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Secular decline in profit rates: time series analysis of a classical hypothesis

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Abstract

Recent global financial crisis and ongoing turbulence in the global economy revived interest in the classical hypothesis of declining profit rates and vanishing profit opportunities as one of the reasons of economic instabilities. This paper, while not joining theoretical debate on the driving factors of profit rates' decline, reconsiders empirically the hypothesis of the secular decline in economy-wide profit rates. A panel of unit root tests is used and deterministic and stochastic trend models (with or without structural breaks) are estimated. It is shown that instead of continuous downward trend, profit rates exhibit diverse dynamics – random walk, deterioration with breaks, reversals, or the absence of trend. Likewise, it is shown in an exploratory analysis that a variety of factors were determining profit rates, with capital productivity and competitive dynamics in the economy likely being the most salient.

JEL Classification: B5, C22, P17

Keywords: profit rates, time series, unit root, trend estimation, classical political economy

1. Introduction

The issue of the declining profit rates in the developed economies comes to fore and becomes topical in light of the slowdown in economic growth and the stagnation and crises tendencies that have been evident in the recent years. These tendencies have been discussed mostly within Keynesian, post-Keynesian and Marxist schools of thought, with profit rates' decline being only one of the many reasons of the instability and crisis-prone nature of capitalism, other explanations including under-consumption problem, capitalism's anarchic nature and lack of planning, excessive financialisation, among others (Edvinsson, 2005: 22-3).

The purpose of this paper is to consider the issue of a secular decline in economy-wide profit rates as one of the drivers and a background of current economic problems. The possibility of profit rates' decline has been subject to debate among classical (Smith, Ricardo, Marx) and modern (Kalecki, Keynes, Feldstein) economists of both mainstream and heterodox schools. In its classical formulation, the secular decline is attributed to the drive for profits embedded in capitalist system that in turn leads to over-accumulation of capital and thus deterioration of profit rates.

Specifically, we carry out empirical analysis of profit rates in a sufficiently large sample of economies to establish the patterns and dynamics of the variable and thereby contribute to the debate. The time series analysis is complemented by an exploratory overview of similarities and differences in the profit rates' patterns, and of the likely determinants of the profit rates. A consideration is also given to the limitations of the conventionally used profit rates' indicators.

The principal distinction of this paper from previous studies is as follows. Firstly, it attempts to consider the largest possible number of economies (both developed and developing, over a range of historical periods), in contrast to previous works that considered one or a handful of economies. Secondly, the paper attempts to use modern

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econometric techniques for the analysis, in contrast to previous studies that relied mostly on visual observation of the series or simple linear trend estimation. Thirdly, due to the variety of ways to conceptualise profit rate in the whole economy, this paper explores and utilises alternative profit rate measures adopted by classical (specifically Marxist) and neoclassical economists. A uniform set of econometric techniques and instruments was used to analyse such diverse settings and measures.

In terms of econometrics methodology, we conduct a sequential procedure using unit root tests (with and without structural breaks) as well as non-parametric techniques to determine the presence of deterministic or stochastic trends (with or without breaks) and to provide respective trend estimates.

The balance of the paper is organised as follows. A review of theoretical and empirical literature is contained in Section 2. Section 3 considers general methodological issues, data used in the paper, as well as econometric approach. Empirical results are presented in Section 4. Exploratory analysis is included in Section 5, while Section 6 provides concluding remarks and discusses avenues for further research in the area.

2. Literature review

The "law of profit" first formulated by K. Marx in 1894 (in the first three chapters of Volume III of Capital) stated that there is a tendency of a secular decline in the rate of profits in a capitalist economy: "With the progressive decline in the variable capital in relation to constant capital, this tendency leads to a rising organic composition of the total capital, and the direct result of this is that the rate of surplus-value, with the level of exploitation of labour remaining the same or even rising, is expressed in a steadily falling general rate of profit." (Marx, 1894/1981, pp. 318-319) The view of long-term deterioration of profit rates is not universally accepted in economics, with several economists (Keynes, Kuznets) considering it unlikely, while others (Jevons, Smith, Ricardo) arguing in favour of secular decline. Importantly, Marx itself was reconsidering and reformulating "the law of profit" in his later works, arguing that decline in profit rates is not a deterministic process (Reuten, 2004). The "law of profit" thus has a status of hypothesis.

The theoretical debate as to the possibility and causes of the rate of profit decline has been ongoing. The views range from no tendency of the rate of profit to fall (Okishio, 1961) to secular tendency of the profit rate to fall (Shaikh, 1992) to the absence of any a priori tendencies (Foley, Michl, 1986; Moseley, 1991; Dumenil, Levy, 2003). In terms of determinants of possible decline in profit rates, Gordon et al (1983) pointed to general failure of structures supporting capitalist accumulation; Shaikh (1983) to rising organic composition of capital; Glyn and Sutcliffe (1972) to rising wages; and Baran, Sweezy (1965) to demand side issues. The purpose of this paper is not to engage in theoretical debate about the causes of profit rates' dynamics, but to conduct empirical analysis and attempt to establish certain statistical regularities pertaining to profit rates time series.

On empirical front, the research of profit rates dynamics has been substantial, considering profit rates dynamics from several angles. The majority of earlier studies was conducted for the US economy and used deterministic trend (with or without exogenous breaks and correction for business cycle) as principal analytical tool.

Gillman (1957), focusing on US manufacturing sector and not adjusting for profit rates' cyclical variation, Gillman identifies secular deterioration of profit rates from 1880s till Great Depression, thereby confirming classical hypothesis. The study by

Lovell (1978) that allowed for cyclical adjustment of manufacturing profit rates but did not include land and inventories in capital stock pointed to deterioration of profit rates in the 1950s and particularly after 1965, followed by sharp increase in the 1970s. The study however did not discover any statistically significant time trends over 1947-77 period.

Nordhaus (1974), estimating after-tax manufacturing sector profit rate and excluding land from calculation, concluded that profit rates declined during 1948-74. This however included a period of profit rates' rise between mid-1950s and 1965.

Feldstein and Summers (1977), considered before-tax manufacturing profit rate series over 1946-76 period, included land in the capital base and used various capacity utilization and GDP gap measures to correct for cyclical fluctuations. The results were inconclusive: based on some measures, statistically significant downward time trend was identified, while other measures suggested cyclical fluctuations in series.

Kopcke (1978) argued that exogenously determined structural breaks in the after-tax manufacturing sector series matter: while no statistically significant trend was identified for longer time series (1947-77), two significant trends with opposing coefficients' signs were identified from 1947-65 and 1965-77 periods.

Extending the series into 1970s and examining both before and after-tax profit rates and a battery of various cyclical adjusters, Liebling (1979) concluded in contrast to Koepcke that there was no restoration of the profit rates in the 1970s: the profit rates did not rise to the levels of 1950s and 1960s, suggesting that some deeper structural shift in the US economy occurred.

Allman (1983) looked at both economy-wide and sectoral before-tax profit rates and concluded that secular deterioration of profit rates in the USA over post-war period was pervasive across various industries and sectors.

More recently, Basu and Manolakos (2013) examined the statistical properties of the US profit rates series over 1869-2007 period and contrasted alternative hypotheses of long-wave cyclical behavior versus secular decline (with countervailing forces leading to temporary profit rates' rises). Analysis utilized Box-Jenkins methodology, first-generation unit root tests (Dickey-Fuller and Phillips-Perron), and Lowess trend. The results suggested that US profit rate has been declining on average by 0.3% per annum over 1947-2007 period (accounting for countervailing tendencies). Roberts (2011) obtained the similar estimate of 0.4% average decline in 1947-2009.

Regarding other economies, empirical studies were conducted for Mexico (Ortiz, 2005), Spain (Camara, 2007), Brazil (Marquetti et al, 2010) and Japan (Alexander, 1998) over post-war period. Analytical methods principally included visual observation or deterministic trends. The results pointed to long-term fall of profit rates (Japan); decline and rebound of profit rate starting from early the 1980s (Mexico); stabilisation of profit rates in 1980-90s (Spain); secular decline with rebound in the 1990s (Brazil).

In terms of multi-country and comparative studies, Chan-Lee and Sutch (1985) estimated manufacturing profit rates in 11 OECD economies over 1960-1980 period. With minor exceptions for certain industries, decline of profit rates in 1970s appeared to be common. The result was confirmed by Downe (1986): in the study of cyclically-adjusted rates of return in seven developed economies, the negative and statistically significant trends were present universally.

Li et al (2007), using world-system model referring to the relative power and hegemony of states on the international arena, considered the long-term profitability for the UK, U.S., Japan and the Euro zone (over 50 year period) and concluded that UK

profit rates were characterised by four cycles over last 150 years and downward decline tendencies, with certain stabilisation taking place in 1980-90s. In the US, despite cyclical fluctuation in the series, the long-term trend appeared to be positive. Eurozone and more so Japan were characterised by declining trends in the long-run.

Daly and Broadbent (2009) examined return on capital in EU5 economies (Germany, UK, France, Italy and Spain), EU5 plus USA, and world as a whole in past three decades. Return on capital included yield on capital (usual rate of profit) plus capital gain, defined as changes in real capital prices relative to changes in prices of consumption goods, affecting the decision by households whether to invest (forego consumption) or not. It was established that 1980s and 2000s witnessed growth in returns, which remained above long-run average level even during global financial crisis of 2008-09.

Maito (2014) looked at profit rates in 14 core and periphery economies and defined rates in Marxian way (using fixed reproducible capital stock as denominator in profit rate equation). The results suggested that long-run deterioration in profit rates was widespread, perhaps more so in periphery economies.

The overall conclusion as to the direction of the rates of profits is mixed, suggesting that the results of empirical estimates depend heavily on the estimation method, time frames, types of profits calculated and economies in question.

In this regards, following methodological issues come to fore.

Firstly, empirical analysis will need to choose between classical Marxian definition of profit rate and modern conventional profit rate definition. This specifically concerns the estimation of capital as denominator in profit rate formula - fixed produced capital in conventional definition, and constant and variable capital (wages) in Marxian definition. Likewise, the decision has to be made about scope of capital base in conventional definition, i.e. whether residential capital, inventories and land need to be included in addition to produced capital.

Secondly, for comparative studies, the inherent difficulties in comparing tax and depreciation rates may suggest estimation of before-tax gross profit rates as preferable methodological approach. Likewise, the inclusion of both developed and developing countries for comparison will require careful interpretation of results, as the overall level of rates and the dynamics path between two groups will likely differ substantially. The calculation of world profit rate (arguable useful for understanding dynamics of globalized economy) will likely require exclusion of countries that only recently adopted capitalist economic system, and will also necessitate the weighting choice (weighted average of individual economies rates).

Thirdly, the choice of timeframe and the scope (profit rates for the private corporate sector, for manufacturing sector or for economy as a whole) are dictated by data availability. Completed studies were mostly conducted for the post-war period, with only few stretching back to 19th century or pre-war periods. Regarding scope, in-depth country studies tended to examine sectoral and industry rates, while comparative studies focused on economy-wide rates.

3. Methodology

3.1. General issues

Firstly, the empirical strategy adopted in this paper was to use secondary data contained in a variety of completed and published papers for the purpose of profit rates'

analysis (specifically, Maito, 2014). Secondly, the analysis was conducted using up-to-date econometric techniques. This is necessary, since the majority of studies, with the exception of Basu and Manolakos (2013), Michl (1988), Feldstein and Summers (1977), Tavani (2007) and Downe (1985), relied on exploratory techniques, such as visual examination of the rate of profit series plots, or on conventional linear deterministic trend estimation. Thirdly, the paper addresses the issue raised by Reuten (2014). Reuten states that there have been two interpretations of profit rates dynamics in literature (resulting from different formulations of the "law of profit" in his early and late works). Firstly, the law has been interpreted as a fluctuation of profit rate around a falling trend, with fluctuations being caused by countervailing factors (that may temporarily lead to the rise in the rate of profit). Secondly, an alternative interpretation has been that profit rate varies cyclically but not necessarily around a falling trend. The empirical strategy adopted in the present paper is based on the former interpretation. Specifically, we incorporate structural breaks and posit that they are likely to correspond to instances when countervailing factors are in operation.

3.2. Data sources

The data used in the paper comes from a variety of sources. As a result, certain methodological differences exist (outlined below), relating to the ways of estimation of the capital stock, and to the types of economic activities considered (e.g. private economy versus total economy). Some caution is therefore exercised when interpreting the levels and trends in the respective profit rate series, which are not directly comparable.

USA

The estimates of the US profit rates came from two sources – January 2013 version of database for US private economy, constructed by Duménil and Lévy (1994) and based on their earlier works; and profit rate data constructed by R. Brenner (2006, pp. 8, 346-347). Duménil and Lévy data covers 1869-2011 period. Profit rate is calculated as net domestic product minus product of number of hours worked and hourly wage, divided by net stock of fixed capital. The data for all relevant variables is presented in chained 2005 dollars. Brenners's data covers period of 1929-2008 and is constructed based on US Bureau of Economic Analysis (BEA) accounts.

UK and Germany

We use profit rates data constructed by Maito (2014), based on "rates of return" data compiled by T. Piketty (2014). The data spans 1855-2009 for UK and 1868-1913 and 1950-2011 for Germany. Data for interwar period in Germany was available but was not used in this paper. As mentioned above, Piketty's "rate of return" is based on a measure of national wealth (instead of produced capital, the concept used by Marxist economists in the calculation of the rate of profit) that includes everything owned by resident and government of the country (financial and non-financial assets). Maito (2014) modified Piketty's data to exclude the influence of non-productive capital, by using for Germany's profit rate "total capital income" (from Piketty) and "business assets" (DATADE1C for 1868-1939, and DATADE2B for 1950-2011), and for UK's profit rate "total capital income" (from Piketty) and "real productive capital" from UK Office of National Statistics series.

Sweden

Profit rates' data constructed by Edvinsson (2010) and contained in Swedish Historical National Accounts was used. The data spans 1850-2000 period. The profit rates' data did not distinguish between capitalist and non-capitalist sectors, or between productive and unproductive activities. Fixed capital included both means of production and residential capital. Capital stock was conceptualized as net stock.

Spain

Estimates of Spanish profit rate are obtained from Camara (2007). Camara conducts analysis using Marxian concept of surplus value, while the basic data comes from Spanish system of national accounts. Profit rate is estimated over 1954-2001 period, as the ratio of surplus value over capital invested in production. The former is calculated in gross terms (i.e. before taxes and interest are subtracted) as new value minus variable capital. New value is roughly equivalent to net value added with certain modifications to usual formula (net value added of non-market services, non-capitalist production and imputed rentals of owner-occupied dwellings are subtracted). Variable capital was defined as capital advanced in the payment of the labour force (i.e. compensation of employees in national accounting terms).

Brazil and South Korea

Relevant series were constructed by Grinberg (2011) for agricultural, industrial, and social sectors of the economies. Data spans 1955-2005 for Brazil and 1956-2005 for Korea (Tables C.12 and C.15 in Grinberg). Profit rates were estimated along classical lines as capital for and profits from production activities, specifically as value added minus consumption of fixed capital minus cost of labour divided by fixed capital advanced (p. 82). Grinberg (2011, p. 89-90) included land rent in agricultural sector profits, which overestimated rate of profit for both countries (which matters particularly for earlier years of their development).

Mexico

Profit rates data for Mexico is obtained from Mariña and Moseley (2001, p. 52). Data spans 1950-1999 period and relates to the whole Mexican economy. In line with Marx's concepts a distinction is made between capitalist and non-capitalist production, as well as between productive and non-productive capital, and rate of profit is estimated accordingly. Profit rate is defined as mass of profits divided by fixed capital (p. 42). Mass of profits is calculated as surplus value minus non-productive costs of labour and materials. Surplus value is defined as value added minus productive labour costs. Fixed capital includes fixed productive and non-productive capitals. Mariña and Moseley use gross rate of profit, i.e. not adjusted for depreciation.

World

The world profit rate data is based on the profit rates for 14 developed capitalist and peripheral capitalist economies over 1955-2010 period, constructed by Maito (2014). Developed capitalist economies included USA, Germany, Netherlands, Japan, UK and Sweden, while peripheral capitalist economies included Argentina, Australia, Brazil, Chile, China, Korea, Spain and Mexico.

Rate of profit for individual economies and respectively world is calculated in Marxian terms as the ratio of net profits to capital advanced in machinery, infrastructure (fixed constant capital) valued at current prices (p. 6). Estimates were made for whole economy, except USA where estimates were made for corporate sector.

While three world profit rate series were constructed (simple average of 14 economies), weighted average of 14 economies (including and excluding China), we considered weighted average excluding China measure, due to the marginal position of Chinese economy in the world until two decades ago, and given very fast growth rate of China recently.

3.3. Econometric approach

As suggested by modern time-series econometrics the identification of long term trends through the visual inspection of series plots or through the estimation of simple log-linear time trend models as well as visual identification of structural breaks may be highly misleading (Cuddington et al., 2002). These methods do not allow establishing the source of non-stationarity (i.e. downward movement in line with classical hypothesis) of series, i.e. whether series follow deterministic time trend, or unit roots are present in the data, or there is (are) structural break(s) in the series. These methods are also prone to delivering spurious results (Granger, Newbold, 1974), i.e. identify statistically significant time trends when in reality there are none, or identify apparent structural breaks in the series when there are no breaks.

The first step was to ascertain the presence of deterministic and stochastic component in the profit time series, as well as to investigate the possibility of structural breaks. Six types of unit root tests with no structural break were performed – Augmented Dickey-Fuller (ADF) test, Phillips-Perron (PP) test, Elliott-Rotherberg-Stock ERS and GLS tests, Ng-Perron test, and KPSS test (Dickey, Fuller, 1979; Phillips, Perron, 1988; Elliott et al, 1996; Ng, Perron, 2001). For all these tests two alternative specifications were tried – with constant, and with constant and trend. All tests (except for KPSS test) have unit root as null hypothesis, and stationarity as alternative hypothesis. The use of ERS, GLS and Ng-Perron tests is required due to shortcomings of ADF and PPP tests: 1). The tests have low power against the alternative hypothesis of trend (stationarity) with large autoregressive root (DeJong et al, 1992); 2) They also have size distortions in the direction of over-rejection of unit root null when series have large negative MA root (Schwert, 1989); 3). The tests have bias to accept false unit root when series are in fact stationary with break (Perron, 1989). Overall, 14 tests without breaks were run for each economy. In line with Mahadeva and Robinson (2004) we note that no single conventional unit root tests gives definitive decision rule as to unit root versus stationarity behaviour. Consequently a decision threshold was set: if 4 or fewer tests indicate stationarity, the series were seen to contain unit root; if 5 of more tests indicate stationarity, the series are considered to be stationary.

As a second step, in order to verify the presence of unit root, we examine V_k estimator (Cochrane, 1988), defined as the ratio of the variance of innovation to the variance of the series. The estimator examines the significance of the permanent component in the series (i.e. persistence of series) and is needed to address the possibility of breaks and instabilities in small samples: high persistence (slow decline in V_k estimator) would then point to unit root patterns, while slow persistence (rapid decline in V_k ratio) would indicate stationarity (Ocampo, Parra, 2003). Specifically, according to the V_k test, series follow deterministic trend when $V_k = 0$, random walk when $V_k = 1$, or stochastic trend when $0 < V_k < 1$.

The possibility of structural breaks in the series was addressed by performing two types of unit root tests with endogenously determined structural breaks – Zivot and

Andrews (1992) test with one structural break (ZA); and Lumsdaine and Papell (1997) test with two structural breaks (LP) as extension of ZA test.

Regarding ZA test, the null hypothesis is that the natural logarithm of profit rate series follows random walk with a drift, whilst the alternative hypothesis is that series are trend stationary with one or two structural breaks respectively. Without a priori knowledge of the type of structural break, the most general version C of the test, allowing for both breaks in trend and intercept was used.

The equation for ZA test has the following form:

$$y_t = \mu + \hat{\theta} DU_t(\hat{\lambda}) + \beta t + \hat{\gamma} DT_t(\hat{\lambda}) + \alpha \hat{y}_{t-1} + \sum_{i=1}^{k} c_j \Delta \hat{y}_{t-j} + \hat{e}_t$$

Where $DU_t(\hat{\lambda}) = 1$ if $t > T\hat{\lambda}$ or 0 otherwise, and $DT_t(\hat{\lambda}) = t - T\hat{\lambda}$ if $t > T\hat{\lambda}$ and 0 otherwise, while Tb represents the time of the break. Under the null hypothesis, $\alpha = 0$, meaning there is a unit root in series. Under the alternative hypothesis, $\alpha < 0$, implying that series are breakpoint stationary.

The paper employed LP test in its most general form (model CC): with two structural breaks – in slope of the trend and in intercept. The test regression equation is given as:

$$\Delta y_t = \mu + \hat{\beta} t + \hat{\theta} DU1_t + \gamma \hat{DT}1_t + \varpi \hat{DU}2_t + \psi \hat{DT}2_t + \alpha \hat{y}_{t-1} + \sum_{i=1}^{k} c_j \Delta \hat{y}_{t-j} + \hat{e}_t$$

For $t = 1,...,T$, where $DU1_t = 1$, if $t > TB1$ and 0 otherwise; $DU2_t = 1$ if $t > TB2$ and 0 otherwise; $DT1_t = t - TB1$ if $t > TB1$ and 0 otherwise; and $DT2_t = t - TB2$ if $t > TB2$ and 0 otherwise.

To account for the annual frequency of the profit series data and in order to remove possible autocorrelation, a maximum lag of 4 (k = 4) was selected in both ZA and LP tests. The actual lag length is selected using Akaike Information Criteria (AIC) in ZA test, and using "general-to-specific" procedure in LP test. In both ZA and LP tests, the breaks are selected within the 'trimming region' specified as (0.15T; 0.85T); as a result some point of the sample are not included, when estimating structural break dates.

We acknowledge that both ZA and LP tests are not the tests of structural break(s) timing, but rather tests for unit roots allowing breaks. Therefore, recursive residual and N-step forecast tests were performed in addition to ZA and LP tests (Cuddington et al, 2002) in order to identify outliers or instabilities in the series. If any of them are identify, this could indicate the need to run model with additional breaks. Several regressions with breaks at different times were tried in this respect. This inter alia addresses another criticism of ZA and LP tests that series may contain three or more breaks. In most cases however (as shown further), the true timing of the break(s) was more or less correctly predicted by ZA and LP tests.

ZA and LP tests were performed sequentially. Initially ZA test was conducted, and if the break was found statistically significant and trend stationarity with a single

break hypothesis was accepted, LP test was performed. If as a result of LP test both breaks were found significant, it was concluded that series are trend stationary with 2 breaks. In the opposite case (only 1 break significant), it was concluded that series follow trend stationary behaviour with 1 break.

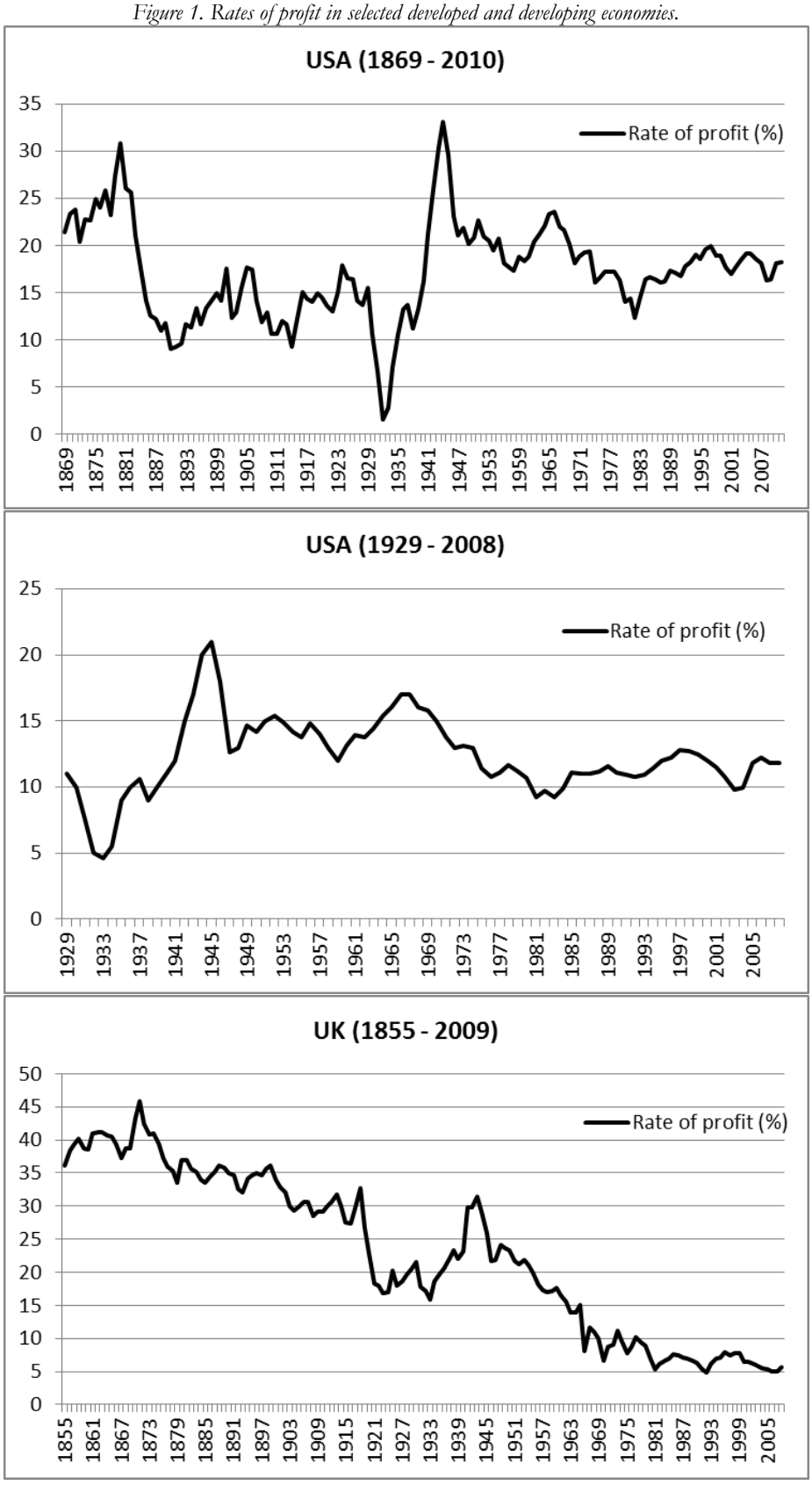
Regarding the choice of regression model, we followed the approach taken by Ocampo and Parra (2003) in the context of modelling commodity terms of trade. The approach accounts for potential bias in the tests and their relative power. Specifically, we employ deterministic trend (DT) model, if conventional unit root tests point to stationarity behaviour, while tests with structural breaks point to presence of unit root without breaks. We employ stochastic trend (ST) model, if both conventional tests and tests with structural breaks indicate unit root (with or without breaks). ST model is also used, if conventional tests point to unit root, while tests with structural breaks point to presence of TS with breaks (however, if V-ratio test indicates trend stationarity, the series are modelled as DT with breaks). Finally, we employ DT model with breaks, both types of tests suggest TS behaviour (with or without breaks). Adopting the approach as a benchmark, we nonetheless try alternative model specifications and (in the case of inconsistencies) select the model that passes all major diagnostic tests (overall significance of equation, adjusted R^2, standard error, normality, autocorrelation, White heteroscedasticity, ARCH, series correlogram, and significance of AR terms) and is in line with economic and historical facts.

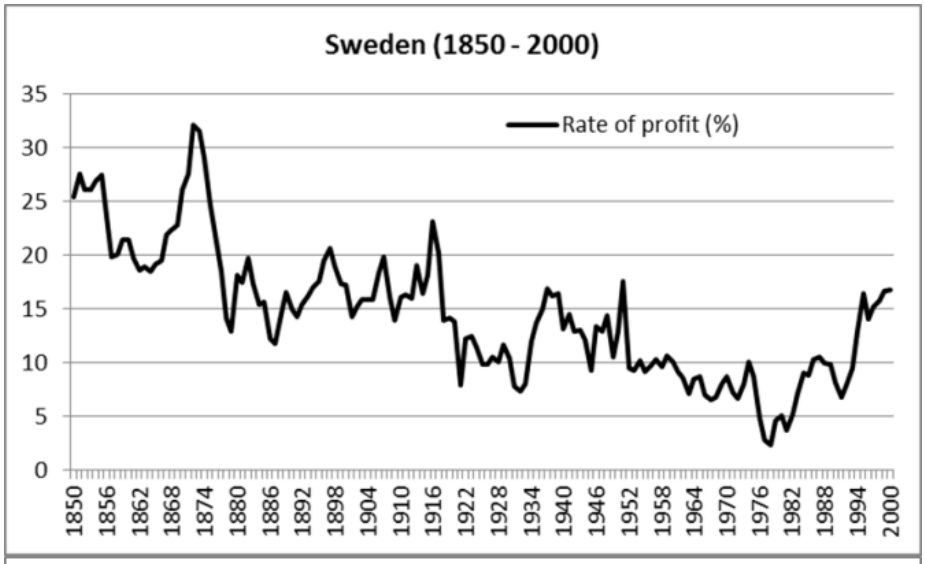
4. Empirical evidence

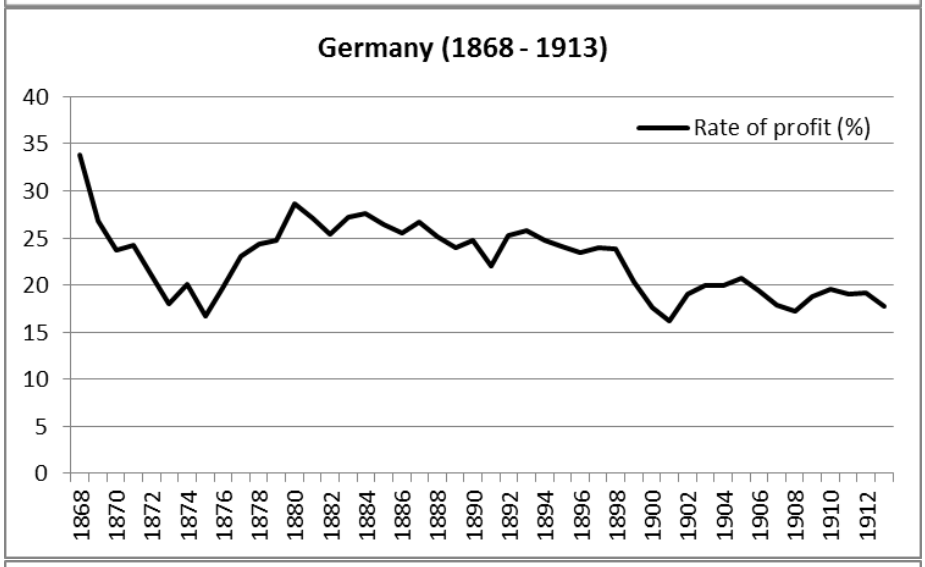
4.1. Results based on the log of series

Figure 1 shows respective profit rate series. The visual inspection of series suggests that in the US series exhibited relative stability and fluctuated around the mean in 1869-2010 and 1929-2008, with major swings taking place in the 1930-40s (i.e. during Great Depression and World War II). UK profit rates have declined substantially over 1855-2009 periods, with the last three decades witnessing some stabilization (moderation of trend). Swedish profit rates demonstrated overall decline (in a step-wise manner) until mid-1970s and reversal of trend afterwards. Profit rates in Germany before and after World Wars exhibited stability overall with only moderate fluctuations (possibly random walk). South Korean series showed trend reversal in mid-1970s (from upward to downward) with decline accelerating in the 1990s (the start of the slowdown of economic growth). Rates in Brazil showed some form of random walk, while rates in Mexico, Spain and in the world as a whole were overall stable (with some moderate downward trend in Mexico).

Figure 1. Rates of profit in selected developed and developing economies.




Sweden (1850 - 2000)
Rate of profit (%)
35
30
25
20
15
10
5
0
1850
1856
1862
1868
1874
1880
1886
1892
1898
1904
1910
1916
1922
1928
1934
1940
1946
1952
1958
1964
1970
1976
1982
1988
1994
2000


Germany (1868 - 1913)
Rate of profit (%)
40
35
30
25
20
15
10
5
0
1868
1870
1872
1874
1876
1878
1880
1882
1884
1886
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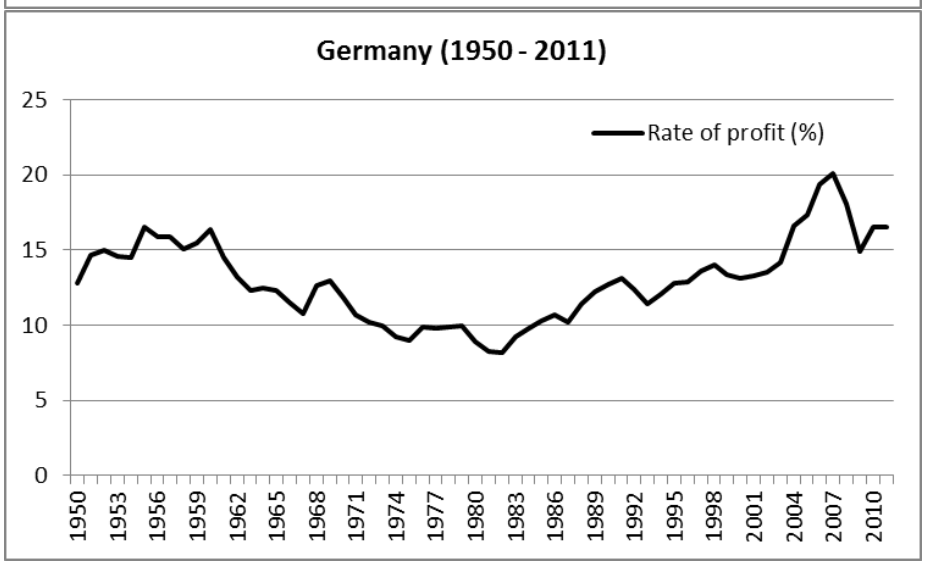
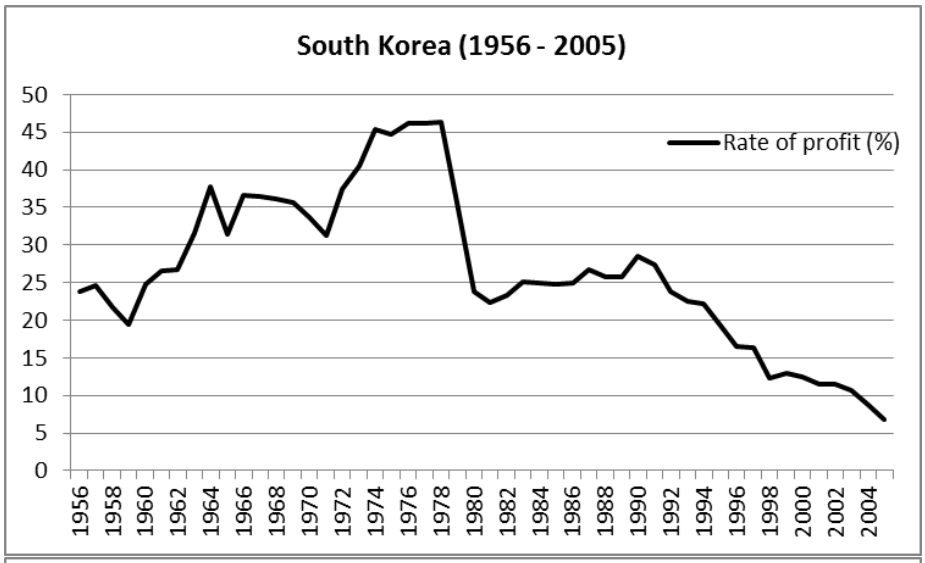
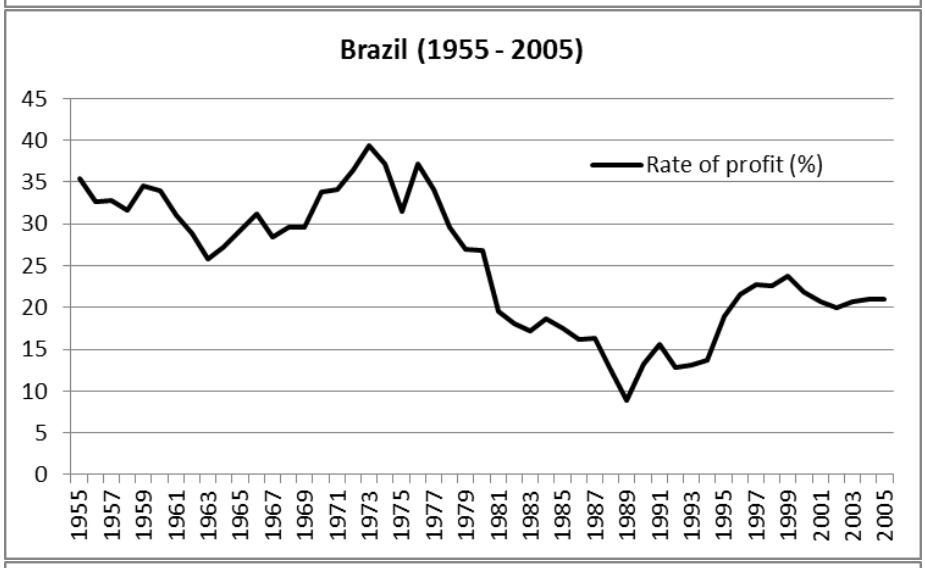
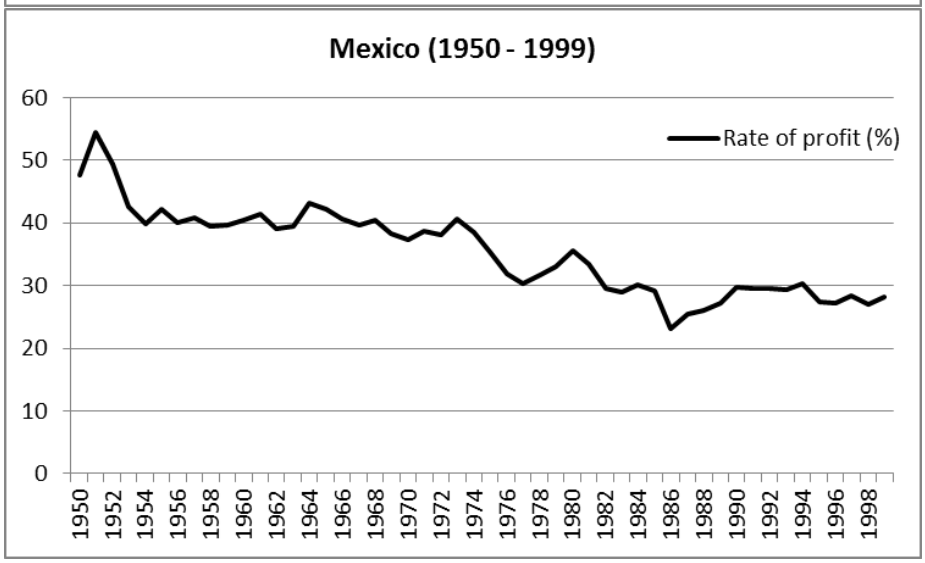
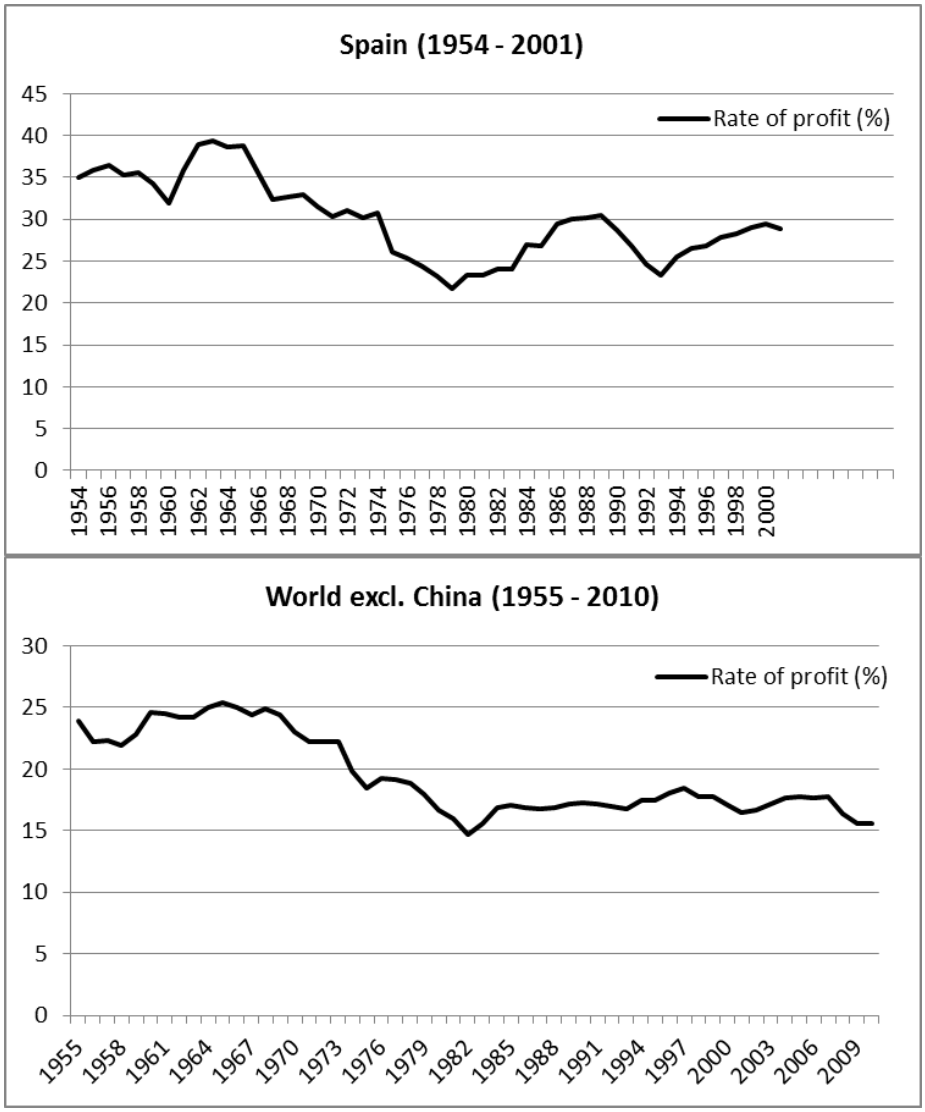
1900
1902
1904
1906
1908
1910
1912


Germany (1950 - 2011)
Rate of profit (%)
25
20
15
10
5
0
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004
2007
2010


South Korea (1956 - 2005)
Rate of profit (%)
50
45
40
35
30
25
20
15
10
5
0
1956 1958 1960 1962 1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004


Brazil (1955 - 2005)
Rate of profit (%)
45
40
35
30
25
20
15
10
5
0
1955 1957 1959 1961 1963 1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005


Mexico (1950 - 1999)
Rate of profit (%)
60
50
40
30
20
10
0
1950 1952 1954 1956 1958 1960 1962 1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998



Tables 1 and 1a in the Appendix respectively present results of unit root tests without structural breaks (for the logs of profit rates' series, as well as original series). For each test, two models were tried (constant and no trend, as well as constant plus trend). The estimates are shown for the log of series at 5% significance level. In USA (1929-2008), unit root is present under Phillips-Perron tests (with or without trend) and KPSS test with constant and trend. Testing longer series in the US (1869-2010) suggests that unit root was present only under Phillips-Perron test with no trend. In Sweden (1850-2000), GLS, Phillips-Perron, ERS and two Ng-Perron tests (all with constant and trend) pointed to stationarity in series, while the remaining tests suggested unit root behaviour.

Two German series (1868-1913 and 1950-2011) were stationary only under KPSS tests, while other tests indicated unit root. For UK series (1855-20100, all tests pointed to possible unit root. Spain (1954-2001), Mexico (1950-1999) and Brazil (1955-2005) series contained unit root according to all tests, except for KPSS with constant and trend. In Korea (1956-2005) and in the world (weighted average, excluding China), profit rate series followed unit root pattern, as indicated by all tests.

Results of ZA and LP unit root tests with structural breaks are shown in Tables 2 and 3. The tests were run sequentially.

Table 2. Zivot-Andrews unit root test with 1 structural break (Calculations for log of profit rate series)

	Tb	**μ**	**θ**	**β**	**γ**	**α**
USA	1997	0.180	0.005	0.000	0.001	-0.146
(1929 - 2008)		(-3.803)	(0.215)	(-1.801)	(0.178)	(-3.370)
USA	1939	0.440	0.133	-0.002	0.001	-0.331
(1869 - 2010)		(-5.742)	(4.052)	(-3.137)	(1.671)	(-6.065)
Sweden	1976	0.563	-0.166	-0.002	0.015	-0.404
(1850 - 2000)		(5.742)	(-4.294)	(-4.882)	(5.483)	(-5.975)
Germany	1876	0.582	0.112	-0.010	0.007	-0.422
(1868 - 1913)		(4.192)	(4.144)	(-1.435)	(1.079)	(-4.871)
Germany	1980	0.600	-0.011	-0.004	0.009	-0.485
(1950 - 2011)		(4.722)	(-0.731)	(-3.969)	(4.438)	(-4.777)
UK	1966	0.448	-0.081	-0.001	0.000	-0.270
(1855 - 2009)		(5.099)	(-3.978)	(-4.564)	(0.025)	(-5.114)
Spain	1975	0.565	-0.044	-0.002	0.003	-0.356
(1954 - 2001)		(3.887)	(-2.722)	(-1.716)	(2.579)	(-3.891)
Mexico	1982	0.796	-0.043	-0.002	0.003	-0.479
(1950 - 1999)		(3.975)	(-2.461)	(-2.805)	(2.139)	(-4.012)
Korea	1972	0.300	0.042	0.002	-0.008	-0.212
(1956 - 2005)		(2.315)	(1.322)	(0.594)	(-1.701)	(-2.192)
Brazil	1981	0.490	-0.133	0.000	0.004	-0.329
(1955 - 2005)		(3.574)	(-3.260)	(-0.004)	(1.889)	(-3.634)
World	1974	0.423	-0.035	-0.001	0.001	-0.301
(1955 - 2010)		(3.963)	(-2.887)	(-1.026)	(0.847)	(-3.869)

Note: Critical values at 1%, 5% and 10% are: -5.57, -5.08 and -4.82 respectively. t-statistics are indicated in parentheses. Values highlighted in bold represent confirmed hypothesis of trend stationarity with break.

According to ZA test (Table 2), null hypothesis of unit root is rejected for the US (1869-2010) series, Sweden (1850-2000), and the UK (1855-2009) at 5% significance level in favour of alternative hypothesis of trend stationarity with a single break. Two dummy coefficients were significant for the US and Sweden, and one for the UK. Tests show that the structural breaks in three profit rate series correspond to critical junctures in respective country's economic systems. In the US, structural break in 1939 relates to the end of the Great Depression and the rise of the US "war economy". In Sweden, break in 1976 corresponds to the period when classical Swedish model based on centralised wage bargaining reached its apex: 1978 witnessed the peak in labour share and worst ever profits (Bengtsson, 2014). This necessitated structural policies to attempt increasing capital share and certain macroeconomic policies, including currency devaluations (Edvinsson, 2010). In the UK, 1960s were the period of the demise of the British Empire, increased competitive pressures on manufacturing sector, and early policy action attempting to modernize British economy and remove supply-side impediments to growth (Pemberton, 2004). Break in 1966 fits this period. For these three economies, LP unit root test with two breaks was performed (Table 3). At 5% significance level, the alternative hypothesis of trend stationarity with two breaks was accepted only for the US (1869-2010) and Sweden (1850-2000). UK series were thus

following trend stationary behaviour with a single break. In the US, the breaks identified were 1929 and 1949 (the latter relating to the post-war boom in the US economy and expanding profit opportunities), while in Sweden the breaks identified were 1933 and 1975 (the former corresponding to Great Depression period). For each series all four dummy coefficients were significant at 5% level.

Table 3. Lumsdaine-Papell unit root test with 2 structural breaks (Calculations for log of profit rate series)

	USA (1869 - 2010)		**Sweden (1850 - 2000)**		**UK (1855 - 2009)**	
Tb1	**1929**		**1933**		**1939**	
Tb2	**1949**		**1975**		**1965**	
μ	0.497	6.522	0.640	6.519	0.667	5.493
θ	-0.197	-4.141	0.078	2.819	0.088	3.684
β	-0.001	6.522	-0.002	6.519	-0.002	5.493
γ	0.020	5.149	-0.002	-2.090	-0.004	-3.080
ω	-0.094	-2.537	-0.165	-3.948	-0.076	-3.117
ψ	-0.019	-5.069	0.018	6.201	0.004	2.893
α	-0.387	-6.942	-0.453	-6.619	-0.396	-5.538

Note: Critical values at 1%, 5% and 10% are -7.34, -6.82 and -6.49 respectively.

As a robustness check and due to certain contradiction in unit root test estimates, V-ratio test was performed. To conserve space, the graphical representations of the V-ratio test are not shown in the paper, but are available upon request. In the case of all series, the variance of innovations and V_k estimator trended towards zero in the long-run (more so in the case of longer US, Sweden and UK series, and less so in the case of US 1929-2008 series). This pattern points to presence of deterministic trend in all cases, except US 1929-2008 series, which can be modelled by either deterministic or stochastic trend.

We thus model (Table 4) the majority of series as stochastic trend (ST) model, except for USA 1929-2008 series (modelled as deterministic trend), and USA 1869-2010, Sweden and UK series (modelled as deterministic trend model with 1 or 2 breaks).

Table 4. Conclusions made for log of profit rate series

	ZA test with 1 structural break	LP test with 2 structural breaks	V-ratio test	Unit root tests without breaks	Suggested modelling procedure
USA (1929 - 2008)	UR	UR	UR	TS	DT
USA (1869 - 2010)	TS (1 break)	TS (2 breaks)	DT	TS	DT (1 break)
Sweden (1850 - 2000)	TS (1 break)	TS (2 breaks)	DT	TS	DT (2 breaks)
Germany (1868 - 1913)	UR	UR		UR	ST
Germany (1950 - 2011)	UR	UR		UR	ST
UK (1855 - 2009)	TS (1 break)	UR	DT	UR	DT (1 break)
Spain (1954 - 2001)	UR	UR		UR	ST
Mexico (1950 - 1999)	UR	UR		UR	ST
Korea (1956 - 2005)	UR	UR		UR	ST
Brazil (1955 - 2005)	UR	UR		UR	ST
World (1955 - 2010)	UR	UR		UR	ST

Note: UR - unit root; TS - trend stationarity; DT - deterministic trend, ST - stochastic trend

The estimation results are as follows.

USA (1929-2008)

The estimation of DT model with no breaks revealed non-normality of residuals, principally due to large swings in profit rate during 1930-40s. Inspection of residuals, as well as recursive residuals and N-step forecast tests suggested instabilities/breaks in 1932, 1935 and 1947. Non-normality problem persisted after re-estimation of DT model with these breaks. As a result, sample was curtailed to 1948-2008. DT model (with AR(1) and AR(2) terms) run on shorter sample passed all diagnostic tests and pointed to statistically insignificant trend.

$$\ln(p) = 2.66 - 0.005t + e_t$$
$$(24.47)\ (-1.64)$$
$$e_t = 1.13e_{t-1} - 0.28e_{t-2} + u_t$$
$$(9.03)\qquad (-2.27)$$

R^2_{adi}=0.87; Jarque Bera = 1.273 (p=0.53); Breusch-Godfrey p(χ^2)=0.65; White p(χ^2)=0.54; ARCH p(χ^2)=0.66

USA (1869-2010)

The estimation of DT model with one or two breaks (based on ZA and LP tests) resulted in non-normality and heteroscedasticity problems. The problem persisted when different break combinations were used (as suggested by recursive residuals and N-step forecast tests. Suggested breaks/instabilities included 1933, 1931-32 or 1933-34. The problem is associated with abrupt falls in profit rate during 1931-33, followed by sharp rise in early 1940s (militarisation of the US economy). The longer sample was therefore split into two shorter one, corresponding to pre-Depression years and (1869-1929) and post-war years (1949-2010). Unit root tests on smaller samples confirmed choice of DT model without breaks. DT model without breaks and AR(1) term run on 1869-1929 sample passed all diagnostic tests and indicated statistically insignificant trend.

$$\ln(p) = 2.86 - 0.005t + e_t$$
(8.35) (-0.55)
$$e_t = 0.87e_{t-1} + u_t$$
(13.06)
R^2_{adj}=0.80; Jarque Bera=1.658 (p=0.44); Breusch-Godfrey p(χ^2)=0.98; White p(χ^2)=0.48; ARCH p(χ^2)=0.83

Running DT model without breaks on 1949-2010 sample justified the need to incorporate additional breaks/instabilities, as suggested by recursive residuals and N-step forecast tests. The breaks/instabilities in 1974, 1980 and 1982 relate to policy transformation in the US economy (demise of Keynesianism and rise of supply side policies). DT model with three breaks and AR(1) term passed all tests but showed insignificant trend.

$$\ln(p) = 2.96 - 0.002t - 0.11D(1974) - 0.09D(1980) - 0.16D(1982) + e_t$$
(24.77) (-0.58) (-2.69) (-2.12) (-3.93)
$$e_t = 0.86e_{t-1} + u_t$$
(12.57)
R^2_{adj}=0.81; Jarque Bera=1.081 (p=0.58); Breusch-Godfrey p(χ^2)=0.27; White p(χ^2)=0.25; ARCH p(χ^2)=0.43

We therefore hypothesised movement in the series solely due to structural breaks and instabilities (Zanias, 2005, argued in favour of such re-estimation, in the context of commodity price analysis).

$$\ln(p) = 2.90 - 0.11D(1974) - 0.09D(1980) - 0.16D(1982) + e_t$$
(50.66) (-2.73) (-2.13) (-3.97)
$$e_t = 0.88e_{t-1} + u_t$$
(14.33)
R^2_{adj}=0.81; Jarque Bera=0.861 (p=0.65); Breusch-Godfrey p(χ^2)=0.35; White p(χ^2)=0.47; ARCH p(χ^2)=0.42

UK (1855-2009)

Similarly to US samples, estimation of DT model with one break resulted in non-normality and heteroscedasticity problems, as attested by large residuals in pre-World War I period. The sample was restricted to 1919-2009 period. In addition to 1966 break, recursive residual test suggested break in 1970. DT model with these two breaks and AR(1) and AR(2) terms passed the tests and demonstrated statistically significant negative trend, with series declining by 1.99% per annum over 1919-2009.

$\ln(p) = 3.44 - 0.019t - 0.51D(1966) - 0.32D(1970) + e_t$
(15.82) (-5.26) (-7.80) (-4.90)
$e_t = 1.15e_{t-1} - 0.26e_{t-2} + u_t$
(10.76) (-2.45)
R^2_{adj}=0.97; Jarque Bera=0.729 (p=0.69); Breusch-Godfrey p(χ^2)=0.06; White p(χ^2)=0.67; ARCH p(χ^2)=0.29

Sweden (1850-2000)

The estimation of DT model with two breaks revealed persistent heteroscedasticity problems (wide fluctuation of residuals in early part of the sample). Also, recursive residuals and N-step forecast tests suggested additional breaks/instabilities in 1921, 1952, 1977 and 1979. To account for these breaks the estimates on curtailed sample (1919-2000) included 1952 and 1976-1981 breaks. The model included AR(1) term and showed insignificant time trend.

$\ln p = 2.32 - 0.000t - 0.29D(1952) - 0.54D(1976\text{-}81) + e_t$
(10.42) (-0.02) (-1.84) (-3.66)
$e_t = 0.78e_{t-1} + u_t$
(10.11)
R^2_{adj}=0.74; Jarque Bera=2.198 (p=0.33); Breusch-Godfrey p(χ^2)=0.12; White p(χ^2)=0.44; ARCH p(χ^2)=0.12

DT model was then re-estimated without time trend term.

$\ln p = 2.32 - 0.29D(1952) - 0.54D(1976\text{-}81) + e_t$
(22.99) (-1.85) (-3.68)
$e_t = 0.78e_{t-1} + u_t$
(10.60)
R^2_{adj}=0.74; Jarque Bera=2.200 (p=0.33); Breusch-Godfrey p(χ^2)=0.12; White p(χ^2)=0.52; ARCH p(χ^2)=0.12

Results showed that instead of continuous downward trend, profit rates were falling in a step-wise manner, declining by 29% in 1952 and 54% during 1976-81.

Other cases

The remainder of profit rates series were represented by stochastic trend (ST) model. Most of the identified breaks and instabilities were significant in economic sense. As shown in Table 5, for the world weighted average profit series (excluding China) the breaks in 1974 and 1982 corresponded to the rise of supply side policies of early 1980s, oil crises of 1970s and demise of Keynesian policies in developed economies, as well as international debt crisis that affected many developing economies. Some country-specific breaks were identified as well. For Spain, break in 1975 relate to the transition to democracy after the death of Gen. Franco. For Korea, likewise the first break (1965) stands for the beginning of Korean economic miracle that continued through 1960s and 1970s, while the second break reflect political and economic instability after 1979 military coup. For Mexico, 1986 break corresponds to the start of neo-liberal reform by

Pres. de la Madrid (1982-88), attempts to combat hyperinflation and Mexico's joining GATT. In a similar fashion, 1990 break in Brazil is related to the economic stabilisation plan by Pres. Collor de Mello (1990-92) and the start of the economic reform decade. For Germany prior to WWI, the break in 1875 stands for the end of speculative boom in the early 1870s (that followed unification of Germany in 1871 and the end of Franco-Prussian war), ensuing depression, adoption of gold standard in 1873 and protectionist trade policy in 1879. For Germany after WWII the break in 2009 corresponds to global financial crisis. Surprisingly, the unification of East and West Germany in 1990, whilst being a massive perturbation and having profound and lasting effects was not reflected in profit rates series, with no structural break identified.

Table 5. Results of stochastic trend models

	Germany (1868-1913)	**Germany (1950-2011)**	**Spain (1954-2001)**	**Mexico (1950-1999)**	**Brazil (1955-2005)**	**Korea (1956-2005)**	**World (1955-2010)**
Constant	-0.003 (-0.15)	0.004 (0.41)	-0.001 (-0.07)	-0.006 (-0.70)	-0.019 (-1.10)	-0.018 (-0.72)	-0.002 (-0.37)
Dummy variable 1	-0.25 (-2.93)	0.2 (-2.90)	-0.17 (-3.18)	-0.22 (-3.61)	0.42 (-3.46)	-0.29 (-2.71)	-0.09 (-2.97)
Dummy variable 2						-0.28 (-2.61)	-0.09 (-2.78)
AR term	0.25 (1.73)	0.22 (1.71)				0.35 (2.19)	0.32 (2.50)
R^2 adj	0.10	0.14	0.17	0.2	0.18	0.24	0.27
Jarque Bera	1.367 (0.50)	0.949 (0.62)	1.074 (0.58)	0.261 (0.88)	5.465 (0.07)	1.332 (0.51)	0.005 (0.99)
Breusch-Godfrey LM	0.56	0.22	0.32	0.19	0.34	0.82	0.19
White	0.20	0.36	0.46	0.44	0.59	0.63	0.29
ARCH	0.84	0.09	0.45	0.39	0.56	0.62	0.55

Note: t-statistics are indicated in parentheses. Values for Breusch-Godfrey, White and ARCH tests are p(χ2) values.

In none of the cases the point estimate of the trend (reflected in the constant term) was statistically significant. It is possible instead to compare the frequency of the positive versus negative shocks on profit rate series.

The estimates of ST model for all series, except Germany after WWII, demonstrated negative constant term. The point estimates of the trend in series showed that profit rates were falling annually by 1.9% in Brazil (1955-2005), 1.8% in Korea (1956-2005), 0.6% in Mexico (1950-1999), 0.3% in Germany (1868-1913), 0.2% in world as a whole (1955-2010), and 0.1% in Spain (1954-2001). This suggests that negative shocks dominated positive ones. In contrast, ST model results for Germany (after WWII) indicate positive values of the constant and rising profit rate (0.4% per annum), suggesting that positive shocks on respective profit rate series were more frequent.

4.2. Robustness analysis

The unit root testing was also performed on the original series (i.e. series prior to log transformation). The comparison of the results in Tables 1 and 1a in the Appendix demonstrate that the unit root properties of the series with and without logs are essentially similar. The only exception is Sweden, for which only 3 tests indicated stationarity. Hence the series were seen to contain unit root (in contrast to stationarity conclusion for series with log transformation). For the UK (1855-2009), Korea (1956-2005), and World excluding China (1955-2010), the number of stationarity cases stood at 3, 2 and 2 (as opposed to zero for series with log transformations). This, however, does not alter overall conclusions, as shown in column 5 of Tables 4 and 6. V ratio tests results were similar for the series with and without logs.

The results for ZA and LP tests with breaks are a little fuzzier. For Korea, ZA test indicated trend stationarity with break (as opposed to unit root on the log of series). For Sweden, trend stationarity with a single break (as opposed to trend stationarity with two breaks) was suggested. For the UK, unit root (instead of trend stationarity with a single break) was identified. For the US (1869-2010) series, unit root behaviour was likely (in contrast to trend stationarity with two breaks). For the US (1929-2008) series, trend stationarity with 2 breaks (as opposed to unit root) was present.

Overall, the alterations in the suggested modelling procedure were minimal (Tables 4 and 6): for the UK, stochastic trend (rather than deterministic trend with 1 break); for Sweden, deterministic trend with 1 break in 1976 (instead of 2); for the US (1869-2008) series, deterministic trend without breaks (as opposed to deterministic trend with 1 break); and for the US (1929-2008) series, deterministic trend with 2 breaks in 1946 and 1974 (as opposed to trend with no breaks).

Table 6. Conclusions made for original profit rate series

	ZA test with 1 structural break	**LP test with 2 structural breaks**	**V-ratio test**	**Unit root tests without breaks**	**Suggested modelling procedure**
USA (1929 - 2008)	UR	TS (2 breaks)	UR	TS	DT (2 breaks)
USA (1869 - 2010)	UR	UR	DT	TS	DT
Sweden (1850 - 2000)	TS (1 break)	UR	DT	UR	DT (1 break)
Germany (1868 - 1913)	UR	UR		UR	ST
Germany (1950 - 2011)	UR	UR		UR	ST
UK (1855 - 2009)	UR	UR	DT	UR	ST
Spain (1954 - 2001)	UR	UR		UR	ST
Mexico (1950 - 1999)	UR	UR		UR	ST
Korea (1956 - 2005)	TS (1 break)	UR		UR	ST
Brazil (1955 - 2005)	UR	UR		UR	ST
World (1955 - 2010)	UR	UR		UR	ST

Note: UR - unit root; TS - trend stationarity; DT - deterministic trend, ST - stochastic trend

The estimation of the aforementioned models confirms the results contained in Section 4.1. For the UK, the ST model with no breaks pointed to insignificant trend coefficient, as well as low R^2_{adj} and non-normality of residuals. The preferred specification is therefore DT model with 2 breaks (Section 4.1), with resulting

statistically significant negative trend of 1.99% per annum. For Sweden, the estimation of DT model with a single break in 1976 reveals insignificant trend. The DT model is this estimated without trend, and a stepwise decline in series by 40.5% in 1976 is identified.

$$\ln(p) = 2.43 - 0.405D(1976) + e_t$$
$$(12.72) \quad (-2.10)$$
$$e_t = 0.86e_{t-1} + u_t$$
$$(13.81)$$

R^2_{adj}=0.70; Jarque Bera=4.303 (p=0.12); Breusch-Godfrey p(χ^2)=0.48; White p(χ^2)=0.10; ARCH p(χ^2)=0.22

This is not fundamentally different from a 54% decline in 1976-81 as in DT model with 2 breaks. For the USA (1869-2008) series, estimation of DT model with no breaks results in multiple diagnostic problems, and therefore running DT models with no breaks on two split samples is a preferred specification. In both samples trend is insignificant. For the USA (1929-2008) series, the non-normality of residuals required curtailing sample to 1948-2008. Running DT model with the break in 1974 on this smaller sample results in statistically insignificant trend (similarly to estimation in Section 4.1).

$$\ln(p) = 2.49 - 0.001t + 0.16D(1974) + e_t$$
$$(27.36) \quad (-0.58) \quad (2.85)$$
$$e_t = 1.06e_{t-1} - 0.29e_{t-2} + u_t$$
$$(8.36) \quad (-2.33)$$

R^2_{adj}=0.88; Jarque Bera=1.642 (p=0.44); Breusch-Godfrey p(χ^2)=0.93; White p(χ^2)=0.69; ARCH p(χ^2)=0.64

Overall, the robustness analysis suggests that results of the modelling based on the original series are not qualitatively different from the one on the log of series.

5. Economic interpretation of the results

In this section an exploratory analysis is conducted that matches the empirical results from the previous section to the available theoretical explanations of the profit rates' determinants and previous estimates of profit rates. Similarities and differences in profit rates' patterns, as well as limitations of the conventional profit rates' measures (return on fixed capital) are also considered.

5.1. Similarities in patterns

The empirical results point to two major similarities in profit rates patterns. Firstly, they demonstrate that there is a general but not a very strong tendency of the profit rates to fall: the comparison of profit rates at the beginning of the respective period with rates at the end of the period show that profit rates were lower at the end of the period in all cases, except for Germany in 1950-2011 and the US in 1929-2008 periods. While this may look like confirmation of Marx's secular decline hypothesis (Maito, 2014: 9, 13), the fitting of linear trends would overlook the frequent reversals

and spikes in profit rates (e.g. wide fluctuations in Korea and Brazil). Also, there were no significant trends identified in the USA and Germany.

Secondly, the results demonstrate upward trend in profit rates in the after-war period, driven by a combination of factors: capital destruction during Great Depression and WWII, the rise of "state capitalism" and Keynesian economic management as a response to major economic dislocations of the 1930s and to growing demand for protection on the part of business and society (Harman, 2007). Empirical results support this view: restoration of profit rates in the 1960s ("golden age" of state capitalism) as well as profit rates' fall in the 1970s (its demise) was observable across all economies. This pattern, however, masks some important differences: 1). In such economies as UK and Sweden, the fall in profit rate marked the return to the earlier downward trend; 2). In the USA, the fall in profit rate signified the return to the mean rate observable prior to WWII; 3). In Germany and Spain, the fall in profit rate was superseded by substantial rise in the 1980-90s; 4). In the developing economies (which did not share same historical trajectories as core capitalist economies), the profit rate dynamics arguably was shaped by national forms of economic management and developmental strategies (rather than Keynesianism in general).

5.2. The absolute level of profit rates

We note that direct comparison of the level of profit rates across economies in the sample is not valid given different methodologies adopted in respective profit rates' estimation (specifically in estimation of capital stock). Notwithstanding these differences, an observation is made that during post-WWII period, the developing economies in the sample (Brazil, Mexico, South Korea and Spain) exhibited periods of substantially high profit rates that exceeded those in the developing economies of Europe and the USA. Likewise, high profit rates were observed in the UK and Germany at earlier stages of their development (i.e. in the 19th century). This disparity may be attributed to the decreasing productivity gap between two groups of the economies, with state-of-the-art technology being imported to developing economies, while the real wage gap is not narrowed down, thereby implying higher and rising profit rates (Marina, Moseley, 1998: 26). Such explanation may hold substance for economies where transformation from agrarian to industrial state is characterized by large population surplus, subsistence wages in agricultural sector, and large marginal gains in productivity (e.g. the case of Sweden in the 1850s). It is not clear whether such characteristics pertained to Korea, Brazil or Mexico in the 1960s. Also, the decline in profit rates, as implied by this theoretical view, would ensue as soon as transformation is complete and wages increase. The timing of profit rates' decrease in the sample does not necessarily correspond to the transformation: the profit rates in the UK persisted above 30% level even in the early 20th century; in Mexico they stood above 30% in the early 1980s. Likewise, the gradual profit rates' declines (Mexico) were as likely as abrupt falls (Korea). Assumptions behind this theoretical view also need further examination, specifically, the link between technological transfer and productivity growth, the presence of productivity convergence (Rodrik, 2013, pointed to the lack of convergence in economy-wide labour productivity); capital stock dynamics that could undermine profit rates' increase even in the presence of the above process.

Similarly, the neoclassical convergence hypothesis (reformulated by Pyo and Nam, 1999, as lower income economies having lower capital stock and higher rates of return on capital, the latter converging to the level of higher-income economies) appears to

find only partial empirical support. On one hand, the USA and Germany had stable and comparable level of profit rates in post-WWII period, implying that these economies have been in a steady-state growth path. On the other hand, other developed economies (the UK) continued to exhibit falling profit rates throughout the period, indicating that convergence process was not complete. Increases in profit rates in Sweden and Germany in the 1990s likewise require further analysis. Developing economies in the sample exhibited a mix of very moderate declines (Mexico), as well as stochastic trends with periods of reversals and stabilizations (South Korea and Brazil).

5.3. Volatility of profit rates

The previous section identified a number of structural breaks in the series and interpreted them in light of political and economic events. The spikes and outliers in the series were present too, attributed principally to factors that either enhanced (decimated) the capital base or increased (decreased) GDP and output. The extreme volatility of the profit rates in the US in the 1930-40s is an illustration of the point: the sharp fall of profit rates in the 1930s was a manifestation of fall in GDP and value added (and profit share); and the strong rebound of profit rates in the 1940s was made possible (in addition to syphoning off capital stock into war production and increase in civilian output, Hughes, 1990: 493) by the prior removal of unprofitable capital and business enterprises during the Great Depression (Duménil, Lévy, 1993: 248). A similar restoration of profit rates is observed in the UK and Sweden, albeit its magnitude looked smaller than in the USA. The war effects on profit rates were shown in Germany as well, with some increase in profit rates in the early 1950s. The overall level of profits (around 15%) appears unrealistic, given the scale of war-time destructions in Germany. This aberration is due to German time series being based on the estimates of capital stock by Hoffmann (1965). These estimates resulted in the value of net fixed assets exceeding official statistics by up to 70% for the year 1950, making profit rate lower and underestimating effects of war. Another instance of profit rates' volatility was seen in Germany in the early 1870s: the rapid industrial boom was to large extent was facilitated by the influx of significant reparation payments into Germany, following the defeat of France in Franco-Prussian war of 1870-71. Importantly, these payments were channelled and transformed into the real investment (including railroad investment), in turn leading to over-accumulation of capital and the end of the boom, once the pace of capital accumulation started to exceed economic growth (Burhop, Wolff, 2005: 647). Similar development (driven by industrialization efforts and activism of the government) was present in Korea in the 1970s. The sharp fall around 1978 is related to over-investment beyond optimal level and inefficient use of already installed capital (Pyo, Nam, 1999: 12). In Sweden too, the investment boom of the 1870 did not immediately lead to significant GDP growth (capital accumulation was localized in transport infrastructure development and residential construction), with fall in profit rate coming as a result (Edvinsson, 2010: 474).

The volatile behavior of profit rates in the UK in the 1870s and following the end of WWI can be related to the changes in hegemonic position of the UK in the international system. The ability to extract colonial surpluses and export capital to colonies, as well as dominance in international export markets and international finance ensured high profit rates until the 1870s, when the strong position started to be undermined by the competition on part of the USA and Germany (Pierenkemper, Tilly, 2004: 150-4). The demise of hegemony (and of profit rates) after WWI was, in addition

to general economic malaise, a result of permanent loss of international market share (specifically in textiles and finance) and the rise of protectionism and fracture of liberal international order that was crucial for British performance (Findlay, O'Rourke, 2007: 429; Cochrane, 2009; Crafts, 2014).

5.4. Profit share and capital productivity as causal factors

As per identity relations, the profit rate is a product of profit share of income and capital productivity. The latter is determined as the ratio of labour productivity to capital intensity (organic composition of capital/OCC). The rise in the profit rate is thereby caused by an increase in profit share (and respectively by a decrease in labour share), by a fall in capital intensity, or by a rise in capital productivity (i.e. growth in labour productivity increasing faster than growth in capital intensity). The relative importance of these factors varied in individual economies in specific periods.

The moderation of wage share (with real wages growing slower than labour productivity) played positive role in profitability restoration in the UK in the 1920s (defeat of transport unions and of the general strike of 1926), under Park Jung Hee regime in South Korea in the 1970s (political repression against trade unions); in Germany following 1981 (the onset of falling labour share and the movement away from Keyensian policies); and in Spain after 1977, following demise of Gen. Franco regime (the demise of the old corporatist wage bargaining system, and implementation of wage restraints and anti-inflationary policies as part of Moncloa Pact and social pacts of 1978-86). These effects are documented by Roberts (2011), Tutan and Campbell (2005), Jeong (1998) and Fina et al (1989: 114-116).

The increase in labour share had negative effects in several instances as well. In Sweden (Bengtsson, 2014), the rising labour share exercised downward pressure on the profit rate starting from the 1920s (prior to that period, the labour share fluctuated within 45-50% of GDP band). During 1940-80 period it became a dominant factor behind profit rates' fall, increasing markedly from around 51% of GDP to 69% of GDP, while capital accumulation was slowing down. In Mexico as well (Marina, Moseley, 1998: 29), during the 1950-70s the rising real wages and slower productivity growth led to rising wage share: this did not lead to falling profit rate, as OCC declined too (the exchange rate of peso and prices of imported capital goods being the main factor behind OCC decline). In Spain (Camara, 2007: 546; Roman, 2002: 97), the rise in labour share took place between the early 1960s and the end of Franco regime in 1975, depressing profit rate by 17.6% over 1963-79. The rise was attributed to real wages growing faster than productivity, starting from a low base (this in turn, is explained by the deliberate efforts of Spanish economic planners of the 1940s-early 1950s to compensate the lack of foreign investment and low capital base with profit share increase). In Korea (Grinberg, 2011: 201, 471-2), the rise in wage share in the 1990s effectively precluded the rise in profit rate (as illustrated by the rise of total labour costs by factor 6.8 but aggregate profits by factor 1.7 over 1990-2005 period), despite sound competitive strategies of the industrial sector (expansion into the high-value added manufacturing, and later to high-tech production). The development strategy that was successful in its earlier years and that relied on the capacity to compete based on the cheap labour was thereby brought to its limit.

Regarding capital productivity, in Germany, according to Weiss (2015: 7), "the rate of return on fixed capital follows more or less the development of the capital productivity, at lower levels". Reversal in 1982 was due to both profit share (more

salient factor) and capital productivity stabilization. The rise in profit rate after 2001 was similarly driven by a decrease in capital stock and rise in capital productivity. In the USA, capital productivity likewise was a dominant driver of profit rates (Duménil, Lévy, 2004), with the share of profit playing subsidiary role. In Korea, the rising OCC was responsible for most of the falls in the profit rates during 1970-2002 (Jeong, 2007; Grinberg, 2011: 82), associated with economic transformation from labour-intensive to capital-intensive industries. In Spain (Botero, 1992: 18-28; Roman, 1997: 21; Camara, 2007: 550-53), rapid capital accumulation (outstripping labour productivity growth) and decline in capital productivity and profit rate characterized period prior to 1978 (specifically, following 1959, when stabilisation and liberalization economic program was initiated). Post-Franco period witnessed a slowdown in capital accumulation and more efficient use of capital inputs, and hence a stabilisation of profit rate. In Mexico, the fall in capital productivity was a driving force of profit rate fall during the crisis years of 1976-1993, with OCC rising substantially (as in the previous period, due to exchange rate misalignments) and offsetting the rise in profit share (Marina, Moseley, 1998: 31). In Sweden as well, the overaccumulation of capital was responsible for the rise in OCC and ongoing profit rate fall (Edvinsson, 2011: 473-4).

Overall, falling capital productivity and rising OCC appeared to be dominant factors behind falling profit rates in most economies. In Sweden, they were confounded with a multiple instances of rising labour share, resulting in a century-long period of falling profit rate. Stabilization of capital productivity had positive effect on profit rates in Germany, Spain and the USA. It is important to consider the factors behind such stabilization and revival of profit rates.

Weiss (2015: 11-12) argues that in Germany and similar economies with a strong manufacturing base the stabilization of profit rates (or even a rise as in Germany after 2001) and increase in Y/K ratio could be related to changing nature of manufacturing. In a globalized economy with more profound division of labour, shorter value chains and manufacturing process innovations (e.g. just-in-time) there is objectively smaller need for capital.

Edvinsson (2010: 471, 473) in the case of Sweden mentions Kaldor's hypothesis of a "desired capital". The progressive development of capitalism involves initially rapidly growing capital-output ratio, the process that is brought to an end when the capital stock attains the level of 'desired capital' (Kaldor, 1960: 295). Swedish case in significant in this regard: the index of produced capital per worker increased 25-fold over 1850-2000, and the volume of machines and equipment per worker increased 1000-fold over 1800-2000 (supposedly well above the desired level), thereby depressing capital productivity to the minimum. The revival of profit rate and capital productivity (through residential capital growth replacing growth in other capital assets, or through negative growth of capital stock in the 2000s) was therefore the only way out of such state.

The changes in the relative prices of capital are likewise mentioned as a solution to falling capital productivity. Edvinsson (2010: 472) defined nominal capital/output ratio (the inverse of capital productivity) as $\Omega = \frac{P_k K_{volume}}{P_Y Y_{volume}}$, where numerator is a product of capital prices and physical volume of capital, while denominator is a product of GDP deflator and volume of output, thereby implying that decrease in capital prices results in the decrease of nominal capital/output ratio (Ω) and increase in capital productivity and profit rate. The cheapening of investment goods taking place starting

from the 1980s (Eichengreen, 2015), resulted in the attempts by the corporate sector to stabilize prices of capital goods and in the smaller use of capital and rising capital productivity and profit rate. This influence potentially played role in restorative process in the USA, Germany and Brazil.

5.5. International trade and exports of capital

The Kalecki's equation (Toporowski, 1999: 362-3) includes positive trade balance as one of the factor countervailing the fall in profit rates. Certain export-oriented economies (Germany) appeared to have quite stable profit rates. On the other hand Korea and Sweden that increased their export share (of GDP and share in international markets) experienced declining profit share (Korea in the recent two decades, Sweden over the course of the 20th century). Weiss (2015: 12) notes that in recent decades the substitution of financial assets for plant, property and equipment assets in the corporate balance sheets was taking place in certain exporting economies (that accumulated financial assets from international trade), resulting in the decrease in physical capital and improvement in profitability. The development documented in Germany in the 2000s does not seem to hold for Korea, where profit rate continued to fall.

Halevi and Kriesler (1996) mention another countervailing factor contributing to higher profitability - the export of capital from the economy experiencing low profitability. Maito (2014) argued that high capital accumulation rates in Germany and the USA and lower profit rate led these countries becoming major capital exporters, thereby restoring profit rates. The hypothesis may be justified for these economies; at the same time, the case of the UK (a major capital exporter that continued to experience falling profit rates) does not seem to yield support to the hypothesis.

With regard to profit rates in the countries-recipients of foreign direct investment and credits, the sustained flow of finance appears important in explaining sustained profitability in such countries as South Korea and Brazil in the 1960-70s. With sharp increase in international interest rates and the end of cheap funds in 1979, the two countries turned out to be among the most heavily indebted in the developing world, the factor contributing to the profitability falls in the 1980s. This explanation may be partial however, since Mexico despite debt crisis of the 1982 did not experience as sharp a fall in profitability. In this regard, an interaction of debt crisis with a second oil shock, both having negative effects on profits, can be hypothesized.

5.6. Effects of military expenditure on profit rates

Harman (1984: 38-49) and Kidron (1974) argued that greater military spending may have positive effect on the profit rate, by reducing productive capital accumulation in the economy and diverting capital into unproductive uses. Harman hypothesized that this factor was important in the earlier years of Cold War in the USA and to smaller extent in the UK and France. The profit rate series in the present paper do not seem to confirm this hypothesis: the profit rates spike was experienced in the UK and the USA during WWII, but not during Korean or Vietnam Wars. Nor did profit rates rose substantially during the new round of militarization in the early 1980s. Likewise, the reduction of arms spending in the early 1990s did not appear to have any sizeable effect of US profit rates. The possibility of indirect effects of arms production on profit rates is considered (Howard, King, 1992: 149-164): e.g. militarization accompanied by repression against organized labour may lower the real wage and labour share and

thereby raise profit rates. This could be one of the factors contributing to positive changes in profit rates in the USA during Korean War (1950-53) and the early 1980s. A similar hypothesis of continuous indirect effect of arms spending on profit rates through technical innovation spin-offs (Howard, King, 1992: 158) is, however, not seen in the series: economies with lower arms spending, e.g. Germany, exhibiting greater dynamism in profit rates than the USA (Szymanski, 1973).

5.7. International division of labour, competition and adaptation factors

Grinberg (2011) notes that capitalism is an international system: the process of capitalist development is essentially global, and only national in its form of realization. Profit rates and capital accumulation in a particular economy thus depend on how the economy integrates into world markets and on its role in international division of labour. Specifically, the availability of opportunities provided by the international market and production resources to capitalize on, as well as the ability to exploit opportunities are viewed crucial for value added creation, and steady rise in profits.

In this regard, the distinction is made 1). Between profit rates' patterns in the economies with relatively cheap, disciplined and skilled labour-power (Korea) or other production resources and advantages (size of market in the USA, access to bigger European market in Spain, advanced technologies in Germany) and economies that may lack one of these characteristics (Mexico, Brazil, UK); 2). Between economies, that faced favourable international competitive environment (the case of Korea in the 1960s) and the economies, that have been losing export markets and competitive advantage (the UK); and 3). Between the economies, that managed to transcend initial competitive advantage and diversify economy (Korea) and economies that did not achieve this (Mexico).

In a broader sense, the countries that adapt well to changing economic and political environment (through adaptation on the part of the business or the state) or attempt to improve their economic structure and position in international system will have higher profit rates, as an indirect effect. Examples of such adaptations and improvements include Korea, climbing the value chains (as opposed to Brazil and Mexico continuing to rely on land rent extraction); Germany, maintaining its manufacturing base (as opposed to the UK economy that becomes increasingly financialized); Germany, managing to re-establish its position in international system after WWII through European integration (as opposed to the UK, reluctant to join the process).

This interpretation may be valid in many but not all cases (e.g. Sweden experienced profit rates fall despite holding numerous production advantages and being quite competitive in general; and Korea that despite its outstanding performance in the 1960-70s did not escape profit rates' decline in the 1990s).

5.8. The limitations of conventional profit rates' indicators

Edvinsson (2005: 166) notes that low profit rates while being a harbinger of crisis, are not always or necessarily accompanied by falling output, and instead may coexist with booming economy. We observe this phenomenon in the case of German economy growing rapidly in the early 1870s: the fall in the profit rate was offset by other propitious developments, national unification, and creation of bigger internal market. Likewise, in the USA a profit rate fluctuating in 15-20% range since the early 1980s

corresponded to various periods – of solid growth in the 1990s, as well as of growth slowdown in the 2000s. The sharp fall in profit rate in 1979 in Korea did not bring growth to a halt, with economy continuing to grow solidly into 1980s and 1990s. This is in contrast to Brazil where profit rate did not fall as deeply as in Korea, but economic problems in the 1980s were substantial. Finally, in Mexico, the virtually stable profit rate in the 1950s to 1970s was accompanied first by a rapid growth, and then a slowdown in growth. Overall, the observation of the profit rates presented in this paper does not suggest deterministic or a "knee-jerk" relation between level of profitability and economy's performance.

Another limitation relates to the fixed capital stock as a basis for profit rate measurement. The structural transformations that developed and developing economies alike underwent in the recent decades, namely the rise of tertiary sector and the growing importance of intangible assets and human capital in value added creation, implies that conventional profit rate indicator potentially becomes less representative. Indeed as illustrated by Weiss (2015: 7) the proportion of financial assets in total assets of German corporate sector increased from 40% in 1970 to up to 60% in 2015. The similar changes are likely to be underway in other economies. The reconceptualization of economic activities in broader sense, where value added is created by human capital and non-fixed assets may thereby imply the need to calculate the profit rate on total economic assets (tangible and intangible).

Finally, a consideration of economy-wide profit rates may overlook the issue of profitability in particular sectors (branches) of the economy. Marina and Moseley (1998: 34) argue in the respect that certain stabilization of the profit rate in Mexico starting from the mid-1980s could be explained by increasing polarization of Mexican economy with profit rates in certain sectors diverging from the average figures for the whole economy. For instance, the closer economic integration with the USA could increase profitability in export-oriented sectors. Likewise, fluctuation of Spanish economy-wide profit rate within 20-30% range in the 1980-90s may be attributed to European integration process, differentially affecting economy post-accession.

5.9. Summary

The overview of profit rates and its determinants was conducted in a qualitative way. A more formal econometric analysis could identify the relative strength and influence of individual determinants of profit rates. The principal preliminary finding is that identification of a uniform pattern (e.g. fall in profit rates across all economies) or a single most important determinant was hardly feasible. One of the factors that could have sweeping effect on profit rates in most economies was the change in the organic composition of capital and capital productivity (the slowdown of OCC rise and capital productivity fall had restorative effect on profit rates in most economies). Certain country-specific factors, such as adoption of economic development strategies that allowed economy-wide growth in value added, and exploitation of "profit opportunities" provided by international division of labour, were crucial in distinguishing the economies that experienced sustained rises in profit rates.

6. Conclusion

The paper demonstrated that confirmation/disproval of the classical hypothesis is highly sensitive to the time frame selected. In general, classical hypothesis is supported

over longer time periods (in the case of data for the UK and Sweden) and is weakened if post-war data is used (developing economies in question, as well as post-war data for USA and Germany). It is possible that if additional data for early 20th century and pre-World War II period was obtained, the statistically significant trends could be present.

Overall, the empirical support for the classical hypothesis is rather weak even when sufficiently long time periods are considered. In most of the economies where structural breaks in the profit time series was not present (or not significant) the trend coefficients were not significant. Also, in economies the structural breaks were present together with insignificant trends, suggesting that classical hypothesis may not hold – the profit rates were not experiencing secular decline, but rather stepwise decline following structural breaks. This is in line with earlier insights by Runyon (1979) stating that decline of profit rates in 1970s was not a secular decline (as classical hypothesis postulates), but instead a decline from unusually high levels of profitability (i.e. stepwise decline).

We note three principal limitations of the modelling approach. Firstly, as noted by Maito (2013), the capital stock used to estimate rates of profit in this study included residential capital, which is not part of capitalist reproduction, rather than reproductive fixed capital alone. This may distort the empirical results of the study. Secondly, estimation of the profit rates was based labour compensation measure that did not include income of self-employed persons. This issue can be addressed by using appropriate method for imputing income of the self-employed. Thirdly, ZA and LP tests were rather imprecise in terms of timing of structural breaks, as well as type of break (permanent shift, temporary change, innovation outlier). This can be remedied through more systematic analysis of breaks, such as Bai-Perron or TRAMO methodology.

The modelling strategy adopted in this paper can be extended in several directions.

Firstly, the cyclical influences on the economy wide profit rates can be removed and trend and cycle factors can be distinguished. This is due to the fact that profit rates tend to decrease during recessions solely due to overhead costs (such as depreciation allowances) not falling proportionately to falls in income. The isolation of cyclical factors can be achieved through inclusion of capacity utilisation indicators in the trend regressions.

Secondly, a dataset containing capital stock, wage and profit share, and depreciation variables could be constructed that would include a broader range of economies, including periphery and developing economies. The dataset could then be used to examine cross-sectional pattern and the dynamics of the economy-wide profit rates in a developing context.

Thirdly, the time span of the profit rate series for several economies (Brazil, Korea, Mexico, Spain) used in this paper was limited to slightly more than 40 years. The review of time series econometric literature suggests that power of unit root tests is likely to be diminished if shorter samples are used. Respectively, the examination of profit rates in a panel framework (including the use of panel unit root tests) would probably be more advantageous.

Fourthly, there exists possibility than more than two structural breaks are present in the profit rate series and hence there are more than three profit rate regimes (and respectively more than three trend equations need to be estimated). In this regard,

future research in the area may employ unit root tests with a greater number of structural breaks, such as those proposed by Atkins (2002) and Ohara (1999).

Finally the methodological approach used in this paper could incorporate the countervailing factors that could prevent the rate of profit from falling. This can be achieved by either using Marxian categories (exploitation of labour, overpopulation, deviation of wage rate from the value of labour-power, and cheapening of constant capital relative to variable capital) that were empirically tested by Basu et al (2013), or Kaleckian categories (ongoing capital investment, rising fiscal deficits, mercantilist trade policies and increased consumptions by capitalists). Whether this approach could be adopted together with structural breaks analysis or instead of it requires further investigation.

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Appendix

Table 1. Unit root tests of the rate of profit series (Calculations for log of profit rate series)

Unit root test	Component	USA (1929-2008)	USA (1869-2010)	Sweden (1850-2000)	Germany (1868-1913)	Germany (1950-2011)	UK (1855-2009)	Spain (1954-2001)	Mexico (1950-1999)	Korea (1956-2005)	Brazil (1955-2005)	World (1955-2010)
ADF	Constant	-3.512	-4.218	-2.636	-2.631	-1.517	-0.420	-1.417	-1.539	1.229	-1.556	-0.979
ADF	Constant + trend	-3.478	-4.299	-3.240	-2.732	-1.174	-3.090	-1.301	-3.030	-0.890	-1.605	-2.195
DF-GLS	Constant	-3.420	-3.586	-1.669	-1.128	-1.532	0.370	-1.100	-0.702	0.230	-1.154	-0.462
DF-GLS	Constant + trend	-3.486	-3.917	-3.285	-2.275	-1.696	-2.271	-1.434	-3.111	-0.915	-1.697	-2.229
PP	Constant	-2.493	-3.423	-2.545	-2.806	-1.235	0.060	-1.580	-1.347	0.899	-1.556	-1.082
PP	Constant + trend	-2.476	-3.417	-3.487	-3.005	-1.271	-2.939	-1.706	-3.035	-0.616	-1.605	-1.532
KPSS	Constant	0.159	0.189	1.168	0.433	0.248	1.364	0.532	0.886	0.586	0.562	0.682
KPSS	Constant + trend	0.165	0.117	0.072	0.121	0.231	0.256	0.145	0.081	0.210	0.105	0.156
ERS	Constant	1.086	1.038	5.552	17.261	4.983	30.651	13.519	21.817	24.814	12.235	19.631
ERS	Constant + trend	3.820	3.203	5.437	14.498	26.145	10.675	19.684	6.543	34.127	15.706	9.768
MZα	Constant	-22.602	-24.823	-5.400	-2.430	-5.012	0.676	-2.181	-1.130	0.043	-2.496	-1.120
MZα	Constant + trend	-23.503	-29.331	-20.741	-7.572	-5.301	-9.862	-4.303	-13.924	-3.663	-5.556	-9.036
MZt	Constant	-3.361	-3.522	-1.634	-0.866	-1.486	0.394	-1.011	-0.534	0.015	-1.060	-0.502
MZt	Constant + trend	-3.427	-3.826	-3.048	-1.944	-1.569	-2.185	-1.380	-2.601	-1.057	-1.612	-2.125

Note: ADF - Augmented Dickey-Fuller test, DF-GLS - Elliott-Rothenberg-Stock DF-GLS test; PP - Phillips-Perron test; KPSS - Kwiatkowski-Phillips-Schmidt-Shin test; ERS - Elliott-Rothenberg-Stock test; MZa and MZt - Ng-Perron tests Stationarity (trend stationarity) statistics are put in bold and italics. All statistics are compared to tests' 5% critical values.

Table 1a. Unit root tests of the rate of profit series (Calculations for original profit rate series)

Unit root test	Component	USA (1929-2008)	USA (1869-2010)	Sweden (1850-2000)	Germany (1868-1913)	Germany (1950-2011)	UK (1855-2009)	Spain (1954-2001)	Mexico (1950-1999)	Korea (1956-2005)	Brazil (1955-2005)	World (1955-2010)
ADF	Constant	-3.362	-3.345	-2.597	-3.103	-1.581	-0.663	-1.395	-1.688	-0.845	-1.505	-0.915
ADF	Constant + trend	-3.382	-3.389	-3.106	-3.112	-1.278	-3.551	-1.336	-3.115	-2.022	-1.538	-2.096
DF-GLS	Constant	-3.186	-2.721	-1.292	-1.046	-1.601	0.288	-1.069	-0.717	-0.996	-0.955	-0.402
DF-GLS	Constant + trend	-3.289	-3.035	-2.981	-2.276	-1.803	-2.606	-1.466	-3.154	-1.679	-1.617	-2.128
PP	Constant	-2.466	-2.828	-2.606	-3.288	-1.318	-0.483	-1.551	-1.530	-0.696	-1.540	-1.114
PP	Constant + trend	-2.472	-2.855	-3.296	-3.458	-1.367	-3.659	-1.666	-2.954	-1.673	-1.643	-1.464
KPSS	Constant	0.175	0.144	1.239	0.441	0.254	1.420	0.559	0.896	0.513	0.605	0.679
KPSS	Constant + trend	0.157	0.114	0.121	0.113	0.231	0.054	0.147	0.085	0.185	0.099	0.157
ERS	Constant	1.271	1.859	9.311	23.231	4.597	38.203	14.032	23.187	6.955	17.143	22.371
ERS	Constant + trend	4.419	5.335	6.502	17.948	22.739	8.412	19.107	6.682	19.638	17.145	11.190
MZα	Constant	-19.650	-14.412	-3.349	-1.865	-5.615	0.465	-2.088	-1.108	-3.477	-1.756	-0.901
MZα	Constant + trend	-20.782	-17.744	-17.894	-7.015	-6.008	-12.385	-4.449	-14.149	-6.135	-5.088	-7.887
MZt	Constant	-3.3134	-2.679	-1.264	-0.736	-1.567	0.316	-0.980	-0.530	-1.113	-0.839	-0.438
MZt	Constant + trend	-3.222	-2.974	-2.793	-1.872	-1.678	-2.489	-1.408	-2.612	-1.660	-1.542	-1.982

Note: ADF - Augmented Dickey-Fuller test, DF-GLS - Elliott-Rothenberg-Stock DF-GLS test; PP - Phillips-Perron test; KPSS - Kwiatkowski-Phillips-Schmidt-Shin test; ERS - Elliott-Rothenberg-Stock test; MZa and MZt - Ng-Perron tests
Stationarity (trend stationarity) statistics are put in bold and italics. All statistics are compared to tests' 5% critical values.