The Dynamics of Manufacturing Profit Rates
in Seven Industrialized Countries

Gyun Cheol Gu

Abstract

This paper aims to overcome some limitations of the previous literature from a Marxist perspective that uses the distinction between productive and unproductive labor by focusing only on manufacturing sector in seven industrialized countries both in Europe and America, decomposing the rates of exploitation and thus profit in a consistent way with the Marxian notion, and comparing them to help understand what produces the differences between the countries during the past 30 years. In so doing, it also illuminates the relationship between conventional, flow, and stock rate of profit rate. The comparative analysis of the different manufacturing sectors shows that the degree to which recent increases in the profit rate are caused by higher rate of exploitation is not varying across the countries, but the capitalist methods to raise the rate of exploitation are quite different from each other.

JEL classification: B51, N60, O30

Keywords: Profit Rate; Exploitation; Wage Share; Labor Structure

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I. Introduction

There have been a number of empirical investigations into Marxian rate of exploitation and rate of profit in several countries, since 1994 when Shaikh and Tonak presented a path-breaking foundation for the measurement of the production of nations from a classically inspired surplus-based perspective. This methodological framework helps to transform official data contained in the National Income Accounts and input-output tables into Marxian categories.

Some of subsequent studies have tried to revise or update the empirical contributions of the seminal book within or without the US. Mohun (2005) examines the methodology of Shaikh and Tonak underlying their calculation of estimates of productive labor in the US economy from 1964 to 2001; and finds that better approximations are possible, and on this latter basis their methodology can be used to provide the labor and wage estimates needed for empirical investigations. Ortiz (2005) proposes a heterodox analysis of the rate of profit, which is especially useful in situation which has no reliable data on capital stocks: the difference between the rates of growth of productivity and wage rates; and compares this with the standard Marxian approach in the Mexican economy.

Others have applied the measurement method to check and explain whether or why the rate of profit has been falling or rising because the conventional estimates of macroeconomic variables fails to reflect the Marxian notion of surplus value; and at the same time they have tried to decompose sources which affect the dynamics of the rate of profit. Wolff (2001) examines the role of the change in the profit share and capital intensity on movements in the rate of profit in the United States between 1947 and 1997; shows that a rise in the profit share in national income and a decline in the capital-output ratio have brought about the rise of profits during that period. Dumenil and Levy (2002) also acknowledge a new upward trend of the rate of profit around 1980s, but they argue that the continuous downward trend and the limited recovery can be more
clearly observed when they remove from the data set a specific group of industries such as railroads – called highly capital intensive industries – whose capital-labor ratio is very large. Turning to the outside of the US economy, Mohun (2003) describes the Australian rate of profit and its decomposition over the same period and finds similar long run developmental tendencies to those described in the US studies even though the Australian recovery of the profit rate is stronger. In examining the historical development of postwar capitalism in Greece by applying the methodology of Shaikh and Tonak, Maniatis (2005) finds strong empirical support for Marx’s theory of the falling rate of profit and concludes that the Marxian theory of capitalist development provides a reasonable account of the historical experience, the current state, and the prospects of the Greek economy. Cronin (2001) examines the neo-liberal reform of the New Zealand economy based on the methodology developed by Shaikh and Tonak (1994), which maps its official national accounts data to classical economic categories for the 1972 to 1995 period; and shows that there was a large increase in unproductive economic activity associated with the economic reform, which neoclassical economists would argue to serve for higher economic growth rate. And Izquierdo (2007) evaluates the profit rate of the Spanish economy from 1954 to 2001, which is primarily influenced by evolution of income distribution – conditioned by a particular performance of real wages – and increase in capital composition – caused by mechanization of the economy.

However, there are three critical limitations on the previous literature. Firstly, all of the empirical researches estimate only highly-aggregated macroeconomic variables from the Marxian perspective. Actually, there has been a primary purpose within the Marxist tradition: the description and explanation of the average rate of profit and its trend over time (Dumenil and Levy, 2002; Shaikh and Tonak, 1994; Wolff, 2001). Thus, that focus on the economy as a whole is in part due to their commitment to verifying the Marxian notion of the falling rate of profit in the whole economy and in part because of the implicit assumption that the profit rates of industries tend to converge to the average profit rate of the economy as a whole. But as the
evidence shows above, the rate of profit tends to recover from around 1980s; and each industry can maintain a different rate of profit from one another even in the long-run. Secondly, there have been few empirical comparative studies of two or more countries in terms of their differences in magnitude and source of the rate of exploitation and the rate of profit. True, Zafirovski (2003) tries to estimate rates of labor exploitation in some industrial countries, but the method has nothing to do with Marxian notion of exploitation because it uses marginalist categories\(^2\) to demonstrate exploitation. The reason why there has been little attention to the multi-national comparative analysis is that as long as they stick to the method of Shaikh and Tonak (1994), the chances are they have little chance to find relevant data sets for all the countries involved during a considerable period. If the attention is paid on industry level such as manufacturing, the obstacle may be easily disappeared as in this paper. Thirdly, they decompose the rate of profit in a variety of way in which income distribution, productivity and technology play main roles as its sources. Yet, there have been few attempts to decompose the rate of exploitation in a consistent way with that of Marx. Given that the rate of profit is determined in part by the exploitation, it can be quite worth investigating its sources as well. Even if Izquierdo (2007) suggests a decomposition of the rate of surplus into productivity and real wage, Izquierdo does not differentiate between productive and unproductive labor by assuming that the ratio between the two class positions remains constant in the long run due to the absence of relevant data, which means that the decomposition fails to reflect the effect of the changes in the ratio of the two groups and their income inequality on the rate of exploitation.

This paper aims to overcome these limitations by focusing only on manufacturing sector in seven industrialized countries, decomposing the rates of exploitation and thus profit in a consistent way with the Marxian notion, and comparing them to help understand what creates the

\(^2\) It refers to Pigou’s measure of exploitation: \(E=(VMP-W)/W\) where VMP is the value of the marginal product of labor and W is the wage rate.
differences between the countries during the past 30 years. Before investigating into them, it is necessary to see fundamental changes we can observe in labor and wage structures.

II. Structural Changes in Labor and Wage Structure since 1975

1. Steadily Increasing Unproductive Labor

The distinction between productive and unproductive labor is one of the cornerstones of the labor theory of value. Savran and Tonak (1999) provide a brief enumeration of the relevant theoretical aspects: the analysis of capital accumulation; the determination of economic variables; the impact on the rate of profit; state intervention and the redistribution of income; and the impact of the growth of the social, financial and consumer service sectors on capitalist economies. Moreover, it has its fundamental importance to the empirical analysis of capitalist economies: the concept of productive labor is essential for the conversion of economic variables of the conventional national account systems into categories coherent with the labor theory of value (Shaikh and Tonak 1994). Nevertheless, there has been a continuing controversy over the definition and refinement of the concept of productive labor in Marxian literature; in part because of the heterogeneous treatment of the subject in Marx’s work and his main writings on productive labor being inconclusive.

Controversy over the concept has recently become evident in the debate held both on theoretical and empirical grounds by significant proponents of either Marx’s labor theory of value or theory of class. Firstly, Marxist scholars such as Anwar Shaikh, Ahmet Tonak, and Simon Mohun have defended the need to maintain the distinction, and have emphasized its importance in empirical analysis (Shaikh and Tonak, 1994; Mohun, 1996, 2002; Savran and Tonak, 1999); contrariwise, some Marxists led by David Laibman and David Houston have proposed abandoning the
distinction, arguing that it is insignificant for the labor theory of value (Laibman, 1992; Houston 1997). Secondly, some Marxists such as Erik Olin Wright and Harry Braverman have argued that the distinction between productive and unproductive labor should be dropped because it divides the working class into different groups; and thus insisted that the two groups’ common fundamental interest necessarily and always places them both in the working class. In contrast, Resnick and Wolff see the need to reassess constantly the changing relationships between productive and unproductive laborers (Resnick and Wolff 1987). The review of these debates is far beyond the purpose of this paper; but given the usefulness of the distinction in Marx’s goal and purpose of his theory of class, I would agree that this distinction – productive and unproductive labor – is essential, integral to Marx’s theory of class, and to his overall critique of capitalism.

To begin with, it is necessary to understand Marxian definition of the distinction before looking at the structure change in the ratio of productive and unproductive laborers and their wage differentials. A distinction between productive and unproductive labor can be traced back to the Physiocrats, who asserted that only agriculture labor was productive since it contributes to the economic surplus. Marx also made a distinction between them for the purpose of accurately measuring exploitation (the magnitude of which determines profits). Marx’s own discussion was rather complex. At the most general level, he maintained, labor is productive if it creates surplus value and unproductive if it does not:

Productive labor is therefore – in the system of capitalist production – labor which produces surplus-value for its employer. (Marx, Theories of Surplus Value, Part I, p. 396)

The result of the capitalist production process is neither a mere product (use-value) nor a commodity, that is, a use value which has a certain exchange-value. Its result, its product, is the creation of surplus-value for capital. (Ibid., p. 399)

In contrast, unproductive labor is that which produces no surplus value. In other words, if and when the work relationship does not contain the aspect of producing surplus value for another,
that is, does not include the capitalist fundamental class process, Marx refers to the labor in that work relationship as unproductive (Resnick and Wolff, 1987: 133). Accordingly, there are three noteworthy aspects associated with the distinction (Howard and King, 1985: 129). Firstly, the dichotomy relates specifically and exclusively to the capitalist mode of production. According to Resnick and Wolff (1987: 133), when work relationships involve the fundamental class process in any but the capitalist form, the labor performed is unproductive; hence the labor of feudal, slave, and so forth – performers of surplus labor – is unproductive: no surplus value is produced. Secondly, value judgments are entirely irrelevant, since there is no question of moral or other standpoints in the case of either the one or the other kind of labor. Thirdly, unproductive labor may be useful, even indispensable to the efficient operation of the capitalist economy, while a use value of a commodity in which the labor of a productive worker is embodied may be of the most futile kind.

Turning to empirical evidence, the number of production employees in manufacturing has been robustly decreasing in all the countries – even if there were some recovery time for Canada
and Austria – during the period reported in Figure 1 and Table 1. We assume that the production workers are the appropriate substitute and proxy variable for Marxian productive laborers (see Appendix A for the details).

Table 1. The Ratio of Production to Total Worker in Manufacturing during 1975-2007

<table>
<thead>
<tr>
<th>Year</th>
<th>USA</th>
<th>CAN</th>
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<td>n.a.</td>
<td>n.a.</td>
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<td>n.a.</td>
</tr>
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<td>n.a.</td>
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<td>0.8059</td>
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Ave. 0.5672 0.6586 0.6471 0.6503 0.5741

Source: (1) Most of figures come from LABORSTA Labour Statistics Database of ILO available at http://laborsta.ilo.org; (2) * indicates data provided by Baldwin and Rafiquzzaman (1998); (3) ** represents ratio that is reported in Hollanders and Weel (2002); (4) Shaded areas means that the data are estimated by the author based on the assumption that production labor ratio changes steadily and proportionally along the linear trend between two observations. For further detail, see appendix A for ILO occupational classification.

See “Table 1E Economically active population, by industry and by occupation” under “Main statistics (annual)".
It should be noted that the ratio in the US manufacturing already maintained to keep low in 1975; hence there might be little room for further reduction in the ratio afterward.

2. Widening Wage Inequality between Productive and Unproductive Worker

The wage differential between productive and unproductive worker has been steadily widening across most of the countries except UK and Spain, where the upward trend was reversed to begin to drop around the early 1990s as Figure 2 shows. In addition, I develop an inequality index to measure the degree (for each country) to which the total wage income is concentrated on the unproductive workers by adapting the notion of Gini coefficient (see Appendix B for the details):

\[
G = a(1 - \frac{w_p}{w})
\]

Figure 2. The Wage Differential of Productive and Unproductive Worker
The inequality index (G) has the same attributes as Gini coefficient, which implies that the higher the index is the more unequal the wage income distribution is between productive and unproductive employees in the manufacturing. Figure 3 shows that the wage income inequality between productive and unproductive employees has been deteriorating except UK, where its upward trend was reversed around the early 1990s only to drop to the level of the late 1970s. It is remarkable to demonstrate that the inequality (or wage income concentration) index G keeps rising even if the number of unproductive workers has been steadily increasing relatively to that of productive ones, which implies that the wage differential should be large enough to cancel out the force of the increasing number of unproductive workers to reduce the index.

Figure 3. Degree of Income Inequality between Production and Nonproduction Workers

![Gini Coefficient between Production and Nonproduction Workers](image)

3. Shrinking Wage Share\(^4\) in Net Output

Figure 4 shows the historical time series of the wage share in net output or net value added. The share of wage compensation tends to decrease while the share seems to behave cyclically but

\(^4\) Here the wage refers to total labor compensation of both productive and unproductive workers.
within narrower bounds. The downward trend has much to do with more labor-saving technology adoption and lesser union bargaining power caused by increasing international trade and competition within manufacturing sector as well as business cycle. These issues are beyond this paper’s main theme; but it would provide better understanding of recent change in manufacturing to investigate their relations.

Figure 4. Wage Income Share of Production and Nonproduction Workers in Net Output

<table>
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<th>CAN</th>
<th>FIN</th>
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</table>

III. Decomposition of Marxian Rate of Exploitation

This chapter deals with Marx’s analysis of exploitation and suggests consistent decompositions for the comparative analysis of the countries. For Marx, labor itself is a two-dimensional activity: duration and intensity. Marx identified four determinants of the rate of exploitation (rate of surplus value): the level of technical development in the wage goods industries, the intensity of labor, the real wage\(^5\) and the length of the working day\(^6\). In order to raise the exploitation rate, on

\(^5\) Real wages are here defined in the modern sense, as the money wage of homogeneous labor deflated by an appropriate price index such as CPI.

the one hand, capitalists increase the length of working day without increasing wages, which leads to higher absolute surplus value; but since the length of the absolute working day has been shortened over 20th century, this paper dismisses this determinant in explaining the sources of the rate of exploitation. On the other hand, they also increase relative surplus value by adopting labor-saving technology and thereby reducing the value of the wage bundle (e.g. reducing CPI in a modern term) and thus labor time necessary to produce a given quantity of wage goods; by lowering real wage (e.g. raising money wage by less amount than that of concurrent increase in CPI) and thus reducing the necessary labor; and by providing more work supervision and discipline through more management resources thereby increasing labor intensity. The first two ways to increase the rate of relative surplus value can be boiled down to keeping constant or reducing the real wage. However, empirically this interpretation fails to explain the actual history that real wages had risen until the early 1970s; and theoretically it should assume away the possibility for technological change to increase productivity. So it is often argued that Marx’s concept of the real wage referred to the share of wages in net output as is suggested in one famous passage by Marx himself7, since it allows for a relative concept of immiseration and a possibility of real wage increase less rapidly than the productivity of labor (Howard and King 1985: 120).

Having said that, the first two relative ways to increase the rate of relative surplus value can be boiled down to reducing the wage share of productive laborers in the net produced value, i.e. net value added. In sum, according to the interpretation of real wage as wage share, the rate of relative surplus value turns out to be determined by two factors: productive labor’s wage share in net value added and unproductive management labor’s share in total labor time. True, the former can be easily derived from the mathematical formula of the rate of exploitation:

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7 “[T]he occupant of the relatively small house will feel more and more uncomfortable, dissatisfied and cramped within its four walls.” (Selected Works, Volume I, Moscow 1969)
\[ e = \frac{S}{V} = \frac{U - W_p}{W_p} = \frac{U}{W_p} - 1 \]  

(1)

where \( S \) is surplus value, \( U \) is net value added, and \( W_p \) is total productive labor compensation.

Here the rate of exploitation is determined by the share of the productive labor’s wage in net output. Furthermore, it can be also expressed in two kinds of distribution relations behind the wage share:

\[ e = \frac{S}{V} = \frac{U - W_p}{W_p} = \frac{U}{W_p} - 1 = \frac{1}{\Theta \theta} - 1 \]  

(2)

where \( W \) is total labor compensation, \( \Theta \) is the labor income share in net value added, and \( \theta \) is the productive labor income share in total labor compensation.

The exploitation rate is composed of the two distribution relations: total labor income share of both productive and unproductive labor in net value added, and the productive labor income only within the total labor compensation. However, they fail to reflect the effect of labor intensity on the rate of exploitation; thus we need new decomposition and interpretation of the rate of exploitation which not only captures the labor intensity but also continues to reflect Marx’s class analysis of both fundamental and subsumed class processes within a capitalist industry. In other words, the new decomposition is supposed to incorporate the ratio of unproductive labor to total labor – a group of managers as unproductive labor exerts supervisory power over productive labor through a number of relevant social processes to intensify the labor process – and/or the wage differential between productive labor (occupying fundamental class position) and unproductive labor (occupying subsumed class position).
To start with, over the past thirty years we observe the historical trend of the rate of exploitation \( e = \frac{S}{V} \) in manufacturing sector of every country involved (Figure 5). They have continued to rise in all the countries during 1975 to 2007.

Figure 5. Marxian Rate of Exploitation

Here I suggest three decomposition formulas in order to investigate the sources of the growth in the rate of exploitation. First of all, the rate of exploitation can be decomposed as follows:

\[
e = \frac{S}{V} = \frac{U - W_p}{W_p} = \frac{uH}{aw_pH} - 1 = \frac{u}{aw_p} - 1 \iff e + 1 = \frac{u}{aw_p}
\]  

(3)

where \( H \) is total hour worked by all employed labor, \( u \) is net value added per labor hour, \( a \) is production worker ratio, and \( w_p \) is average hourly compensation of a productive worker.

Assuming that \( e + 1 \) is a good substitute for \( e \), equation (3) shows that the rate \( (e+1) \) is composed of productivity measure \( u \), the level of productive labor compensation \( (w_p) \), and production worker ratio \( a \). Given that the main objective of compositions here is to see the sources of the
upward trend, the growth rate of (e+1) is determined by three factors derived from equation (3): growth rate of net value added, growth rate of productive worker ratio, and growth rate of productive worker compensation:

\[ e + 1 = (u - w_p) - a \]  

(4)

In equation (4), the first term of the right hand side can be seen as a surplus which stems from the difference between productivity and wage growth, whereas the second term (a) can be considered the inverse index of labor intensity. We come to one conclusion from equation (4) that the growth of the rate of exploitation is accelerated by the growth of the unpaid surplus from increase in productivity and the growth of the number of the unproductive managers. We decompose average annual growth rate of (e+1) for each country into average annual growth rate of u, w, and a. Figure 6 shows the absolute contribution of the change in the three sources to the average annual growth rate; and Figure 7 graphs the relative contribution of that change to the average annual growth rate of (e+1).
Let us take the United State for an example. The rate of exploitation has been increasing by 1.2 % per year on average, which is the sum of increase in unpaid productivity gain (1%) and decrease in productive labor (0.2%). In other words, most of the growth of exploitation rate stems from the underpaid labor relatively to productivity growth (about 83%); and the rest comes from increased labor intensity caused by newly-employed managers. The relatively larger contribution of the unpaid productivity gain is observed across the other countries except UK and Spain, in which the major method to raise exploitation rate is to increase unproductive management resources.

Figure 7. Relative Decomposition of Growth Rate of $e+1$ from equation (4)

Secondly, the rate of exploitation can be decomposed into three sources: total labor income share, productive labor ratio, and wage differential.

$$e = \frac{S}{V} = \frac{U - W_p}{W_p} = \frac{U}{W} - \frac{aw_p H}{wH} - 1 = \frac{1}{\Theta a \frac{w_p}{w}} - 1 \Leftrightarrow e + 1 = \frac{1}{\Theta a \frac{w_p}{w}}$$ (5)
where \( H \) is total hour worked by all employed labor, \( w \) is average hourly compensation of all employed workers, \( w_p \) is average hourly compensation of a productive worker, and \( a \) is production worker ratio.

Equation (5) indicates that the rate of exploitation is increasing the lower the labor wage share is; the more the unproductive workers are, and the larger the wage differential between productive and unproductive workers is. We can derive components of the growth rate of \((e+1)\) from equation (5):

\[
e + 1 = -\Theta - a - \frac{w_p}{w}
\]

According to equation (6), the growth rate of \((e+1)\) is negative function of growth rate of labor income share, growth rate of production worker ratio, and growth rate of the ratio of production worker to average worker hourly compensation. Figure 8 shows the absolute contribution of the change in the three sources to the average annual growth rate; and Figure 9 reports the relative contribution of that change to the average annual growth rate of \((e+1)\).

Figure 8. Absolute Decomposition of Growth Rate of \((e+1)\) from equation (6)
As mentioned earlier, in the case of the United State, there has been little room for further reduction in the productive worker ratio, which allows other methods to prevail in increasing the rate of exploitation in this manufacturing sector as represented in Figure 6-9.

Figure 9. Relative Decomposition of Growth Rate of e+1 from equation (6)

![Bar Chart](chart.png)

Thirdly, the rate of exploitation can also be decomposed into other three sources: real productivity of hourly average labor, the wage income inequality and labor intensity:

\[
e = \frac{S}{V} = \frac{U - W_p}{W_p} = \frac{u}{aw_p} - 1 = \frac{w}{aw_p} \frac{u}{w} - 1 = \frac{u}{w} - 1 \iff e + 1 = \frac{u}{a - G} \quad (7)
\]

In equation (7), the numerator \((u/w)\) can be seen as a measure of real productivity of hourly average labor, whereas the denominator \((a-G)\) can be considered the sum of labor intensity and wage income inequality. We decompose average annual growth rate of \((e+1)\) for each country into average annual growth rate of \(u/w\) and \(a-G\):
Equation (8) allows us to demonstrate that the growth of the rate of exploitation \((e+1)\) is accelerated by the growth of the real productivity and the deterioration of working conditions (higher labor intensity and gaping wage differential) for productive workers. Figure 10 shows the absolute contribution of the change in the two sources to the average annual growth rate of \((e+1)\); and Figure 11 indicates the relative contribution of the changes in \(u/w\) and \(a-G\) to the average annual growth rate of \((e+1)\).

\[
e + 1 = \frac{u}{w} (a - G)
\]

(8)

Figure 10. Absolute Decomposition of Growth Rate of \((e+1)\) from equation (8)

Figure 11. Relative Decomposition of Growth Rate of \((e+1)\) from equation (8)
Lastly, we can demonstrate by using another decomposition that the conventional measure of exploitation rate (total profit/total wage) fails to take into account wage income inequality among productive and nonproductive workers (G) and managerial discipline factor (a):

\[
e \equiv \frac{S}{V} = \frac{U - W_p}{W_p} - 1 = \frac{u}{aw_p} - 1 = \frac{p + w}{aw_p} - 1 = \frac{w}{aw_p} (1 + \frac{p}{w}) - 1 = \frac{1 + \frac{p}{w}}{a - G} - 1 \tag{9}
\]

where \( p \) is conventional profit (net value added – wage bill) per labor hour.

Equation (9) allows us to see internal subsumed class process – distribution to unproductive employees of surplus value that is extracted and appropriated from the productive workers – which the conventional measure dismisses. Now that we analyze the constituent sources of the exploitation rate and compare them across the countries, it is time to turn to the rate of profit which has as its key ingredients the rate of exploitation and the organic composition of capital which introduces the effect of technological changes.

**IV. Conventional, Flow, and Stock Rate of Profit**

In this chapter, we compare three kinds of rate of profit: conventional, flow, and stock rate of profit. Figure 12-14 report the historical trend for each country respectively. They have been gradually rising since the early 1980s, in which neo-liberalism began to prevail across the industrialized Western countries.

Firstly, conventional rate of profit – defined as net value added (U) minus wage bill (W) divided capital stock (K) – shows a little different movements to the stock rate of profit – defined as surplus value (S) divided by capital stock (K) – while their absolute levels are more different.
Equation (10) shows what bring about the differences. The conventional rate of profit (p/k) does not include in the profit the compensation of unproductive workers, and thus underestimates the ‘true’ profit rate which should reflect additional profits extracted from within-labor inequality (G), disciplinary effort (1-a) as well as technological change (w/k).
\[ r_s = \frac{S}{K} = \frac{H}{K} = \frac{p + w - aw_{r}}{k} = \frac{p}{k} + \frac{w}{k}(1 - a + G) \]  

(10)

where \( r_s \) means the stock rate of profit and \( k \) is gross capital stock per labor hour.

In other words, the stock rate of profit can be increased by hiring more unproductive laborers (1-\( a \)) relatively to productive ones and aggravating the wage income inequality between workers (G), which is exactly what we witness during the period in the chapter II.

Figure 14. Flow Rate of Profit

Secondly, the evidence in some countries shows the possibility of flow rate of profit to play an appropriate estimate for the stock rate of profit: Spain and Austria have the two rates of profit almost identical to each other. But others do not show any evidence of such convergence.
What makes such divergence among the countries? A decomposition shown in equation (11) provides a possible answer to that specific question:

\[
\frac{S}{K} = \frac{e}{g} = \frac{C}{V} = \frac{C}{K} \approx r_f \frac{C}{K}
\]  

(11)

where \( g \) is organic composition of capital, i.e. the ratio of constant capital to variable capital (\( C/V \)), and \( r_f \) is flow rate of profit.

Assuming that \( e/g \) is not so different from \( e/(g+1) \) that they become almost the same\(^8\), the decomposition is a reasonable starting point to the answer. If \( C/K \) is constant, stock and flow rates of profit are almost the same. In other words, the two have the same movement only when the amount of intermediate goods which can be processed by one unit of capital stock is unchanged. Indeed, Figure 15 indicates that Spain and Austria maintain a very stable ratio of \( C \) and \( K \) over the period while others tend to increase the ratio \( C/K \).

Turning to focus on the determinants of the stock rate of profit, equation (11) gives us the decomposition of the growth in the stock rate of profit:

\[
\dot{r_s} = e - g + \frac{\dot{C}}{K}
\]

(12)

It shows that the stock rate of profit can be seen as the sum of three growth rates: the rate of exploitation (\( e \)), organic composition of capital (\( g \)), and input-capital ratio (\( C/K \)). The input-

\(^8\) Indeed, \( e/g \) becomes a more appropriate measure for \( e/(g+1) \) as \( g \) is increasing; since the ratio of the two is \( 1+1/g \), which means that \( 1/g \) is the error that prevent them from converging to each other. Empirically, \( g \) has been growing approximately from 5 to 10 in all the countries over the period, which implies that \( e/g \) tends to overestimate the flow rate of profit by 10-20%.
capital ratio can be interpreted in two ways. On the one hand, the higher ratio of C to K can imply that the larger value of intermediate inputs is being processed by the current capital stock than before, i.e. a capital efficiency measure. On the other hand, the higher ratio can mean that one country’s manufacturing is evolving into a high-tech intermediate input processing industry. It should be noted that in either way, the ratio C/K has nothing to do with labor productivity; but it is much more concerned with such technical factors in the production process as in input coefficients of I-O system.

Figure 15. Ratio of Input Flow and Capital Stock

![Input Flow-Capital Stock Ratio (C/K): Proxy for Efficiency of K in Production](image)

Figure 16 shows the absolute contribution of the change in the three sources to the average annual growth rate; and Figure 17 reports the relative contribution of that change to the average annual growth rate of stock profit rate. Consider the United States an example.
Figure 16 reports that the organic composition of capital (g) has been growing annually by 1.5% on average; the rate of exploitation has been risen annually by 2% on average; and the input-capital ratio (C/K) has also been increasing per year by 1 %. According to equation (12), the growth of the stock rate of profit is a positive function of the growth of the exploitation rate and the input-capital ratio; at the same time it is a negative function of the growth of organic composition of capital. Hence the stock rate of profit has been growing at an annual rate of 1.5 % on average.
Figure 17 provides each source’s contribution to the annual growth rate of the stock rate of profit (1.5%) in a relative term. The three factors interact to one another to produce the growth of profit rate. A relative contribution means power or force which is exerted on the profit rate in a positive or negative way; and we can interpret each part of a bar in figure 17 as a vector indicating the size and direction of each factor. On the one hand the growth of the rate of exploitation has a positive effect over the growth of the rate of profit; and the growth of the input-capital ratio also makes a positive contribution to the annual profit growth. On the other hand, the increase in the organic composition of capital has a negative influence on the growth of the profit rate. In addition, the size of each bar means a relative power which is wielded by each factor: about 40, 25 and 35 for e, C/K, and g respectively.

Remarkably, the rate of exploitation creates a positive, major effect of around 40 percent on the growth of the profit rate across all the countries involved, even if they diverge in terms of an absolute level of the annual profit rate growth shown in Figure 16. In other words, all the countries have the strikingly similar degree of the relative importance of the growth of the rate of exploitation as a main source of the growth of the profit rate.

V. Conclusion

In the chapter IV, we see the noteworthy similarity of the relative importance of the exploitation rate in determining the growth rate of the profit rate. At the same time, we observe that the manufacturing sectors in the countries show fundamentally different contributions of the same factors or sources to the exploitation rate growth over the past 20 years as chapter III explains. From the two observations, we can conclude that the growth of the exploitation rate plays a significant role in determining the growth rate of the profit rate in a similar degree across the
countries; but the methods for extracting more surplus value from productive workers are entirely different from one another, which implies that the specific means or procedures are produced and formed in a highly complex way by their own social, political, economic, and cultural processes.

References


Appendix A: ISCO (International Standard Classification of Occupations) at one-digit level (Major Group)

I. ISCO-1968

Nonproduction Workers

ISCO 0/1 Professional, technical and related workers
ISCO 2 Administrative and managerial workers
ISCO 3 Clerical and related workers
ISCO 4 Sales workers
SICO 5 Service workers
ISCO 6 Agriculture, animal husbandry and forestry workers

Production Workers

ISCO 7/8/9 Production and related workers, transport equipment operators and labourers

II. ISCO-1988

Nonproduction Workers

ISCO 1 Legislators, senior officials and managers
ISCO 2 Professionals
ISCO 3 Technicians and associate professionals
ISCO 4 Clerks
SICO 5 Service workers and shop and market sales workers
ISCO 6 Skilled agricultural and fishery workers

Production Workers

ISCO 7 Craft and related trade workers
ISCO 8 Plant and machine operators and assemblers
ISCO 9 Elementary occupations
Appendix B. Gini Coefficient (G)

The Gini coefficient is usually defined mathematically based on the Lorenz curve (below). It can be seen as the ratio of the area that lies between the line of equality and the Lorenz curve (marked 'A' in the diagram) over the total area under the line of equality (marked 'A' and 'B' in the diagram): \( G = \frac{A}{A+B} \). The graph shows that while the Gini is technically equal to the area marked 'A' divided by the sum of the areas marked 'A' and 'B' (that is, \( G = \frac{A}{A+B} \)), it is also equal to \( 2A \); since \( A+B = 0.5 \) — the axes scale from 0 to 1 — and the total surface of the graph therefore equals 1.

Assuming that every production worker receives the same compensation as his or her peer and likewise that the labor costs of nonproduction workers are distributed evenly among them; and based on the fact that average compensation of production workers is always less than that of nonproduction counterparts, we have the area of A and B as follows:

\[
B = \frac{1}{2} a \frac{w_p a}{w} + \frac{1}{2} \left( \frac{w_p a}{w} + 1 \right)(1-a) = \frac{1}{2} \left( \frac{w_p a}{w} a + 1 - a \right) \quad (a)
\]

\[
A = \frac{1}{2} - B = \frac{1}{2} a \left( 1 - \frac{w_p}{w} \right) \quad (b).
\]

Substituting (a) and (b) gives \( G = \frac{A}{A+B} = a \left( 1 - \frac{w_p}{w} \right) \).
## Appendix C. Data Sources

<table>
<thead>
<tr>
<th>Data</th>
<th>USA</th>
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<th>FIN</th>
<th>NOR</th>
<th>ESP</th>
<th>AUT</th>
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<tr>
<td>production worker ratio ((a))</td>
<td>Data are mainly based on “LABORSTA Labour Statistics Database” of ILO while seven observations are drawn from two papers; see Table 1 for further detail.</td>
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<td>average hourly compensation of all employed worker ((w))</td>
<td>“Hourly compensation costs for all employees in manufacturing 32 countries or areas 1996-2007” and “International Comparisons of Manufacturing Productivity and Unit Labor Cost Trends” both available at U.S. Department of Labor Bureau of Labor Statistics; see for further detail <a href="http://www.bls.gov/fls">http://www.bls.gov/fls</a>; For Finland and Austria, “Labour Compensation per Hour (PPPs)” from OECD Database at <a href="http://stats.oecd.org">http://stats.oecd.org</a></td>
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<td>total labor compensation ((W))</td>
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<td>value added at current prices ((VALU))</td>
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<td>intermediate inputs at current prices ((INTI))</td>
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<td>depreciation rate ((Cd))</td>
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<td>gross capital stock ((K))</td>
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### Appendix D. Derived Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
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<tbody>
<tr>
<td>average hourly compensation of nonproduction worker ((w_u))</td>
<td>(aw_p + (1 - a)w_u = w \iff w_u = \frac{w - aw_p}{1 - a})</td>
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<td>total hour worked by all employed labor ((H))</td>
<td>(aw_pH + (1 - a)w_uH = W \iff H = \frac{W}{aw_p + (1 - a)w_u})</td>
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<td>Variable Capital ((V))</td>
<td>(V = aw_pH)</td>
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<tr>
<td>Constant Capital ((C))</td>
<td>(C = INTI + Cd)</td>
</tr>
<tr>
<td>Surplus Value ((S))</td>
<td>(S = VALU - Cd - V = U - V)</td>
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<tr>
<td>Conventional Profit ((P))</td>
<td>(P = VALU - Cd - W)</td>
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<tr>
<td>Labor Income Share in Net Value Added ((\Theta))</td>
<td>(\Theta = \frac{W}{VALU - Cd} = \frac{W}{U})</td>
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<tr>
<td>Productive Labor Income Share in Total Wage Compensation ((\theta))</td>
<td>(\theta = \frac{W_p}{W})</td>
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<tr>
<td>Net Value Added ((U))</td>
<td>(U = VALU - Cd)</td>
</tr>
<tr>
<td>Net Value Added Per Labor Hour ((u))</td>
<td>(u = \frac{U}{H})</td>
</tr>
<tr>
<td>Gini Coefficient ((G))</td>
<td>(G = a(1 - \frac{w_p}{w})), See Appendix B for more detail.</td>
</tr>
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</table>