

István Magas

# *Economic Growth and Changes in Capital and Labour Income in the USA (1988–2016)*

## *Additional Information to the Piketty Thesis*

**SUMMARY:** The significant political changes which have occurred both in the USA and Europe over the past one and a half years as well as the stabilisation of processes in the world economy have raised the question again: How reliable is the Piketty thesis ( $r > g$ ) regarding the forecast of income distribution processes by future growth and production factors? After the publication of his world famous book in English (Piketty, 2015), Piketty asked himself the aforementioned question again. He thought that his statement in his original thesis was shrouded in uncertainty. This study provides empirical data to the modified Piketty thesis. After an overview of the original theoretical starting points, the growth, productivity and factor income dynamics of the American private sector between 1988–2016 is analysed. The most important conclusion is that the variations of growth and return to capital differ, the  $(r-g)$  difference varies, and in the almost three decades in review considerable substitution effects can be identified between capital and labour in line with the CES type neoclassical production function. The persistently low interest rate environment is likely to increase non-financial investments, which may lay the foundations for a steadier long-term growth trend. In view of the above, mainstream criticism related to the Piketty thesis is often true.

**KEYWORDS:** CES production function, elasticity of capital-labour substitution, factor income

**JEL CODE:** A10

In Chapter 3 of the World Economic Outlook published by the International Monetary Fund (IMF) in April 2017, it was stated that the percentage of labour income in the GDP (in its income segment) has been shrinking since the mid-1980s, though not steadily. The main reasons for shrinking are technological progress and deepening commercial and financial integration. The decrease of labour income to GDP reached nearly 4 percentage

points in developed countries (it fell from 55% in 1988 to 51%). On the other hand, there was a slight increase in developing countries due to global commercial and financial integration as well as the deepening division of labour. In a strictly economic sense, the percentage of labour income decreases within the total if the growth of nominal wages is steadily slower than the rate of productivity expansion (In fact, the rate of wage growth is slower than the output growth per working hour). The evolvement of this unfavourable process,

*E-mail address:* [istvan.magas@uni-corvinus.hu](mailto:istvan.magas@uni-corvinus.hu)

namely the permanent difference between the growth of wages and productivity, means that efficiency growth mainly increases capital income. The appearance of capital ownership is principally typical of upper income deciles, considering total income distribution, therefore the decreasing wage ratio results in growing disparity in income distribution. As far as developed countries are concerned, based on the calculations of IMF (IMF, 2017), almost half of the decrease in wage ratio is due to technological changes or, more precisely, to substitution effects of production factors caused by technical progress. Consequently, the substitution of labour, automation and robotisation are behind this process. The birth of big global value chains and the spread of multinational company networks brought about noticeable change already in the 1970s. Owing to this prominent global economic process, labour-intensive sectors and industries moved to countries with lower wages. As a result, the rate of labour income has dropped in countries with higher wages, especially in labour-intensive industries. Over the past few decades, this process has further intensified, therefore in developed industrial countries, technological progress along with the expansion of international trade account for 75% of the drop in the labour income ratio (e.g. in Germany and Italy). Even in the USA half of the decrease is linked to such factors. As the American economy is considered to be the most developed economy in the market of production factors, especially in the labour market, at least as far as the mobility of human factors within the country and its technical, legal, geographical and infrastructural conditions are concerned, we focus on the details of the American transformation trends. Our starting point is *Thomas Piketty's* concept on the roles of capital, which many experts consider to be revolutionary.

The debate triggered by *Capital in the*

*Twenty-First Century*, a book selling more than 2 million copies and written by Thomas Piketty, a French professor of economics, according to the English weekly *The Economist* the “modern Marx”, is still heated in academic circles. Strangely enough, the prominent liberal-conservative newspaper of a more-than-a-century-long history, founded in 1843, intended to praise the author by drawing a parallel between him and Marx, rather than criticise him in an ironic manner when the English translation of the book was published three years ago. According to *The Economist*, Piketty's analysis should be taken seriously.<sup>1</sup> However, the newspaper warned that the economic policy lessons of the bestseller should be treated carefully. As if the warning had been a legitimate demand. After the publication of the book, Piketty's theses were hoped to start an “ideological revolution”, but they had no power to shake mainstream ideology in any significant way. Although this hope might have seemed reasonable based on the reactions which have not calmed down since the publication of the theses. Looking back, however, their effect on mainstream ideology was moderate. This moderate effect is reflected by a new book published by Harvard University (Boushey, H., DeLong, B. & Steinbaum, M., 2017), whose length is as imposing as that of *Capital in the Twenty-First Century*. Though its renowned authors acknowledge the outlines of the historical perspective presented by Piketty, they throw light on several weaknesses of the technical details of Piketty's model and conceptual reasoning.

For example, *Devesh Raval* [in: Boushey, H., DeLong, B. & Steinbaum, M. (eds.) 2017] criticises Piketty's basic hypothesis, claiming that the French author assumes the elasticity of capital-labour substitution to be more than a unit, that is 1, generally allowing unbroken capital accumulation. In agreement with several other authors, Raval notes that

the elasticity of substitution is often less than a unit. In our review of the American capital and labour income statistics from the past 30 years, we wish to represent the “mainstream” viewpoint that allows a high-level of variability of the factors of production.

“*Putting Distribution Back at the Center of Economics: Reflections on Capital in the Twenty-First Century*” was the title of the study written by Thomas Piketty, published in the first issue of the *Journal of Economic Perspectives (JEP)* in the winter of 2015 (Piketty, 2015). *Capital in the Twenty-First Century* was published in English by Harvard University Press in 2014, while the Hungarian version was published by Kossuth Publishing House in Budapest, in 2015. The renowned French author intended to “defend” and partly correct and spread his views in the leading American journal, reacting to fierce criticism following his work that had been published in English a year earlier.

As we know, the main idea of the book published in 2014 was the following: If the return to capital ( $r$ : return to capital) used in production steadily exceeds the growth of the total output (GDP) ( $g$ ), that is  $r > g$  on a permanent basis, the income and wealth inequalities will be destined to increase *indefinitely over time*. In his writing referred to above (JEP 2015), the author softened his claim. As far as the change of inequalities is concerned, despite the fact that Piketty still emphasises the importance of the  $(r-g)$  difference, considering it to be a key parameter when retrospectively examining 19th and 20th century processes, he seems to be withdrawing the penetrating, universal force of his basic hypothesis, claiming:

*“I do not view  $r > g$  as the only or even the primary tool for considering changes in income and wealth in the 20th century, or for forecasting the path of income and wealth inequality in the 21st century. Institutional changes and political shocks – which can be viewed as largely exogenous to the inequality and development process*

*itself – played a major role in the past, and will probably continue to do so in the future. In addition, I certainly do not believe that  $r > g$  is a useful tool for the discussion of rising inequality of labor income: other mechanisms and policies are much more relevant here, for example, the supply and demand of skills and education. One of my main conclusions is that there is substantial uncertainty about how far income and wealth inequality might rise in the 21st century.”*<sup>2</sup> (Piketty, 2015, pp. 67–68)

The above significantly modify Piketty’s original viewpoint, “withdraw” it to a certain extent, especially as far as the forecasting ability of his model is concerned.

This article seeks to provide additional information to this modified viewpoint. After an overview of Piketty’s original theoretical considerations, we highlight some problematic points, which even Piketty himself mentioned. The legitimate doubts are illustrated with some empirical examples in the course of the examination of the capital and labour income processes over a period of economic growth of nearly 30 years (from 1988 to 2016) in the United States.

The focus point of the analysis is the assumption of greater capital/output and capital/labour variability. When examining the possibilities of the substitutability of factors in production, depending on the elasticity of capital/output ratios, even Piketty makes a brief reference to the so-called Cambridge capital debate that took place decades earlier. During the original debate, each participant assumed greater capital/output variability (Piketty, 2014, pp. 230–232). I would like to add that the marginal productivity of production factors and the production function played a key role in these debates, especially in the assessment of the marginal return to capital. The following statement is an essential element of our argumentation: If we accept the rate/power of marginal return to capital in the

case of the CES-type (Constant Elasticity of Substitution production function), the same cannot be excluded in the case of the marginal productivity of labour, either.

In spite of the fact that the standard neo-classical model of economic growth [ $Y = f(K, L)$ ] provides satisfactory explanation for *growth-accounting* by clearly separating the most important factors, it fails to provide the real dynamics, a possible description suitable for forecasting in respect of the estimation of the effects of investment and factor income. In this respect, we wish to confirm *Medvegyev's* statements (2015) related to the different variation of the rate of the return to capital ( $r$ ) and the rate of growth ( $g$ ). Regarding adaptation to the labour market, especially the arising frictions, we rely principally on the modern works of *Kónya* (Kónya, 2015 and Jakab–Kónya, 2012). When examining the dynamics of growth, productivity and factor income in the private sector of the American economy, excluding agriculture, over a period of nearly three decades, we provide, inter alia, statistical information to such adaptations to the labour market.

The second part of the study presents a theoretical starting point for the most disputed issues by the mainstream. The third part examines statistics related to the change of the American output, productivity and factor prices between 1988–2016. The article ends with a summary and conclusions.

## THEORETICAL CONSIDERATIONS

### Theoretical considerations: the fundamental logic of distribution dynamics according to Piketty

In Piketty's book, the dynamics of income distribution is based on two basic equations: (2) and (3). These two equations are based on

another equation (1) expressing the ratio of the section of the total available capital stock ( $K$ ) and the output aggregated net income ( $Y$ ) at the level of the national economy as follows:

$$K/Y = (R/Y)/(R/K) \quad (1)$$

where  $R$  represents non-wage income, while  $K$  represents capital stock.

$$\beta = \alpha/r \quad (2)$$

where  $\beta$  represents the aggregated capital/income ratio, which in fact means the capital/output (or as it is often called the capital/production ratio – hereinafter referred to as capital/output, that is  $K/Y$ ;  $\alpha$  represents the ratio of non-wage income to the total income;  $r$  represents the ratio (return) of capital income to the total capital ( $K$ ). It should be emphasised that Piketty uses the term 'capital' in a broader sense: "*In this book, capital is defined as the sum total of non-human assets that can be owned and exchanged on some market. Capital includes all forms of real property (including residential real estate) as well as financial and professional capital (plants, infrastructure, patents etc.)*" (Piketty, 2014, p. 46) Capital includes natural resources, raw materials, however, it does not involve valuable consumer goods, assets representing accumulated values (paintings and works of art), which, according to Piketty's reasoning, constituted 36–60% of the total treasured income.<sup>3</sup>

Perhaps one of the most important empirical results of Piketty's book is the following: If you examine the behaviour of the two key variables ( $\beta$  and  $\alpha$ ) over the past two centuries, you see that they form a U-shape. In the case of the capital/output ( $K/Y$ ) ratio, the capital requirement of production was constantly increasing mainly owing to the permanently high level of the return to capital ( $r$ ). As the rising

capital/output ratio can be considered to be the natural state of capital growth dynamics, according to Piketty’s argumentation, a period of permanent decrease or of long-lasting flat increase is an interregnum that evolved in the decades after the Second World War and lasted until the mid–80s (i.m. pp. 193–203). Referring to those years in which difficulties arose related to the accurate measurement of the accurate percentages of non-wage income, Piketty determined a plausible  $r$  amounting to 5% in general. As a result,  $\alpha$  will also be an artificially generated number, depending  $\beta$  and  $r$ . As Piketty explains in many places, equation (2)  $\beta = \alpha/r$  can be interpreted in a different way, according to which it expresses the percentage of capital income compared to the total national income, provided  $r$  is known. According to another interpretation, the equation expresses the percentage of the return to capital provided  $\beta$  and  $\alpha$  are known. Our choice of calculation depends on which parameter is easier to estimate (Piketty, 2014, p. 169).

Piketty summarises his most important empirical observation as follows: In the long run, the *pure rate of return to capital* stabilised at around 4–5% (Piketty, 2014, p. 202). However this pure rate of return to capital is not risk-free return at all, but the aggregated average cost of the use of the capital (Piketty, 2014, p. 200, p. 208). If the return is not risk-free, Medvegyev’s argumentation cannot be ignored: “...in the case of non-deterministic values, the average growth rate largely depends on the variation, i.e. the risk undertaken.” In other words, one of the possible reasons for the  $r > g$  inequality may be the difference between variations behind  $r$  and  $g$ . The assumption that the variation of  $r$  significantly exceeds the variation of  $g$  does not seem to be out of touch.” (Medvegyev, 2015, p. 952). Based on the American statistics, the assumption above seems to be verified.

Regarding long-term distribution dynamics, equation (3) is even more important:

$$\beta = s/g \tag{3}$$

where  $s$  represents the net savings rate (after depreciation) compared to the total gross national income and  $g$  represents the increase of the annual gross national income.

Piketty described the following logic of growth-distribution:

If the level of net private savings is given at a given point in time ( $t$ ) ( $S_t$ ), it is equal to the growth of the capital stock ( $\Delta K_t$ ), then:

$$\Delta K_t / \Delta Y_t = (S_t / Y_t) / (\Delta Y_t / Y_t) = S_t / g_t \tag{4}$$

where  $\Delta Y_t$  represents the change in  $Y$  at  $t$ .

Later, Piketty claims that the aforementioned ratio is the same as the capital/output ratio at  $t(\beta_t)$ :

$$K_t / Y_t = \Delta K_t / \Delta Y_t \tag{5}$$

and:

$$\Delta Y_t / Y_t = \Delta K_t / K_t \tag{6}$$

which means that equation (3) is valid only when  $\beta$  is considered to be steady or if we assume steady state growth, during which  $\beta$  stably and asymptotically converges with an infinite level if  $g$  and  $s$  are given.

$$K_{t+1} = K_t + S_t \tag{7}$$

Take  $Y_{t+1} = (1+g_t)Y_t$ , and divide formula (7) by  $Y_{t+1}$ .

$$\beta_{t+1} = K_{t+1} / Y_{t+1} = (\beta_t + S_t) / (1+g_t) = \beta_t [1 + (S_t / \beta_t)] / (1+g_t) \tag{8}$$

After a slight algebraic change, we get the formula  $(S_t / \beta_t)$ , which indicates the rate of annual wealth increase. Supposing  $(S_t / \beta_t) = g_t$ ,  $\beta$  steady if  $s$  and  $g$  are stabilised at a con-

stant value, which means that  $\beta$  will drop or  $\beta_t$  will converge with  $s/g$ . This convergence is the most important feature of Piketty's distribution dynamics, the ( $\beta=s/g$ ) equation (3) (Piketty, 2014, pp. 166–169, a further technical appendix is available on the author's own website: <https://piketty.pse.ens.fr/capital21c>).<sup>4</sup>

When using equation (3) and calculating with  $\beta$  values instead of the existing  $s$ ,  $g$  values (e.g. Piketty, 2014, pp. 166–167), Piketty compared various steady states with constant but different capital/output values. Moreover, the equation  $s=\Delta K$  is correct only when, in the set of all the assets, asset prices are constantly changing, e.g. the prices of raw materials, the yields of financial assets and other types of capital income are constantly increasing. Otherwise, the value of the capital acquired in the given year shall be considered as the current value of the capital, instead of its current market value. The latter, as the current price may significantly differ from the acquisition values upwards or downwards, as well, may cause a serious assessment problem. Piketty was aware of it, therefore he called it the German paradox (Piketty, 2014, pp. 144–146).

Although the  $\beta$  defined by Piketty compares assets based on their market value (Piketty, 2014, p. 149), he tries to use this  $\beta$  and compare it with  $g$  representing growth, then estimate an empirical savings rate. However, his method raises theoretical as well as practical problems. In view of the above,  $s$  cannot be more than an aggregated index of savings rate which includes *capital gain* at market price (the dividend paid and the collectable lease etc.).

After clarifying the points above, it is worth reviewing briefly what the determining causality is characterised by in Piketty's concept.

Piketty does not allow the free substitution between capital and work. However, if we accept the rate/power of marginal return to

capital in the case of the CES-type (Constant Elasticity of Substitution) production function, the same should be accepted in the case of the marginal productivity of labour, as well. Piketty tries to solve the controversy by limiting the range of the elasticity of substitution in a way that both  $\beta$  and  $\alpha$  increase in time. If the elasticity of capital/labour substitution is higher than 1, based on the CES production function:

$$Y = [xK^{(\sigma-1)/\sigma} + (1-x)L^{(\sigma-1)/\sigma}]^{\sigma/(\sigma-1)} \quad (9)$$

where  $K$ ,  $L$  are standard variables (output, capital, labour),  $x$  is a positive parameter ( $0 < x < 1$ ), while  $\sigma$  represents the elasticity of substitution. The capital marginal productivity is  $x\beta^{(-1/\sigma)}$ , and the capital ratio in production is  $\alpha = r\beta^{(\sigma-1)/\sigma}$ . The  $\sigma > 1$  criterion ensures that both  $\alpha$  and  $\beta$  grow with the output.

Piketty adds that both key variables have been rising since 1970, which may be due to the fact that the bargaining power of the labour force has significantly increased over the past four decades (Piketty, 2014, p. 221).

According to Piketty, the logical chain of key variables, the causality itself, is the following: In equation (3) ( $\beta = s/g$ ), the growth rate of the GDP ( $g$ ) can be considered as a dependent variable, as the rearranged equation (3) is:  $g = s/\beta$ .

Based on the above, Piketty interprets the determination of variables according to the traditional supply concept, in which the potential output productivity is the key factor, and the per capita productivity growth and the net expansion of the labour force constitute the source of economic growth. However, the acceptance of this concept is equivalent to the confirmation of the neoclassical growth theory and the logic behind marginal productivity, as other experts also emphasise, referring to recent empirical works (Baushey et al., 2017). Inter alia, part 3 of the study contains

statistics which can be interpreted by means of this logic.

Piketty considers the savings rate ( $s$ ) to be an independent variable, as well. The change of the aforementioned two independent variables ( $s$  and  $g$ ) determines  $\beta$ , i.e. the rate of wealth increase. If  $g$  and  $s$  represent stable values, they determine the *steady state* of the change of  $\beta$  in the long run. The capital/output represents the capital intensity ratio of production, therefore it is an independent variable, as well.  $\sigma > 1$  is a restrictive condition, which ensures that  $\beta$  and  $\alpha$  grow simultaneously.

### Further theoretical considerations

If economic growth is expected to slow down in general in the 21st century, especially owing to decreasing demographic and productivity factors in developed countries, the increase in the difference ( $r-g$ ) seems to be likely. From a purely theoretical point of view, however, the slowing-down of economic growth, that is the decrease of  $g$  and the change of the ( $r-g$ ) difference, is not obvious at all. Change can occur in both directions: the difference may increase, but may also decrease depending on how the change in  $g$  affects the long-term return to capital ( $r$ ). However, the expected return depends on the change of several factors: on the change in people's willingness to save, the possibility for substitution provided by technology in several sectors, the possibility for substitution of labour by capital, as well as on the changing bargaining power of institutional or production factors – but principally of labour –, as it was pointed out in the case of several countries Acemoglu & Robinson, 2012).

In general, the lower value of  $g$  can be the result of demographic change or slowing productivity. In fact, it leads to a higher capital/

output ratio,  $\beta=K/Y$ , as well as to lower return to capital,  $r$  (supposing that the technological conditions are the same, at least in the *steady state* model). Considering a simplified case, in which we calculate with a fixed (exogenous) savings rate ( $s$ ), the capital/production ratio [ $\beta=s/g$ ] will increase, while  $g$  will decrease even in this *steady-state* process. Supposing that the competition is perfect and the return of scale is steady, depending on the CD production function, the fact whether the decrease of the return to capital ( $r$ ) compensates for the drop of  $g$  or exceeds it is conditioned by the elasticity of substitution. If the substitution of labour by capital is relatively easy, which has become typical of the past century due to robotisation, IT developments and the spread of capital intensive technologies, it may get even more wide-spread in the 21st century (IMF, 2017). The return to capital ( $r$ ) is falling relatively slowly, as  $\beta$  is growing, therefore the ( $r-g$ ) difference, along with a lower  $g$ , is supposed to be greater. At the same time, it is obvious that models supposing perfect mono-product competition are not very practical for empirical observations. In the multi-sector model where modern capital intensive industries (including the real estate or the energy industry) play a significant role, the more extensive alternatives of capital/labour substitutability and possibilities for changes in the relative factor prices are possibly more visible (Karabounis & Neiman, 2014). Moreover, in multi-sector models, the intersectoral rates of elasticity of substitution may be much higher than the elasticity within the sector.

A permanently low international interest rate environment is likely to increase the long-expected purchases of non-financial assets, as well as stimulate new fixed capital investments not only in the US and Europe, but also in Asia, with China playing a key role. In a possible new global economic situation, due

to the new, internationally harmonised infra-structural investment boom, the permanently slow growth period, which is typical all over the world, may be replaced by a longer period promising a permanently higher rate of economic expansion, in which  $g$  may reach a much higher level. Such a consequence may shed new light on the long-term change of  $(r-g)$ .

To sum up, the results considered to be likely according to the Piketty distribution dynamics are very questionable due to the arising theoretical problems and forced simplifications. This fact was admitted by Piketty himself in his aforementioned JEP article:

*“If we combine all these different effects, it is clear however that there is no general, universal reason why  $r - g$  should increase as  $g$  declines: it could potentially go either way. Historical evidence and new technological developments suggest that it should increase, ... but I fully agree that this remains relatively uncertain....”* (Piketty, 2015, p. 82).

This admitted multi-factor uncertainty related to measurements and forecasts seems to appear based on the American growth and factor income statistics from the past 30 years. Below the study will present such statistics.

### GROWTH, TOTAL FACTOR PRODUCTIVITY AND PRODUCTION FACTOR INCOME IN THE PRIVATE SECTOR, IN THE UNITED STATES (1988–2016, NOT INCLUDING AGRICULTURE)

By examining the dynamics of economic growth in the almost three-decade-long period between 1988–2016, the following conclusions can be made based on *Figures 1 and 2*.

**FIRSTLY:** The top line of Figure 1 shows that as opposed to the strong economic growth (with an annual average of 4%) in the period between 1988 and 2000, a considerable de-

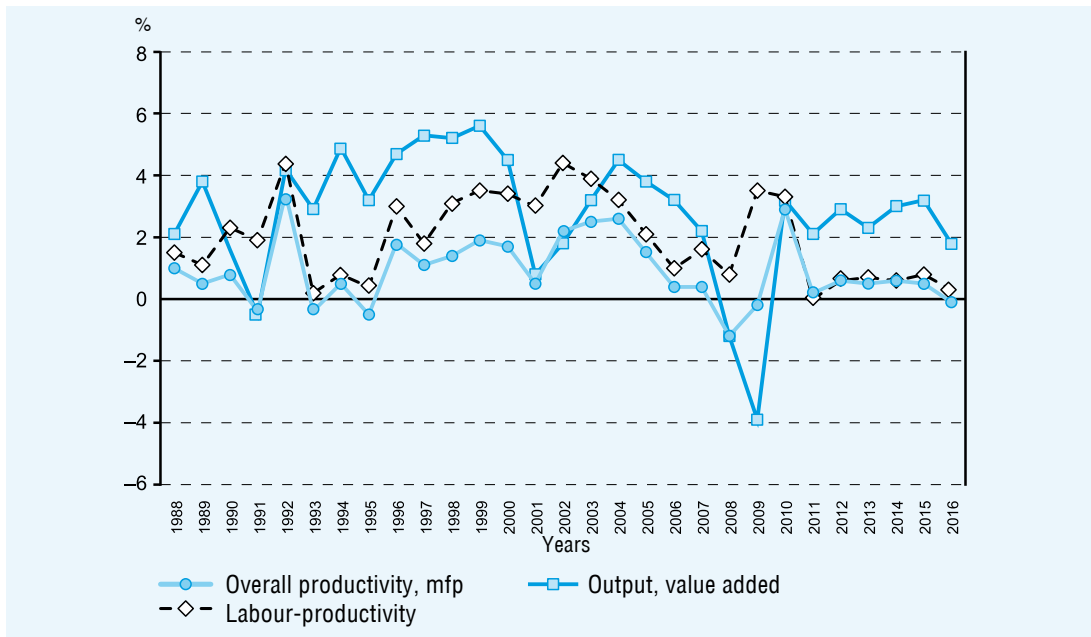
cline in the dynamics of the annual average output expansion characterised the period between 2001 and 2016. The annual economic growth was only 1.8% over the past one and a half decades. However, this average was dramatically deteriorated by the crisis of 2008–2009, which brought about a 0.5–4% drop. It is conspicuous that after 2001, in the American private sector, the growth levels of labour productivity and total factor productivity both have lost the momentum that had characterised them in earlier decades. Currently, the MFP power that could lay the foundation for an annual growth of at least 3% is hardly observable. A study published by the Committee for Responsible Federal Budget (CRB) found the same. According to the estimate of the study the return of the negative output consequences of unfavourable demographic processes would require an annual MFP expansion of min. 2.3% on average over at least 10 years.<sup>5</sup> At the same time, this goal will be very hard to reach, as there has not been a 10-year long period since 1949 in the history of the US economy in which this desired high average was reached. Moreover, it is remarkable that productivity is generally slowing in all OECD countries: Between 2005 and 2015, the output expansion/working hour was 0.9%, while it was 1% in the USA. In view of the above, this difference is not expected to grow steadily and considerably in favour of the USA in the next 5–10 years.

**SECONDLY:** If the 28 years are considered to be one period, the decreasing trend in growth, as the negative slope of the linear trend curve indicated in *Figure 2*, is plastically visible, although the annual variation is over 2%. As far as the assumption of a decrease in  $g$  in the USA over the examined period is concerned, Piketty was basically right. Although the decline was caused by several reasons, the most important ones are the slowing down of labour productivity (this slowing trend is



Figure 1

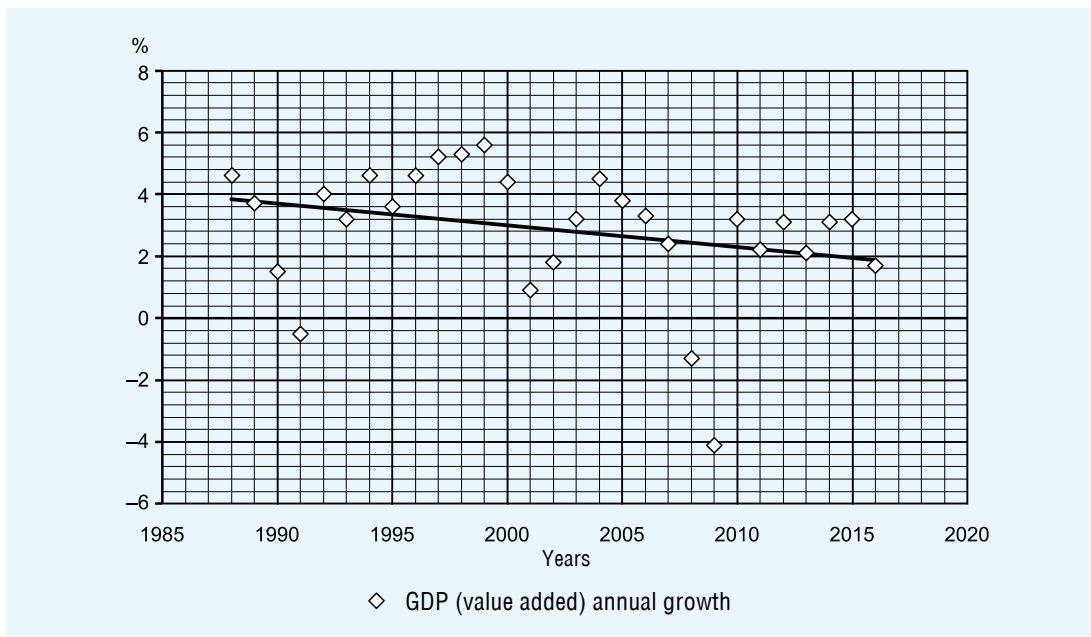
**OUTPUT, LABOUR AND TOTAL FACTOR PRODUCTIVITY (MFP) IN THE AMERICAN PRIVATE SECTOR (ANNUAL CHANGE, PERCENTAGE) 1988–2016**



Source: own edition (data: Bureau of Labor Statistics, BLS, March 2017)

Figure 2

**THE SLOWING TREND OF GROWTH IN THE USA, 1988–2016 (YEAR/YEAR, PERCENTAGE) (PRIVATE SECTOR, NOT INCLUDING AGRICULTURE)**



Source: own edition (data: Bureau of Labor Statistics, BLS, March 2017)

highlighted by *Figure 4*) and the unfavourable changes in demographic factors, as the neo-classical growth model also explains.

As we have already said in the theoretical part, the Piketty thesis explaining distribution dynamics relies on the  $(r-g)$  difference, as the most important variable examined. Based on the official growth and capital income statistics of the US private sector, excluding agriculture, this key variable representing the difference between annual capital income and economic growth, behaved in a very “strange” way.

The assumption according to which the difference of return to capital and the annual economic growth is fundamentally increasing, is much weaker empirically, at least in the USA. Based on *Figure 3*, the  $(r-g)$  difference had various positive and negative values, showing only a slightly rising trend, with a high 3.34%(!) variation. This can hardly be called a powerful trend in the American private sector between 1988 and 2015, especially not one that will continue determining the income and wealth distribution tendencies in the rest of the 21st century, in particular by the permanent  $(r-g)$  difference. In the period investigated, as a proof of Medvegyev’s observation (2015), the variation of capital income (3.4%) was significantly higher than the variation of output growth (2.1%).

Piketty himself pointed out in his aforementioned JEP study (Piketty, 2015) why he became uncertain on a theoretical level. He believed that the changing productivity and profitability of capital and labour, the substitution effects between technological development, bargaining power and production factors were the most important uncertainties.

This paper will describe such substitution related uncertainties below through the empirical analysis of the features of the production factor markets in the American private sector.

First, we will analyse nominal income earned in dollars.

*Figure 5* shows the change of nominal capital and labour income year/year between 1988–2015. Based on *Figure 5*, the years in which capital income exceeded labour income were prevailing. Actually, capital income grew 15 times faster than labour income over the 27 years examined. At the same time, there was a 12-year-long period during which the opposite happened: the growth of compensation for labour in current USD exceeded that for capital. It can also be established that the decline in labour income was recordbreaking low (–6%) in 2009, during the crisis, while capital income shrank only by 4%.

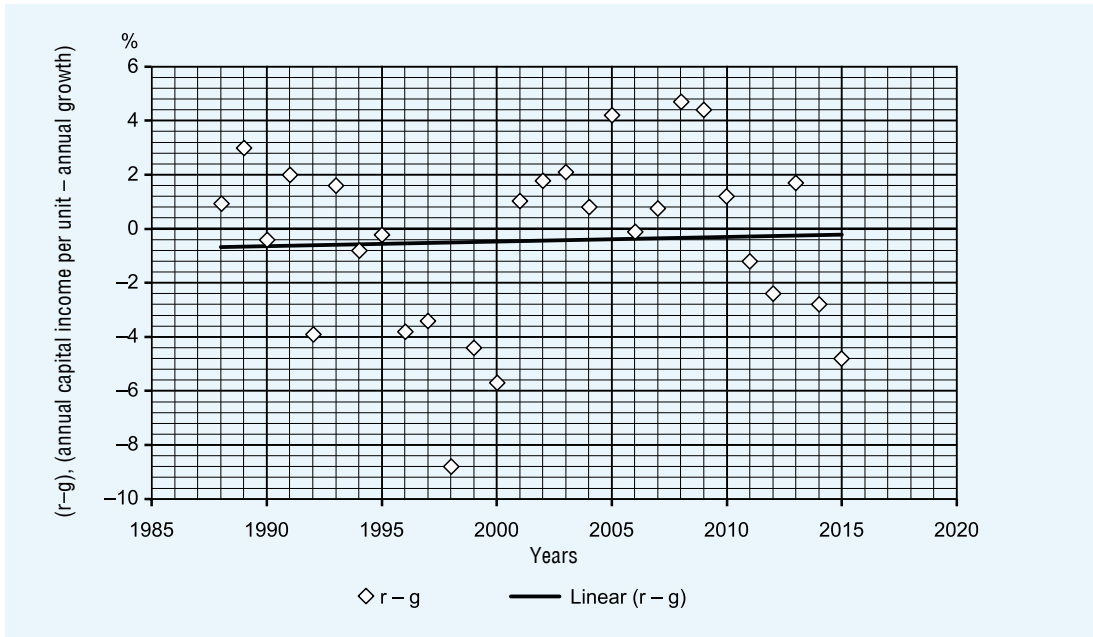
*Figure 6* shows the change of *unit-capital income* and *unit labour cost* corrected by productivity in the same period, between 1988 and 2015. Based on *Figure 6*, it is obvious that the annual growth of capital income did not dominate the period: in 14 out of the 27 years examined, the unit labour cost grew faster, while in 13 years capital costs grew at a faster pace. Based on the above, the relative weight of production factors on the cost side changed relatively evenly, which suggests the presence of a substitution effect, as well as the absence of a clear crowding out effect and steady/permanent return to capital dominance. It can be reasonably assumed that the majority of effects limiting the growth of labour productivity also appeared.

In view of the above, of course, in a theoretically substantiated manner, it is worth examining whether there was permanent interaction or any typical tendency for substitution between the two production factors, capital and labour. *Figure 7* illustrates such changes:

*Figure 7* illustrates the correlation in the form of a scatter diagram, in which the annual change of unit capital income is running along  $x$  axis, while the annual change of

Figure 3

**THE DIFFERENCE BETWEEN CAPITAL INCOME AND OUTPUT DYNAMICS (R-G) IN THE USA, 1988-2015**



Source: own edition (data: Bureau of Labor Statistics, BLS, March 2017)

Figure 4

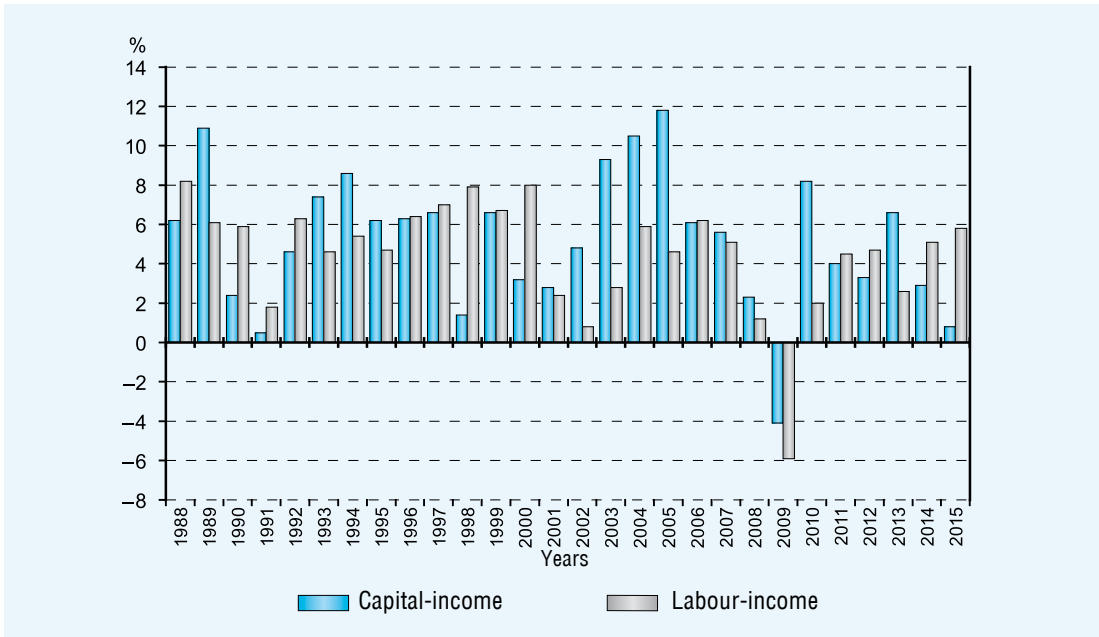
**THE SLOWING LABOUR PRODUCTIVITY IN THE USA 1988-2016 (YEAR/YEAR, PERCENTAGE)**



Source: own edition (data: Bureau of Labor Statistics, BLS, March 2017)

Figure 5

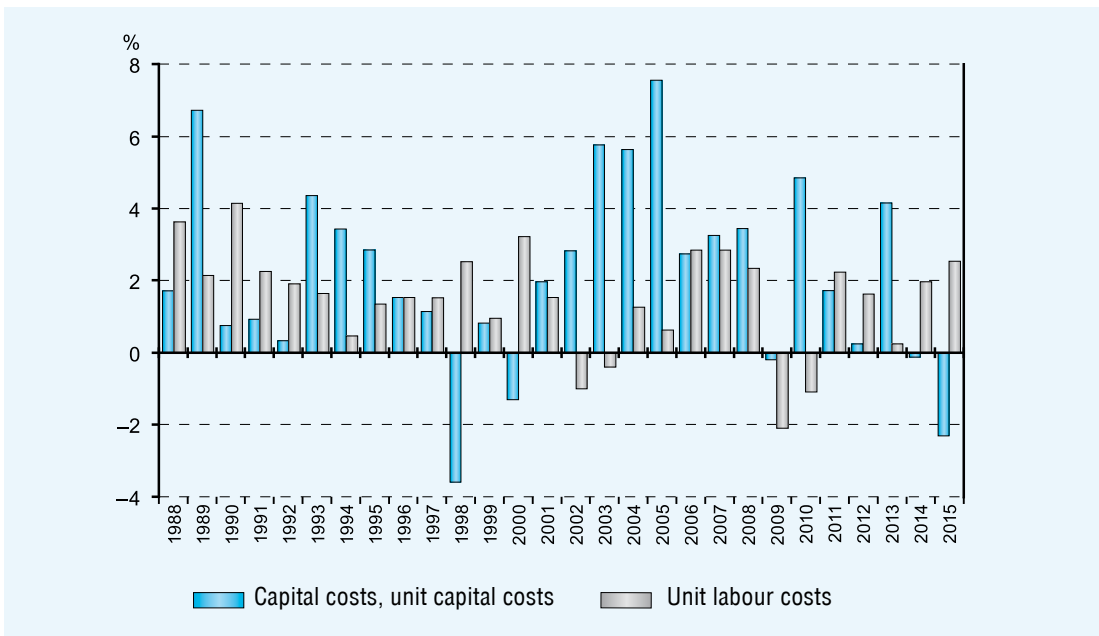
**THE CHANGE IN NOMINAL CAPITAL AND LABOR INCOME IN THE USA, 1988–2015 (YEAR/YEAR, PERCENTAGE)**



Source: own edition (data: Bureau of Labor Statistics, BLS, March 2017)

Figure 6

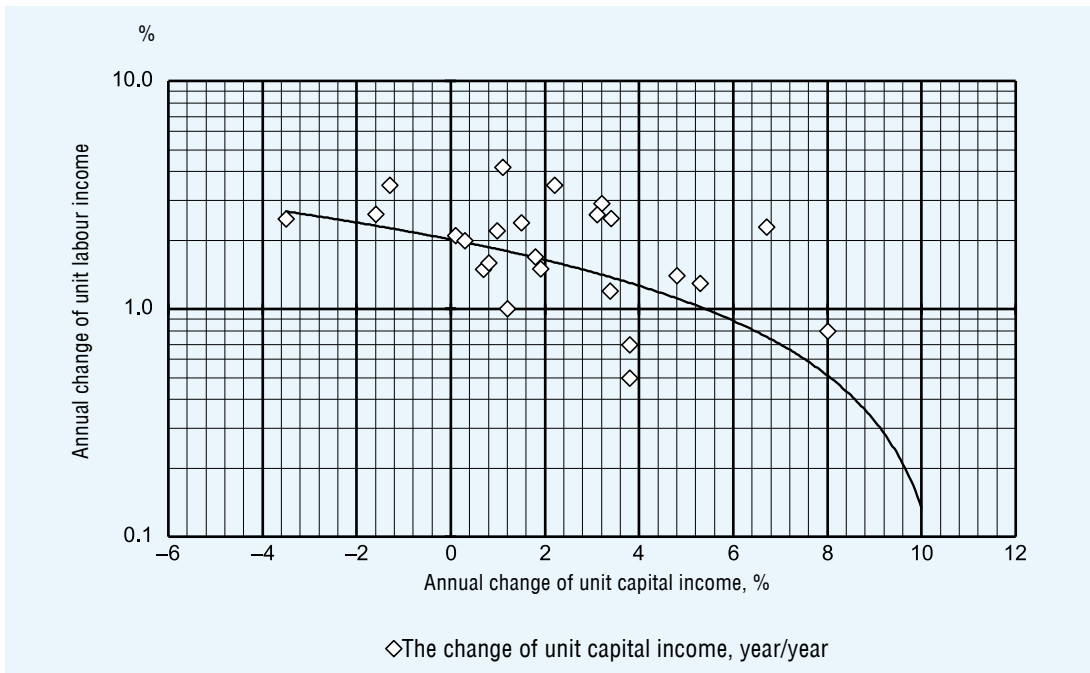
**THE CHANGE OF UNIT FACTOR COSTS IN THE PRIVATE SECTOR OF THE USA 1988–2015 (YEAR/YEAR, PERCENTAGE)**



Source: own edition (data: Bureau of Labor Statistics, BLS, March 2017)

Figure 7

**THE CHANGE OF UNIT CAPITAL AND UNIT LABOUR INCOME IN THE USA, 1988–2015  
(YEAR/YEAR, PERCENTAGE)**



Source: own edition (data: Bureau of Labor Statistics, BLS, March 2017)

unit labour income is running along y axis. All points between 1988 and 2015 represent the percentage change of annual capital and labour income over a period of few years.

If there is supposed to be some kind of dominant correlation or strong tendency for substitution between factor productivity and factor prices based on the distribution in the picture, it is worth calculating a correlation indicator:

$$\text{Corr.}(x,y) = \frac{\text{cov}(x,y)}{\sigma_x \times \sigma_y} = -0,32 \text{ derived.}$$

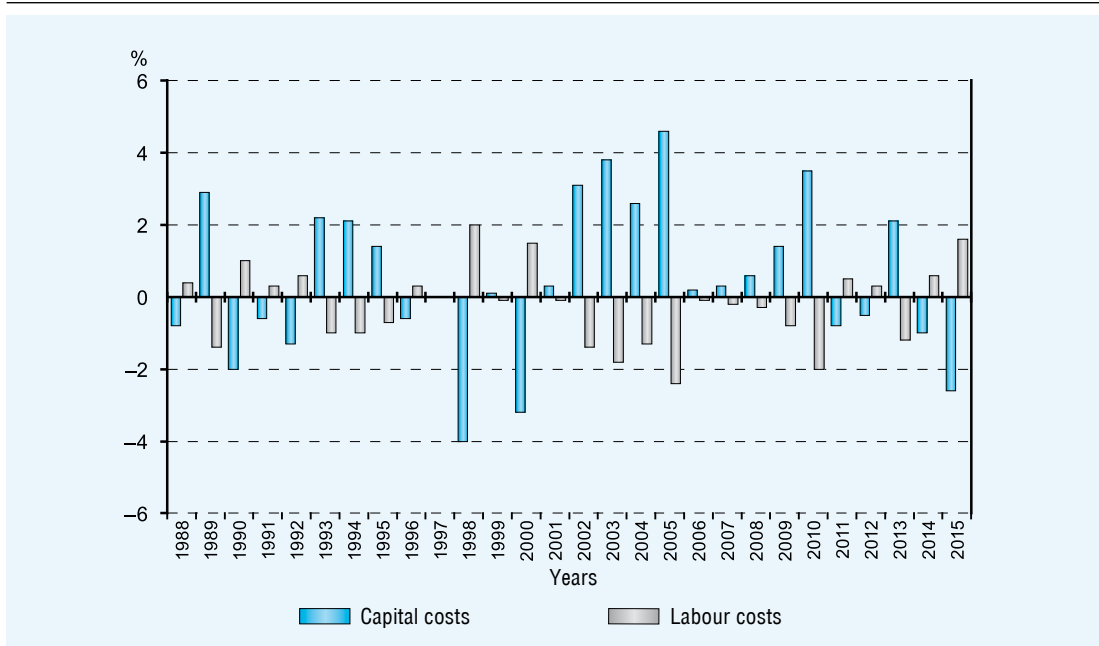
A fairly weak, negative indicator shows that, if one factor gets more expensive, the substitution moves towards the other factor and the ratio of production factors changes accordingly, which can intuitively be expected. Although the result is not completely trivial, it

is compatible with the CD and CES production functions. At the same time, the sign and amount of the correlation coefficient can be explained by the easier or more difficult convertibility of taxation and other technologies (corporate production functions).

Figure 8 seems to prove this relatively weak relationship, following the change of the capital and labour cost ratio in terms of the total costs. On the side of the capital, the substitution of labour is higher. Significant changes (of 3% or higher) occurred only between 2001 and 2005, and also in 2009, after the crisis of 2008. As far as frequency is concerned, the period was principally characterised by the substitution of capital. The weight of labour was higher in the new, rearranged structure of total costs. However, no clear dominance or signs indicating unidirectional substitution can be identified.

Figure 8

**THE CHANGE OF CAPITAL AND LABOUR COST RATIO IN THE TOTAL COST, IN THE USA, 1988–2015 (YEAR/YEAR, PERCENTAGE)**



Source: own edition (data: Bureau of Labor Statistics, BLS, March 2017)

**SUMMARY AND CONCLUSIONS**

In developed industrial countries, the percentage of labour income within the total income has been decreasing since the mid-1980s. Even according to the leading researchers of IMF (IMF, 1017) the main reasons for the decrease can be explained by technological progress and the international financial and commercial integration (in short: by globalisation processes). Due to the aforementioned several-decade-long process, along with generally slow productivity improvement, the larger part of the income growth arising from actually realised productivity improvement consists of return to capital. The output growth/working hour does not automatically lead to the same rate of rise in wages. This is a general trend in the global economy. However, the actual technical analysis of the phenomenon is a controversial issue. The study considered

theoretical and empirical questions related to this phenomenon by taking Thomas Piketty’s world famous thesis ( $r > g$ ) as a starting point.

To what extent can we rely on the permanence of the most important Piketty thesis ( $r > g$ ), i.e. the difference between return on capital and the rate of economic growth regarding the future? The French author asked himself this same question, as well, and answered it in his already cited work published in 2015: “I certainly do not believe that  $r-g$  is a useful tool for the discussion of rising inequality of labor income.” (Piketty, 2015, pp. 67–68). The above significantly modify Piketty’s original viewpoint, “withdraw” it to a certain extent, especially as far as the forecasting ability of his model is concerned. The aim of this study is to provide additional information to the modified viewpoint mentioned above, after reviewing Piketty’s original theoretical considerations and pointing out some of their

problematic points. The focus of our analysis was the assumption of a larger capital/output and capital/labour variability, following Piketty's own presumption that examined the possibilities of the degree of factor substitutability in production, depending on the elasticity of capital/output ratios (Piketty, 2014, pp. 230–232). The marginal productivity of production factors and the production function played a key role in earlier debates on capital, especially in the assessment of the marginal return to capital. Referring to the idea above, the following statement was an essential element of our argumentation: If we accept the rate/power of marginal return to capital in the case of the CES-type (Constant Elasticity of Substitution production function), the same cannot be excluded in the case of the marginal productivity of labour, either. Our aim was to illustrate that, in spite of the fact that the standard neoclassical model of economic growth provides satisfactory explanation for *growth-accounting*, it fails to provide a dynamic description suitable for forecasting in respect of the possible income distribution outcome. It is especially inaccurate in respect to the estimation of capital-labour income. In this respect, we reinforced *Medvegyev's* statements (Medvegyev, 2015) related to the different variation of the rate of the return to capital ( $r$ ) and the rate of growth ( $g$ ). We have examined the dynamics of growth, productivity and factor income in the private sector of the American economy, excluding agriculture,

over a period of nearly three decades, to provide, inter alia, statistical information to support these statements.

As far as the assumption of a decrease in  $g$  in the USA, over the examined period, is concerned, Piketty was basically right. Although the decline has several reasons, the most important ones are the slowing down of labour productivity and the unfavourable changes in demographic factors, as the neoclassical growth model also explains.

As in the US private sector, excluding agriculture, the weight of production factors on the cost side alternated evenly between 1988 and 2016, depending on the dynamics of factor prices, therefore the existence of a significant substitution effect and a slight crowding out effect on the capital side seem to be likely, whereas superdominance on the capital side seems to be unlikely. If one factor got more expensive, the substitution moved towards the other factor and the ratio of production factors changed accordingly, which was intuitively expected, as this consequence is compatible with the CD, CES production function.

Based on the aforementioned theoretical, technical and measurement problems, we are probably not far from reality if we support the world famous French author's statement by citing his own self-criticism: “... *we still have too little data on historical and current patterns of income and wealth, these are key reasons why my book is at best an introduction to the study of capital in the 21st century.*” (Piketty, 2015, p. 87)

## NOTES

<sup>1</sup> The weekly magazine reminds reader of this fact, mentioning its own commentary published three years earlier and the publication of Boushey-De-Long-Steinbaum's book. *The Economist*, May 20<sup>th</sup> 2017 p. 66

<sup>2</sup> “*I certainly do not believe that  $r-g$  is a successful tool for the discussion of rising inequality of labor income; other mechanisms and policies are much more relevant here, for example the supply and demand of skills and education. One of my main conclusions is that there*

*is substantial uncertainty about how far income and wealth inequality might rise in the 21<sup>st</sup> century....”* (Piketty, 2015, pp. 67–68).

<sup>3</sup> Palánkai discussed the issue of definition in detail (2016).

<sup>4</sup> The issue above is analysed in detail by Móczár (2008, p. 499) and Mellár (2015, Chapter 3).

<sup>5</sup> Quoted: The Trump Dilemma. *The Economist* May 13th 2017, p. 17

## REFERENCES

ACEMOGLU, D. & ROBINSON, J. A. (2012). *Why Nations Fail: The Origins of Power, Prosperity, and Poverty*. New York: Crown Publishers. [https://doi.org/10.1111/nana.12079\\_6](https://doi.org/10.1111/nana.12079_6)

ATKINSON, A. B., PIKETTY, T. AND SAEZ, E. (2011). Top Incomes in the Long Run of History. *Journal of Economic Literature*. 49(1), pp. 3–71 <https://doi.org/10.1257/jel.49.1.3>

BOUSHEY, H., DELONG, B. & STEINBAUM, M. (eds.) (2017). *After Piketty: the agenda for economics and inequality*. Harvard University Press, Cambridge, Massachusetts

DAO, M.C., DAS, M., KOCZAN, ZS. & LIAN, W. (2017). Drivers of Declining Labor Share of Income. *IMF Blog*. Online: <https://blogs.imf.org/2017/04/12/drivers-of-declining-labor-share-of-income/>

DAVIES, J. B., LLUBERAS, R. AND SHORROCKS, A.F. (2017). Estimating the level and distribution of global wealth, 2000–2014. *Review of Income and Wealth*. Volume 63, Issue 4, December 2017. pp. 731–759 <https://doi.org/10.1111/roiw.12318>

JAKAB M. Z., KÓNYA I. (2012). Munkapiaci súrlódások DSGE modellekben. (Frictions in DSGE Models in the Labour Market). *Közgazdasági Szemle*. (Economic Review), Volume LIX, September 2012 (pp. 933–962), Online: [http://epa.oszk.hu/00000/00017/00194/pdf/EPA00017\\_Kozgazdasagi\\_szemle\\_2012\\_09\\_01\\_szazalek20Jakab\\_szazalek20Konya.pdf](http://epa.oszk.hu/00000/00017/00194/pdf/EPA00017_Kozgazdasagi_szemle_2012_09_01_szazalek20Jakab_szazalek20Konya.pdf)

KARABARBOUNIS, L. & NEIMAN, B. (2014). Capital Depreciation and Labor Shares around the World: Measurement and Implications. NBER Working Paper. <https://doi.org/10.3386/w20606>

KÓNYA I. (2015). Több gép vagy nagyobb hatékonyság? Növekedés, tőkeállomány és termelékenység Magyarországon 1995–2013 között. (More Machines or Greater Efficiency? Growth, Capital Stock and Productivity in Hungary between 1995–2013), *Közgazdasági Szemle*. (Economic Review), Volume LXII, November 2015 (pp. 1117–1139) <http://dx.doi.org/10.18414/KSZ.2015.11.1117>

MEDVEGYEV P. (2015). Nagyobb kockázat, nagyobb növekedési ütem – kockázat nélkül nincs növekedés! Hozzászólás Thomas Piketty A tőke a 21. században című könyvéhez. (Why are interest rates higher than growth rates? A comment on Thomas Piketty’s Capital in the Twenty-First Century). *Közgazdasági Szemle* (Economic Review), 62(9), pp. 943–951 <https://doi.org/10.18414/KSZ.2015.9.943>

MELLÁR T. (2015). *Szemben az árral – Rendbogyó közgazdasági előadások*. (Against the Mainstream – Nonconformist Presentations on Economics). Akadémiai Kiadó, Budapest, DOI: <http://dx.doi.org/10.18414/KSZ.2016.2.222>

MÓCZÁR J. (2008). *Fejezetek a modern közgazdaságtudományból* (Chapters from Modern Economics). Akadémiai Kiadó, Budapest

PALÁNKAI T. (2016). Gondolatok egy nagyhatású



könyvhöz. Thomas Piketty: A tőke a 21. században. (Thoughts on an Impressive Book. Thomas Piketty: Capital in the Twenty-First Century), Kossuth Kiadó, Budapest, p. 703 *Közgazdasági Szemle* (Economic Review), Volume LXIII, February 2016, pp. 209–221, DOI:10.18414/KSZ.2016.2.209

PIKETTY, T. (2014). *Capital in the Twenty-First Century*. Harvard University Press. <https://doi.org/10.1017/s0266267115000061>

PIKETTY, T. (2015). Putting Distribution Back at the Center of Economics: Reflections on Capital in

the Twenty-First Century. *Journal of Economic Perspectives*, Volume 29, Number 1–Winter 2015, pp. 67–88, <https://doi.org/10.1257/jep.29.1.67>

PIKETTY, T., SAEZ, E. & STANTCHEVA, S. (2014). Optimal Taxation of Top Labor Incomes: A Tale of Three Elasticities. *American Economic Journal: Economic Policy* 6(1), pp. 230–271, <https://doi.org/10.1257/pol.6.1.230>

IMF (2017). World Economic Outlook April 2017: Gaining Momentum? Online: <https://www.imf.org/external/pubs/ft/weo/2017/01/index.htm>