Structural Change and Economic Dynamics 61 (2022) 380–397

Contents lists available at ScienceDirect

Structural Change and Economic Dynamics

journal homepage: www.elsevier.com/locate/strueco

Determinants of the profit rates in the OECD economies: A panel data analysis of the Kalecki's profit equation

Ivan D. Trofimov

Kolej Yayasan Saad (KYS) Business School, Malaysia

ARTICLE INFO

Article history:
Received 12 October 2020
Revised 15 December 2021
Accepted 4 March 2022
Available online 15 March 2022

JEL Classification:
E11
E01
E25
C22

Keywords:
Profit rate
Panel data
Cointegration
Panel vector autoregression

ABSTRACT

The paper considers several determinants of profitability (investment rate, trade surplus, and budget deficit) in the OECD economies in the 1960–2014 period, using the Kalecki's profits equation framework. We estimate and utilise the aggregate profit rate measures for the total economy, employ a series of panel unit root and panel cointegration tests, and apply panel vector autoregressive (PVAR) model to examine the relationship between the profit rate and its determinants in the short- and long-run. The empirical evidence supports the hypothesis of positive effects of trade surplus on profitability, in line with Kaleckian views concerning the cyclical and secular dynamics of profits and profit restoration forces in the capitalist economies. The positive effects of investment rate on profitability are not confirmed, while the effects of fiscal activism on profitability are demonstrably negative; in contrast, a strong positive influence of profit rate on the pace of capital accumulation (investment) is indicated. The results are robust across sub-periods and panels with smaller cross-sectional dimension. Empirical results highlight the divergence between real investment and profitability, capital formation slowdown, and fiscal policy implementation problems in OECD economies over recent decades.

1. Introduction

The level and dynamics of the rate of profit and the relationship between profitability and other economic variables have long been an important theoretical and empirical matter in both orthodox and heterodox economic theory. The literature on profit rates is voluminous and a number of issues have been considered from both micro- and macroeconomic perspectives, including the secular decline of profit rates (Feldstein and Summers, 1977; Michl, 1988; Duménil and Lévy, 2002), the revival of profitability and role of countervailing forces in the process (Wolff, 2003; Basu and Manolakos, 2013), the convergence of the rates of profit across industries (Vaona, 2011) and economies (Carter, 2003; Glyn, 2004; Chou et al., 2016), financialisation and financial components of profitability (Duménil and Lévy, 2004), profit rate persistence (Mueller, 1977), profitability decline and the globalisation process (Ramirez, 2012), the movements of profit rates in the context of world hegemony cycles (Li et al., 2007), determinants of profitability, and other topics.

Regarding profitability determinants, the literature contrasts the short-run macroeconomic factors (capacity utilisation, overhead labour costs, the bargaining power of labour, wage growth) that affect distributive shares and thereby profit rates across the business cycle (Weisskopf, 1979; Hahnel and Sherman, 1982; Bowles and Boyer, 1988), and the structural forces, such as deregulation, trade and capital flow liberalisation, demographic change, and so on, that affect distributive shares and profits in medium- and long-term (Jayadev, 2007; Schmidt and Vosen, 2013). In a related vein, the impact of capital variables (in particular the public and government capital and investment) and other supply side variables (labour and capital productivities, real factor prices) have been examined (Aschauer, 1988; Uctum and Viana, 1999). The strand of research on profitability determinants pioneered by Kalecki (1942, 1954, 1971, 1991) is particularly salient, given that it conceptualises profit as a product of expenditure and savings in the economy, considers the complexity of economic relationships involving the rate of profit (the distinction between current and expected profitability, the decision locus in the economy and differences in the relative power of the labour and the capital as far as expenditure is concerned, and the causality between the variables in the profits equation), rests on the categories and variables that are consistent with and that can be constructed from the national accounts data, allowing consideration of multiple sectors (government and external).

This paper examines determinants of aggregate profitability in the OECD economies in recent decades (1960–2014), based on the Kalecki's profit equation framework. The specifics and the novelty

E-mail address: ivan.trofimov1@gmail.com

https://doi.org/10.1016/j.strueco.2022.03.004
0954-349X/

of the paper is as follows. Firstly, in contrast to previous research that focuses on Kalecki's profit relationships in a few individual economies (the US, the UK, and Spain), for which corporate profit series are available in the national income and product accounts (NIPA), we consider a panel of 18 economies and construct requisite profit rate series for each of them. Secondly, in contrast to previous research that decomposes macroeconomic profits according to their sources (to verify the relative importance of each source), we consider the functional relationship in which the aggregate (total economy) rate of profit is a dependant variable and examine the size, significance, and the signs of the effects of the independent variables (trade surplus, budget deficit, and investment rate) on profitability. Thirdly, up-to-date econometric methods are used, including panel unit root and cointegration tests, as well as panel vector autoregression (PVAR) model to examine the relevant relationships (Pesaran and 2004, 2007; Pedroni, 1999; Kao, 1999; Westerlund, 2007; Bun and Kiviet, 2006; Holtz-Eakin et al., 1988). The use of panel data models is justified, given the low power of time series models (unit root and cointegration tests) in the small samples and the focus of the study on commonalities between the countries, as far as profit equation determinants are concerned.

The rest of the paper is organised as follows. Section 2 considers the mechanics and theoretical aspects of Kalecki's equation and examines the empirical research pertaining to the estimation of the equation. Section 3 elaborates on the empirical model, data sources, and econometric methodology. Section 4 presents econometric results and discusses the significance of the results. Section 5 presents the concluding remarks.

2. Literature review

2.1. 'Profit-investment nexus' - conceptual frameworks

The Kalecki's profit equation is a component of a broader theory of growth and distribution that was developed by Kalecki and other economists from Keynesian and post-Keynesian school in the 1930–50s and that is different in major respects from neoclassical conceptualisation of distribution and growth, and, when it comes to the principle of effective demand,[1] from classical (Marxian and Ricardian) theories. In the discussion that follows we review these theories and frameworks and examine how they treat the relationship between profit and its determinants (specifically the investment).

In neoclassical school, the distribution factors (e.g. profits) play limited role in the economic dynamics. The growth process is modelled by assuming away the intertwined relationship between income distribution, capital accumulation and growth (with multiple possible solutions and outcomes) and by ignoring the social and structural context of growth and accumulation. The factor prices are determined by demand and supply relations in the factor markets, while income shares of production factors are conditioned by the production technology. The economic dynamics is driven by savings that sets the path of capital stock accumulation, capital intensity of production and productivity and decides the equilibrium growth path, while the natural rate of growth is determined by exogenous population growth and technological progress. In neoclassical endogenous growth models the savings may affect the natural rate of growth, while the growth trajectory is determined by growth generating R&D and human capital investments in combination with consumption time preferences (Hein, 2014: 4). Economy is assumed to operate at or near the full employment level of output ($L = L^*, Y = Y^*$) with flexible prices. For the purpose of 'profit-investment' relationship determination it is further assumed that the capital and labour are compensated based on their respective marginal products, and the savings are made only by capitalists and business owners (while owners of labour do not save). Given that Y is real output, L is labour, $\bar{Y}$ is previous period real output consumed in current period as input, W is nominal wage, P is output price, R is gross profit in nominal terms, S is gross savings in nominal terms, s_r is savings out of profit propensity, I is real investment, a system of six equations is specified and solved to establish that causality runs from profits on the right-hand side of Eq. (6) to investment on the left-hand side (Gupta, 1988: 10–11):

$$Y = Y(L, \bar{Y}) \tag{1}$$

$$W/P = \partial Y/\partial L \tag{2}$$

$$PY = WL + R \tag{3}$$

$$S = s_r R \tag{4}$$

$$PI = S \tag{5}$$

$$I = s_r(Y^* - \partial Y^*/\partial LL) \tag{6}$$

In classical theories of Smith, Ricardo and Marx, the functional income distribution is seen as a product of power relationship between the classes and other social and institutional factors. The profit rate, however, is treated as a residual from real wage determination. Together with a capitalists' propensity to save (s_r), it sets the path of accumulation and growth that ensures validity of Say's law: the general and encompassing overproduction crises are deemed impossible,[2] albeit unemployment tends to be endemic to capitalism. Importantly, the profits are used completely for investment and accumulation, and thus the problem of lacking effective demand is not experienced (Hein, 2014: 4–5). In the short-run context during the business cycle stages, Marxist economics does not consider investment as a driver of business cycle, as investment itself is a result of changes in profit (Tapia Granados, 2013: 10–12). As put by Marx (1981: 348–9), the rate at which capital is valorised (i.e. rate of profit) "is the spur to capitalist production, so that a decline in this rate slows down the formation of new capitals and ... promotes overproduction, speculation and crises." During the cyclical upswing, the labour experiences gains in terms of wages, which cause profit-squeeze that in turn reduces the stimulus by capitalists to invest. In a cyclical downturn that follows, the profits are restored and bring acceleration to capital accumulation and hence the new upswing stage. In the long-run, the feedback effect from capital accumulation to profits is experienced, whereby over-accumulation of capital results in the tendency of the profit rate to fall (Reuten, 1991).[3]

In the post-Keynesian models (both Kaldor-Robinson and Kalecki-Steindl),[4] the investment decisions and capital accumulation are independent of savings (contra neoclassical approach), and the accumulation process is a determinant of functional and income distribution (contra classical models). The profit rates are set by the pace of capital accumulation and propensity to save out of profits[5] (in Kaldor-Robinson model), and by the profit share (the

[1] The concept of effective demand implies that the levels of output and employment are determined by the aggregate demand, while the aggregate supply adjusts to this level (Hein, 2014: 181; Kalecki, 1971: vii).

[2] Some classical economists, such as Malthus and Sismondi, allowed the possibility of crisis and stagnation due to lacking effective demand, Sowell, 1972.

[3] The tendency can be reversed by stagnation of wages, export of capital, e.g. through foreign investment, gain of access to foreign markets, destruction of the capital stock, among other factors. In Ricardian model, the accumulation of capital brings decline in the profit rate through decreased marginal productivity of land (Mizuta, 2015).

[4] Steindl (1952), Kaldor (1955/56), Robinson (1956).

[5] The savings are made by capitalists and no savings out of wages is presumed. The profits received by capitalists are either reinvested in the business (through purchasing productive assets produced by the capitalists and corporate sector) or saved (through placing the savings in the financial sector and purchasing financial assets; Hein, 2014: 166).

result of imperfect competition and mark-up pricing in oligopolistic markets) and capacity utilisation (that results from aggregate demand and capital accumulation) in Kalecki-Steindl model (Hein, 2014: 6).[6] In both post-Keynesian models the causality runs from capital accumulation and investment to profits (contra classical approach).

The Kalecki's model of growth and distribution adopts the following representation of the economy. Firstly, two modes of price formation (that imply different effects of price changes) across the sectors are distinguished. In the primary sector, the changes in demand interacting with inelastic supply produce adjustment in prices with no quantity adjustment. In contrast, in the industrial and corporate sector of the economy, the aggregate demand changes trigger adjustment in output and capacity utilisation (which is an endogenous variable in Kalecki's framework). The price setting does not rest on the assumption that marginal revenue would equal to marginal cost; instead the prices are seen as fixed at the level of unit variable costs plus a mark-up, up to the point where aggregate demand is smaller than the full capacity. Secondly, given the mark-up pricing, the oligopolistic and monopolistic market structures with substantial degree of market power tend to dominate the industrial sector (Hein, 2014: 186–7). The degree of market power and the size of a mark-up in turn are conditioned by the degree of industry concentration, the relative importance of price versus non-price competition, the overhead costs (that have potential to 'eat away' the profits), and the power of trade unions. Thirdly, the functional income distribution likewise results from a mark-up pricing: the wage and profit shares are determined by "the degree of monopoly, the ratio of prices of raw materials to unit wage costs and the industrial composition" (Kalecki, 1954: 30; 1971: 64). The functional distribution is therefore not given a priori but is an outcome of the bargaining process between capitalists and the organised labour, the pricing decision of the capitalists and business owners, and the price policies of the government. Fourthly, in contrast to Keynesian formulation where the business expectations of the rates of return on capital in excess of costs are the main driver of investment process (alongside interest rate over the life of the capital asset), in Kalecki's formulation past investment decisions affect the current level of investment and the main motive for the investment decision in the present is the profit that was realised in the past. Additionally, for a given interest rate the movement downwards along marginal efficiency of capital (MEC) curve in order to achieve higher investment, income and profits would not result in equilibrium position, but would instead cause outward shift of MEC and respective cumulative effects (Hein, 2014: 222). Fifthly, the implementation of investment decision involves lags, particularly due to making investment orders, production, delivery and installation of investment goods, implying that in the short-run the level of current investment may be treated as exogenous. While the pace of investment and capital accumulation depends on both long-term interest rate and rate of profit (having the negative and positive effects on investment respectively), the former can be treated as fixed in the short-run. Thus, the current investment is a function of the rate of profit and the existing level of capital stock (the respective effects being positive and negative). However, the rate of profit itself is a product of past expenditure decisions by capitalists (as per causality mechanism in Kalecki's profit equation that is explained further). The cyclical fluctuations in Kalecki's framework are driven by two opposing forces: the present investment (driven by past investment expenditure) through change in the profit rate builds up the capital stock, but the greater capital stock reduces profit rate and dampens the investment (given that the rate of profit is the rate of return on capital stock and the ratio of operating surplus to capital stock).[7] Lastly, the Kalecki's model is dualistic in that the pricing decisions based on setting the mark-up determine the profit and wage shares, while at the macroeconomic level the investment expenditure decisions (together with the expenditure by the government and the external sector) determine the level of profits and wages and national income.

Notation-wise Eqs. (1) to (5) are supplemented and modified by the following relationships that describe exogeneity of investment, mark-up pricing, absence of full employment, and capital accumulation (Gupta, 1988: 12–3):

$$I = \bar{I} \tag{7}$$

$$W/P = a/1 + m \tag{8}$$

$$Y = aL \tag{9}$$

$$g = f(I, K), \tag{10}$$

where $m$is a mark-up, $a$is a real output per unit of labour, $K$is the capital stock. The model is closed and the relationship between profits and investment is then obtained by substitution as:

$$R/P = m\bar{I}/S_r \tag{11}$$

The Structuralist-Keynesian cumulative growth model (Sylos Labini, 2004; Corsi and Guarini, 2009: 2–3; Guarini, 2016) presupposes causality from profits to investment. For the economy dominated by oligopolistic structures (as the most common form of industrial organisation), the chain of causation starts with investment (autonomous or induced) as a major source of growth and development that has effects on aggregate income and labour productivity. The productivity is in its turn influenced by the static and dynamic economies of scale ('Smith effect'),[8] absolute cost of labour that initiates organisational innovations and affects productivity indirectly ('organisation effect'), and the relative cost of labour (the difference between prices of labour and capital) that brings efficiency investments in capital ('Ricardo effect').[9] The increase in both income and productivity is reflected in the opposing forces that influence wages and profits. On one hand, increase in income leads to greater employment and bargaining power of labour; on the other, productivity growth weakens labour' bargaining power and may result in lower wages (higher profits). The distributional interest are conflicting, with capitalists preferring $W < (Y/L)$ and labour aiming at $W > P$ and $W > (Y/L)$, where W is a money wage, P is product price, and Y/L is labour productivity. Lastly, wages have twofold effect on investment: firstly, they stimulate consumption and encourage investment (through accelerator effect); secondly, the growing wages reduce profits and investment out of profits. Given the conflicting forces, the maximum investment would correspond to the optimal level of wages and profits, where the interest of workers (and unions) and capitalists are balanced.

2.2. Kalecki's equation

The Kalecki's equation (otherwise known as the 'Levi-Kalecki's equation') is an identity based on the national accounts categories and that indicates the breakdown of profit at macroeconomic level according to its sources (Kalecki, 1942, 1954; Levy, 2001).

The economy is assumed to consist of three departments (production of investment goods, production of consumption goods

[6] Thus, the growth process in Kalecki-Steindl incorporates both the creation of new production capacity and utilisation of the existing capacity.

[7] Kalecki (1939: 148-9), Targetti and Kinda-Hass (1982: 2540.

[8] Junius (1997), Corsi (2005).

[9] Gehrke (2003).

for capitalists, production of consumption goods for workers). All activities along the production process happen within the department (Hein, 2014: 192–3). We note a major shortcoming of Kalecki's theorising: the clear-cut division of economy in the departments and of the society into classes may be unwarranted in the modern economic reality that is characterised by moderation of class conflicts and greater sophistication of economic processes relative to the 1930–50 s when Kalecki's theory was formulated. Provided that in period t, Y_t is income, Y_{et} is expenditure, W_t are wages, I_t is investment, C_t is consumption by workers (consumption out of wages), P_t are profits, X_t and M_t are exports and imports, G_t and T_t are government expenditure and revenue, and CC_t is capitalist consumption (consumption out of profits), the Kalecki's equation in a two-sector economy with no government or external sector is derived as:

$$Y_t = Y_{et} \tag{12}$$

and

$$P_t + W_t = I_t + C_t + CC_t, \tag{13}$$

where income is composed of profits and wages, and expenditure is composed of investment and consumption). The prices of investment and consumption goods that determine the values of I_t, C_t and CC_t are determined by mark-up pricing and thus are considered fixed (when economy operates below full capacity; Hein, 2014: 193) Eq. (2). may be re-written as:

$$P_t = I_t - HS_t + CC_t, \tag{14}$$

where HS_t are household savings (savings out of wages) represented as $HS_t = W_t - C_t$. Given that workers in Kalecki's scheme are unlikely to make substantial savings (in extreme case consuming all their income, so that propensity to consume out of wages is equal to one), the Eq. (13) is simplified further as:

$$P_t = I_t + CC_t, \tag{15}$$

where profit is the sum of investment expenditure on capital stock and consumption out of profits.

It is further assumed that:

$$CC_t = A + \lambda P_{t-n} \text{ and} \tag{16}$$

$$Y = \frac{P}{1-\alpha}, \tag{17}$$

where the parts A and λP are autonomous and induced components of the capitalist consumption, CC_t; $\lambda \in (0, 1)$ is a parameter that enters the equation with a lag; $(1-\alpha)$ is the share of profits in the national income.

For an open economy with government, the equation includes other sources of savings due to international trade and fiscal activism by the government and is expanded as:

$$P_t = I_t - HS_t - GS_t - FS_t + CC_t, \tag{18}$$

where $GS_t = T_t - G_t$ indicates government savings and $FS_t = M_t - X_t$ indicates foreign (rest of the world) savings. Representing government deficit (D_t) as $D_t = G_t - T_t$ and trade surplus (NX_t) as $NX_t = -FS_t = X_t - M_t$ the equation expresses profit as a positive function of investment, trade surplus, budget deficit and capitalist consumption, and a negative function of household savings:

$$P_t = I_t + (X_t - M_t) + (G_t - T_t) - HS_t + CC_t \tag{19}$$

The Kalecki's equation shows, broadly, that the income of each sector is a function of that sector's expenditure decisions (Kalecki, 1991; Toporowski, 1999: 357). The decision locus in the economy is crucial for determination of causality between left- and right-hand side variables in the equation. Kalecki accentuates the importance of capitalists', government, and external sector expenditure decisions on profits and causality from the right- to the left-hand side of Eq. (19) (in the case of capitalists, they can decide their levels of consumption and investment, but cannot decide the level of their income, hence causality from investment to profits). As argued by Laski and Walther (2013: 9), this type of causality may render certain post-Keynesian models of profit-led growth problematic (Bhaduri and Marglin, 1990). Given that reverse effect from profits to capitalist consumption and investment, according to Kalecki, is experienced with a lag, the reduction of wage share in the profit-led growth models would require that I_t and CC_t rise immediately (or even in advance of decrease in wage share) to compensate for falling C_t and to foster growth.

Importantly, the change in investment (and other types of expenditure mentioned above) affects the level of profits, without affecting the profit share (which is the outcome of mark-up pricing decisions of the firms). On the other hand, the change in profit share will have effect on aggregate income and output (as shown in Eq. (5)): for instance, higher profit share and respectively lower wage share would imply lower demand for output produced in Department 3 (consumption goods for workers). The increased demand for consumption goods for capitalists (Department 2) would not compensate for the shortfall in demand in Department 3, given that propensity to consume out of wages is unity and propensity to consume out of profits is necessarily smaller than unity (Hein, 2014: 197).

A stable level of investment in the Kalecki's model necessarily leads to a decline in profit rate: investment is a necessary condition for prosperity and output (and hence profitability), but every additional investment induces competition between capitals (old and new), creates extra capacity for the available demand, and ultimately leads to falling profitability while capital accumulation is ongoing (Toporowski, 1999: 355–6). The fall in profit rate can be averted by an increase in gross investment and adoption of capital-intensive production techniques (as long as investment goods are not imported); hence, the positive sign of the I_t coefficient.

Budget deficit (government dissaving) in the Kalecki's scheme is a positive contributing factor to profitability. The flows to the private sector from the government in the form of government expenditure that exceed the reverse flows in the form of taxes directly add to business sector revenues through government purchases and indirectly through increase of households' purchasing power due to government transfers (Topowski, 1999: 363; Levy et al., 2008). In contrast, budget surplus (government saving) increases the expenses of the business sector and reduces households' buying power. The budget deficit (and the growing indebtedness that accompanies it) is therefore not a hindrance to economic expansion and profitability, but rather a facilitator, as long as the economy operates below full employment and capacity.

Regarding trade surplus element in Eq. (19), the expenditure decisions of capitalists with regard to exports and imports allow them to gain access to foreign markets and limit access to own market and thereby 'increase profits at the expense of capitalists of the other countries' (Kalecki, 1954: 51). Kalecki argues that it is trade surplus, rather than the gross exports, that positively influence effective demand, and hence wages and the volume of profits. In addition, it is assumed that international trade transactions take place between companies, rather than households or governments, with domestic companies' profits increased by greater sales to overseas companies and decreased by smaller purchases from them. In the absence of a mechanism to lend surpluses to the deficit countries, and in the presence of mercantilist trade practices, the increase in domestic profit is paralleled by a decrease in profits on overseas capitals, thereby being the source of imperialist policies of the past and trade conflicts of the present (Kalecki, 1954: 51).

Concerning household savings, the wages are received by the worker and subsequently spent on consumption goods and thus, through circular flow, return to the capitalist and contribute to its profits. Savings from wages, however, reduce consumption spending and capitalist profit, and thus enter the Kalecki's equation with a negative sign (Toporowski, 1999: 358).

Capitalist consumption (consumption from profits) is determined by the dividends policies of the companies (and hence the level of retained earnings) and by the saving behaviour of the self-employed businesspersons and small proprietors (Kalecki, 1942: 258–9; Toporowski, 1999: 356–7; Laski and Walther, 2013: 1–2, 4–5). The increase in consumption from profit boosts profits (given that capitalists have full control over their expenditure $P_t = I_t + CC_t$and that the more they spend as a class, the higher their profits), in particular through redistribution of profits from entrepreneurs to rentiers who have a higher propensity to consume, financial asset inflation, and luxury consumption.

2.3. Empirical research

The empirical analyses of the determinants of profit rates along Kaleckian lines (or those studies relevant to the topic in question) include Asimakopulos (1982, 1992), Toporowski (1993, 1999), Baeza and Munoz (2012), Brennan (2014), Lopez Bernardo (2015), Bakir and Campbell (2016), as well as certain others in the business press that relate profit dynamics to changes in equity price (Montier, 2012; Huebscher, 2013). amongst analyses of the determinants along neoclassical lines, the works by Aschauer (1988) and Uctum and Viana (1999) are prominent.[10]

In an earlier study, Asimakopulos (1982) looked at the quarterly data for the US economy (Q1:1950 - Q4:1982) and used gross retained earnings as a profit measure. Investment and personal savings were the major determinants of the retained earnings and had positive and negative effects, respectively. The contribution of government budget deficit was positive and largest in the earlier part of the period. The contribution of the international trade surplus alternated between positive and negative.

J. Toporowski (1993) derived the Kaleckian profit rate for the UK economy during the 1978–1989 period and demonstrated that official profit figures tended to be understated, while his 1999 paper (Toporowski, 1999) illustrated, using OECD statistics, the salience of investment for profitability in six major OECD economies (the US, the UK, France, Germany, Japan, and Italy), the important relative contribution of fiscal deficit in all economies in question apart from Japan, and the support of profit by trade surplus in Germany and Japan.

Baeza and Munoz (2012) attempt to explain the paradox of concurrent growth of trade deficits and corporate profits in the US economy in 1960–2010. Previous studies (Milberg, 2006, 2011) explained the paradox based on corporate strategy analysis and post-Keynesian theory of mark-up pricing: the change in the corporate strategies of oligopolistic firms in the US and the emphasis on cost control instead of price control brought in the disintegration of the production process and greater reliance on intermediate imports, without substantial increase in products' final prices. This helped to maintain corporate profits in the presence of growing imports (and hence a trade deficit). Baeza and Munoz, in contrast, attribute the paradox to the combination of the prominent position of the US dollar as a major currency and its overvaluation, which allows the accumulation of profits through foreign trade deficit (the profits being determined not only domestically, but also through international transactions of the country, and the trade deficit being equivalent to the transfer of profits from the rest of the world to the US, in line with theorising by Shaikh and Tonak, 1994: 67). The growing trade deficit arguably helps to explain the sharp rise of profits in the US between 2001 and 2006 in the absence of equivalently large divergence between wages and productivity.

Lopez Bernardo (2015) examined the volume of profits of financial and non-financial corporations as a percentage of GDP in Spain in 1999–2014. By looking specifically at the operating component of profits (operating profits) and by excluding capital gains (due to real estate appreciation), it was shown that profits as percentage of GDP declined from 6.7% in 1999 to 3.3% in 2005 – thus prior to global financial crisis (GFC) – and then returned to 8% in the post-GFC period, indicating the growing importance of the operating activities of the corporate sector (and highlighting the decline of the growth model based on expanding real estate and financial sectors). As to sources, prior to GFC, the decline in profits was accompanied by, contrary to the Kalecki's equation, rising investment and reduction of household savings, and in line with Kalecki's equation, with external sector deficit; while government balances played a minimal role in profit determination. After the GFC, the relative importance of the determinants altered: the rise and stabilisation of profits after 2007 was then associated with the improvement of the current account (in line with Kalecki's equation), while the opposing forces were the growth of household savings and government savings and sluggish investment.

Bakir and Campbell (2016) derived after-tax profit for the US domestic private sector, as well as other components of the Kalecki's equation, from the US NIPA accounts of the 1949–2009 period. In addition to confirming the revival of the US profit rate after the early 1980s, they indicate the positive and significant contribution of personal dissaving, private investment, and a budget deficit to profit rate, and a much smaller and negative (post-1970) contribution of net exports. In addition, the personal dissaving and net domestic investment switched positions as largest contributors to profit rate changes (the former becoming most prominent) in the pre- and post-1980 period. The contribution of government deficit to profit rate dynamics was more or less stable during 1949–2009.

3. Methodology

3.1. Model

Most previous studies estimate profit as a residual after expenditure has been made or income has been earned, comparing the average values of the Kalecki's equation elements to the level of profit rate or expressing the variables as a percentage of net fixed assets or of the lagged retained earnings. In contrast, this paper represents the Kalecki's equation as a functional relation between profit rate, investment rate, budget deficit, and trade surplus. The baseline specification is therefore as follows:

$$PR = f(INV, BD, TS) \tag{20}$$

where PR is the rate of profit, INV is the investment rate (gross fixed capital formation as percent of GDP), BD is budget deficit, and TS is trade surplus. We adopt a more formal approach to testing economic significance, size, and sign of the effect of independent variables on profit rate (controlling for endogeneity amongst and the lags of the variables), and examine the presence of the long-

[10] A related stream of literature analysed the profit rate-investment relationship and causality, and tended to deliver conflicting results. The studies by Bar-Yosef et al. (1987) and Inci et al. (2009) did not find evidence of investment to profits causality Gupta (1988)., using Granger causality and forecastability tests, likewise did not corroborate Kalecki's thesis of investment to profit causality in the case of the US and Canada during 1950-1982 period. In contrast, Stubejl (2014), using Granger causality tests and Toda-Yamamoto procedure, provided supporting evidence for investment-profit causality hypothesis using Denmark, Finland, Italy and Netherlands aggregate-level data over 1977-2007 period, in line with earlier studies by Shapiro et al. (1983) and Mahdavi et al. (1994) Lee and Nohel (1997). established bi-directional causality between profits and investment.

run co-movement (cointegration) and the short-run dependencies between the variables, using panel data econometric methods. The above functional relationship is examined over the whole 1960–2014 period, as well as over shorter sub-periods (1960–1980, 1980–2000, and 2000–2014).

Earlier research (Carter, 2003; Laybourn-Langton and Jacobs, 2018) identifies the late 1970s and the early 1980s as years of paradigmatic and broad-based change in the political economies of the OECD, characterised by the breakaway from the Keynesian economic policies of the previous decades and the demise of the existing distributive regimes (manifested in the onset of a divergence between productivity and real wages). Whilst the process was not uniform across individual economies, the choice of 1980 to distinguish the relevant sub-periods is warranted. The choice of 2000 as the beginning of the third sub-period is justified by the following. Firstly, it allows consistency across the periods of approximately similar length (20, 20 and 14 years respectively). Secondly, while the third sub-period includes the global financial crisis, the origins of the latter can be traced to the events of the late 1990s and early 2000s: in the US, the end of the longest post-war expansion of 1991–2000 (with the following expansion period being shorter and less robust), the collapse of the dot-com bubble; in both the US and Europe, the slowdown of productivity that likewise started in the late 1990s, and the unfavourable resource re-allocations that manifested in real estate and housing bubbles (Cette et al., 2016; Kotz, 2015: 112). To take into account the salience of the global financial crisis (GFC) of 2008–09 we estimated the relationship for the pre- and post-GFC periods. Lastly, to address the heterogeneity of the panel, we considered panels with smaller cross-sectional dimension: the panel that excludes non-European economies (Australia, Canada, the US), as well as the panels that discard economies with budget surplus, trade deficit, or with outlier values of the rate of profit or investment rate.

Profit rate is defined as the ratio of the net operating surplus in the total economy to the net capital stock in the total economy and is expressed in gross terms, without deduction of the dividends (Feldstein and Summers, 1977: 213; Chen-Lee and Sutch, 1985; Walton, 2000; Basu, 2012: 12). The profit equation is estimated in a reduced form, excluding the household savings and capitalist consumption variable due to the absence of available data and methodological problems. For instance, with regard to household savings, the household disposable income and household consumption expenditure data in OECD household accounts is available from 1996 for most economies. In the AMECO database, the gross savings rate and the net savings data are likewise not available for the 1960–80s. The estimation of capitalist consumption also faces methodological and conceptual challenges: the absence of the national accounts data for capitalist consumption, the use of crude proxies (such as luxury consumption), the re-distribution of profits within the capitalist class (e.g., between rentiers and entrepreneurs), and additional problems associated with the estimation of capitalist income (treatment of mixed income, estimation of dividends payout) and consumption propensities. (One possible solution, adopted by Muir et al. (1994), is to derive capitalist consumption as total consumer expenditure minus after-tax wages and salaries, net of savings, plus transfer payments).

3.2. Data

The economy-wide profit rates are calculated using AMECO, the European Commission macroeconomics database. The profit rate is defined as the ratio of net operating surplus to the net capital stock. Specifically, in the case of the economy-wide profit rate,

$$PR = \frac{(Y - (W \times (E/L)}{(K \times P_k)} \times 100, \tag{21}$$

where $Y$is domestic income at current prices (*UVND* code in AMECO database),[11] W is the compensation of employees for the total economy (*UWCD*), E is total employment in all domestic industries (*NETD*), $L$is the number of employees in all domestic industries (*NWTD*), $K$is the net capital stock for the total economy at 2010 prices (*OKND*) and $P_k$is the price deflator for gross fixed capital formation (*PIGT*). The profit rates were estimated for 18 economies (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, the UK, and the USA) over 1960–2014 period.

The budget deficit variable was constructed as the difference between government expenditure and government revenue (as percent of GDP), based on Mauro et al. (2013) data. The missing data for 2012–2014 period was supplemented by general government deficit (as percent of GDP) series from OECD database. The external balance on goods and services as percent of GDP, obtained from the World Development Indicators (World Bank, indicator code NE.RSB.GNFS.ZS), was used as a proxy for trade surplus. The gross capital formation share of GDP data at current purchasing power parities was obtained from the Penn World Table (version 9.0) and served a proxy for the investment share.

3.3. Econometric method

The use of traditional panel data models (pooled ordinary least squares, or models with one- or two-way fixed, random, country or time specific effects) and estimators is arguably inappropriate in the long panels (where the number of the cross sections is smaller than the number of time observations), or when the data is characterised by non-stationary or trends, mixed orders of integration, endogeneity, cross-section specific dynamics, or cointegration (Asteriou and Monastiriotis, 2004: 37). A sequential approach adopted in this paper addresses these problems: it establishes (non-)stationarity and cross-sectional dependence properties of the series, considers the possible presence of the long-run relationship amongst the variables (cointegration), and, in the absence of cointegration, estimates short run effects in panel vector autoregression (PVAR) model.

The first generation panel unit root tests (Im-Pesaran-Shin/IPS, Levin-Lin-Chu/LLC, Breitung, ADF-Fisher$\chi^2$and PP-Fisherχ^2tests)[12] tend to bring biased outcomes in the presence of cross-sectional dependence and in the short samples. In addition, while the movements in the profit rate are to the certain extend country specific, there are commonalities as to the drivers of profit rates across the OECD economies (i.e. cross section dependency is likely present). Therefore, after conducting these tests (the mathematical description of these tests is omitted for the sake of brevity), the cross-sectional dependence amongst the economies is considered by means of Pesaran (2004) cross-sectional dependence test, and if cross-sectional dependence is present, the Pesaran (2007) cross-sectionally augmented IPS test (CIPS) that is robust to the cross-sectional correlation is used.

The test is given as:

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\rho_{ij}\right) \tag{22}$$

$\rho_{ij}$is the estimate of the pairwise correlation of the residuals $\mu_{it}$from the regression of y_{it} on intercept and vector of regressors:

$$y_{it} = \alpha_i + \beta' x_{it} + \mu_{it}, \tag{23}$$

[11] In AMECO database, the domestic income at current prices is a measure of net domestic product (GDP at current prices minus consumption of fixed capital at current prices).

[12] Maddala and Wu, 1999; Breitung, 2000; Choi, 2001; Levin et al., 2002; Im et al., 2003.

where $i = 1, \ldots, N$ and $t = 1, \ldots, T$. Under the null hypothesis of no cross-sectional dependence, $CD \rightarrow N(0,1)$ when $N \rightarrow \infty$. The test is thus valid for N and T tending to infinity in any order, and has good properties when N and T are small (Pesaran, 2004: 9; De Hoyos and Sarafidis, 2006: 485).

The cross-sectionally augmented IPS test is based on individual cross-sectionally augmented ADF statistics from:

$$\Delta x_{it} = \mu_i + \varphi_i t + b_i x_{it-1} + \gamma_i \bar{x}_{t-1} + \sum_{j=1}^{p_i} \delta_{ij} \Delta x_{it-j} + \sum_{j=0}^{p_i} \lambda_{ij} \Delta \bar{x}_{it-j} + \varepsilon_{it}, \quad (24)$$

where $\bar{x}_t$ is a cross-section term and $\varepsilon_{it}$is i.i.d. error term. The cross-sectionally augmented IPS test statistic is the given as:

$$CIPS(N,T) = \bar{t} = \frac{1}{N} \sum_{i=1}^{N} \tilde{t}_i(N,T), \quad (25)$$

where $t_i(p_i)$ is the t-statistic for b_i in the cross-sectionally augmented ADF regression. The null hypothesis $H_0 : b_i = 0$ for all i is contrasted against the heterogeneous alternatives $H_1 : b_i < 0, i = 1, 2, \ldots, N_1, b_i = 0, i = N_1 + 1, N_2 + 2, \ldots, N$(Pesaran, 2007: 268). Thus, H_1 implies that at least one of the series is stationary, and failure to reject H_0 would imply the possibility that all series are non-stationary.

To establish the presence of the long-run relationship amongst the variables, the paper employed three panel data cointegration tests: Pedroni (1999) and Kao (1999) residual dynamics based tests with no cointegration under the null hypothesis, and Westerlund (2007) structural dynamics based error-correction test with cointegration under the null Pedroni (1999, 2004) test allows for heterogeneous intercepts and trends across the cross-sections and requires estimation of the cointegrating equation:

$$PR_{it} = \alpha_{it} + \delta_i t + \beta_{1i} INV_{1i,t} + \beta_{2i} BD_{2i,t} + \beta_{3i} TS_{3i,t} + \varepsilon_{it}, \quad (26)$$

where parameters $\alpha_{it}$and δ_i represent individual and trend effects, $i = 1, \ldots, N$, $t = 1, \ldots, T$, with Nreferring to the number of cross-sections and T referring to the number of observations. The equation residuals are then considered:

$$\hat{\varepsilon}_{it} = \hat{\gamma}_i \hat{\varepsilon}_{it-1} + \hat{\mu}_{it}, \quad (27)$$

where $\hat{\gamma}_i$ is the autoregressive coefficient of the residual $\hat{\varepsilon}_{it}$. The null hypothesis of no cointegration $H_0 : \gamma_i = 1$ is contrasted with the homogeneous (common γ_i) and heterogeneous alternatives, $H_1 : (\gamma_i = \gamma) < 1$ for all i and $\gamma_i < 1$ for all i. Under the homogeneous alternative, the four panel statistics are estimated: non-parametric variance ratio, Phillips-Perron non-parametric rho- and t-statistic, and Augmented Dickey-Fuller (ADF) parametric t-statistic (within-group tests). Under the heterogeneous alternative, the three group mean statistics are estimated: non-parametric group rho- and t-statistic of Phillips-Perron and non-parametric group ADF t-statistic (between-group tests).

Kao (1999: 3–7) cointegration test allows for varying intercepts across the panels, specifies fixed effects and common slopes across i, and is based on estimation (for the first specification of Kalecki's equation and likewise for other specifications) of the least-squares dummy variable (LSDV) regression model:

$$PR_{it} = \alpha_i + \beta_1 INV_{it} + \beta_2 BD_{it} + \beta_3 TS_{it} + e_{it}, \quad (28)$$

where $i = 1, \ldots, N$and $t = 1, \ldots, T$. The DF and ADF tests are further applied to the residuals from Eq. (18) using:

$$\hat{e}_{it} = \rho \hat{e}_{it-1} + \upsilon_{it}, \quad (29)$$

where $\hat{e}_{it}$ is the estimate of e_{it}. The null hypothesis of no cointegration and nonstationarity of residual series ($H_0 : \rho = 1$) is contrasted to the alternative hypothesis, $H_1 : \rho < 1$.

Westerlund (2007) cointegration test that is applied next allows for individual specific short-run dynamics and cross-sectional dependence and has data-generating process defined as:

$$\Delta y_{it} = \delta_i' d_t + \alpha_i (y_{i,t-1} - \beta_i' x_{i,t-1}) + \sum_{j=1}^{p_i} \alpha_{ij} \Delta y_{i,t-j} + \sum_{j=-q_i}^{p_i} \gamma_{ij} \Delta x_{i,t-j} + e_{it}, \quad (30)$$

where d_t represents deterministic components (trend and constant, constant, or the absence of trend and constant). The null hypothesis is of no error correction and no cointegration, $H_0 : \alpha_i = 0$ for all i. The alternative hypotheses are the presence of error correction and cointegration for at least one i, i.e. $H_1^g : \alpha_i < 0$ (group-mean tests), or the presence of cointegration for all i so that $\alpha_i$is equal for all i, i.e. $H_1^p : \alpha_i = \alpha < 0$ (panel tests).

The group-mean test statistic are given as:

$$G_\tau = \frac{1}{N} \sum_{i=1}^{N} \frac{\hat{\alpha}_i}{SE(\hat{\alpha}_i)} \text{ and } G_a = \frac{1}{N} \sum_{i=1}^{N} \frac{T\hat{\alpha}_i}{\hat{\alpha}_i(1)} T \quad (31)$$

And the panel test statistic are:

$$P_\tau = \frac{\hat{\alpha}}{SE(\hat{\alpha})} \text{ and } P_\alpha = T\hat{\alpha}, \quad (32)$$

where $SE(\hat{\alpha}_i)$ is a standard error of $\hat{\alpha}_i$.

As shown in the following section, the results of Pedroni, Kao, and Westerlund cointegration tests are unambiguous, pointing to the absence of cointegration in Kalecki's equation. Given such evidence, as well as the possible endogeneity problem between the investment, profits and other variables (that was highlighted in the previous research),[13] the paper applies the PVAR model.

The panel VAR that combines the features of VAR and panel data models has several advantages: this is a data orientated approach with no a priori assumptions, allowing for dynamic effects and lags, that treats all variables as endogenous and related, while ensuring the heterogeneity of individual economies and including cross-sectional measurement in the analysis (Canova and Ciccarelli, 2013; Lin et al., 2019). The panel VAR and VAR models in general are frequently called 'atheoretical' in the sense that they are not based on some predetermined structural relations from a particular economic theory, but instead reveal the relations between the variables through the modelling. The structural VAR models that impose theoretical restrictions to identify parameters have been suggested as a remedy (Bernanke, 1986). The atheoretical characteristic of VAR is appropriate for the analysis in this paper, given no apriori knowledge of the direction and strength of the relationship between, for instance, profit and investment (the profit may determine investment as per neoclassical theorising, but the reverse effects as per Kaleckian equation are also possible). As noted by Qin (2008), VAR modelling is a type of empirically driven but nonetheless methodologically robust research that marks shift from a purely confirmatory towards a combination of confirmatory and exploratory analysis. It is atheoretical only to the extent that it drops the ex ante assumption of the true model 'about which nothing is unknown except parameters' (Hansen, 2004: 276).

The PVAR model is given as:

$$X_{it} = \alpha_i + \Theta(L) X_{it} + \mu_i + \varepsilon_{it}, \quad (33)$$

where $\Theta(L)$ is a lag operator,$X_{it}$is a vector of the endogenous series, $\mu_i$is the vector of the country-specific fixed effects, and $\varepsilon_{it}$is

[13] Asimakopulos (1982: 20-21) indicated the complex relationships within Kalecki's equation: profits and investment may mutually influence each other, investment can have effect on profits through household savings and international surplus, while budget deficit, international surplus and household savings may also have independent effects on profits.

a residual vector. The lag order of the model in this paper was determined by the combination of Akaike, Schwarz Bayesian and Hannan-Quinn information criterions (i.e. when all three criterions or two out of three indicated the same lag order).

The direction of transmission across the variables was determined by Cholesky decomposition based on Kalecki's equation. The Kalecki's profit equation implies that profit rate is endogenous to trade surplus, budget deficit, trade surplus and investment (i.e. is determined by these exogenous variables, but does not affect them). Additionally, the variables that pertain to the external economy and the government sector (trade surplus and budget deficit) are considered endogenous to the variables that relate to private sector activities (investment and profit rate). The Cholesky decomposition determines the direction of transmission of the effects across the variables by allowing the more exogenous variables enter PVAR system first and putting the more endogenous variables last. Specifically, the lower triangular matrix is constructed with zeros assigned to all entries above the diagonal, and the causal relationships are imposed as follows. The trade surplus variable contemporaneously affects the other three variables (given that external economic forces affect domestic variables in any economy), while the budget deficit, investment and profit rate do not have the like contemporaneous effect on the trade surplus, but rather affect it with lag(s). Importantly, along Kalecki's lines, the investment will have more immediate effect on profit rate, while profit rate will affect investment with a lag. Overall the Kalecki's equation ordering is given as$X_{it} = [TS_{it} BD_{it} INV_{it} PR_{it}]'$. The ordering of the variables along Marxian or neoclassical lines keeps trade surplus and budget deficit in the same position as in Kalecki's ordering but makes profit rate more exogenous with respect to investment, i.e. causality runs in the opposite direction, with profit rate contemporaneously influencing investment, but investment having lagged effects on the profit rate.

Following estimation of the PVAR parameters, we presented impulse response functions (IRFs) to examine the propagation of (one standard deviation) shocks in each PVAR variable on all other variables in the system and forecast errors variance decompositions (FEVDs) to demonstrate the contribution of each shock to the variance of each endogenous variable. The forecast horizon is set at 8 periods (years) and the confidence intervals are obtained through 1000 Monte Carlo replications (Traoré, 2018: 20–23).

Given that there was no cointegration amongst the variables in levels (and that some of them were non-stationary according to panel unit root tests), PVAR was estimated in differences to ensure PVAR as a system of endogenous stationary variables and to remove fixed effects. As a matter of checking, we also estimated PVAR is levels, given that PVAR in levels has standard asymptotic distributions even when some of the variables are non-stationary (Sims et al., 1990; Ludvigson, 1998). In addition, given the ambiguity between the profit rate and investment rate causation (along Kaleckian lines where investment causes profits, or Marxian and neoclassical lines, where causation runs the opposite direction), the PVAR system was estimated with $X_{it} = [TS_{it} BD_{it} PR_{it} INV_{it}]'$ vector of series. Lastly, to account for heterogeneity of the panel (with countries belonging to different regions or having different patterns in dependant and independent variables) and to address the possibility that relationships were affected by the Global Financial Crisis (GFC) of 2008–9, the PVAR model was run on sub-panels with smaller cross-sectional or time-series dimension.

The paper used two methods for PVAR estimation. The first, developed by Bun and Kiviet (2006) and implemented by Cagala and Glogowsky (2014), employs a least square dummy variable (LSDV) estimator, that fits a multivariate panel regression of each regressor on its own lags as well as other regressors. The method is the most suitable in panels with medium time and relatively small cross sectional dimension; it, however, does not consider cross-sectional dependence, assuming no serial correlation in errors. The second, proposed by Holtz-Eakin et al. (1988) and implemented by Love and Zicchino (2006) and Abrigo and Love (2016), addresses the problem of biased coefficients (that typically result when fixed effects are correlated to regressors and are removed by the first differencing) by performing Helmert transformation (forward mean-differencing). Following elimination of fixed effects, the procedure uses lagged regressors as instruments and estimates PVAR coefficients using generalised method of moments (GMM).

4. Empirical results

4.1. Baseline model

As a first step, we considered the bi-variate associations between profit rate and each of the independent variables in the 1960–2014 period and the 1960–1980, 1981–2000 and 2001–2014 sub-periods (with profit rate being regressed against each variable), then presented them in the scatterplot diagrams with stack cross-sections (Fig. 1). Visual observation suggests strong and positive relationship between profit rate and trade surplus, moderately negative between profit rate and investment rate, and negative between profit rate, and strongly negative between profit rate and budget deficit over 1960–2014 period. Bivariate regressions of the budget deficit, trade surplus, and investment rate on the logarithm of the profit rate confirm the observations that a 1% increase in budget deficit and investment rate caused 0.99% and 0.46% declines in profit rate per annum in 1960–2014, while a 1% increase in trade surplus led to a 2.05% increase in profit rate per annum over the same period. The scatterplots for the sub-periods (not presented to conserve space) reveal that the association between the rate of profit and budget deficit was absent in the 1960–1980 and 1981–1996 sub-periods (arguably, it could be moderately positive but insignificant relationships), with a strongly negative relationship observed during the 1997–2014 sub-period. There was little correlation between trade surplus and the rate of profit during 1960–1978 and a positive correlation afterwards (being particularly strong from the early 1990s, likely demonstrating the economic effects of trade liberalisation after the GATT Uruguay Round and an increase in economic openness in the 1990s).[14] With regard

[14] We note the negative relationships between trade surplus and profit rate in a number of economies: in Greece, Spain and the UK during the 1981-2000 and 2001-2014 periods, and in the US during the 1981-2000 period. In the US trade deficit appeared in the 1970s and worsened during Reagan presidency and particularly in the 2000s. The profit rate, on the other hand, restored starting from the 1980s. In the UK, the comovement between trade deficit and profit rate was observed in the 1960-70s, while the asynchronous pattern similar to the US started in the 1980s. In both countries the underlying drivers of divergence between two variables were the financialisation of the economy (characterised by liberalisation of financial markets and the growth of financial profits), decrease in wage shares, lower investment in capital stock, sluggish performance of the productive sectors, and thus slack in the export capacity and deterioration of the current account (Hein, 2012; Hein and Martschin, 2021). Both countries financed trade deficit by attracting foreign capital inflows. In the UK, the real appreciation of the pound and the so-called 'Dutch Disease' (expansion of oil and gas exports, currency appreciation, decrease in competitiveness of non-oil sectors and manufacturing, and trade deficits in these sectors) were explanatory factors behind trade balance deterioration (Forsyth and Kay, 1980; Muellbauer et al., 1990). The economy of Greece was characterised by the decline in trade surplus and restoration of profitability starting from the 1980s. During this period, Greece was not able to alter its export structure away from labour intensive to more technologically sophisticated products (Arghyrou and Bazina, 2002: 17-8), while Greek exports had high income elasticity and hence were quite vulnerable to cyclical fluctuations (hence slowdown of Greek exports during the economic slowdowns of the 1990s. Competition on the part of transition and developing economies in the sectors where Greece had comparative advantage (textiles, agriculture and tourism) became more vigorous. The problems were exacerbated by the real appreciation of drachma in the 1990s (when Greece aimed at reducing inflation through closer peg to German mark, Magoulos and Athianos, 2013: 193), and later by adoption of Euro. With regard to the profit

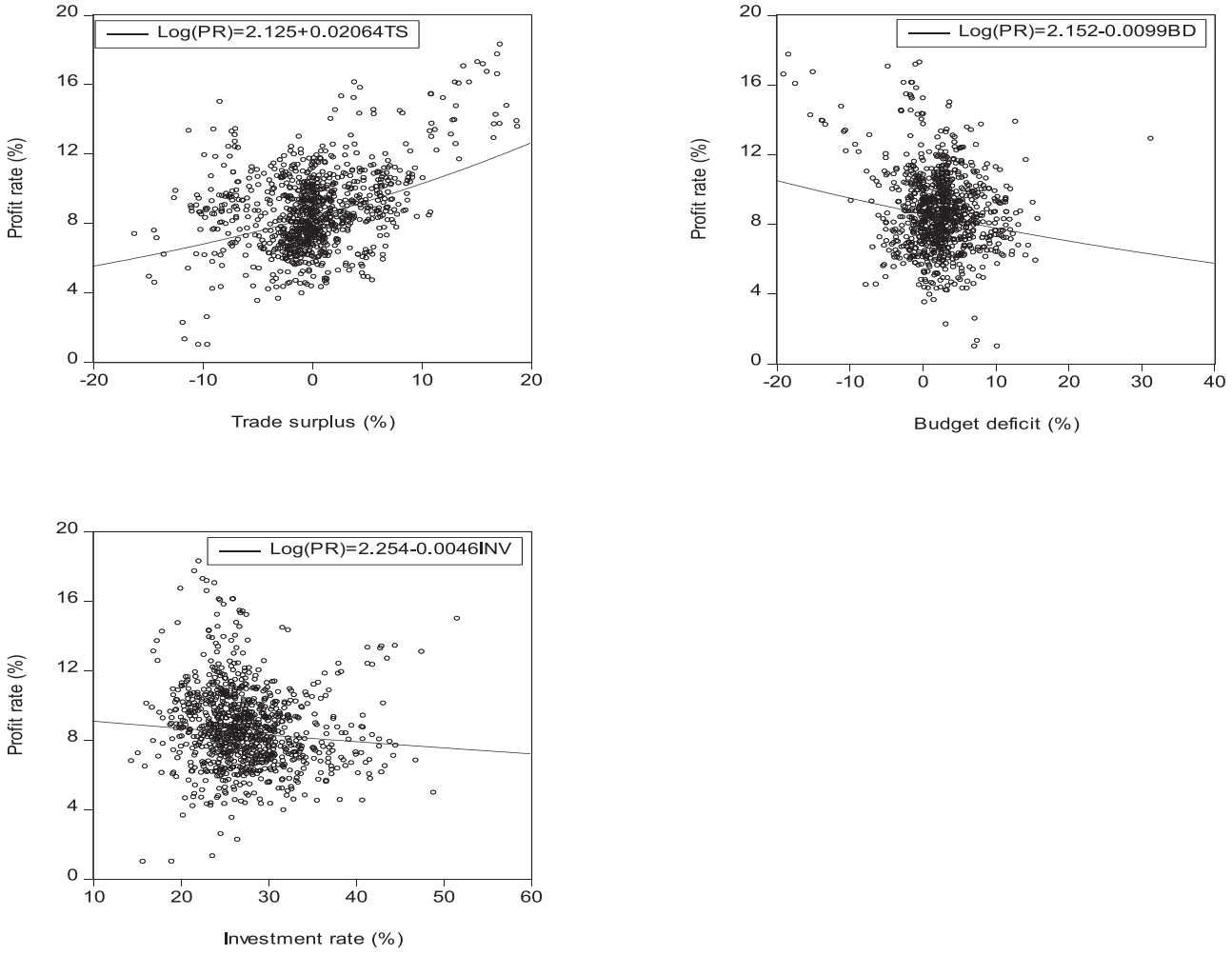

Fig. 1. The rate of profit and its determinants (1960–2014).

to correlation between the investment rate and the rate of profit, in the earlier sub-period (1960–1980), the relationship was positive; while in the later sub-periods, the correlation became negative (particularly during 1981–2000).

Note. The negative value for budget deficit indicate budget surplus, the negative values for trade surplus indicate trade deficit. In this figure and henceforth PR, TS, BD and INV represent profit rate, trade surplus, budget deficit and investment rate respectively.

In this analysis, we considered Pesaran (2004) cross-sectional dependence and Pesaran (2007) cross-sectionally augmented IPS tests, alongside the conventional panel unit root tests (Table 1). According to the Pesaran (2004) test, each of the variables in question is correlated across the economies, and hence cross-sectional dependence must be incorporated into unit root and cointegration tests. The profit rate was found to be non-stationary in levels and stationary in the first differences, according to the Im-Pesaran-Shin (IPS), Levin-Lin-Chu (LLC), ADF-Fisher, and PP-Fisher panel unit root tests, indicating that it was I(1) variable. With trend and constant included, the profit rate was likewise non-stationary in levels and trend stationary in the first differences (the Breitung test indicated trend stationarity in levels). Budget deficit was stationary in levels and in the first differences in all tests and specifications, suggesting that the variable is I(0). Trade surplus was non-stationary in levels according to LLC test, stationary according to other tests, and stationary in the first differences according to all tests (tests with constant and no trend). With constant and trend components, all tests (except LLC) indicated stationary in levels and stationarity in the first differences (all tests), thus trade surplus was likely I(0) variable. Investment rate was likewise I(0) variable, stationary in both levels and first differences. According to the Pesaran (2007) CIPS test, implemented with alternative deterministic components (constant or constant and trend), the profit rate, budget deficit, and investment rate were non-stationary in

rate, the Greek economy could not lessen the problem of the distorted competition and existence of monopolistic and oligopolistic markets (Anastasatos, 2008: 26). The capital productivity rose progressively staring from the mid-1980s (while wage increased more or less in line with productivity), thus being another driver of profitability restoration (Economakis et al., 2015: 142). In post-GFC period, the profits fell and the trade surplus rose, the latter mainly due to import compression (Arkolakis, et al., 2017). During this period, the decrease in profit rate was due to the reduction of labour productivity and increase in the intensity of capital stock, while the average labour compensation fell less than productivity (hence increase in labour share and decline in profit share (Economakis et al., 2015: 147). In Spain in the 1980s and 1990s both variables moved more or less in unison, but the magnitude of change in trade balance was more substantial. In the 2000s, prior to GFC, sharp decline in trade balance was experienced, while profit rate was stable (Prol and Palazuelos, 2016: 114-5). Prolonged period of stead growth in GDP, investment and profitability took place in 1994-2007. According to Hein and Martschin (2021), Spain in the years prior to GFC could be depicted as a 'debt-led growth regime' economy, where debt-led private demand growth was accompanied by a negative financial balances of domestic sectors, positive financial balances of external sectors (capital account surplus) and hence current account deficit. After the GFC, the revival of trade surplus and decline in profit rate were observed. We note as well that Spain in 1980s was better able to improve economic and trade performance in contrast to Greece and eliminate structural drawbacks through the use of EEC structural funds (Magoulos and Athianos, 2013: 192-3).

Table 1
Panel unit root tests' results.

A. Pesaran cross sectional dependency test			
Variable	Stat	df	p-value
PR	44.259	153	(0.000)
TS	11.964	153	(0.000)
BD	38.119	153	(0.000)
INV	16.639	153	(0.000)

B. Panel unit root tests (model with constant)								
Variable	LLC		IPS		ADF - Fisher		PP - Fisher	
PR	−1.156	(0.124)	−0.911	(0.181)	38.288	(0.366)	34.201	(0.554)
TS	−0.109	(0.456)	−2.103	(0.018)	60.955	(0.006)	60.868	(0.006)
BD	−3.806	(0.000)	−5.683	(0.000)	96.184	(0.000)	82.600	(0.000)
INV	−2.616	(0.005)	−3.353	(0.000)	66.048	(0.002)	66.801	(0.001)
d.PR	−18.031	(0.000)	−18.301	(0.000)	363.242	(0.000)	504.753	(0.000)
d.TS	−17.349	(0.000)	−19.596	(0.000)	394.327	(0.000)	594.529	(0.000)
d.BD	−16.353	(0.000)	−19.901	(0.000)	401.195	(0.000)	590.418	(0.000)
d.INV	−20.493	(0.000)	−21.072	(0.000)	431.822	(0.000)	629.913	(0.000)

C. Panel unit root tests (model with constant and trend)										
Variable	LLC		Breitung		IPS		ADF - Fisher		PP - Fisher	
PR	−0.313	(0.377)	−2.960	(0.002)	−0.824	(0.205)	37.013	(0.422)	30.863	(0.711)
TS	−0.127	(0.449)	−1.942	(0.026)	−2.424	(0.008)	57.860	(0.012)	58.141	(0.011)
BD	−2.703	(0.003)	−5.164	(0.000)	−3.894	(0.000)	70.856	(0.001)	59.243	(0.009)
INV	−2.845	(0.002)	−3.507	(0.000)	−4.385	(0.000)	79.755	(0.000)	63.384	(0.003)
d.PR	−17.460	(0.000)	−12.256	(0.000)	−16.480	(0.000)	292.268	(0.000)	434.597	(0.000)
d.TS	−16.388	(0.000)	−15.214	(0.000)	−18.141	(0.000)	327.513	(0.000)	524.170	(0.000)
d.BD	−15.005	(0.000)	−10.677	(0.000)	−18.232	(0.000)	330.428	(0.000)	515.915	(0.000)
d.INV	−20.111	(0.000)	−14.061	(0.000)	−19.608	(0.000)	358.888	(0.000)	560.686	(0.000)

D. Pesaran CIPS panel unit root test								
Variable	PR	TS	BD	INV	d.PR	d.TS	d.BD	d.INV
$CIPS_c$	−1.814	−2.274	−1.735	−1.822	−3.140	−3.080	−3.206	−3.152
	(0.437)	(0.011)	(0.583)	(0.423)	(0.000)	(0.000)	(0.000)	(0.000)
$CIPS_{c+t}$	−2.421	−2.585	−2.296	−2.142	−3.232	−3.136	−3.230	−3.228
	(0.344)	(0.114)	(0.587)	(0.835)	(0.000)	(0.000)	(0.000)	(0.000)

Note. p-values are in parentheses.

levels and stationary in the first differences under both specifications, and their order of integration was one. Trade surplus was stationary in levels and first differences in the specification with constant, non-stationary in levels, and stationary in the first differences under constant plus trend specification. None of the variables was I(2), while the profit rate (the dependant variable) was I(1) in all tests, making it possible to conduct cointegration tests.

As demonstrated in Table 2, the overall evidence of cointegration between the levels of variables was weak (particularly when referring to a more powerful cross-sectionally robust Westerlund test). In the case of the Pedroni test for cointegration with four lags and deterministic trend component, we did not reject the null hypothesis of no cointegration ($p > 0.05$ for 5 out 7 statistics). Similar results were obtained for the Pedroni test with four lags but without trend and for the test with demeaned variables and four lags. Regarding the Kao cointegration test (implemented with four lags), all five statistics indicate that the null hypothesis of no cointegration was not rejected (a similar result was obtained when cross-sectional means were removed). A more powerful Westerlund test likewise pointed to the absence of cointegration: p-value exceeded the 5% level for each of the four statistics, in the case of test with constant and test with constant and trend and up to four augmenting lags.

In light of these results, two panel VAR models (both having order of one) were estimated for the following vectors of endogenous series: $X_{it} = [TS_{it} BD_{it} INV_{it} PR_{it}]'$ to examine the effects of trade surplus, budget deficit and investment rate on profit rate along Kaleckian lines (Model 1), and $X_{it} = [TS_{it} BD_{it} PR_{it} INV_{it}]'$ to examine the effect of profit on investment along neoclassical and Marxian lines (Model 2). Given that PVAR is atheoretical model with no apriori scheme that indicates how variables affect each other, the interpretation of PVAR coefficients (Table A1 in the Appendix) is complemented by the analysis of IRFs (Figs. 2 and 3) and FEVD (Table 3). In both models, the trade surplus, budget deficit, investment and profit rate responded positively to own shocks, the effect attenuating and becoming insignificant after two periods. Some of IRFs exhibited certain degree of oscillation around zero before convergence, a frequent pattern in stationary VAR models. In the first model this was the case of response of profit rate to shocks in the investment rate and budget deficit, of budget deficit to innovations in investment rate, and of investment rate to shocks in trade surplus. In the second model, oscillation was observed in two impulse-response pairs: budget deficit-profit rate and trade surplus-investment rate. In both models, the impacts of investment rate on trade surplus, of trade surplus on budget deficit, of profit rate on budget deficit, and of budget deficit on investment rate were negative. The reaction of trade surplus to budget deficit shock was insignificant, while the sign of the effect of trade surplus on investment rate switched from negative to positive. Regarding Kalecki's equation, in both models the influence of trade surplus on profit rate was positive and the sign of the effect of budget deficit on profit was negative in the first period, and positive in the second and third periods. The response of profit rate to shocks in the investment rate was negative in the second model, and was ambiguous in the first model. The opposite effect (from profit to investment rate) was positive at all times, the finding that supports the earlier works of Bar-Yosef et al. (1987), Akyuz and Gore (1996), Inci et al. (2009), and Basu and Das (2017), as well

Table 2
Panel cointegration test results.

A. Pedroni cointegration test	Model A		Model B		Model C	
	Statistic	p-value	Statistic	p-value	Statistic	p-value
Within dimension						
Panel v-statistic	−2.2314	(0.013)	−2.8194	(0.002)	−2.1036	(0.018)
Panel rho-statistic	0.9979	(0.159)	0.7212	(0.235)	0.8513	(0.197)
Panel PP-statistic	−0.2590	(0.398)	−0.1334	(0.447)	−0.0503	(0.480)
Panel ADF-statistic	0.1172	(0.453)	0.2925	(0.385)	−0.3466	(0.364)
Between dimension						
Group rho-statistic	2.3091	(0.011)	1.3600	(0.087)	2.0359	(0.021)
Group PP-statistic	0.7190	(0.236)	−0.0829	(0.467)	0.4412	(0.330)
Group ADF-statistic	1.1030	(0.135)	0.5548	(0.290)	1.1207	(0.131)

B. Kao cointegration test	Statistic	p-value
Modified DF t-statistic	−0.5871	(0.279)
DF t-statistic	−0.7668	(0.222)
ADF t-statistic	−0.3316	(0.370)
Unadj. modif DF t-statistic	−1.2501	(0.106)
Unadj. DF t-statistic	−1.1786	(0.119)

C. Westerlund cointegration test	Model A		Model B	
	Statistic	p-value	Statistic	p-value
Gt	−2.049	(0.796)	−1.689	(1.000)
Ga	−6.763	(0.994)	−6.914	(1.000)
Pt	−5.498	(0.994)	−5.637	(1.000)
Pa	−3.649	(0.993)	−5.164	(1.000)

Note. In Pedroni cointegration test all models include 4 augmenting lags. Model A includes trend, Model C excludes trend, and Model C is based on de-meaned data. Kao cointegration test includes 4 lags and no trend. Westerlund test (Model A) includes constant and 4 lags, while Model B includes constant plus trend and 4 lags. p-values are in parentheses.

Table 3
PVAR(1) abridged variance decompositions.

Model 1 Periods ahead	Responses: impulses TS:TS	TS:BD	TS:INV	TS:PR	BD:TS	BD:BD	BD:INV	BD:PR
2	97.4639	0.0767	2.2851	0.1743	0.7179	95.6411	1.4894	2.1516
4	97.3808	0.0818	2.2876	0.2497	0.9034	95.3261	1.5730	2.1975
6	97.3804	0.0818	2.2877	0.2500	0.9041	95.3249	1.5730	2.1980
8	97.3804	0.0818	2.2877	0.2500	0.9041	95.3249	1.5730	2.1980
Periods ahead	Responses: impulses INV:TS	INV:BD	INV:INV	INV:PR	PR:TS	PR:BD	PR:INV	PR:PR
2	32.0561	4.6220	60.5990	2.7229	11.3101	10.5267	17.6383	60.5249
4	32.1261	4.6397	60.4906	2.7436	11.2945	10.5019	17.8525	60.3511
6	32.1264	4.6398	60.4899	2.7439	11.2948	10.5019	17.8533	60.3500
8	32.1264	4.6398	60.4899	2.7439	11.2948	10.5019	17.8533	60.3499
Model 2 Periods ahead	Responses: impulses TS:TS	TS:BD	TS:PR	TS:INV	BD:TS	BD:BD	BD:PR	BD:INV
2	97.4639	0.0767	1.1635	1.2959	0.7179	95.6411	3.4903	0.1508
4	97.3808	0.0818	1.2189	1.3184	0.9034	95.3261	3.4955	0.2750
6	97.3804	0.0818	1.2193	1.3184	0.9041	95.3249	3.4958	0.2752
8	97.3804	0.0818	1.2193	1.3184	0.9041	95.3249	3.4958	0.2752
Periods ahead	Responses: impulses PR:TS	PR:BD	PR:PR	PR:INV	INV:TS	INV:BD	INV:PR	INV:INV
2	11.3101	10.5267	76.2557	1.9075	32.0561	4.6220	16.7992	46.5228
4	11.2945	10.5019	76.1881	2.0155	32.1261	4.6397	16.7544	46.4798
6	11.2948	10.5019	76.1871	2.0162	32.1264	4.6398	16.7544	46.4795
8	11.2948	10.5019	76.1871	2.0162	32.1264	4.6398	16.7544	46.4795

as the recent critique of the Keynesian profit-investment nexus by Roberts (2017).

Overall, only one of the lagged regressors (trade surplus) had clear positive effect on profit rate in the short-run, in line with Kalecki's predictions. The profit rate positively determined investment (but the reverse was not always true), pursuant to neo-classical models (investment determined by profits, given the savings propensities of capitalists and technological conditions at full employment (Gupta, 1988: 11)) or Marxist models (profit being a result of distributive conflicts over produced surplus and profit opportunities being determinant of potential investment (Roberts, 2017: 1)).

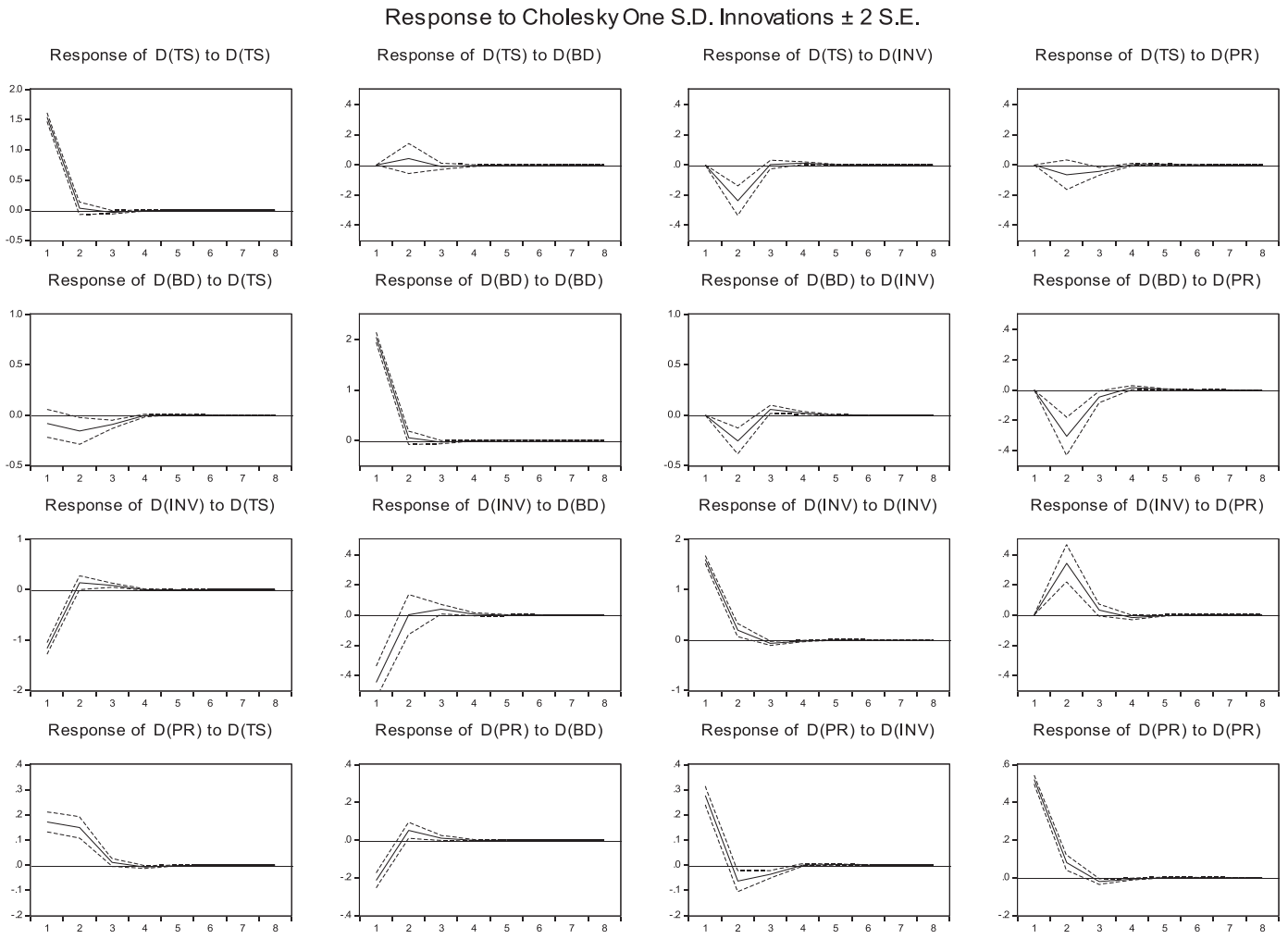

Fig. 2. Impulse-response functions for PVAR (Model 1).

The analysis of the variance errors decompositions (Table 3) suggests that in the first PVAR model the movements in trade surplus and budget deficit were, to a large extent, due to their own shocks rather than shocks in other variables, while the shocks in other variables were prominent determinants of variation in profit and investment rates. In the case of profit rate, eight periods ahead, the rate of profit explained 60.35% of its own variation; while investment rate, trade surplus, and budget deficit explained 17.85%, 11.29% and 10.51% of the profit rate variation, respectively. Likewise, 60.49% of investment rate variations were attributed to own variation, 32.13% to trade surplus changes, 4.69% to budget deficit changes and 2.74% to profit rate fluctuations. In contrast, the trade surplus explained 97.38% of its own variation (while 0.25% of trade surplus variation was due to profit rate), eight periods ahead. For budget deficit, 95.32% of fluctuations after eight years were due to own variation and 2.20% due to profit rate shocks. In Model 2, the own variation explain 97.38%, 95.32%, 76.19% and 46.48% of changes in trade surplus, budget deficit, profit rate and investment rate respectively. The second largest sources of variation were: investment rate for trade surplus (1.32%), profit rate for budget deficit (3.50%), trade surplus for profit rate (11.29%), and trade surplus for investment rate (32.12%). The smallest sources of variation were: budget deficit for trade surplus (0.08%), investment rate for budget deficit (0.28%), investment rate for profit rate (2.01%), and budget deficit for investment rate (4.64%). Overall, trade surplus and budget deficit explained a sizeable portion of the profit rate variance, while contribution of investment was substantial only in Model 1. This latter finding is in line with that of an earlier study of the Kalecki's equation in the US (Asimakopulos, 1982), which confirmed investment rate as a principal driver of profitability and is somewhat at odds with the work of Bakir and Campbell (2016), who, in the US context, documented the declining contribution of investment and rising contribution of private dissaving on profit rate movements.

4.2. Robustness checks and the analysis of the sub-periods

As part of a robustness check, the PVAR model based on GMM estimation was considered. The coefficient of determination was minimized at lag one, and thus PVAR(1) model was estimated. All eigenvalues lay within the unit circle, hence the model was stable. The impulse response functions (presented, for the sake of brevity, for the trade surplus-profit rate, budget deficit-profit rate, investment rate-profit rate and profit rate-investment rate impulse-response pairs), indicate similar impulse-response patterns to Model 1: positive influence of trade surplus on profit rate and profit rate on investment rate, negative effect of budget deficit on profit rate, as well as positive effect of investment rate on profit rate in Period 1 followed by a negative effect in the next two periods (Fig. 4). In the presented IRFs, the shocks reduced gradually after the first three or four periods.

Given that some of the panel unit root tests indicted stationarity of the variables, we estimated PVAR in levels (without first difference transformation). The results of the PVAR in levels are

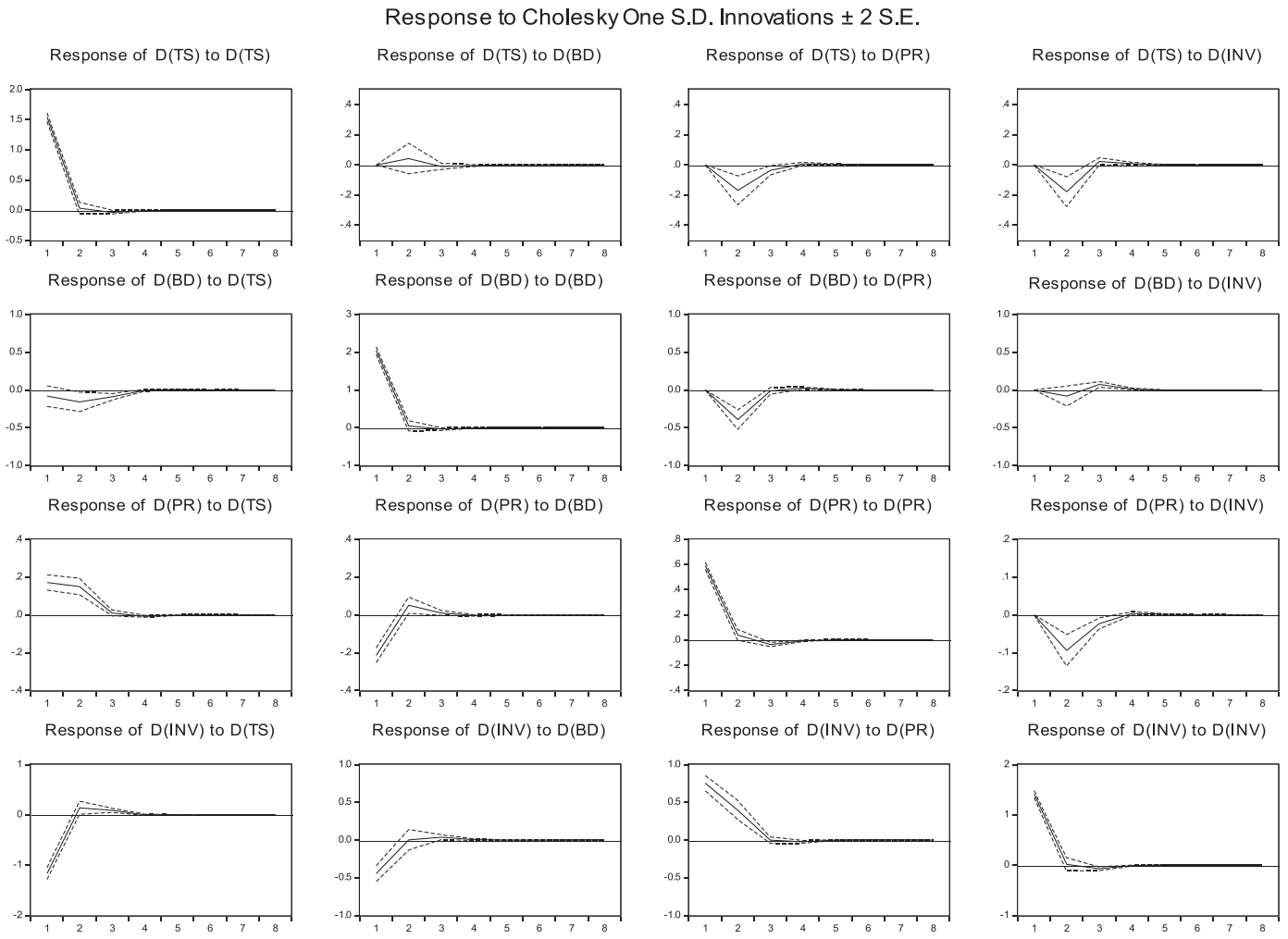

Fig. 3. Impulse-response functions for PVAR (Model 2).

similar in most respects to the above estimates, with one notable exception: the effect of investment on profit rate was clearly positive.

We also considered Kalecki's equation during the sub-periods (not reported to conserve space, but available upon request). The positive effect of trade surplus on profitability in the earlier sub-period (1960–1980s) was a result of two opposing processes. On one hand, the intensification of trade conflicts in the GATT system, and the growing competition in international markets, e.g. on the part of Japan (that is not part of the sample in this paper) made it more difficult for trade surplus and exports to perform as a countervailing force to falling profit rates during this period (Cohen and Zysman, 1983; La Barca, 2013). On the other hand, these developments were offset by the mercantilist policies of OECD economies with respect to non-OECD economies, export expansion by OECD economies in the third markets, specifically by the growing export share of trade-surplus members of OECD (Germany, Italy) that facilitated contribution of trade surplus to profit revival in OECD economies as a whole (Ostry, 1997). The positive influence of trade surplus on profit rate was also observed in the following period (1980–2000), that witnessed the expansion of international investment, intra-industry trade and manufacturing outsourcing that boosted profitability in the industrialised economies.

The effect of budget deficit had alternative pattern of signs during the 1960–1980 and 2000–2014 periods (negative in the first year following the shock and positive in the second). In the 1980–2000 period, the budget deficit effects were clearly negative. Some evidence of positive influence of budget deficit on profit rate during the 2000–2014 period could be attributed to restoration of profit that was accompanied by rising budget deficits and government debt during this period. The influence of investment on profit was ambiguous (negative across three sub-periods in Model 1 ordering, positive in Model 2 ordering, and oscillating with sign changes in Model 1 ordering). The reverse influence of profit on investment was positive, becoming insignificant in 2000–2014 (the slowdown in investment growth in comparison to earlier years despite restoration of profitability).

Lastly we examined the Kalecki's profit equation relationship (Model 1) prior and port-GFC, by splitting the panel into the two sub-periods – 1960–2008 and 2009–2014. The respective impulse response functions are included in the Appendix (Figs. 6 and 7). The models for both periods were estimated with a single lag for all variables, based on Schwarz Bayesian and Hanna-Quinn criterions. The results for the 1960–2008 period were virtually similar to the baseline specification: negative response of the profit rate to the shocks on the part of budget deficit, positive response to own and trade surplus shocks, ambiguous reaction to investment rate shock, as well as positive effect of the profit rate on investment rate. The sources of variation in the rate of profit were (in order of decreasing importance) the rate of profit (62.38% of variation), investment rate (15.82%), trade surplus (13.45%) and budget deficit (8.34%). In the post-GFC period, the sign of the effects remained same as in the pre-crisis period, but the significance of relations

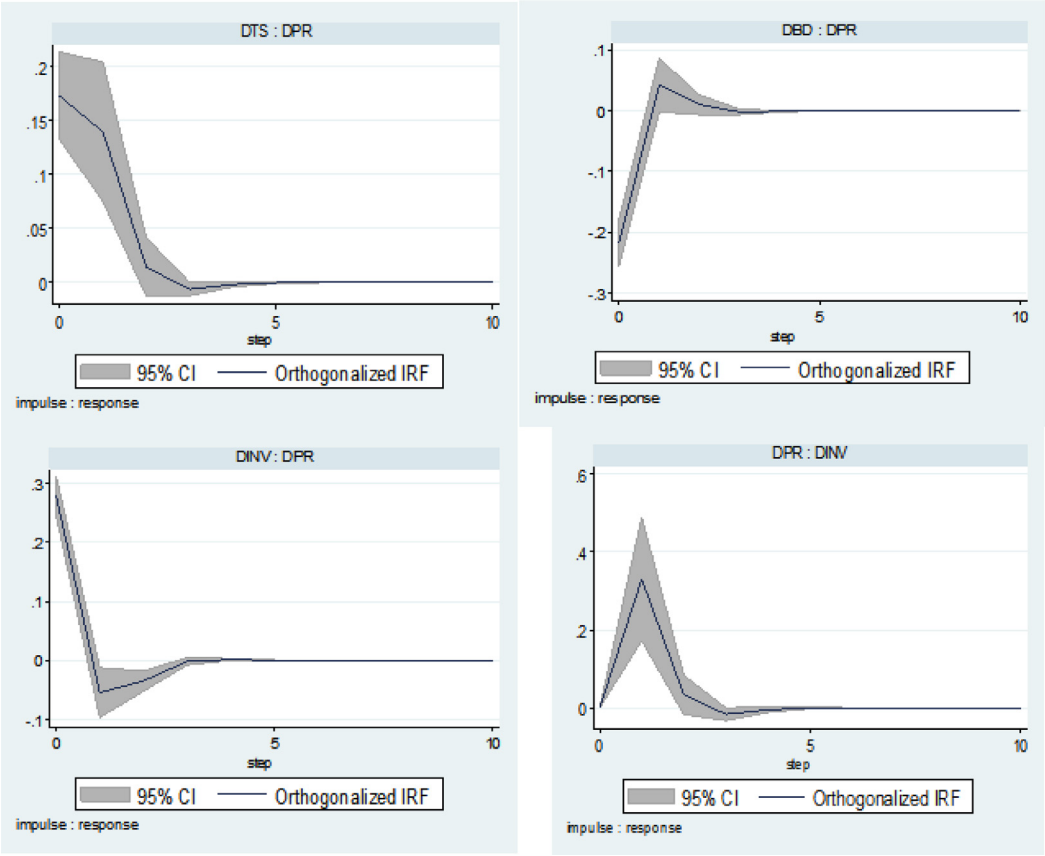

Fig. 4. PVAR(1)-GMM impulse-response functions.

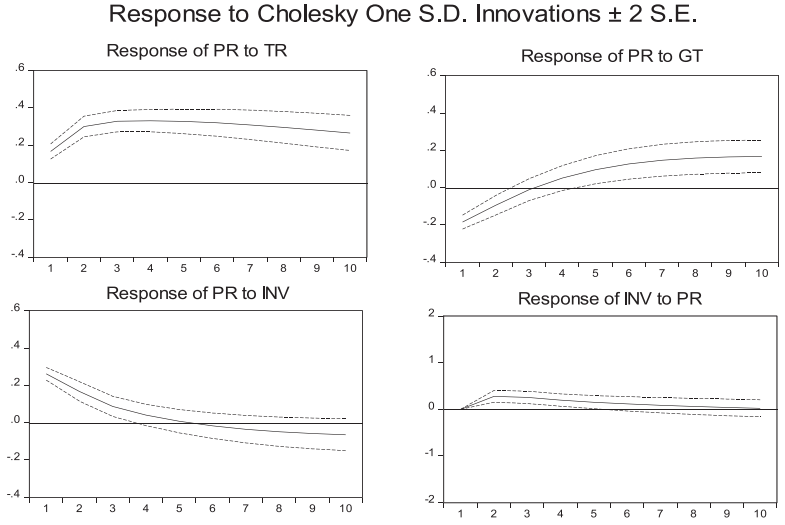

Fig. 5. PVAR in levels (impulse-response functions).

declined: the positive effect of the trade surplus, the negative effect of the budget deficit on the rate of profit and the positive response of the investment rate to changes in the profit rate were all significant only in period 1 after the shock. This is in line with the analysis by Brennan (2014: 253–4) who in the US context noted that in the post-GFC period the profit realisation relies less on such determinants as investment, budget deficit and even trade liberalisation gains, and more so on stagnant levels of labour compensation and accumulation of debt, more in line with Marxist view of determination of profit based on class conflict. On the other hand the own profit rate effects and the effects of investment rate on the profit rate were both positive and significant. The investment rate, budget deficit and trade surplus respectively explained 33.14%, 21.75% and 4.06% of the profit rate variation. As a final step we experimented with estimating PVAR for smaller panels. The estimates for a panel that excluded non-European economies (Australia, Canada and the US) were identical in terms of the signs and sizes of the effects to the baseline specification. The mean profit rate for most economies except Canada, Ireland and Portugal fluctuated within 7%–10% range during the whole period (Canada and Ireland experienced elevated profit rates, in the former case due to vibrant export capacity of the primary sector that com-

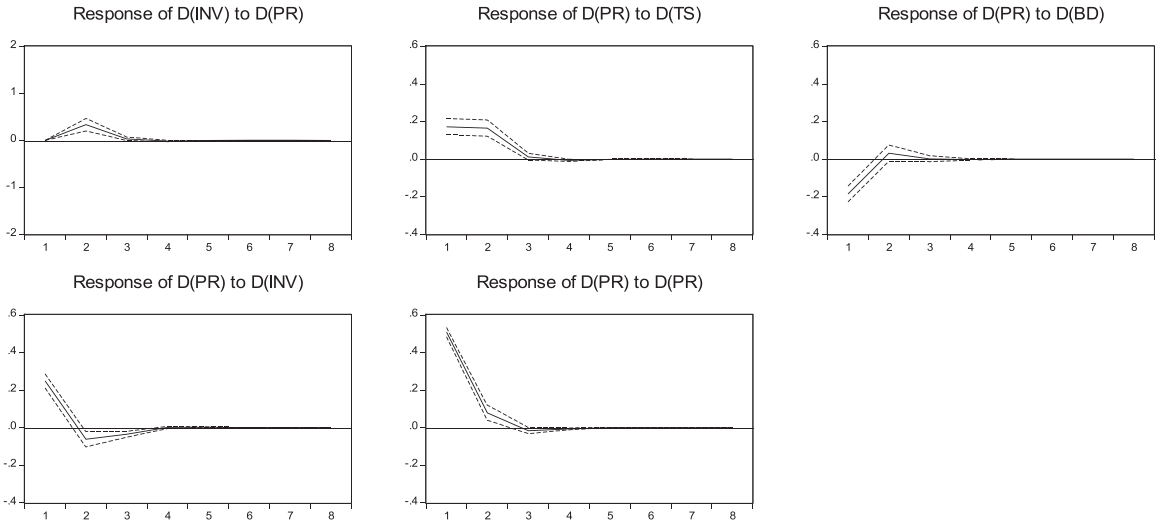

Fig. 6. Impulse-response functions for PVAR, Model 1 (1960 – 2008).

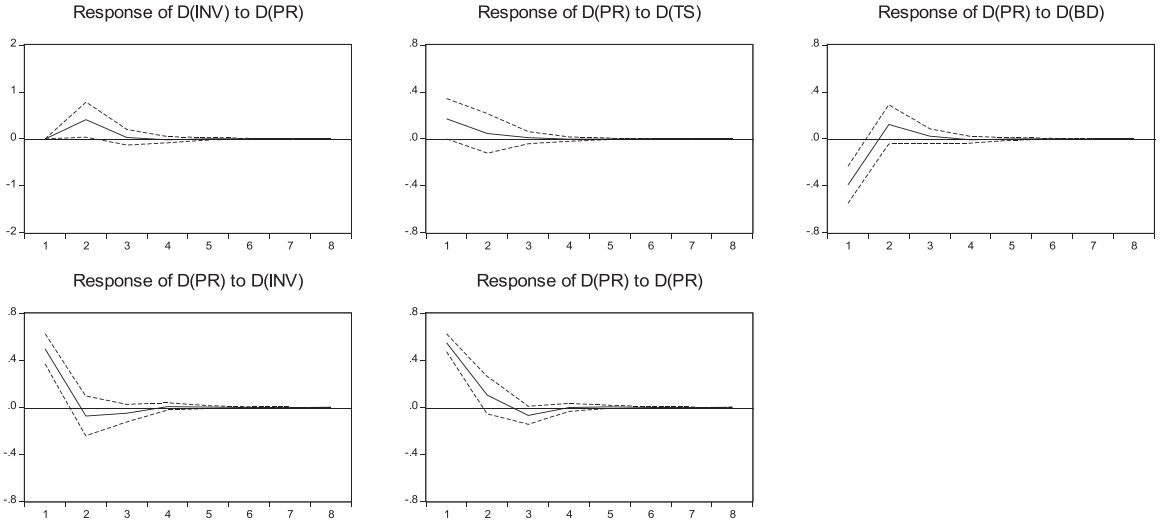

Fig. 7. Impulse-response functions for PVAR, Model 1 (2009 – 2014).

pensated for sluggish profitability in manufacturing, in the latter case due to expansion of profit share as a result of favourable tax regime that attracted multinational companies), while Portugal was characterised by lower profit rates, weak manufacturing base and competitiveness of exports, redistributive policies in favour of labour that were common in the 1970–80s, the low capital productivity in agriculture). We excluded the three economies from the panel and obtained the results that were likewise similar to other PVAR estimates. The baseline results were also robust in the panel that included only trade-surplus economies (that had mean trade balance positive during the 1960–2014 period),[15] or only budget-deficit economies (negative mean budget balance), or panels that excluded economies with outlier mean investment rates.

The ambiguous relationships between profit rate and investment (in particular, the negative effects of the latter) were attributed to a number of factors in the literature: on the profit rate side, to the proliferation of illusory (fictitious) profits in real estate and finance, the rise of sectors with excess Schumpeterian profits (e.g., information technologies in the 1990s), the stagnation of the labour share, and the rise of profit shares (Jones, 2013: 18; Bellofiore and Vertova, 2014: 62; Baker and Dew, 2017); on the investment side, to the structural changes towards less investment-intensive production, the rising share of intangible investment with faster depreciation schedules (OECD, 2015), the export of capital to developing economies with higher rates of return on capital (Halevi and Kreisler, 1996), the lack of new investment opportunities to absorb tangible capital investment outlays and the related problem of the slow-down of the technological progress (Cowen, 2011; Gordon, 2014), sluggish aggregate demand as a disincentive to investment (Summers, 2015), a corporate culture that values short-term profits and discourages capital expenditures and earnings reinvestment (Krehmeyer et al., 2006), and other factors.

Regarding the relationship between budget deficit and profit rate, the heterodox and a number of mainstream economists (Tinbergen, 1950; Roberts, 2017: 12; Tapia Granados, 2013) argue that negative relationships are unsurprising if it is (more realistically) assumed that profit rate (rather than investment) is an exogenous variable that cannot rise without limits (because labour share cannot be suppressed below certain level), and if profits plus household, government, and foreign capitalist savings determine investment. In the absence of any increase in household savings (which have been declining across the OECD in the last three decades (Dean et al., 1989; Guidolin and La Jeunesse, 2007) or foreign sector savings (trade surplus, the negative of foreign savings,

[15] The respective trade-deficit economies were Australia, Greece, Portugal, Spain, the UK and the US.

has been rising across the OECD from the late-1970s), or the reduction of capitalist consumption (which has evidently been on the rise, particularly luxury consumption (Toporowski, 1993, 1999)), the budget deficit and government dissaving would eat into profitability and deprive the business sector of potential profits, thus adversely affecting both profitability and investment. The inconsistency of the results as far as they concern the positive or negative effects of fiscal activism on profitability is in line with the findings of Tapia Granados (who, in the US setting, did not establish clear effects of government spending), and the observations of Kalecki (1943) and Roberts (2017: 13), who conclude that much depends on the type of public investment and acknowledge the possibility of negative influence of fiscal activism on private profitability.

On balance, in contrast to the positive trade surplus-profit rate relationship, the empirical results do not firmly support the hypothesis of positive contribution of domestic private investment to the rise (or restoration) of profitability: the investment rate had a sizeable (as demonstrated by FEVD analysis) but ambiguous effect on profit rate. In the case of fiscal activism, the findings reject the positive contribution hypothesis (except for one of the sub-periods). At the same time, profit rate had a positive and significant effect on investment in all specification (excepting the last sub-period, when the link appeared broken).

5. Conclusion

The paper considered the determinants of profitability in the OECD economies using the Kaleckian framework, for the period of 1960–2014. Specifically, we focused on the relationship between the rate of profit and the total economy on one side, and trade surplus, investment rate, and budget deficit (as a percentage of countries' GDP) on the other. The summary of the findings is as follows.

First, it was shown that the series in question were integrated of different orders (with all regressors being stationary in levels, and profit rate being integrated of order one), and, importantly, that there was weak evidence of cointegration amongst the variables (the result obtained from a series of panel unit root and cointegration tests). This implied the absence of co-movement of the variables in the long-run, albeit this does not preclude the possibility of short-run relationships and influences. Second, given the stationarity of the majority of the series and the absence of cointegration, the PVAR was used. This highlighted the important role of trade surplus and budget deficit in explaining profit rate variance (and the somewhat ambiguous role of investment rate). It also demonstrated the positive impact of trade surplus and negative of budget deficit on the profit rate, in line with (and, in the case of budget deficit, contrary to) Kaleckian postulates. The investment rate-profitability relationships were more complex: the effect of investment on profitability was either positive or negative depending on Cholesky ordering of variables (profit or investment rate as the most endogenous variables in the system), however, the contribution of investment to the forecast error variance in the profit rate was the highest when effect was negative. In addition, the opposite effect of profit on investment was positive and significant most of the time and in all models, along neoclassical and Marxian lines. Overall, the positive influence on profitability was unambiguously demonstrated only in the case of trade surplus as a regressor, and inconclusively in the case of investment rate. Third, we examined the Kalecki's equation for the 1960–1980, 1980–2000, and 2001–2014 sub-periods, with necessary consideration given the structural changes that took place in the industrialised economies in the late 1970s and early 1980s and the economic perturbations of the 2000s. The influence of trade surplus was remarkably consistent across the periods. The most significant negative effect of budget deficit was experienced in the 1980–2000 period, while the positive influence of profit on investment became weaker and less significant in the 2000–2014 period. Additional robustness checks were performed by examining pre- and post-GFC sub-periods, as well as by excluding the economies that consistently experienced budget surplus, trade deficit, or had outlier values in the rate of profit or investment rate. The resulting estimates were found to be similar (in terms of size, sign and significance of the effects) to the baseline PVAR models, perhaps with the exception of the post-GFC period, when the size and significance of the effects was smaller than in other periods.

Future research should consider verification of the Kalecki's identity and the functional relationship in individual countries for which profit rate data is available, such as developing and emerging market economies and other country groups (e.g., surplus and deficit economies). In addition to panel data analysis, this could apply time series methods, particularly those that incorporate structural breaks in the series. Variable-wise, alternative profit rate measures could be used (private economy or corporate rates, or profit indicators along Marxian lines), and alternative measures of fiscal activism may be adopted (government final consumption expenditure, government-to-private capital ratio, etc.).

Author statement

The author received no financial support for the research, authorship and publication of this article.

Declaration of Competing Interest

The author declares no conflicting interests.

Appendix

Table A1.

Table A1
Panel VAR estimates.

Response of	Response to			
	$TS_{(t-1)}$	$BD_{(t-1)}$	$INV_{(t-1)}$	$PR_{(t-1)}$
$TS_{(t)}$	−0.0623	−0.0193	−0.1259	−0.1253
	(−1.3655)	(−0.7497)	(−3.6365)	(−1.3692)
$BD_{(t)}$	−0.0826	−0.0495	−0.0575	−0.5895
	(−1.3639)	(−1.4444)	(−1.2513)	(−4.8532)
$INV_{(t)}$	0.0278	0.0717	0.0097	0.6567
	(0.4638)	(2.1126)	(0.2126)	(5.4543)
$PR_{(t)}$	0.0314	0.0263	−0.0662	0.1521
	(1.6347)	(2.4167)	(−4.5327)	(3.9424)
No. observations		954		
No. groups		18		

Note. t-statistics are in the parentheses.

References

Abrigo, M., Love, I., 2016. Estimation of panel vector autoregression in Stata: a package of programs. Stata J. 16 (3), 1–27.

Akyuz, Y., Gore, G., 1996. The investment-profits nexus in East Asian industrialization. World Develop., 24 (3), 461–470.

Anastasatos, T., 2008. Greek monetary policy and the lessons for the New Europe. Econ. Mark. (Eurobank Research) 3 (10), 1–27 November.

Arkolakis, C., Doxiadis, A., Galenianos, M., 2017. The challenge of trade adjustment in Greece. In: Meghir, C., Pissarides, C., Vayanos, D., Vettas, N. (Eds.), Beyond Austerity: Reforming the Greek Economy. MIT Press, Cambridge.

Arghyrou, M., Bazina, E. (2002). Competitivness and the external trade performance of Greece in the 1990s: a Cross-Sectoral Investigation. Brunel university, economics and finance discussion papers No. 02–06.

Aschauer, D.A., 1988. Government spending and the "falling rate of profit". Federal Reserve Bank of Chicago. Econ. Persp. 12 (3), 11–17.

Asimakopulos, A., 1982. A Kaleckian profits equation and the United States economy, 1950-82. Metroeconomica 35 (1–2), 1–27.

Asimakopulos, A., 1992. The determinants of profits: United States, 1950-88. In: Papadimitriou, D.B. (Ed.), Profits, Deficits and Instability. Palgrave Macmillan, New York.

Asteriou, D., Monastiriotis, V., 2004. What do unions do at the large scale? Macroeconomic evidence from a panel of OECD countries. J. Appl. Econ. 7 (1), 27–46.

Baeza, A.V., Munoz, I.M., 2012. Profit and trade deficit in the US Economy:. a Marxist Perspective.. Marxism 21 (3), 353–372 9.

Baker, D., Dew, B. (2017). Corporate profits and investment: not moving together. Center for Economic and Policy Research blog, available on http://cepr.net/blogs/cepr-blog/corporate-profits-and-investment-not-moving-together, accessed on 10 February 2019.

Bakir, E., Campbell, A., 2016. Kalecki and the determinants of the profit rate in the United States. Rev. Radical Polit. Econ. 48 (4), 577–587.

Bar-Yosef, S., Callen, J., Livnat, J., 1987. Autoregressive modeling of earnings-investment causality. J. Finance 42 (1), 11–28.

Basu, D. (2012). Replacement versus historical cost profit rates: what is the difference? When does it matter? University of Massachusetts, Amherst, Working Paper No. 2012-11, pp. 1–20.

Basu, D., Manolakos, P., 2013. Is there a tendency for the profit rate to fall? Econometric evidence for the U.S. Economy, 1948-2007. Rev. Radical Polit. Econ. 45 (1), 76–95.

Basu, D., Das, D., 2017. Profitability and investment: evidence from India's organized manufacturing sector. Metroeconomica 68 (1), 47–90.

Bellofiore, R., Vertova, G., 2014. The Great Recession and the Contradictions of Contemporary Capitalism. Edward Elgar, Cheltenham.

Bernanke, B., 1986. Alternative explanations of the money-income correlation. Carnegie-Rochester Conference Series on Pub. Pol. 25, 49–100.

Bhaduri, A., Marglin, S., 1990. Unemployment and the real wage: the economic basis of contesting political ideologies. Cambridge J. Econ. 14, 375–393.

Bowles, S., Boyer, R., 1988. Labor discipline and aggregate demand: a macroeconomic model. Am. Econ. Rev. 78 (2), 395–400.

Breitung, J., 2000. The local power of some unit root tests for panel data. In: Baltagi, B. (Ed.), Nonstationary panels, panel cointegration, and dynamic panels. Advances in Econometrics 15, 161-178.

Brennan, D.M., 2014. "Too Bright for Comfort": a Kaleckian view of profit realization in the USA, 1964-2009. Cambridge J Econ 38 (1), 239–255.

Bun, M.J.G., Kiviet, J.F., 2006. The effects of dynamic feedbacks on LS and MM estimator accuracy in panel data models. J. Econ. 132 (2), 409–444.

Cagala, T., Glogowsky, U. (2014). XTVAR: Stata module to compute panel vector autoregression. Boston College, Department of Economics, Statistical Software Components. Available at https://econpapers.repec.org/software/bocbocode/s457944.htm

Canova, F., Ciccarelli, M. (2013). Panel vector autoregressive models: a survey. ECB working paper series No. 1507.

Carter, M.S., 2003. Three Essays on Empirical Patterns in Functional Distribution For a Cross Section of Countries: Evidence from the Extended Penn World Tables, 1963-1996. New School University Unpublished Dissertation.

Cette, G., Fernald, J., Mojon, B. (2016). The Pre-great recession slowdown in productivity. Federal reserve bank of San Francisco Working Paper No. 2016-08, pp. 1–47.

Chen-Lee, J., Sutch, H. (1985). Profits and rates of return in OECD countries. OECD Economics Department Working Papers No. 20, pp. 127–167.

Choi, I., 2001. Unit root tests for panel data. J. Int. Money Finance 20 (2), 249–272.

Chou, N.-T., Izyumov, A., Vahaly, J., 2016. Rates of return on capital across the world: are they converging? Cambridge J. Econ. 40 (4), 1149–1166.

Cohen, S.S., Zysman, J., 1983. The mercantilist challenge to the liberal international trade order. Berkeley J. Int. Law 1 (1), 1–46.

Corsi, M., 2005. The theory of economic change: a comparative study of Marshall and the 'Classics'. Invest. Economica (253) 15–42.

Corsi, M., Guarini, G. (2009). Financial crises and cyclic development according to the approach of Paolo Sylos Labini. Munich: MPRA paper no. 19169.

Cowen, T., 2011. The Great Stagnation: How America Ate All the Low-Hanging Fruit of Modern History, Got Sick, and Will (Eventually) Feel Better. Dutton, New York.

Dean, A., Durand, M., Fallon, J., Hoeller, P., 1989. Saving Trends and Behaviour in OECD Countries. OECD Publications, Paris.

De Hoyos, R.E., Sarafidis, V., 2006. Testing for cross-sectional dependence in panel–data models. Stata J. 6 (4), 482–496.

Duménil, G., Lévy, D., 2002. The profit rate: where and how much did it fall? USA 1948-2000. Rev. Radical Pol. Econ. 34 (4), 437–461.

Duménil, G., Lévy, D., 2004. The real and financial components of profitability (United States, 1952-2000). Rev. Radical Pol. Econ. 36 (1), 82–110.

Economakis, G., Androulakis, G., Markaki, M., 2015. Profitability and crisis in the Greek economy (1960-2012): an investigation. In: Mavroudeas, S. (Ed.), Greek Capitalism in Crisis. Routledge, London.

Feldstein, M., Summers, L., 1977. Is the rate of profit falling? Brookings Pap Econ Act 1, 211–228.

Forsyth, P., Kay, J., 1980. The economic implications of North Sea oil revenues. Fisc. Stud. 1 (3), 1–28.

Gehrke, C., 2003. The Ricardo effect: its meaning and validity. Economica 70, 143–158.

Glyn, A., 2004. The assessment: how far has globalization gone? Oxford Rev. Econ. Pol. 20 (1), 1–14.

Gordon, R.J. (2014). The demise of US economic growth: restatement, rebuttal, and reflections. Cambridge, National Bureau of Economic Research, NBER Paper No. 19895.

Guarini, G., 2016. Macroeconomic and technological dynamics: a Structuralist-Keynesian cumulative growth model. PSL Quart. Rev. 69 (276), 49–75.

Guidolin, M., La Jeunesse, E., 2007. The decline in the US personal saving rate: is it real and is it a puzzle? Federal Reserve Bank of St. Louis Rev. 89 (6), 491–514.

Gupta, S., 1988. Profits, investment, and causality: an examination of alternative paradigms. South. Econ. J. 55 (1), 9–20.

Hahnel, R., Sherman, H., 1982. Income distribution and the business cycle: three conflicting hypotheses. J Econ Issues 16 (1), 49–73.

Halevi, J., Kreisler, P., 1996. Asia, Japan and the internationalization of effective demand. Economies et Sociétés (10) 303–322.

Hansen, L.P., 2004. An interview with Christopher A. Sims. Macroecon. Dynam. 8, 273–294.

Hein, E., 2012. The Macroeconomics of Finance-Dominated Capitalism – and Its Crisis. Edward Elgar, Cheltenham.

Hein, E., 2014. Distribution and Growth after Keynes: A Post-Keynesian Guide. Edward Elgar, Cheltenham.

Hein, E., Martschin, J., 2021. Demand and growth regimes in finance-dominated capitalism and the role of the macroeconomic policy regime: a post-Keynesian comparative study on France, Germany, Italy and Spain before and after the great financial crisis and the great recession. Rev. Evolut. Pol. Econ. 2, 1–35.

Holtz-Eakin, D., Newey, W., Rosen, H.S., 1988. Estimating vector autoregressions with panel data. Econometrica 56 (6), 1371–1395.

Huebscher, R. (2013). Why a shrinking deficit means lower earnings. advisor perspectives, 26 November 2013. Available at https://www.advisorperspectives.com/articles/2013/11/26/why-a-shrinking-deficit-means-lower-earnings

Im, K.S., Pesaran, M.H., Shin, Y., 2003. Testing for unit roots in heterogeneous panels. J. Econ. 115 (1), 53–74.

Inci, A.C., Lee, B.S., Suh, J., 2009. Capital investment and earnings: international evidence. Corp. Govern.: An Inter. Rev. 17 (5), 526–545.

Jayadev, A., 2007. Capital account openness and the labour share of income. Cambridge J. Econ. 31 (3), 423–443.

Jones, P., 2013. The falling rate of profit explains falling US growth. Paper Presented at the 12th Australian Society of Heterodox Economists Conference.

Junius, K. (1997). Economies of scale: a survey of the empirical literature. Kiel Institute of World Economics, Working Paper No. 813, pp. 1–72.

Kaldor, N., 1955. Alternative theories of distribution. Rev. Eco. Stud. 23, 83–100.

Kalecki, M., 1939. Essays in the Theory of Economic Fluctuations. George Allen and Unwin, London.

Kalecki, M., 1942. A theory of profits. Econ. J. 52 (206/207), 258–267.

Kalecki, M., 1943. Political aspects of full employment. Polit. Q 14 (4), 322–330.

Kalecki, M., 1954. Theory of Economic Dynamics: An Essay On Cyclical and Long-run Changes in Capitalist Economy. George Allen and Unwin, London.

Kalecki, M., 1971. Selected Essays on the Dynamics of the Capitalist Economy, 1933-1976. Cambridge University Press, Cambridge.

Kalecki, M., 1991. Collected Works of Michal Kalecki. Volume II: Capitalism. Economic Dynamics. Clarendon Press, Oxford.

Kao, C., 1999. Spurious regression and residual-based tests for cointegration in panel data. J. Econ. 90 (1), 1–44.

Kotz, D., 2015. The Rise and Fall of Neoliberal Capitalism. Harvard University Press, Cambridge.

Krehmeyer, D., Orsahg, M., Schacht, K., 2006. Breaking the Short-Term Cycle: Discussion and Recommendations on How Corporate Leaders, Asset Managers, Investors, and Analysts Can Refocus on Long-Term Value. CFA Institute, Charlottesville.

Laski, K., Walther, H. (2013). Kalecki's profit equation after 80 years. The Vienna Institute for International Economic Studies, Working Paper no. 100, pp. 1–26.

Laybourn-Langton, L., Jacobs, M., 2018. Paradigm shifts in economic theory and policy. Intereconomics 53 (3), 113–118.

La Barca, G., 2013. International Trade in the 1970s. The US, the EU and the Growing Pressure of Protectionism. Bloomsbury, London.

Lee, B.S., Nohel, T., 1997. Value maximization and the information content of corporate investment with respect to earnings. J. Bank. Fin. 21 (5), 661–683.

Levin, A., Lin, C.F., Chu, C., 2002. Unit root tests in panel data: asymptotic and finite-sample properties. J. Eco. 108 (1), 1–24.

Levy, S., 2001. Profits: the views of Jerome Levy and Michal Kalecki. J. Post Keynes Eco. 24 (1), 17–30.

Levy, D.A., Farnham, M., Rajan, S., 2008. Where Profits Come From: Answering the Critical Question That Few Ever Ask. The Jerome Levy Forecasting Center, New York.
Li, M., Xiao, F., Zhu, A., 2007. Long waves, institutional changes, and historical trends: a study of the long-term movements of the profit rate in the capitalist world-economy. J. World-Syst. Res. 13 (1), 33–54.
Lin, W.L., Law, S.H., Ho, J.A., Sambasivan, M., 2019. The causality direction of the corporate social responsibility - corporate financial performance nexus: application of panel vector autoregression approach. North Am. J. Eco. Fin. 48, 401–418.
Love, I., Zicchino, L., 2006. Financial development and dynamic investment behaviour: evidence from panel VAR. Q. Rev. Econ. Finance 46 (2), 190–210.
Ludvigson, S., 1998. The channel of monetary transmission to demand: evidence from the market for automobile credit. J. Money Credit Bank 30 (3), 365–383.
Maddala, G.S., Wu, S., 1999. A comparative study of unit root tests with panel data and a new simple test. Oxf. Bull Econ. Stat. 61 (S1), 631–652.
Magoulos, G., Athianos, S., 2013. The trade balance of Greece in the Euro era. South-Eastern. Europe J. Eco. 2, 187–216.
Mahdavi, S., Sohrabian, A., Kholdy, S., 1994. Cointegration and error correction models: the temporary causality between investment and corporate cash flow. J. Post Keynes Econ. 16 (3), 478–498.
Marx, K., 1981. Capital – A Critique of Political Economy [1894], Volume III. Vintage Books, New York.
Lopez Bernardo, J. (2015). The Levy-Kalecki profit equation in action: the Spanish case. Available at: https://www.eoi.es/blogs/the-spanish-paradox/2015/11/26/the-levy-kalecki-profit-equation-in-action-the-spanish-case/
Mauro, P., Romeu, R., Binder, A., Zaman, A. (2013). A modern history of fiscal prudence and profligacy. International Monetary Fund, IMF Working Paper No. 13/5.
Michl, T., 1988. The two-stage decline in U.S. nonfinancial corporate profitability, 1948-1986. Rev. Radical Pol. Eco. 20 (4), 1–22.
Milberg, W. (2006). Pricing and profits under globalized competition: a post Keynesian perspective on us economic hegemony. New School's Schwartz Center for Economic Policy Analysis (SCEPA) Working Paper no. 2006-5.
Milberg, W., Schmitz, L., 2011. The business of macro imbalances: comparing 'gluts' in savings, money and profits. In: Arestis, P. (Ed.), Microeconomics, Macroeconomics and Economic Policy. Essays in Honour of Malcolm Sawyer. Palgrave Macmillam, London, pp. 72–95.
Mizuta, K., 2015. Ricardo's Theory of International Trade and Capital Accumulation. Presentation at the 31st Seminar of Ricardo Society. Chu University August 1, 2015.
Montier, J. (2012). What goes up must go down! GMO White Paper, March 2012, pp. 1–8.
Mueller, D.C., 1977. The persistence of profits above the norm. Economica 44 (176), 369–380.
Muellbauer, J., Murphy, A., King, M., Pagano, M., 1990. Is the UK balance of payments sustainable? Economic Pol. 5 (110), 347–395.
Muir, D., Laramie, A., Toporowski, J., 1994. The economic consequences of Weintraub's consumption coefficient. The Jerome Levy Economics Institute of Bard College, Working Paper No 115, 1–25.
OECD, 2015. Lifting investment for higher sustainable growth. OECD Economic Outlook 2015/1, 205–279.
Ostry, S., 1997. The Post-Cold War Trading System: Who's On First. The University of Chicago Press, Chicago.
Pedroni, P., 1999. Critical values for cointegration tests in heterogeneous panels with multiple regressors. Oxf. Bull Econ. Stat. 61 (S1), 653–670.
Pedroni, P., 2004. Panel cointegration: asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. Econ. Theory 20 (3), 597–625.
Pesaran, M.H. (2004). General diagnostic tests for cross section dependence in panels. IZA discussion Paper No. 1240, pp. 1–39.
Pesaran, M.H., 2007. A simple panel unit root test in the presence of cross section dependence. J. Appl. Econ. 22 (2), 265–312.
Prol, J., Palazuelos, E., 2016. The profit-investment ratio: economic growth in Spain, 1994-2007. Probl. Desarro 47 (185), 109–134.
Qin, D., 2008. Rise of VAR modelling approach. J. Econ. Surv. 25 (1), 156–174.
Ramirez, M., 2012. Is the falling rate of profit the driving force behind globalization? Contrib. Polit. Econ. 31 (1), 91–102.
Reuten, G., 1991. Accumulation of capital and the foundation of the tendency of the rate of profit to fall. Cambridge J. Econ. 15, 79–93.
Roberts, M. (2017). The profit-investment nexus: Keynes or Marx. Proceedings of Historical Materialism conference, New York, April 21-23.
Robinson, J., 1956. The Accumulation of Capital. Macmillan, London.
Schmidt, T., Vosen, S., 2013. Demographic change and the labour share of income. J. Popul. Econ. 26 (1), 357–378.
Shaikh, A., Tonak, E., 1994. Measuring the Wealth of Nations. Cambridge University Press, New York.
Shapiro, D.M., Sims, W.A., Hughes, G., 1983. The efficiency implications of earnings retentions: an extension. Rev. Econ. Stat. 65 (2), 327–331.
Sims, C., Stock, J., Watson, M., 1990. Inference in linear time series models with some unit roots. Econometrica 58 (1), 113–144.
Sowell, T., 1972. Say's Law: A Historical Analysis. Princeton University Press, Princeton.
Steindl, J., 1952. Maturity and Stagnation in American Capitalism. Blackwell, Oxford.
Stubelj, I., 2014. Investment and profits: causality analysis in selected EU countries. Managing Global Trans. 12 (4), 395–413.
Summers, L., 2015. Demand side secular stagnation. Am. Econ. Rev. 105 (5), 60–65.
Sylos Labini, P., 2004. Torniamo Ai Classici. Produttivita del Lavoro, Progresso Technico e Sviluppo Economico. Laterza, Rome.
Tapia Granados, J., 2013. Does investment call the tune? Empirical evidence and endogenous theories of the business cycle. Res. Pol. Eco. 28, 229–259.
Targetti, F., Kinda-Hass, B., 1982. Kalecki's review of Keynes's General Theory. Aust. Econ. Pap 21 (38), 244–260.
Tinbergen, J., 1950. The Dynamics of Business Cycles: A Study in Economic Fluctuations. University of Chicago Press, Chicago.
Toporowski, J., 1993a. Profits in the UK economy: some Kaleckian models. Rev. Polit. Econ. 5 (1), 40–54.
Toporowski, J., 1993b. Housing as a wage and luxury good: absolute poverty and the distribution of income in supply-side economics. Inter. Rev. Appl. Econ. 7 (3), 330–344.
Toporowski, J., 1999. Kalecki and the declining rate of profit. Rev. Polit. Econ. 11 (3), 355–371.
Traoré, M., 2018. Government spending and inclusive growth in sub-Saharan Africa: a panel VAR analysis. CERDI, Études et Documents. No 15, 1–50.
Vaona, A., 2011. An empirical investigation into the gravitation and convergence of industry return rates in OECD countries. Inter. Rev. Appl. Econ. 25 (4), 465–502.
Uctum, M., Viana, S., 1999. Decline in the US profit rate: a sectoral analysis. Appl. Econ. 31 (12), 1641–1652.
Walton, R., 2000. International comparisons of profitability. UK Office of National Statistics. Econ. Trends 554, 33–46.
Weisskopf, T.E., 1979. Marxian crisis theory and the rate of profit in the postwar US economy. Cambridge J. Econ. 3 (4), 341–378.
Westerlund, J., 2007. Testing for error correction in panel data. Oxf. Bull Econ. Stat. 69 (6), 709–748.
Wolff, E., 2003. What is behind the rise in profitability in the US in the 1980s and 1990s? Cambridge J. Econ 27 (4), 479–499.