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Capital intensity, unproductive activities and the Great Recession in the US economy

Lefteris Tsoulfidis and Dimitris Paitaridis*

The purpose of this article is to show that the Great Recession of 2007 in the USA is of the classical type featuring the rising value composition of capital which more than fully offsets the rising rate of surplus value giving rise to a falling rate of profit. The tendential fall of the latter, from a point onwards, led to a stagnant mass of real net profits, thereby decreased net investment and eventually impacted on employment. The evolution of capital intensity and the consequences of unproductive activities remain key issues in the discussions of capital accumulation and its periodic ruptures.

Key words: Composition of capital, Unproductive labour, Capital accumulation, Rate of profit, Growth accounting
JEL classifications: B5, D33, E1, N12, O51

1. Introduction

The purpose of this article is to review some crucial relations among the key variables that relate to the rate of profit, the principal macroeconomic variable that shapes the process of capital accumulation, and its rupture through periodic crises. The testing ground for these variables will be the US economy which continues to shape, to a great extent, the stage of the world economy. The main thesis of this article is that in the postwar USA, there have been two successive phase changes in the long-wave-like evolution of its economy. The first, starting with a period of expansion lasting up until the mid- to late-1960s and it has been characterised as the 'golden age of accumulation' and was followed by the 'stagflation crisis' of the late-1960s (known as the 'silent depression') that ended in the early to mid-1980s (Tsoulfidis, 2002). The rising phase of the second postwar long wave (known as the 'new golden age of accumulation' or 'neoliberal period') reaches its tipping point around the middle to the end of the first decade of the new millennium. The current situation is characterised by a continuation

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of the recessionary phase although the US economy seems to have recovered somewhat since 2007; however, the general sense, the data and our estimates show that this is still far from a vigorous recovery and the onset of new expansion wave. The phenomena observed in the identification of the two tipping points (by the late-1960s and the late-2000s) are quite similar and these are the falling rate of profit and the associated with it stagnant mass of real net profits. The latter slows down new investment spending, thereby leading to the devaluation of capital and to quite severe unemployment, especially when the discouraged workers are counted in the official statistics as well as the rising number of the long-run unemployed population while part-time employment by no means should be equated to full-time employment. The fall in the rate of profit is consistent with the hypothesis of a rising rate of surplus value and a simultaneously increasing value composition of capital (VCC)—the latter reflecting changes in the technical composition of capital, concepts explicated in the next section. Furthermore, the fall in the rate of profit affecting, and *being affected by*, the expansion of unproductive expenditures encapsulates interesting new developments in the area of technical change.

It is important to note that this description of the US postwar economy has been challenged by Zarembka (2015), who takes issue with the idea of the rising materialised composition of capital (MCC, or capital–output ratio in current prices) which he finds it to be more or less trendless for the 1956–2011 period and so argues that the evolution of the rate of profit has been shaped mainly by distributional factors, in particular by the rate of surplus value which is also behind the rising VCC. Mohun (2014), on the other hand, challenges the claim that the rising non-production labour and expenditures contributed to the precipitation in the fall of the net rate of profit. Clearly, these are important issues that must be fully addressed in the face of updated and newly released more detailed data (see Appendix A1) which allow for longer time span estimations and also for the more refined construction of the above key variables. As a consequence, the present article responds to the issues raised by the above two authors and by doing so sheds additional light to the current predicament.

The remainder of the paper is organised as follows: Section 2 discusses the notion of productive and unproductive labour, and finds its counterparts in the North American Industry Classification System (NAICS) of industries and activities. In this effort, we point out the startling similarities of the classical distinction of production and non-production activities with the good business practices and related classification of labour activity. Section 3 discusses the various compositions of capital and the rate of surplus value, and points to their differences from their official national accounts (ONA) counterparts. Section 4 analyses in a growth accounting framework the relationship among the VCC, the evolution of the so-called MCC and the rate of surplus value as well as the effects of relative prices and demand. Section 5 argues that the fall in the rate of profit affects and is being affected by the unproductive expenditures which weaken the growth potential of the economy leading to the present prolonged recessionary situation. Section 6 summarises and makes some concluding remarks.

2. Productive–unproductive labour and business accounting practices

The question of productive–unproductive labour is of utmost importance in the classical and Marxian analyses of capital accumulation and the economic crises; nevertheless, there is no consensus among followers of this tradition (Foley, 1986; Shaikh and

Tonak, 1994; Duménil and Lévy, 2004; Mohun, 2014). Hence, we will treat as productive the wage labour which is activated in the sphere of production, where capital hires labour and purchases non-labour inputs to produce more value than the value of all the utilised inputs. In contrast, non-productive labour is activated in the spheres of distribution and social maintenance and as such it does not change the total output produced. In particular, the labour employed in the sphere of distribution just changes the possession or rather the ownership of the produced output and, therefore, not only this kind of labour does not have the wealth-creating capacity, but also it utilises part of the produced wealth to perform its distributive or circulating functions. In similar fashion, the labour employed in the sphere of social maintenance, that is, the state activities whose main purpose is to preserve the existing social order and conditions under which wealth is created and accumulated. The distinction and classification of labour activity to different spheres of social reproduction by no means implies that the employment in the spheres of distribution and social maintenance are not important or less useful; to the contrary, they are absolutely essential for the growth of the wealth produced in the economy. Despite disagreements and differences in interpretations among economists in the classical and Marxian traditions, the prevailing view is that the expansion of non-productive activities interferes with the system's ability to create and accumulate wealth. In particular, the larger is the share of non-productive activities in the economy, the lower is the remaining investible product and therefore the lessening of the growth potential of the economy. Furthermore, the classification of economic activities into productive and unproductive is an absolutely necessary requirement for the meaningful estimation of the classical and Marxian categories of surplus value and variable capital and the various compositions of capital.

In a previous effort (Paitaridis and Tsoulfidis, 2012), our estimations of the above variables were based on data provided according to the Standard Industrial Classification (SIC) System of 1987. However, the revision of the US industrial classification system from SIC into the NAICS of 1997 has necessitated the reconsideration of the productive and unproductive activities in a manner that suits better to the new classification system as given in Table 1.

The purpose of the revision of the accounting system was to capture the changing structure of the US economy of the recent decades with the emergence of the new (mainly information based) technology and the expansion of the service sector and especially its production activities. This revision resulted in the availability of more detailed data with respect to the service sectors; thereby making possible the more detailed and, therefore, more consistent with the theory, of production and non-production labour classification of industries than those in the previous SIC system. Furthermore, the NAICS renders possible the inclusion of a number of service industries with increasing importance, in the production activities of the economy. For example, the trade sector (Wholesale Trade and Retail Trade, SIC codes 50-51 and 52-59) was treated in the past studies simply as unproductive; even though, there are some particular activities within this sector which are near the completion stage of the product that ought to be classified in the sphere of production. For instance, the cutting and packaging activities which take place within the trade sector are in effect productive and, in principle at least, although practically nearly impossible, these activities must be reclassified. At the same time, there are other industries such as Eating and Drinking Places (SIC code 58) which, although belong to the sphere of production nevertheless in the former (SIC) system, were subsumed under the trade

Table 1. *Classification of sectors*

Production activities	Non-production activities	
Farms	**Trade**	Wholesale trade
Forestry, fishing and related activities		Retail trade
Mining		Real estate
Utilities		Rental and leasing services and lessors of intangible assets
Construction	**Royalties**	Federal Reserve Banks, credit intermediation and related activities
Manufacturing		Securities, commodity contracts and investments
Transportation and warehousing		Insurance carriers and related activities
Information		Funds, trusts and other financial vehicles
Computer systems design and related services		Legal services
Educational services		Miscellaneous professional, scientific and technical services
Health care and social assistance		Management of companies and enterprises
Arts, entertainment and recreation		Administrative and support services
Accommodation and food services		Waste management and remediation services
Other services, except government		Federal general government (defense)
Government enterprises (federal)		Federal general government (nondefense)
Government enterprises (state and local)		State and local general government

sector without any clue as to how to reclassify them. The NAICS treats the Eating and Drinking Places as a separate industry and so we can place it in the productive sectors of the economy without the need to adopt any *ad hoc* assumptions for its possible reclassification, as was done in the former system.[1] This is also the case with the New Technology industries such as the Data Processing, Internet Publishing, and Other Information Services (NAICS codes 518 and 519) and the Computer Systems Design and Related Services (NAICS code 5415). In the former classification system, these productive activities were included in the Computer Data and Processing Services (SIC code 7370) which in turn was part of the non-productive Business Services (SIC code 7300) again with no clue as to how to classify it properly.

With the NAICS industry detail, there is no doubt that the estimation of the categories of surplus value and compositions of capital will be more accurate and therefore more reliable than those of the past studies. However, in order to carry out such estimations, we should recast all the economic categories on the basis of the

[1] For instance, Moseley (1991) assumed that one-half of the non-supervisory employment in the trade sector is productive; of course, since more detailed data are now available, we need not recourse to such heroic assumptions.

distinction between productive and unproductive labour, starting with the concept of surplus value and net profits, continue with the wages and employment of workers in production and finally provide new estimates for the gross capital stock of the US economy.[2]

It is important to stress that Table 1 distinguishes between production and the non-production activities of distribution and social maintenance; however, this distinction is not detailed enough and needs further elaboration. The idea is that even within a production sector, the wages of production workers (variable capital) must be separated from those of the non-production workers (CEO's, people working in administration, security and the like) whose payments are derived from the surplus value and in effect such payments are subtracted from the gross profits—that is, the accountants' definition of surplus (value).

Surprisingly enough, such issues of the classical and Marxian economic analysis are well known in business management, finance and accounting, where the labour costs in business engaged in production activities (see Table 1) are partitioned into direct labour costs and indirect labour (or overhead) costs, depending on the way in which a particular worker contributes to the production of goods. More specifically, direct labour describes workers who are directly occupied in the actual production of goods and services. For example, workers at a factory who physically produce products perform direct labour. Similarly, workers at a beauty salon who actually perform haircuts, hair colouring and other similarly related services are engaged in direct labour.[3] The materials that these workers use and, therefore, enter directly into the final product are characterised as direct materials. The cost of paying wages to workers involved in production is a business' direct labour cost or what is the same thing, from the Marxian perspective, variable capital in the sense that the directly involved labourers actually produce the commodities whose sales bring revenues enough to cover the direct cost of production (the labour and materials that went into the production) and leave profits sufficient to justify the whole business enterprise. In contrast, indirect labour (part of overhead) cost describes wages paid to workers who perform tasks assisting direct labourers and therefore do not directly contribute to the actual production of goods or provision of final services. Examples may include janitors to keep facilities clean, supervisors to oversee production workers, and guards and security personnel in general to keep facilities safe. All of these workers are occupied in indirect labour, because they do not actually produce any goods or provide any final services. Other usual examples of workers engaged in indirect labour may include managers, accountants and maintenance staff.

It is important to stress that the indirect labour cost is treated as part of the business gross income along with taxes and insurance costs. More specifically, the gross income is residually determined if, from total revenues from sales, we subtract the cost of goods or services sold which includes all costs that are directly related to production,

[2] In our estimations (see Appendix A2 for a discussion of the estimating procedure), we follow the method suggested by Shaikh (2016) who applied it to the US corporate sector and also Malikane (2017) for the South African economy; hence our estimates refer to the total US economy.

[3] The major difference between goods and services has mainly to do with the time of consumption. Services are consumed at the same time that they are produced and goods at a time different from that of their production.

such as direct labour costs and the cost of raw materials that went directly to the production of goods and services (commodities). This treatment of indirect labour and indirect cost, in general, is quite similar to the Marxian treatment of value-added, that is, the sum of variable capital or direct labour cost plus surplus value in which besides the net profits are included the indirect wages along with the indirect material costs and all other overheads. Production activities may also be found in the non-production distribution such as, for example, the trade sector. We know that good accounting practices acknowledge this difference by distinguishing trade activities in those that merely transfer goods and titles of ownerships from those that maintain inventories. The people who are engaged in inventories are treated as direct labour and similar is the treatment of related wage cost.

Furthermore, in good business management, finance and accounting practices, net income or profit is the total amount of sales a business makes during a specified period of time minus its total expenses, that is, the cost of goods and services sold and all other costs including indirect labour costs and other overhead cost such as indirect materials and depreciation, taxes, insurance and the like. A business with high indirect labour costs and other overheads could potentially have high gross income, but a low or even negative net income or profit. If a business has a low net income, relative to its invested capital, it means it underperformed and if net income is negative, the business suffered losses over the examined period. In analysing direct and indirect cost, relative to profits, the clear demarcation between direct and indirect labour costs allows management to view changes in production and profits, compared to labour figures. For example, if direct labour has not increased, while production levels and revenue have increased, but net profits have fallen, management may re-evaluate the growth of indirect labour costs. Reducing indirect labour costs and expenses, in other words, 'keeping lean', is a way that businesses may attempt to increase net profits, in the sense of a reward for *undertaking* the risks of *business enterprise*. Understanding and valuing the two types of labour activity and related costs provides management with knowledge of how business generate revenue and control the costs associated with generating revenue.

In spite of the fact that the above distinctions are so meaningful for businesses, one wonders why they should not be true for the entire economy and in fact economists in the classical tradition pay particular attention to the fact that the non-production sectors of trade and finance as well as government in order to perform their socially useful functions employ labour and other inputs, while at the same time their capital stock depreciates; all such expenses are drawn out from the surplus generated by the productive sectors of the economy. Thus, these expenses must also be treated as constituent components of surplus value. Finally, the government sector's unproductive activities are also supported out of surplus value and in particular by taxation. As a consequence, the expenses of these activities must not be included in the estimations for reasons of double-counting (Shaikh and Tonak, 1994, p. 61).

3. VCC and the rate of surplus value

If the ONAs were restricted to production activities, then there would be no differences in the estimation of wages (variable capital) or gross profits (surplus value) between the two accounting systems. The distinction between production and non-production

activities gives rise to substantial differences in the two accounting systems.[4] As a consequence, it is possible for the classical macroeconomic variable of the rate of surplus value to be rising over time while, at the same time, the ONA macroeconomic variable of the profit–wage ratio might be falling. In a similar fashion, the measurement of productivity will be different in the two accounting systems, because in the ONA, all employment is treated as if it were productive, whereas in the classical accounts, only the labour time of workers in production counts as output-creating; therefore, as the number of workers in production relative to those in non-production (distribution and social maintenance) activities decreases over time, productivity measured in terms of ONA might be falling while in classical and Marxian terms may be rising. At this point, it is important to emphasise that, in the context of empirical research, there will always be slippery issues that cloud the *a priori* and uncontroversial definition of the character of labour activity as involved in production or not. But the challenges in empirical research should not discourage the efforts to using and analysing this fundamental category of classical economic theory (Foley, 1986; Shaikh and Tonak, 1994). Ideally, our estimated variables must be in terms of labour values; however, such time series estimates are extremely difficult to carry out for a single year, let alone for a long period of time such as in the study at hand. However, a stylised fact of the hitherto research has shown that the labour values and market prices are startlingly close to each other and, therefore, our estimates of variables of interest in terms of market prices are not expected to differ in any empirically significant way from their labour value counterparts (Shaikh, 1998; Tsoulfidis, 2008, 2010, *inter alia*).

The various compositions of capital became the focus of analysis of many radical authors during the 1970s and 1980s (e.g. Rosdolsky, 1977 and Shaikh, 1987 and the literature cited there). The definitions of these variables are complex as they are cast in terms of labour values and then one needs to hypothesise monetary expressions of labour values and subsequently compare these figures with their national income counterparts. In what follows we define the technical, value, organic and the materialised compositions of capital in terms of market prices and the ONA holding through the concepts of production and non-production activities and related distinctions of employment. Starting with the VCC, this can be written as follows:

$$VCC = \frac{p_k K}{p_y w l_p} \tag{1}$$

where $p_k K$ is the (gross) capital stock in current prices, hence we have a product of the price index, p_k, multiplied by the quantity of capital expressed in constant prices, K. Similarly, $p_y w l_p$ is the nominal wage, that is, the product of the business value-added deflator, p_y, times the real product wage, w, times the number of employees in the production activities, l_p. We use the real product wage, that is, the money wage divided by the business value-added deflator to estimate the cost of labour from the point of view of businesses; in contrast, the use of consumers price index would give us the

[4] For a detailed presentation of the transformation of the orthodox categories of national accounts into classical and Marxian categories, see the pioneering studies of Gillman (1957), Mage (1963) and of course the classical by now work of Shaikh and Tonak (1994). For updated estimates of these variables for the US economy, see Paitaridis and Tsoulfidis (2012).

workers' standard of living, which is not what business are really interested in. Clearly, our major difference from the ONA estimates concerns the issue of productive labour.

The next variable of interest which is contained in the VCC is the so-called MCC, which Shaikh (1987) defined as the ratio of nominal capital stock over current prices value-added, $p_y y$, where y is the real value-added. Thus, we may write

$$MCC = \frac{p_k K}{p_y y}. \tag{2}$$

Clearly, both the VCC and MCC depend on the technical composition, TC, that is, the real capital–productive labour ratio, K/l_p, but also on the relative prices, p_k/p_y, along with the distributional factors, namely wages and profits. However, the crucial determinant turns out to be the TC since the two prices are not expected to be too far from each other and in the long run their ratio is expected to be not far from one.[5] The idea is that the rising TC induces changes in the unit prices of the means of production and the means of consumption, because the two prices refer to general categories of commodities, which, on the one hand, may overlap while, on the other hand, it is in the nature of technological change not to be confined to any single industry or collection of industries, but rather to rapidly diffuse throughout the economy.[6] The connecting link between the VCC and the MCC is the rate of surplus value, $e = s/p_y wl_p$ where $s = p_y y - p_y wl_p$. Thus, we may write

$$VCC = \frac{p_k K}{p_y y}\frac{p_y y}{p_y wl_p} = \frac{p_k K}{p_y y}\left(\frac{p_y wl_p + s}{p_y wl_p}\right) = \frac{p_k K}{p_y y}(1+e). \tag{3}$$

If the MCC or what is the same thing the current prices capital–output ratio is rising, as shown in Figure 1, then the VCC will be higher than the MCC and the equality holds only in the hypothetical case that the total wages are equal to the total net value-added. Furthermore, the VCC in the long run is expected to converge to the organic composition of capital, OCC, in so far as the relative price of capital, p_k/p_y, tends to one. By combining equations (1), (2) and (3), we derive the following relations between the compositions of capital:

$$\underbrace{\frac{p_k K}{p_y y}}_{\text{MCC}} \leq \underbrace{\frac{p_k K}{p_y wl_p}}_{\substack{\text{VCC}\approx\text{OCC} \\ \text{iff } p_k/p_y \approx 1}} \leq \frac{K}{l_p}. \tag{4}$$

[5] The theoretical expectation and the empirical findings on price value deviations suggest that the more aggregated the input–output tables, the closer the labour values to market prices. This is an empirical regularity ascertained in a number of studies (Tsoulfidis, 2010, and the literature cited there).

[6] 'If it is further assumed that this gradual change in the composition of capital is not confined only to individual spheres of production, but it occurs more or less in all, or at least in the key spheres of production, so that it involves changes in the average organic composition of the total capital of a certain society, then the gradual growth of constant capital in relation to variable must necessarily lead to a gradual fall of the general rate of profit [...]' (Marx, [1894] 1968, p. 212), see also Mage (1963, pp. 82–83).

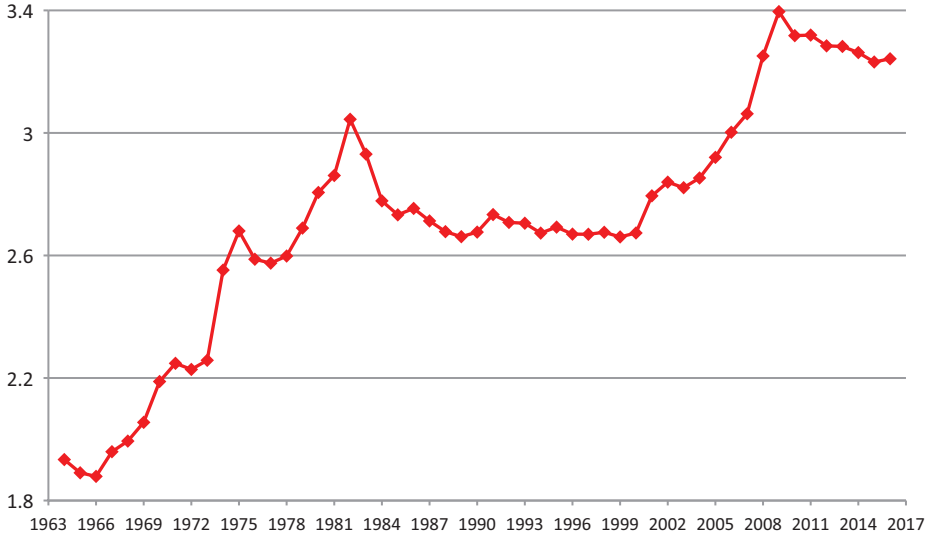

Fig. 1. *Gross capital net value-added ratio or MCC, USA, 1964–2016.*

The availability of data allows us to take a long enough time period of 52 years starting from 1964, a year near the end of a rising phase known as the 'golden age of accumulation' and including the 'stagflation crisis' of the 1970s and early to mid-1980s followed by the period of neoliberalism of steady growth, known as the 'new economy' which was interrupted by the end of year 2007, that is the starting year of what has been characterised by orthodox and heterodox economists alike as the onset of the Great Recession whose impact extends up to the year 2016, the last year that we managed to collate reliable data. It is important to point out that in the estimation of the MCC, we used our estimates of gross capital stock data which we constructed for the total US economy. The rationale for the utilisation of gross (instead of the available net) capital stock data as well as the estimating method are discussed in Appendix A2.

4. A growth accounting framework and the movement of the rate of profit

The average annual growth rate of the VCC during the period 1964–2016 is estimated at 1.50% while that of the rate of surplus value is at 1.02% giving rise to an overall falling rate of profit.[7] Meanwhile, the MCC grows, albeit with long fluctuations, over the years at an average annual rate of 0.99%. In Figure 1, we observe that during the period 1999–2009, the growth of the MCC accelerates at the average annual rate of 2.44% and becomes negative the year after. Zarembka (2015) presents estimates of the MCC adjusted by the degree of capacity utilisation for the period 1958–2011. The so-estimated MCC displays a pretty much trendless path leading to the idea that the rising VCC may be attributed to the rising rate of surplus value and not necessarily to the MCC. However, such an idea deserves detailed examination which we do by breaking down the total growth of the VCC into its constituent components. The results of the growth accounting exercise conducted (see Tsoulfidis, 2017) on the basis of net capital

[7] See Appendix A1 for the detailed estimation of the surplus value and variable capital.

stock showed that both the distributional and the technical factors are major determinants of the evolution of the VCC, but also that between the two, the technical factor, that is, the capital–output ratio in constant prices, was somewhat more influential. We repeat the growth accounting exercise using a longer time span and data that we constructed for the gross capital stock of the total economy and also adjust it by the degree of capacity utilisation.[8]

Hence, we have an old empirical issue, the evolution of the capital–output ratio, which in the classical tradition is expected to be rising, because technological progress tends to be capital-using and labour-saving. Our data show that the nominal capital–output ratio displays long fluctuations around a rising trend (see Figure 1). From the early-1980s and the full decade of the 1990s, the nominal capital–output ratio is nearly constant, indicating that the growth in output is approximately equal to the growth of capital stock and from the late-1990s onwards, the nominal capital–output ratio displays a rising trend up until the year 2009. To what extent, if any, the rising trend in the nominal capital–output ratio (or MCC) is responsible for the rising VCC and the falling tendency in the rate of profit is a question that can be dealt with by breaking down the growth rate of the VCC to its four constituent components or factors—namely, the price, technological, demand and distributional effects.

The breakdown of the VCC evaluated in market prices can be shown starting with the definition of the adjusted for capacity utilisation, u, value composition of capital, AVCC, which will be

$$AVCC = \underbrace{\left[\frac{p_k K}{p_y y}\right]}_{\text{MCC}} u \underbrace{\left(\frac{p_y y}{p_y wl_p}\right)}_{1+e}. \tag{5}$$

The bracketed term in relation (5) includes the components of the MCC, whereas the term in the parenthesis is the ratio of value-added to the variable capital or the term $1 + e$. By taking growth rates in equation (5), we can attribute the growth rate of the AVCC into its constituent components and assess their relative contribution to the overall growth of the AVCC. Thus, we may write

$$\left(\widehat{\frac{K}{v}}\right) = \underbrace{\left(\widehat{\frac{p_k}{p_y}}\right)}_{\text{Price effect}} + \underbrace{\left(\widehat{\frac{K}{y}}\right)}_{\text{Technology effect}} + \underbrace{\hat{u}}_{\text{Demand effect}} + \underbrace{\left(\widehat{\frac{p_y y}{p_y wl_p}}\right)}_{\text{Distribution effect}} \tag{6}$$

[8] For the estimation of the gross capital stock of the total US economy, we use the method employed by Shaikh (2016, appendix 6.5) for the US corporate sector. The capacity utilisation estimates for the period 1967–2016 are derived by the annual averages of monthly data of the total industrial sector that are reported by Federal Reserve Bank (https://www.federalreserve.gov/releases/g17/ipdisk/utl_sa.txt). For the years 1964–66 and due to the lack of data for the total industry, we used the annual average capacity utilisation rates of the total manufacturing sector which are behaving very similarly to those of the total industry. Hence, we are assuming that full capacity utilisation is 82%, the usually stipulated benchmark rate beyond which there are exercised inflationary pressures on the economy (Mattey, 1996). Finally, we used data on non-residential investment and net business value-added price indices from the BEA (https://www.bea.gov/) with 2009 as the base year.

where a hat over a variable or a term indicates its annual average growth rate.[9] It is important to stress at this point that the distribution effect can be rewritten as $\left(\widehat{\frac{y1}{l_p w}}\right)$, which is equal to the growth rate of productivity, $\left(\widehat{\frac{y}{l_p}}\right)$, minus the growth rate of the real wage rate, $\hat{w}$.

The growth of the AVCC, therefore, reflects not only the changes in the material features of the process of production but also the induced changes in the structure of prices (relative prices) and income distribution as well as the strength of demand relative to supply as this reflected in the degree of capacity utilisation. The effects of each and every one of the terms in equation (6) along with the components of the distributional factor, for meaningfully selected periods of time, are displayed in Table 2.

We start off with the periods 1964–82 and 1983–2007, two long periods; the first a recessionary one during which the US economy experienced the so-called 'stagflation crisis' and the second during which the growth rate was strong enough and this particular phase came to be known as 'the new economy'. The underlying idea here is to examine to what extent, if any, these two long periods work in a way that their net effect leads to an overall rising AVCC. In examining each of these two successive phases, we observe that in the 'stagflation crisis' of 1964–82, the growth rate of the VCC is 2.00%, a result attributed mainly to the technical change effect amounting to 2.42%, an all periods high. The effect of the distributional factor was positive but minimal amounting to the anaemic 0.33%, which is another way to say that during a recessionary period, real wages kept up with the growth in productivity, 1.12% versus 1.45%, respectively, thereby, holding down the growth of the rate of surplus value, as shown in Figure 2. The price effect was equal to 0.10% reflecting the lack of devaluation of the gross fixed capital stock, as this can be estimated by the difference in the growth rates of the investment deflator minus the value-added deflator. Not surprisingly, in a recessionary period, the demand effect was negative and its impact is estimated at −0.84%.

Table 2. *Growth accounting of the AVCC, annual rates*

Periods	Growth rates						
	Adjusted value composition of capital	Relative price factor effect	Technical change factor effect	Demand factor effect	Distributional factor effect	Productivity effect	Real wage effect
	(1) = (2) + (3) + (4) + (5)	(2)	(3)	(4)	(5) =(6) − (7)	(6)	(7)
1964–1982	2.00	0.10	2.42	−0.84	0.33	1.45	1.12
1983–2007	1.76	−1.34	1.53	0.31	1.26	2.11	0.85
2008–2016	−0.02	−0.84	0.81	−0.39	0.41	0.98	0.57
1964–2016	1.50	−0.78	1.78	−0.25	0.75	1.68	0.93

[9] For the estimating methods and data sources, see Appendix A1.

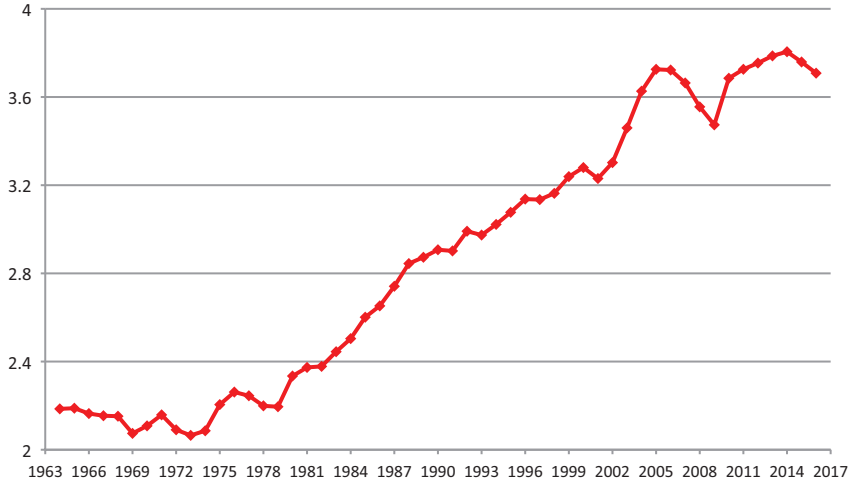

Fig. 2. *The rate of surplus value in the US economy 1964–2016.*

In contrast, in the 1983–2007 period of the so-called 'new economy', we observe the relatively high growth rate of the AVCC with an estimated annual growth rate of 1.76% which is attributed, in large part, to the growth of the distributional factor, amounting to 1.26%, the all periods high due to the sluggish growth in real wages equal to 0.85% and to the unprecedented growth in productivity of 2.11%. In contrast, the growth of the technical change factor of 1.53% is strong enough while the demand factor, equal to 0.31%, although positive nevertheless not strong enough as one would have expected for a growing economy. It is also of interest to note that the price effect was negative and equal to −1.34%, indicating the information technologies impacted more to the devaluation of capital rather than to the output produced. Such results, at first sight, might lend partial support to the view that the rate of surplus value is responsible for the growth rate of the AVCC. On further examination, however, we conclude that the growth of the distributional factor is due neither to the influence of supervisory labour nor to the stagnant MCC but rather is due to the application of neoliberal austerity policies that kept the real wage low which in combination with the rapidly growing productivity led to a sharply increased rate of surplus value and the distributive factor. The contribution of the latter to the growth of the AVCC, although significant, nevertheless remains lower than that of the technical change factor whose impact is always the highest.

For the period of the Great Recession which starts with the year 2008 and continues as of this writing, we observe that the AVCC displays a negative growth rate of −0.02% which is attributed to the sluggish growth of the technical change factor equal to 0.81% the lowest of all periods. There is a negative relative price effect of −0.84% while the demand effect was also negative and equal to −0.39%; the positive but weak distributional effect, the result of low growth rates in productivity of 0.98% and in real wages of 0.57%, the lowest in all periods, shaped the observed stationarity in the growth of the AVCC. These results strengthen the view that the Great Recession is not yet over and it is reasonable to expect that will continue as long as no significant innovations take place to devaluate sufficiently the capital stock and restore profitability at a level higher than the current one.

The examination of the whole 1964–2016 period completes the picture in which what stands out is the rising AVCC at the annual growth rate of 1.50% which is attributed mainly to the technical change effect of 1.78% with the distributional factor contributing only by 0.75% while the effects of the other factors are negative and by far smaller.

The next step in our analysis is to examine the impact of the technological and distributional variables on the movement of gross or general rate of profit. For this purpose, we express the gross rate of profit $r = s/C$ in terms of the nominal capital–output ratio or what is the same thing in Marxian terms the MCC, and by putting limits to the variation of the rate of surplus value, $e = s/(p_y wl_p)$, according to the total labour time l, with $l = p_y y = s + w_p$. Thus, we may write

$$r = \frac{p_y y - p_y wl_p}{p_k K} = \left(\frac{s}{s + p_y wl_p}\right)\left(\frac{p_y y}{p_k K}\right) = \left(\frac{e}{1+e}\right)\left(\frac{1}{MCC}\right) \tag{7}$$

The expectation is that in the long run, both e and MCC will be rising but that the increase in e although it may be higher than that of MCC will nevertheless have a positive but progressively diminishing effect on the rate of profit since the potential increase of the term $e/(1+e)$, that is, the profit share, will be, at most, equal to 1 (Tsoulfidis, 2017). While, on the other hand, the MCC, because of mechanisation, increases without limits and, therefore, supersedes, in general, the increase in e. We can show the limited effect of the rate of surplus value on the rate of profit by taking the partial derivative of the rate of profit of relation (7) with respect to (w.r.t.) e and by multiplying the resulting relation by e/r we arrive at the following elasticity formula:

$$\frac{\partial r}{\partial e}\frac{e}{r} = \frac{1}{(1+e)^2 MCC}\frac{e}{r} = \frac{1}{(1+e)^2 MCC}\frac{e}{\frac{e}{(1+e)MCC}} = \frac{1}{1+e} \tag{8}$$

That is the elasticity of the rate of profit w.r.t. e equals the term $1/(1 + e)$, which is in fact the wage share. Clearly, the higher the rate of surplus value, other things equal, the lower the wage share or what is the same thing the elasticity of the rate of profit w.r.t. e. As a consequence, in the hypothetical case that wages tend to zero, the elasticity of the rate of profit w.r.t. e becomes absolutely inelastic.

Alternatively, we could rewrite relation (8) in Keynesian terms and instead of the share of surplus value in value-added to estimate the gross rate of profit using the wage share, ψ, that is,

$$r = (1-\psi)\left(\frac{p_y}{p_k}\right)\left(\frac{y}{K}\right) \tag{9}$$

with a very similar interpretation, that is, the elasticity of the rate of profit w.r.t. the wage share will be

$$\frac{\partial r}{\partial \psi}\frac{\psi}{r} = -\left(\frac{p_y}{p_k}\right)\left(\frac{y}{K}\right)\left(\frac{\psi}{(1-\psi)\left(\frac{p_y}{p_k}\right)\left(\frac{y}{K}\right)}\right) = -\frac{\psi}{1-\psi} = -e^{-1} \tag{10}$$

which signifies, on the one hand, the expected inverse relationship and, on the other hand, that a rising rate of surplus value above one hundred percent gives rise to an elasticity of the rate of profit w.r.t. the wage share less than one in absolute value. Theoretically speaking, this particular elasticity decreases without bound, that is, it becomes absolutely elastic (minus infinite) in the hypothetical case that wages are at maximum and profits (or surplus value in Marxian terms) tend to zero. And the elasticity of r w.r.t. ψ takes on the value of zero, that is, it becomes absolutely inelastic in the hypothetical case when profits are at maximum and wages tend to zero. In a similar fashion with relation (8), the zero or upper bound of relation (10) shows the wage (share) reductions in the effort to increase the profit rate become less and less efficient as this particular elasticity approaches its upper inelastic bound. By way of a realistic example, in the last year of our analysis, 2016, the rate of surplus value is equal to 3.71 which would give us an elasticity of the r w.r.t. ψ equal to $-1/3.71 = -0.269$.

The other key variable that determines the evolution of the rate of profit, that is, the capital deepening or technological factor, K/y, exerts a downward pressure on the gross rate of profit and the findings displayed in Table 2 suggest that the capital intensity effect increases at a rate higher than that of the distributional effect in all periods of our analysis. Thus, we have

$$\frac{\partial r}{\partial (K/y)}\frac{(K/y)}{r} = -(1-\psi)\left(\frac{p_y}{p_k}\right)\frac{1}{(K/y)^2}\frac{K/y}{(1-\psi)\left(\frac{p_y}{p_k}\right)\left(\frac{1}{K/y}\right)} = -1. \tag{11}$$

Thus, the elasticity of r w.r.t. K/y is unitary negative, meaning that if the capital intensity changes say by 1%, all else constant, the rate of profit will also change by 1%, but in the opposite direction. In similar fashion, the last components of the rate of profit, that is the prices p_y and p_k, are expected in the long run, at least, to give a ratio equal to one,[5,6] it follows therefore that the two elasticities of the rate of profit w.r.t. p_y and p_k will be equal to plus and minus one, respectively. As a consequence, the net effect of relative prices on the rate of profit will be equal to zero or negligible.

In Figure 2, we observe that the rate of surplus value in the US economy displays an overall rising trend. More specifically, the average rate of surplus value over the period 1964–2016 is 287% while in the last 15 years of our analysis, the average is 365%. It follows then that an increase in the capital intensity by 1% requires, other things constant, a nearly fivefold increase in the rate of surplus value to maintain the rate of profit at the same level. This is equivalent to saying that the movement of the capital intensity is decisive in the actual movement of the rate of profit and that the effect of the rate of surplus value weakens with the passage of time. For example, the average rate of surplus value in the period 1964–82 was 219% and increased to 309% in the 1983–2007 period and in the years of the

Great Recession 2008–16 increased to 369% making even more inelastic the rate of profit with respect to changes in the rate of surplus value. A corollary of this discussion is that the economic policy efforts to increase the rate of surplus value through austerity policies are not so effective in restoring profitability in the long run compared to the devaluation of capital through innovations and, in general, technological change.

As the capital–output ratio becomes ever more important in the movement of the rate of profit, we discover that the official estimates of this ratio become less and less reliable probably because of the build-in neoclassical conceptualisation of the movement of this ratio. More specifically, in the neoclassical theory, the capital–output ratio is expected to be a mean-reverting variable. If this ratio increases, it follows that capital is cheap (abundant) and labour is expensive (scarce); the extensive use of capital and the saving of labour will make capital more scarce than labour, and the capital–output ratio will start its falling pattern. Thus, the neoclassical theory expects a mildly cyclical and an approximately constant capital–output ratio. The estimates of the capital stock by the Bureau of Economic Analysis (BEA) seem to bear this out to a certain extent. In fact, our estimates of the net capital–output ratio of the USA, based on data from the BEA for the year 1964, gave a net capital–output ratio of 2.70 while for the year 2016 this ratio was somewhat higher at 3.03. Very similar are the estimates that one derives from the measurement of the real capital–output ratio by the EU's AMECO database (http://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm), where we observe, in most cases, trendless capital–output ratios. For example, in the AMECO database, it is assumed that all countries begin with the same real capital–output ratio which is equal to 3 in 1960. However, a few countries among which Greece and also Spain, two Great Recession ridden countries, display in 2016 a real capital–output ratio substantially higher than its starting value, namely 4.24 and 3.55, respectively. The majority of countries display a capital–output ratio near 3! The average of all EU (28) countries in 2016 is 2.91 while that of the Euro area is 3.04! Meanwhile, the data show the USA to display the same capital–output ratio with the other EU countries with a value at 3 in 1960 while in 2016 this ratio dropped to 2.35, a level that remains approximately constant since the year 2007.[10] Clearly, there is something mysterious in the estimates of the real capital–output data, and we daresay that the measurement of this ratio is ideologically ridden. This is the reason that we opted for an alternative estimation of the capital–output ratio based on the gross capital stock whose rationale and details of its construction are discussed in Appendix A2.

The growth in the technical change factor during the examined 1964–82 period as well as the Great Recession of the post-2007 years together with the negative growth in the rate of capacity utilisation and the fact that the prices of capital goods grow at a rate lower than that of the value-added deflator led to a relatively slow growth in the VCC and MCC. Such a result should not come as a surprise given the 'stagflation crisis' and the Great Recession periods. The devaluation of capital was manifested in that the growth rates of the price index of capital goods were lagging behind those of the value-added deflator.

[10] For further discussions on capital–output ratio of the US economy and its evolution since the nineteenth century, see Mejorado and Roman (2014, ch. 7).

5. The rate of profit, unproductive activities and the Great Recession

The concept of unproductive activity is fundamental for classical economists in general and Marx in particular. The idea is that the growth of unproductive activities implies that a portion of surplus value produced that would be available for investment is diverted to non-production activities to the detriment of capital accumulation and economic growth (e.g. Gillman, 1957, p. 85; Moseley, 1991, p. 153, Shaikh and Tonak, 1994, among others). Mohun (2014) takes issue with this analysis by arguing, from a class perspective point of view, that unproductive labour, on the one hand, did not increase to such an extent as to thwart profitability and, on the other hand, supervisory labour (classified as unproductive) instead of being detrimental to surplus production turned out to be surplus-generating labour. Furthermore, supervisory labour increased since the 1960s and may have important insights to offer on the rising inequalities in the distribution of income and wealth during the period of neoliberalism.

Starting with the growth of unproductive labour, Mohun (2014) is right that there has not been any spectacular increase in the ratio of unproductive labour so as in and of itself to threaten the stability of the system. However, Mohun limits his investigation to unproductive labour alone while the issue is broader for it refers to the growth of unproductive activities in general and not restricted to labour in particular. Under these circumstances, it is worth stressing that in Marx (1857 [1973], p. 757 and [1869] 1969, p. 573), there are hints about unproductive activities which are thought to have an inherent tendency to expand. In fact, our estimates show that the value of unproductive activities[11] as a share in total net Marxian value-added from 51.1% in the year 1964 increased to 65.1 in the last year of our analysis. To what extent Marx's conjecture is ascertained or not is, in our view, a mainly empirical question that must wait for its resolution (or at least have a more precise idea) until we have consistent time series data spanning a longer than the present time period. The underlying idea for the expansion of unproductive activities is that competition is intensified over time and thus larger and larger amounts of resources must be devoted to promotional efforts. Furthermore, the growth of government expenditures (hence, one may also invoke the so-called Wagner's law or other relevant Schumpeterian arguments about the bleak future of capitalism under the pressure of growing state activities) leads to an increase in taxation; as a consequence, the surplus produced is used for the maintenance of social order rather than in investment in production activities. Surprisingly enough, this idea may also be found in the neoclassical approach and more particularly in the hypothesis of the cost disease of (public) services (Baumol, 1967, *inter alia*) or the rent-seeking activities (Tullock, 2008). According to Baumol, the increasing burden of services has mainly to do with the idea that the productivity of the service sectors is not only very hard to pinpoint but even when the various obstacles to its measurement are superseded, it is found that the labour productivity in services lags behind the economy's average productivity. Meanwhile, the tendency for uniform wage rates across sectors makes the cost of services progressively higher slowing down the

[11] The value of unproductive activities includes the various royalties (taxes, rents, interests) paid by the productive sectors to the royalty sectors of the economy (financial institutions, unproductive services and government) plus the gross output of trade, real estate and rental and leasing sectors net of imputations plus the total compensation of the unproductive employees occupied in the production sectors of the economy.

economy's growth potential. Until very recently, at least, the idea that services are labour-intensive activities and that it is a much more difficult enterprise to apply further division of labour and mechanisation to services and by extent to many non-production activities was widespread. In other words, technological change is not easily applicable to service activities which remain persistently labour intensive. It seems that during the neoliberal period of the 'new economy', the situation with respect to the labour process in services has changed radically, and even the hard to mechanise non-production activities became amenable to mechanisation and thus both the number of people engaged in such activities as well as the cost of provision of these activities relative to the invested capital were reduced.

Figure 3 may be used to explain these developments and lend partial support to Mohun's (2014) findings of the slowdown in the growth of unproductive activities. In effect, the share of non-production labour shown in Figure 3 was rising up until about the year 1990 and then became pretty much trendless indicating that the computerisation, that is, the modern form of hyper-mechanisation, reduced to some extend the share of the non-production labour to total employment. Nevertheless, if we take the whole 1964–2016 period into account, there is a slightly upward sloping trend. While this is true in terms of employment, we cannot say the same thing in terms of the wages of non-production labourers, whose share kept rising up until the years of the Great Recession and then stabilised at a level much higher than that of the start year. These developments show that during the neoliberal period, there has been a redistribution of income in favour of the workers in the non-production activities and since their number did not keep rising, we can reasonably speculate that, in this case, it was not the rise of the average wage but rather the super-high salaries (plus commissions and bonuses) of the corporate officers (the so-called CEOs) for their supervisory and managerial functions that accounted for the observed inequalities. By no means has this implied that the managerial or supervisory labour contributed, in any way, to the

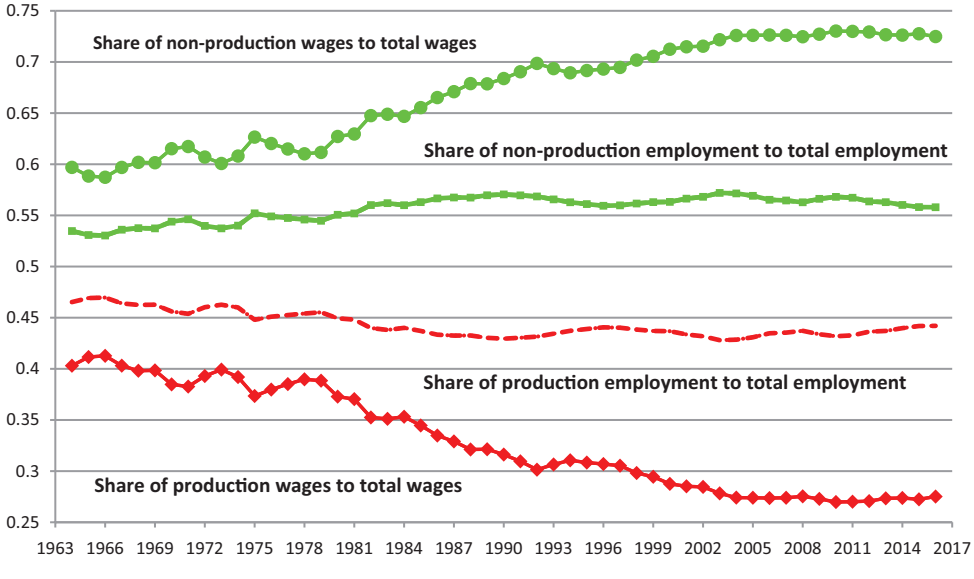

Fig. 3. *Shares of wages and employment, 1964–2016.*

creation of surplus value; this type of labour activity merely contributed to the redistribution of surplus value among its claimants. Mohun (2014) is right in that the excessively high payments to supervisory and managerial activity led to the rising income and wealth disparities found in a number of recent studies.

A rising general (or gross) rate of profit is fully consistent with rising unproductive expenditures even when their increase is so large that depresses the net rate of profit. The idea is that the rising general rate of profit shows that the system is basically healthy and capable of sustaining the increasing burden of unproductive activities. The situation changes when the general rate of profit is falling which may depress the net rate of profit even further in its downward direction. If the unproductive expenditures and activities are rising, then they apply additional pressure on the economy-wide net rate of profit compressing it furthermore down, thereby, worsening the situation by leading the economy sooner rather than later to the tipping point of a phase change. Thus, the gross or general rate of profit, R, is equal to the net rate of profit, r, plus the ratio of unproductive expenditures, s_u, to capital stock K. Thus, we may write

$$R = \frac{s}{K} = \frac{s_p}{K} + \frac{s_u}{K} \quad \text{and } r = R - \frac{s_u}{K}, \tag{12}$$

where s is the surplus value (or gross profits) measured by subtracting from the current net Marxian value-added the variable capital (or production wages); s_p stands for the net profits, which is the share of surplus value that can be spent productively and enhance the growth potential of the economy. The remainder of surplus value contains the unproductive expenditures, s_u, that is, the sum of 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 and other unproductive services including the indirect business taxes paid to the government (see Table 1). Figure 4 displays the evolution of the gross and net rates of profit, along with the rate of unproductive expenditures s_u/K, all estimated with the use of the gross capital stock in the US economy. During the entire period of our analysis, both variables display very similar fluctuations along very similar trends.

We observe that near the tipping points (of the late-1960s and late-1990s), the unproductive expenditures weighted by the capital stock remain at a high level and with the onset of the falling rate of profit follow in the downward direction, as we very well know from downsizing and restructuring of the business organisation after the early-1980s. The subsequent growth of the US economy was accompanied by its necessary complement, that is, the growth of unproductive expenditures. The rising (gross and net) rate of profit is accompanied by the rising unproductive expenditures until the attainment of another tipping point around 2000, where once again the unproductive expenditures will take another dip. A closer look at Figure 4 reveals that the falling pattern of the net rate of profit in the post-1982 years seems to have begun in the year 1997, however as it has been repeatedly stated a falling rate of profit in and of itself does not lead to a crisis and may be fully consistent with a growing economy.[12] Only if the net rate of profit falls persistently then a point is reached where the mass of real net profits becomes stagnant.

[12] Net profits were deflated by the price index for business sector net value-added: https://bea.gov/iTable/index_nipa.cfm. Net private investment was deflated by the price for non-residential private fixed assets https://apps.bea.gov/iTable/index_nipa.cfm.

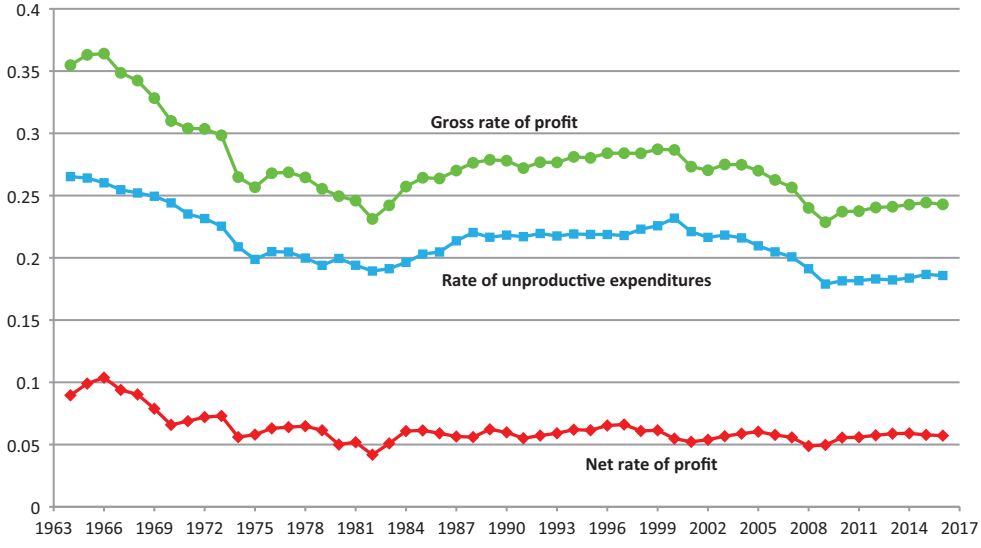

Fig. 4. *Rates of profit and unproductive expenditures, 1964-2016.*

In Figure 5, we display the evolution of real net profits along with real net private non-residential investment.[13] We observe that the real net profits stagnate once in the late-1960s and that this stagnation lasts up until the early-1980s and the same pattern is repeated in the mid to late-2000s with net profits stagnating, once again, punctuating the period of the Great Recession. Under these circumstances, that is, stagnating mass of real net profits, businesses on average are reluctant to invest, either because the profits that they make are not enough or because the expectations for future profits are bleak and also potential lenders are particularly reluctant to finance new investment projects. As a consequence, bankruptcies and unemployment rates are on the rise. This is the period of time when we also expect and in fact observe the declining rate of unproductive expenditure consequent upon the paths of the gross and net rates of profit.

In effect, both the net rate of profit and the rate of unproductive expenditures move together in a downward direction and we may hypothesise that the movement of the net rate of profit shapes the movement of the rate of unproductive expenditures (see Figure 4). The rationale is as follows: A rising net rate of profit offers the fuel for the expansion of the non-production activities; the idea is that the rising net 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.[14] The latter, in order to avoid or minimise losses from the defaults of their borrowers, are bound to lower their interest rates in order to supply the needed liquidity and

[13] For some industries, there were no available data with the SIC system. In that case, we relied upon Mohun's (2005) methodology.

[14] Preliminary econometric analysis utilising the Toda–Yamamoto test of the rate of profit, the weighted by the capital stock unproductive activities showed unidirectional causality from the rate of profit to the unproductive activities.

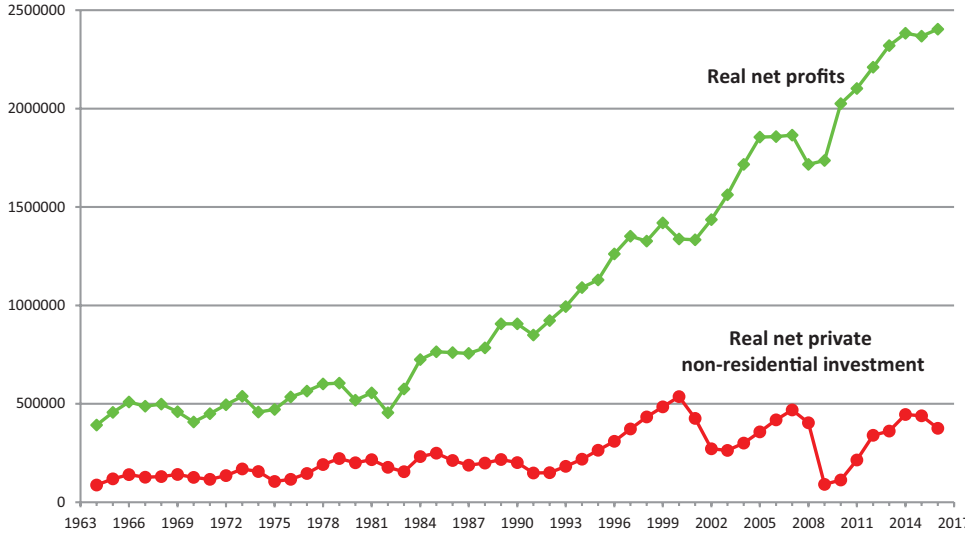

Fig. 5. *Real net profits and investment billions of 2009 dollars, 1964–2016.*

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 much consideration about the fundamentals of the borrowers and, at the same time, their own limitations. This is the reason that from the 1980s onwards financial institutions are pressing governments for more deregulation of what banks consider to be a growth-stifling financial environment. The low and falling rate of profit discourages investment and the financial institutions reduce further their interest rates in the effort to sustain investment activity through the loans that they provide. But lower interest rates imply the supply of more loans from the part of financial institutions in order to obtain the same revenues as before the fall in the interest rates. However, the lower interest rates direct business activities in 'speculative investment,' that is, the purchasing of financial instruments in general rather than in investment proper, that is, in 'enterprise investment' according to Keynes. The result is the creation of a number of bubbles which either have already burst becoming 'case studies' of Minsky moments as for example in the real estate sector of the US economy, and to a certain extend the stock market or the spiralling up of sovereign and private debt which make very likely the arrival of another Minsky moment. It is also important to stress at this point that when the net rate of profit is in such a low level and remains at this stage for such a long period of time it follows that new investment is not stimulated by low interest alone without demand driven policies and major institutional changes.

6. Concluding remarks

The US and the world economy in the post-2007 years entered a new phase that bears startling similarities with that of the late-1960s. The evolution of the profit rate and the

mass of real profits identify the year 2007 as the tipping point, that is, the year when profits stagnate and start their falling course. The falling net rate of profit is responsible for this new phase change, the Great Recession, and this fall in the net rate of profit is attributed mainly to the rising VCC, further exacerbated by the rise in unproductive activities and the associated with these expenditures which reached a plateau somewhat earlier than 2007.

The empirical evidence corroborates the idea that despite their differences, the Great Recession of the late-2000s shares the same salient features with the 'stagflation crisis' of the 1970s. More specifically, unlike the 'stagflation crisis' in the current Great Recession, the new technologies associated with computerisation and automation seem to have expanded their scale of their application by including the service industries and the unproductive activities in general. As a consequence, the growth in employment in these industries slowed down and the share of employment in unproductive activities in the total employment remained constant or slightly falling. However, we showed that this is not true for the share of unproductive wages which kept rising, lending support to the idea that the managerial and supervisory labour in these activities has been rewarded by much higher salaries which explain, at least in part, the currently acknowledged increasing income and wealth disparities. The fall in the rate of profit led to the stagnant mass of net profits around the late-2000s that reduced the net investment up until the recent years. For example, net investment of the US private sector as a percentage of GDP during the Great Recession of 2007–16 was on an average equal to 2.01% as opposed to 4.08% of the 1964–2016 period while during the 'new economy' period, the share of net investment in GDP was 3.70% which is lower than the average of the whole period suggesting a downward long-run trend in this ratio.

The evolution of the mass of real net profits does not seem to have run its full trajectory thereby justifying all those that characterised it as the 'Great Recession'. Marx's (1857 [1973], p. 750) view that '[…] these regularly recurring catastrophes lead to their repetition on a higher scale, and finally to its violent overthrow' we cannot predict that will be fulfilled. All we can say is that the capitalist system will be quite different in the years to come, as major institutional changes are already under way and the sign of their direction (in favour of capital or labour) will depend on the way in which the political element will exert its influence or pressure.

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Appendix

A1. Data and their source

Despite the advantages of the US NAICS over the former SIC, the estimation of long-term Marxian categories is not easy to carry out. The reason is that the US statistical agencies such as the BEA and the Bureau of Labor Statistics (BLS) have not fully updated the industrial data for the US postwar economy according to the NAICS. In particular, although the BEA has made significant progress in updating the GDP by Industry and the Input-Output Accounts, nevertheless there has not yet been equal progress in the case of employment and wage data, whose update is limited to the period from 1998 onwards. The same holds true with the BLS where in many industries, the updated data do not fully cover the postwar period or at least the period from the early 1960s onwards. The treatment of this inconsistency in the data was overridden in two steps. First, we attempted an abridgment between the industries that are classified according to the SIC and the NAICS following the guidelines of the US Census Bureau (2000). Second, we estimated the NAICS missing data[14] by extrapolating backward through the following formula:

$$Z_{t-1}^{\text{NAICS}} = 1 + \left(\frac{\sum_{j=1}^{n} Y_{j,t-1}^{\text{SIC}} - \sum_{j=1}^{n} Y_{j,t}^{\text{SIC}}}{\sum_{j=1}^{n} Y_{j,t}^{\text{SIC}}} \right) \cdot X_{t}^{\text{NAICS}}, \tag{A1.1}$$

where X is the last available data of NAICS industry at time t, Y is the SIC proxy industry to X, Z is the resulting estimated data of NAICS industry. Finally, $j = 1, 2, \ldots n$ stands for the various SIC industries. Comparing our new NAICS-based estimations on Marxian categories with our past SIC-based estimations (Paitaridis and Tsoulfidis, 2012), we find relatively small deviations[15] thereby lending support to our proposed estimating method.

Having accomplished the integration of the time series, we are able to proceed with the estimation of the Marxian categories starting with the Marxian value-added (MVA).[16] In national account terms (see Table 1), the MVA is defined as the sum of the net (of depreciation) value-added of production sectors of the economy plus their royalties (i.e. taxes, rents, interests) paid to the royalty sectors of the economy (i.e. financial institutions, unproductive services and government) plus the gross output of trade, real estate and rental and leasing sectors net of imputations.[17]

In economic terms, the MVA is the total value produced by the productive workers and consists of two parts, the surplus value and the variable capital. Thus, subtracting the variable capital, that is, the wages of the productive workers, we can estimate the

[15] For instance, for the period 1964–2007, the mean absolute deviation between the different estimations on Marxian value-added is 1.72% and on surplus value is 2.04%.

[16] For details about the methodology used for the estimation of the Marxian value-added, see Shaikh and Tonak (1994, ch. 3).

[17] In the imputations, we include the owner-occupied housing output, the farm tenant-occupied housing owned by farm operator landlords, the farms owned by non-operator landlords and the various royalties (i.e. patents, license fees, etc.).

surplus value. For the estimation of variable capital, we need two variables, the number of productive employees (L_p) and their respective nominal wage. We assess the number of productive employees starting with the total number of workers $(L_j)_{\text{NIPA}}$ employed in the production sectors ($j = 1, 2, \ldots, n$) according to NIPA tables. In this total are included both employed and self-employed. In order to identify the number of the unproductive employees (and the so-called corporate officers) of the productive sectors, we use data from the BLS, and for each productive industry j, we take the share of productive to the total number of employees, that is $(L_p/L)_j$. Consequently, the number of productive workers in sector j is estimated as follows:

$$(L_p)_j = (L_p/L)_j \cdot (L_j)_{\text{NIPA}}. \tag{A1.2}$$

The estimation of variable capital should also include the employer's social security contributions because this is a labour cost for businesses. For this purpose, we estimate the ratio of the compensation of productive workers (EC) to the wages and salaries (WS) for each sector. The ratio between those two variables gives us a markup with the aid of which, we can estimate the social security contributions:

$$x_j = (\text{EC/WS})_j. \tag{A1.3}$$

Subsequently, we multiply the average weekly wage of productive workers (w_j) in each productive sector by x_j in order to estimate in the wage data of the BLS the social security contributions. The so-estimated average wage is multiplied by 52 weeks to get the average annual wage, which multiplied by the total number of productive workers in each sector gives the variable capital in each productive sector of the economy:

$$V_j = (w_j \cdot x_j) \cdot (L_p)_j \cdot 52. \tag{A1.4}$$

Finally, the total variable capital is estimated by summing the variable capitals across industries.

A2. Estimation of the total gross fixed capital stock

The capital stock is the accumulation of the past investment flows. Easy as this definition may be, its application to actual data is fraught with many difficulties associated with depreciation and replacement investment. In the USA, the BEA publishes annual estimates of the capital stock based on the assumption of a given geometric growth rate of depreciation where the lifetime of investment goods is infinite. This was not true in the pre-1993 estimates of capital stock where the assumption was that the lifetime of fixed capital investment was finite and for this reason, Shaikh (2016), in his estimations of capital stock for the US corporate sector, employs the assumption of the finite life of capital goods utilising a depletion rate for the gross capital stock as well as a depreciation rate for the net capital stock. Furthermore, both the old and the new BEA definitions of capital stock do not take into account the impact of the great depression of the 1930s and the effects of WWII. For this reason, Shaikh (2016) in his estimations constructs an adjustment ratio utilising the accounting values of fixed capital stock of

the US corporate sector and applying this ratio to estimate the fixed capital of the BEA (1993) for the period 1925–47 while for the period 1948–2011, he utilises the Gross Perpetual Inventory Model (GPIM).

It is important to note that our estimations refer to the total private non-residential fixed assets and government enterprises of the US economy and not only its corporate sector. We refer to the total capital stock in order our estimates to be more general since productive or non-productive activities and employment are not restricted to the corporate sector. More specifically, starting from the year 1925 we estimate, following Malikane (2017), the initial capital stock and for the remaining years we apply Shaikh's GPIM methodology. The formula for the estimation of the current value gross capital stock (*GC*) is as follows:

$$GK_t = IG_t + (1+\delta_t)\frac{P_{k_t}}{P_{k_{t-1}}}KC_{t-1} = IG_t + (1-\delta_t)(1+g_{pk})KC_{t-1}, \qquad \text{(A2.1)}$$

where IG is the gross investment in current prices, δ is the rate of depreciation $(\delta = D_t/NK_{t-1})$, NK is the net capital stock and g_{pk} is the growth rate in prices. For the estimation of KC_t, we need a starting value for the capital stock, that is, GK_0 for which we apply the following formula:

$$GK_0 = \frac{IG_1}{(1+g_1)-(1-\delta)(1+g'_{pk})}, \qquad \text{(A2.2)}$$

where $(1 + g_1)$ is the average growth rate of the gross investment in the period under examination. In particular, for the estimation of g_1, we determine initially the natural logarithm of the investment and subsequently we regress it against time and a constant. The advantage of this approach is that the information contained in the used investment series is making the result less sensitive to the initial period conditions (Nehru and Dhareshwar, 1993). The coefficient of the time trend is the g_1, the parameter δ represents the average depreciation, while g'_{pk} is the average growth rate of prices during the examined period. It is important to note that the estimation of gross capital stock is based on the gross investment and that during the 1970s, there has been a slowdown in the growth of investment *IG* which is also reflected on the stagnating or falling growth rate of *GK* while the rate of surplus value was growing at record high rates during the same time period.