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The Rise and Fall of Unproductive Activities in the US Economy 1964-2015: Facts, Theory and Empirical Evidence

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Abstract

The general idea about unproductive labour and the associated with it activities is that they tend to expand and by expanding reduce the investible product and the growth potential of the economy, however little is known about the determinants of their movement. In this study, we take a closer look at the US unproductive labour and activities in general during the long enough 1964-2015 period. As possible determinants of the movement of unproductive activities we consider the economy-wide average rate of profit, the real interest rate and the degree of capacity utilization. The Toda Yamamoto causality tests, as well as the ARDL econometric model, lend support to the view that the unproductive expenditures and activities are determined rather than determine the above variables. Furthermore, the error correction term indicates that a long-run equilibrium relationship exists and it is attainable after the passage of not too long time.

Keywords: Unproductive expenditures, rate of profit, Great recession, ARDL

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1. Introduction

The question of unproductive activities and their effect on the growth potential is central to the economic thought and dates back to the Physiocrats, the classical economists and Marx. The detrimental effects of unproductive labour were so much established in the economic philosophy that the emerging neoclassical economics had to develop a strategy in order to undermine the scientific significance of the concept. For example, Alfred Marshall (1890, 54) argued, as if it were an issue of choice, that "it would be best to regard all labour as productive" and "a fresh start" would call for the dismissal of the distinction. A suggestion that was taken on board by Schumpeter (1954, 631) who characterized the productive/unproductive labour distinction as a "dusty museum piece" and thereby dismissing the whole issue. However, the history of economic thought teaches time and again that suppressed meaningful ideas, one way or another, resurface latter in distorted forms. In effect, the idea of unproductive activities and expenditures made a comeback in neoclassical economics in the forms of "rent-seeking", Wagner's law of the ever-rising government expenditures and also in the "cost disease of services" story put forward by Baumol (1967). And in so doing neoclassical economics justifies Shaikh's (1978, 240) remark according to which "those who ignore theory are condemned to reconstruct it" and we may add that such in such a reconstruction many issues remain open.

The fundamental unified idea in the Physiocratic, classical and Marxian approaches is the concept of surplus, that is, what is left if, from the value of total output, the cost of labour and intermediate inputs is subtracted. This residually determined income is called surplus because it is available for either consumption or investment purposes. The higher the share of the surplus going to the investment the higher the growth potential of the economy or in Marxian terms the economy is reproduced on a higher scale. Hence, we have two limiting cases, the first is when the entire surplus is invested in production activities and the economy grows at its maximum growth potential and the second is when the entire surplus is consumed, that is, net investment is zero, and the economy is simply reproduced on the same scale or finds itself on its steady state. In the intermediate and also realistic cases, the more the surplus is invested in production activities the higher the growth potential of the economy and vice versa.

Turning to the neoclassical view, the issue of production non-production labour appears in the way in which the economy's resources are obtained and utilized. In particular, if labour is paid it means that it produces utility and therefore is considered productive and all activities to the extent that they produce marketed products or services they are regarded productive. In this context, there are some ethical overtones associated with such activities. For example, the rent-seeking activities do not contribute to the production of new output but they are merely financed by current output and in so doing reduce the amount of output left for investment thereby lessening the economy's growth potential (von Seekamm 2017). Since the very purpose of rent-seeking is the extraction of excess profits at the expense of their competitors is in general viewed as socially undesirable and, by and large, result in, at best, a zero-sum gain for society. The growth of government expenditures may also be viewed as detrimental to growth for reasons that have to do with increasing government intervention in the economy and therefore interfering with competition or that the government services, to a great extent, are not marketed (Bacon and Eltis, 1996). Finally, Baumol's (1967) "cost disease of the service sector" includes both private and government-provided services. The idea is that services, in general, are labour-intensive activities and they are not easily amenable to capital-using and labour-saving technological change, and therefore labour productivity in services falls behind that of the rest of the economy. Assuming that wages are paid according to their marginal contribution to production, it follows that wages, in the non-service sectors of the economy, increase as a result of rising marginal productivity of labour consequent upon technological change. By contrast, wages in services, particularly in those of the workers in the public sector, also increase in line with those of the rest of the economy albeit not as a result of their rising productivity, which remains stagnant, but rather because of the threat of labour mobility to the higher wage sectors or because of high unionization factor or both.[1] Consequently, the cost of production in the economy, as a whole, increases and this interferes with profits, thereby discouraging investment leading to the slowdown in the economic activity. The recessionary period of the late-1960s until the early-1980s in the US and other major economies is attributed to "cost disease" and the same cause might be claimed for the great recession of the post-2007 years.

[1] Real wages in the USA were rising at least up until the early 1970s (see Paitaridis and Tsoulfidis 2012).

In this article we make an effort, on the one hand, to give an estimate of the size of unproductive activities in the US economy spanning the period 1964-2015 and data from the North American Industry Classification System, NAICS, and, on the other hand, to apply econometric techniques in order to explore the causal relationships between the movement of unproductive activities, the rate of profit, the real interest rate and the degree of capacity utilization. To the extent that we know the literature although all studies argue about the detrimental to economic growth effect of unproductive expenditures; nevertheless, there is no study that we know, at least, and subjects to empirical testing the possible determinants of the unproductive expenditures as well as the attainment of an equilibrium state. This study makes an effort, on the one hand, to identify the determinants of the unproductive activities and evaluate their quantitative significance and, on the other hand, to investigate the possible causal relationships between the variables involved. In the last five decades or so there have been a number of important studies in this area and the availability of appropriate data with the use of econometric analysis enable the more detailed investigation of the very old issue of the growth of unproductive expenditures. The Toda Yamamoto causality tests initially and subsequently the autoregressive distributive lag (ARDL) econometric technique are utilized in order to derive whether there is a long-run equilibrium relationship among the variables involved and at the same time to ascertain the short and long-run causal relationships between those variables.

The remainder of the chapter is structured as follows: Section 2 reviews the classical approach regarding the concepts of production and non-production activities and the associated with these, employment. Section 3 discusses our estimates of the size of the unproductive activities in the US economy spanning the period 1964-2016. Section 4 presents the econometric specification of our model and outlines the various tests to be employed. Section 5 test the causality properties of our model using the suitable to the case Toda-Yamamoto test whose results are also ascertained by the application of ARDL cointegration method. Section 6 summarizes and makes some concluding remarks for future research efforts.

2. Production, surplus and investible product

Physiocrats were the first to emphasize the importance of production activities and the surplus generated in these activities which they visualized of it as emanating from nature (agriculture) and not necessarily from human effort. This is an aspect of their thought that Smith criticized and by criticizing it advanced his own view according to which surplus is generated by labour activity. Smith was very careful in distinguishing surplus (or wealth)-creating labour from the surplus-consuming labour. He argued that all wage-labour engaged either in agriculture or manufacturing was productive, insofar as it was being paid directly from capital and gave rise to a profit for the owners of capital. By contrast, the wage-labour paid out of revenue, that is, profit, rent or even wage, was considered unproductive. The following often cited quotation exemplifies his position

> Thus the labour of a manufacturer adds, generally, to the value of the materials which he works upon, that of his own maintenance and of his master's profit. The labour of a menial servant, on the contrary, adds to the value of nothing. Though the manufacturer has his wages advanced to him by his master, he, in reality, costs him no expense, the value of those wages being generally restored, together with a profit, in the improved value of the subject upon which his labour is bestowed. But the maintenance of a menial servant never is restored. A man grows rich by employing a multitude of manufacturers: he grows poor, by maintaining a multitude of menial servants. (Smith 1776, 314)

Hence, Smith clarified the distinction between productive and unproductive labour according to social relations. This distinction, however, was immediately followed by a second rather 'vulgar' material definition of production according to which only the labour activity resulting in a material (tangible) product is productive and unproductive is the labour resulting in non-material (non-tangible) outcomes (Smith 1776, 314-5). In this second definition, the provision of all services was treated as non-production.

Perhaps, at Smith's times the provision of services (mainly a government activity) was very limited and as a total approach, Smith's two definitions would not result in any significant quantitative differences. But as the time went by the amount of non-tangible "products" expanded and so if we were to follow Smith's definition, we would fall into a series of challenging issues. Notwithstanding the deficiencies in his definition, Smith could argue that the expansion of unproductive activities and labour is not without consequences for society at large. Thus, he notes

> Such people [employed in services], as they themselves produce nothing, are all maintained by the produce of other men's labour. When multiplied, therefore, to an unnecessary number, they may in a particular year consume so great a share of this produce, as not to leave a sufficiency for maintaining the productive labourers, who should reproduce it next year. The next year's produce, therefore, will be less than that of the foregoing, and if the same disorder should continue, that of the third year will be still less than that of the second. (Smith 1776, 325)

Hence, the expansion of unproductive activities and labour is not without limits and there might be a threshold past of which the unproductive labour and the associated with these activities become unsustainable for they interfere with the normal process of capital accumulation.

Marx continued this tradition by praising Smith's penetrating approach to the classification of labour activity and to the articulate discussion on the importance of this categorization to the growth of wealth of a capitalist society. Marx seems to expect that with the passage of time unproductive activities would expand, thus, he writes:

> The extraordinary productiveness of modern industry [. . .] allows of the unproductive employment of a larger and larger part of the working class, and consequent reproduction, on a constantly extending scale, of the ancient domestic slaves, under the name of a servant class, including men servants, lackeys, etc. [. . .] (Marx 1867, 487)

In the above quotation, Marx argues that the expansion of unproductive activities is not arbitrary but it is conditioned upon the growth in productivity and therefore the growth of surplus-value to sustain the unproductive activities. The latter may grow for a number of reasons including the intensification of competition which forces capitalists to spend progressively higher amounts of their surplus-value in administration, supervision and marketing in the effort to ascertain order within their corporation and maintain, and if possible expand, their market share at the expense of competitors. Furthermore, distribution activities, such as wholesale and retail trade, tend to expand along with real estate and other non-production services, when interest rates are low and borrowing easy and, at the same time, the returns on investment plummet. Furthermore, social cohesion requires increasingly more resources to be devoted to the provision by the government of social security benefits for the unemployed and retired population. Finally, the international competition for sources of raw materials as well as for markets exerts an ever-present pressure on governments to increase their military expenditures.

Our discussion of productive-unproductive labour is based on Shaikh's distinction of four spheres of social reproduction, that is production, distribution, social maintenance and consumption, where the first three spheres utilize labour whereas the fourth one is essentially non-labour (or in neoclassical economics leisure) activity. Productive labour is defined as the wage labour employed in production activities and it is paid out of capital (see Shaikh and Tonak 1994, 25; Tsoulfidis and Tsaliki, 2014). This is the kind of labour that creates wealth, whereas the other kinds of labour employed in distribution and social maintenance activities are sustained by the surplus value created in production activities. It goes without saying that even within the sphere of production there might be labour engaged in the non-production activities such as supervision, securitizing, accounting and the like that are treated as unproductive. It is well known that in accounting of corporations the businesses expenses such as for example the corporate officers salaries, the materials or the depreciation of equipment used for administrative purposes are included in gross profits (a rough corporate accounts' measure of surplus-value) and not in cost proper, that is, to the wages of workers and the depreciation of plant equipment in production (see also Shaikh and Tonak 1994, 305 and Mage 1963, 188-189).

It is important to stress at this point, that the distinction of labour activity has nothing to do with issues related to whether a kind of labour is more or less necessary than another. Furthermore, the distinction has nothing to do with the kind of commodities produced, that is, whether they are necessary or luxury, basic or not basic and other related issues (Shaikh and Tonak 1994, ch. 1). Hence, all spheres of social reproduction and labour utilized are necessary and they are important in their own right and that the society at large cannot be sustained without the synergy of all kinds of labour activities and spheres of social reproduction.

3. Unproductive Expenditures and Labour in the US Economy, 1964-2016

A visual inspection of the Figure 1 below shows that the share unproductive employment, Lu, to total employment, L, denoted by Lu/L and measured on the left-hand side axis was rising with small fluctuations up until the year 1990 and then stabilized without displaying any particular tendency, giving rise to an overall slightly rising trend. A pretty much similar overall picture is obtained with the share of unproductive expenditures, U, to total surplus-value, S, denoted by U/S and measured also on the left-hand side axis of Figure 1.[2] We observe that the U/S ratio displays much higher volatility than that of employment and picks much earlier in 1982, however it fluctuates at high levels up until 2000 and then points to a downward direction. The earlier studies of unproductive expenditures starting from Gillman (1958), Mage (1963) which are more in line with our work but also studies by Baran and Sweezy (1966) concluded that the unproductive expenditures cannot but expand in the future and chock off the process of capital accumulation. More recent studies in the 1980s and 1990s (Shaikh and Tonak 1994, Moseley 1985, 1991, *inter alia*) ascertained these bleak trends for the future of capital accumulation which as we can see from Figure 1 are justified up until, at least, the 1990s; however, the years after show more like a stabilized effect.[3] A better idea, we may obtain about the evolution of unproductive expenditures, when weighted by the total gross capital stock, K, of the economy denoted by U/K and measured on the right hand side axis of Figure 1. In our view the ratio U/K conveys much better the evolution of unproductive expenditures and their effect on the economy. The rationale is that with the passage of time the economy's surplus-value increases along with the increase in labour productivity which becomes possible mainly through technological change, which is embodied in new investment and their accumulation into the total capital stock. Thus, the capital stock is a better yardstick to weigh the true size of the unproductive

[2] The unproductive expenditures, U, includes the sum of gross profits, wages, materials and depreciation of the unproductive sectors of the economy, namely, the retail and wholesale trade as well as the finance and real estate sectors along with some non-production services augmented by the indirect business taxes. The total surplus-value S includes in addition to U the profits of the production activities. For the details of the classification between production and non-production activities in accordance with NAICS and for the estimates of these variables see Tsoulfidis and Paitaridis (2017, Appendix 1).

expenditures, precisely for the same reason that surplus-value or profits are weighted against the capital stock.[4]

A visual inspection of Figure 1 shows that the variable U/K displays an overall falling trend reflecting the fact that the unproductive expenditures increase at a rate slower than that of the capital stock. Notwithstanding this is the overall trend, we observe that there are important long fluctuations characterizing expansionary or contractionary periods of economic activity. In particular, we observe that in every major recession the ratio U/K falls and in every period of economic expansion increases. Since our analysis starts off with the year 1964, that is, at the end of the 'golden era of accumulation' and from the late-1960s onwards, we have the onset of the 'stagflation crisis' whose trough is in 1982, the 'neoliberal period' of growth is accompanied by a rising U/K ratio which picks in 2000 a year prior to the burst of the dot-com bubble and remains at high levels until the burst of the real estate bubble 2006/2007 and the onset of the 'great recession' of post-2007 years.

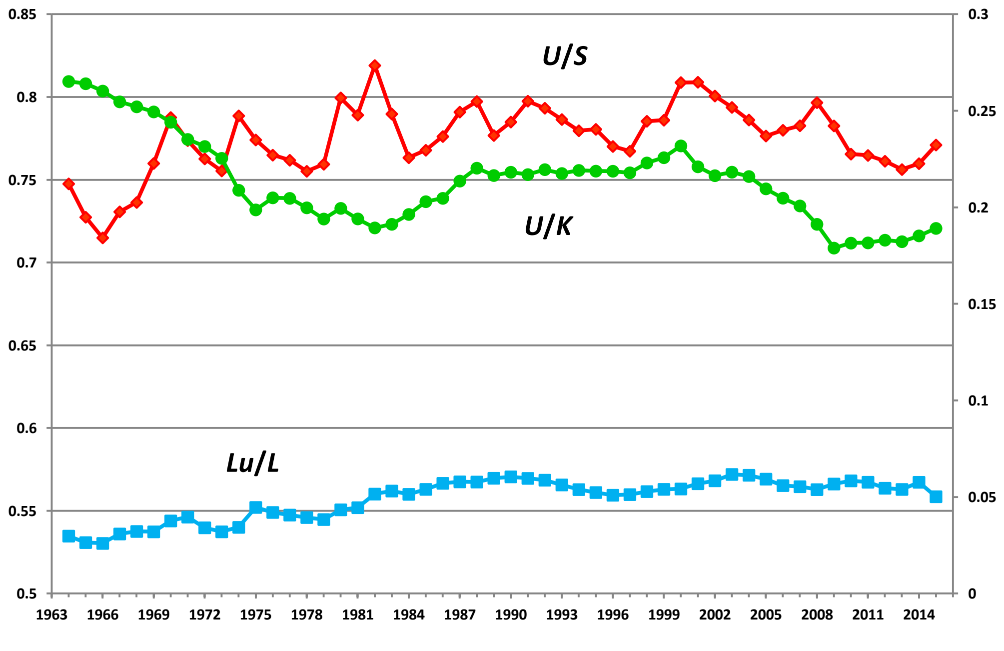

Figure 1. Shares of non-production expenditures and employment, 1964-2015

[3] For a differentiated view of the concept of productive-unproductive labour and activities see Mohun 2014.
[4] For the rationale of the use of gross capital stock see Shaikh (2016, ch. 6) and Tsoulfidis and Paitaridis (2017).

The evolution of the *U/K* ratio is of great interest and its further in-depth investigation with other related variables is in order. In effect, the classical economists and Marx provide us with important clues as to the selection of these variables, at the same time, however, we have collected enough empirical evidence from the hitherto research of the USA and other economies. Thus, it does not require a lot of sophisticated investigation and analysis to figure out the major variables affecting and being affected by the ratio of the unproductive expenditures to gross capital stock. In this set of variables, we include the rate of profit, that is, the net profits over the gross capital stock along with the real interest rate and the degree of capacity utilization. The idea behind the selection of these variables is that since the rate of profit is the principal determinant of the investment behaviour it follows that a rising or falling rate of profit will exert an effect on the movement of the unproductive expenditures and activities. Taking the analysis a step further, we can think of a falling rate of profit in the face of rising real interest rate as the worst combination against investment spending in production activities. Under these circumstances one expects the slowdown in investment in production activities and in the expansion of the unproductive activities. It goes without saying, that there are other important combinations, such as a falling rate of profit and a falling, by more, real interest rate, which increases the gap between the two variables, the 'rate of profit of enterprise'. A gap which stimulates investment mainly in unproductive activities as witnessed during the neoliberal period, starting in the early-1980s up until the period of the great recession of post-2007 years (Shaikh 2016, ch. 16). The role of the degree of capacity utilization must also be taken into account for it encapsulates the effect of demand on (real or financial) investment expenditures.

In Figure 2 below, we display scatter diagrams of all possible combinations of the four related variables in an effort to identify their simple correlations and, at the same time, to pave the way for various causality tests, starting from the very simple but as we will show appropriate to the task Toda Yamamoto test to the more sophisticated ARDL cointegration, error correction and subsequent causality tests of all of our four variables. The correlation coefficients are displayed in Table 1 below and indicate the strength of the association of the selected variables.

Table 1. Correlation Matrix

Correlation [t-Statistic] (p-value)	*u*	*r*	*cu*	*ir*
u	1.000 --- ---			
r	0.799 [9.426] (0.00)*	1.000 --- ---		
cu	0.716 [7.270] (0.000)*	0.755 [8.150] (0.000)*	1.000 --- ---	
ir	0.163 [1.169] (0.247)	-0.054 [-0.388] (0.699)	0.151 [1.082] (0.284)	1.000 --- ---

Notes: * denotes rejection of the null hypothesis at the 1% significance level respectively.

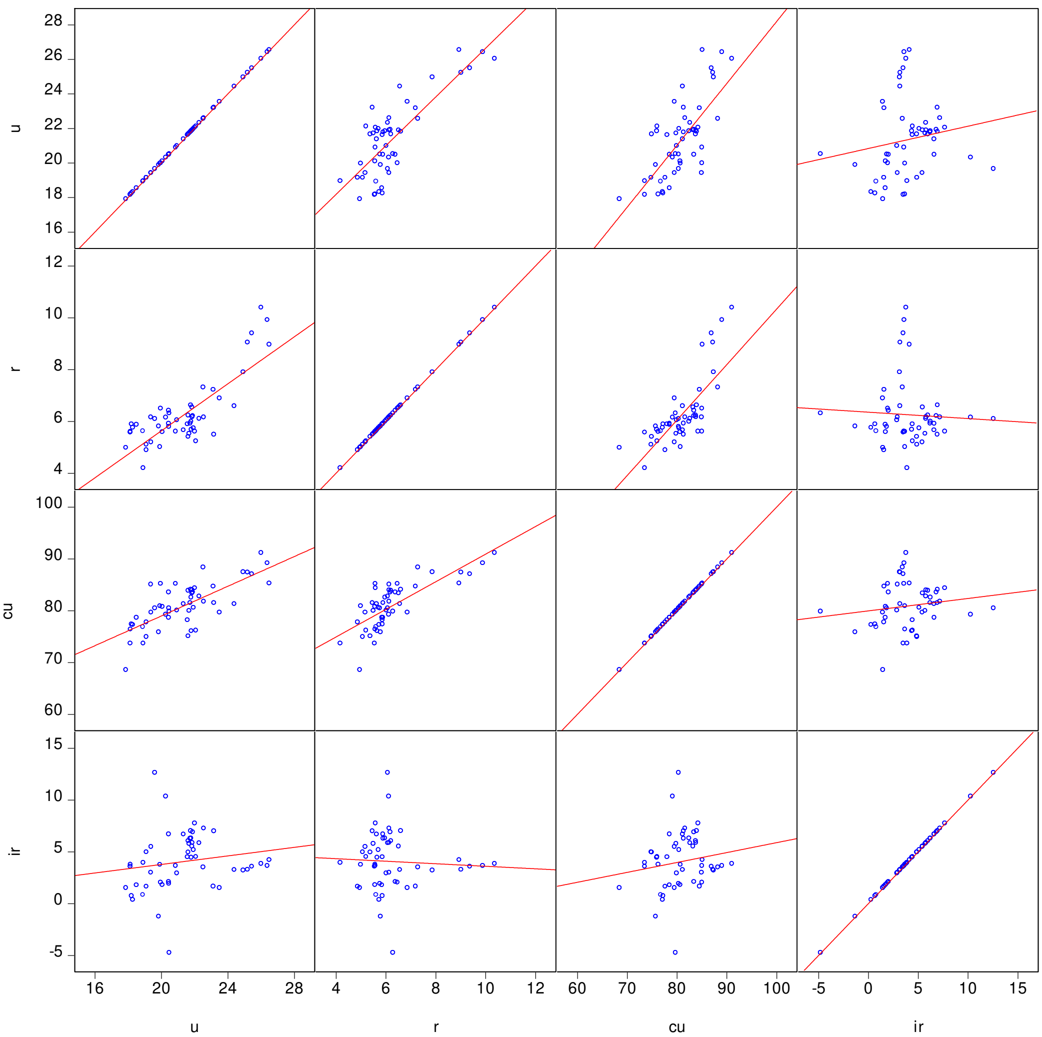

Figure 2. Unproductive expenditures, rate of profit, real interest rate and capacity utilization

Our findings (see Figure 1) have shown that in the long-run, unproductive expenditures constitute a rising portion of total surplus-value in the economy, however, this is an empirical and, we think, a long-run issue. With the available span of time and quality of data, we can only say that the growth of unproductive expenditures is limited by the evolution of productivity which in our case gives rise to a rising surplus-value (see Tsoulfidis and Paitaridis 2017 and the literature cited there). A falling maximum rate of profit sooner or later entails a fall in the net rate of profit and also the rate of unproductive expenditures. Consequently, both the average rate of profit and the rate of unproductive expenditures move to a downward direction and we may hypothesize that the movement of the average rate of profit shapes the movement of the unproductive expenditures. The rationale is as follows: A rising average rate of profit offers the fuel for the expansion of the nonproduction activities; the idea is that the rising rate of profit means more investment activity, higher production and higher need for the promotional efforts entailing the growth of retail and wholesale trade, the finance and real estate activities which may follow suit. The build-up of fixed capital stock, sooner or later, leads to a falling rate of profit which discourages investment and so slows down the demand for new loans, that is, the demand for the output of financial institutions. The latter, in order to avoid losses from the defaults of their borrowers, are bound to lower their interest rates in order to supply the needed liquidity and stimulate in any way possible the investment activity. However, the lower interest rates induce the financial institutions to expand (in the beginning and up to a point, at least) their lending activity in order to acquire the same revenues as before the fall in the rate of interest which makes them to lend out money without a thorough examination of the fundamentals of the borrowers and at the same time their own limitations. This is the reason that from the 1980s onwards the so-called financialization period during of which the financial institutions were pressing governments for more deregulation of what they consider to be a growth-stifling financial environment. The result was the creation of a number of bubbles which, when they burst, led to a fall in the size of the unproductive activities and, at the same time, to lower profit rates.

4. Model and Econometric Specification

We start our econometric analysis with the Toda Yamamoto (hereinafter TY) approach to Granger non-causality test. The reason is that the usual bivariate Granger non-causality tests suffer from a number of limitations which have to do mainly with their sensitivity to the number of variables included in the model as well as to the number of lags. In this case, a two-variable model is subject to possible specification bias (Gujarati, 2006) for the results may differ had we from the specified model excluded other important variables. Moreover, many time series variables are characterized by stochastic trends and are cointegrated, which means that the F-tests are no longer reliable because the test statistics do not have a standard distribution. Considering the above drawbacks, Toda and Yamamoto (1995) proposed a simple procedure to Granger non-causality, which requires the estimation of an augmented VAR ($m + d_{\max}$) model and can be applied regardless of the order of integration. This implies that the estimation of the above model guarantees the asymptotic distribution of the Wald statistic, i.e. an asymptotic x^2 distribution. The TY Granger non-causality test is based on the following equations:

$$Y_t = \omega + \sum_{i=1}^{m} \beta_i Y_{t-i} + \sum_{i=m+1}^{m+d_{\max}} \beta_i Y_{t-i} + \sum_{i=1}^{m} \lambda_i X_{t-i} + \sum_{i=m+1}^{m+d_{\max}} \lambda_i X_{t-i} + \varepsilon_{1t}$$

$$X_t = \psi + \sum_{i=1}^{m} \varphi_i X_{t-i} + \sum_{i=m+1}^{m+d_{\max}} \varphi_i X_{t-i} + \sum_{i=1}^{m} \delta_i Y_{t-i} + \sum_{i=m+1}^{m+d_{\max}} \delta_i Y_{t-i} + \varepsilon_{2t}$$

where X_t and Y_t are the endogenous variables of the model, that is, the unproductive expenditures, the economy-wide average rate of profit, the real interest rate and the capacity utilization. Hence, the number of endogenous variables is 4, i.e. m=4, and therefore we form a system of four equations and the estimation of the following parameters, $\omega, \psi, \beta's, \lambda' s,\ \varphi's$ and $\delta's$ while $d_{\max}$ denotes the maximum order of integration in the above system. Finally, the null hypothesis of granger non-causality can be expressed as $H_o\colon \lambda_i = 0, \delta_i = 0$.

4.1 Unit root tests

In order to perform the TY approach to Granger non causality, we have to ensure that our VAR model is stable, by checking whether all of the eigenvalues of our system of equations lie inside the unit circle. The selection of the appropriate lag-length m of the VAR model will be based on the Akaike and Schwarz information criteria (AIC and SC respectively), which will ensure that our VAR model is well specified. Finally, we have to select the maximum order of integration of our variables using the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root tests. More specifically, in order to detect whether there are trends in our series, we apply unit root tests to the levels of the variables. Firstly, we use the Augmented Dickey Fuller along with the Phillips-Perron (PP) unit root test. For the ADF test we use the following relation:

$$\Delta y_\tau = \mu + \lambda t + \psi y_{t-1} + \sum_{i=1}^{p} a_j \Delta y_{t-j} + u_t$$

where μ is the constant and t refers to the trend and Δ is the difference operator. The ADF procedure uses the t-test for the ψ coefficient and corrects the autocorrelation in the residuals using p lags of the dependent variable. The null and alternative hypotheses for the existence of unit root in y_t are formed as follows:

$$\mathrm{H}_0: \psi = 0$$

$$\mathrm{H}_1: \psi < 0$$

On the other hand, the PP test correct for autocorrelation and heteroscedasticity in the error term modifying the t-statistic and it is given by running the following regression:

$$\Delta y_\mathrm{t} = a + \beta t + \pi y_{t-i} + u_t$$

where a is the constant and t is the time trend. The null and alternative hypotheses are:

$$\mathrm{H}_\mathrm{o}: \pi = 0$$

$$\mathrm{H}_1: \pi < 1$$

While ADF and PP unit root tests the null hypothesis of non stationarity, the KPSS is a stationarity test and it will be used as a crosscheck. Kwiatkowski et al. (1992) assume that a time series y_t can be decomposed into a deterministic time trend, a random walk and a stationary error as follows:

$$y_t = \delta t + r_t + \varepsilon_t$$

where r_t is a random walk. i.e. $r_t = r_{t-1} + u_t$. The null and alternative hypotheses are formed as follows:

$$\mathrm{H_o}: \delta = 0$$

$$\mathrm{H_o}: \delta \neq 0$$

4.2 Unit roots with breakpoints

Following Perron (1997), we are going to use two different forms of structural breaks, the Additive Outlier (AO) and the Innovational Outlier (IO) models. In particular, the AO model is designed to capture sudden changes in the mean of the series, while the IO model is better in detecting gradual changes over time. The IO model has two versions, the first captures gradual changes in the intercept (IO_1) and the second allows for gradual changes in both the intercept and the trend (IO_2). The above models are formed as follows:

$$IO_1 = x_t = \mu + \theta DU_t + \beta t + \delta D(T_b)_t + \alpha x_{t-1} + \sum_{i=1}^{K} c_i \Delta x_{t-i} + e_t$$

$$IO_2 = x_t = \mu + \theta DU_t + \beta t + \gamma DT_t + \delta D(T_b)_t + \alpha x_{t-1} + \sum_{i=1}^{K} c_i \Delta x_{t-i} + e_t$$

Where T_b denotes the time of the break, which is unknown and determined endogenously, DU_t is the intercept dummy, $DU_t = 1$ if $t > T_b$ and zero otherwise, DT_t is the slope dummy, $DT_t = T_t$ if $t > T_b$ and zero otherwise, and $D(T_b)_t$ is the crash dummy, $D(T_b)_t = 1$ if $t = T_b + 1$ and zero otherwise. The null hypothesis of non-stationarity is tested for $a = 1$, by minimizing the value of the t-statistic. Thus, if the absolute value of the t-statistic is greater than the corresponding critical value, then we can reject the null hypothesis of non stationarity, implying that $a > 1$.

In contrast, to the IO model, the AO model is a two-step procedure (Perron, 1994). In the first step, the time series y_t is detrended by regressing it on the trend components. That is:

$$y_t = \mu + \beta t + \gamma DT_t^* + \tilde{y}_t$$

where $\tilde{y}_t$ is the detrended series. Now, the second step uses the following regression with the residual of the first step:

$$\tilde{y}_t = \alpha\tilde{y}_{t-1} + \sum_{i=1}^{K}\Delta y_{t-i} + e_t$$

The most widely used method to choose the time of the break, i.e. T_b, is by minimizing the value of the *t*-statistic when $\gamma = 0$ (Harris and Solis, 2003). Finally, it is important to note that in both models, IO and AO, the equations are estimated sequentially for all possible values of T_b.

4.3 The ARDL model

One major advantage of the ARDL approach to cointegration is that it can be applied to a small sample size. Furthermore, the selected variables may have different order of integration, i.e. I(0) and I(1), contrary to the standard cointegration tests that assume that all the variables should be non-stationary. Also, by using the ARDL model, we can estimate both the short-run and long-run dynamics of the unproductive expenditures simultaneously. Below we describe the steps that we will follow to estimate the ARDL model and perform the bounds test.

The long-run equation for the unproductive expenditures is specified as follows:

$$u_t = \alpha + \beta_1 r_t + \beta_2 ir_t + \beta_3 cu_t + \varepsilon_t \quad (1)$$

where u_t stands for the ratio unproductive expenditures to capital stock, ir_t is the interest rate, defined as the 10 year US government bond yields minus the growth rate of the investment deflator, cu_t stands for the degree of capacity utilization, and ε_t is the error term.[5] The error correction specification of the ARDL model can be specified as follows:

$$\Delta u_t = \alpha + \sum_{i=1}^{N}\beta_i\Delta u_{t-i} + \sum_{i=0}^{N}\gamma_i\Delta r_t + \sum_{i=0}^{N}\delta_i\Delta ir_t + \sum_{i=0}^{N}\zeta_i\Delta cu_t + \lambda ecm_{t-1} + v_t \quad (2)$$

[5] The data for the interest rate and capacity utilization rate are from the Fed of Saint Luis (https://fred.stlouisfed.org). In order to have an estimate of the real interest rate we opted to subtract from the nominal interest rate (10 year US government bond yields) the growth rate of the non-residential investment deflator instead of the usual consumers price index because the former is more relevant to the investment decisions. The difference in the results is minimal quantitatively but it is important to distinguish inflation from the point of view of the investor.

Hence $-1 < \lambda < 0$ is the speed of adjustment towards equilibrium and ecm_{t-1} is the error correction term and more precisely is the solution of equation (1) for ε_t lagged by one period, that is, $ecm_{t-1} = u_t - \beta_1 r_t - \beta_2 ir_t - \beta_3 cu_t$. Furthermore, the coefficients β_i, γ_i, δ_i and ζ_i capture the short-run dynamics of our model.

Before we proceed in the short and long run dynamics of the ARDL model, we have to ensure that none of our variables are $\mathrm{I}(2)$. Despite the fact that the ARDL approach to cointegration is useful for variables that have different order of integration, that is $\mathrm{I}(0)$ and $\mathrm{I}(1)$, the estimator cannot capture variables that are integrated of order higher order than $\mathrm{I}(1)$. Thus, we have to apply unit root tests in order to avoid having $\mathrm{I}(2)$ series, because the presence of such variables invalidates the F-statistic, which is essential in testing for cointegration**.** For this purpose, we will apply the ADF, PP and KPSS unit root tests.

The next step is to estimate equation (2) using OLS and choose the appropriate lag order using the Akaike information criteria (AIC). Moreover, in order to ensure that our model is well specified and does not suffer from A/C, H/S and non normality, we are going to apply diagnostic and stability tests. It is important to note that parameter stability is absolutely required, because unstable parameters may result in model misspecification. After we ensure that our model is well specified, we are going to test whether there is a long-run relationship between our variables by applying the bounds test[6] proposed by Pesaran et al. (2001). The null and alternative hypotheses are specified below:

$\mathrm{H}_0\colon \beta_1 = \beta_2 = \beta_3 = 0 \sim$ no cointegration
$\mathrm{H}_1\colon \beta_1 \neq \beta_2 \neq \beta_3 \neq 0 \sim$cointegration

If the computed F-statistic of the bounds test is higher than the higher bound for the 5% significance level, then there is a long-run equilibrium among our variables, while, if the F-statistic is lower than the lower bound, then there is no cointegration. Likewise, if the F-statistic is between the lower and higher bound, then the presence of cointegration is ambiguous.

[6] The bounds test is based on the Wald test (F-statistic). The lower and upper bound critical values are given by Pesaran et al. (2001).

As a final step, we are going to conduct Granger non-causality tests to investigate the casual relationships between our variables in the short-run as well as in the long-run. More specifically, we will test the joint significance of the lagged terms of Δr_t, Δcu_t and Δir_tusing an F-test, in order to examine the short-run causality, whereas the long-run causality will be tested by applying a t-test on the error correction term, i.e. ecm_{t-1}. If the ecm_{t-1} is negative and statistically significant, then long-run causality is running from all the independent variables towards u_t. On the other hand, if $\sum_{i=1}^{N} \beta_i \Delta u_{t-i} \neq 0$, $\sum_{i=0}^{N} \gamma_i \Delta r_t \neq 0$, $\sum_{i=0}^{N} \delta_i \Delta ir_t \neq 0$ and $\sum_{i=0}^{N} \zeta_i \Delta cu_t \neq 0$, then, in the short-run, the explanatory variables can Granger cause u_t.

5. Empirical Results and their Discussion

The results in Table 2 suggest that the profit rate, *r*, and unproductive expenditures, *u*, are non stationary at levels and they become stationary at their first differences. In particular, both ADF and PP unit root tests fail to reject the null hypothesis at the 5% level of significance for the *u* and *r*, ensuring that these variables are non stationary at their levels. By contrast, the real interest rate's null hypothesis of non-stationarity is not rejected at the 10% significance level, when a constant is introduced for both ADF and PP unit root tests. On the other hand, the degree of capacity utilization as a theoretically cyclical variable is expected and found stationary, i.e. I(0), at level, when a constant and a time trend is introduced, except from the PP unit root test in the case of a constant and a time trend[7], where the null hypothesis of unit root is rejected for the 10% significance level. Furthermore, the results of the KPSS unit root test indicate that u is non-stationary at the 10% significance level when we include a constant and a constant plus a time trend, but stationary at first difference. Regarding *r,* the null hypothesis of stationarity at level[8] is rejected at the 5% significance level, while the rate of profit is stationary at first differences. Furthermore, the real interest rate is stationary at level and first difference, when we include a constant, whereas non-

[7] Since the estimated trend was not found statistically significant in the PP unit root test, we may assume that capacity utilization is I(0) in levels.

[8] The null hypothesis for the unproductive expenditures at level is not rejected at the 5% and 1% significance level, since the computed LM-statistic is lower than the 5% and 1% critical value respectively. Likewise, the null hypothesis for the rate of profit at level is not rejected for the 1% significance level.

stationary at level and first difference at the 5% significance level[9], if we include both a constant and a time trend at the. Finally, the KPSS test indicates that the *cu* is stationary at level and first difference, except from the case of a constant and a trend. However, since the time trend is not statistically significant it follows that the variable *cu* is I(0) at the first difference.

Table 2: Results of Unit Root Tests

	Level		First Differences	
Variables	Constant	Constant and Trend	Constant	Constant and Trend
		ADF		
u	-2.380(0.152)	-2.181(0.488)	-4.723(0.000)*	-4.813(0.001)*
r	-2.369(0.155)	-2.260(0.447)	-6.422(0.000)*	-6.594(0.000)*
ir	-2.676 (0.084)***	-2.638(0.265)	-8.269(0.000)*	-8.263(0.000)*
cu	-3.611(0.008)*	-4.880(0.001)*	-7.340(0.000)*	-6.435(0.000)*
		PP		
u	-2.129(0.234)	-1.965(0.605)	-4.741(0.000)*	-4.834(0.001)*
r	-2.333(0.165)	-1.915 (0.631)	-6.484(0.000)*	-7.045(0.000)*
ir	-2.678(0.084)***	-2.638(0.265)	-9.150(0.000)*	-9.962(0.000)*
cu	-3.013(0.041)**	-3.413(0.061)***	-12.901(0.000)*	-12.972(0.000)*
		KPSS		
u	0.423***	0.122***	0.191	0.133
r	0.522**	0.171**	0.211	0.108
ir	0.169	0.169**	0.201	0.176**
cu	0.690**	0.091	0.500**	0.021

Notes: P-values are reported in parentheses, *, ** and *** denote rejection of the null hypothesis at the 1%, 5% and 10% level respectively. The asymptotic critical values for the KPSS statistic with constant are taken from Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1).

Regarding the results of the standard unit root tests and the existence of potential breaks in our time series, we have to ensure that none of our variables is I(2). It is important to note that there is evidence of structural breaks in the rate of profit as well as in the rest of variables, implying that the standard unit root tests may give rise to

[9] The null hypothesis of stationarity for the real interest rate is not rejected at the 1% level of significance. Thus we assume that *ir* is stationary at first difference.

false results. Hence, we have to further investigate the order of integration of our variables by applying unit root tests with structural breaks. In Table 3 **below,** we interpret the results of the breakpoint unit root test for both Innovational and Additive Outlier models indicated by IO and AO respectively**.** Our findings suggest that unproductive expenditures are non-stationary after applying both IO and AO models at the 5% significance level. On the other hand, the rate of profit becomes stationary after applying the AO model, which takes into account the sudden effect of the structural break in 1981. Also, the IO2 model that allows for gradual changes in both the intercept and the trend reveals that the rate of profit is stationary at level. Furthermore, IO1 model provides no evidence against the null hypothesis of a unit root for the real interest rate, whereas the IO2 and AO models suggest that the real interest rate is I(0) at the 1% significance level when a time break is introduced in 1981 and 1983 respectively. Finally, capacity utilization, after taking into account both gradual and sudden effects of a structural break, becomes stationary at the 1% significance level.[10]

Table 3. Unit Roots with breakpoints

Variables	Model	*t*-stat	*p*-value	T_b	Result
	IO1	-4.233	0.089***	2000	I(1)
u	IO2	-2.726	0.987	1983	I(1)
	AO	-2.720	0.988	1983	I(1)
	IO1	-3.492	0.391	1979	I(1)
r	IO2	-5.514	0.019**	1982	I(0)
	AO	-5.869	< 0.01*	1981	I(0)
	IO1	-3.869	0.205	1976	I(1)
ir	IO2	-5.972	<0.01*	1983	I(0)
	AO	-6.284	<0.01*	1981	I(0)
	IO1	-4.930	0.011**	2000	I(0)
cu	IO2	-6.396	<0.01*	1986	I(0)
	AO	-6.538	<0.01*	1985	I(0)

Notes: The lag-length selection was based on Schwartz information criterion. The breakpoint selection method was based on the Dickey Fuller minimization of t-statistic. The reported p-values are one-sided p-values and taken from Vogelsang (1993). *, ** and *** denote rejection of the null hypothesis at the 1%, 5% and the 10% significance level respectively.

[10] The same results hold for the first differences of capacity utilization.

Now that we have ensured that none of our variables is I(2), we can proceed in the TY approach to Granger non-causality. In Table 4 below we display the results of the AR root table and diagnostic tests of our estimated VAR model.[11] Our findings suggest that the estimated residuals suffer neither from A/C up to three lags and nor of H/S, whereas it is evident the residuals suffer from non-normality.[12] Finally, our model is stable as this can be judged from the distribution of eigenvalues all of which lie inside the unit circle (see Figure 3 below).

Table 4. VAR stability diagnostic tests

Diagnostic tests		
A/C		
Lags	Lm-stat	p-value
1	32.270	0.009*
2	15.135	0.514
3	14.141	0.588
H/S		
df	Ch-sq	p-value
160	270.719	0.084**
Normality		
df	JB	p-value
8	49.258	0.000*
Stability		

Root	Modulus
0.876523 - 0.108832i	0.883253
0.876523 + 0.108832i	0.883253
0.066765 - 0.757804i	0.760740
0.066765 + 0.757804i	0.760740
0.563485 - 0.423412i	0.704836
0.563485 + 0.423412i	0.704836
0.539047 - 0.281803i	0.608264
0.539047 + 0.281803i	0.608264
-0.388290 - 0.397340i	0.555562
-0.388290 + 0.397340i	0.555562
-0.429085	0.429085
0.168586	0.168586

Notes: * and ** denote rejection of the null hypothesis at the 5%and 10% significance level respectively.

[11] The lag selection was based on the AIC and was set to 3 lags. The Schwarz information criterion (SC) suggested that the appropriate lag order was 1. However, the estimated VAR(1) model suffered from A/C.

[12] When we introduce a dummy variable to capture the gradual and sudden effects of the estimated time breaks in Table 3, the estimated residuals become normal (JB-stat = 12.343, p-value = 0.136).

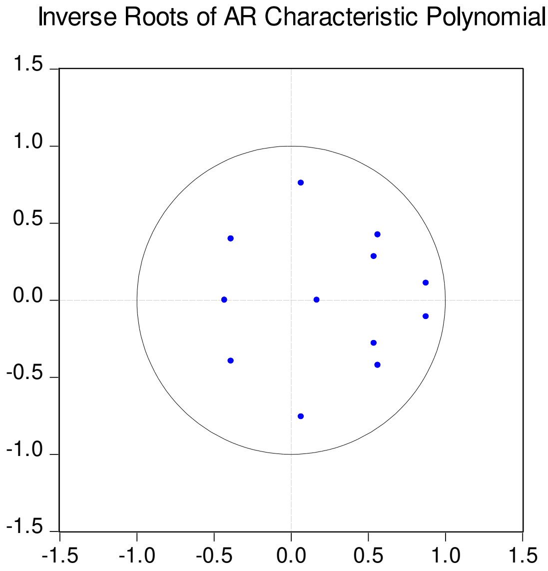

Figure 3. Stability of the VAR model

Since our VAR model is well specified and the variables at hand are integrated of order one and zero, the appropriate method to test the casual relationship among them is the TY approach to Granger non-causality. The results of the TY test are reported in Table 5 and suggest that the rate of profit and real interest rate are statistically significant in predicting the movements of unproductive expenditures, since the estimated p-value of the Wald-test is lower than the 1% significance level. The capacity utilization is not statistically significant, implying that we cannot draw conclusions about the causal relationship between ir and u, before we proceed in the ARDL model and examine further the dynamics of the selected variables. Regarding the rate of profit, r, as the dependent variable, the econometric results show that the arrow of causality runs from the capacity utilization to the rate of profit at the 10% significance level. Finally, it is evident that the unproductive expenditures, the rate of profit and the real interest rate are essential in explaining the capacity utilization for the 10% and 1% significance level respectively.

Summing up, the results point out that a two-way causality exists between the rate of profit and capacity utilization whereas there is one-way causality running from the rate of profit and real interest rate to unproductive expenditures as well as from the unproductive expenditures and real interest rate to capacity utilization. These results were repeated in the case wherein our VAR model we included various dummy variables to account for the estimated structural time breaks, which is another way to say that our model is robust to alternative specifications.

Table 5. Results of Toda Yamamoto Granger non-causality

Dependent /independent variable	u_t	r_t	ir_t	cu_t
u_t	-	24.977(0.000)*	15.655(0.001)*	4.118(0.249)
r_t	0.969(0.806)	-	23.421(0.000)*	6.339 (0.096)***
ir_t	3.009(0.390)	0.992(0.803)	-	0.695(0.873)
cu_t	6.702(0.082)***	24.621(0.000)*	6.526(0.087)***	-

Notes: *, **, *** denote rejection of the null hypothesis at 1%, 5% and 10% level respectively.

In Table 6 we interpret the results of the ARDL bounds test. The optimal lag-length of this test was based on the AIC information criterion. Our findings show that a long-run relationship exists between u and r, ir and cu, since the estimated value of the F-statistic is higher than the upper bound, i.e. I(1), for the 1% significance level.

Table 6. ARDL Bounds Test

Test-Statistic	Value	Signf.	I(0)	I(1)
F-stat	8.95	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Before we proceed in the investigation of the short and long-run dynamics, we have to apply various diagnostic and stability tests for the estimated ARDL model. The results displayed in Table 7 show that there is no A/C and non-normality, whereas the results of the BPG test indicate that there is H/S in the estimated residuals at the 10% significance level and there is no evidence of ARCH effects in the residuals. Also, the results of the RESET test point out that the model is well specified and the CUSUM test implies that the model is stable, since the estimated coefficients lie within the 5% error band (see Figures 4 and 5 below).

Table 7. ARDL Diagnostic Tests

Tests	Value	Probability
Normality~JB	1.399	0.496
H/S~BPG	23.862	0.067***
H/S~ARCH	1.961	0.375
A/C~LM	5.923	0.115
RESET	0.759	0.476

Notes: *** denotes rejection of the null hypothesis at the 10% level.

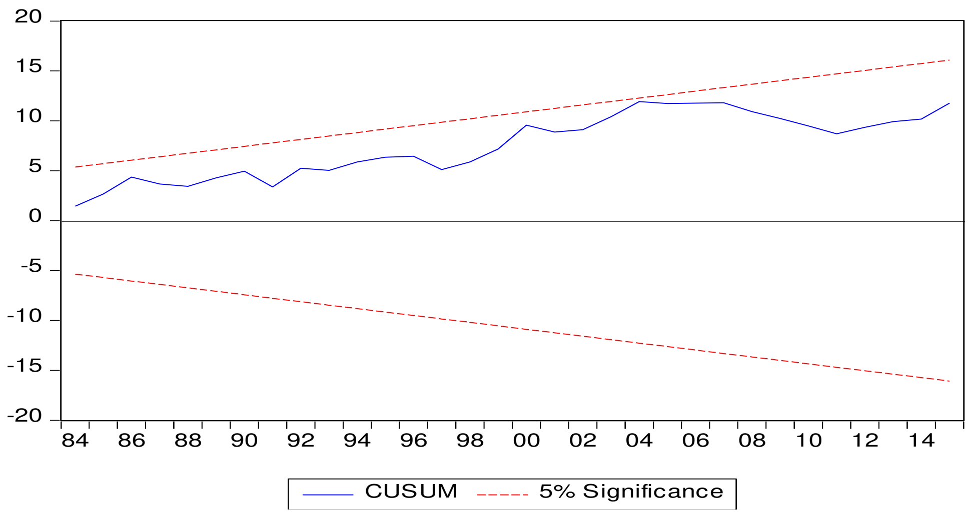

Figure 4. CUSUM test

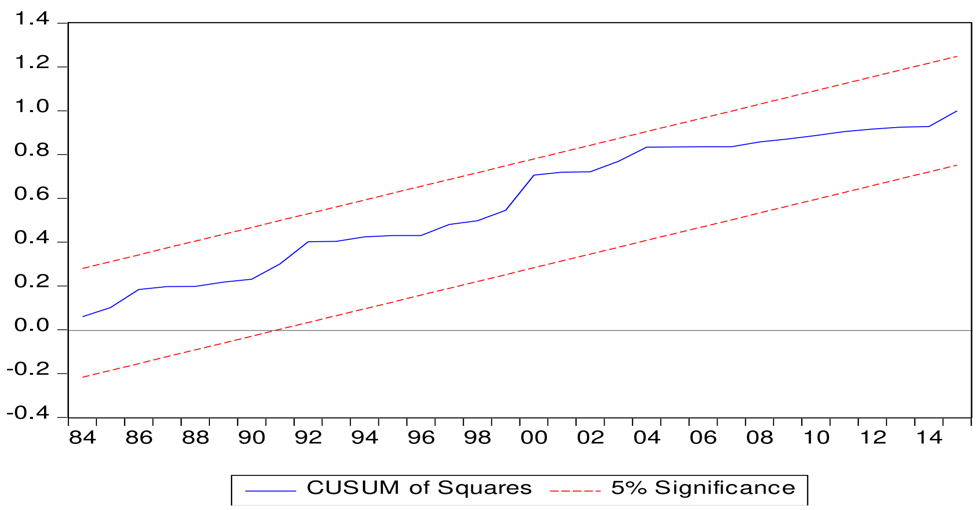

Figure 5. CUSUM of squares

The next step is the estimation of the ARDL model and the examination of its short-run and long-run dynamics. In Table 8 below, we report the results of equation (2), i.e. the ARDL model. The optimal lag-length was based on the AIC resulting in an ARDL(4, 1, 4, 3) model. The results reveal that, in the short-run, the estimated lagged coefficients of the real interest rate affect negatively the unproductive expenditures up to 2 years. The idea is that a lower demand for loans, due to a fall in the rate of profit, will force financial institutions to further lower interest rates in order to stimulate demand and pump up the investment activity. Hence, a lower interest rate is expected to contribute to the expansion of the finance and real estate sectors of the economy. However, at a lower interest rate, the financial institutions are in much higher need to expand their lending activity in order to acquire the same amounts of money as before the fall. It is possible that the so-called financialization of the US economy to be explained along these lines. On the other hand, capacity utilization exerts a positive impact on the unproductive expenditures in the short-run at the 5% level of significance while its lagged values affect negatively the dependent variable. A possible explanation might be that the effect of demand and, therefore, capacity utilization on u might be only short-run and whatever gains are made in the short-run if they are not accompanied by technological change, evaporate in the longer-run. Furthermore, the rate of profit and the lagged values of the unproductive expenditures do not have a statistically significant effect on u in the short-run. Finally, the error correction term (ecm_{t-1}) is equal to -0.391, a rather fast speed of adjustment, implying that the disequilibrium is being corrected by approximately 39% each year. It is important to note that the results did not change qualitatively when our model specification was augmented to include various dummy variables in order to capture the structural breaks as well as when the lag-length order selection of the ARDL model was based on the SC. For example, the ARDL model with the optimal length determined by the SC gave a value of the ecm_{t-1} equal to -0.31.

Table 8. Estimation results of the ARDL model

Variable	Coeff.	t-Stat	p-value
α	-1.094	-0.639	0.527
u_{t-1}	-0.391	-6.070	0.000*
r_{t-1}	0.419	3.462	0.001*
cu_{t-1}	0.075	2.451	0.019**
ir_{t-1}	0.146	4.495	0.000*
Δu_{t-1}	0.141	1.148	0.259
Δu_{t-2}	0.035	0.276	0.783
Δu_{t-3}	0.228	1.764	0.087***
Δr_t	0.062	0.447	0.657
Δcu_t	0.065	2.563	0.015**
Δcu_{t-1}	-0.089	-3.722	0.000*
Δcu_{t-2}	-0.066	-2.683	0.011**
Δcu_{t-3}	-0.053	-2.084	0.045**
Δir_t	-0.030	-0.992	0.328
Δir_{t-1}	-0.103	-2.723	0.010**
Δir_{t-2}	-0.100	-3.325	0.002*
ecm_{t-1}	-0.391	-7.094	0.000*

Notes: *, ** and *** denote rejection of the null hypothesis at the 1%, 5% and the 10% significance level respectively.

The econometric results of the long-run relationship between the unproductive expenditures and the set of our independent variables are reported in Table 9 and they suggest that the rate of profit exerts a statistically significant and positive impact on the unproductive expenditures. This means that a rising (falling) rate of profit will lead to an expansion (contraction) of the unproductive activities in the long-run. More specifically, when the degree of CU increases reflecting the rising state of demand the rate of profit rises and with it the unproductive expenditures. However, the accumulation of capital stock will put downward pressure on the rate of profit withholding the investment activity in the economy; as a consequence, the unproductive expenditures sooner or later will follow suit. Furthermore, the long-run estimate of capacity utilization is statistically significant at the 1% significance level, implying that demand is an important factor in shaping the path of the unproductive expenditures in the long-run. Finally, the role of the real interest rate on the unproductive expenditures is also statistically significant and of the same sign but the value of its coefficient is by far lower than that of the rate of profit which is somewhat higher than one. One potential reason is that when interest rates rise, the productive expenditures become more expensive relative to the unproductive ones giving incentives to investors to engage in unproductive activities. Another reason for the positive long-run relationship between the unproductive expenditures and the real interest rate might be that the production activities are much more capital intensive and therefore they are characterized by a much higher volume of investment per worker. The high-interest rate, therefore, operates as a disincentive to investment in the production activities and the converse is true, other things equal, for the unproductive activities characterized by lower investment requirements per worker. In addition, a high-interest rate, we may speculate that leads to higher returns in the financial sectors of the economy, which may attract the money capital to the finance sector to the detriment of investment for all sectors.

Table 9. Long-run Estimates

Variable	Coeff.	t-Stat	p-value
r	1.071	4.216	0.000*
cu	0.193	2.955	0.005*
ir	0.374	4.804	0.000*
a	-2.793	-0.659	0.514

Notes: * denote rejection of the null hypothesis at the 1%, 5% and 10% level respectively.

As a final step of our analysis, we are going to conduct Granger non-causality tests, in order to examine the causal relationships among our variables in the short and long-run. It is important to note that since our variables are cointegrated, the TY cannot capture accurately the casual effects because it ignores the long-run dynamics of the system. According to the results displayed in Table 10**,** the arrow of causality runs from the real interest rate and capacity utilization towards the unproductive expenditures, since the estimated p-value of the F-test is lower than the 1% significance level for the lagged terms of both the real interest rate and the capacity utilization. However, the rate of profit and the unproductive expenditures do not Granger-cause the dependent variable, implying that policymakers should focus on the aggregate demand and the interest rate in order to affect the unproductive expenditures in the short-run. Finally, the long-run causality between our variables is tested on the significance of the lagged error correction term using the t-test. It is evident that the error correction term is statistically significant, since the estimated p-value of the t-statistic is lower than the 5% level, implying that there exists a long-run causal relationship between our variables.

Table 10. Short-run and Long-run Causality

	Short-run Causality	
	F test	p-value
Δu_t	1.591	0.211
Δr_t	0.201	0.657
Δir_t	4.661	0.008*
Δcur_t	5.612	0.001*

	Long-run Causality	
	t-test	p-value
ecm_{t-1}	-7.094	0.000*

Notes: * denote rejection of the null hypothesis at the 1% and 5% level.

6. Summary and Conclusions

The importance of unproductive expenditures and activities, in general, has been emphasized by many authors in the recent years; however, little research has been done in estimating the relative size of these expenditures and in exploring their determinants. The general view is that unproductive expenditures tend to expand and a limit may be reached when all investible product is spent unproductively thereby disrupting totally the accumulation process. These considerations prompted us to take a closer look at the actual magnitude of these expenditures and more importantly their evolution over time.

For this reason and based on past research efforts, we gave an estimate of the relative size of the unproductive expenditures of the US economy over the long enough period 1964-2015 and we found that the movement of unproductive expenditures is not without limits but is conditioned by more fundamental variables. In effect, we hypothesized that the unproductive expenditures depend on real, financial and demand variables which we captured in the movement of the economy-wide average rate of profit, the long-run real interest rate and the degree of capacity utilization, respectively. The econometric investigation showed that the selection of the above variables is consistent with the behaviour of the unproductive expenditures as this can be judged by the presence of a long-run cointegrating relationship identified with the ARDL model. Furthermore, the causality tests (both short run and long run) lent support to the view that the arrow of causality runs toward the unproductive expenditures. Furthermore, the error correction term showed a rather fast adjustment process taking place between 2.5 to 3 years toward the equilibrium relationship.

Future research efforts may try the examination of an even longer time period and also investigate further alternative combinations of real, financial and demand variables for other major economies. The results of such analyses will shed further light on this key economic variable of the classical economists and also illuminate the dark and unexplained sides of the neoclassical analysis.

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