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# Critical remarks on Piketty's *Capital in the Twenty-first Century*

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This article discusses the central macroeconomic claims that are made in Thomas Piketty's book *Capital in the Twenty-first Century*. The article aims to show that Piketty's contentions are not only logically flawed but also contradicted by his own data.

**Keywords:** capital; wealth; income distribution; taxes

**JEL Classification:** D31; E; H24

## I. Introduction

Presently, Thomas Piketty's book *Capital in the Twenty-first Century* is being passionately discussed by economists and the public press. This interest may be due to Piketty's strong policy recommendations, which include a top income tax of 80% and a top wealth tax of 10%. If one follows Piketty in assuming a normal return on capital of 4% for the 21st century, a 10% tax on wealth is equivalent to a 250% tax on the resulting capital income. Combined with the 80% income tax, taxpayers would face effective tax rates of up to 330%.<sup>1</sup> Such figures seem to fit the spirit of the age.

This article does not discuss the political suggestions, nor is it a comprehensive review. Rather, the following text identifies the book's central macroeconomic claims and examines them – logically, theoretically and empirically. The article's contribution is to show that Piketty's contentions are not only logically flawed but also contradicted by the data that he presents.

**Section II** starts with the claim that a return on capital in excess of the growth rate, formally  $r > g$ , implies that wealth grows faster than output and wages. **Section III** examines Piketty's 'first fundamental law of capitalism' and its relationship with the capital-labour split. **Section IV** then discusses the so-called 'second fundamental law of capitalism', which attributes changes in wealth–income ratios to savings and growth rates. The central objection to the book, regarding the equalization of capital and wealth, is outlined in **Section V**, which demonstrates that recent increases in wealth largely reflect increases in land values. **Section VI** concludes.

## II. The 'Central Contradiction of Capitalism'

The rate of return on capital ( $r$ ) represents the sum of interest payments, dividends, rents and other forms

<sup>1</sup> The supposedly 'optimal' top tax rates can be found in Piketty (2014), p. 512 and p. 572. For the normal return on capital, cf. p. 206. As a numerical example, a taxpayer's wealth of 100 yields a pretax income of 4. The wealth tax is 10, the income tax is 3.2, and the total tax is 13.2 or 330% of the capital income.

of annual income, except labour income, as a percentage of total wealth. The growth rate ( $g$ ) represents the annual growth of national income. Both rates are understood in real terms, that is they exclude inflation. Piketty (2014, p. 571) states that the return on capital exceeds the growth rate. He considers this relationship to be ‘the central contradiction of capitalism’ and claims that ‘[t]he inequality  $r > g$  implies that wealth accumulated in the past grows more rapidly than output and wages’.

As a logical implication holding independently of further premises, this claim is incorrect: Denote wealth as  $S$ , its change as  $\dot{S}$  and the total return on capital as  $rS$ . Wealth grows at the rate  $r$  if  $\dot{S} = rS$ , that is if the entire return on capital is reinvested. Assuming that the return on capital is partly spent rather than reinvested, wealth grows at a rate  $\dot{S}/S < r$ . In this case, wealth does not need to grow more rapidly than output even if  $r > g$ . The error in Piketty’s claim arises from the implicit assumption that savings are *never* consumed, nor spent on charitable purposes or used to exert power over others. It is only under this outlandish premise that wealth grows at the rate  $r$ . If people use their savings later, the growth rate of wealth is independent of the return on capital – wealth may grow more rapidly than output, less rapidly or at the same pace.

As a numerical illustration, assume that  $r = 3\%$  and that  $g = 2\%$ . If the entire return on capital is reinvested, wealth will grow at a rate of 3% and the wealth–income ratio will rise. However, if one-half of the return is reinvested and the rest is spent

otherwise, wealth will grow at a rate of 1.5%, implying a permanent decrease in the wealth–income ratio. As an interim result, no ‘central contradiction of capitalism’ exists to the effect that the wealth–income must increase under all circumstances if the return on capital exceeds the growth rate. Quite to the contrary, the behaviour of the wealth–income ratio is an empirical matter.

On p. 354, Piketty reports that, at the world level, the return on capital has consistently exceeded the world growth rate over the last 2000 years. Figure 1 reproduces his data for a shorter time span of roughly 200 years and shows that the return on capital indeed exceeded the growth rate. According to the ‘central contradiction of capitalism’, this would have implied steadily increasing wealth–income ratios.

Yet, over the period for which data are available, wealth–income ratios have remained relatively stable in countries such as the United States or Canada. In Britain, France, or Germany, which were heavily affected by the wars, wealth–income ratios declined at the start of World War I and recovered after the end of World War II.<sup>2</sup> Figure 2 demonstrates that in all of these industrialized countries, wealth–income ratios are *lower* today than at the end of the 19th century. According to the ‘central contradiction of capitalism’, however, wealth–income ratios should have markedly *risen* over the mentioned period. Hence, the data that Piketty presents rebut his ‘central contradiction of capitalism’: During the entire time span for which data are available, the premise that  $r > g$  is sustained, but the

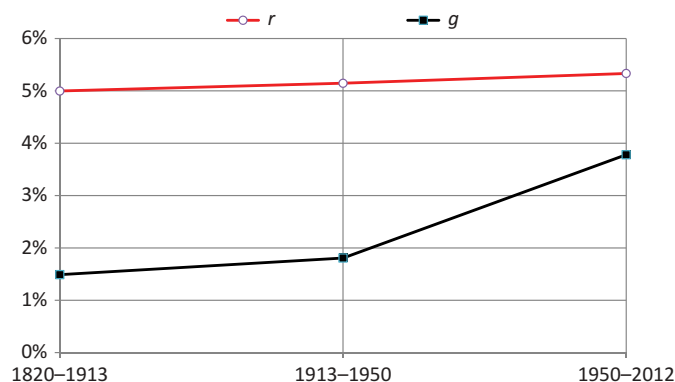


Fig. 1. Rate of return versus growth rate at the world level<sup>3</sup>

<sup>2</sup> See Piketty (2014), p. 151, for the United States; p. 157, for Canada; p. 116, for Britain; p. 117, for France; and p. 141, for Germany.

<sup>3</sup> Source: <http://piketty.pse.ens.fr/en/capital21c2>, retrieved 18 October 2014.

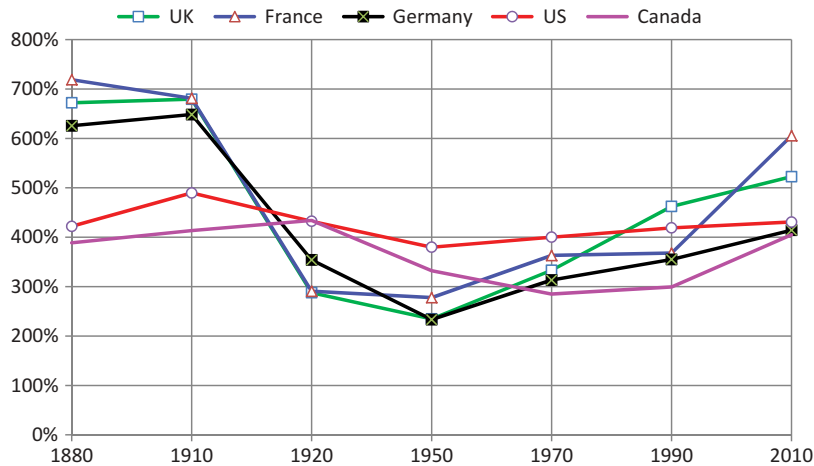


Fig. 2. National capital as a percentage of national income<sup>4</sup>

conclusion of increasing wealth–income ratios is disproved.<sup>5</sup>

The preceding objections hold independently of any theoretical framework: The first objection was purely a matter of logic and accounting; the second was an empirical matter. It is also interesting, however, to relate Piketty’s ‘central contradiction of capitalism’ to standard growth theory. In the textbook workhorse model, invented by Diamond (1965), young persons’ born in period  $t$  accumulate wealth in line with their budget constraints:

$$\begin{aligned} \text{i) } C_t^1 + S_t &= w_t \\ \text{ii) } C_{t+1}^2 &= (1 + r_{t+1}) S_t \end{aligned} \quad (1)$$

where  $C_t^1$  denotes consumption when young,  $C_{t+1}^2$  denotes consumption when old,  $S_t$  denotes the stock of desired wealth,  $r_{t+1}$  is the return on capital, and  $w_t$  is the wage rate. Preferences and production technologies may be represented by Cobb–Douglas functions, depreciation is disregarded and population growth and technical change are assumed to be absent. Under these premises, which are overly strong but useful to concentrate on the key argument, the economy approaches a stationary state ( $g = 0$ ) with a strictly positive return on capital ( $r > 0$ ). The return on capital exceeds the growth rate. However, contrary to

Piketty’s claim, wealth does not grow more rapidly than output. Rather, it stays constant, as do the wealth–income ratio and the functional distribution of income, which are determined by the coefficients of the Cobb–Douglas functions. Operative bequests, as considered by Weil (1987), do not affect these results: In a stationary state, each generation inherits a certain amount from the preceding generation and transfers it to the next. And if one admits population growth, a steady state in which wealth and income grow at the same rate is reached. Again, the wealth–income ratio is constant and independent of the relationship between  $r$  and  $g$ .

As a final remark concerning this point, the relationship between  $r$  and  $g$  is important for not only capitalistic societies but also socialist economies, where  $r$  represents an imputed capital rental rate. In both systems, a return on capital in excess of the growth rate is not a problem but is socially useful because it prevents dynamic inefficiency: In the opposite case  $r < g$ , one could make a particular generation better off without making other generations worse off, as is well known. Piketty does not explain why the return on capital should be greater than the growth rate. On p. 353, he starts a long-winded explanation, which leads nowhere, but does not cite his compatriot Jacques Turgot (1766). According to Turgot, the return on capital is strictly positive ( $r > 0$ ) in a stationary economy ( $g = 0$ )

<sup>4</sup> Source: <http://piketty.pse.ens.fr/en/capital21c2>, retrieved 18 October 2014. For Canada and Germany, data for only 1890 rather than 1880 were available.

<sup>5</sup> Piketty’s references to the world wars and the implied destruction of capital abound. They are intended to rescue the claim that  $r > g$  implies an ever-rising wealth–income ratio. The United States and Canada as obvious counter-examples remain unmentioned in this context.

because land values would become infinite otherwise; hence, the return on capital exceeds the growth rate. This fundamental insight can be generalized to arbitrary growth paths if the land income share is uniformly positive, cf. Homburg (1991).

### III. The 'First Fundamental Law of Capitalism'

The first fundamental law of capitalism reads  $\alpha = r \times \beta$ , where  $\alpha$  represents the capital income share and  $\beta$  denotes the wealth–income ratio. This equation states that the capital income share equals the product of the interest rate and the wealth–income ratio. The equation is a mere accounting identity, as Piketty notes. Nevertheless, he gives it a causal interpretation on p. 221, claiming that an increase in  $\beta$  is likely to induce subsequent increases in  $\alpha$  because 'the accumulation effect will outweigh the decrease in the return on capital'. This text passage contains the book's central point: Because of strong accumulation and low growth, the wealth–income ratio rises, as does the capital income share – with the effect that workers receive a correspondingly smaller piece of the total cake.

Starting on p. 200, Piketty presents British and French capital income shares over the 1770–2010 and 1820–2010 periods, respectively. These long-run series suggest anything but an upward trend in capital income shares. Quite to the contrary, capital income shares were *lower* in 2010 than in 1820 and 1900, reaching record lows in the 1970s and 1980s. Rising capital income shares show up only in time series starting in 1975, at about the all-time minimum; see Piketty (2014, p. 222). Hence, the premise that the functional distribution is apt to change against labour income is unconvincing, and Piketty acknowledges this by pointing out the possibility 'that technological changes over the very long run will slightly favour human labour over capital, thus lowering the return on capital and the capital share' (p. 233). The future development of the income shares is simply a matter of speculation.

### IV. The 'Second Fundamental Law of Capitalism'

The second fundamental law of capitalism reads  $\beta = s/g$ , where  $s$  represents the savings rate. This

equation states that the wealth–income ratio equals the savings rate divided by the growth rate. Denoting wealth as  $S$ , the change in wealth as  $\dot{S}$ , and the growth rate of income as  $\dot{Y}/Y$ , the equation can be rewritten in the form

$$\frac{S}{Y} = \frac{\dot{S}}{Y} \times \frac{Y}{\dot{Y}} \quad (2)$$

In contrast to the first law, the second law is not an identity; rather, it holds only in a steady state where income and wealth grow at the same rate,  $\dot{Y}/Y = \dot{S}/S$ . In this case, the wealth–income ratio remains constant. Piketty's characterization of economic growth by both the 'central contradiction of capitalism' and the 'second fundamental law of capitalism' is self-contradictory because the 'central contradiction of capitalism' alleges a *rising* wealth–income ratio, whereas the 'second law' presupposes a *constant* wealth–income ratio. Independent of the theoretical position that one takes and independent of the data, one cannot simultaneously propagate the 'central contradiction' and the 'second law'. The two are mutually exclusive.

Piketty conceives of  $s$  and  $g$  as two independent variables, which jointly determine the wealth–income ratio. This coincides with the Harrod–Domar–Solow tradition and raises a serious division-by-zero problem in the case of a stationary economy ( $g = 0$ ) where the wealth–income ratio becomes infinite. In the Diamond model considered above, such a problem does not arise because each generation holds the *same* wealth  $S$  as its predecessor in a stationary economy. Changes in desired wealth, that is savings  $\dot{S}$ , only result from population growth or from changing technologies or preferences. Viewed this way, the coefficient  $s$  is not exogenous but an increasing function of the growth rate,  $s(g)$ , running through the origin. Low growth will not drive wealth–income ratios to infinity – and has never done so – but will result in lower savings. On the other hand, as will become clear in the next section, wealth–income ratios can rise markedly without changes in savings or growth rates.

### V. Capital versus Wealth

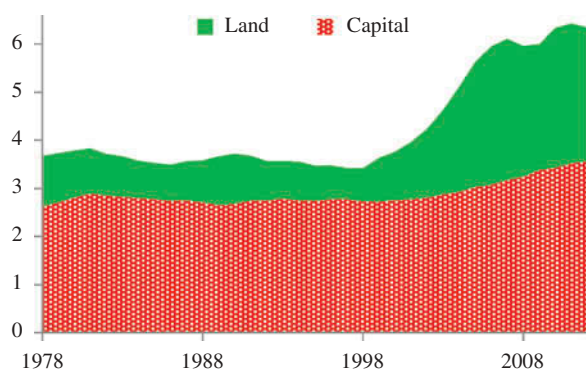
Piketty treats the terms *capital* and *wealth* interchangeably, and deliberately so (p. 47), because he

believes that distinguishing between produced capital and nonproduced land is cumbersome. However, as the present standard of national accounting, the SNA (2008) provides separate stocks of capital and land, and an increasing number of countries actually publish the corresponding figures. It is difficult to see why one should disregard these official statistics. Of course, macroeconomic textbooks and simple theoretical models also equate capital with wealth and use the symbol  $K$  to represent both. Within an empirical approach, however, distinguishing produced capital, on the one hand, from nonproduced land, on the other, is crucial and overturns many of Piketty's results and speculations.<sup>6</sup> To make matters concrete, let  $K$  denote the stock of produced capital,  $L$  the stock of pure land, and  $q$  the land's price, measured in output units per square meter. In every period  $t$ , national nonfinancial wealth  $S_t$  is given by

$$S_t = K_t + q_t L \quad (3)$$

Increases in wealth can be due to either savings (capital accumulation) or rising land prices (revaluation). Taking France as a typical example, Fig. 3 shows the decomposition of national wealth into capital and land between 1978 and 2012.

The development depicted in Fig. 3 resembles the corresponding figure in Piketty (2014, p. 117). France's net financial worth is excluded here, and

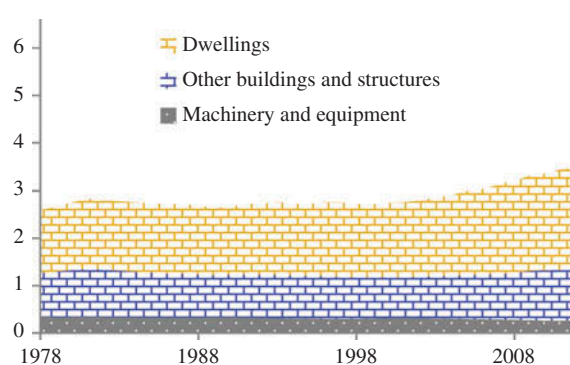


**Fig. 3.** Capital and land in France as multiples of GDP<sup>7</sup>

national nonfinancial wealth is expressed as a multiple of GDP rather than of national income, but these differences are immaterial. The crucial point is that the strong increase in the wealth–income ratio, which commenced in 1999, the year of the introduction of the euro, was driven by an increase in land values, which almost tripled by 2012. The rise in the wealth–income ratio, rather than proving how much capital is amassed through savings, essentially stems from a revaluation.

This point is reinforced if one decomposes capital into its three main components: (i) dwellings (excluding land values), (ii) other buildings and structures (also excluding land values) and (iii) machines and equipment. Figure 4 shows that Piketty's subtext of 'sophisticated robots' (p. 221), which replace employees and 'claim' ever higher shares of national income – at the expense of the middle class – is oddly at variance with the data because produced capital mostly comprises dwellings and other buildings and structures. In fact, the item 'machinery and equipment' is trifling – composing only 5% of total wealth. Moreover, machinery and equipment as well as other buildings and structures, expressed as percentages of GDP, have declined slightly over the last 34 years. Dwellings are the only component of capital that has shown a noticeable increase.

In summary, if one interprets 'capital' narrowly as the value of produced means of production, its ratio



**Fig. 4.** Components of produced capital in France as multiples of GDP<sup>8</sup>

<sup>6</sup> Cf. also Bonnet *et al.* (2014) who make a similar point.

<sup>7</sup> The figure shows 'fixed assets' and 'land', which compose the bulk of reproducible and nonreproducible assets, respectively. The data set (retrieved 24 April 2014) is available at <http://stats.oecd.org>, annual national accounts, detailed tables, table 9B: Balance sheets for nonfinancial assets. The time series start in 1978.

<sup>8</sup> Source: See footnote 7.

to GDP has remained nearly constant over the last decades. A certain rise in this ratio is detectable if one includes dwellings. However, the substantial increase in the ratio of wealth to GDP is due to the sharp rise in land values. These facts rebut Piketty's claim that 'capital is back' with respect to production and income distribution. They also question his approach of ignoring the official distinction between produced assets (AN1) and nonproduced assets (AN2) and merging both types of assets under the label 'housing', which obscures what has been going on.

The above figures suggest that the increase in the wealth–income ratio largely relates to the middle-class: Beginning right after the Volcker reflation, North America and Western Europe enjoyed a prolonged period of declining interest rates that persists today. This decline in interest rates rendered home purchases affordable for middle-class families and increased land prices. With inflation and interest rates back at their 19th-century levels, land values also returned to their historical values, with an important shift from agricultural use to urban use. There is nothing dramatic in this story. However, a decline in land prices to their previous levels – for example in case of a euro zone breakup – would pose a major challenge since land constitutes the most important part of bank collateral.

## VI. Conclusion

From a macroeconomic perspective, Piketty's book, which is written in a truly dialectic style, makes for difficult reading. It lacks a coherent analytical framework and spreads its theses over several hundred pages. Almost every contention is later repealed or qualified, and every strong statement has a 'possibly' attached. In a nutshell, the book's core message is that something terrible *may* happen over the next 100 years unless governments implement expropriation now.

The present article has examined the ostentatious claims on which this outlook is based, among them the 'central contradiction of capitalism', the 'first fundamental law of capitalism' and the 'second

fundamental law of capitalism'. All these claims were found to be unwarranted: First, the relationship  $r > g$  does not imply a rising wealth–income ratio, and Piketty's very own data rebut his claim. Second, an increase in wealth does not imply a rise in the capital–income share, and long-term data do not show such a tendency. Third, the 'central contradiction of capitalism' and the 'second fundamental law of capitalism' are mutually exclusive since the former asserts a rising wealth–income ratio, whereas the latter presupposes a constant wealth–income ratio.

Conceptually, the book's most significant pitfall is the confusion of the terms 'capital' and 'wealth'. Because of this semantic shift, readers are liable to get the impression that recent increases in wealth indicate a new 'industrial revolution' that will change the income distribution in favour of capital. Such a presumption is unfounded, however, because the increases in wealth reflect rises in land values rather than changes in production processes. And, again, Piketty's own data do not indicate a long-run decrease in labour income shares. Whether such a decrease will occur in the future is purely a matter of speculation – not an established result.

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