

Piketty's Capital in the Twenty-First Century: Criticisms and Debates

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Abstract: This paper extensively examines criticisms and debates about Piketty's book, "Capital in the Twenty-First Century". I discuss the most important points raised by critics including the elasticity of substitution between capital and labor, the implication of the housing sector in the rise of the capital income share, and the role of the inequality $r > g$ in driving wealth inequality. By reviewing critical arguments and investigating Piketty's original data, I argue that his argument has limitations in explaining historical dynamics of inequality. Specifically, his finding is not consistent with the presumed elasticity of the neoclassical production function. I also find that the rise in housing income played an important role in increasing the capital income share. Finally, there is no empirical evidence to support his argument that the saving rate and the rate of return on capital are exogenous, nor that $r > g$ is associated with wealth inequality. I emphasize that a study from the political economy perspective is warranted.

Keywords: Piketty, Capital, Inequality, Growth

JEL Classification Numbers: E10, E20, D30, D31, D33

1. Introduction

Piketty's book, "*Capital in the Twenty-First Century*" presents historical analysis of the long-run evolution of income and wealth inequality in advanced countries. By investigating long-run historical data, he finds that the wealth-income ratio rose in the recent decades after falling rapidly in the early and mid-20th century due to shocks of two world wars and the Great Depression. Along with the rise of the wealth-income ratio, the share of capital income in total income and the top-income concentration have both risen since the 1970s. Piketty invokes two "laws of capitalism" to describe the capital income share and the wealth-income ratio. He also argues that capitalism has internal dynamics of rising wealth inequality because the rate of return on capital is higher than the growth rate of the economy. His prospects for inequality in the future are rather gloomy based on his expectation that the growth rate of the economy will fall. He proposes a global capital tax based on international cooperation and an increase of the top income tax rate as remedies for rising inequality. His work made a great contribution to study of inequality by putting distribution back at the center of economics. Since its publication, however, there have been hot debates about his argument. Critics question his theoretical framework and his interpretation of the data (Rognlie, 2014; 2015; Krussel and Smith, 2015; Acemoglu and Robinson, 2015). In spite of Piketty's reply (Piketty, 2015a; 2015b), there are several issues that are not

yet settled.

This paper aims to critically examine the most important criticisms of Piketty and debates about his study in mainstream economics. First, I review a controversy about the elasticity of substitution between capital and labor in his work. By calculating the elasticity using his data, I demonstrate that his finding is not consistent with the simple neoclassical production function approach. Second, I discuss the important criticism about the role of the housing sector in the dynamics of inequality in his work. I attempt to evaluate this criticism by decomposing Piketty's original data. Third, I empirically examine the stability of the saving rate and the rate of return on capital, and investigate whether the inequality $r > g$ is associated with wealth inequality, using his historical data. In sum, I underscore that Piketty's argument has limitations and we need to develop a study of inequality that takes the perspectives of political economy into account more seriously.

2. Elasticity of substitution

2.1 High elasticity of substitution

One of the common criticisms presented by several researchers is on the elasticity of substitution between capital and labor in Piketty's work. Theoretically, it should be higher than 1 so that both the capital income share and the wealth-income ratio move in the same direction. Piketty reports that the estimation of elasticity of substitution is higher than 1, referring to another study (Piketty and Zucman, 2014; Karabarbounis and Neiman, 2014a). However, the gross elasticity should be much higher because Piketty's study presents the net elasticity, dealing with net income after excluding depreciation of capital. Rognlie (2014) asserts that the gross elasticity in Piketty's work is too high in comparison with estimates from recent empirical studies that report the gross elasticity of substitution is usually less than 1.

In his book, Piketty mentions that the high elasticity of substitution between capital and labor is associated with the widening uses for capital and the ease of replacement of labor with capital. For example, the elasticity of substitution could rise along with the development of robot technology and other capital-intensive technologies (Piketty, 2014). But the empirical ground for this capital-biased technological progress is not strong. In fact, the capital income and the wealth-income ratio both declined in the early and mid-20th century, which may suggest that long-run historical data are not consistent with a neoclassical aggregate production function. In a more recent paper, Piketty argues that understanding the multidimensional nature of capital including the real estate sector, rather than rapid technological progress, is a key to understanding the high elasticity at the current stage (Piketty, 2015a). He also posits that a multi-sector model of capital accumulation with movements in relative prices and variations of bargaining power is necessary to think of the rise of wealth-income ratios and capital income shares (Piketty, 2015c)¹. For instance, if capital in the housing sector increases due to the rise of prices then both capital income from rent and the wealth-income ratio can rise at the same time.

Others support Piketty's result in that his long-run data can result in a much higher elasticity than most studies that use short-run or industry-level data (Steinbaum, 2014).

Hot debate on the measurement of elasticity of substitution is ongoing. While Rognlie (2015) demonstrates that the capital income share has not risen if we exclude housing income, resulting in the net elasticity around 1, Karabarbounis and Neiman (2014b) argue that net elasticity could be higher than 1 without the housing sector. My decomposition of Piketty's data excluding the housing sector income demonstrates that the net elasticity in some countries is higher than 1. Therefore, more extensive empirical work is called on to measure the elasticity of substitution and find its determinants. We may well think of the effect of technical change seriously or use the different definition of the capital-income ratio with only fixed assets used in production (Lawrence, 2015). Another alternative explanation could be to take power relationship more seriously into account. If distribution of income is not exactly based on marginal productivity of capital and labor, the simultaneous increase of capital income and the wealth-income ratio may reflect the rising bargaining power of capital along with the decline of labor unions in the recent period. In fact, Piketty himself points to this in several places of his book such as a chapter about the rising income of CEO and in recent papers and interviews, showing a sort of trembling of his positions. However, he does not appear to take this perspective fully in his theory, only turning to neoclassical distribution theory based on marginal productivity theory (Moseley, 2015). This political economy perspective leads us to think that distribution between capital and labor is not fully determined by technology or a feature of production function. The elasticity of substitution *ex post* should be influenced by changes in power relationship to a large extent.

2.2 Calculation of elasticity of substitution

In this section, I present a simple calculation of the elasticity of substitution using Piketty's original data in this section. The equation for the elasticity of substitution (σ) between capital K and labor L is classically defined to be

$$\sigma \equiv \frac{F_K \cdot F_L}{F \cdot F_{KL}}$$

The elasticity of F_K with respect to a change in the capital-output ratio K/F is also given by $-1/\sigma$ (Rognlie, 2014). This means that the elasticity of the capital income share $F_K K/F$ with respect to the capital-output ratio K/F is

$$\frac{d(\log(F_K K/F))}{d(\log(K/F))} = 1 - \frac{1}{\sigma}$$

This indicates that if $\sigma > 1$, the capital income share will increase as the capital-output ratio K/F rises. Moreover, σ can be calculated from this equation by

$$\sigma = \frac{1}{1 - \left(\frac{d \log \alpha}{d \log \beta} \right)}$$

Thus, we can rewrite the elasticity of substitution between capital and labor using the log difference between two points of time, of the wealth-income ratio (β) and of the capital income share (α).

Piketty and Zucman (2014) report that the net elasticity of substitution is about 1.5 using their original long-run historical data between 1970 and 2010. The wealth-income ratio rose from about 2.5 in 1970 to 5 in advanced countries on average, while the capital income share rose from 0.28 in 1970 to 0.36 in 2010. If we calculate the elasticity of substitution using these data from 1970 to 2010 it is about 1.57 as they report. They expect that in the next 40 years the wealth-income ratio will rise up to 8 and the capital income share will rise to about 0.42. In this case, the elasticity of substitution from 1970 to 2050 is about 1.54 and that from 2010 to 2050 is about 1.49.

Now, I will calculate the net elasticity for individual countries with and without the housing sector in the recent period from 1975 to 2010, using the simple method above². When we calculate the elasticity of substitution without the housing sector, we use the capital income share excluding housing sector income and the wealth-income ratio excluding housing sector capital. Table 1 presents the results for the US, the UK, France and Japan. The elasticity is frequently very high and also shows some negative values, due to the rises in both the capital income share and the wealth-income ratio over the period. The result also demonstrates that there is a very large heterogeneity across countries and time periods, so that we cannot generalize his finding to all countries. It is remarkable that the elasticity tends to be higher in Anglo-Saxon countries, while it is relatively low in Japan. This reflects the fact that the capital income share has risen significantly in countries such as the UK, while the real estate market bubble collapsed in the early 1990s in Japan. The elasticity also varies when the periods are different and when we use ten year averages to smooth data. For example, in the US, the elasticity up to 2010 is much higher than it is up to only 2007 since the value of wealth fell sharply after 2007 when the real estate market bubble burst, while the capital income share rose rapidly after 2007. In France, the elasticity from 1975 is much higher than that from 1970 since the capital income share without the housing sector in France fell sharply from 0.15 in 1970 to 0.11 in 1975.

Interestingly, our calculation highlights the fact that the housing sector played an important role in the high elasticity of substitution for the whole economy as we will discuss in the next section. When we calculate the elasticity using ten year average data from the 1970s to the 2000s, the elasticity without the housing sector is lower than that with the housing sector in three countries but not for France where there was a large increase in the wealth-income ratio with the housing bubble in the late 2000s. This suggests

that the housing sector could explain the high elasticity for the whole economy from the 1970s to the 2010s, particularly in the Anglo-Saxon countries. Of course, this is not always true since the elasticity for the whole economy is sometimes lower than that without the housing sector, depending on countries and time periods ³. It is, however, certain that we find that the elasticity of substitution is very high with or even without the housing sector, in comparison with the results of other empirical studies. We should note that, except for Japan, elasticities of substitution are frequently much higher than the 1.5 that Piketty suggests based on the long-term historical data. This apparently high elasticity is indeed puzzling in view of the simple production function approach, which we need to understand, taking into account several possibilities.

Table 1. Calculation of the Elasticity of Substitution for Countries

		US	UK	France	Japan
1970-2010	σ (all)	-1.10	1.80	1.12	0.73
	σ (nonhousing)	-16.25	1.20	0.66	0.65
1970-2007	σ (all)	3.16	2.35	1.35	0.79
	σ (nonhousing)	2.55	4.69	1.11	0.73
1975-2010	σ (all)	-4.35	-34.37	2.15	1.62
	σ (nonhousing)	2.46	377.59	4.78	1.04
1970s-2000s	σ (all)	2.72	2.74	2.68	0.95
	σ (nonhousing)	1.45	2.15	-30.0	0.80

Notes:

- 1) The negative value of the elasticity means that the percentage change in the capital income share is even larger than that in the wealth-income ratio.
- 2) For full data and calculation, see the appendix 1 and Piketty and Saez (2014).

3. Housing Problem in Piketty's Argument

3.1 Why housing matters

Several economists criticize Piketty, arguing that his finding stems from the increase in value of the housing sector or from his including imputed rent in capital income. Since his capital includes all net wealth including real estate, the measurement of housing capital based on prices or rent could make a big difference in the rise of the wealth-income ratio (Bonnet et al., 2014). More importantly, Rognlie (2015) finds that the recent rise in the capital income share is closely associated with rising income from housing in national accounts. Income from housing is different from other forms of capital income since

most output in the housing sector is recorded as imputed rent. According to him, it has been increasing in many advanced countries along with the rise in real estate market prices, while the share of capital income without it did not rise. He refutes Piketty's finding by presenting his calculation of averages for seven advanced countries together and also in Piketty's data (Rognlie, 2014; 2015, p. 37).

This is a fundamental criticism since imputed rent is not really paid to landlords but just the amount of rent that homeowners do not need to pay in reality, and it is hardly relevant to the distribution of income between capital and labor. If the role of imputed rent is crucial to the recent rise in the capital income share, we cannot conclude that there has been a worsening of distribution between classes, resulting from the inherent dynamics of capitalism. Besides, we should extensively examine factors that increase imputed rent such as the changes in the housing market for the purpose of understanding the rising capital income share.

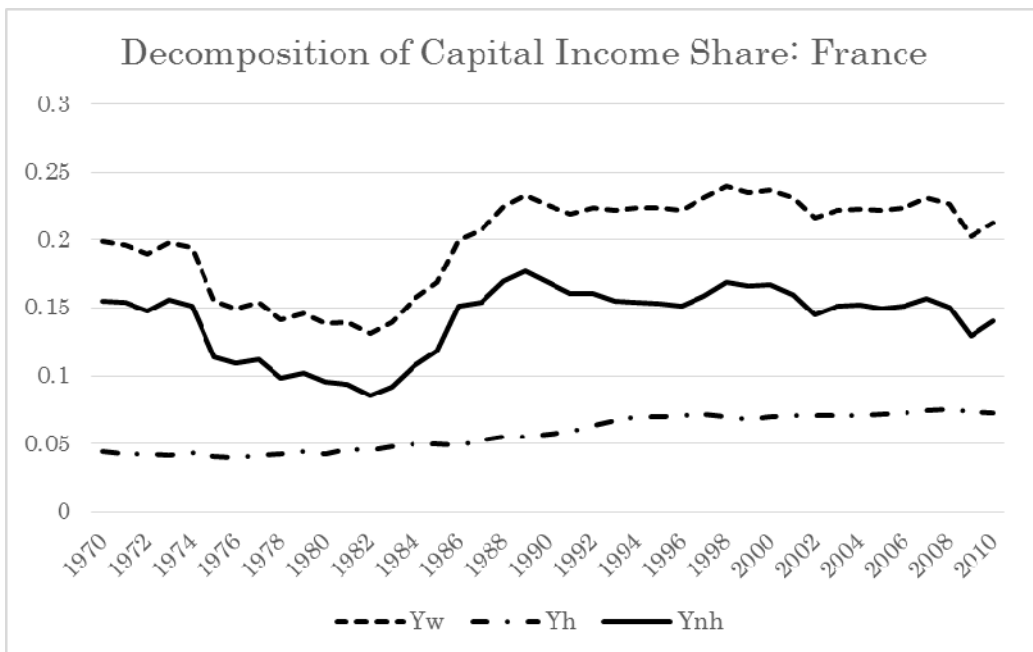
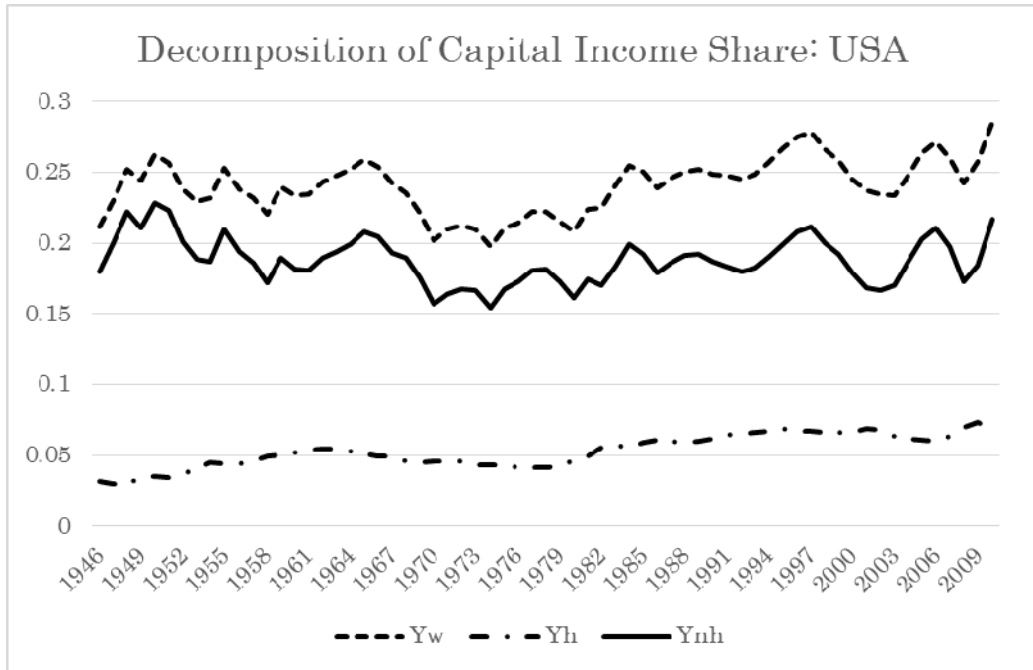
3.2 Decomposition of Piketty's data

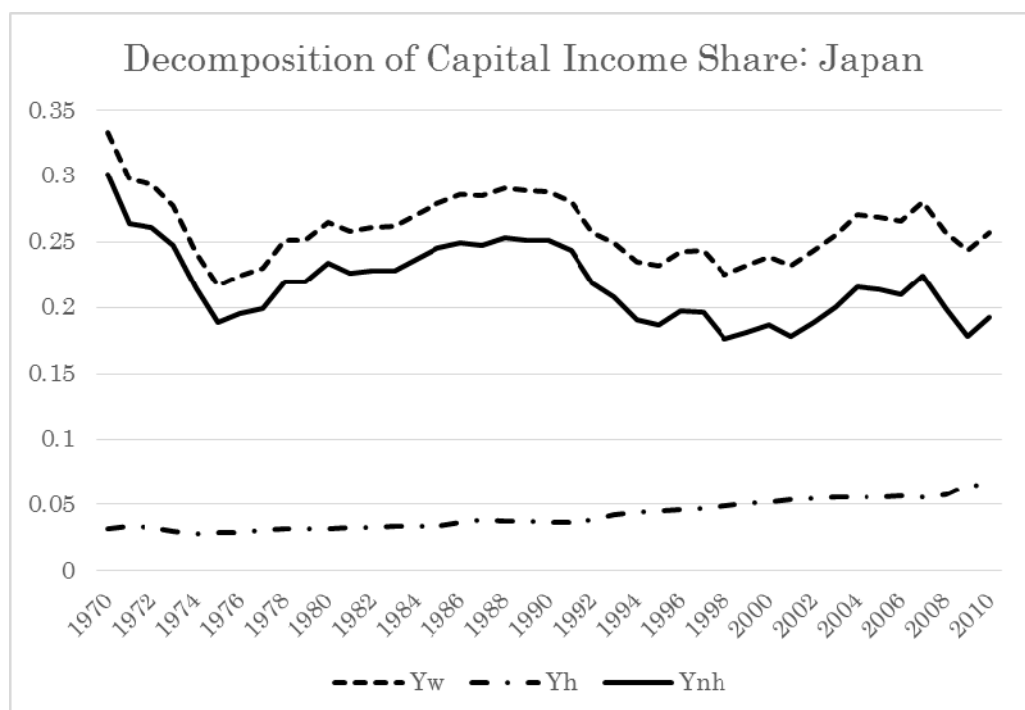
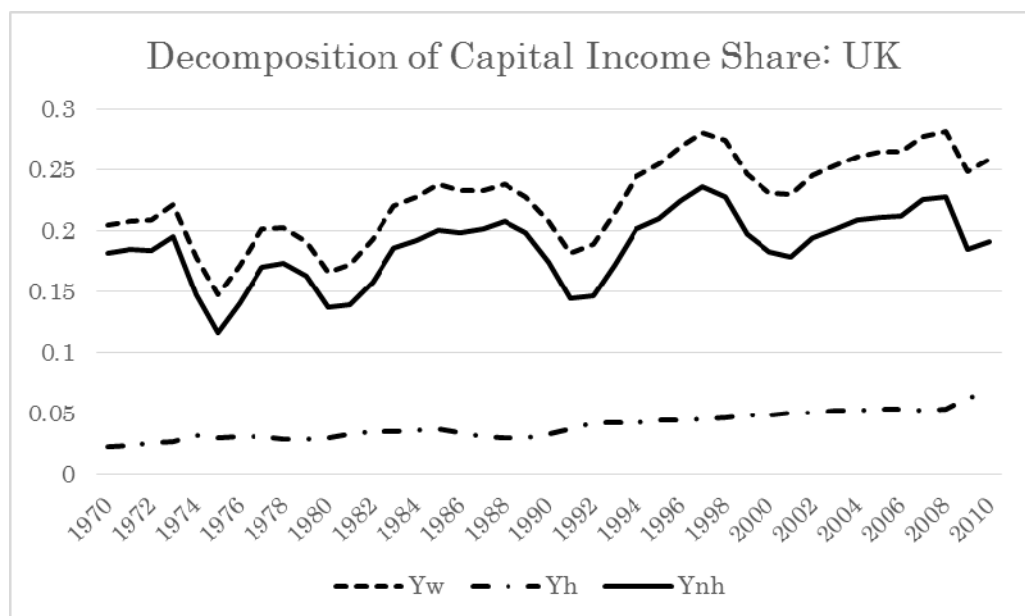
This section presents the share of capital income with and without the housing sector in individual countries. Rognlie (2015) does not report the information of individual countries but just shows the average of seven advanced countries. Production and distribution, however, occur within each country, which should be a unit of analysis, and thus it would be more appropriate to examine them in individual countries. The following graphs demonstrate the capital income share for the whole economy and that for the non-housing sector for the US, the UK, France and Japan from 1970 to 2010. It is calculated by total pre-tax capital income and that minus housing income divided by net total income from the dataset of Piketty and Zucman (2014).

We first find that there is a large heterogeneity across countries in the capital income share with and without housing⁴. For example, in the UK there is a clearly rising trend of both the total capital income share and that without the housing sector income, and there is a similar trend in the US though it is less evident. There is, however, no significant trend of the rising capital income share in Japan for the whole period, nor for France after the late 1980s. The capital income share rose in Anglo-Saxon countries only. It is remarkable that all countries experienced a continuous rise in the housing capital income share. Therefore, when we exclude the effect of housing income, the rise in the capital income share becomes smaller in all countries. Specifically, housing capital income plays such an important role in increasing the capital income share for the whole economy in the US that the capital income share without the housing sector does not appear to have risen significantly⁵.

This finding indeed weakens Piketty's argument and supports the criticism about the role of the housing sector, although not true for all countries. Piketty himself indicates this, arguing that the multidimensional nature of capital and changes in its relative prices including capital in the housing sector should be taken into account (Piketty, 2015a; 2015b). Piketty does, however, neither examine the role of housing in the increase of the capital income share nor the cause of changes in the housing market in terms of inherent dynamics of capitalism. To him, capital accumulation is the essential factor for

Figure 1. Decomposition of Capital Income Share in 4 Countries





Note: Yw: capital income share from the whole economy, Yh: that from the housing sector, Ynh: that from the economy without the housing sector

Source: Piketty and Zucman (2014).

changes in inequality; the rise and fall of real estate prices tend to offset each other in the long run (Piketty and Zucman, 2014). But we cannot ignore the crucial role of the housing sector in the recent increase of capital income and the wealth-income ratio as well (Weil, 2015). In fact, according to Piketty and Zucman's own estimation, the rise in capital gains such as the rise in real estate prices accounts for 42% of the increase in the wealth-income ratio from 1980 to 2010 in the US.

This calls on us to make more efforts to investigate thoroughly why housing capital income increased⁶. With regard to the recent rise in the prices of the housing sector, it is particularly worthwhile to focus on the role of political factors behind the housing market bubble after the 1980s. The so-called financialization of the economy under neoliberalism that represents the response of financial capital to the structural crisis of capitalism in the 1970s, which strengthened the power of capital against labor, was an important background for the asset market bubble (Dumenil and Levy, 2010). Furthermore, tight regulation in the real estate sector, for example in California, which was influenced by political pressure from vested rights to some extent, was also associated with the rise in real estate market prices. This suggests that a political economy viewpoint would help us to properly examine the recent change in the housing sector and its role in rising inequality.

4. $r > g$ and Wealth Inequality

4.1 The role of the inequality $r > g$ and its limitation

The most confusing issue in Piketty's work is the role of his famous inequality $r > g$ that the return of capital is higher than the growth rate. Many critics assert that $r > g$ is not essential to historical changes in inequality of income or wealth. Mankiw (2015) argues that if wealth inequality is going to rise r should be much higher than g , which is unrealistic. Acemoglu and Robinson (2015) emphasize that we should study institutions and politics rather than this simple inequality to examine the dynamics of inequality. In fact, the recent rise of top income concentration in the US is much more closely related with changes in politics and institutions than $r > g$. The controversy about $r > g$ may have much to do with misunderstanding about Piketty's original argument. As Jones (2015) indicates, Piketty argues that the effect of $r > g$ is mainly on wealth inequality, derived from a model of wealth inequality that assumes a Pareto distribution⁷. Piketty also posits that while the gap between r and g is a crucial amplification mechanism of inequality in a model of wealth distribution with realistic shocks, the role of $r > g$ is different across time and place (Piketty, 2015a; 2015b). For instance, its role is limited in the recent rise in the top income share in the US, which is more associated with the increase in top labor income, while its role was essential in the rise of inequality in Europe in the 19th century. Piketty stresses $r > g$ as a law of capitalism in his book but he also points to the importance of institutions in his book repeatedly.

Piketty's explanation, however, does not resolve the controversy. In Piketty's theory, lower g would result in higher wealth concentration and a higher wealth-income ratio given that r and s are stable and exogenous. He reports that r has been stable in history, around 4-5% before tax, even though the

wealth-income ratio has changed, which is why the capital income share rose along with capital accumulation in the recent period. Though it is against the intuitive idea that the marginal productivity of capital would have declined, based on historical data, Piketty finds that r is stable. He also assumes that the saving rate is about 10% of net income, and the growth rate of income is affected by population growth in the long run. Variables such as the return of capital, the growth rates and the saving rate could, however, be endogenous in reality, different from Piketty's assumption. As Jones (2015) notes, when the parameters that determine Pareto wealth inequality are interrelated, we may not assume that changing any single parameter will have an unambiguous effect on the distribution of wealth. Stiglitz (2015) also argues that for a variant of the Solow growth model in which r is not exogenous, $r > g$ is not relevant to wealth inequality. He underscores the need for a new income distribution theory that divides the economy into the productive sector and unproductive rent-seeking sector. Furthermore, if the saving rate is affected by the growth rate, the wealth-income ratio, which is determined by $\frac{s}{g}$ in steady state equilibrium in Piketty's theory, would not rise high along with the decline of the growth rate (Krussel and Smith, 2015).

We will empirically test endogeneity of variables in the next section. Before doing that, let us first consider theory to see whether r and s are exogenous. The common neoclassical production function with the constant elasticity of substitution (CES) is as follows,

$$Y = \left[\alpha K^{\sigma - \frac{1}{\sigma}} + (1 - \alpha) L^{\sigma - \frac{1}{\sigma}} \right]^{\frac{\sigma}{\sigma - 1}}$$

In the first order condition for profit maximization,

$$r = \alpha \beta^{-\frac{1}{\sigma}},$$

$$\text{and in steady state } r = \alpha \left(\frac{s}{g} \right)^{-\frac{1}{\sigma}}, \quad \alpha = r * \beta$$

In this model, r is affected by g in the steady-state equilibrium because r is a positive function of g . This means that when the growth rate becomes lower the rate of return on capital will also become lower. This is not consistent with Piketty's finding that r has been stable. Of course, the historical data could be different from the steady state equilibrium condition because the real state of the economy could be far from the equilibrium. Notwithstanding this, let us consider the change in $r - g$ with respect to the change in g . As the equation for r demonstrates, the change in $r - g$ along with the change in g is associated with the elasticity of substitution at the equilibrium condition. Table 2 presents a simple simulation result with the different elasticities of substitution. In the result, $r - g$ will rise when g falls only if the elasticity of substitution is extremely high. Although this holds only in the equilibrium, the unrealistically high elasticity indicates the difficulty when we apply the neoclassical production function to Piketty's argument.

Table 2. Simple simulation of the change in $r-g$ along with the fall of g

g	σ	r	$r-g$	β	α
0.04	1	0.12	0.08	2.5	0.3
0.03	1	0.09	0.06	3.333333	0.3
0.02	1	0.06	0.04	5	0.3
0.01	1	0.03	0.02	10	0.3
g	σ	r	$r-g$	β	α
0.04	2	0.189737	0.149737	2.5	0.474342
0.03	2	0.164317	0.134317	3.333333	0.547723
0.02	2	0.134164	0.114164	5	0.67082
0.01	2	0.094868	0.084868	10	0.948683
g	σ	r	$r-g$	β	α
0.04	4	0.238581	0.198581	2.5	0.596453
0.03	4	0.222025	0.192025	3.333333	0.740082
0.02	4	0.200622	0.180622	5	1.00311
0.01	4	0.168702	0.158702	10	1.687024

Notes: 1) Using CES production function.

2) Assuming that $s = 0.1$ and originally $\alpha = 0.3$.

Therefore, as Piketty himself states (Piketty, 2015c), future study should comprehensively discuss factors other than just $r > g$ that are relevant to changes in inequality. We should highlight the role of politics and institutions, and investigate factors that affect power relationship, such as globalization, technology, and population, for example. Globalization has been generally considered as a cause for rising inequality and a reason for the weakening in workers' bargaining power for long by many researchers. In addition, the effects of robot and IT technology may be harmful to workers' position since they could bring about serious unemployment⁸. A recent study also asserts that a decline of working-age population due to low birth rates in emerging markets such as China would result in a reversal of the trend of inequality between capital and labor in the future (Goodheart et al., 2015). The authors of that study argue that the rising inequality has been associated with an increase in the number of workers owing to the integration of former socialist countries including China into the global economy.

4.2 Empirical examination

This section presents empirical results to evaluate Piketty's argument, using his historical data (Piketty,

2014) and econometric tests. We first investigate whether the saving rate and the rate of return on capital are exogenous, or are instead affected by the growth rate. Second, more importantly, we examine if $r - g$ influences wealth inequality as Piketty argues. We use historical data from the 1870s to the 2000s in several advanced countries. The regressions employ the OLS (Ordinary Least Square) or fixed effects model including country dummies without controlling for other variables. Thus, our test is mainly a check for statistical correlation between two variables using long-run data, reporting the graphs together with coefficients and t ratios, following Krussel and Smith (2015).

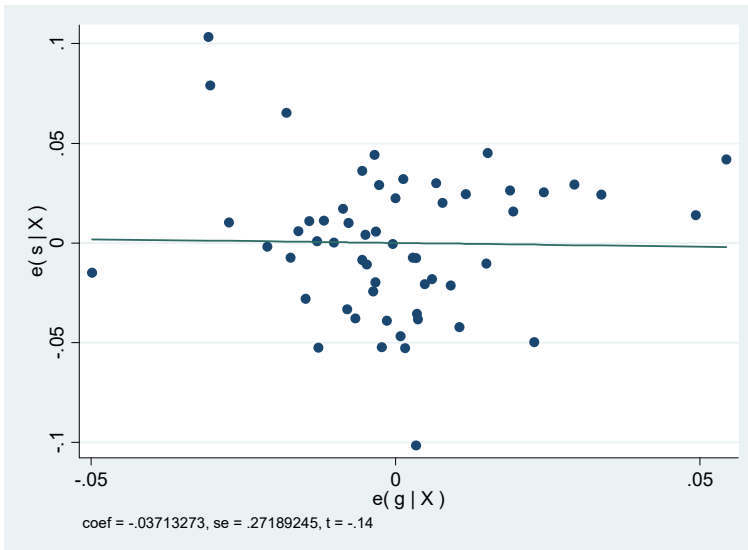
Figure 2 demonstrates the regression result of the effect of the growth rate on the saving rate. Using ten-year average data to reduce volatility, we find that the saving rate is not affected by the growth rate when we use long-run data of four countries, whether using the OLS or fixed effects model. This appears to support Piketty's original assumption. We, however, find that the growth rate is statistically significant to the saving rate after the Second World War for seven countries, as shown in Figure 3. This is consistent with the recent finding of Krussel and Smith (2015). If the saving rate is endogenous as they argue, the historical dynamics of the wealth-income ratio could be different from the original argument of Piketty. Furthermore, the rate of return on capital is affected significantly by the growth rate in both the long-run model and the model after the Second World War. This refutes Piketty's assumption and finding that r is stable, while it verifies the result that r is a positive function of g in steady state as we discussed in the former section. Though the causality is not certain since it could run from the return on capital to the growth rate, or from the saving rate to the growth rate, our finding suggests variables such as r , s and g are interrelated and endogenous.

Finally, what is the effect of $r - g$ on wealth inequality? Acemoglu and Robinson (2015) find that $r - g$ is not significant for income inequality in empirical examinations using historical data for a panel of advanced countries. Piketty, however, replies that the inequality $r > g$ is not relevant to income inequality but to wealth inequality as we discussed. Therefore, we test how wealth inequality is affected by $r - g$, using long-run historical data of top 1 % wealth concentration. The data include the US, France and UK from the 1870s to 2000s, all from Piketty (2014). Figure 4 demonstrates that their statistical correlation is not significant. There is no empirical evidence that $r - g$ is significant for top 1% wealth concentration, either in the OLS model or fixed effects model.

This result does not support Piketty's argument in his book and in other related theoretical and simulation results (Piketty and Zucman, 2015). To be sure, it should be taken with caution. Our regression includes only three countries. The measurement of wealth inequality is very difficult, so that the coverage of the data is very limited. Besides, there could be a time lag for the larger gap between r and g to amplify wealth inequality. The nature of shocks to the process of wealth concentration in reality could be complex and could change over time. All these factors could make the relationship between $r - g$ and wealth inequality too complicated to be tested by simple regressions. It is, however, certain that we do not find evidence for the role of $r > g$ in the rise of wealth inequality in the test with available historical data.

Figure 2. Correlation between the saving rate and the growth rate

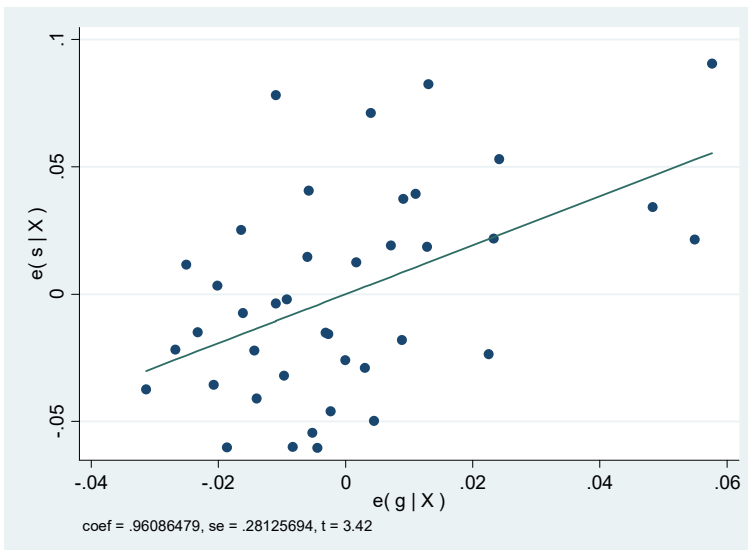
(1) Long-run relationship



Notes: 1) Using ten-year average data for 1871-2010 using data for the US, France, the UK and Germany

2) This is the result of OLS regression, and panel fixed effects model gives the qualitatively same results.

(2) The relationship after the Second World War

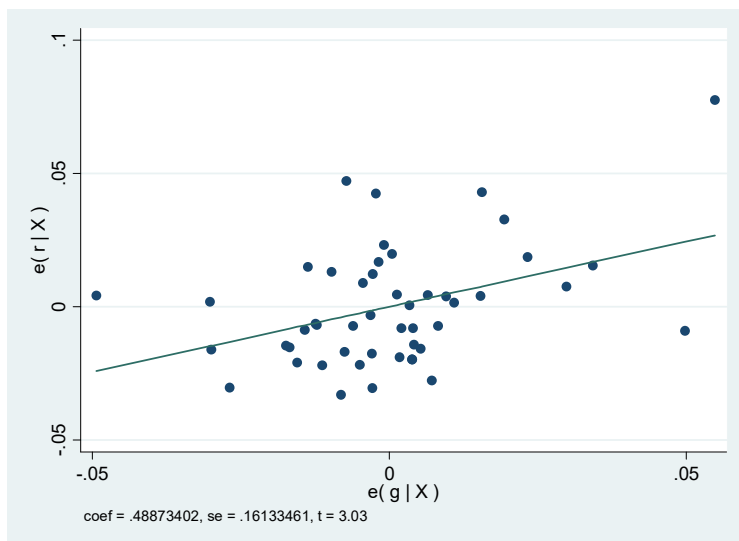


Notes: 1) Using ten-year average data for 1951-2010 using data for seven advanced countries

2) *ibid.*

Figure 3. Correlation between the rate of return on capital and the growth rate

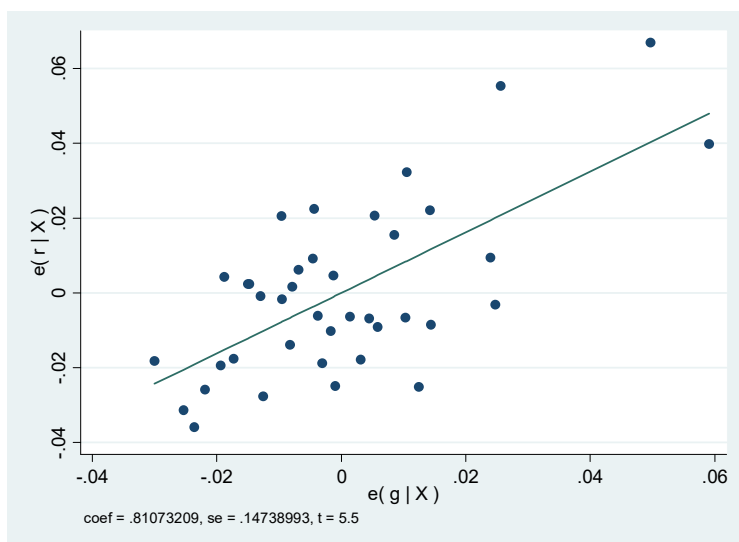
(1) Long-run relationship



Notes: 1) Using ten-year average data for 1871-2010 using data for the US, France, the UK and Germany

2) Ibid.

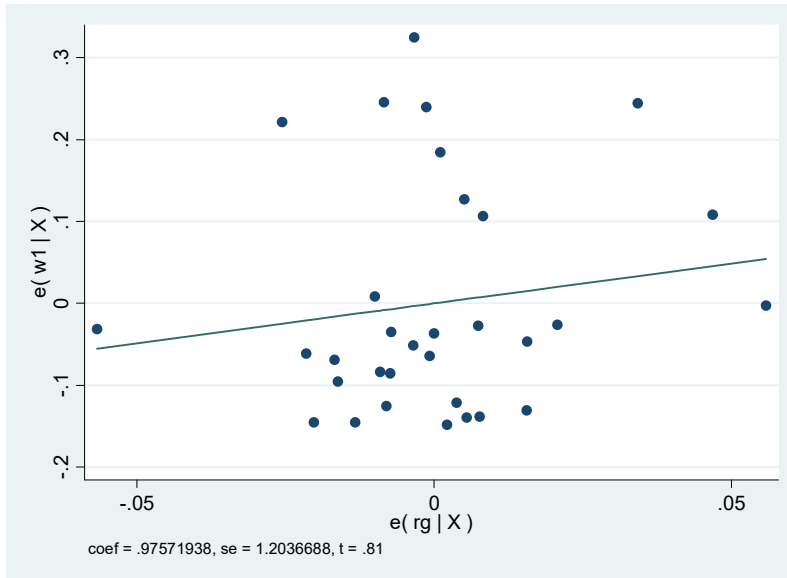
(2) The relationship after the Second World War



Notes: 1) Using ten-year average data for 1951-2000 using data for seven advanced countries

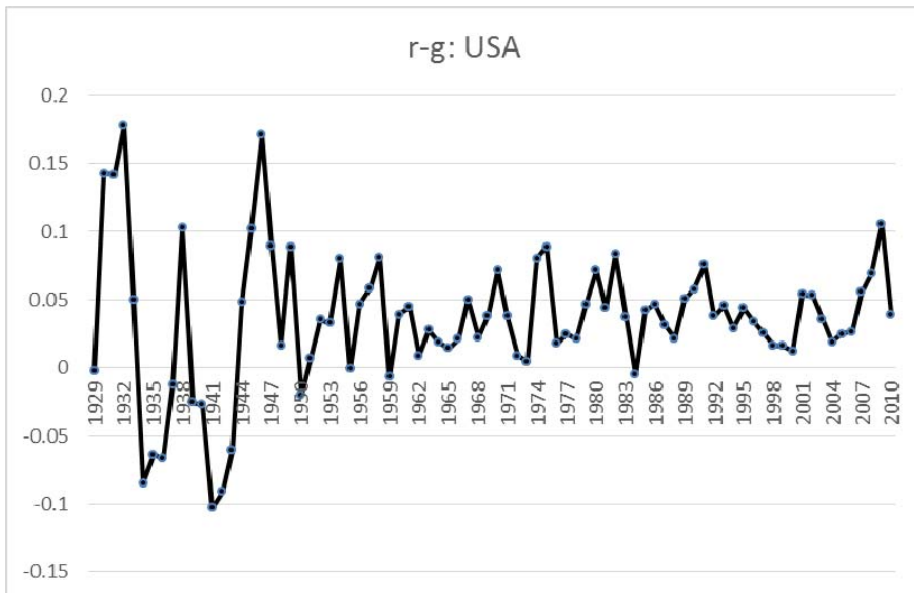
2) Ibid.

Figure 4. $r-g$ and top 1% wealth concentration



Notes: 1) Using ten-year average data for 1871-2010 using data for the US, France and the UK
 2) Ibid.

Figure 5. $r-g$ in the US



Source: Piketty and Zucman (2014).

We also observe a similar result when we compare the historical data of $r - g$ in Figure 5 and wealth inequality in the US. There is no clear U-shaped trend for $r - g$, while the top 1% and 10% wealth concentration does show a U-shaped trend after the 1920s as Saez and Zucman (2014) report. Overall, there is no strong empirical evidence to support Piketty's argument about the exogenous saving rate and the return of capital, and the effect of $r - g$ on wealth concentration. This encourages us to conduct more extensive empirical analysis about the changes of r and s , and about the role of $r > g$ in wealth inequality, in order to study capital accumulation and distribution altogether.

5. Conclusions

Piketty's study examines the historical dynamics of inequality along with capital accumulation. He finds that the capital income share and top income concentration have been rising since the 1970s along with the rise of the wealth-income ratio. This suggests that the elasticity of substitution between capital and labor is higher than 1, as he assumes that the rate of return is stable along with capital accumulation. In addition, he argues that the gap between the rate of return on capital and the growth rate contributes to the rise in wealth inequality significantly, although he also indicates the important role of politics and institutions in the change of inequality.

Piketty's argument has ignited hot debates among economists. Many economists criticize it, pointing to the problem of the elasticity of substitution, the role of the housing sector and the issue of the inequality $r > g$. In this paper, I attempt to review these critiques extensively and present an analysis that emphasizes the political economy perspective. First, I investigate the issue of the elasticity of substitution by measuring it with and without the housing sector. The result shows that Piketty's data are not very consistent with the common neoclassical production function approach. Second, my examination of the role of the housing sector has demonstrated that housing income contributed to the rise in the capital income share though there is a large heterogeneity in the change of the capital income share across countries. A more comprehensive study about the change in the real estate sector in terms of financialization and neoliberalism after the 1980s is called on. Finally, I have conducted an empirical analysis of the saving rate, the rate of return on capital and the effect of $r > g$ on wealth inequality using Piketty's historical data. I have found that there is no empirical evidence to support his argument.

In conclusion, my examination asserts that the future study about rising inequality in the recent period should overcome Piketty's limitations. There are several studies following Piketty's work, including an empirical analysis of the elasticity of substitution and a study about the historical trend of wealth inequality in mainstream economics (Karabarabounis and Neiman, 2014b; Saez and Zucman, 2014). It is, however, necessary to develop study about inequality from a political economy perspective. Theoretical and empirical study that takes politics and the bargaining power of capitalists and workers into consideration is warranted.

Notes

- ¹ See Piketty's following statement. "Now, does this (more different uses of capital and robot technology) mean that it is the right explanation for what we have seen in recent decades? Certainly not. As I make clear in my book, there are many other explanations for what happened in recent decades and this comovement of α and β . One is the increase in the bargaining power of capital: globalization, the decline of labor unions, etc. The general increase in the bargaining power of capital has certainly contributed to the rise of the capital share." (Piketty, 2015c).
- ² It should be noted that this simple calculation does not take technical change into account. Recently, Lawrence (2015) argues that the rising capital income share and the capital-output ratio as well could be explained by the elasticity of substitution less than 1 if technical change is labor-augmenting. He presents the empirical evidence for it and supports a neoclassical account.
- ³ For example, the elasticity of substitution without the housing sector in the US from 1970 to 2010 is higher than that with the housing sector. It is because the growth rate of the capital income share, measured by the log difference, without the housing is higher than that with the housing sector, since the capital income share without the housing sector rose rapidly in 2010.
- ⁴ Rognlie (2014) reports that he cannot find the rising trend of the capital income share without housing income from 1970 to 2010 by showing the information in individual countries. We could, however, see the slight increase of the capital income share without the housing sector in several countries if we start the graph from 1975 even in his study. The graphs in Piketty (2014) actually start from 1975 and report the rising capital income share.
- ⁵ A number of studies report that the capital income share rose, particularly after the 2000s, using the data of the corporate business sector only and the data of the gross share, different from Piketty (2014) (Jacobson and Occhino, 2012). Bridgman (2014) argues that the rising trend of the net capital income share excluding depreciation is less outstanding because depreciation increased recently.
- ⁶ In many advanced countries, the rise in housing capital income and that of the housing price occurred at the same time. However, it is not always so. For instance, the housing capital income share rose after the burst of bubble in the early 1990s of Japan, while that did not increase rapidly in 2000s of France even though there was real estate market bubble then.
- ⁷ For another theoretical model that shows the effect of $r - g$ on wealth inequality in the long run through inheritance, see Piketty and Zucman (2015).
- ⁸ Many mainstream economists argue that the skill-biased technological change resulted in the rise of wage inequality among workers after the 1980s by promoting job polarization. The empirical ground of this argument is not strong and the reality is much more complex (Mishel et al., 2013). However, there is a serious concern that the effect of the recent robot technology on inequality and workers' position could be much bigger than before because it could replace human workers with robots in many sectors.

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Appendix 1. Calculation of the Elasticity of Substitution for 4 Countries

All sector	USA		France		UK		Japan	
	β	α	β	α	β	α	β	α
1970	3.422654	0.202233	3.100413	0.199049	3.056061	0.204531	2.986215	0.332998
1975	3.199627	0.21056	3.170465	0.154937	3.011896	0.14718	3.855352	0.216998
2007	4.940232	0.259926	5.534599	0.231383	5.227108	0.278296	5.785061	0.279931
2010	4.099219	0.285582	5.745578	0.212928	5.21876	0.259133	6.012375	0.257351
1970s	3.340641	0.211199	3.123684	0.169247	3.13929	0.191268	3.773597	0.262084
2000s	4.4323	0.252547	4.833501	0.222598	4.979743	0.256333	5.87621	0.255742
	σ		σ		σ		σ	
70-10	-1.09503		1.122663		1.79269		0.730868	
70-07	3.163168		1.350907		2.34621		0.79207	
75-10	-4.34686		2.149354		-34.3665		1.622881	
70s-00s	2.719863		2.685675		2.736846		0.947587	
Nonhousing	USA		France		UK		Japan	
	β	α	β	α	β	α	β	α
1970	2.433457	0.156834	2.26466	0.154963	2.30755	0.181983	2.071427	0.301335
1975	2.134015	0.167347	2.10319	0.114118	1.906157	0.116733	2.527198	0.18881
2007	3.541528	0.197005	2.618691	0.1573	3.032002	0.225584	4.601511	0.223986
2010	3.299561	0.216675	2.735608	0.14049	3.133298	0.191631	4.758631	0.193028
1970s	2.260299	0.167682	2.09553	0.126987	2.032173	0.163147	2.508216	0.231387
2000s	3.208466	0.186871	2.46856	0.150385	3.023663	0.201789	4.601677	0.198826
	σ		σ		σ		σ	
70-10	-16.2531		0.658334		1.203204		0.651254	
70-07	2.5491		1.11489		4.686878		0.729045	
75-10	2.455743		4.780479		377.5864		1.036175	
70s-00s	1.447837		-31.0128		2.150342		0.800056	

Note: β : the wealth-income ratio, α : the capital income share

Source: Piketty and Zucman (2014).