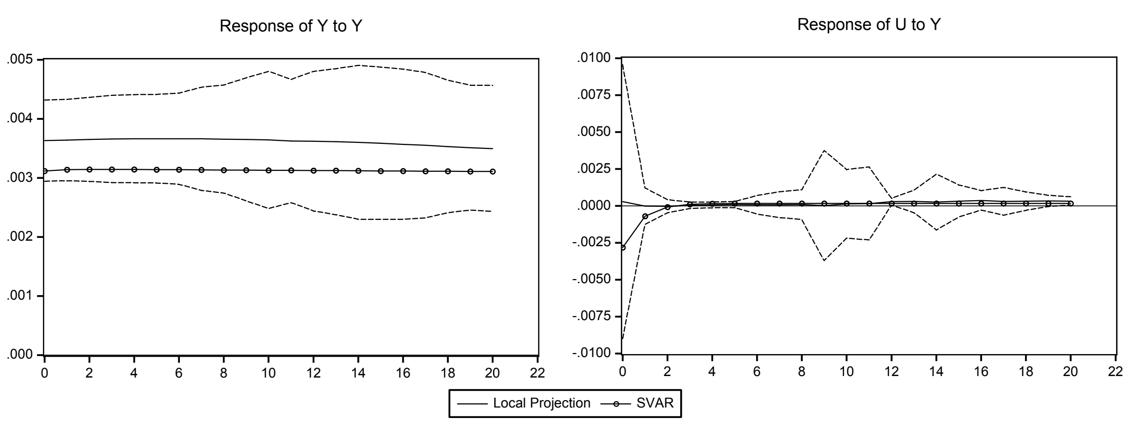


Fig. 50. Output and capacity utilisation shocks - Ireland

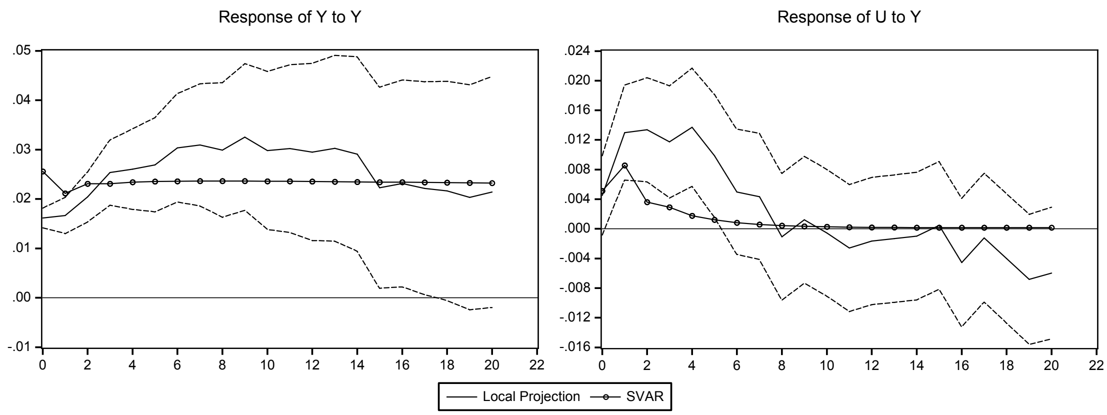


Fig. 51. Output and capacity utilisation shocks - Italy

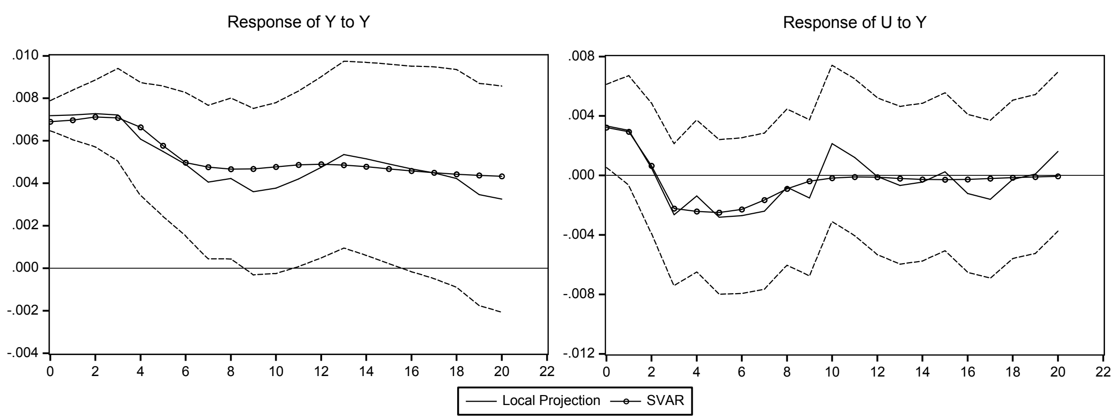


Fig. 52. Output and capacity utilisation shocks - Japan

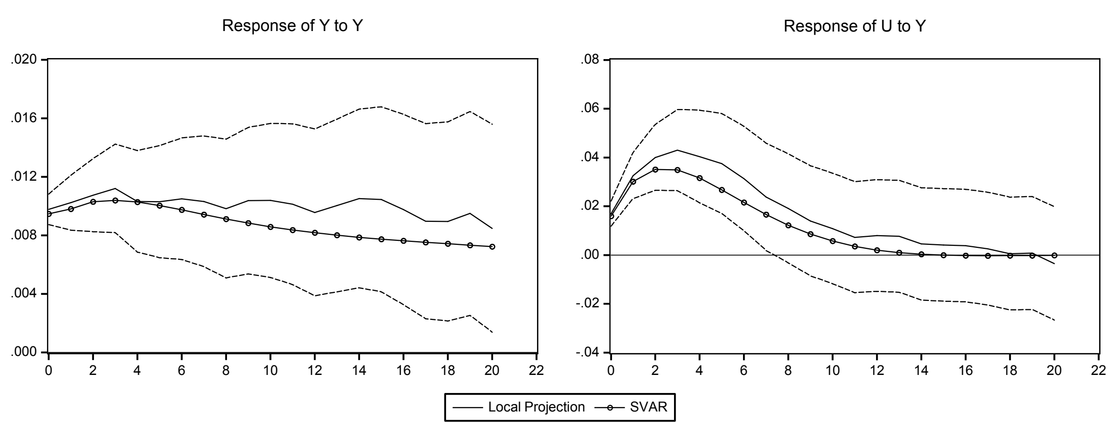


Fig. 53. Output and capacity utilisation shocks - Latvia

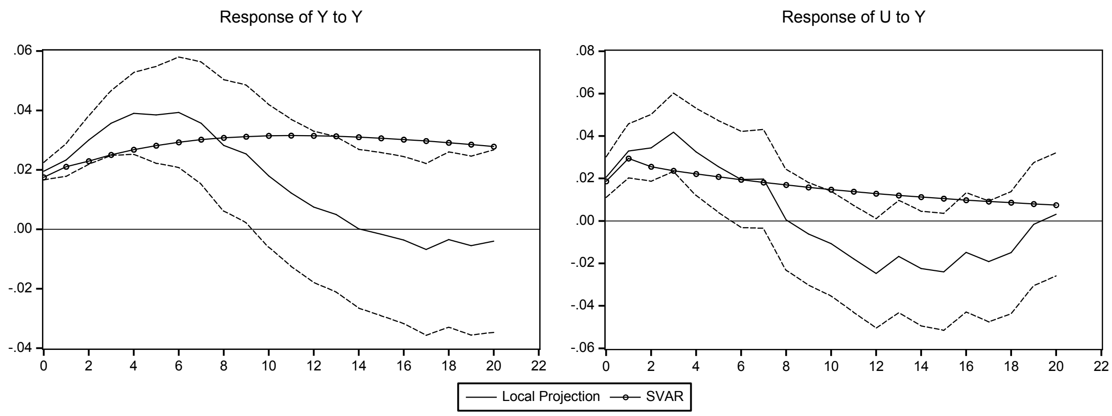


Fig. 54. Output and capacity utilisation shocks - Lithuania

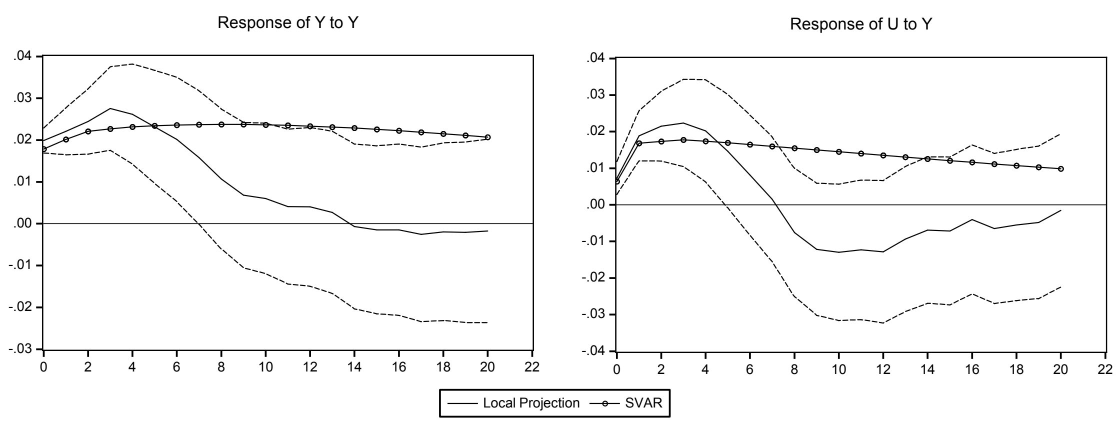


Fig. 55. Output and capacity utilisation shocks - Luxembourg

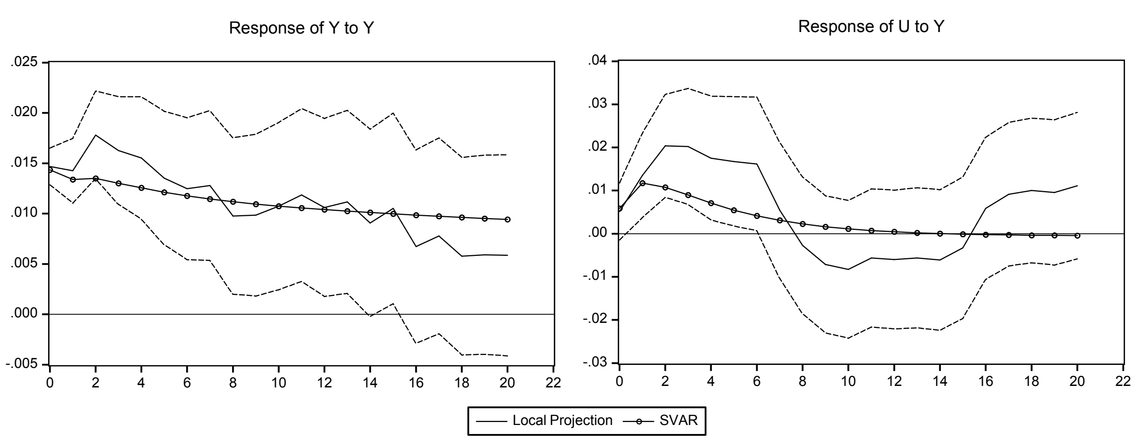


Fig. 56. Output and capacity utilisation shocks - Netherlands

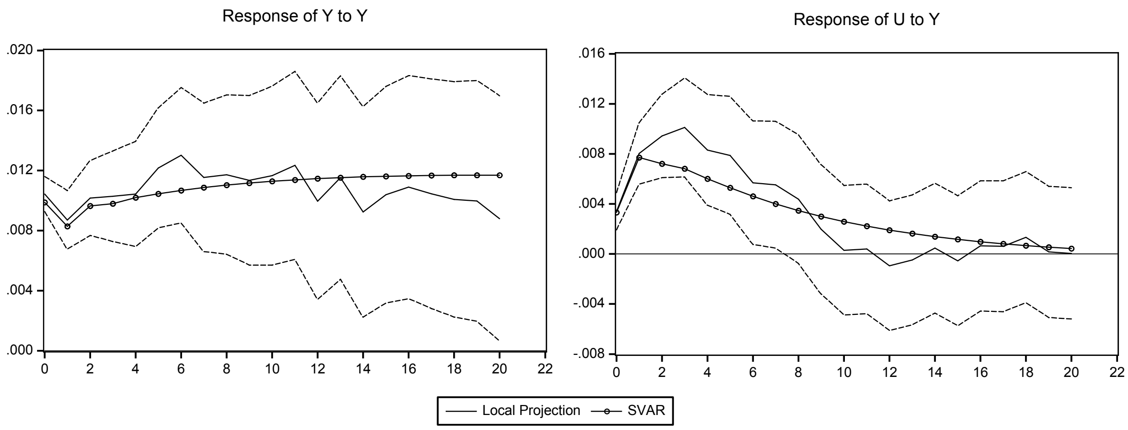


Fig. 57. Output and capacity utilisation shocks - New Zealand

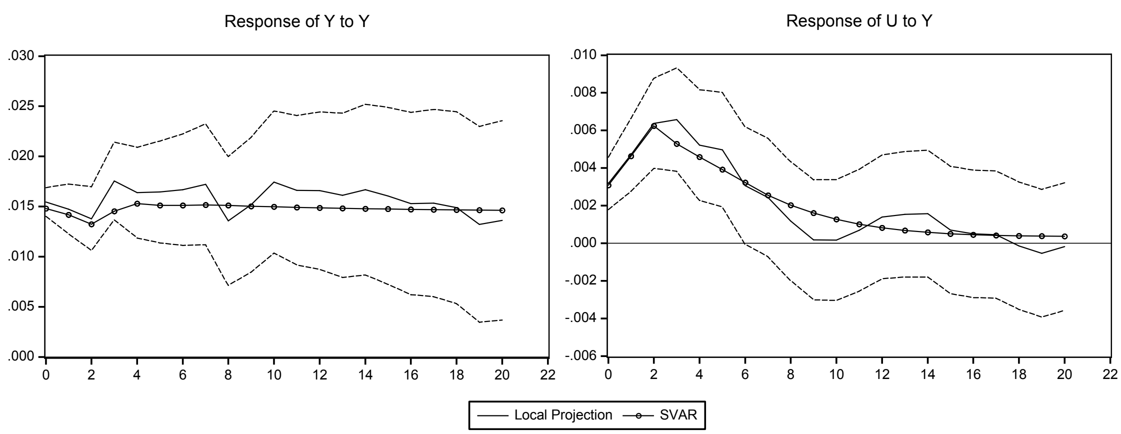


Fig. 58. Output and capacity utilisation shocks - Norway

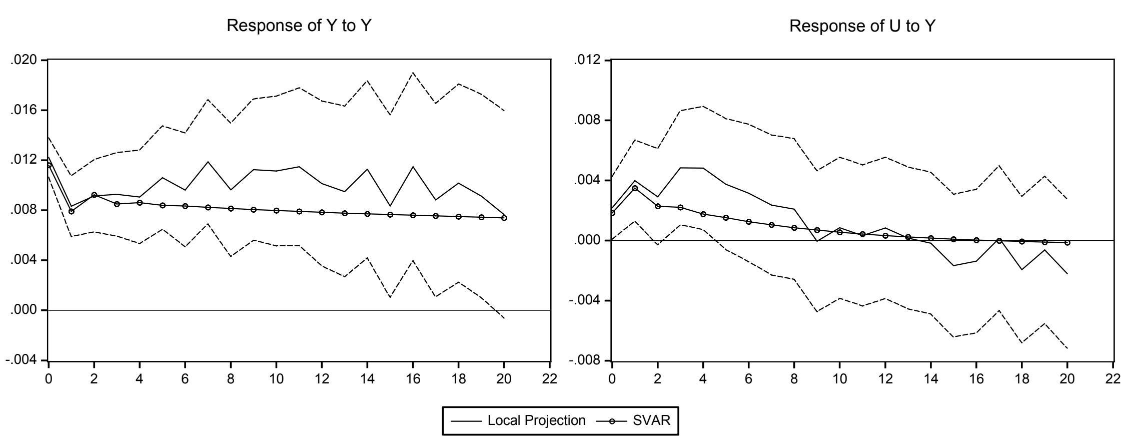


Fig. 59. Output and capacity utilisation shocks - Poland

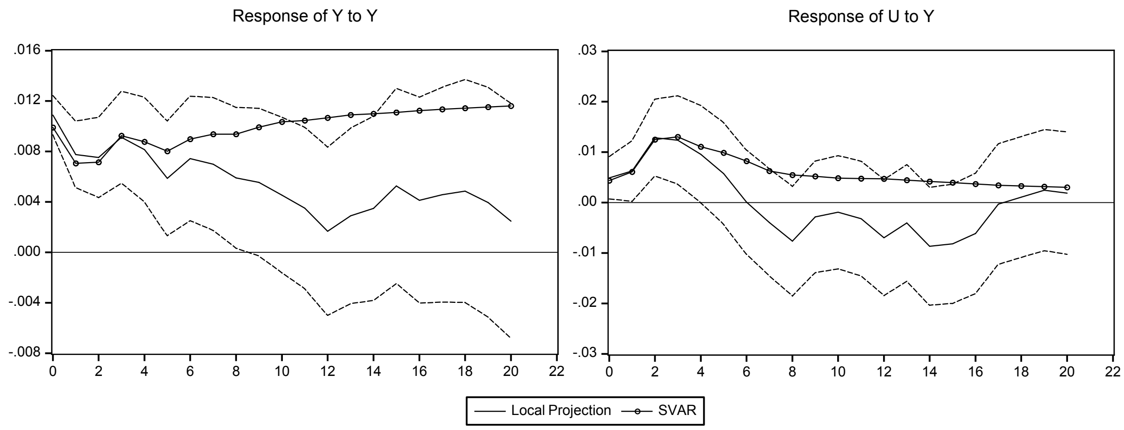


Fig. 60. Output and capacity utilisation shocks - Portugal

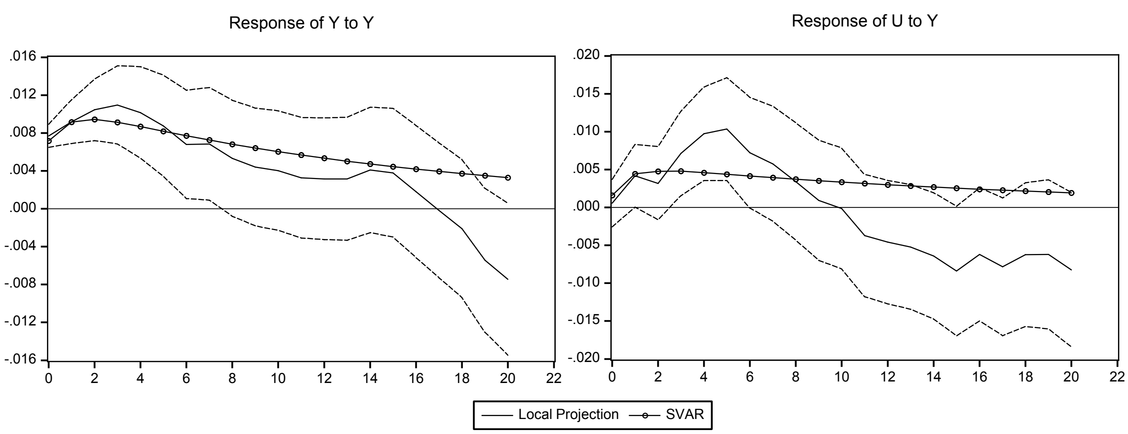


Fig. 61. Output and capacity utilisation shocks - Slovak Republic

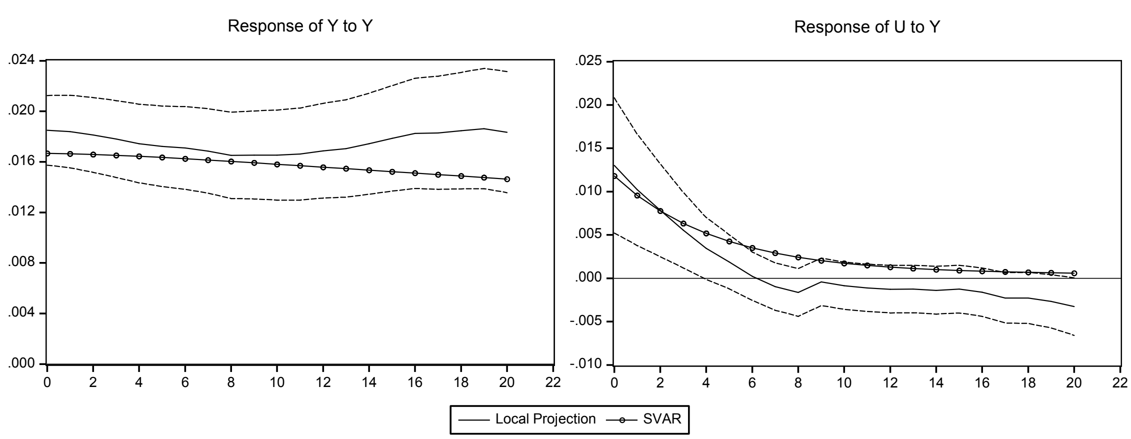


Fig. 62. Output and capacity utilisation shocks - Slovenia

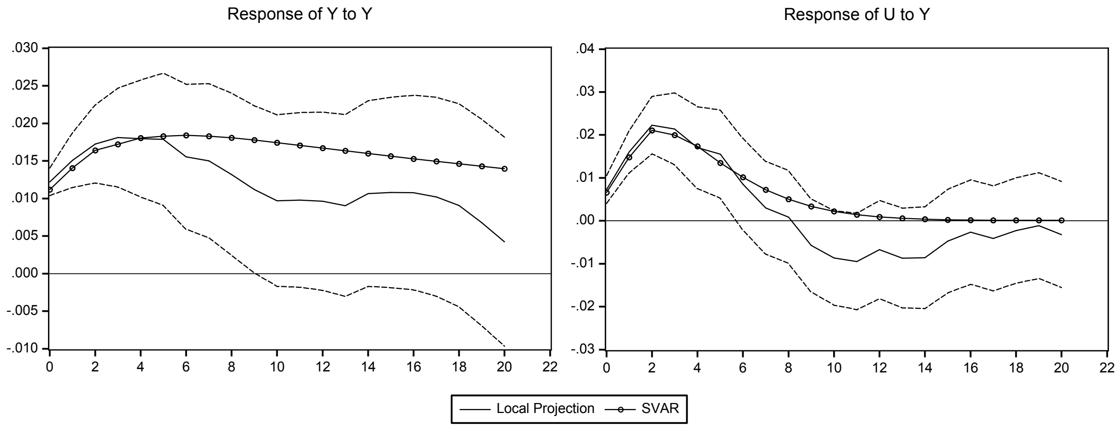


Fig. 63. Output and capacity utilisation shocks - South Africa

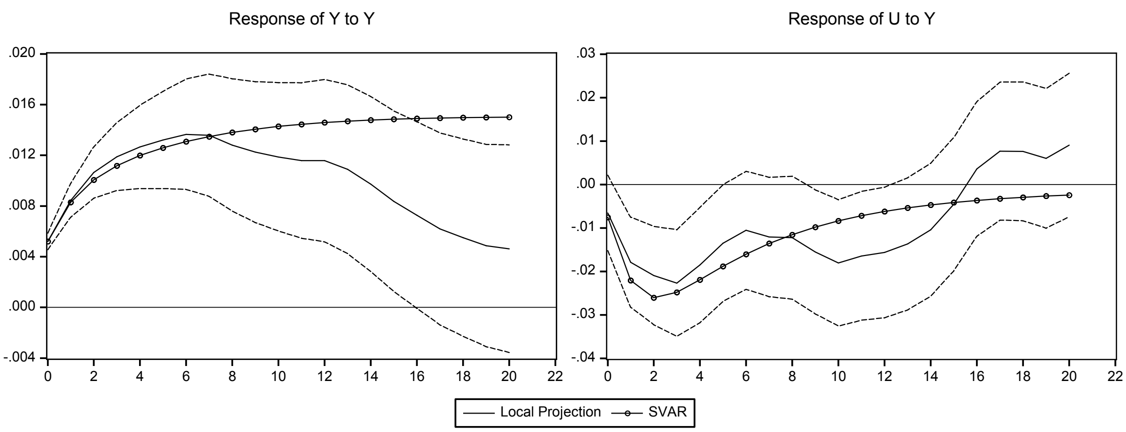


Fig. 64. Output and capacity utilisation shocks - Spain

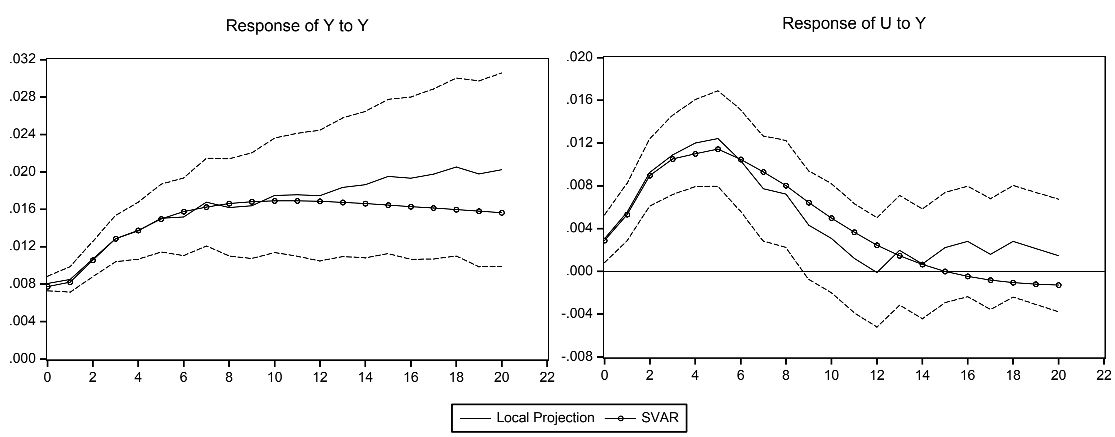


Fig. 65. Output and capacity utilisation shocks - Sweden

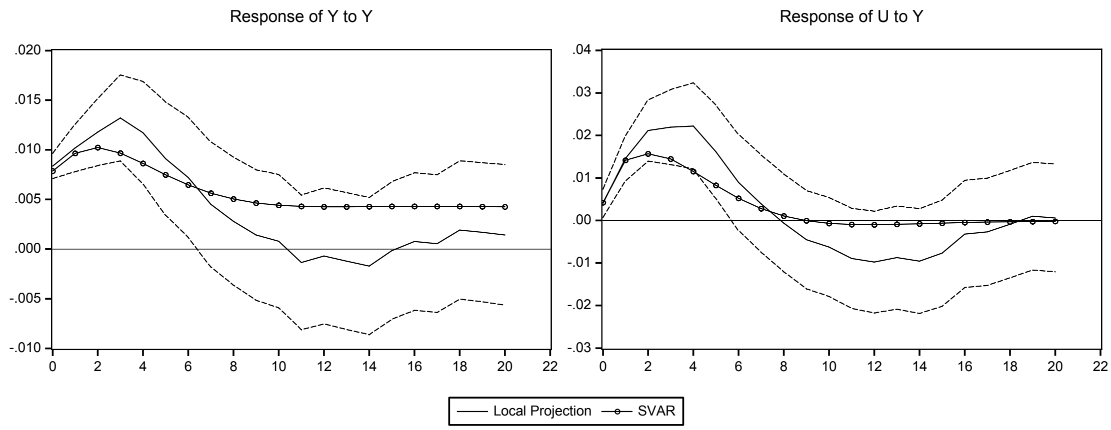


Fig. 66. Output and capacity utilisation shocks - Switzerland

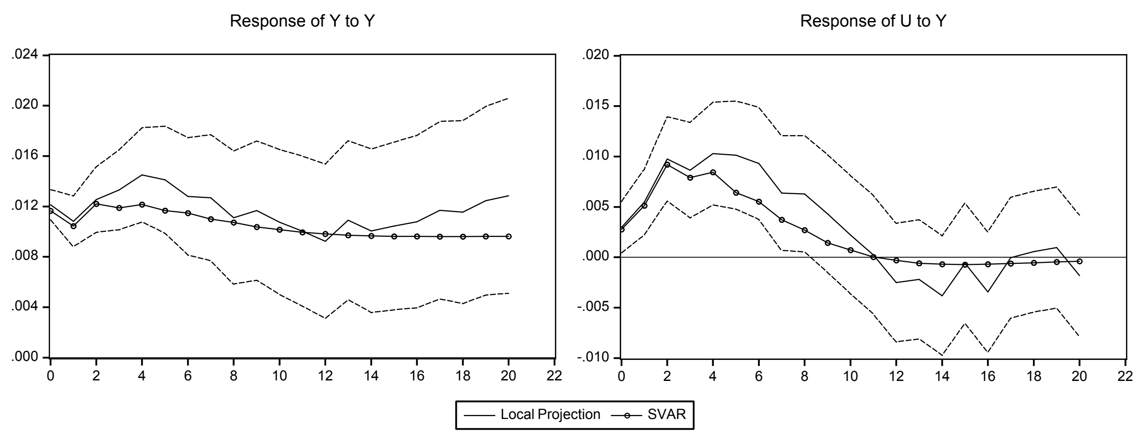


Fig. 67. Output and capacity utilisation shocks - United Kingdom

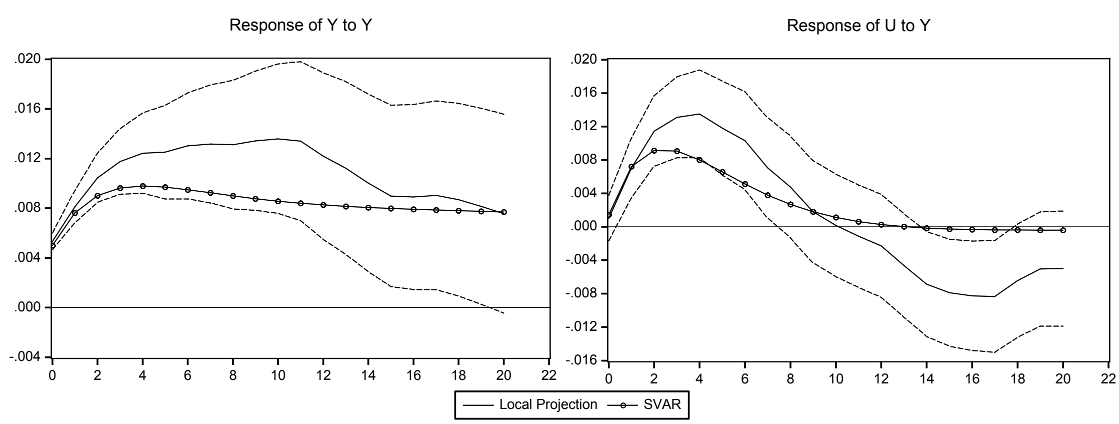
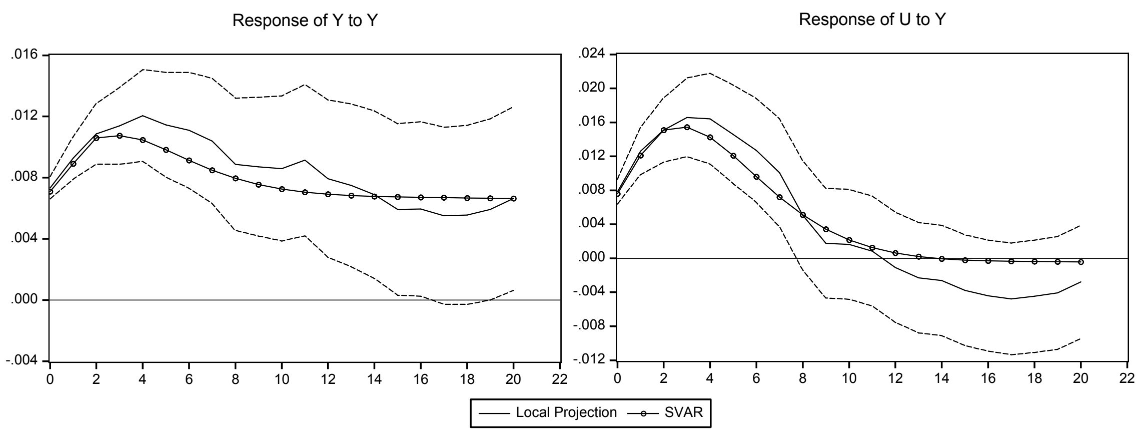


Fig. 68. Output and capacity utilisation shocks - United States



Appendix C. Lag selection criteria

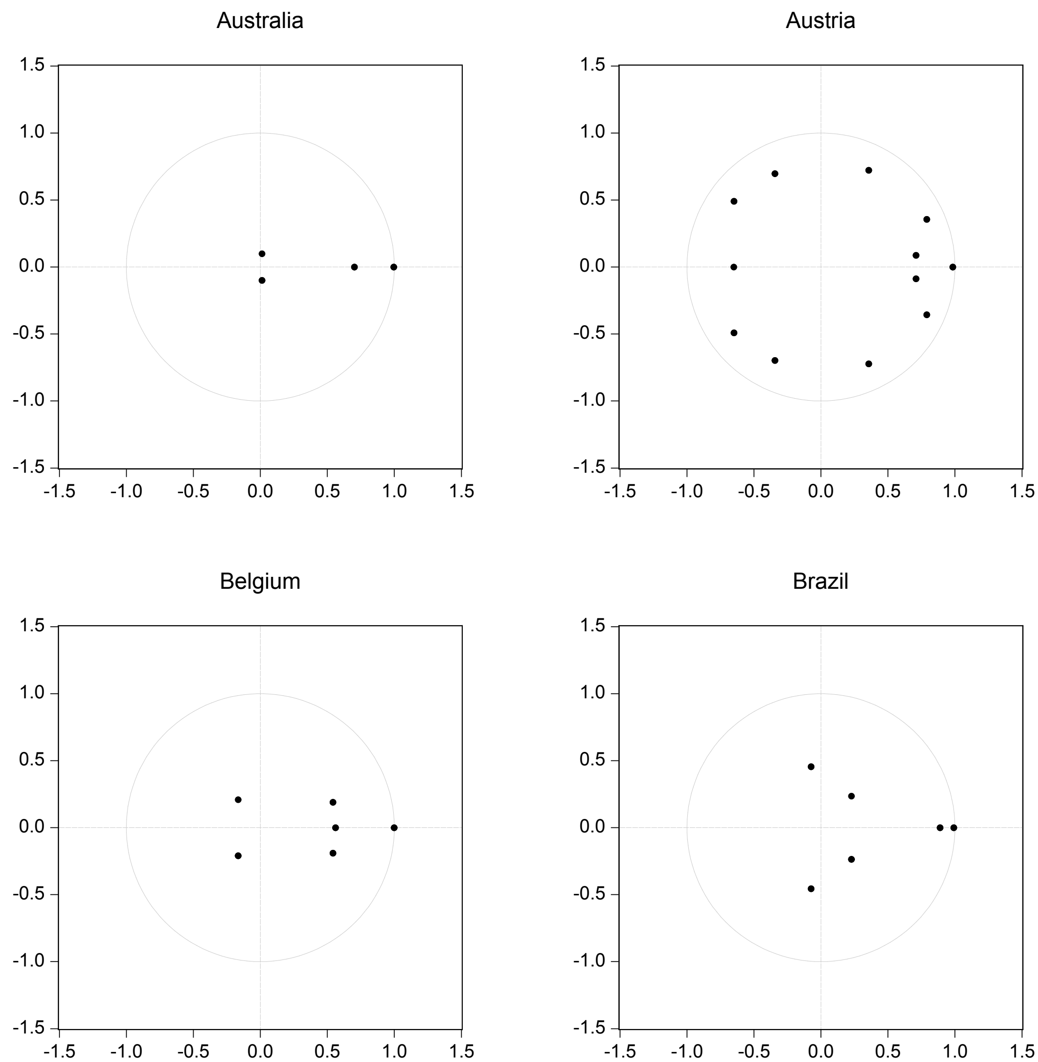
Table 2: Lag selection by country

Country	AIC lags	Value
Australia	2	-9.805
Austria	6	-13.865
Belgium	3	-13.494
Brazil	3	-12.667
Colombia	5	-11.162
Czech Republic	2	-12.633
Denmark	2	-11.880
Estonia	4	-9.768
Finland	4	-10.920
France	3	-14.455
Germany	4	-12.312
Greece	6	-9.976
Hungary	2	-11.397
India	1	-9.937
Indonesia	1	-12.518
Ireland	2	-8.609
Italy	5	-12.410
Japan	2	-10.638
Latvia	3	-8.878
Lithuania	2	-10.220
Luxembourg	3	-9.423
Netherlands	4	-13.311
New Zealand	5	-11.836
Norway	4	-12.233
Poland	4	-11.486
Portugal	3	-12.378
Slovak Republic	1	-9.056
Slovenia	3	-11.586
South Africa	2	-10.619
Spain	4	-12.381
Sweden	5	-12.427
Switzerland	3	-11.420
United Kingdom	3	-13.167
United States	4	-13.674

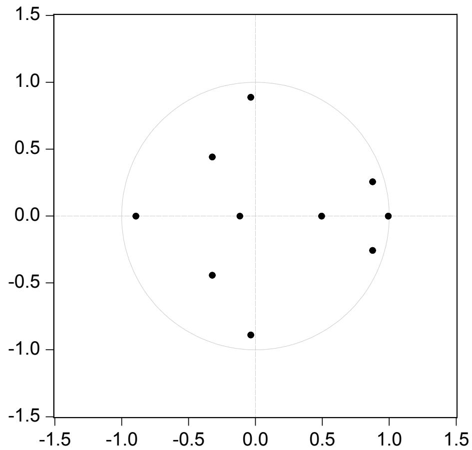
Source: own elaboration based on data provided.

Appendix D. Stability

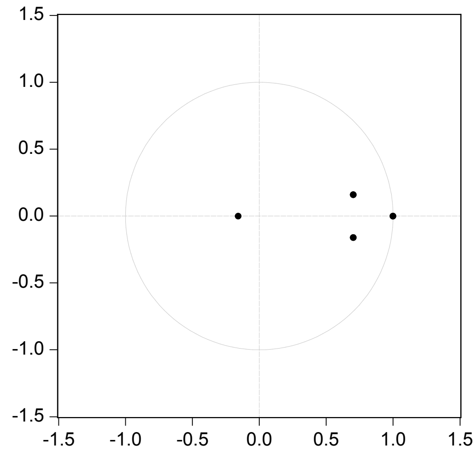
Fig. 69. Inverse Roots of AR Characteristic Polynomial



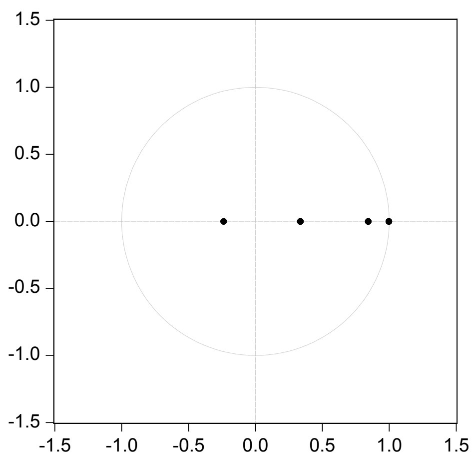
Colombia



Czech Republic



Denmark



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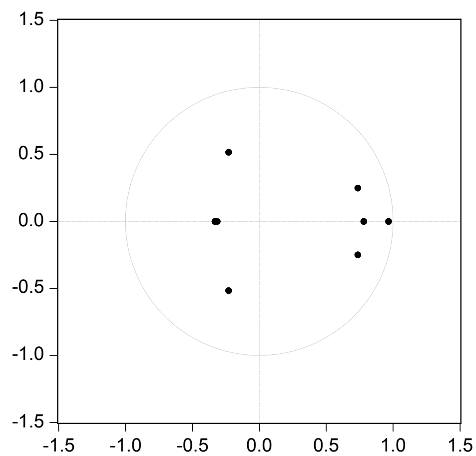

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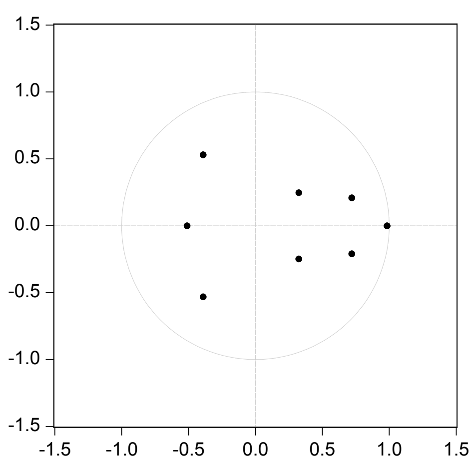

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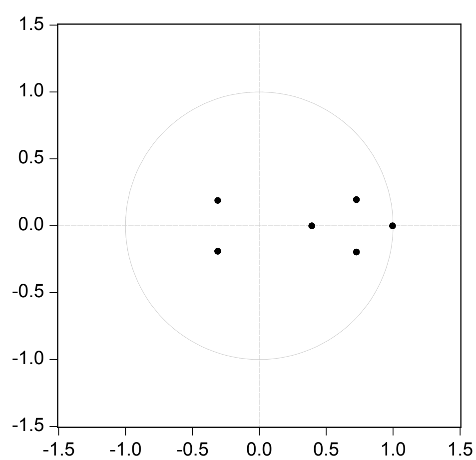

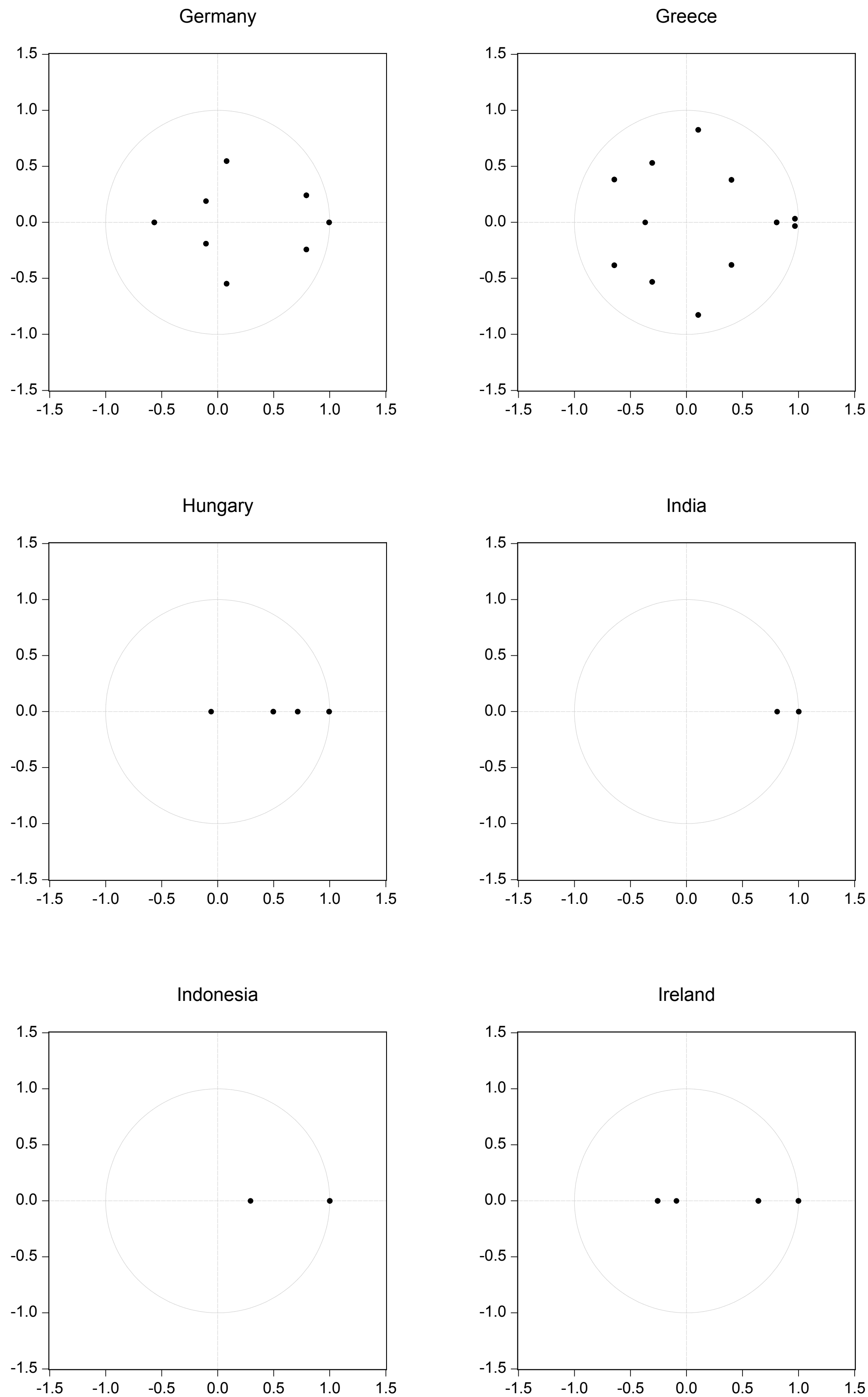
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Indonesia
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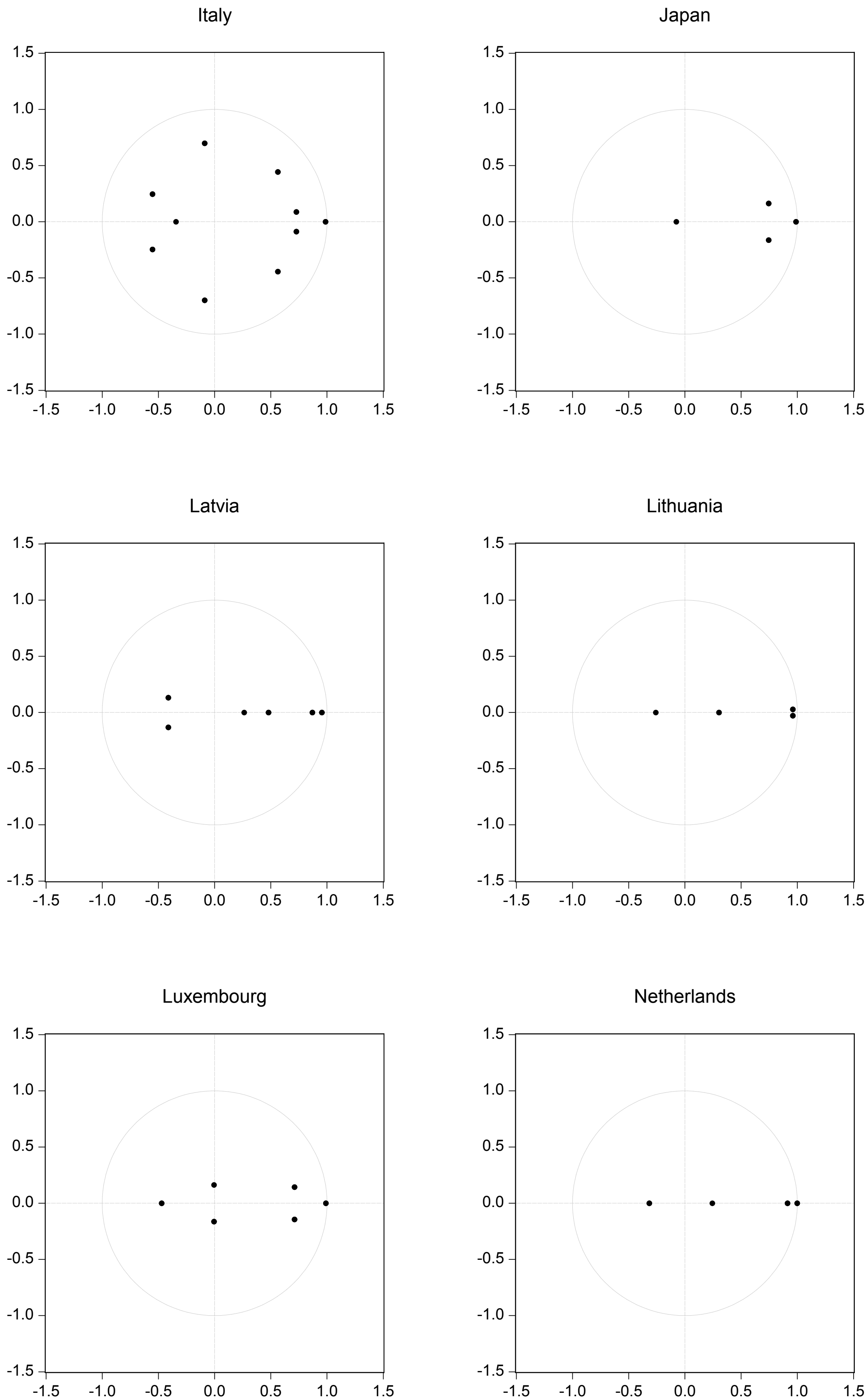
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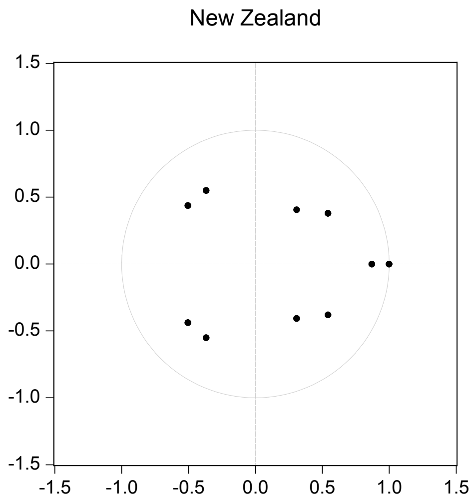
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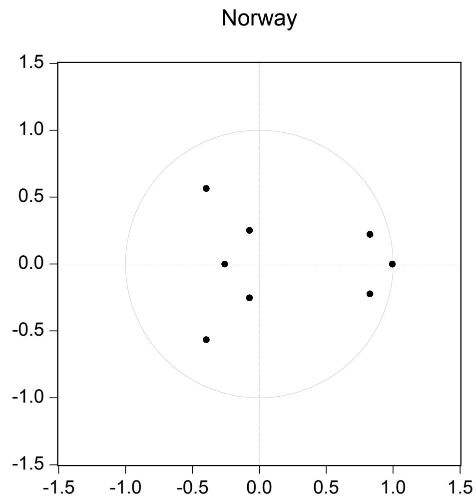
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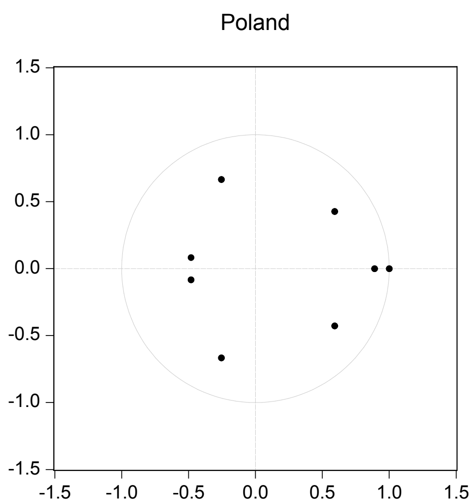
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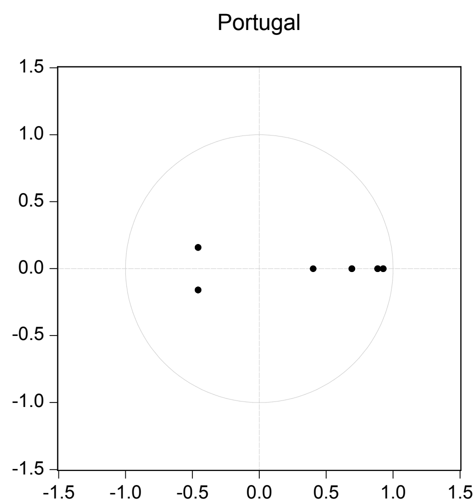
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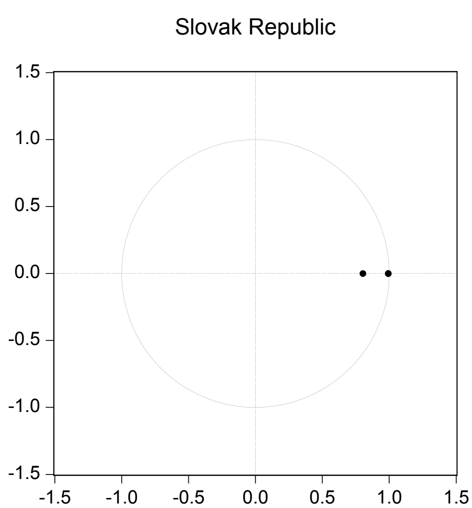
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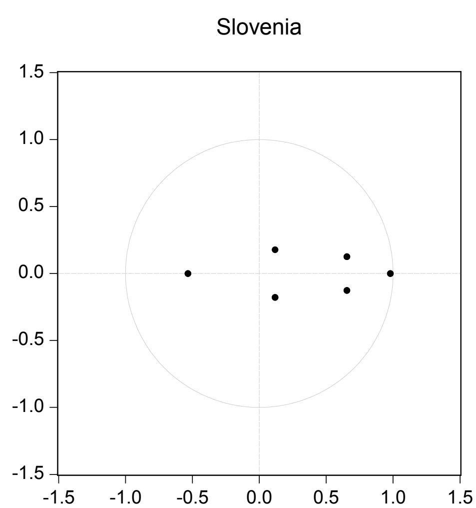
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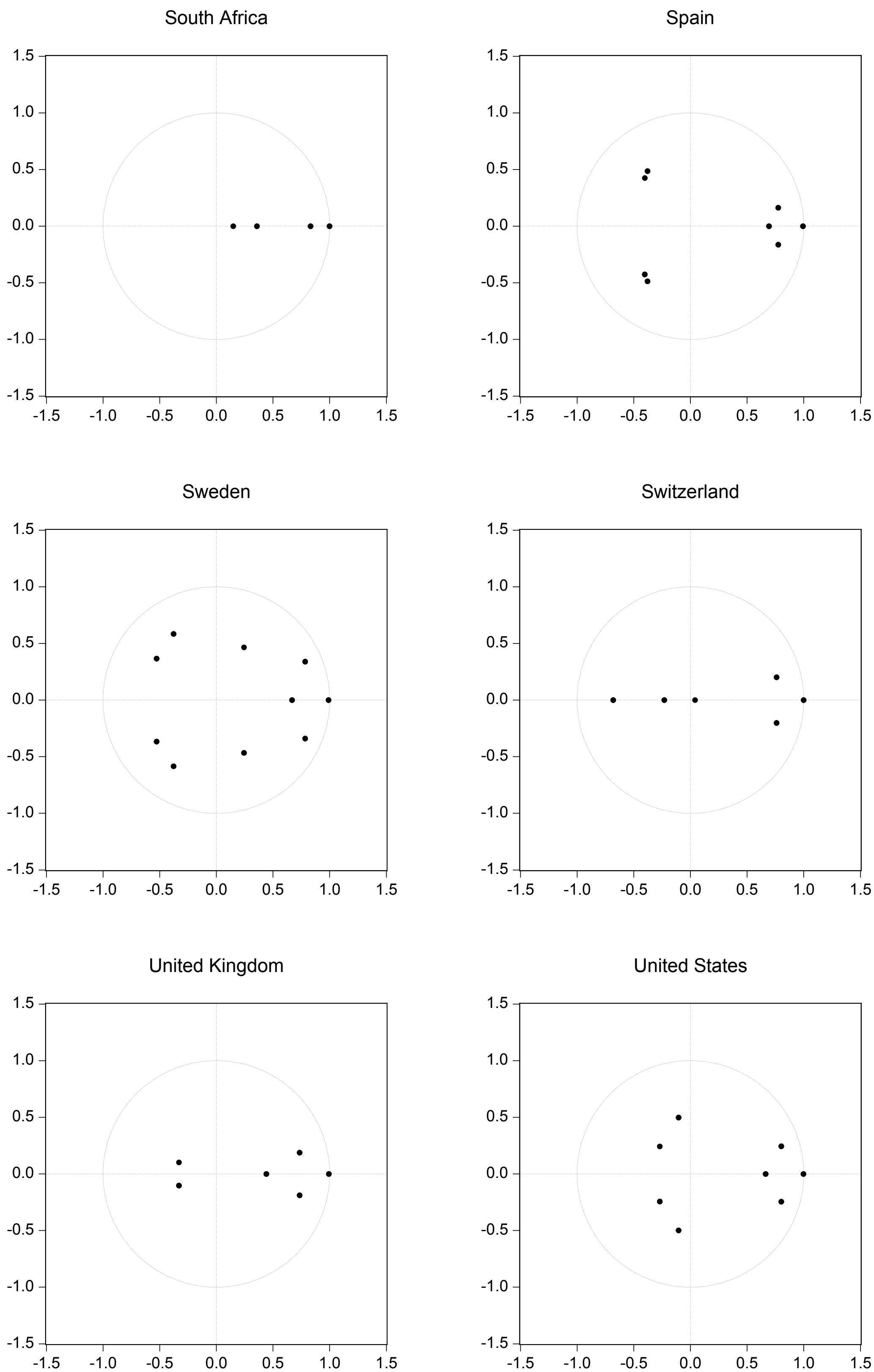


Source: own elaboration.

Appendix E. Unit Root Tests

Table 3: Time Series Unit Root Tests

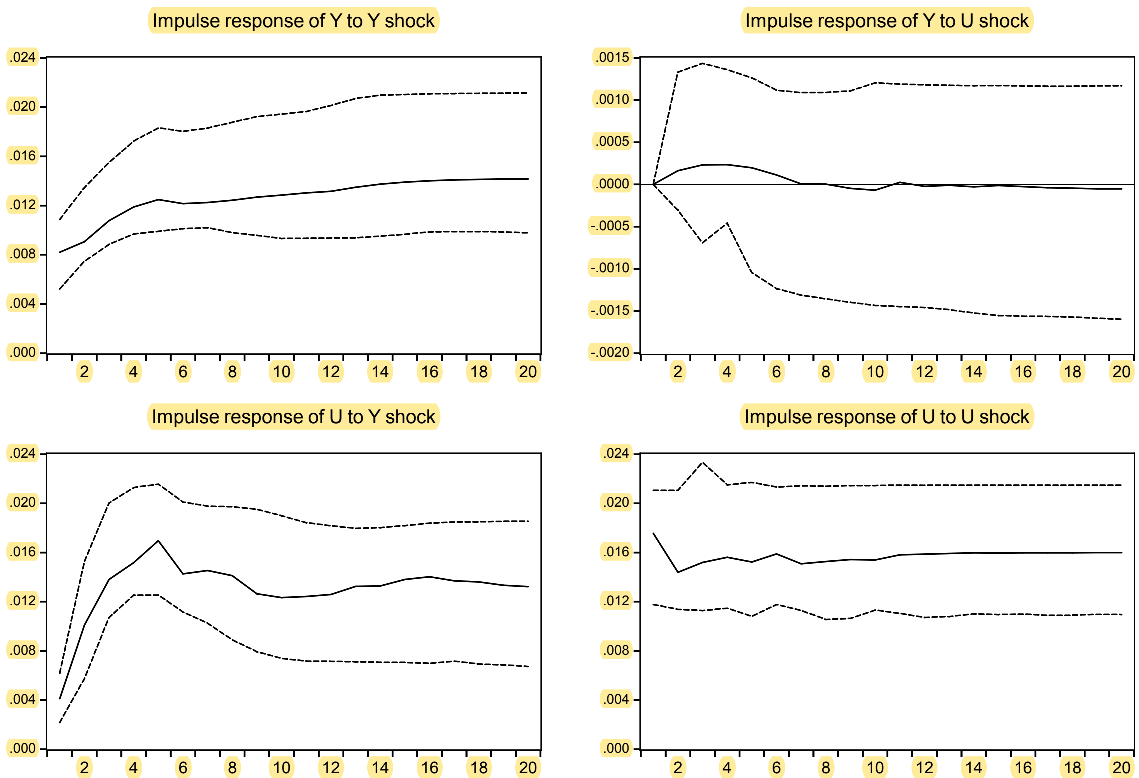
Country	Utilisation	Output-GDP
Australia	-4.052***	-2.391
Austria	-3.858***	-1.355
Belgium	4.698***	-1.117
Brazil	-2.958**	-1.577
Colombia	-2.733*	-0.733
Czech Republic	-2.156	-0.414
Denmark	-3.660***	-1.433
Estonia	-3.080**	-1.861
Finland	-3.658***	-1.939
France	-4.300***	-1.797
Germany	-5.902***	-3.793***
Greece	-1.778	-1.607
Hungary	-3.156**	-0.701
India	-2.272	0.363
Indonesia	-4.043**	-0.579
Ireland	-5.918***	-0.670
Italy	-4.214***	-3.921**
Japan	-4.426***	-4.920***
Latvia	-2.348	-1.350
Lithuania	-1.335	-1.536
Luxembourg	-3.378**	-2.588*
Netherlands	-3.391**	-0.917
New Zealand	-3.028**	-0.109
Norway	-3.501***	-1.373
Poland	-6.776***	-1.305
Portugal	-2.763*	-2.349
Slovak Republic	-3.214**	-1.366
Slovenia	-3.157**	-1.507
South Africa	-2.173	-0.161
Spain	-2.115	-1.253
Sweden	-3.719**	-1.601
Switzerland	-3.381**	-0.411
United Kingdom	-3.998***	-1.698
United States	-3.054**	-1.318

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

Source: own computations based on data provided in Appendix A in logarithms. ADF test for unit root in level with intercept; following Akaike Information Criterion (maxlags=11).

Appendix F. Panel Structural VAR: Composite, Idiosyncratic and Common shocks

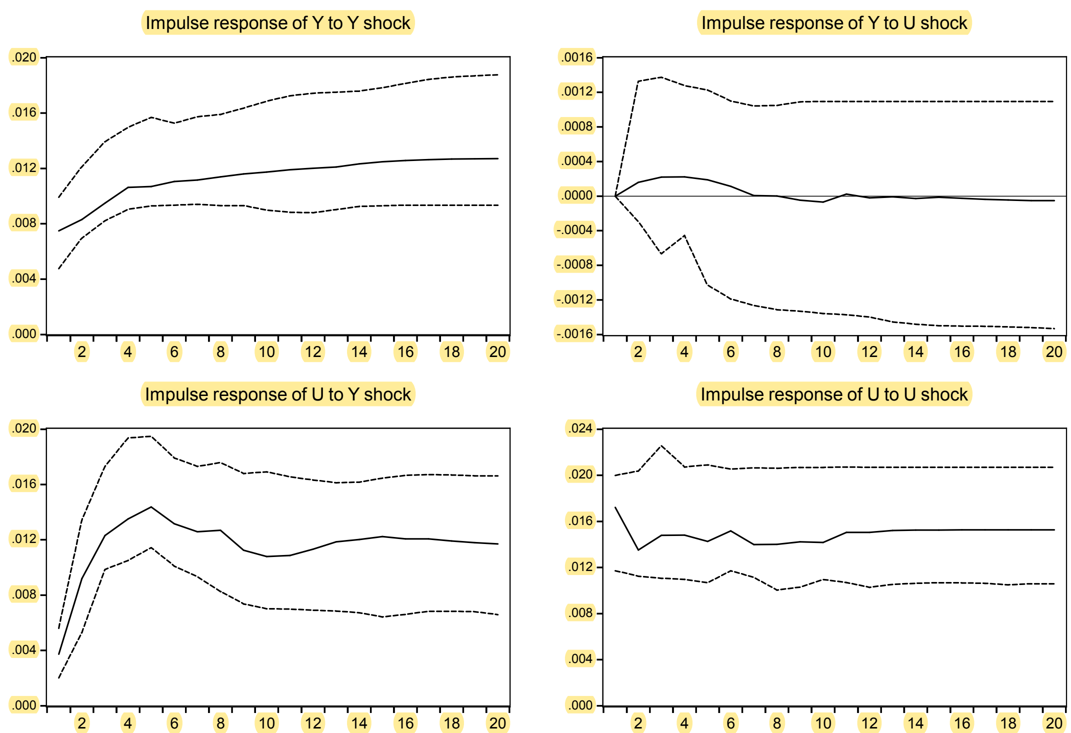
Fig. 70. Output and capacity utilisation - Composite shocks



Source: own elaboration based on data provided.

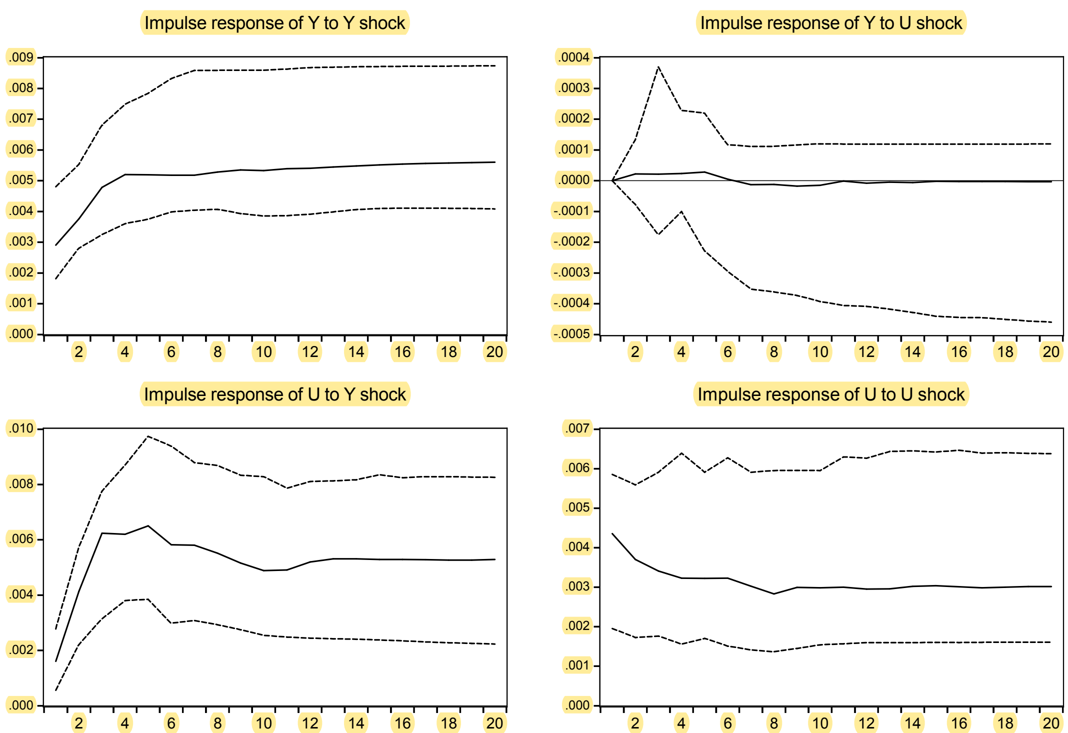
In the two columns of Figure 70 - also Figure 71 and Figure 72 - I can see the impacts interwoven between the two variables: output and capacity utilisation. Figure 70 are composite shocks, while Figure 71 and 72 are idiosyncratic and common, respectively. In the first row it can be seen the impacts of output on output (LHS) and of utilisation on output (RHS). In the second row it is shown the impacts of output on utilisation (LHS) and utilisation on utilisation (RHS). It must be clarified that the results presented here are *accumulated*. When the graph shows that a variable becomes stationary after a particular period, this implies that the effect is null afterwards. What it can be observed is that both a change of output and a change on utilisation generate transitory effects on capacity utilisation. However, these transient shocks take a certain amount of time to adjust, which in the case of composite plots can take up to ten years. These results are visually clearer when we re-express them using the non-accumulated impulse response functions (see Figure 3 in the main text).

Fig. 71. Output and capacity utilisation - Idiosyncratic shocks



Source: own elaboration based on data provided.

Fig. 72. Output and capacity utilisation - Common shocks



Source: own elaboration based on data provided.