

# **Analysing the world rate of profit: A new approach**

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## **Statement of originality**

This is to certify that to the best of my knowledge, the content of this thesis is my own work.

This thesis has not been submitted for any degree or other purposes.

I certify that the intellectual content of this thesis is the product of my own work and that all the assistance received in preparing this thesis and sources have been acknowledged.

Pooya Karambakhsh

# Abstract

Profitability is the driver of capital accumulation and a key factor, globally and nationally, for economic growth and crisis. This thesis explores the long-term trend of profitability, which is one of the main questions in Marxian political economy. To control for the impacts of scope, definition, and data sources on the results, the thesis maps four different definitions to different data sources to derive the world rate of profit. A downward trend for the rate is consistently found, from the mid-twentieth century to nearly the end of the second decade of the twenty-first century (1952 to 2019).

Although several previous world rate of profit studies have reached similar conclusions, they suffer from limitations that this study seeks to address. This study covers the largest number of countries (32) over a 68-year period for which data is available; it applies four definitions of the rate of profit and maps each definition against multiple data sources; it assesses a wider range of impacting factors compared to previous studies; and, more importantly, it includes the Marxian concept of productive labour. Previous studies have ignored the distinction between productive and unproductive activities, treating the total amount paid in wages as the equivalent of variable capital. By contrast, this study distinguishes productive labour as the labour employed by capital to produce use values and surplus value.

The results of this study demonstrate that the driver of the fall in the world rate of profit is faster growth of the composition of capital compared to the change in the rate of surplus value. In other words, the investment in labour-saving technologies has raised surplus value per hour of paid work but at a slower pace than the growth of advanced capital. Nevertheless, there have been periods of recovery, e.g. 1982–1997, in which higher growth of the rate of surplus value prevailed and led to a temporary recovery of the world rate of profit.

The long-term trend of the falling rate of profit is not due to a profit squeeze. In fact, the share of global value added appropriated by workers has fallen since the mid-twentieth century, although this fall has not translated into a substantial rise in the profit share. The growth of depreciation has absorbed an increasingly larger portion of the value added. During the period examined, the fall in the output-to-capital ratio has contributed more to the fall of the world profit rate.

The trends of national profit rates were found to vary across studied countries. Developing countries are more likely to have higher profit rates than developed countries. However, most countries have falling rates of profit, irrespective of their development status. Here, the main driver of the fall is also technological change.

The latest downward phase of the world profit rate began in the mid-1990s, well before the 2007–2009 global financial, and ensuing economic, crisis. This result confirms the hypothesis that the most recent global economic crisis was rooted in profitability. The downward phase of the rate of profit did not end after this crisis, indicating that the period of recovery has not been discernible in recent years.

In short, the results of this research confirm that the Marxian law of the tendential fall in the rate of profit is evidenced over the 70-year period to 2019. The most recent downward phase of the rate of profit, accompanied by the declining rate of worked hours since the 1970s, the declining share of productive labour of the total worked hours, and the allocation of new investment to unproductive activities, point to a slower growth rate. Without a destruction or devaluation of capital on a large scale, a reversal of the world rate of profitability trend is unlikely in the foreseeable future.

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## Glossary and abbreviations of terms

The list below offers brief definitions and abbreviations of the terms used in this thesis. The goal has been to use the most general and consented descriptions. However, some of the concepts have been interpreted differently by different scholars. Throughout the thesis, I present justifications and arguments supporting the chosen interpretations.

<b>Term</b>	<b>Abbreviation</b>
<u><i>Constant capital</i></u> The part of capital whose value does not change during the process of production but only transfers to the commodity and includes fixed capital and circulating constant capital.	C
<u><i>Depreciation</i></u> The cost of using fixed capital, e.g. the wear and tear of machinery; also referred to as consumption of fixed capital.	D
<u><i>Compensation of employees</i></u> The cost of labour paid by employers, including wages and social contributions.	EC
<u><i>Extended Penn World Tables</i></u> A data source for the world economy	EPWT
<u><i>Gross domestic product</i></u> The total value added within an economic territory, e.g. a country, without deducting depreciation.	GDP
<u><i>Gross output</i></u> The sum of gross value added and intermediate inputs.	GO
<u><i>Gross operating surplus</i></u> Surplus or deficit produced from the operation of enterprises, including depreciation, rent, interest, etc.	GOS
<u><i>Input-output (Table)</i></u> A national accounting table consisting of five other tables: the product supply table, the intermediate use table, the final use table, the production account by industry, and the allocation of income account by industry.	IO

Term	Abbreviation
<p><u>Advanced capital</u> Total capital advanced for production, including constant and variable capital</p>	K
<p><u>The law of the tendential fall in the rate of profit</u> The argument that the rate of profit tends to fall over the long term; has also been interpreted as the argument for the cyclic pattern of the rate of profit</p>	LTFRP
<p><u>The labour share</u> The ratio of total compensation of employees to total value added.</p>	LS
<p><u>The (Marxian) labour theory of value</u> The collection of theoretical concepts that examine the social relations involving labour, value, and price.</p>	LTV
<p><u>Intermediate inputs/consumption</u> The sum of goods and services used in the process of production within the period.</p>	M
<p><u>Monetary equivalent of labour-time</u> The amount of value added, in monetary terms, per hour of work.</p>	MELT
<p><u>Multi-region input–output table</u> A data source for the world economy developed by the Eora Project.</p>	MRIO
<p><u>Net operating surplus</u> Gross operating surplus net of depreciation.</p>	NOS
<p><u>Organic composition of capital</u> Equivalent to the value composition of capital as long as it is determined by, and reflects the changes in, the total composition of capital.</p>	OCC
<p><u>Output-to-capital ratio (capital productivity)</u> The ratio of gross value added to the stock of fixed capital.</p>	OCR
<p><u>The Organisation for Economic Cooperation and Development</u> One of the sources of world data.</p>	OECD
<p><u>Profit Margin</u> The ratio of profits to the flow of capital.</p>	PM

Term	Abbreviation
<u>Price of production</u> The cost of the means of production and labour plus a markup.	PP
<u>The profit share</u> The ratio of total operating surplus to total value added.	PS
<u>Penn World Table</u> A data source for the world economy.	PWT
<u>The rate of exploitation</u> The ratio of surplus labour to necessary labour, equivalent to the rate of surplus value.	RE
<u>The rate of profit</u> <i>The rate of surplus value to advanced capital.</i>	RP
<u>The rate of profit (average approach)</u> The rate of profit calculated without distinguishing productive labour.	RP <sup>A</sup>
<u>The rate of profit (detailed approach)</u> The rate of profit that distinguishes productive labour at the level of industries and occupations/professions.	RP <sup>D</sup>
<u>The rate of profit (simplified average approach)</u> The rate of profit that does not distinguish productive labour and does not deduct depreciation from profits.	RP <sup>SA</sup>
<u>The rate of profit (simplified Marxian approach)</u> The rate of profit that distinguishes productive labour but only at the level of industries.	RP <sup>SM</sup>
<u>The rate of surplus value</u> The ratio of surplus value to variable capital, equivalent to the rate of exploitation.	RSV
<u>Surplus value</u> The amount of value that workers produce beyond the equivalent of the value of their labour-power.	S
<u>Socially necessary labour-time</u> The amount of labour-time needed to produce a commodity, given the average conditions of production and the productivity of labour at the time.	SNLT

Term	Abbreviation
<u>Structural Analysis Database</u> A data source for the world economy developed by the OECD.	STAN
<u>Technical composition of capital</u> The mass of the means of production to necessary labour.	TCC
<u>Transformation problem</u> <i>Argument that differences in compositions of capital can lead to value–price discrepancies.</i>	TP
<u>Variable capital</u> <i>The part of capital that changes quantitatively by producing the equivalent of its own value and surplus value</i>	V
<u>Value composition of capital</u> The ratio of the value of the constant capital to that of variable capital	VCC
<u>The value of labour-power</u> The value of workers’ commodity, i.e. their labour-power, equivalent to the value of necessary labour and variable capital	VLP
<u>World Input–Output Database</u> A data source for the world economy	WIOD
<u>Output</u> Equivalent to gross value added and distinct from gross output.	Y

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## Chapter 1: INTRODUCTION

Economists from different schools of thought, including classical, Marxian and neoclassical economics, have argued that, in capitalism, the rate of profit (RP) tends to fall over the long term. Paradoxically, this tendency is rooted in the profit-seeking motive, revealing the contradictory dynamics of the capitalist mode of production (Cohen & Harcourt 2003: 209; Marx 1973: 669; Moseley 1991: 104; Ricardo 2001: 113). For Marx (1973: 666), the Law of the Tendency to Fall in the Rate of Profit (LTFRP) is “the most important law of modern political economy” and Moseley (2003: 160) considers the long-term trend of the RP as the “main question” of Marxian economics. This thesis focuses on this question.

Surplus value and its monetary form of appearance, profits, drive economic growth. The RP, the ratio of surplus value to advanced capital, forms the upper bound of the rate of capital accumulation because investments are ultimately funded by profits. Low profitability for a sustained period renders an economy susceptible to crises. It hinders firms’ growth and, if continued, instigates mass bankruptcies and unemployment.

This introductory chapter outlines the main arguments and analyses put forward throughout the thesis. Section 1.1 explores the main argument of LTFRP and offers a summary of counterarguments and the empirical studies on it. Section 1.2 discusses the limitations of previous studies and the need for a new study to address these limitations. Section 1.3 explains the method this thesis adopts to address the limitations of previous studies. Section 1.4 summarises the key findings. Applying four different mapping approaches to six data sources, the thesis finds that the world rate of profit has fallen between 1952 and 2019. The main driver of the fall, for the entire world as well as most of the country studies, is technological change, as reflected in the faster growth of advanced capital compared to profits. The results confirm that the LTFRP explains well the pattern of profitability in the real world. Moreover, the analysis of key economic indicators, e.g. profitability, capital accumulation, working hours, and productive activities, all point to a weak foundation for future economic growth.

## **1.1. The law of the tendential fall in the rate of profit**

The long-term fall of the rate of profit is driven by the superimposition of multiple concurrent and ongoing competitions that are inherent in the capitalist mode of production. Within an industry, the competition between capitals, as sellers, over more buyers tends to equalise prices. Price equalisation is dynamic; it oscillates around a centre of gravity but never fully reaches a steady state. Firms have different technologies of production, i.e. their fixed capital and labour, and hence production costs vary. Price equalisation entails different profits for firms. A capital with the lowest cost can apply price-cutting as its competition strategy. By doing so, it loses some profit, but lowers its competitors' profits and share of the market (Shaikh 2016: 261-264).

Firms are always incentivised to lower costs. The competition between capital and labour, over their share of value added, is rooted in this incentive. From the firm's perspective, labour is a cost similar to the material input, which it needs to minimise. Implementing new labour-saving technologies is the common tool here, which requires investments.

Between industries, capitals compete over investments. New investment tends to move to an industry where regulating capital has the highest expected rate of return on new investment. The regulating capital in an industry is the one with the best reproducible conditions of production. The regulating capital's unit cost is not necessarily the lowest. Reproducibility of the conditions of production is key here. Adjusting for quality and considering reproducibility of the conditions of production, the regulating capital often, but not necessarily, has the lowest cost of production (Seretis & Tsiliki 2012: 969-970; Shaikh 2016: 265).

New investment helps the receiving capital to expand production. Ramping up production does not necessarily raise demand at the same pace, and so the ratio of new investment to demand accelerates in that industry and decelerates in industries with lower rates. The flow of investment raises production and supply faster than demand, and consequently lowers prices and the rate of profit (Shaikh 2016: 264).

The mobility of capital between industries perpetuates the competition forces. New investments lower the RP of the industry with the highest profitability. Then, they move to another industry, which now has the highest RP, and increase its production levels, equalise

prices, eventually lower its RP, and so on. The ongoing operation of this dynamic process leads to the downward trend of the RP in the entire system.

The above formulation is in price terms, but the law can be expressed in labour value terms. The value of a commodity is determined by the gross amount of spent labour, either directly producing the commodity or indirectly, e.g. by producing the means of production. Machinery does not create value but passes its own value to the product, and never more than the average value it loses by depreciation. Only the human that works with the machine creates new value. Compared to manual production, producing commodities by machinery decreases the total value of the product because a key reason for using machinery is to save on direct and indirect labour. In this type of production, the share of value transferred to the product by the instrument of labour increases relative to the share of direct labour. Thus, with mechanisation of production the value transferred to the product by the instruments of labour increases relatively but decreases in absolute terms (Marx 1976: 509-512). In other words, each unit of labour-time sets in motion a larger volume of constant capital. Technological advancement increases the level of raw and ancillary material turning into final product per labour hour, i.e. it raises labour productivity (Marx 1976: 772-781). This formulation relies on the assumption that the change in the composition of capital is universal and not limited to a certain industry or sphere of production and that the rate of surplus value (RSV) remains constant (Marx 1991: 317-319).

Another way to explain the law is by considering that variable capital is the upper bound of surplus value. The upper bound occurs in the hypothetical case that the cost of labour falls to zero. So, the maximum value of the RP equals variable capital to constant capital. Technological change progressively lowers that upper bound towards zero, forcing a downward trend on profit rate (Mohun 2012b: 297; Shaikh 1978: 233).

Many scholars, such as Okishio (1961) and Heinrich (2013), have raised questions about the validity of the LTFRP. It is not immediately clear why the composition of capital must rise, and with a pace that overcomes the increase in the RSV. Moreover, if real wages remain constant, there is no incentive for capitalists to introduce a technology of production that would reduce their RP. Furthermore, if innovations in the means of production reduce the costs of

production faster than the fall in prices, profits rise. If profits increase faster than the expansion of advanced capital, the RP rises.

Other than theoretical debates, the LTFRP has been subjected to multiple empirical studies. Most of these studies have focused on the United States (US) (see Table 1.1), perhaps because it has been the centre of capitalism and the world hegemon for most of the 20th century and it has comprehensive national accounts from at least the 1950s. Nevertheless, in more recent decades, more studies of other countries (see Table 1.2) and the world economy (see Table 1.3) have emerged.

Table 1.1: Single country analyses (the US)

Study	Period	Method	Findings on RP	Explanation
Moseley (1991; 2003)	1947–1987 1947–2002	Marxian RP	Falls	The rise of unproductive activities (1991: xiv, 122) and invested capital per worker, both of which are the result of technological change (2003: 162)
Shaikh (Shaikh 2011; Shaikh 2016; Shaikh & Tonak 1994)	1948–1989 1947–2009 1947–2011	Detailed RP	Falls	Rising composition of capital
Duménil and Lévy (2002: 438-439; 2011)	1948–2000	Average RP	Falls (and recovers slightly)	Decline in capital productivity and relative price of output to fixed capital as well as a faster decline of labour productivity compared to the lower growth of real wage
Freeman (2009b: 2)	1929–2000	Average RP	Falls	Technical change, reflected in output to capital ratio
Kliman (2012: 75-77)	1929–2009	Average RP	Falls (Recoveries after destruction of capital)	Smaller rate of employment increase compared to the rate of capital accumulation.
Basu and Vasudevan (2013)	1946–2010	Multiple RPs	Falls (with short recoveries, except when using historical cost)	Capital productivity in the 1960s and 1970s Profit share and capital-saving information technology in the neoliberal period
Basu and Manolacos (2012)	1869–2007	Average RP	Conditionally falls (with recoveries)	Technological change

Study	Period	Method	Findings on RP	Explanation
				Countertendencies: overpopulation, RSV, wages below the value of labour-power, cheapening of capital stock
Jones (2021: 190, 214)	1930–2011	Simplified Marxian RP (with a new approach to turnover)	Falls (with recoveries)	Rising organic composition of capital (OCC) overcoming RSV
Jefferies (2023: 269)	1964–2017	Simplified Marxian RP (with a new interpretation of stock of capital)	Rises (with local falls)	Globalisation and the entry of China to the capitalist system as sources of growth after the 1980s

Table 1.2: Single country analyses (countries other than the US)

Study	Region	Period	Method	Findings on RP	Explanation
Mohun (2003)	Australia	1965–2001	Average RP	Falls and recovers	Falls due to declining capital productivity Recovers due to rising capital productivity and favourable price effects
Marquetti, Maldonado Filho and Lautert (2010)	Brazil	1953–2003	Average RP	Falls (with slight recovery since the 1980s)	Declining capital productivity (i.e. technological change) Rise due to institutional arrangements and the overall high profitability of the country
Maniatis and Passas (2013: 632, 639; 2018)	Greece	1958–2009	Detailed RP	Falls	The LTFRP and the rise of unproductive activities and labour
Patidis (2016)	Greece	2000–2009	Micro-approach	Falls	Rising OCC overcoming RSV
Alexiou (2022)	UK	1985–2019	Average RP	Falls	RP is related to capacity-to-capital ratio positively and to wage share and recession negatively.
Jeong and Jeong (2020: 270-272)	South Korea	1980–2014	Detailed and average RP	Falls (with temporary recoveries)	Rising OCC overcoming RSV

Table 1.3: World analyses

Study	Region(s)	Period	Method	Findings on RP	Explanation
Li, Xiao and Zhu (2007)	US, UK, Japan, Germany, France, and Italy	Late 19th century to early 21st century	Average RP	Falls	Rising wages and taxation
Li (2020)	Britain, the US, Japan, China	1855–2018 1900–2018 1955–2017 1980–2018	Average RP	Falls (with temporary recoveries)	Rising wages and taxation
Zachariah (2009)	US, Japan, Canada, and France UK, Italy, Switzerland, and Australia	1964–2000	Average RP	First four falls Second four recover completely	Rise of capital stock and downward trend of workforce growth
Maito (2014; 2018)	Germany, US, Netherlands, Japan, UK, and Sweden (core countries) and Argentina, Australia, Brazil, Chile, China, Korea, Spain and Mexico (periphery)	1850–2009 (varies over countries)	Average RP	Falls (with temporary recoveries)	Rising composition of capital (implicit)
Roberts (2012)	G7 and BRIC	1963–2007	Average RP	Falls	Technological change

Study	Region(s)	Period	Method	Findings on RP	Explanation
Roberts (2015)	G20 countries	1963–2010	Average RP	Falls (neoliberal recovery due to a rising RSV)	Technological change
Trofimov (2018)	Germany, US, Netherlands, Japan, UK, Sweden, Argentina, Australia, Brazil, Chile, China, Korea, Spain and Mexico	1855–2010 (varies across countries)	Average RP	Falls (but evidence is weak) Recoveries occur	Falling capital productivity and rising OCC (with exceptions and partial impact of other factors)
Basu et al. (2022: 4, 23)	25 countries	1960–2019	Average RP	Falls (with temporary recoveries)	technological progress, declining output–capital ratio and the falling profit share

## **1.2. Justification for a new study of the LTFRP**

Despite the long history of the theoretical debates and existing empirical analyses, there are two general reasons why further research on the LTFRP is still required. First, the validity of the law cannot be fully proven by theoretical debates alone. Following Foley (2009: 134-140), I argue that the LTFRP should not be approached as a theoretical/logical law, which can be deduced from a priori axioms. It is possible to hypothesise situations in which the LTFRP does not apply. Instead, it should be viewed as an empirical law or hypothesis. In this sense, it presents what is more likely to occur, without seeking to predict the future. As an empirical law, it can be validated by demonstrating how well it applies to empirical observations. Second, the empirical studies to date have applied different analytical scopes or their inputs have differed, i.e. definitions, mappings, and sources of data.

### **1.2.1. The law as a theoretical proposition**

In this sense, the law can be derived by a sequence of propositions, e.g. the way Marx or others have formulated, and verified logically. To be a law, there cannot be even a single example within its boundaries that does not follow it. However, there have been theoretical arguments, hypothetical scenarios, and empirical analysis, e.g. Okishio (1961), Heinrich (2013) and Jefferies (2023), that show situations in which the RP increases.

To demonstrate that the impact of new technologies on profitability is not determinate, we could hypothesise four scenarios in which a firm adopts a new technology to reduce its costs of production, as the key criteria (this will be discussed further in Chapter 3).

1. Labour-saving technology: The new technology would be accepted only if the change in depreciation is smaller than the savings in labour cost.
2. Material input-saving technology (excluding depreciation): It must ensure that savings in the cost of material inputs are larger than the increase in depreciation costs.
3. Depreciation-saving technology: If the cost of fixed capital remains the same, this condition can be satisfied by increasing the life cycle of the machinery. Alternatively, if the life cycle remains the same, the condition can be satisfied by reducing the cost of machinery.

4. Increased production: The new technology must satisfy the same conditions as Scenario c.

Assuming fixed prices, the result of these scenarios is increased surplus value and profits. Except for one variant of scenario c and d, all four scenarios entail rising capital. There is nothing in these formulations determining that the rise in surplus value is always and necessarily smaller than advanced capital. In other words, at this level of “theoretical” analysis, the impact of innovation on the RP is indeterminate.

Shaikh (1980b: 76-77) argues that real competition forces capitalists to always choose the method that lowers costs and increases transitional profit margins, even if it entails a lower transitional profit rate. If the new technique lowers the RP and becomes the dominant method, it reduces the general RP. However, this argument does not mean that new cost-reducing technologies necessarily, and in all circumstances, lower the RP.

Another formulation of the law, at core, is that the composition of capital tends to rise faster than productivity. The rate of change in capital composition is equal to the difference between the rate of changes of fixed capital and variable capital with respect to time. If we assume that all workers work the same number of hours, on average, and that the rate of growth of the number of productive workers equals the rate of population growth, the composition of capital rises if capital accumulates faster than population. This condition is quite likely to be the case. However, there is no obvious necessity for it to be so. This gap in the argument has been acknowledged by others, such as Shaikh (1978: 234) and Moseley (1991: 10).

Based on the above, I argue that LTFRP is not an a priori determinate law because it is possible to hypothesise scenarios in which it does not fall. In fact, Marx implicitly concedes to this possibility by introducing countertendencies, and hence expanding the boundaries of the law.

### **1.2.2. The LTFRP as an empirical “law” or hypothesis**

Another way to look at the LTFRP is as a hypothesis of what is most likely to occur, instead of a law that predicts the future. Then, the assessment of the LTFRP is not by theoretical debate but by empirical analysis. Many have taken this path in the past (see Table 1.1, Table 1.2, and

Table 1.3), but have reached different conclusions on the trend and drivers of the RP. The differences are generally over scope, definitions and mappings, and data sources.

#### A. Scope

Most previous studies consider only one country, particularly the US. However, this approach, at best, leads to incomplete conclusions about capitalism and the LTFRP. Because of capitalism's global nature and the presence of value transfer between countries, the assessment of the LTFRP should be conducted at a global level.

Capitalism is essentially and from the outset a world economy (Albo 2012: 87; Hoe-Gimm 2012: 384; Moseley 1991: 154, 182; Roberts 2012: 1). The tendency towards a world market is inherent in the concept of capital. The drive to create more absolute surplus value necessitates the constant expansion of the sphere of circulation, by increasing points of exchange and production (Marx 1973: 333-334). That expansion via foreign trade transforms the market into a world market, which, in turn, transforms money into world money and abstract labour into social labour. The world market is both the precondition of the development of capitalism and a result of its reproduction, and hence, historically and logically, enters Marxian value theory from the beginning (Fine, Jeon & Gimm 2010: 71; Hoe-Gimm 2012: 384-386).

The movement of capital across borders impacts the stabilising powers of macroeconomic policies as well as the long-run balance of international exchange rates, interest rates, and stock market indices (Duménil & Lévy 2011: 140). The international exchange markets equalise labour times (Foley 2009: 27). Through these mechanisms, value, abstract labour, and money are determined at the global level (Smith 2005: 228). Uneven and combined development as well as the growing size and impact of transnational corporations are other examples of the global nature of capitalism (Dunn 2014: 8, 74-75; Radice 2012: 357). International trade contributes to the persistent balance of payment deficits in low-income countries and their underdevelopment (Shaikh 1979; Shaikh 1980a; Weeks 2012: 99-100).

Yet, the emphasis on the global essence of capitalism does not negate the importance of the particularities of space and time. In fact, various elements of capitalism, including value production, realisation and distribution, accumulation, the division of labour, and inter-state relations, occur simultaneously at local, national and global levels (Li, Xiao & Zhu 2007: 33,

36; Saad-Filho 2019: 198; Trofimov 2018: 5, 25). The inter-state competitions and the inter-imperialist hierarchical networks are intrinsically related to the development of the capitalist relations of production (Duménil & Lévy 2011: 320; Dunn 2014: 77-78).

The movement of capital across borders enables the transfer of value between countries through different mechanisms: unequal exchange, monopoly rent, brain drain, illicit capital flows by evading tax and regulation by relocating capital, trade barriers, product dumping, debt repayments, unfavourable trade terms or intellectual property rights, and colonial tribute (Cope 2019: 18-21).

Value transfer, as a systemic element of the capitalist mode of production, is the result of competition. Prices and profit rates of (regulating) capitals are equalised via intra- and inter-industry competitions, respectively. Within an industry, a firm with a higher composition of capital attracts surplus value from others. Between industries, the one, in which the regulating capital is the most efficient, loses surplus value to others (Seretis & Tsaliki 2012: 967-974). Metaphorically, at the global level, capitalist exploitation creates a global pool of surplus value, from which capitals extract based on their size, composition and efficiency (Foley 2013: 259-261). However, the mechanism does not work in its ideal form globally because free competition and the perfect mobility of the factors of production do not always exist (Kidron 2018: 66-67).

Another cause of value transfer is wage differentials between the core and periphery, which is often termed “super-exploitation” (Amin 2010: 89; Cope 2019: 12, 85; Smith 2016). Although there is only one, globally determined, value of labour power, labour compensations vary across the world (Amin 2010: 84). Emmanuel (as cited in Kohler (1998: 157) and Seretis and Tsaliki (2012: 967)) argues that the combination of lower wages, higher exploitation, and undervalued exports in the Global South leads to the transfer of value to the core. Ideally, the free movement of labour should equalise wages, but migration and border restrictions inhibit that possibility (Smith 2015: 82, 93) .

Critics argue that global wage differentials are based on productivity, and unequal exchange is only accidental and not systemic, as just a form of primitive accumulation or positive centralisation (Kidron 2018: 68, 71). However, Suwandi (2019: 58-61) shows that the average unit labour cost in developing countries is systematically lower than in developed countries, with the difference being greater than productivity gaps. That is why transnational

corporations do take advantage of global labour arbitrage. By moving production to the South, they raise productivity while labour remains the same and wages fail to rise at the same pace (2019: 54-56).

### B. Definition and mapping

Even among the studies focused on a single country, like the US, the results vary substantially. The differences are not only the magnitude of the RP but also its long-term trend and the drivers of this trend. Part of these differences is due to different views on what the RP includes and how its elements are measured. For instance, the RP has been measured in monetary and labour-value terms; variable capital and inventories have been included or ignored in the denominator of the rate; and the stock of fixed capital has been measured in historical and current cost or net and gross estimates. Moreover, the mapping of conventional national account measures to the Marxian labour categories varies among studies. One group of studies includes all workers and industries in the calculation of the RP, while another group distinguishes between productive and unproductive activities. Table 1.4 offers a snapshot of the differences in the definition of the elements of the RP and presents examples for each interpretation.

*Table 1.4: Variations in interpretation of the RP elements and measurement*

<b>Concept</b>	<b>Variant</b>	<b>Used by</b>
Measurement	Value	Shaikh and Tonak (1994)
	Money	Basu et al. (2022); Kliman (2012); Li (2020); Mohun (2003); Moseley (1991); Moseley (2003); Shaikh and Tonak (1994)
Constant capital	Stock	Basu et al. (2022); Duménil and Lévy (2011); Freeman (2009b); Jefferies (2023); Jeong and Jeong (2020); Jones (2021); Kliman (2012); Li (2020); Mohun (2003); Mohun (2012b); Moseley (1991); Shaikh (2011); Shaikh (2016); Shaikh and Tonak (1994)
	Flow	Fine and Harris (1979); Gillman (1957)
	Historical cost	Carchedi and Roberts (2018); Freeman (2012); Kliman (2012)
	Current cost	Freeman (2009b); Jones (2021); Moseley (1991); Moseley (2003); Shaikh (2011); Shaikh (2016); Shaikh and Tonak (1994)
	Gross	Jeong and Jeong (2020); Shaikh and Tonak (1994)
	Net	Basu and Manolakos (2012); Duménil and Lévy (2011); Kliman (2012); Li (2020); Roberts (2012)

Concept	Variant	Used by
Variable capital	All workers	Basu et al. (2022); Kliman (2012); Li (2020)
	Productive workers	Jones (2021); Moseley (1991); Moseley (2003); Shaikh and Tonak (1994)
	Included in denominator	Jefferies (2023); Jeong and Jeong (2020); Jones (2021); Mage (1963)
	Excluded from denominator	Kliman (2012); Moseley (1991); Moseley (2003); Shaikh and Tonak (1994)
Taxes	Included	Moseley (1991); Moseley (2003); Shaikh and Tonak (1994)
	Excluded	Li (2020)
Inventories	Included	Jefferies (2023); Jeong and Jeong (2020)
	Excluded	Shaikh Kliman (2012); Shaikh (2011); Shaikh and Tonak (1994)

### C. Source of data

The choice of data source also can impact the estimated RP, because measurement techniques and definitions vary among data sources. However, even in a single country, the definitions and measurement techniques may vary across different government organisations. For instance, the definitions of industries and professions are different between the US Bureau of Economic Analysis (BEA 2021) and Bureau of Labor Statistics (BLS 2023). The issue is more pronounced when studying the world economy. The definitions of industries and professions, the separation of public and private sectors, the measurement techniques, and even the general quality of national accounts vary across countries (Lequiller & Blades 2014: 39, 84-86). That is why collating data from different national sources always poses the risk of inconsistency and there is always some level of difference between different global data sources.

### 1.3. The approach, structure, and points of difference

To address the first point of difference, scope, I take a global approach. By studying the world economy, the cross-border value transfers become internal and part of a single economy. To control for the impact of mapping, I apply three RP mappings. The detailed and simplified Marxian versions incorporate Marxian labour categories. I clarify how conventional accounting industries and professions correspond with the Marxian productive and unproductive definitions. The average mapping approach does not distinguish between

productive and unproductive activities but aligns with previous publications on the WRP and hence enables comparison.

To control for the impact of the source of data, I apply the mappings to several data sources and compare the results. I use world datasets, which have already homogenised the data from different national and global sources. This decision alleviates the risk of inconsistencies rooted in conflicting national data sources.

Table 1.5 summarises how this thesis compares with and enhances past studies of the WRP. The analysis for this thesis follows an abstract-to-concrete path. It starts with value, surplus value, and capital, then moves to the elements of the rate of profit, the mapping of conventional accounting frameworks to the Marxian labour categories, and the assessment of data sources, and finishes with the calculation and analysis of the WRP.

*Table 1.5: Comparison with other studies*

<b>Study</b>	<b>Limitations</b>	<b>This thesis adds</b>
Li, Xiao and Zhu (2007)	Few countries Disparate sources	Marxian labour categories Drivers of the fall Depreciation More countries
Li (2020)	Few countries Disparate sources Not world	Marxian labour categories Drivers of the fall World More countries
Zachariah (2009)	Not world Few countries Short time frame	Marxian labour categories World Longer timeframe More countries Depreciation
Maito (2014; 2018)	Few countries Disparate sources	Marxian labour categories Consistent sources More countries Individual countries' trends and impact Depreciation, growth, accumulation
Roberts (2012)	Few countries Questionable approach No individual countries' trends No individual countries' impact on world	Marxian labour categories More countries Longer timeframe More parameters More theoretically sound weighting Individual countries' trends and impact Depreciation

<b>Study</b>	<b>Limitations</b>	<b>This thesis adds</b>
Roberts (2015)	Few countries Questionable weighting approach No individual countries' trends and impacts on the world	Marxian labour categories More countries Longer timeframe More parameters More theoretically sound weighting Individual countries' trends and impact Depreciation
Trofimov (2018)	Few countries Disparate sources A statistical assessment of other research	Marxian labour categories More countries Longer timeframe More parameters Individual countries' trends and impact
Basu et al. (2022)	Does not discuss crises No individual countries' trends and impacts on the world Few parameters evaluated	Marxian labour categories More countries Longer timeframe More parameters Individual countries' trends and impact

### **1.3.1. Structure of the thesis**

Chapter 2 acknowledges the possibility of different interpretations of Marxian concepts and outlines the justification for how basic concepts, such as value or labour categories, are used in this thesis. It argues that the source of value is labour, its measure is the socially necessary labour-time (SNLT), whose necessary form of appearance is money (Marx 1976: 188-190). Based on this and other presented arguments, it concludes that the transformation problem does not pose a challenge to the analysis of the world rate of profit in monetary terms.

The concept of productive labour is critical to a Marxian analysis of the RP. Among different possible definitions, this thesis takes productive labour as the labour spent in the production of commodities within the capitalist sector. Other labour, e.g. in trade, the public sector, or households, may be essential to the creation, realisation or circulation of surplus value but not directly involved in its production. Such labour is unproductive.

Chapter 3 explores the definition and measurement of the RP. First, it discusses constant capital, the largest component of the denominator of the rate. The denominator of the rate is advanced capital, which could be interpreted as stock or flow. Considering the entire process of production, the distinction vanishes because all advanced capital is consumed. However, within one period of the process, e.g. a year, only a part of fixed capital in the form of

depreciation is consumed along with material input and variable capital. The sum of these inputs is a flow parameter. Examining the views on the use of flow and stock measures, it is concluded that the RP is the ratio of the flow of profits to the stock of capital and profit margin is ratio of the flow of profits to the flow of basic costs. The latter is a better measure of a point-in-time profitability, closer to the notion of productivity, and, as Shaikh (1980b: 76-77) argues, more important in choosing new techniques of production. On the other hand, the RP pertains to the long-term perspective, presenting the overall capacity of producing surplus value, and a measure of the opportunity cost of investing in production activities compared to the interest rate or the rate of return on financial products. The chapter also explores other aspects of stock valuation and depreciation measurement of fixed capital. It argues that ideally the measure of capital for the analysis of the rate of profit should be based on actual measurement, instead of estimation, expressed in gross and historical costing terms, and adjusted for general price changes. However, it also acknowledges that many contemporary national accounts do not offer such measures.

Chapter 3 also considers variable capital, equating it with the value of labour-power (VLP) of productive workers. One interpretation of the VLP defines it as what workers consume on average. Another view equals it to workers' share of the net product. Ultimately, in practice, both use wages. The best equivalent in the national accounts is the compensation of productive employees because it includes social costs of labour, e.g. the cost of social security.

Variable capital also appears in the stock form in the denominator of the RP. There are methods to calculate the stock of variable capital, which depend on the turnover time or the measure of inventories. The extra information is seldom available over the long-term. Moreover, the magnitude of the stock of variable capital is small compared to the stock of fixed capital. Following other studies, such as Kliman (2012), Shaikh and Tonak (1994) and Moseley (1991; 2003), I do not include variable capital in the denominator of the RP.

Chapter 4 shifts the analysis further towards the concrete by exploring the methods of calculating the RP and assessing the sources of data. The differences in theoretical foundations necessitate mapping between conventional national accounting data and the Marxian categories. The chapter discusses four mappings that have been used by other researchers: the detailed version (Shaikh & Tonak 1994), the simplified Marxian approach (inspired by Moseley 1991), the average approach (Jeong & Jeong 2020: 271; Kliman 2012: 75-76), and the

simplified average method (Mohun 2003: 89). The detailed approach maps occupations and industries to the Marxian productive/unproductive categories. The average RP uses the net operating surplus of the entire economy as the numerator and the total stock of fixed capital as the denominator. The simplified Marxian approach is in between the other two; it does distinguish between productive and unproductive industries but only works with operating surpluses. The simplified average method ignores the impact of depreciation and uses gross operating surplus.

The detailed and simplified Marxian approaches are, in my view, the most appropriate for a Marxian analysis. However, their reliance on the input–out data at the level of industries and occupations limits their application to currently available world data. Using the examples of Australia and the US, I show that although the magnitudes of the average and detailed rates are quite different, their trends are similar. Because the main subject of investigation is the trend of the RP, this finding allows for the use the average rates as a proxy for the detailed rate. Moreover, for the world economy, I calculate the simplified Marxian RP to complement the average and simplified average RPs.

The definitions of industries and occupations as well as measurement techniques vary across countries (Lequiller & Blades 2014: 85-86). That is why, instead of collating individual national data, the calculation of the WRP in this thesis only relies on world datasets that have already homogenised national data. Six different sources have been assessed and used in this thesis: Penn World Table (PWT) (Feenstra, Inklaar & Timmer 2015), Extended Penn World Tables (EPWT) (Marquetti, Miebach & Morrone 2021), the aggregate national accounts by the Organisation for Economic Cooperation and Development (OECD 2023) and its Structural Analysis (STAN) Database (OECD 2024), the World Input–Output Database (WIOD) (Timmer et al. 2015), and the multi-region input–output table (MRIO) by the Eora global supply chain database (Lenzen et al. 2012; Lenzen et al. 2013). They are assessed by comparing the US's and Australia's RPs calculated using these sources with those based on official national accounts, as the most reliable sources.

Table 1.6 outlines the features of the data sources. It should be noted that even within one data source, the coverage of parameters can vary across countries and years. For instance, although PWT includes 184 countries, only 32 of those have continuous GDP, capital stock,

and wages data from 1952, 48 countries from 1960 and 128 countries from 1993. This issue is noted as inconsistent coverage in the table and discussed in detail in Chapter 4.

*Table 1.6: Sources of world data*

<b>Indicator</b>	<b>PWT</b>	<b>EPWT</b>	<b>OECD (Aggregates)</b>	<b>OECD (STAN)</b>	<b>WIOD</b>	<b>Eora</b>
GDP	Y	Y	Y	Y	Y	Y
Wages	Y	Y	Y	Y	Y	Y
Depreciation	Y	Y	Y	Y	N	Y
Capital Stock	Y	Y	N	Y	Y	N
Investment	Y	Y	Y	Y	Y	Y
Intermediate inputs	N	N	N	Y	Y	Y
Industry aggregate	N	N	N	Y	Y	Y
Inter-industry flows	N	N	N	N	Y	Y
Period	1950–2019	1963–2019	1950–2021	1970–2019	2000– 2014	1990– 2015
# Countries	184	176	36	36	43	189
Notes	Inconsistent coverage	Inconsistent coverage	Inconsistent coverage	Inconsistent coverage		

The WIOD, MRIO and OECD (STAN) offer the best level of detail necessary for a Marxian analysis. However, their timeframes are insufficient for the assessment of the long-term trend of the RP. Moreover, MRIO lacks capital stock details. Nevertheless, I use all three for analysing the recent changes in parameters, such as working hours and depreciation. I also use the OECD (detailed) dataset to calculate the simplified Marxian rate of a bundle of 10 countries over the period of 1989 to 2017. Because this period is not quite long enough, I also calculate average RPs over longer time periods.

Chapter 5 presents the estimates of the WRP and analyses the impacting factors. For the calculation of the average WRP, I use the PWT because it offers longer-term data for more countries compared to other sources. It is the base of the Extended Penn dataset. To control for the sensitivity to the source and definition, I calculate another variant of the average RP using the OECD (aggregate) dataset. The results show close agreement between the two. Table 1.7 shows the four variants of the WRP calculated in this thesis. A summary of the results of the analysis of these rates is presented in the next section.

*Table 1.7: The two constructed worlds*

<b>Source</b>	<b>Mapping</b>	<b>Period</b>	<b>Number of countries</b>
PWT	Average RP	1952–2019	32
OECD (aggregates)	Simplified Average RP	1971–2019	7
OECD (detailed)	Simplified Marxian RP	1989–2017	10
WIOD	Detailed RP	2000–2014	43

## **1.4. Conclusion**

This thesis applies a range of mapping techniques and data sources to control for the impacts of definition and source on the results. It shows that the WRP has fallen between 1952 and 2019. The dominant driver of this trend has been technological change, reflected in the faster growth of capital and its composition compared to the growth of profit and the rate of surplus value. The downward trend of the RP and its main driver are common among most studied countries. These results confirm that Marx’s LTFRP does explain well the movement of the WRP and its drivers over the past seven decades.

The decline of the WRP over the studied period has not been linear. It underwent a period of recovery in the 1980s and 1990s. Over the entire period, the capital-to-wages and output-to-capital ratios (representing the technological effects) had stronger impacts on the movement of the RP than the profits-to-wages ratio and the profit share (distributional effects), respectively. However, during the recovery phase, the reverse was the case and the faster growth of the rate of surplus value raised the WRP.

The foundations for growth and profitability have weakened over the past decades. Since the 1970s, the growth rate of worked hours has declined. Moreover, the level of unproductive activities has increased, which is reflected in the rising investment flows and the proportion of unproductive hours out of total worked hours. These effects have been combined with the rising depreciation rate, which imposes an increasingly larger cost of production and deduction from the value added. As a result, the rates of capital accumulation and GDP growth have slowed.

The latest declining phase of the RP began in the mid-1990s and did not end till 2019. Since then, the exceptional global events, including the Covid-19 pandemic and the war in Ukraine, have led to global production disruption, bankruptcies, and increased government interventions. These events may have temporarily reversed the global profitability downturn,

signified by the high inflation rates of the past two years. Yet, the trends of various economic parameters studied in this thesis indicate weak growth fundamentals. If we take the past 70 years as a guide, it is more likely that the post-pandemic overheating of the global economy is only temporary, and its growth and profitability will remain low in the immediate future.

## Chapter 2: THEORETICAL FRAMEWORK: VALUE AND LABOUR

A caveat of the richness and diversity of Marxian political economy is that even the most basic concepts, such as capital or value, have been defined and interpreted differently among economists and researchers. Hence, before assessing the world rate of profit, it is necessary to outline which interpretations of the key concepts are used in this thesis. This chapter focuses on the abstract and fundamental concepts: the meaning and measure of value, surplus value, the rate of profit (RP), and labour categories.

Section 2.1 outlines the arguments supporting the chosen definitions and interpretations regarding value, money, and capital. It argues that the essence of value is labour, its measure is the socially necessary labour-time, whose form of appearance is money. Surplus value is the amount of value that workers produce beyond the value of their labour-power. The ratio of surplus value to invested capital is the RP, which can be decomposed into the rate of surplus value (RSV), equal to the ratio of surplus value to variable capital, and the value composition of capital (VCC), i.e. advanced capital to variable capital.

Because firms' compositions of capital are different, there could be the perception of discrepancies between their values and prices, commonly known as the transformation problem. Section 2.1.3 reviews the responses and solutions to this problem. It argues that the problem only appears at the level of individual capitals but vanishes at the level of total social capital. Thus, even disregarding the discussed solutions, the use of monetary measures in this thesis is not invalidated by the transformation problem, because the analysis is conducted at the aggregate level of the global economy.

Critical to the Marxian analysis of the RP is the concept of productive labour. Section 2.2 reviews different definitions and interpretations of the concept. This thesis adopts a definition that is more directly supported by Marx's work and more widely used in Marxian empirical studies. In this definition, only labour that is employed by capital for the purpose of creating use values and generating surplus value is productive. Other types of labour, irrespective of their importance to social reproduction, are unproductive.

## 2.1. Value, money, and capital

The commodity is the basic element of capitalism because its collection represents the wealth of societies, and its qualities satisfy some human needs, hence rendering it desirable for exchange. The utility or usefulness of the commodity is its “use-value” and its purchasing power in relation to other commodities is its “exchange-value”. Exchange establishes an equation, which expresses the relative exchange values of the commodities involved. It signifies the existence of an equal amount of a common element in them and indicates that both are equal to a third thing. That third thing is their value, which is immaterial and abstracted from the physicality of either commodity (Marx 1976: 125-128). Harvey (2010: 22-23) summarises the distinction well: use-value is heterogenous and about material quantities and qualities, exchange-value is homogenous and quantitative, and value is immaterial and relational. The distinction between the three meanings has often been blurred in the classical and Marxian political economy, perhaps due to its seventeenth century English usage (Foley 2009: 13; Marx 1976: 126; Saad-Filho 2019: 33).

What all commodities have in common, irrespective of their particular use-values, is being the product of human labour. Labour is performed in particular concrete forms, e.g. nursing, carpentry or programming, which grants commodities their particular use-values. Disregarding particular use-values, what remains is the expenditure of human labour in its abstract, i.e. abstract labour. All labour is at the same time concrete, because it is the expenditure of human labour-power in a particular form and with a particular aim to create particular use-values, and abstract, because it is the expenditure of abstract human labour (1976: 128, 137). Considering this distinction, the commodity manifests three “peculiarities”. First, its use-value is the form of appearance of value. Second, although the commodity’s body is the product of concrete labour, it acts as the equivalent form and demonstrates abstract human labour. Third, private labour takes the form of social labour (1976: 148-151).

As exchange became a core part of the social system to the point that the aim of production became exchange, the products of labour have attained a “socially uniform objectivity as values”, distinct from their use-values (1976: 165-6). Their value form is their objective feature, which expresses human labour and is purely social. Value can only be expressed as an “objectivity”, which is materially different from that object but common to it and all other

commodities (1976: 142). Labour is the “value-forming substance” (1976: 129) and the commodity is the “bearer of value” (1976: 138, 143).

The value of a commodity cannot be expressed independently but only relative to another commodity. The expression can take four forms: simple, extended, general, and money. The simple value form is when an equivalence is established between two commodities, i.e.  $x$  amount of commodity A =  $y$  commodity B. The extended form is when the simple form is extended to multiple commodities. The general form is when the equivalence is set between a series of commodities and a single commodity (1976: 148-157). The development of the general form promotes one commodity to the universal equivalent form, becoming the money commodity or, simply, money. The expression of the labour objectified in a commodity in terms of money is the commodity’s price. Price may create the misconception that money is the precondition and value the result of circulation. However, value is the precondition, already expressed in the commodity’s price when it enters circulation. In other words, circulation never creates value (1976: 260-264).

In Marx’s formulation, money emerges out of the development, proliferation, and generalisation of an exchange system. However, there is evidence of quasi monetary systems and various forms of tokens before the proliferation of the exchange system. Harvey (2010: 31-32) argues that Marx’s formulation does not seek to describe the historical development of money; it either aims explain the logical approach to money or how it evolved in capitalism in contrast to other modes of production. Nevertheless, as will be discussed in the next section, money is central to the Marxian labour theory of value (LTV), and hence to the measurement of the rate of profit.

### **2.1.1. The measure of value**

Assessing economic parameters, such as the rate of profit, requires some quantifiable measure of value. In this section, based on Marx’s texts and Marxian debates, I argue that labour is the essence of value, and its true measure is labour-time and, more accurately, the socially necessary labour-time. However, the necessary form of appearance of the SNLT is money and the measurement of the wealth of nations and hence their rates of profit should be done in monetary terms.

For Smith (2000: 12, 50-52, 54, 57-59), labour is the true measure of value. However, it is not used in practice because of the difficulties in comparing the spent time, intensity, and skills involved in different concrete labours. That is why often a commodity, such as gold or silver, is used as the measure. Smith argues that corn is a better measure of value because its value remains constant over the long-term compared to gold and silver.

Ricardo (2001: 14) criticises Smith for sometimes using corn and sometimes labour as the measure of value, often alternating between embedded and commanded labour. Ricardo acknowledges that the comparative quantities of labour used in the production of commodities determine the rule of exchange (2001: 17, 21). Yet, he argues that labour goes through more significant variations in the short- and long-term and thus gold and silver are the preferred measures because of their value and physical durability. Ultimately, “neither labour nor any other commodity can be an accurate measure of real value in exchange” (2001: 422). Ricardo hypothesises a commodity as an invariable measure of value, which could help explain the fluctuations of commodity prices and their value contents. This commodity needs to satisfy several conditions, which cannot be met in reality, and hence such a commodity cannot be found (2001: 46-7). For the rest of his intellectual life, Ricardo tried but failed to find an actual or theoretical version of that commodity, an effort that in Marx’s words was wasted in “blind alleys” (Tsoulfidis & Tsaliki 2019: 15).

For Marx (1976: 230), the value of a commodity is a measure of its owner’s wealth. At the same time, the commodity has value only because equal, identical, and abstract human labour is materialised in it. Labour is the “value-forming substance”, whose quantity, in the form of the duration of labour-time, reflects the magnitude of the commodity’s value (1976: 129, 131, 677). The value of a commodity is not determined individually nor as the direct labour spent on it. It is determined by the amount of SNLT, i.e. the amount of labour-time needed to produce the commodity, given the average conditions of production and the productivity of labour at the time. This definition accounts for the temporal variation of the SNLT and the value of commodities because the average level of skills, science, technology, social organisation of production, the extent and effectiveness of the means of production, and natural conditions vary over time (1976: 129-131, 434).

The SNLT is the intrinsic measure of value. It does not appear directly in social relations of production but necessarily in its phenomenal form, i.e. money (1976: 188-190). Functioning

as the measure of value to determine prices, money's own value is assumed and the changes in that value are presented in the fluctuations of other commodities' prices, although with a time-lag (1976: 214). Harvey (2010: 36-7) argues that due to the immaterial, phantom-like, yet objective, status of value, it cannot be measured directly. It only exists in the relations between commodities and can only be expressed in "the contradictory and problematic form of the money commodity". Even the SNLT cannot fully and directly represent the social relations involved but must rely on the money form. This form supports the role of value as the "guiding principle" of the capitalist system.

As Moseley (2016: 9) argues, the nature of capital is essentially monetary: "money that becomes more money". The circuit of money, i.e. the valorisation process, is "the logical framework of Marx's theory" (2016: 3, 12, 15), which combines the spheres of circulation and production. Although Marx at some points measures value by labour and its duration, Reuten (1999: 12) argues it is just "a simplification to be transcended later on". As Marx moves from the abstract to the concrete, it becomes clear that money is the only measure of value, and social labour the source of value and the foundational background (1999: 15, 18-19). From another perspective, because abstract labour cannot appear empirically, monetary value entities and labour-time can be used as quantitative equivalents, which can be measured directly (Fine & Saad-Filho 2016: 27; Foley 2009: 17; Pilling 2013: 25; Taylor & Bellofiore 2004: 26).

In short, based on the arguments presented, abstract labour is the source of value, labour-time its measure, and money its form of appearance. Money is a critical concept in Marx's conceptualisation of surplus value production and distribution, which highlights the relationship between price and value. This relationship is not always straightforward and at times appears contradictory. For instance, price fluctuations may appear detached from value equivalents. To explore this issue, commonly referred to as the transformation problem (TP), first we need to clarify concepts such as constant capital, variable capital, and the rate of profit, in the next section.

### 2.1.2. Capital, surplus value, and the rate of profit

In simple commodity exchange, the owner sells the commodity (C) to obtain money (M) to purchase another commodity (C). In this process of selling to buy (C-M-C), the only role of money is the means of payment. By contrast, the capitalist exchange begins with money. A capitalist uses money (M) to buy the means of production and labour-power, produces the commodity (C), and exchanges it with more money ( $M' = M + \Delta M$ )<sup>1</sup>, in short M-C-M'. In this process of buying to sell, money acts as capital as well as the means of payment. The difference between the final and the advanced moneys ( $\Delta M$ ) is surplus value. Money only becomes capital when it enters the process of exchange to create surplus value. From this perspective, capital is self-expanding value and M-C-M' is the "general formula of capital" (Fine & Saad-Filho 2016: 30-32; Marx 1976: 247, 248, 256).

The capital advanced for production can be categorised as constant and variable. The use-value of the means of production is consumed but its value remains quantitatively unaltered and gets transferred to the commodity, and so is called constant capital (1976: 317). Constant capital can be further divided into fixed (instruments of labour) and circulating or fluid capital (raw materials) (1976: 284-287). The distinguishing feature of fixed capital is that a part of its value remains within it and distinct from the product (Marx 1992: 237-241). On the other hand, the part of capital that turns into labour-power is variable capital because it does go through quantitative value change, as it produces the equivalent of its own value as well as an extra, i.e. surplus, value (Marx 1976: 317). Marx was the first to introduce these categories in political economy (Lequiller & Blades 2014: 34, 143; Marx 1976: 760).

The production and appropriation of surplus value can be considered from the labour process perspective. Most workers do not produce their means of subsistence directly but purchase them by the wages they receive in exchange for their labour-power. During any working period, a worker creates more value than the value of her means of subsistence. The time spent on generating this value is necessary labour-time and the labour expended on it is necessary labour. The rest of the period is surplus labour-time producing surplus labour. It creates surplus value for the owner of the means of production, which includes profits,

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<sup>1</sup> Only in this paragraph and to follow Marx's notation, I use M to denote money and the symbol ' to denote more money. In other parts of the thesis, M represents intermediate inputs and the symbol ' denotes the derivative with respect to time.

interest, rent, etc. Both working and capitalist classes have incentives to increase their share of the total produced value. Here, individual intentions do not matter because in capitalism and under competition pressures, the immanent laws of the system confront individuals as external forces (1976: 381).

The ratio of surplus value to necessary labour is the rate of surplus value (RSV), which presents the ratio of the valorisation of variable capital. It is an indicator of how much of the worker's labour is used for her reproduction and how much is appropriated by the capitalist. In other words, the RSV demonstrates the level of exploitation and hence is referred to as the rate of exploitation (Marx 1976: 324-325).

A concept related to, but distinct from, the RSV is the rate of profit (RP), which is the ratio of surplus value to the value of constant and variable capitals advanced for production (Marx 1971: 191; Marx 1976: 529). It represents the relation between the capital exchanged for living labour, raw materials, and fixed capital (Marx 1973: 665). The RP does not fully reveal, and might even conceal, the dynamic and exploitative nature of the capitalist mode of production because it might misrepresent total capital or even just constant capital as the source of surplus value instead of labour. That is why Marx (1991: 134) considers surplus value and the RSV the essence of what appear as profit and the RP, respectively.

Different social, economic, and technological factors affect profitability. To discern their impacts, the RP can be decomposed into different ratios. It can be presented as the product of the RSV and the VCC, i.e. the ratio of advanced capital to variable capital (Marx 1991: 141-142; Mohun 2012b: 301; Moseley 1991: 11; Shaikh & Tonak 1994: 122).

$$RP = \frac{S}{K} = \frac{\frac{S}{V}}{\frac{K}{V}} = \frac{RSV}{VCC} \quad \text{Eq. 2.1}$$

In which,

$S$  = surplus value

$K$  = advanced capital

$V$  = variable capital

$\frac{S}{V}$  = RSV

$$\frac{K}{V} = VCC$$

Alternatively, the RP can be decomposed into the profit-to-output ratio (profit share) and output-to-capital ratio, also known as capital productivity (Basu & Vasudevan 2013: 65; Li 2020: 13; Mohun 2003: 89; Mohun 2012b: 301; Shaikh 2016: 108).

$$RP = \frac{S}{K} = \frac{S}{Y} \frac{Y}{K} = PS \times OCR \quad \text{Eq. 2.2}$$

In which,

$Y$  = output

$PS$  = the profit share

$OCR$  = output-to-capital ratio (capital productivity)

The RSV and profit share represent the division of the value added between the two classes. The concept of the composition of capital and the OCR are arguably related to technological advancement and rising labour productivity, notwithstanding the latter often being referred to as capital productivity. Marx develops the concept of capital composition from *Grundrisse* to *Theories of Surplus Value to Capital* (Saad-Filho 2002: 72-73). He introduces three variants of the concept: technical composition of capital (TCC), the VCC, and the organic composition of capital (OCC). The VCC is the ratio of the value of the constant capital to that of variable capital. The TCC considers the same ratio but in material terms, i.e. the mass of the means of production to that of necessary labour. As long as the VCC is determined by, and reflects the changes in, the TCC, Marx calls it the OCC. He also notes that the VCC and the OCC are determined by the division of capital into constant and variable capital, while the TCC demonstrates the material aspect and is determined by the relation between the means of production and living labour (Marx 1976: 762).

As Saad-Filho (2002: 80) notes, Marx's three variants of the composition of capital "may at times look ambiguous" and have led to different interpretations. For instance, in terms of definitions, Moseley (1991: 4) and Mage (1963: 68-74) define the VCC as the ratio of advanced capital to variable capital ( $K/V$ ) and the OCC as the ratio of advanced capital to new value, i.e.  $K/(V+S)$ . However, Shaikh and Tonak (1994: 122) and Tsoulfidis and Tsaliki (2019: 359) define the latter ratio as the materialised composition of capital. Moreover, there is disagreement over what the concepts represent. It is common to take the VCC as an indicator of the degree

of mechanisation and technological advancement of an economy (Paitaridis & Tsoulfidis 2012: 223). However, Zarembka (2015: 108) and Moseley (1991: 3-6) argue that the VCC can be impacted by factors other than technological change, such as the real wage, labour and capital distribution across industries, capital turnover time, and the utilisation intensity of fixed capital. Fine and Harris (1979: 59) and Mohun (2012b: 298-299) argue that the OCC is in pre-production values and thus relevant to the process of production and the law of the tendential fall in the rate of profit (LTFRP), but the VCC relates to the feedback of the circulation sphere and new values, and thus is more relevant to the counteracting tendencies.

Acknowledging these arguments, this thesis uses both decompositions in the analysis, and refers to the composition of capital and the OCR as indicators of the technological effects and to the RSV as measures of distributional effects. Following Mage (1963: 68-74), Moseley (1991: 4), Shaikh and Tonak (1994: 122), and Jeong and Jeong (2020: 269), I take VCC as  $K/V$ .

Having defined the key concepts of the RP and the composition of capital, the next section returns to the transformation problem. The problem relates to potential discrepancies between prices and values, rooted in the differences in the composition of capital within an economy.

### **2.1.3. The transformation problem**

In value terms, the process of production transforms the values of the means of production and labour-power into a commodity. The difference between the values of the commodity and inputs is surplus value. In money terms, the price of production (PP) of a commodity equals the cost of the means of production and labour plus a markup. The markup usually equals the cost of inputs multiplied by the economy's general rate of profit. There is a general correspondence between the value and price components, but not always. This discrepancy has raised an issue referred to as the transformation problem (TP). With a history longer than a century, the debate on the problem has deepened the knowledge of capitalism, Marxian economics, divergences of market prices from the SNLT, forms of value, the complexity of price as a form of value, and the distribution of labour (Saad-Filho 2019: 106, 115).

To demonstrate the problem, I simplify an example in Chapter 9 of *Capital III* (Marx 1991: 254-259) by assuming the system consists of only two capitals in different industries (see Table

2.1). Capital A uses \$40 on constant capital (C) and \$70 on variable capital (V) and produces \$30 of surplus value (S). Capital B's inputs are \$50 and \$20, respectively, and \$50 of surplus value. The value rate of profits,  $S/(C+V)$ , of capital A, B, and the system are 27.3%, 71.4%, and 44.4%, respectively. The prices of production of capitals A and B, i.e. the cost of inputs plus the system's general RP multiplied by input costs, are \$158.9 and \$101.1, respectively. The profits of the two capitals, i.e. prices of production minus input prices, are \$48.9 and \$31.1, respectively. In short, the capital's profits and price RPs differ from their surplus values and value RPs.

*Table 2.1: An example of the transformation of values to prices in a two-sector economy*

	<b>Constant capital</b>	<b>Variable capital</b>	<b>Surplus value</b>	<b>Total value</b>	<b>Rate of profit</b>	<b>Price of production</b>	<b>Profit</b>
Capital A	40	70	30	140	27.3%	158.9	48.9
Capital B	50	20	50	120	71.4%	101.1	31.1
System	90	90	80	260	44.4%	260	80

A common criticism is that Marx only transforms the value of outputs into PPs and leaves out the transformation of inputs. At each point in time, the output of an industry can be the input of the same or another industry. Producers do not purchase their inputs in value terms but in PPs. So, if the value of an output is transformed, the same should be done for it as an input (Foley 2009: 98-99; Hunt & Glick 1990: 358). Another formulation is that the value RP is not the same as the price RP (Saad-Filho 2019: 104-105). When Marx discusses an economy's RP, it is in value terms and relates to total social capital and capital in general. However, transformation is in the context of many capitals in competition. Fine and Harris (1979: 22-25) argue that Marx is wrong to derive the general RP based on capital in general and to suggest that each capital earns the value RP.

Before turning to the responses to the TP, several points are worth mentioning. First, Marx's transformation of value into PPs relies on aggregate equalities: total value equals total PP and total surplus value equals total profit. Second, in an economic system, surplus value is generated socially and at the level of total social capital. Competition between capitals of different sectors leads to the distribution of total surplus value based on the size of each capital. The competition also transforms labour values into PPs, which can then explain the equalisation of profit rates (Fine & Harris 1979: 23; Foley 2009: 97; Saad-Filho 2019: 103).

Third, in most of *Capital*, particularly volumes I and II, Marx assumes equal exchange, i.e. commodities exchange at their values. Here, as he moves from the abstract to the concrete, he abandons that assumption (Hunt & Glick 1990: 357; Saad-Filho 2019: 103-104).

Shaikh (2016: 12, 212) notes that all economic schools of thought have transformation problems. The Marxian TP has raised a variety of responses, from the outright rejection of the labour theory of value to the reformulation of the problem and to the enhancement of Marx's approach (Foley 2009: 102-103; Shaikh 2016: 240-241). They also vary from mathematic and algebraic to theoretical and philosophical.

On the mathematical side, Bortkiewicz (1952 [1907]) uses simultaneous equations to transform both inputs' and outputs' values. Shaikh (1977; 1984) enhances that approach by applying it iteratively. The main criticism of these approaches is that they cannot satisfy both aggregate conditions, i.e. total value equalling total price or total surplus value equalling total profit (Hunt & Glick 1990: 358, 360).

From a theoretical perspective, Shaikh (2016: 12) argues that if there is surplus product, while aggregate money profit remains a representation of total surplus labour, it can change with relative prices. This relationship and the transformation problem are common to all theories of price in all schools of economic thought. The changes in prices can lead to wealth transfers between the circuits of capital (business) and revenue (households) due to unequal exchange by the difference in sale and purchase prices (2016: 223). Transfers within the capital circuit do not change profits, and the sum of transfers between the two circuits is zero. However, they create "profit on vibration" and hence alter aggregate profit (2016: 222). Shaikh puts forward this formulation as the general solution to the transformation problem (2016: 12, 221). So, aggregate profit can originate from profit on production and on transfer. At least part of the confusion in the literature is that this duality is ignored (Shaikh 2016: 240). Finally, there are transfers of wealth within the circuit of capital that alter current profits by changing future ones (2016: 226).

There are arguments, e.g. by Hunt and Glick (1990: 361), Gerstein (Knafo 2012: 370), and Fine and Harris (1979: 21), that the TP requires socioeconomic investigation based on the LTV instead of, or in addition to, mathematical solutions. Such investigations should be able to consider the totality of the system and articulate analytically the relation between the production and circulation spheres. Saad-Filho (2019: 104, 111, 115) argues that Marx is

aware that he does not transform input values to demonstrate that they should be understood conceptually rather than algebraically and to highlight that labour is the source of profit. Overall, Marx's main point is that the abstract essence of value reproduces in a more complex and concrete form, which is the PP. In other words, the PP is a more concrete form of value that facilitates more nuanced analysis of capitalist relations of production. Similarly, Fine and Harris (1979: 34) argue that the TP is not just technical or formal but essentially relates to class struggle. The variety of stances on class struggle leads to different readings of the TP and potentially misses the unity of the spheres of production, exchange, and distribution.

Fine and Harris (1979: 24) also highlight the importance of the level of analysis and argue that Marx's treatment of transformations such as the formation and equalisation of the RP is based on total social capital as well as competing capitals. The transformation problem essentially relates to the entire capitalist system, i.e. production, exchange, and distribution together. Moseley (2016: 6) also argues that most debates about TP revolve around the transformation of individual values to individual PPs. However, Marx's analysis is essentially at the macro level. In other words, he transforms aggregate price and total surplus value to individual PPs and surplus values.

In sum, the discussion in this section demonstrates that the TP does not pose a serious challenge for the purposes of this thesis. First, the assessment of the world rate of profit (WRP) is done at the macro level, while the TP is on the micro level. Second, the socio-philosophical and mathematical responses mentioned in this section are sufficient to demonstrate that the TP does not undermine the LTV, at least for this thesis.

So far, the chapter has established that the analysis of the WRP in this thesis is within the LTV framework. Money is value's necessary form of appearance and thus can be used as its measure. This role is not undermined by the TP because of the level of analysis and the arguments presented in this section. The next section takes the analysis further to the concrete by turning to the concept of labour categories. This theoretical concept is pivotal to the empirical application of the LTV to the analysis of the WRP.

## 2.2. Labour categories

The concept of productive labour, i.e. the labour that creates surplus value, is integral to the definition of the Marxian RP. The denominator of the rate is the capital advanced in productive activities, and the variable capital deducted from the value added in the numerator of the rate is the value of labour-power of productive workers (Jeong & Jeong 2020: 269; Moseley 1991: 42). This section first discusses the mainstream, particularly neoclassical, approach to production. Then, it turns to the Marxian approach, possible definitions, and argues for taking productive labour as labour in capitalist and production activities. The labour spent in other activities, regardless of their importance for social reproduction or the circulation and realisation of surplus value, is unproductive. Such activities are funded by the surplus value produced by productive activities.

All economic schools distinguish between production and consumption. Neoclassicals differentiate between utility creation and personal consumption. Marketability, revenue generating, and the potential for enhancing welfare and utility of a country's residents are the general criteria for a productive activity. In practice, production is measured based on market activities supplemented by imputations to include services such as owner-occupied dwellings and non-payment financial intermediaries, excluding transfer payments because the recipient does not provide a service (Shaikh & Tonak 1994: 12, 14, 33). The Organisation for Economic Co-operation and Development (OECD) defines production as economic activities that create output, jobs, income for workers and owners of capital, and goods and services. Output is the key term here, which refers to the "monetised" goods and services consumed by households and firms. Although output is monetised and often appears in national accounts in monetary values, it is essentially measured in volume. It is the outcome of three factors of production: capital, labour, and intermediate inputs. However, the focus of national accounts, particularly in calculating GDP, is on value added, which is net of intermediate inputs (more detailed discussion of the reason for the value-added approach is presented in Section 4.1). Although national accounts consider productive activities those that generate income for the three factors of production, they do not include holding gains and losses in GDP measurements. Holding gains are when owners of products make profit by merely retaining inventories. From a conventional national accounts perspective, such activities are not productive and do not contribute to GDP (Lequiller & Blades 2014: 104-107, 115-121).

Despite not being marketed, government services are generally included in GDP as non-market services. The size of the government sector is about 15–20% of GDP for the OECD countries. Services provided by households are also usually non-marketed. Most of them, such as childcare or cooking, are not included in national accounts as outputs. The only exception here is owner-occupiers' services, which is an imputation based on the assumption that homeowners provide housing services to themselves. These services are calculated based on the actual rents of similar properties in similar areas. While not in OECD countries, in some developing countries the amount of goods (food, clothes, tools, buildings, etc.) that farmers produce for themselves is significant and so the convention is to impute all goods that households provide for themselves. Services are not imputed, except for owner-occupiers. Services that households offer others for free are not included but if paid (e.g. babysitting or paid lessons) they could be estimated in the accounts (2014: 107).

The conventional national accounts approach to the government and household sectors has been criticised even by neoclassical economists. Studies on productivity exclude government activities and owner-occupier services and only focus on the marketed sectors (2014: 117). On the other hand, it has been argued that the conventional national accounts underestimate the public sector's contribution to the economy. They ignore the value added of services provided by public entities, such as schools or hospitals, because they are not marketed, but include it if provided by the private sector. The same applies to household activities. These shortcomings have inspired research into quantifying government and household activities. However, because they are not marketed, there are significant challenges and debates on how to determine their monetary values (2014: 115-121).

From a Marxian perspective, productive labour in the capitalist process does more than produce commodities. It creates surplus-value, and by doing so fuels economic growth. Moreover, the concept of productive work is more than just a relation between an activity and its effects; it is a historical social relation that defines the worker as capital's means of valorisation (Marx 1976: 643-644). It represents socially determined labour, which is exchanged directly for money as capital. The relationship between objective and living labour that converts objectified labour into capital at the same time converts living labour into productive labour (1976: 1043).

The Marxian productive concept is irrespective of the material content of labour, its utility, or the use-value in which it is objectified. Capitalist fetishism falsely presents economic categories as qualities of their material bodies. In the labour process, it depicts labour as productive if it creates a material product. In the process of reproduction, fetishism entails considering labour productive when it creates articles necessary for reproduction and not luxuries (1976: 1046). The same concrete labour can be productive or unproductive depending on social relations. For instance, a “singer who sings like a bird” and does not sell her product is not a productive worker. However, if she sells her songs for money, she might be a merchant or a wage-labourer. If someone hires her to sing in order to make money, she becomes a productive worker because she directly produces capital (1976: 1044).

The next section demonstrates the diversity of Marxian views on productive labour. The social form, function, and material outcome of labour lead to different possible definitions of productive labour. Among them, capitalist-production labour is chosen as productive, which is discussed in more detail in a following section.

### **2.2.1. Possible definitions of productive labour**

This section follows Roberts’ (2014) comprehensive review and categorisation of the Marxian debates on productive labour. He argues that the productive–unproductive distinction serves two purposes. First, it shows that exploitation exists, and productive workers fund unproductive activities by producing more than they consume. Second, there are processes that redistribute total produced surplus value among productive and unproductive activities (2014: 337). Labour can be categorised along three axes: capitalist/noncapitalist relations of production (the social form of labour), production/nonproduction activities (the function of labour), and basic/nonbasic activities (the material result of labour). Any definition of productive labour can be located within the three-dimensional space formed by these axes.

The capitalist/noncapitalist distinction relates to the presence or absence of the social form of value. Capitalist labour leads to the production of goods or services that are sold as commodities in exchange for capital. Noncapitalist labour is diverse, with at least three varieties: wage labour outside of capitalist firms, e.g. government employees; commodity

producers who do not earn wages, e.g. self-employed commodity producers; and those who do not earn wages or produce commodities, e.g. domestic or voluntary labour.

The production/nonproduction distinction is based on the function of labour within the larger economic processes of reproduction. Marx distinguishes between production and circulation spheres, while acknowledging their interconnectedness. In the circulation sphere and through exchange, value transforms qualitatively and may undergo quantitative redistribution, but no new value is created (2014: 341-343).

Basic activities produce use-values that, directly or indirectly, enter the reproduction process of direct producers. They depend on the material result of labour and can include commodity- and non-commodity producing labour. The basic approach's focus on use-values can be related to the Marxian productive labour concept only via a broad view on surplus value generation. In a narrow sense, producing surplus value means performing more labour than the equivalent wage. Broadly speaking, increasing efficiency, cheapening consumption goods or services, reducing the reproduction cost of labour-power, and raising the surplus portion of working hours can all lead to more surplus value. This view includes labour such as housework as basic, while any work that does not contribute to the reproduction of labour-power as nonbasic (2014: 343-345).

The combination of these three axes opens up the possibility of various definitions of productive labour. Roberts (2014: 347-350) considers six of these possibilities: production, capitalist, basic, capitalist-production, capitalist-basic, and production-basic. All these variants include capitalist-basic, which is the chosen definition in this thesis and is discussed in the next section.

Any definition of productive labour has political and theoretical implications, e.g. in relation to gender, privatisation, financialisation, health care, and sustainability (2014: 340, 351-352). The focus on the production of surplus value (productive/unproductive distinction) could be viewed as dismissive of many female-dominated activities.

The focus on the social form could have the contradictory appearance that privatisation makes an industry or nation more "productive" and seems to undermine the continuity of value in time. It also seems to ignore the importance of the state for the functioning of the society, the

provision of the public good, and the reproduction of labour-power (Cockshott & Zachariah 2006: 517-518; Dunn 2011: 495-8).

Similarly, most definitions present domestic labour as unproductive. Not only does this approach seem to belittle women's role in social reproduction, but it also has the appearance of ignoring the critical role of the reproduction of labour-power. There are arguments for considering domestic labour as productive. For instance, Dunn (2011: 498-503) argues that for Marx (1976: 274), the value of labour-power is the labour-time necessary for its production and reproduction, and by extension, for the reproduction of its owner, the worker. Domestic labour is essential to that reproduction and, notwithstanding the practical difficulties in its calculation, should be included in the VLP.

Defining productive labour as production-basic portrays finance as unproductive, an approach that some heterodox economists and even national accounts have historically taken. However, the rise of financialisation has inspired arguments to regard finance as productive (Christophers & Fine 2020). For instance, Bryan, Rafferty and Jefferis (2015: 308-310) argue for ascribing a more central role to finance and rising beyond treating it as fictitious and unproductive to engage better with the new and rapid changes in money and labour in contemporary capitalism. They argue that this approach would recognise the "contingency of the future", i.e. risk, and would incorporate it into valuation.

In short, the Marxian definitions of productive labour are diverse. Choosing any of the definitions and ascribing the term "productive" may appear to undermine the importance of unproductive labour, which is often essential to social reproduction. However, the aim of the productive/unproductive labour distinction is to clarify how surplus value is produced and distributed. Being a productive worker is not in itself positive or a "piece of luck" but a "misfortune" (Marx 1976: 644). In this thesis, I use the capitalist-production definition because it is more directly supported by Marx's *Capital* and more widely used among empirical studies, which creates continuity in debate and facilitates comparison. The next section discusses this definition in more detail.

### **2.2.2. Capitalist-production labour**

The “dominant Marxian analytic definition” (Roberts 2014: 347) of productive labour is the labour spent on capitalist-production activities. It is used in empirical Marxian analysis, such as Moseley (1991), Shaikh and Tonak (1994), Patidis (2016), Jeong and Jeong (2020), Jones (2021), and Jefferies (2023). This definition is more directly supported by Marx’s work. For him, the value-producing labour is abstract, simple, and social. Only the labour-time that is necessary to the production counts towards value. Moreover, the product of labour must be a commodity and exchanged on the market. If the product of private labour is not exchanged, it is not a commodity and has no value, no matter how essential it is to the society. Childrearing and domestic work are examples of this type of labour. Any labour that is not production is a form of consumption, either social or individual (Foley 2009: 15-18; Marx 1976: 1038-1046; Shaikh & Tonak 1994: 20-30).

Capitalist production creates both capital and surplus-value, but the latter is its immediate purpose (Marx 1976: 1060). In this sense, labour is productive only if it is consumed to valorise capital and create surplus-value. From the labour process point of view, labour is productive if it objectifies itself in commodities, as “the unity of exchange-value and use-value” (1976: 1038-1039). Hence, all productive workers are wage-labourers but not all wage-labourers are productive. With the expansion of capitalist production, more workers earn wages via working for capital, which may blur the line between productive and unproductive labour. There are always some activities that contribute to the productive process but are run in a pre-capitalist manner, e.g. self-employment. In such cases, the capitalist concepts of productive and unproductive are inapplicable. Moreover, unproductive work might link to the process of production in a way that its price is factored in the price of the commodity and its cost taken as part of invested capital. The labour involved in this type of work appears to be exchanged directly for capital and not for revenue. An example here is taxes, which is the price of government services. If all indirect taxes were converted into direct ones, they would change from capital investment into revenue disbursement. The effect of such a change would be superficial but a comparable transformation of productive labour would be radical to the relations of production (1976: 1041-1043).

A commodity as the bearer of value must enter the sphere of circulation to valorise and turn into capital. However, the labour involved in exchange is not productive. In its pure form, the

exchange of commodities is an exchange of equivalents and thus no new value is created. Although unequal exchange might happen in individual exchange, at the average level of the market, the formation of surplus-value is not the result of exchanging commodities above or below their values. Otherwise, there would be a class of buyers who do not sell (Marx 1976: 260-264, 268).

Considering Marx's  $M-C...P...C'-M'$  formulation, Mohun (2012a: 279-281) argues that only the labour in the transformation of production capital to commodity capital is productive. The transformation of money capital to productive capital involves exchanging money and finance with production inputs. These transactions do not alter the quantity of value and thus are not productive (of surplus value). The transformation of productive capital to commodity capital involves changing both the form and value of capital. Because of changing the magnitude, the labour involved in this phase is productive. The division of labour in capitalist production still involves activities such as management and supervision, which are unproductive. These activities are financed by the productive activities that they supervise. Finally, the transformation of commodity capital to money capital only converts the form of capital and does not create new value. Therefore, labour involved in them is not productive. The first and third phases form the sphere of financial and monetary circulation. In this sphere, non-supervisory workers do not create value. Although they are exploited like productive workers and do create more revenue than their costs, the value that finances them is created elsewhere.

From a different but related perspective, Shaikh and Tonak (1994: 11-24) classify social reproduction activities into four general categories: production, distribution, social maintenance, and personal consumption. In production activities, use-values are utilised to create or transform use-values. In distribution activities, use-values are employed to transfer use-values, titles, or money from current owners to the next. These activities transform use-values but only as objects of possession, instead of objects of social use. Because money is the means of circulation, money-dealing activities are distribution. Advertising and sales are similar as their aim is to change the knowledge of use-values and not their use. However, the production of a commercial is a productive activity. Social maintenance activities utilise use-values to administer, maintain, and reproduce the social order. They are important costs of

maintaining the social fabric but still nonproduction activities. Finally, in personal consumption activities, use-values are consumed directly by individuals.

### **2.3. Conclusion**

This chapter outlined the theoretical foundation of this thesis, drawing on from the Marxian labour theory of value. It argued for taking labour-time as the true measure of value, whose necessary form of appearance is money. That is why the empirical analysis of Chapter 5 is in monetary terms. The key analytical concepts, including the rate of profit, the rate of surplus value, and different compositions of capital were also discussed. At the general level, the definitions of these concepts are simple and straightforward. However, the variances in the interpretation and measurement of the elements of these parameters, particularly the RP, have led to a variety of RPs. These variances are discussed in the next chapter.

The chapter also reviewed the debates on the transformation problem, which concerns a perceived discrepancy between using labour-value or monetary terms in the Marxian analysis. Strong, already existing theoretical and mathematical responses and solutions to the problem were presented. More importantly, it was argued that, at the aggregate level, there is no inconsistency in using monetary or labour-value terms and hence the problem vanishes. The analysis of the WRP is conducted at this level.

The chapter also reviewed the debates on the Marxian concept of productive labour. Classifying some labour as productive is not to prioritise it over unproductive labour, as the latter is often quite vital to social reproduction. The distinction only highlights that productive labour is the direct creator of surplus value and the source of funds for other activities. Acknowledging the possibility of alternative definitions and that any definition has limitations and implications, this thesis takes capitalistically employed labour in the production sector as productive. This definition is well supported by Marx's work, and its broad usage in the empirical literature facilitates comparison with other studies.

This chapter covered theoretical concepts that are fundamental to the empirical analysis but at a different level of abstraction. The next chapter bridges between these two levels by exploring the concepts at a more concrete level. It delves deeper into the elements of the rate of profit, including constant and variable capital. Outlining different interpretations and

methods, it offers justification and reasoning for the ones most suitable for the purpose of this study. Then, it turns to the main question of the trend of the rate of profit.

## Chapter 3: THEORETICAL FRAMEWORK: THE RATE OF PROFIT

The concept of the rate of profit (RP) has a unique place in Marxian political economy. As argued in Chapter 2, it is closely related to accumulation, growth, and crises. Marx (1973: 666) puts forward the argument that the RP tends to fall in the long-term as “the most important law of modern political economy” and Moseley (2003: 160) views the assessment of this trend as the “main question” of Marxian economics. The main goal of this thesis is to explore that question empirically and at the global scale. To outline the theoretical foundations, this chapter builds on the debates on the labour theory of value presented in the previous chapter. It explores the main components of the rate and outlines the theoretical justification for the choices made in the empirical analysis.

Section 3.1 explores the concept of constant capital in relation to the calculation of the RP. It considers whether the denominator of the rate is in a flow or stock form. Although both versions have been used by Marxian economists, the section concludes that the RP is based on stock and profit margin (PM) on flow. Section 3.1.2 explores other aspects of constant capital, including the depreciation of fixed capital, stock measurements, devaluation, and costing methods.

Section 3.2 considers the other component of the RP, variable capital, which appears in the numerator as the deduction from the total value added and in the denominator as part of advanced capital. Variable capital equals the value of labour-power (VLP). There are two major Marxian approaches to the VLP: the bundle of goods and the share of the net product. It concludes that in empirical analysis, both approaches ultimately resort to the money paid in wages. In this thesis, the compensation of employees (EC) measure in the national accounts is used as an estimate of the VLP because it includes all costs of labour to firms.

Having outlined the main components of the RP, Section 3.3 turns to the main question of this thesis: the trend of the RP. It offers different formulations of the problem, arguing that the law should be viewed as an empirical hypothesis and assessed empirically. By reviewing the literature on the topic, it highlights why new research into the long-term trend of the world rate of profit is still needed.

### 3.1. Constant capital

The part of capital whose value cannot change but only transfers to the commodity is constant capital (Marx 1976: 317). The means of production, such as machinery and buildings, are fixed constant capital while raw material and auxiliary material are circulating constant capital (Marx 1976: 284-287; Marx 1992: 472). Fixed capital enters the labour-process in its entirety and as use-value, but enters gradually into value creation and circulation as exchange-value (Marx 1968: 196; Marx 1992: 237-241). The national accounts distinguish fixed capital based on its durability, i.e. if the life cycle is longer than a year. However, from a Marxian perspective, whether a capital is fixed or circulating depends on its place in the production process and not its durability in relation to an arbitrary time period (Marx 1992: 239-240; Shaikh 2016: 796; Shaikh & Tonak 1994: 13-17). In the national accounts, the three main elements of fixed capital include: pure households, i.e. dwellings; government, including defence, public infrastructure, offices, schools, and hospitals; and businesses, i.e. “machinery, vehicles, offices, industrial buildings, software, R&D” used by the business sector, which constitute the largest part of the stock of capital (Lequiller & Blades 2014: 143). The closest equivalent of circulating capital in the national accounts is intermediate consumption or input. It includes the flow of all goods and services used up during a period, usually a year. Depreciation is often excluded from the former and recorded as the consumption of fixed capital (2014: 1112, 133).

Defining a part of capital as constant capital does not mean its value never changes. The value of the means of production, similar to any other commodity, is determined by the socially necessary labour-time for its production, which may change due to factors such as technological innovation. If an invention cheapens the production of a type of machinery, it also reduces the value of similar machines that were built before. This value loss happens outside the production process and thus does not transfer to the product. In other words, technological change not only cheapens the production of new machines, but also cheapens older, similar machines.

The means of production can transfer value to commodities equal to the amount of value they lose as a result of a reduction in their use-value. If a means of production has no value because it is not a product of labour, such as wind, water, or land, it cannot transfer value to the product irrespective of how vital its role is in the production process. Thus, not all means of production that appear in the production process contribute to the valorisation process. On the other

hand, there are occasions in which not all parts of a means of production enter the production process but all of it enters the valorisation process. An example is the wastage of materials that happens under the normal process of production. In any case, the maximum value that a means of production can transfer to the product is its independent value (Marx 1976: 312-314, 318).

All parts of advanced capital participate in the production of a commodity but only the value of circulating capital (variable and constant), including the depreciation of fixed capital, enters the cost price of the commodity. That is why there is debate over whether to use the stock of fixed capital in the denominator of the RP or just the part consumed within a specific period. Section 3.1.1 reviews the literature, concluding that a stock denominator aligns with the RP concept and a flow measure with profit margin. Section 3.1.2 explores other aspects of constant capital in relation to calculating the RP, including the depreciation of fixed capital, costing methods, and stock measurements.

### **3.1.1. Stock vs flow**

This section argues that the proper measure for the denominator of the RP is stock, while a flow denominator aligns with the profit margin concept. Both these measures represent profitability but from different viewpoints. The RP represents the overall capacity of an economic unit to generate profits. Profit margin reflects the profitability of each period of production and the relation between inputs and profits. The RP is the concept relating to Marx's law of the tendential fall in the rate of profit (LTFRP) and, as this section shows, most empirical studies have correctly used a stock denominator.

In *Capital III*, to explore capitalists' incentives for adopting technological change, Marx (1991: 370-371) uses the example of an industry using two different types of machines, whose depreciation rates differ. In calculating the rate of profit, he divides surplus value to the cost of wages, auxiliary materials, and the wear and tear of the machines. In other words, he ignores the total value of fixed capital in the denominator. In *Theories of Surplus Value* (1969a: 214-215), comparing two cases with and without machinery, Marx calculates profit rate as a ratio of flow to flow. For the case without machinery, he calculates the RP as surplus value to the sum of the costs of raw materials, instruments of labour, and wages. In the second case,

he adds depreciation to the previous costs. In *Grundrisse*, Marx (1973: 487-488) mentions an example by Malthus. In this example, the total value of fixed capital (building and machinery) is given but only the interest and depreciation enter the calculation of the RP.

Several theoretical and empirical studies have followed the same approach in using the flow of advanced capital. As discussed in Section 2.1.2, the RP can be decomposed into the value composition of capital (VCC) and the rate of surplus value (RSV). For the constant capital, Fine and Harris (1979: 59) use “the mass of means of production consumed per production period (i.e. abstracting from fixed capital)” for the TCC and the value of that mass for the VCC. Similarly, Gillman (1957: 16 as cited in Mage 1963: 69) defines the organic composition of capital (OCC) as the ratio “between constant capital consumed and variable capital consumed”. Shaikh (2016) works with a range of profit rates, one of which is the incremental RP. This rate is essentially the derivative of the average RP, defined as profits gross of depreciation over gross investment. This rate is essentially the rate of return on new investment and quite crucial to the classical theory of equalisation of industries’ RPs (2016: 66-68, 855).

In contrast, the use of the stock of fixed capital is more prevalent. Marx notes that surplus can be seen from two angles. First, it is an excess over cost price, which includes variable and circulating constant capitals. Second, surplus can be seen as an excess value over total advanced capital, including total fixed capital (Marx 1991: 138-139). Surplus value is essentially an increment of variable capital, but in the process of production it is also an increment of total capital. It is the product of the entire invested capital, both the part that enters directly in the self-expansion process, i.e. circulating capital, and the part that does not, i.e. fixed capital (1991: 126, 402). Total capital contributes partially to cost price and the process of self-expansion but in full to the creation of surplus value in the labour-process. That is why, as Marx recites Malthus, “The capitalist ... expects an equal profit upon all the parts of the capital which he advances” (1991: 126). While it is true that the price of the commodity is influenced more by raw materials than by fixed capital, the RP is determined by total capital, irrespective of how much of it is used in one period (1991: 203).

Marx highlights a misconception that the RP is the share of capital in production. He notes that if the RP is 10%, it does not mean that the share of capital and labour in production are 10% and 90%, respectively. From the viewpoint of capital, that 10% is the profit on the entire

capital, including the means of production, raw materials, and wages (1973: 298-299). If capital is comprised more of fixed capital, the risk of depreciation and the difficulty to dispose of fixed capital are higher. While this situation does not affect surplus value, the capitalist includes the risk in the calculation of the RP (1971: 395).

Marx often tends to ignore fixed capital altogether just to simplify the examples, especially if the rate of turnover of capital is involved (1968: 411; 1971: 395-396; 1991: 207, 303). However, there are several examples in which he explicitly discusses fixed capital. In an example in *Capital III*, Marx (1991: 165-167) considers several situations in which the value of fixed capital varies, and circulating capital and the rate of turnover are adjusted so that the RP is the same. In all cases, advanced capital is the sum of fixed capital plus circulating constant and variable capital, irrespective of the number of turnovers. He does not include depreciation in the advanced capital. Later on, in an example originally from *Capital I* (1976: 327-328), he uses the same approach by using total fixed and circulating capital in the denominator of the RP (1991: 168-169).

In an example in *Theories of Surplus Value II*, Marx (1968: 191-193) aims to show how cost-prices are regulated by an average RP and how they can differ from a commodity's value. He calculates the RP of the manufacturer the same as that of the farmer, i.e. the ratio of surplus value to total capital invested. The total capital of the farmer only includes his wages while for the manufacturer it includes wages and fixed capital. Marx notes that the profit of the farmer equals the RP multiplied by wages while for the manufacturer it is multiplied by the sum of wages and fixed capital. He also mentions that the procedure would be the same for circulating capital.

In *Theories of Surplus Value III*, to demonstrate the effect of the use of machinery in increasing productivity and lowering prices, Marx (1971: 65-66) considers a product being produced by human labour alone or by a combination of fewer workers and a machine. In this example, he uses the entire value of the machine in the denominator, even when considering the cost of the repair of the machine. Later on, citing an example first provided by Torrens, Marx (1971: 71-72) compares the different technological settings of wool and silk manufacturers. Marx calculates their RPs based on total capital including fixed capital and depreciation. While he criticises the assumption of a customary RP, he does not dispute how the rate is calculated.

In empirical Marxian analyses, the use of the stock of fixed capital as the denominator of the RP is more common. Mage (1963: vii), Shaikh (1980b; 2016: 65, 68), Moseley (1991: 11; 2003: 160; 2016: 35-36), Shaikh and Tonak (1994), Mohun (2003: 89), Foley (2009: 92), Kliman (2012: 80), Basu and Vasudevan (2013: 64), Tsoulfidis and Paitaridis (2019: 635), Jones (2021: 59), Basu et al. (2022: 7), and Jefferies (2023: 268), among others, define the Marxian RP as the ratio of total profit to total advanced capital. The same approach is also adopted by theory-oriented Marxian economists. For instance, Saad-Filho (2002: 73-74) defines the OCC as the value of the means of production per hour of labour and “relates the total value of the constant capital (including fixed and circulating capital)” to total labour necessary to transform that to products.

As Mage (1963: 70), in his critique of Gillman’s (1957) approach, argues, one reason why the flow estimate has been used is mis-identifying the formula for capital and for the commodity product. These two only become the same if no fixed capital exists and all parts of circulating capital have the same rate of turnover. As mentioned before, Marx often makes this simplifying assumption and perhaps that is the root of the misconception in the Marxian works afterwards.

Yet, a flow denominator does have utility for economic analysis. Shaikh (1980b: 76-77) acknowledges the difference between profit rate and profit margin and argues that true competition forces a capitalist to adopt a technology that delivers the highest transitional profit margin. This choice is made even if it entails a lower transitional rate of profit. If that is the case, it leads to a lower general RP in the long run. In short, it is profit margin that determines the adoption of a new technology.

### **3.1.2. Stock valuation and depreciation**

As discussed in the previous section, the denominator of the RP is the actual stock of capital that has been advanced for production. The definition, measurement, and estimation of capital stock and its depreciation have been the subject of long debates within and between schools of economic thought, leading to “capital theory controversies” (Cohen & Harcourt 2003: 210-212). This section discusses stock valuation, depreciation patterns, historical and current costing methods, gross and net measures, and the issue of inventories. It argues that

ideally, the denominator of the RP should be based on actual measurement of what has been invested, adjusted for inflation, in gross terms, and inclusive of inventories. However, some major economies, such as the US, does not currently offer such measures and consequently, world data sources lack a comprehensive history of such data. That is why, the empirical part of this thesis relies on the available data in the net, current-cost format as the closest approximation.

The way capital and its depreciation are measured depend on how the measure is to be used, the definition of capital, and the perspective from which they are viewed. Generally, from the national accounts perspective, capital has two aspects: a) wealth and income and b) production and productivity. More specifically, the measurement of capital is used in the investment function, the consumption function, the production function, budgeting and planning, and connecting various national accounts. The measurement of capital is intrinsically related to the way it is implicitly or explicitly defined. The definitions vary and include instantaneous productive capacity, long-run productive capacity, cumulated consumption forgone, and real wealth. The measurement or estimation can also be approached from the supply or demand side. From the supply side, it is the product of production, and its price should cover the input costs plus a margin. From the demand side, the price of capital is expected to be proportional to its future return (Dan 2008: 3-5, 13; OECD 2009: 25-26).

The concepts of asset value and depreciation (consumption of fixed capital) are closely connected. Depreciation and devaluation happen in different ways. An asset deteriorates physically from use as well as the lack of use. The first type is almost directly proportional to the length and duration of the operation of the machine while the second is inversely proportional. Other than physical deterioration, a machine also goes through moral depreciation, i.e. when it loses exchange-value because new machines with lower prices and/or better capabilities are produced. In both cases, its value is no longer equal to the SNLT objectified in it. Instead, its value is determined by the SNLT of the cheaper or better machine (Marx 1976: 528). The current value of the old machine can be determined based on an equivalent portion of the better machine that does the same job. So, if, for instance, the old machine produced 4 units of the product per day and the new machine 5 units, the current value of the old machine would be 80% of the SNLT of the new machine.

While physical destruction is one mechanism of devaluation, the dominant factor is the decline in the prices of equities, financial instruments, and even produced commodities, e.g. consumer goods and services (Kliman 2012: 22). Freeman (2009b: 15-16) acknowledges that the RP can be restored via capital disaccumulation. It occurs during periods where economic demand and activities drop and capital depreciation grows faster than investment, e.g. during 1937–1943 in the US, or when demand rises but without increasing private investment, e.g. during wars.

Ideally, for assessing the historical trend of profitability, the valuation of an asset and its depreciation should be based on actual information on its acquisition cost, including interests. Using the information on the asset's efficiency over time as well as when it is retired or discarded, the depreciation can also be exactly determined. While this approach may be possible for a single asset, the task of collating and processing precise asset information at the national level is extremely difficult, if not impossible. It requires substantial resources, which may not always be available. Moreover, because investment and depreciation are closely related to tax purposes, there are risks of data manipulation in arbitrary ways (United Nations 2009: 124). Furthermore, for economic planning and assessment, forward-looking projection often become necessary. Due to such reasons, countries such as Australia (ABS 2021: 421) rely on estimation methods and do not collect direct measurement data.

Even the estimation, instead of actual measurement, of the stock of a single asset, with varying characteristics, efficiencies, and ages, is not a simple task. Theoretically, "perfect" second-hand asset markets could provide such information. However, such markets do not exist for all assets (United Nations 2009: 124, 416). Alternatively, rental markets could provide information about capital services, which can then be transformed into asset values. However, not all assets have rental markets and the information on existing ones has not been regularly and rigorously collected (Jorgenson & Landefeld 2006: 75).

The methods of calculating depreciation are complex and vary across countries. Moreover, they rely on numerous assumptions, which ultimately undermine the accuracy of data (Lequiller & Blades 2014: 21, 221; Shaikh & Tonak 1994: 7). Below I discuss two approaches to the measurement of capital and depreciation. The first is common in the economic literature while the other takes an accounting approach. Following Jefferies (2023), I refer to them as the economists' approach and the accountants' approach. To explain the economists'

approach, I mainly follows OECD's (2009) *Measuring Capital*, which is the reference material for the SNA 2008 (United Nations 2009) on capital measurement. As an example of the accountants' approach, I discuss the method used by the Internal Revenue Service (2024).

### The economists' approach

Three variations of capital stocks are used in contemporary national accounts. Gross stock is a measure of gross investments minus retired/discarded assets, which is determined by applying a retirement function. Net stock is calculated by deducting depreciation from gross stock by applying an age-price function. In mainstream economics and the language of conventional national accounts, net stock is a measure of the wealth of a nation and is referred to as the "wealth stock" (OECD 2009: 26). Productive stock is based on the concept of capital services, i.e. how much capital contributes to production. It is calculated by applying an age-efficiency function to gross stock and correct accumulated investment for retirements and loss of productivity (OECD 2009: 24-27).

The determination of the value of capital in the system of national accounts is based on the concept of Net Present Value. The value of an asset is equated with the discounted stream of its future return. This equation can be made using income, cost, or market perspectives. All perspectives fundamentally rely on the assumption of perfect, competitive, "functioning" markets, which leave "no expected residual profits above and beyond the costs of capital input" (OECD 2009: 31). From the cost perspective, it implies that gross operating surplus, i.e. the residual of value added after deducting the cost of labour, is the cost of capital. Alternatively, from the income perspective, gross operating surplus is the income of capital. And from the market perspective, the price of an asset in the used capital market is regulated by demand-supply mechanism and stabilises on a value that incorporates gross operating surplus (OECD 2009: 31-32).

For instance, from the income perspective, the price of a new asset at the time of purchase equates the sum of the prices of capital services in the years until retirement discounted back to the beginning of the purchase year:

$$p_0^t = \sum_{s=0}^T \frac{c_a^{t+s}}{(1+r)^{(s+1)}} = \frac{c_0^t}{(1+r)^1} + \frac{c_1^{t+1}}{(1+r)^2} + \frac{c_2^{t+2}}{(1+r)^3} + \dots + \frac{c_T^{t+T}}{(1+r)^{T+1}} \quad \text{Eq. 3.1}$$

In which,

$p$  = price of the new asset at year  $t$

$c_a^{t+s}$  = capital services at year  $t + s$

$s$  = age of the asset

$r$  = discount rate

$T$  = the retirement age of the asset

The efficiencies of assets usually decline with age. Exceptions are assets such a lightbulb, which retain efficiency until complete retirement. The values of capital services are proportional to efficiencies and so, for normal assets, they tend to fall with age. General price levels may also change over time and the prices of capital services should be adjusted for that effect. In short, the value of capital services should be determined for each year of service (age-efficiency profile), adjusted for general asset price changes (age-price history), and then discounted back to the purchase year to obtain the present value of the asset.

Every individual asset can have its unique efficiency profile. But using data on the class of an asset, we can have a profile that applies to the average asset in that class. Some simplified profiles are presented in Figure 3.1. A linear age-efficiency profile indicates that the asset loses the same proportion of its initial efficiency each year until retired. A horizontal-line profile indicates that the asset, e.g. a lightbulb, retains its efficiency until the end of its service life. Another possibility is a geometric decline in efficiency. In this scenario, in each year, the asset loses the same proportion of its efficiency at the beginning of the year. In other words, the rate of efficiency loss is constant. A caveat of this scenario is that the asset's lifespan is virtually indefinite. The combined effect of efficiency and price changes are presented in Figure 3.2, which follows Hulten and Wykoff (1981: 84-89) as early advocates of this method. OECD (2009: 32-36) offers a numerical example, which clarifies the calculation steps. In this figure, the age-efficiency profile of the asset is presented by lines  $t$ ,  $t+1$ , and  $t+2$ . They are here presented as linear, but they can have any shape. If an asset starts from age  $s$  and price  $p_1$ , within the first year, its efficiency drops from point  $a$  to point  $b$  on the  $t$  curve. However, by the beginning of the next year, prices have increased. So, in the beginning of the second year, the price of a one-year-old asset has moved to point  $c$ . Within the second year, the efficiency drops to point  $d$  but the price changes raise it to point  $e$  in the beginning of the third year. The

value of the asset, therefore, moves on the a-c-e line, which presents the combined efficiency-price effect.

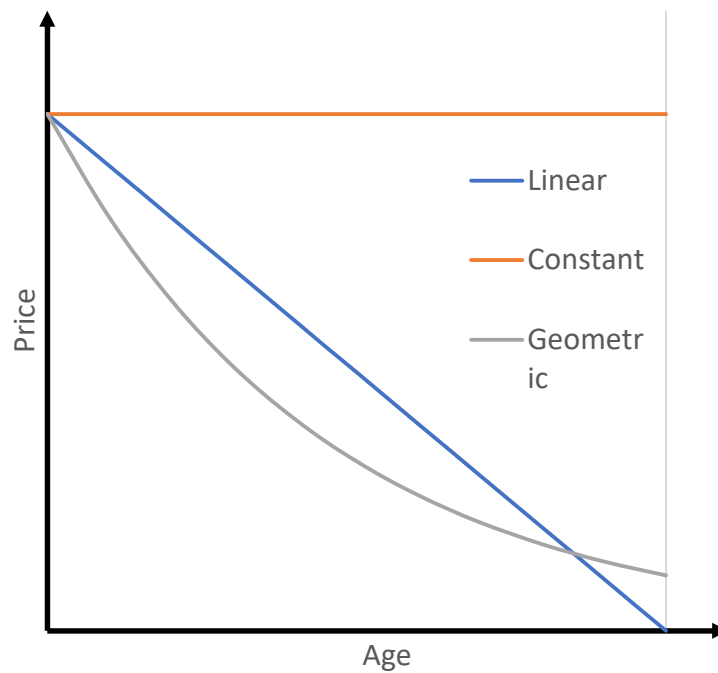


Figure 3.1: Examples of possible depreciation patterns

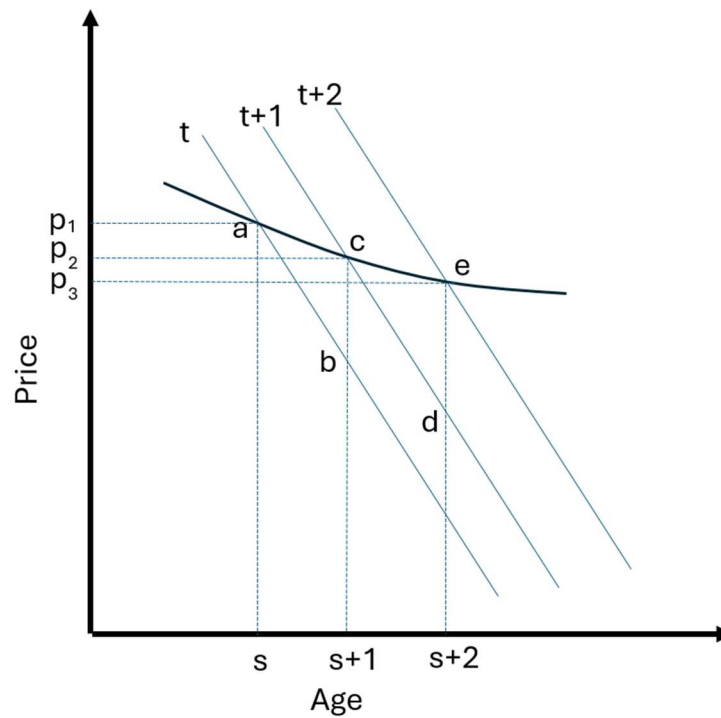


Figure 3.2: The evolution of an asset's price due to aging and general price changes

Age-price profiles are used to calculate capital income flows and age-efficiency profiles help calculate physical capital stocks (Hulten & Wykoff 1981: 90). The two are often connected via a discount rate. The discount rate, or the nominal rate of return, reflects the opportunity cost of purchasing the asset instead of alternative products. At a minimum, it should be equal to the financing cost, but realistically, is higher to account for the risk of investing in production, instead of earning a passive income. The risk, of course, varies across asset classes due to the differences in uncertainties. OECD (2009: 35-36) notes that an endogenous approach to the rate of return is more common, which is difficult to combine with non-geometric age-efficiency and age-price profiles. The geometric case, i.e. when efficiency or price drops at a constant rate, is a special case as it entails identical age-price and age-efficiency curves. This case is more common in the economists' approach.

The estimation of the national stock can be done via different methods. The physical inventory method uses a direct count of physical units of assets and applies independently estimated prices to calculate the total stock. The perpetual inventory method uses previous flows of investment to indirectly measure current stocks. Almost all countries use this method. By contrast, the utilisation of the physical inventory method is more restricted. For instance, in the US, it is only used for autos (BEA 2003: M-6; Shaikh 2016: 807).

### **The accountants' approach**

The accounting method is based on firms' actual cost of purchasing assets including associated financial costs. It incorporates different depreciation patterns for various classes of assets. Here, the focus is on the IRS (2024) method as an example of contemporary accounting practice.

The IRS uses the Modified Accelerated Cost Recovery System (MACRS), which itself consists of the General Depreciation System (GDS) for most assets and the Alternative Depreciation System (ADS) for specified types of properties. The GDS offers the 200% and 150% declining balance and the straightline methods while the ADS only uses the straightline method.

The 200% and 150% declining balance methods are essentially geometric, i.e. they use constant depreciation rates. For example, an asset with a 5-year effective service life, i.e. recovery period, depreciates  $200\%/5 = 40\%$  of its remaining value each year. The 200% and 150% declining balance methods allow for higher depreciations in initial years and switch to

the straightline method when the latter offers an equal or higher depreciation value. The switch to straightline remedies the caveat of an infinite life in geometric depreciation.

The IRS (2024: 10) permits the income forecast method instead of the straightline method for specific intangible assets such as films, sound recordings, books, patents, etc. The amount of depreciation in each year equals the cost of the property multiplied by the share of that year's income out of ten years of income. This approach resembles the economists' method in projecting future incomes. The IRS also has conventions in terms of what percentage of an annual rate can be deducted in the first year of installation. For instance, the half-year convention entails that a business deducts half an annual depreciation for the first and last year of the asset's life.

In short, the main difference between the two methods is not in how they evaluate depreciation but in asset valuation. Both methods, in their contemporary form, favour geometric patterns of depreciation. The accountants' method takes a backward-looking, supply-side approach by relying on tax declaration data. The economists' method has a forward-looking, demand-side approach by equating the price of an asset with its net present value of future capital services. While it uses survey data on price and lifespan of assets, it shifts focus from measurement to estimation. The benefit of this shift is a lower vulnerability to the manipulation of tax data and perhaps better theoretical consistency (United Nations 2009: 124).

However, estimation inevitably relies on theory, which is neoclassical economics for the economists' method (OECD 2009: 16). It explicitly and fundamentally relies on the assumption of perfect, "functioning" markets as well as informed, rational buyers and sellers. The economists' method of stock valuation is well constructed on its theoretical foundation. However, the core, neoclassical economics assumptions of perfect markets and information have been criticised widely by a diverse range of heterodox economists.

By contrast, the accounting method has the core advantage of relying on actual purchase information, which can be used directly, indexed to different price-history points, or used in models to determine various costing formats. However, it is not as widely accessible as the other method and the accuracy of its data has been questioned (United Nations 2009: 124).

As discussed in the previous section and based on Marx's conceptual analyses (Marx 1971: 395; Marx 1973: 298-299; Marx 1991: 126, 138-139, 203, 402) and empirical examples (Marx 1968: 191-193; Marx 1971: 65-66; Marx 1991: 168-169), the denominator of a Marxian RP is the total capital that has actually been advanced for production. Marxian studies on profitability have used both net and gross measures of capital stock to calculate the RP; Shaikh and Tonak (1994: 125) and Jeong and Jeong (2020) use the gross estimate but Kliman (2012: 11, 145), Li (2020: 16), and Roberts (2012: 12) use net capital stock. The gross estimate seems closer to Marx's notion of advanced capital, as it presents the invested fixed capital in its entirety instead of its depreciated value. However, in recent years, some organisations such as BEA have stopped producing estimates of gross stock of capital. The reason is the wide adoption of geometric pattern of depreciation. By this pattern, some assets theoretically live indefinitely, and thus, do not have a distinct discard/retirement time (BEA 2003: M-5).

The stock of fixed capital can be measured in current or historical prices. Historical cost evaluates assets at the time of purchase. In that sense, it is "analogous to book value estimates used on company reports and financial statements" (BEA 2003: M-10). Current cost accounting evaluates assets, and their depreciation based on any given year, as if they were purchased in that year. One benefit of this method from the perspective of national accounts is that it translates capital stock and depreciation to the prices of other key parameters such as intermediate input, taxes, etc.

Kliman (2012: 102-117) argues that the current-cost RP is not a real profit rate. Instead, the money that businesses actually invested on their stock of fixed assets should be used. He offers several reasons. The current cost method overestimates the value of stocks in times of high inflation and incorrectly underestimates the RP and vice versa in times of disinflation. Businesses base their actual and expected rate of return and profit-maximisation decisions on historical costs, i.e. on the return on the funds they actually invested in the past. In his analysis, the rates of accumulation and return of equity markets do not relate to the current-cost RP.

Historical-cost approach has been criticised on various grounds. Hashimzade, Myles and Black (2017) and Pearce (1992: 103) argue that when inflation is high, the current cost of assets rises and the historical depreciation costs fall below replacement measures. That is why assets are re-evaluated periodically and replacement cost depreciation method is used to reflect the current depreciation costs. Basu and Vasudevan (2013: 70), following Foley, argue that the use

of historic valuation in calculation of the RP distorts time-series, because by ignoring inflation it overestimates early data and underestimates the later. Shaikh (2016: 798-800) also argues that for the calculation of the real RP, similar to the classical RP, the stock of capital and other parameters should be in current values and adjusted for inflation. Most physical items enter production in the current period and thus are in their current prices. But some inventories and capital goods enter at various times and with different historical prices.

I argue that the historical-cost measure is a more suitable measure for the stock of capital in the denominator of a Marxian RP, as long as it is based on actual measurements and not estimation. It should also be based in gross terms, so that it represents the total advanced stock until discarded. As discussed above, a key criticism of the historical costing approach is its treatment of inflation. For calculating the stock of capital, it should be adjusted for inflation, but not re-valued. In this way, the prices of different vintages are added up using the same monetary denominator, yet the impact of time on efficiency is still reflected. In this sense, I agree with Kliman that the historical-cost RP is a better measure for a Marxian profitability analysis but I disagree that the current cost is “not a rate of profit in any normal sense of the term” (Kliman 2012: 102). The current-cost RP is still a measure of profitability, which considers the economic system at a point in time and based on its present state of wealth and production capacity.

Finally, there is the issue of including inventories in the denominator of the RP. Some researchers, e.g. Jeong and Jeong (2020: 269) and Jefferies (2023: 268, 283), include inventories in the denominator of the RP as the stock of circulating constant capital. Kliman (2012: 81) argues that although inventories include the stock of raw materials, they also include unfinished and unsold products. As such, it does not seem accurate to include them as advanced capital for the purpose of production. Moreover, the small size of inventories does not affect the RP notably. Because of these reasons, as well as the unavailability of the data for most countries over the long-term, I do not include inventories in the denominator of the RP.

To sum up, this section explored the concept of constant capital in relation to the calculation of the RP. It argued that the stock of fixed capital should be used for the RP and its flow for PM. For calculating a Marxian RP, capital stock should ideally be what has been actually advanced. In national accounts' terms, the closest measure is historical, gross, and actually

measured, rather than projected. However, none of the sources of the world economic data offer such a measure. That is why, the empirical part of this study uses the net, current cost values as the closest available proxy.

### **3.2. Variable capital**

Variable capital is the part of capital that changes quantitatively during the process of production by producing the equivalent of its value as well as surplus value (Marx 1976: 317). It equals the VLP of productive workers. Its flow appears in the numerator of the rate as the deduction from total value-added. In the stock form, it is part of advanced capital and, as such, also a component of the denominator of the rate. In this section, other issues including the measurement of VLP, its relationship with wages, its inclusion in the denominator of the RP, and the role of skills are explored.

Labour-power is the only commodity whose use-value is the source of value and whose consumption is the objectification of labour, the source of production of other commodities, and the generation of surplus-value. Labour is the substance of value but has no value itself (Marx 1976: 677). What is meant by the erroneous term “the value of labour” is essentially the value of labour-power. Labour-power is essentially different from its function, i.e. labour. The use-value that the worker supplies is not the labour-power but a particular form of useful labour. Wages, price, and value of labour are the forms of appearance, but the value and price of labour-power are the essence (1976: 682).

Marx argues that demand and supply cannot fully explain VLP. They only explain fluctuations in the market price of a commodity around an average, and in equilibrium cease to offer any explanation (1976: 678). The VLP relies on the cost of developing it. The existence of labour-power relies on the existence of its owner, the worker, whose existence, in turn, relies on a minimum, or necessary, quantity of the means of subsistence, which is known at any given time in each society (Marx 1976: 271-275).

Another factor is the diversity of labour-power delivered by different workers. Moreover, the price of labour-power and consequently surplus value depend on the extensive magnitude of labour, i.e. the length of the working day, the intensive magnitude of labour, i.e. the normal intensity of labour, and the productivity of labour (1976: 655).

Class struggle and workers' resistance are also critical to the determination of the VLP (Lebowitz 2010 as cited in Fine 2012; McIntyre 2017). Carchedi (2017: 45-46) argues that the VLP changes are driven by its relation to wages. If wages are kept below the VLP long enough to change the normal living standard of workers, they become the new VLP. The VLP and the rate of exploitation are "co-determined" by the power relations between capital and labour. Similarly, Sinha (2019: 248) argues that trade unions play a crucial role in balancing the business cycle of wages, i.e. lowering wages in recessions and increasing them in economic booms to compensate the former. Fine (2012: 123-124), acknowledging the importance of the class struggle and workers' resistance, argues that the diversity of the workforce does not allow the social and historical elements of the VLP to be averaged across all workers.

Perhaps the most important determinant of the VLP is the means of subsistence, whose amount varies over time due to historical, cultural, social, and technological norms. As such, the determination of the VLP has "a historical and moral element" (1976: 275) and depends on a "traditional standard of life" (Marx 1969b: 29). This role of the means of subsistence has inspired the bundle of goods approach, which equates the VLP with the value of a basket of goods and services necessary for the sustenance of workers and their families, ensuring the continuation of the delivery of work with the same quantity and quality (Carchedi 2017: 45; Mandel 1990: 21; McIntyre 2017: 181; Sinha 2019: 182). A slightly different formulation considers the VLP equivalent to the basket of goods purchasable by a given wage (Desai 1990: 366). Other factors impacting the size and quality of the bundle, and thus the VLP, include geography, development, the status of the class struggle, and power relations between capital and labour (Carchedi 2017: 46; McIntyre 2017: 181).

The bundle of goods view has been criticised on various grounds. Saad-Filho (2002: 48-49) argues that it offers only a limited interpretation of Marx, potentially downplays workers' exploitation, and does not sufficiently explain how wages are determined and vary across workers. It reduces workers to the goods they consume or their spending of wages to how labour-power is produced, which implies that workers are produced for profit. From a different perspective, Foley (1982: 39-43) argues that the bundle of goods view misrepresents the production of labour-power as any other commodity. However, labour-power is inseparable from the labourer, and its production is essentially human reproduction. It is not capitalistically produced because the labour involved is unpaid and there is no surplus value.

Moreover, the bundle of goods view “short-circuits” the social relations around wage bargaining and workers’ “freedom” to spend wages however they want and ignores money as the “mediating element”.

Instead, Foley and the New Interpretation (NI) approach propose viewing the VLP as workers’ share of the net product. In this approach, VLP is the portion of total abstract social labour that workers can have a claim over via wages. Whether or not prices and values are proportional, the VLP can be defined as wages multiplied by the value of money, i.e. the labour value of the monetary unit. If labour values and prices of production are proportional and we take the value of the commodity labour-power to be the value of the commodities necessary for its (re)production, the VLP is equal to the value of the basket of goods. However, in the more general case, where values and prices are not necessarily proportional, the VLP and the value of the bundle of goods are not equal (1982: 40-43).

The NI’s interpretation of the VLP has not been exempt from criticism. Moseley (2016: 253) argues that the NI does not completely abandon the “standard physical quantities interpretation” of the bundle-of-goods view. Saad-Filho (2002: 49-52) argues that Marx (1971: 93-94) explicitly rejects that the VLP is determined by workers’ share of the product. Instead, workers’ share of the product is determined by their wages, which is, in turn, determined by its sale to capitalists. Second, the NI approach does not explain the size of workers’ share of the net product and what they purchase with that. Third, it assumes a symmetry in the capital–labour relationship and the determination of the share of the net product by market power. Fourth, the NI’s definition of the VLP is too general for a theory of value. Finally, both the wage share and the bundle of goods approaches are inadequate because they try to tie the VLP to a concrete outcome through goods or money. However, the VLP is a quantity of value, i.e. the abstract SNLT to produce necessities. As such, the VLP cannot be analysed independently of the dynamic structures of consumption, employment, and distributive struggle.

Another challenge regarding determining the VLP is the diversity of concrete labour, particularly in terms of skills. Labour value is based on the concept of homogenous simple abstract labour, but in reality, there are numerous concrete labours and various degrees of skills and intensity. Marx (1976: 135) suggests considering skilled labour as multiplied simple labour. However, it is extremely difficult, if not impossible, to derive the multiplication factors

for all the varieties of concrete labours (Moseley 1991: 30-31). To complicate the situation more, the factors change constantly depending on social, cultural, and technological changes. Another question is the use of variable capital in the denominator of the RP. Although theoretically it should be included (Marx 1971: 191), in practice its magnitude is small compared to the stock of fixed capital and can be ignored in calculations (Mohun 2012a: 295; Moseley 1991: 191). The stock of variable capital can be calculated as “the wages cost component of the stock of unsold and unfinished commodities” (Jones 2017: 88). Alternatively, it can be calculated as the annual wage bill divided by the number of turnovers (Kliman 2012: 80). The rate of turnover can be approximated by the turnover of circulating constant capital (Jeong & Jeong 2020: 280). By either approach, the size of the stock of variable capital is small compared to the stock of fixed capital. Maito (2014: 5-6) points out that although in countries like the US or Japan the wage bill can be as high as half the GDP, the high turnover rate leads to the annual VC of about 5%.

To conclude this section, despite some theoretical contradictions that Marx (1976: 675-680) mentions, the VLP and wages are intrinsically related. Although the fluctuations in the means of sustenance and wages might be independent, the translation of the value and price of labour into wages also reflects the laws governing both (Marx 1976: 701). That is perhaps why in empirical analysis, both bundle-of-goods and share of net product approaches ultimately rely on wages that workers receive. In this research, I also use wages and compensation of employees to calculate variable capital and the RP. Considering the argument that money is the necessary form of appearance of value (see Section 2.1.1), in the empirical part I assume that wage differences reflect skill variances. In other words, there is no further need to modify Marxian variables that are in monetary terms for the effect of skills. The decision to use the compensation of employees does not deny the social, political, and economic complexities involved in the determination of wages, which include skill development, collective bargaining, and structures of labour markets (Fine, Lapavitsas & Saad-Filho 2004: 12-13; Saad-Filho 2002: 49-52). The analysis of those capitalist relations is simply beyond the scope of this research.

### 3.3. The trend of the rate of profit

This section focuses on the law of the tendential fall in the rate of profit. First, it acknowledges the differences in the definition and measurement of the rate. Then, it moves to the theoretical formulation and assessment of the LTFRP, arguing that abstract debates alone cannot resolve the question of its validity. Empirical research is necessary to examine the long-term trend of the RP. Finally, it offers a review of the empirical studies on this topic.

As previous sections demonstrated, Marxian studies on the RP differ in how they define and measure constant and variable capitals. They also differ in what to deduct from the value added to obtain surplus value. Taxes and depreciation are two notable examples. The result is a range of profit rate definitions in Marxian studies. Discrepancies around the RP are not exclusive to the Marxian economics but are also present in other schools. A relevant measure in the conventional national accounts and mainstream economics is the rate of return. It is the rate of earnings to invested capital and represents the opportunity cost of holding fixed capital versus financial assets. It can be the expected rate or risk-adjusted market rate. Over the long-term, RR equalises on similar assets within an industry and on assets with similar risks. The investment used in the definition can be on physical, financial, or even human capital. The traditional accounting and business definition takes profits net of depreciation and taxes. Both profits and capital could refer either to their initial value in the first year of a project or to the average over the lifetime of a project. There are also differences in calculating the rate. The most used method is the endogenous, ex-post approach, in which capital services are taken as the sum of gross operating surplus and the capital part of gross mixed income. On the other hand, the exogenous, ex-post method uses information from the financial market, e.g. the rate on corporate debt (OECD 2009: 66-67; Pearce 1992: 363-364). The discussions and discrepancies on the rate of return or rate of profit in the mainstream economics are out of the scope of this research. Here, I only focus on the differences within the Marxian literature. It should be noted that this discussion is not comprehensive but only to demonstrate existing variances.

Kliman (2012: 95-96) notes that Marx uses different rates of profit throughout his work: the value RP, the nominal RP, the RP based on SV, and the RP based on actual profit. Other rates can be found in the Marxian studies. The Marxian general RP is usually defined as mass SV over the stock of capital. The average RP is the ratio of operating surplus, or profit-type income

minus business taxes, to capital stock (Jeong & Jeong 2020: 269, 271; Shaikh & Tonak 1994: 122, 125). Maniatis and Passas (2013: 629) define the net RP as surplus value minus the sum of the cost of unproductive labour, circulation, and indirect taxes divided by the stock of capital exclusive of agriculture and residential sectors. Moseley (1991: 42) uses surplus value minus the cost of unproductive capital for the numerator of the RP and, for the denominator, the stock of productive capital, i.e. excluding unproductive capital. There is also the RP of enterprise, defined as the RP minus the rate of interest, which Shaikh (2011: 46) traces to Marx and classical economists and argues that it determines investment.

As the discussion so far presented, Marxian studies define the RP differently and use different measures of its components. These differences easily impact the magnitude of the RP. However, as the empirical chapter of this thesis and studies such as Basu and Vasudevan (2013) show, the long-term trend is less affected. The differences are covered in Section 3.3.2, which reviews the empirical studies of the LTFRP. But first, the next section outlines the theoretical concept and debate around the LTFRP at a general level, ignoring the discrepancies on the measurement of components.

### **3.3.1. The law of the tendential fall in the rate of profit**

This section explores the LTFRP, which states that continuous technological change leads to the fall of the RP over the long-term. First, I lay out different formulations of the law and present the arguments supporting it. Then, I consider the counterarguments and simple hypothetical examples. I argue that the general, abstract formulation is indeterminate. It is not possible to a priori assert that the RP necessarily falls all the time. The question of the long-term trend of the RP is essentially one for empirical investigation.

The capitalist incentive to capture more surplus value can be satisfied by prolonging the working day, which is confronted by two main barriers. First, there are physical limits to labour-power. A worker can work only a certain number of hours a day, beyond which there are higher risks of injuries and errors. Second, there are moral obstacles due to workers' intellectual and social needs, determined socially, historically, and culturally (Marx 1976: 341). The profit motive incentivises the capitalist to ignore these barriers unless confronted with enough resistance from workers and the society. This tension between capitalists and workers

over the length of the working day has been at the core of class struggle throughout the history of capitalism (1976: 394-5, 411-414).

An alternative to lengthening the working day is increasing the productivity of labour. Higher productivity reduces the SNLT required to produce commodities. If it happens in industries producing the means of subsistence, it reduces the value of labour-power (VLP), which is equivalent to the part of the working day that compensates workers. In other industries, assuming a constant VLP, it increases the produced value and surplus value. Capital has a strong tendency to increase the productivity of labour and, by doing so, to cheapen commodities including labour-power (1976: 432-7, 442). In Marx's terminology, increasing surplus-value by lengthening the working-day is absolute surplus-value and by raising productivity is relative surplus-value (1976: 432).

Labour productivity can be enhanced by external natural conditions that impact necessary labour-time. These conditions include endowment in the means of subsistence, such as fruitful soil, or wealth in the instruments of labour, such as wood or metal (1976: 648). Although these factors can have significant impact on the emergence and rise of an industry, competition eventually balances out historical and geographical advantages. For these industries, the main way to increase productivity and relative surplus value is by technological advancements. Implementing technologies, however, requires capital investment and decisions must be made whether increased profits can compensate further investment. Such decisions affect and are affected by profitability.

The value of a commodity is determined by the gross amount of labour that is socially necessary directly for its production or indirectly for its parts and the tools to produce it. Machinery does not create value but passes its own value to the product, and never more than the average value it loses by depreciation. Only the human that works with the machine creates new value. Compared to manual production, producing commodities by machinery decreases the total value of the product because a key reason for using machinery is to save on direct and indirect labour. With the mechanisation of production, the share of value transferred to the product by the instrument of labour increases relative to the share of direct labour. In other words, the value transferred to the product by the instruments of labour increases relatively but decreases in absolute terms (Marx 1976: 509-512). Capitalist development involves a rise in total used capital and a relative decline of variable capital to

constant capital. Technological advancement increases labour productivity, i.e. each unit of labour-time transforms a larger volume of constant capital into a final product (Marx 1976: 772-781).

In *Capital III*, Marx (1991: 317-319) expands that argument. Assuming the rise in the composition of capital is universal and not limited to a certain industry or sphere of production and that the RSV remains constant, the relative increase of constant capital to variable capital leads to a fall in the rate of profit. The reason is that with mechanisation, labour productivity rises, and the values of individual commodities fall. Assuming a constant proportion of surplus value to total produced value, the result of labour-saving technologies is a reduction of surplus value per item. At the same time, due to the investment in new technologies, the amount of capital tied to production rises. As a result, the RP falls. Marx names this argument the LTFRP and considers it the “the most important law of modern political economy, and the most essential for understanding the most difficult relations” (1973: 666).

The LTFRP exposes a key contradiction of capitalist production: the profit motive ultimately undermines profitability. It is essentially rooted in different forms of competition. Within an industry, the competition between capitals, as sellers, over more buyers tends to equalise prices. Price equalisation operates dynamically around a centre of gravity but most likely never fully reaches a fully steady state. Capitals have different technologies of production, i.e. different absolute and relative sizes of fixed capital and labour, and hence different production costs. Price equalisation entails different profits per commodity and different RPs for capitals. The capital with the lowest cost can use price cutting as its competition weapon. By doing so, it may lose some profit, but its competitors lose more profits and potentially their share of the market (Shaikh 2016: 261-264).

Another level of inter-capitalist competition occurs between industries. This competition relies on the notion of regulating capital. The regulating capital in an industry has the best reproducible conditions of production, but its unit cost is not necessarily the lowest. Reproducibility of the conditions of production is key here. For instance, in the mining industry, a capital using the best mine has the lowest cost but is not the regulating capital because its conditions are not reproducible. By contrast, in a technology-driven industry, the capital with the newest technology could be the regulating capital, because its conditions are reproducible. Adjusting for quality and considering reproducibility of the conditions of

production, the regulating capital often has the lowest cost of production (Seretis & Tsaliki 2012: 969-970; Shaikh 2016: 265).

Between industries, new investment tends to move to an industry whose regulating capital has the highest expected rate of return on new investment. This rate is likely to differ from the industry's average rate of profit. Because investment and ramping up production do not necessarily raise demand at the same pace, the ratio of new investment to demand accelerates in that industry and decelerates in industries with lower profit rates. The flow of investment raises production and supply faster than demand, and consequently lowers prices and the rate of profit (Shaikh 2016: 264).

The mobility of capital between industries perpetuates the operation of the two levels of competition. New investments lower the RP of the most profitable industry, move to the industry which now has the highest profit rate, increase its level of production, equalise its prices, and eventually lower its profitability, and so on. The ongoing operation of this dynamic process leads to the downward trend of the RP in the entire system.

Another justification for the falling tendency of the RP is that variable capital is the upper bound of surplus value, in the hypothetical case that the VLP falls to zero. So, the maximum value of the RP equals variable capital to constant capital, which is the inverse of the value composition of capital. Technological change continuously raises the VCC and with that the possible band of the RP progressively narrows between zero and a lowering maximum. So, the RP must present a downward tendency (Mohun 2012b: 297; Shaikh 1978: 233).

Other schools of economic thought also consider similar formulations of the law. Smith argues the fall in the RP is facilitated by competition between capitals but Ricardo argues that competition only establishes an average RP among industries and capitals (1973: 669). Ricardo (2001: 113) notes that with the accumulation of capital on land and the rise of wages, the RP falls but absolute amount of profit rises. This formulation is arguably only applicable to the context of stagnant technology (Mohun 2012b: 296). As Cohen and Harcourt (2003: 209) note, neoclassical economics also proposes that countries with higher capital to labour ratio should have lower RPs. However, Keynesians, such as Robinson, criticise the argument, noting that while the US has a higher ratio of input to labour, its RP is not exceptionally low. What distinguishes Marxian economic in this regard is that, while the decline of the RP has been empirically studied by mainstream economics, its cause has not (Moseley 1991: 104).

The LTFRP has raised various reactions. Moseley (1991: 1) cites three criticisms. Despite the general formulation, it is not self-evident why the composition of capital must necessarily rise; even if the composition of capital rose, why its pace would counter and overcome the rising RSV; and if real-wages were constant, why capitalists would choose a technology that reduced their RPs. Heinrich (2013: 4) raises the criticism that, if productivity rises and price-cutting occurs in the industries producing the means of production, it reduces the cost of production. If the decline of production cost outpaces the reduction in prices, it increases the RP. In this scenario, the ratio of constant to variable capital is constant or falling, which removes the pressure on the RP to fall. Shaikh (1978: 234), who generally supports LTFRP, acknowledges this argument as valid, indicating a gap in the LTFRP argument.

The third point mentioned above is known as the Okishio (1961) theorem. It has been criticised on different grounds. Shaikh (1978: 234-235) argues that in capitalism the method of production is not a simple choice, but a necessity imposed on capitalists. They must choose a method that reduces production costs in the long-run but reduces their RPs rather than choosing a method that only raises their transitional RPs. Moseley (1991: 23) notes that the theorem seems valid only if we accept its assumptions, i.e. a constant wage and that new equilibrium prices are established after the introduction of a new production technique. However, Okishio (2001) later acknowledged that his original assumptions were flawed.

To better understand the mechanisms of the LTFRP, below I consider how the implementation of new technologies can affect production costs and profitability. A producer's decision to implement a technological change relies on the cost-cutting outcome. In the example below, I assume zero markup just for simplifying the analysis. I also separate depreciation cost from material input to isolate the changes in the stock of capital. I assume that the cost of new technology implementation is part of the cost of fixed capital and reflected in depreciation.

*Table 3.1: Definition of variables in the cost-reducing technology example*

<b>Parameter</b>	<b>Old technology</b>	<b>New technology</b>
Number of commodities produced	$n_1$	$n_2$
Hours of labour per item	$h_1$	$h_2$
Wages per hour	$w_1$	$w_2$
Amount of material input per item	$m_1$	$m_2$
Depreciation of fixed capital	$D_1$	$D_2$

Costs of production (CP)

$$CP_1 = D_1 + n_1 h_1 w_1 + n_1 m_1 \quad \text{Eq. 3.2}$$

$$CP_2 = D_2 + n_2 h_2 w_2 + n_2 m_2 \quad \text{Eq. 3.3}$$

Assuming constant prices, technological change must be cost-reducing to be accepted for implementation:

$$\Delta CP = CP_2 - CP_1 < 0 \quad \text{Eq. 3.4}$$

Here I consider four scenarios, in which different parts of the cost are isolated to assess their impacts. Real world scenarios are more likely to be a mix of all.

1. Labour-saving technology

$$h_1 w_1 > h_2 w_2, n_1 = n_2 = n, m_1 = m_2 = m \quad \text{Eq. 3.5}$$

$$D_2 + n h_2 w_2 < D_1 + n h_1 w_1 \quad \text{Eq. 3.6}$$

$$\Delta D < n(h_1 w_1 - h_2 w_2)$$

In this scenario, the new technology would be accepted only if the change in depreciation was smaller than the change in labour cost.

2. Material input-saving technology (excluding depreciation)

$$h_1 w_1 = h_2 w_2, n_1 = n_2 = n, m_1 > m_2 \quad \text{Eq. 3.7}$$

$$D_2 + n m_2 < D_1 + n m_1 \quad \text{Eq. 3.8}$$

$$\Delta D < n(m_1 - m_2)$$

To be accepted, the material saving technology must ensure that the savings in the cost of material inputs are larger than the increase in the depreciation cost.

3. Depreciation-saving technology

$$h_1 w_1 = h_2 w_2 = h w, n_1 = n_2 = n, m_1 = m_2 = m, D_1 > D_2 \quad \text{Eq. 3.9}$$

$$D_2 + n h w + n m < D_1 + n h w + n m \Rightarrow \Delta D < 0 \quad \text{Eq. 3.10}$$

In other words, innovation must reduce the cost of fixed capital depreciation while keeping all other factors constant. If the cost of fixed capital remains the same, this condition can be

satisfied by increasing the life cycle of the machinery. Alternatively, if the life cycle remains the same, the condition can be satisfied by reducing the cost of machinery.

#### 4. Increased production

$$h_1w_1 = h_2w_2 = hw, n_1 < n_2, m_1 = m_2 = m \quad \text{Eq. 3.11}$$

$$\Delta D < (n_1 - n_2)(m + hw) \quad \text{Eq. 3.12}$$

$$hw > 0, m > 0, n_1 - n_2 < 0 \Rightarrow \Delta D < 0 \quad \text{Eq. 3.13}$$

This scenario requires technological innovation to reduce depreciation costs while raising production levels. Ultimately, its requirements are similar to Scenario 3's.

Assuming fixed prices, the result of any of any of the cost reduction strategies above is increased surplus value and profits. Except one case of Scenario 3 and 4, all four scenarios entail an increase in advanced capital. There is nothing in these formulations that determine whether the rise in surplus value is less than the rise in advanced capital. In other words, at this level of "theoretical" analysis, the impact of innovation on the RP is indeterminate.

Labour-saving technologies (the first scenario above) are often the focus of debates on the LTFRP. Without delving into the broad subject of the choice of technique (Shaikh 1980b), here I only consider a simple algebraic formulation. I assume that the inputs using the old technology are C and V, and using the new technology are C + ΔC and V + ΔV. The prices of production are calculated by adding a markup to the inputs, usually equal to the general rate of profit (r). The prices of production (PP) are calculated as:

$$PP_1 = (1 + r)(C + V) \quad \text{Eq. 3.14}$$

$$\begin{aligned} PP_2 &= (1 + r)(C + \Delta C + V + \Delta V) & \text{Eq. 3.15} \\ &= (1 + r)(C + V) + (1 + r)(\Delta C + \Delta V) \end{aligned}$$

For the new technology to be chosen, it should reduce the cost of production, i.e.

$$(C + \Delta C + V + \Delta V) < (C + V) \Rightarrow \Delta C + \Delta V < 0 \quad \text{Eq. 3.16}$$

$$\Delta C < -\Delta V, \text{ i. e. } |\Delta C| < |\Delta V| \quad \text{Eq. 3.17}$$

It also entails that

$$\Delta PP = (1 + r)(\Delta C + \Delta V) < 0 \quad \text{Eq. 3.18}$$

Assuming PP1 is the current price and no price cutting occurs,  $\Delta PP$  is the extra profit that the innovative capitalist earns. It is also the limit for price reduction while retaining the same profit margin on input costs. In other words, the capitalist can reduce the price by up to  $\Delta PP$  to drive competitors out of the market.  $\Delta PP$  is the transitional margin and its ratio to the initial cost price is the transitional profit margin.

The change in the RP depends on the size of price cuts. If prices remain constant, the effect of the transition on the RP is uncertain, because profits (the numerator) rise, but so does advanced capital (the denominator). There is no predefined relationship between the size of increases in advanced capital and transitional margin. At the other extreme, if prices drop to PP2 and all other factors remain constant, the RP necessarily falls. The reason is that the margin falls while advanced capital rises:

$$\Delta C + \Delta V < 0 \Rightarrow r(C + \Delta C + V + \Delta V) < r(C + V) \quad \text{Eq. 3.19}$$

Shaikh (1980b: 76-77) notes that real competition forces capitalists to always choose the method that lowers costs and increases the transitional profit margins, even it entails lower transitional profit rate. If the new technique lowers the RP and becomes the dominant method, it reduces the general RP. However, this argument does not mean that new cost-reducing technologies necessarily and in all circumstances lower the RP.

We can also consider how the RP is affected by the temporal variance of surplus value and constant capital. In formulas below, the symbol ' denotes derivation with respect to time.

$$r = \frac{S}{K} \quad \text{Eq. 3.20}$$

$$r' = \frac{S'}{K} - \frac{SK'}{K^2} \quad \text{Eq. 3.21}$$

For the rate to be downward trending:

$$r' < 0 \Rightarrow \frac{S'}{K} < \frac{SK'}{K^2} \Rightarrow \frac{S'}{S} < \frac{K'}{K} \quad \text{Eq. 3.22}$$

At one extreme, if we assume that advanced capital remains constant, the rate only falls if surplus value falls.

$$K' = 0 \Rightarrow \frac{S'}{S} < 0 \quad \text{Eq. 3.23}$$

At the other end, if we assume that surplus value remains constant, the rate falls if advanced capital increases.

$$S' = 0 \Rightarrow 0 < \frac{K'}{K} \quad \text{Eq. 3.24}$$

In general, the RP falls if the growth rate of surplus value is lower than the growth rate of advanced capital. Neither of the equations above pre-empts the possibility of rate increases. It is possible to hypothesise situations where the growth of surplus value outpaces the growth of advanced capital and hence raises the RP. What happens in the real world and what actually existing capitalism imposes on choices of technology and the growth of different components of the RP can be quite different from the realm of possibilities that these simple algebraic formulae present. And that is why the analysis of the RP and its trend cannot be exclusive to the theoretical field but necessarily requires empirical verification.

Another way of looking at the LTFRP is through the lens of the composition of capital. With the advancement of technology and accumulation, machinery progressively replaces workers, the VCC rises, and the share of constant capital in the price of the commodity increases compared to that of variable capital (Marx 1976: 762). New technologies raise productivity, and labour transforms more means of production into commodities but contributes to a smaller portion of total created value. The combination of these two forces means that with the rise of the composition of capital more commodities are produced per worker per hour, and a larger mass of the means of production is transformed into final products, but their value compared to the mass drops (1976: 774).

The core of this argument is that the VCC has a tendency to rise and does so with a higher rate than the rise of productivity. The rate of change in VCC with respect to time ( $VCC'$ ) can be expressed as the difference between the rate of change of constant capital and that of variable capital:

$$VCC' = K' - V' \quad \text{Eq. 3.25}$$

$K'$  is the rate of accumulation of capital and  $V'$  is the rate of change of productive working hours. If we assume that all workers work the same number of hours, on average, and that the rate of growth of the number of productive workers equals the rate of population growth, VCC rises if capital accumulates faster than population. This condition is quite likely to be the

case. However, there is no obvious necessity for it to be so. This gap in the argument has been acknowledged by others, such as Shaikh (1978: 234) and Moseley (1991: 10).

As the examples above demonstrate, the LTFRP appears indeterminate. Roberts and Carchedi (2013) and Carchedi (2009: 59-60, 75) argue that the indeterminacy of the law is only the result of the application of formal logic. Viewing capitalist production via dialectical logic, it is consistent and determinate. While this argument might be satisfactory for a specific reading of Marxism, it pre-empts the possibility of debate with those who do not subscribe to dialectical logic.

The processes of technological change, rate equalisation, and the fall of the RP are, like capitalism itself, turbulent, dynamic, and never at complete equilibrium. I argue that Marx acknowledges this nature by using the term “tendency” in describing the law and including in it the socioeconomic forces that may slow or even reverse the decline of profitability as countertendencies. That is why Reuten (2004: 175-176) argues that the term “law” is misleading, and Marx attempted to reframe it in a less deterministic and more cyclic form.

The six countertendencies identified by Marx (1991: 339-348) are: intensification of labour exploitation, reducing wages below VLP, cheapening constant capital, rise of relative surplus population, foreign trade, and increase of share capital. The question here is whether countertendencies, such as capital devaluation, only have short-term impact on the trend of the rate or their effects can last over the long-term. In a hypothetical scenario where constant innovation causes rapid and on-going obsolescence of fixed capital, the “moral depreciation” of capital (Marx 1976: 528) reduces the denominator of the RP and turns its trend upward. Whether such a case could happen over a long-term period cannot be deduced based on some axioms about capitalism but is essentially an empirical question.

As the above shows, the arguments for and against the law are numerous and at the abstract level seem to offer some valid points. That is why some, e.g. Kliman et al. (2013: 3), Jones (2021: 17, 20), and Foley (2009: 135), note that Marx proposed the law as an explanation of what happens rather than to deduce from axioms and to predict the future. His formulation, as evident in the term “tendency”, seeks to highlight the likelihood that the rise in the composition of capital outweighs countertendencies, rather than “proving” that it always does. As Foley (2009: 139) notes, it is impossible to say a priori if the RP in actually existing capitalism rises or falls. The question of the trend of the RP is essentially an empirical one.

### **3.3.2. The review of empirical research on the rate of profit**

Most Marxian studies on profitability tend only to focus on a single country, and particularly the US. The main reasons are the availability of detailed data and the US being the centre of capitalism for the most part of the last century (Shaikh 2011: 46). Nevertheless, in recent years, perhaps due to the improved accessibility of data, more studies on other countries have emerged. The publications on the world rate of profit (WRP) have also increased over the past two decades. In the following, I start with the research on the US, then move to those on single countries other than the US, and finally to the research on the WRP. Although most studies on the US show a long-term trend, there have been disagreements over whether there was a recovery in the 1980s. The views on the trend of other countries' and the world's profit rates are even more diverse.

Moseley, distinguishing productive and unproductive labour, estimates the US's profitability for the periods 1947–1987 (Moseley 1991) and 1947–2002 (Moseley 2003). He finds a steep decline between 1950 and 1975, with the rate falling by more than 50% of its peak value. He associates the fall to the rise of unproductive activities (1991: xiv, 122) and invested capital per worker, both of which being the result of technological change (2003: 162). The rate increased in the 1980s and early 1990s due to lowering wages and intensification of labour. However, these strategies eventually exhausted and the rate began to fall again from 1997 (2003: 163).

For more than three decades, Shaikh has been assessing the US rate of profit: 1948–1989 (Shaikh & Tonak 1994), 1947–2009 (Shaikh 2011), and 1947–2011 (Shaikh 2016). He uses a detailed method, distinguishing productive and unproductive professions as well as production and non-production industries (discussed further in Section 4.1.1). In all publications, he reports that the RP has a secular long-term downwards trajectory and its movement is the cause of economic crises. He associates the fall mainly to the rising composition of capital.

Considering the US economy between 1948 to 2000, Duménil and Lévy (2002: 438-439) find that the RP fell in most industries. For the entire economy, the rate fell by up to 50% between the 1960s and 1980s and afterwards it gained only about half of its loss. They argue the profitability loss occurred due to the decline in capital productivity and relative price of output to fixed capital as well as a faster decline of labour productivity compared to the lower growth

of real-wages. Duménil and Lévy (2011: 58) also show that the *RP à la Marx* fell between 1952 and 2008.

Freeman (2009b: 2) finds a declining trend in the US's *RP* between 1929 and 2000 and associates it with technical change, reflected in output to capital ratio. In his analysis, Freeman uses the current-cost method of calculating fixed capital (2009b: 21), although he argues in favour of the historical-cost measurement (Freeman 2009b: 12; Freeman 2012: 170).

Using the historical-cost method of estimating fixed capital, Kliman (2012: 75-77) shows that the before-tax *RP* and property-income rate fell from 1929 to the mid-1930s. They rose substantially till 1950 but fell afterwards, with mild, temporary short-term recoveries. Kliman (2012: 12, 138) argues that the downward trend is due to the smaller rate of employment increase compared to the rate of capital accumulation. He notes that crises are endemic in capitalism and so is the consequent destruction of capital. As a result, there are recurring recoveries of profitability after each crisis and thus a determinate secular downward trend in the rate of profit is not feasible (2012: 25). Kliman (2012: 11, 12) acknowledges that current-cost US *RP* rebounded after the 1980s but argues that that rate is "not a rate of profit in any meaningful sense".

Basu and Vasudevan (2013) study the trend of the *RP* in the US from 1946–2010. They use a range of profit rates, for corporate, corporate business, non-financial corporate business, and non-farm non-financial corporate business sectors. They consider both historical and current cost fixed capital as well as before- and after-tax measures. All profit rates, except one, fall until the 1980s and afterwards, have a slightly upward or flat trend. The only exception is the profit rate with historical-cost capital stock and before tax measurement, which showed a continuous decline over the time period. Technological change was the main driver of the fall of the *RP* in the 1960s and 1970s. During the neoliberal era, the rising profit share partially restored profitability and was supported by capital-saving information technologies.

Basu and Manolakos (2012) use a time-series regression framework to assess LTFRP, using Duménil and Lévy's (1994; 2016) dataset for the *RP* and labour productivity. They follow Duménil and Lévy's definition of the *RP* as the ratio of the flow of profit (net domestic product minus the wage bill) over the net stock of fixed capital valued at replacement cost. Overall, they find a stochastic trend in the US's *RP*, which is downward and statistically significant. Based on their analysis, an increase in "overpopulation" has a lagged positive effect on the *RP*.

The intensity of exploitation has a positive impact on the RSV and hence on the RP. The deviation of real wages from VLP negatively impacts profitability, i.e. when the real wages exceed the VLP, RSV and RP decrease. The cheapening of the relative price of capital stock increases the RP and seems to be the strongest countertendency with a variable time lag.

In a more recent study, Jones (2021: 190, 214) finds that the US's RP fell from 1930 to 2011. The driver of the fall has been the rising OCC overcoming the impact of RSV. During that period, RSV, OCC and VCC rose but the turnover time of variable capital, the RP, and the real interest rate fell. His analysis shows that the RP had slight recoveries in the mid-1950s to mid-1960s and in the 1980s to mid-1990s (2021: 171-178).

Jefferies (2023: 269) argues that the neoclassical approach to the valuation of fixed capital is an overestimation compared to the actual purchase and replacement prices, unless in the hypothetical case of perfect competition and zero profit rate. Instead, he uses the value of depreciable assets minus depreciation, i.e. the purchase price of fixed capital net of accumulated depreciation, as an arguably more accurate measure of advanced fixed capital. He defines the RP as the ratio of domestic profits over the sum of advanced fixed capital, inventories, unproductive variable capital and productive variable capital divided by its rate of turnover. He finds that the rate undergoes several periods of rise and fall but, overall, rises from 1964 to 2017 (2023: 283-284). The rate rises notably in the early 2000s, which Jefferies attributes to the integration of China and former soviet countries in global capitalism.

Over the past few decades, there have been more publications on the profitability trends of countries other than the US. Mohun (2003) assesses Australian RP from 1965 to 2001. He finds that the rate peaked in 1969, dropped to its trough in 1983, then recovered afterwards. The recovery was steady but by 2001 the RP level was still below its peak in 1969.

Examining Brazil's RP between 1953 and 2003, Marquetti, Maldonado Filho and Lautert (2010) find that profitability fell overall but went through three phases. The first twenty years showed a slow decline leading to a sharp fall in the second phase. From 1989 to 2003, the rate rose slowly. The authors link the phases to institutional arrangements and the overall high profitability of the country to higher capital productivity of developing economies.

Following Shaikh and Tonak's (1994) method, Maniatis and Passas (2013: 632, 639; 2018) measure Greece's RP during the period of 1958–2009. They show that the general and net RPs

have a long-term downward tendency, with a mild recovery between the mid-80s and 90s. They argue the decline has been the result of the LTFRP and the rise of unproductive activities and labour. Also considering Greece's economy, Patidis (2016) takes a micro-approach, using company-level data to assess the LTFRP. His study only spans 10 years (2000–2009) and shows a notable increase in the VCC and decline in the RP.

Jeong and Jeong (2020: 270-272) consider South Korea's RP from 1980 to 2014. They show that the Marxian RP, after a rising period, began to fall since 1986, losing about one-third of its peak value by 2014. Moreover, the average non-farm business RP fell steeply after 1986 till 1997. The rebound after 1997 turned into a slow decline since 2002. They associate the 1997 crisis to the sharp fall of the RP during the previous decade and the recovery period of 1997–2002 to the intensification of exploitation. Overall, they argue that the long-term declining trend of the RP is due to the rising composition of capital, which overcame rising RSV (2020: 261, 274, 279).

Although most empirical research on the RP focuses on individual countries, new studies on the WRP have emerged over the last two decades. They are justified by the arguments for considering the global RP (Section 1.2) and facilitated by increasing accessibility of data. Some of the publications on the WRP choose a few countries, calculate individual country rates, and then compare trends. Others build panels of multiple countries as a representative of the world and calculate the rate for that "world". Both groups are discussed here. This thesis mainly follows the latter but does discuss individual countries' profitability.

As one of the first publications on the world RP, Li, Xiao and Zhu (2007) explore the combined RP of the US, the UK, Japan, and the Euro zone, as a representative of the world. They find a long-term downward trend in the WRP, rooted in the institutional structure of global capitalism, in particular in the form of rising wages and taxation. They do not find any general long-term trend in output–capital ratio. More recently, Li (2020) explores the long-term economic trends of four major economies: Britain (1855–2018), the US (1900–2018), Japan (1955–2017), and China (1980–2018). Data limitations prevented considering the four economies on the same timeframe. Using an after-tax measure (2020: 16), Li finds that all four have demonstrated a long-term decline in profitability, with some periods of temporary recovery. He notes that the capital–output ratio does not have a particular trend in the long term in the four studied countries (UK, US, Japan, China) (2020: 7).

Zachariah (2009) considers the profitability trend of several countries separately over the period of 1964–2000. The rate began to fall in all the countries in the 1960s. In the US, Japan, Canada, and France the trend continued, with partial and modest recoveries. In the UK, Italy, Switzerland, and Australia the recoveries starting in the 1970s were strong enough to compensate for the loss of profitability (2009: 3-4). Zachariah (2009: 7-8, 12) attributes the fall to the rise of capital stock and the downward trend of workforce growth.

Using a wide range of data sources (Chan-Lee & Sutch 1985; Duménil & Lévy 2005; Li, Xiao & Zhu 2007; Zachariah 2009), Maito (2014; 2018) analyses the long-term trend of the RP of a bundle of fourteen countries: Germany, the US, Netherlands, Japan, United Kingdom and Sweden (core countries) and Argentina, Australia, Brazil, Chile, China, Korea, Spain and Mexico (peripheral countries) (2014: 10). Over the 1850–2009 period, he finds a downward trend in the RP with periods of temporary recovery, which he attributes to the countertendencies. He expects the RP to be lower in core countries but also notes that there has been a greater decline in the RP of the periphery (2014: 8). Based on the results, he suggests that Ricardian, heterodox, and Marxian theories based on profit squeeze have lost their strength in the current context (2014: 6).

Roberts (2012) explores the rate of profit for eleven countries of the G7 (Canada, France, Germany, Italy, Japan, the United Kingdom and the United States) and BRIC (Brazil, Russia, India and China), using the Extended World Penn Tables (Marquetti 2012). The period of study is from 1963 to 2007, during which the rate falls until 1975, recovers until the mid-1990s, and since then has been declining slowly. The trend of G7's RP is quite similar to, but slightly higher than, what is presented by Li, Xiao and Zhu (2007). The difference might be due to the role of China. Roberts (2012) argues that globalisation was the major force driving the countervailing factors in the 1990s, including the reduction of the value of constant capital relative to variable capital and the rise of productivity while wages remained constant. A key factor here is that the size and the growth rate of the industrial workforce in the emerging markets are much larger than those in the advanced economies. This combination in the “truly global” system helped the counteracting factors to raise the rate of profit.

Roberts (2015) uses the raw data from the Penn World Table (Feenstra, Inklaar & Timmer 2013), Eurostat AMECO database (European Commission 2020), and the Extended Penn World Tables (Marquetti 2012) to calculate a weighted average of the rate of profit for the G20

countries. He presents different versions of the rate, all of which demonstrate an overall decline between 1963 and 2010 due to technological change, with a period of recovery between the 1980s and early 2000s. He associates the neoliberal recovery to a rising rate of exploitation as a countertendency. He also notes that the neoliberal-era rise in the RP based on the Penn and AMECO databases might be due to the inclusion of the real estate and government sectors. He suggests that the countertendencies are not strong anymore to counter the decline in the rate of profit, and that a further destruction of capital, via another major crisis in global capitalism, is needed to raise profitability. Nevertheless, he argues that capitalism has not reached its absolute limits yet, because the industrial workforce in emerging markets is still growing and has potential to be exploited (2015: 10).

Trofimov (2018) builds a large database of country and world data, including the US (Brenner 2006; Duménil & Lévy 2016), the UK, Germany (Maito 2014; Piketty 2014), Sweden, Spain (Cámara Izquierdo 2007), Brazil, South Korea (Grinberg 2011), Mexico (Mariña Flores & Moseley 2001), and the world (Maito 2014). The overall timespan is 1855 to 2010, but it varies across studied countries. Trofimov employs a range of econometric techniques to assess the trends and explores alternative methods of calculating profit rate. His conclusion is that the evidence supporting the falling profitability hypothesis is rather weak and only demonstrable on a specific time period. Trofimov notes that from an econometric point of view, the common methods, using visual linear trends, are not sufficient because they do not pinpoint the source of non-stationarity, cannot show structural breaks, or falsely show statistically significant trends. He also notes that the LTFRP should be approached as a hypothesis rather than a law.

Using the Extended Penn Database and the World Input–Output Database (WIOD), over the 1960–2019 period, Basu et al. (2022: 4, 23) show that the RP of a “world”, consisting of 25 countries, fell sharply during the regulated era (post–World War II to the mid-1980s). During the neoliberal period, the rate recovered slightly but then fell to a level below the start of the period. The authors associate the overall downward trend of the world RP to the technological progress, rising output–capital ratio, and the falling profit share.

As the review in this section presents, the Marxian literature on the RP is quite diverse. However, the part focusing on the world is new and still quite limited. Although most studies in this field point to a declining RP since the 1960s, with a slight recovery in the neoliberal era,

some conclude differently. The studies also differ on the driver of the fall. Moreover, the number of studied countries, the definition of RP, and the weighting methods also vary, limiting the comparability of results. Also, perhaps due to the lack of detailed data on the Chinese and BRIC economies, it is likely that the US's RP affects the trend of the WRP more than its share of global capital. The empirical analysis in this research seeks to address part of these gaps.

### **3.4. Conclusion**

In this chapter, I argued that the long-term trend of the RP is not determined a priori. To build that argument, the chapter explored the components of the RP, and its long-term trend. Profits are the form of appearance of surplus value, which is essential to the concept of capital. Expanding the extraction of surplus value can be achieved via different methods but, over the long term, raising productivity is more feasible than increasing the extensity and intensity of labour. However, as a contradiction of capitalism, rising productivity can lower profitability. The RP is the analytical tool to assess this relation.

The RP is the intersecting point of constant capital, variable capital, and surplus value. Section 3.1 explored the debates on constant capital, including its measurement and inclusion in the RP. There is inconsistency around the use of the stock or flow of advanced capital in the denominator of the RP. Section 3.1.1 reviewed the studies that have used these interpretations. It concluded that the stock measurement leads to the concept of the RP and the flow to profit margin. The section also explored other aspects of constant capital including the depreciation and devaluation of fixed capital, its measure in historical or current costing, and its stock measurement. Based on this discussion, in the empirical chapter, I use the stock of capital in current cost for calculating the RP.

Variable capital was discussed in Section 3.2. The VLP is the key concept related to variable capital and has two main definitions in the literature. One view defines it as the value of the bundle of goods that the working class consumes or purchases by wages. The other view considers the VLP as the share of the working class out of the net product. The relationship between the VLP and wages is complex and at times contradictory. However, as Marx argues,

the laws governing wages reflect those that determine the fluctuations of the VLP. That is why I use wages as the measure of the VLP and variable capital in the empirical chapter.

Section 3.3 started with a summary of variances in the use of the components of the RP. The differences can indeed affect the measurement and trend of the RP and potentially the debates around it. Avoiding the variances and keeping the discussion at a general level, Section 3.3.1 turned to the debate on the long-term trend of the RP and with respect to LTFRP. It offered algebraic presentations of the effects of technological change and the movement of related variables. I argue that the abstract formulation of the law is insufficient to “prove” that the rate necessarily has a downward tendency. The introduction of countertendencies shows that Marx was aware that the dynamic nature of capitalism pre-empts a predetermined absolute law. The assessment of the movement of the RP and the validity of the law cannot be done by theoretical debate alone but requires empirical analysis. Section 3.3.2 presented a review of the empirical research on the trend of the RP of single countries and the world. Despite some similarities, particularly around the trend of the US’s RP, there is no consensus on the trend of the RP. That is why new research, such as the current thesis, is needed to develop our knowledge of the subject.

## Chapter 4: APPLYING THE ANALYTICAL APPROACH

This chapter applies the theoretical concepts of previous chapters to the calculation of the world rate of profit. Because the theoretical foundations of the conventional national accounts and world data sources differ from the Marxian economics, mapping techniques are required to align conventional classifications with the Marxian categories and prepare the data for analysis. Section 4.1 explores three general definitions of the rate of profit (RP) and how they can be applied to national accounts. The first follows Shaikh and Tonak (1994). It identifies productive activities at the level of industries as well as professions, and for that I refer to it as the detailed approach. The necessary details for this approach are only available for a few countries over the long-term. To overcome this limitation, a second approach can be used, which identifies productive activities only at the level of industries and uses operating surpluses as a measure of profit. I refer to this definition, which generally follows Moseley (1991), as the simplified Marxian approach.

At the time of writing, none of the world data sources offers industrial information over periods longer than 30–40 years. To enable a long-term analysis of the WRP, a third approach can be employed. It relies only on aggregate measures such as the value added, wages, and capital stock, and ignores the concept of productive labour. Although it is a deviation from a strictly Marxian rate of profit, it does represent profitability; it makes a wider range of data sources usable for analysis; and because it is used by many other researchers, it provides a means of comparison. A variant of the average approach is also introduced in this chapter, which further simplifies the average method by ignoring depreciation and consequently only using gross operating surplus (GOS). As will be shown, this simplification does not impact the trend of the RP substantially.

Section 4.2 assesses available sources of global economic data. First, the three definitions of the RP are applied to Australia's and the United States' (US) official national accounts. The assumption is that a country's national accounts are the most detailed and reliable sources of its economic data. The US's and Australia's profit rates are then used as benchmarks to assess six data sources: the Penn World Table (PWT), the Extended Penn World Tables (EPWT), Organisation of Economic Cooperation and Development's (OECD) aggregate accounts and

the Structural Analysis (STAN) Database (OECD 2024), World Input–Output Database (WIOD), and the Eora Global Supply Chain Database (Eora). The assessment identifies two sources (PWT and OECD aggregates) for the long-term analysis using the average approach, one source (OECD’s STAN) for the medium term using the simplified Marxian approach, and one source (WIOD) for the detailed analysis. Nevertheless, all sources have been used in the analysis of the world rate of profit and the discussion of its trend and impacting factors, which are covered in the next chapter.

## **4.1. Mapping conventional data to Marxian variables**

The main sources of economic data, which are detailed enough to accommodate comprehensive empirical analysis, are conventional national accounts. Data collection is inherently theory-laden. The theoretical foundation of national accounts differs from those informing Marxian economics, despite being partially inspired by it (Lequiller & Blades 2014: 34, 143). To analyse the Marxian RP, it is, therefore, necessary to map national accounting categories to Marxian variables. Here, as with many other Marxian concepts, there is no single, consented method to do so and the differences in mapping approaches lead to yet another range of the RPs, in addition to what was discussed in Chapter 3.

This section explores three approaches to mapping national accounts to Marxian variables. First, it introduces the detailed approach, which uses national accounting data at the level of industries and occupations to identify productive activities. The second approach, the simplified Marxian, ignores the productive distinction at the level of professions and instead works with operating surpluses of industries. The third approach, the average RP, further simplifies the previous approaches by completely ignoring the productive-unproductive labour distinction. This step is a major compromise to circumvent the reliance of the other approaches on detailed data but enables the analysis of the largest sample of countries over the longest available timeframe.

### **4.1.1. The detailed approach**

The detailed approach to calculate the Marxian RP follows Shaikh and Tonak’s (1994) method of analysing the US’s profit rate. It has been used by others, such as Shaikh (2016), Maniatis

and Passas (2013), and Jeong and Jeong (2020). The key strength of this approach is that it distinguishes between productive and unproductive activities by segmenting industries as well as professions (occupations).

A national economy can be divided into primary, secondary, foreign trade, and noncapitalist sectors. Primary sectors are those that are directly involved in the production and domestic realisation of total commodity products, i.e. production, wholesale and retail trade. Secondary sectors are mainly involved in the recirculation of the value generated in the primary sectors, such as finance, land sale and rental, and general government (1994: 39). The distinguishing feature of noncapitalist production is that its output is either not sold, e.g. households, or is not sold to make profits, e.g. government (Section 2.2).

The primary sectors are production and trade. Production sectors include productive goods, services, and transportation. Trade includes wholesale and retail trade, distributive transportation, and the rental of buildings, equipment, and cars. The output of retail and wholesale, i.e. distribution, is not consumed directly, and is treated as trade margins on the cost of products. Due to the lack of detailed data, I follow Shaikh and Tonak (1994: 41) in assuming all transportation as productive. Secondary sectors' revenue is from recirculation of the money flows generated in the primary sectors and/or the circulation of claims on those flows, including "ground rent, finance charges, fees, royalties, and taxes" (1994: 52). Secondary flows are part of total transactions but not total value or total product (1994: 53).

Total government expenditure that appears in the accounts are wages paid to employees and purchases of goods and services including royalty payments, ground rent, and finance charges. The payments to government by businesses and households are royalties, already counted in the primary sectors, and thus excluded from aggregate output. This decision is consistent with the theoretical discussion in Section 2.2 on the unproductive nature of government work.

Conventional national accounts exclude non-traded activities of households, such as housekeeping activities and childcare. This exclusion aligns with the capitalist-production interpretation of productive labour (Section 2.2.2). The only exception is owner-occupiers' housing services. Imputations are made, which treat these dwellings as if owners rent their own houses. It is noteworthy that in some developing countries the amount of goods (food, clothes, tools, buildings, etc.) that farmers produce for themselves is significant and so the convention is to impute all goods that households provide for themselves. Services are not

imputed, except for owner-occupiers. Services that households provide to others for free are not included but if paid (e.g. babysitting or paid lessons), there are methods to estimate and include them (Lequiller & Blades 2014: 107-108). Nevertheless, based on the discussion on productive labour in Section 2.2, I take the household sector as unproductive and part of the dummy sector.

Following Shaikh and Tonak (1994: 87-88), I assume that the consumption of workers is almost equal to their compensation. To calculate variable capital, I use the compensation of employees (EC) measure, instead of wages or salaries. The reason is that employers contribute to social security, such as superannuation contribution in Australia, and the total expenditure is their cost of labour (Lequiller & Blades 2014: 30, 191; Shaikh & Tonak 1994: 304).

Among various information that conventional national accounts provide, the input–output (IO) table is most useful for the detailed mapping approach. An IO table consists of five other tables: the product supply table, the intermediate use table, the final use table, the production account by industry, and the allocation of income account by industry. Combined together in the form an IO table, they provide a snapshot of an economy’s goods and services accounts (Lequiller & Blades 2014: 318).

Although IO tables often provide total wages in each industry, the wages of profession categories are not always directly provided. To calculate the wages of productive professions (see Table A.1 for Australia and Table A.2 for the US) in production industries (see Table A.3 for Australia and Table A.4 for the US), I assume equal pay among all workers in each industry. I use the number of hours worked in each profession, add up the number of hours for productive workers, divide that to total hours worked in each industry, then multiply that ratio by total wages of the industry to estimate the wages of its productive labour force.

Corporate officers’ salaries are part of capitalists’ income and hence unproductive and should be deducted from the total compensation of employees (Moseley 1991: 173-174; Shaikh & Tonak 1994: 305). By excluding managers, professionals, and administrative workers from the productive category, as presented in Table A.1 and Table A.2, these salaries are removed from the estimate of variable capital.

The general mapping of conventional IO tables to the Marxian categories, following Shaikh and Tonak (1994: 74), is presented in Table 4.1. The notations and subscripts used for the

measures and sectors are presented in Table 4.2 and Table 4.3, respectively. As mentioned before, the superscript D indicates that a variable is based on the detailed method, to distinguish from similar variables in the methods introduced later in this chapter. Below, I only discuss the use side but the mapping can be easily done for the product or revenue side (Shaikh & Tonak 1994: 74-77). Total use and total product, like many other accounting statistics, might not match perfectly because they are compiled differently, i.e. using different questionnaires, people, classifications, or methods. Despite statistical discrepancies, there is general consistency between the measures (Lequiller & Blades 2014: 306-307).

*Table 4.1: Mapping IO tables to Marxian categories*

Sector	Industry	Production	Total Trade	Royalties	Dummy Sectors
Production	Mining Manufacturing Health, Education ...	$M_P$	$M_T$	$M_R$	-
Total Trade	Wholesale trade Retail trade				-
Royalties	Finance Insurance Real Estate (partially)	$R_P$	$R_T$	$R_R$	-
Dummy Sectors	Government Household	-	-	-	-
Value added	Wages (W) Taxes (Tx) Profits (Pr)	$VA_P$	$VA_T$	$VA_R$	$VA_{DY}$
Gross Output		$GO_P$	$GO_T$	$GO_R$	$GO_{DY}$
		TV			

*Table 4.2: Notations*

Measure	Notation
Depreciation	D
Total value	TV
Value added	VA
Gross output	GO
Intermediate inputs	M
Royalties	R
Compensation of Employees	EC
Taxes	Tx
Profit	Pr

Table 4.3: Subscripts and sectors' notations

Sector	Subscript
Production	P
Productive workers in production industries	PPw
Unproductive workers in production industries	PUw
Trade	T
Royalties	R
Dummy	DY
Government	G
Rest of World	ROW

Surplus value (S) equals the value added (VA) minus variable capital (V) or the value of labour-power.

$$S^D = VA^D - V^D \quad \text{Eq. 4.1}$$

$$VA^D = TV^D - M_P - D_p \quad \text{Eq. 4.2}$$

The above definition of VA differs from what Shaikh and Tonak (1994) use in the theoretical discussion. The difference is in the explicit use of depreciation, which they assume is included in intermediate inputs (1994: 45, 78) but is not a common practice in national accounts. In their empirical estimates, they do deduct depreciation from gross value added (1994: 95, 283). Depreciation, or the consumption of fixed capital (CFC) in national accountants terminology, is the decline in the current value of fixed assets during an accounting period due to “physical deterioration, normal obsolescence or normal accidental damage” (Lequiller & Blades 2014: 220). It is calculated by applying depreciation coefficients to the current (market) prices of assets. Depreciation estimates rely on various assumptions, which vary across countries. As a result, net measures, such as net national product (NNP) and net national income (NNI), are less reliable than gross ones (Lequiller & Blades 2014: 21, 221; Shaikh & Tonak 1994: 7).

$$\begin{aligned} VA^D &= TV^D - C^D = GO_P + GO_T - M_P - D_p \quad \text{Eq. 4.3} \\ &= (M_P + R_P + VA_P) + (M_T + R_T + VA_T) - M_P - D_p \\ &= VA_P + VA_T + (R_P + R_T + M_T) - D_p \end{aligned}$$

$VA^D$ , i.e. the Marxian value added, essentially originates from the primary sectors. The other sectors are excluded because, as mentioned before, their revenue is the recirculation of the primary sector's money flows and the claims on those flows. The exclusion of some sectors,

instead of considering the entire economy's value added, renders comparison between countries quite difficult. The main reason is that the definitions of sectors vary across countries. For instance, Germany and Italy include many quasi-corporations, those similar to sole-traders with many non-salaried workers, in their corporate sector. France does not. Because the wages of these employees are included in the operating surplus, profits in the first two countries are inflated compared to France. While theoretically one can make adjustments for non-salaried workers, the task requires the details of the number and the compensation of those workers. Those numbers are not available for some countries. Similarly, the definition of the public sector varies among countries. This is despite the fact that the size of this sector in terms of total value added can be 15–20% of the GDP of an OECD country (Lequiller & Blades 2014: 85-86).

$$V^D = EC_{PPW} \quad \text{Eq. 4.4}$$

This definition of variable capital is also slightly different from what Shaikh and Tonak (1994: 49, 50) present in their formulas but more aligned with their theoretical discussion. Variable capital is the value of labour power of productive labour. Assuming the compensation of employees as the equivalent of the value of labour-power (VLP), variable capital should be equal to the compensation of productive workers in the production sector, not that of all production sector's workers. That is why  $EC_{PPW}$  is a more accurate measure than  $EC_p$ . The difference could also be substantial in terms of surplus value. If we assume that the productive workers were half of the workforce in the production sector and that total employee compensation was half of value added ( $EC_p = 0.5 VA$ ), then the impact on  $S$  due to the inclusion of the wages of unproductive workers in production sectors could be about 50% ( $S = 0.75 VA$  vs  $S = 0.5 VA$ ).

$$S^D = VA^D - V^D = (Pr_p + Pr_T) + (Tx_p + Tx_T) + (R_p + R_T) + (EC_T + M_T) + EC_{PUW} - D_p \quad \text{Eq. 4.5}$$

Eq. 4.5 is slightly different from what Shaikh and Tonak (1994) present. The difference is the addition of  $EC_{PU}$  (wages of unproductive workers in production industries). Now, we have all the mainstream parameters to calculate the detailed RP ( $RP^D$ ). These variables can also be used for the calculation of profit margin (PM).

$$RP^D = S^D / K \quad \text{Eq. 4.6}$$

$$PM^D = S^D / (M_p + D_p + V) \quad \text{Eq. 4.7}$$

The denominator of PM is the flow of capital input, i.e. the material input, the depreciation of productive fixed capital, and variable capital. The equivalent of material input in IO tables is intermediate consumption, whose estimates are not always reliable. Intermediate use includes all goods and services used up within the economic borders over a certain period. It comprises the value of all elements of production other than labour and fixed capital services, including items such as “electricity, the cost of rents, IT services, insurance, legal and accounting services” (Lequiller & Blades 2014: 112). It is equal to the value of purchases minus the change in materials inventories. Final uses are all other goods and services. “Final” implies that those goods and services have not been entirely used up in the period. All spending during a period is intermediate except investment and inventory changes. These two categories are final because they are not consumed within one period (Lequiller & Blades 2014: 131-133).

The magnitude of intermediate consumption depends on the organisation of production and the structures of firms. To explain this issue better, we can consider the example of bread production presented in *Understanding National Accounts* (Lequiller & Blades 2014: 18-26). Let us assume that the process has only two steps: 50 hours of labour turns 100 kg of wheat to 100 kg of flour and then 25 hours labour to make 100 kg of bread. We also assume that the prices of one kilogram of wheat, flour, and bread are \$1, \$2, and \$2.50, respectively and one hour of labour costs \$2.

These two scenarios are summarised in Table 4.4. It shows that the total value added is similar in both cases, i.e. 75 hours of labour equivalent to \$150, but intermediate consumption and total output differ. As the example shows, it is quite likely to have double-counting of intermediate inputs if the same activity is done by two or more firms instead of one. That is why, compared to total output, value-added is a better measure for the analysis and comparison of economic activities. For the same reason, interpreting the changes of the value of intermediate inputs cannot be done unequivocally without further data about the organisation of production and structure of firms. For instance, assuming constant value added, the reduction of intermediate consumption might mean more efficient use of materials or rising number of mergers and the size of conglomerates.

Table 4.4: Impact of production structure on the measurement of intermediate inputs

Parameter	Firm 1	Firm 2	Total		Firm 3	Total
Intermediate inputs / consumption	100 kg of wheat \$100	100 kg of flour \$200	100 kg of wheat + 100 kg of flour \$300		100 kg of wheat \$100	100 kg of wheat \$100
Labour	50 hours \$100	25 hours \$50	75 hours \$150		75 hours \$150	75 hours \$150
Output	100 kg of flour \$200	100 kg of bread \$250	100 kg of flour + 100 kg of bread \$450		100 kg of bread \$250	100 kg of bread \$250
Value added	50 hours \$100	25 hours \$50	75 hours \$150		75 hours \$150	75 hours \$150

In short, the detailed approach has the important strength of identifying Marxian productive labour based on industries and professions. As discussed, some approximation is unavoidable because the theoretical basis of conventional national accounts differs from that of a Marxian analysis of the trend of the RP. Such analysis also requires long-term data, typically longer than 30 years. For such a timeframe, industry- and profession-level data, indispensable to the detailed approach, is only available for a small number of countries. This challenge necessitates compromise on mapping. The next section presents one way to do so.

#### 4.1.2. The simplified Marxian approach

The detailed method relies on detailed data, usually in the form of input–output tables coupled with information on professions, which is not available for many countries over the long-term. To circumvent this limitation, one option is to make the productive/unproductive distinction only at the level of industries and assume that all workers in productive industries are productive. This option is a simplified version of Moseley’s (1991) Marxian RP, and that is why I refer to it as the simplified Marxian approach and present it as RP<sup>SM</sup>.

Surplus value is the difference between newly produced value (NV) and variable capital. As discussed in the previous section, for a Marxian analysis, NV is the new value of production and trade sectors, and V is the compensation of productive workers. The newly produced value equals the gross value-added net of depreciation.

$$S^{SM} = NV - V = NV_{P+T} - EC_P \quad Eq. 4.8$$

$$NV_{P+T} = GVA_{P+T} - D_{P+T} \quad Eq. 4.9$$

$$S^{SM} = GVA_{P+T} - D_{P+T} - EC_P \approx GVA_{P+T} - D_{P+T} - EC_{P+T} \quad Eq. 4.10$$

This equation resembles national accounts' gross operating surplus. GOS is a "profits-like" measure of surplus or deficit generated from the operation of enterprises and ownership of dwellings, before deducting depreciation (consumption of fixed capital), interests, rent, and other property incomes on financial assets and natural resources. For unincorporated enterprises, owned by households, GOS is equivalent to Gross Mixed Income (GMI). For the government sector, it is only equal to the consumption of fixed capital (ABS 2021: 556; BEA 2022c: 2-10; Lequiller & Blades 2014: 209, 511). Net operating surplus (NOS) is equal to GOS net of depreciation. Using these two concepts, Eq. 4.10 becomes

$$S^{SM} \approx GOS_{P+T} - D_{P+T} = NOS_{P+T} \quad Eq. 4.11$$

So, in the simplified Marxian approach, surplus value is almost equal to the net operating surplus of the production and trade sectors. By working only with the aggregate-level information, this definition enables the analysis of a larger number of countries over a longer timeframe.

### 4.1.3. The average approaches

However, the industry-level information is not available in world data sources for many countries before 1990. The final step to facilitate a long-term analysis of the trend of the RP is to ignore the productive concept and calculate the rate at the level of the entire economy. I refer to this method as the average approach. I present the profit measure in this approach by  $Pr^A$ , which can be estimated as the net operating surplus of the entire economy.

$$Pr^A = GVA - EC - D = GOS - D = NOS \quad Eq. 4.12$$

Comparing surplus value in the detailed method and profit in the average method, we get

$$\begin{aligned} S^D - Pr^A &= [(Pr_P + Pr_T) + (Tx_P + Tx_T) + (R_P + R_T) + (EC_T + M_T) - D_p] - \\ &\quad [(Pr_P + Pr_T + Pr_R + Pr_D) - (Tx_P + Tx_T + Tx_R + Tx_D)] \\ &= (R_P + R_T) + (EC_T + M_T) - D_p - (Pr_R + Pr_D) - (Tx_R + Tx_D) \end{aligned} \quad Eq. 4.13$$

This equation shows that the difference between the two estimates of surplus depends on the movement of different parameters in production (royalties), trade (royalties, wages, and intermediate inputs), and royalties and dummy sectors (taxes and profits). In short, the two measures of surplus value and profits are not equal or even equivalent, i.e.  $S^D \neq Pr^A$ . Because of ignoring the productive–unproductive distinction, the advanced capital in this approach ( $K^A$ ) is the total advanced capital in the economy. By contrast, the detailed approach’s advanced capital is only productive. Therefore,  $K^D \neq K^A$  and in short, the average profit rate ( $RP^A$ ) is not equal to  $RP^D$ .

The data on depreciation is not always available, and even if so, it is not entirely reliable. To circumvent this limitation, the average method can be even further simplified. Profits can be defined as total value added in the economy minus total compensation of employees (Mohun 2003: 89). This definition of profits is equivalent to national GDP minus total wages or GOS plus total taxes minus subsidies. Similar to  $RP^A$ , the stock of capital is also taken for the entire economy. Thus, the RP in simplified average approach ( $RP^{SA}$ ) equals

$$RP^{SA} = (GDP - EC) / K = (GOS + Tx) / K \quad \text{Eq. 4.14}$$

There is a close similarity between  $RP^A$  and  $RP^{SA}$ . They only differ on depreciation and so are quite likely to follow a similar trend (as examined in Section 4.2.1). However, they are quite different from the  $RP^D$ . Shaikh and Tonak (1994: 76, 114) refer to such RPs as “naïve” estimates, which cannot present Marxian profitability arguments properly. Moseley acknowledges that the profit rates, such as the average definition, differ from a Marxian RP but argues that they are “more direct” determinants of the rate of accumulation (1991: 42). However, the  $RP^A$  takes a step further and ignores the productive labour distinction. As such, it is only a broad indicator of profitability in the entire economy and potentially more susceptible to Shaikh and Tonak’s criticism. Nevertheless, the average method is quite commonly used in the literature on the Marxian RP, e.g. by Kliman (2012: 75-76), Jeong and Jeong (2020: 271), and particularly the WRP, e.g. Basu et al. (2022) and Li (2020). In this research, I use all these methods. The first two enable the distinction of productive activities, while the average method facilitates a longer-term analysis of profitability trends. Before turning to the analysis of the WRP, it is necessary to first assess the available data sources, which is conducted in the next section.

## 4.2. Assessment of data sources

This section offers the estimates of the profit rates of Australia and the US based on the definitions discussed in the previous section. It uses the official national accounts and labour statistics sources, which offer the most detailed and accurate economic data. The results verify that the definitions and variants have substantial impact on the level of data. However, for these two countries, all definitions (i.e.  $RP^D$ ,  $RP^{SM}$ ,  $RP^A$  and  $RP^{SA}$ ) lead to a similar trend. Assuming official national data sources are the most reliable, the rates calculated in this section are then taken as benchmarks for the rest of the chapter.

In Section 4.2.2, I assess world data sources: the PWT, EPWT, OECD (detailed and aggregate), Eora, and WIOD. The investigation shows that the source of data does impact the magnitude of the RP but not significantly its trend. The WIOD provides the closest estimate to benchmark rates and has enough detail to accommodate all definitions. However, it covers only 15 years, which is insufficient for the analysis of the WRP's long-term trend. The Eora database not only suffers from the same limitation but also lacks the estimates of the stock of fixed capital, and results in profit rates that differ from the benchmarks. The EPWT offers enough data to calculate  $RP^A$  and  $RP^{SA}$ . However, because of the difference between its versions, I also test its underlying data source, PWT. Although there is not enough data provided for the assessment of  $RP^D$ , the length and quality of PWT data is satisfactory. The same applies to OECD data, except that it lacks long-term depreciation detail. Based on these assessments, the WIOD, PWT, and the OECD databases will be used to calculate different versions of the WRP in the next chapter.

### 4.2.1. Benchmarks: Australia's and the US's rates of profit

For the analysis of Australia's profitability, I rely on the Australian Bureau of Statistics' (ABS) data. The information on industry intermediate inputs, value added, and outputs are from the national accounts' IO tables on the use-side (ABS 2023a). ABS national accounts are published with titles as N – N+1, e.g. 2022–2023, because Australian financial years are from July to June. In the following, the years of datapoints are the ending years, i.e. N+1.

The available data online are from 1990. Since then, the definition and number of industries in IO tables have changed several times. In 1990, they included only 28 industries. By 2021,

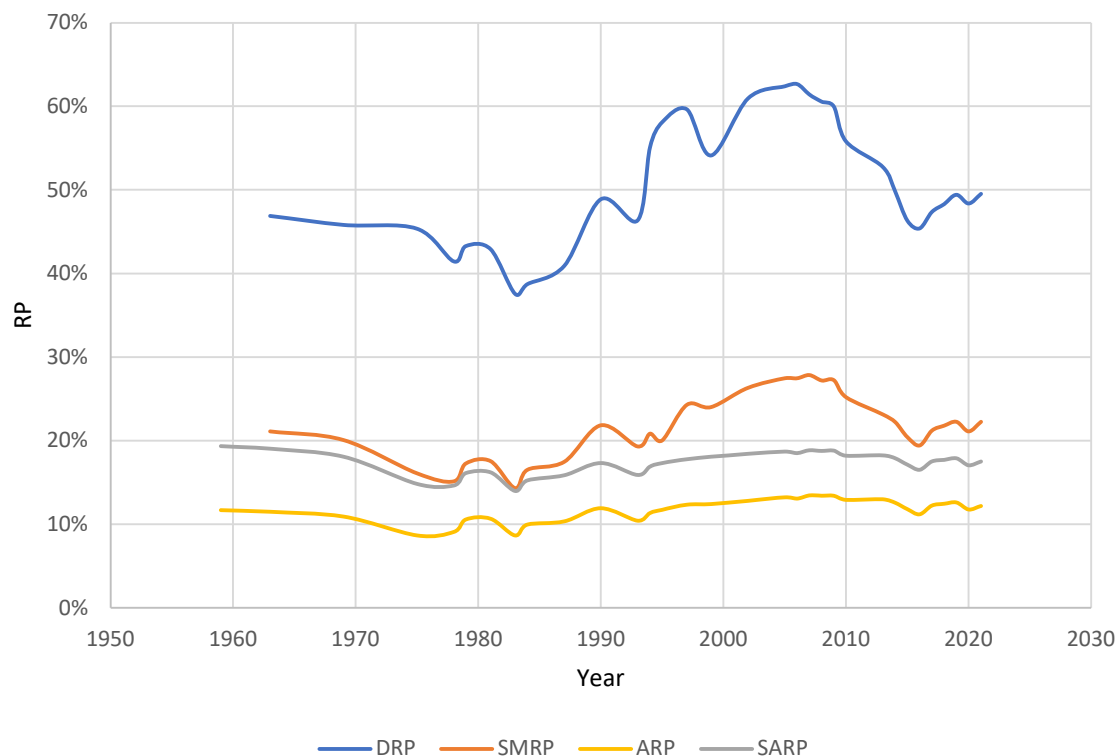
that number increased to 117 industries and 70 industry groups. The changes have implications in terms of mapping to Marxian categories. For instance, from 2007, the ABS has included rental and hiring services, which was previously part of the finance, insurance, and real estate (FIRE) industries. Shaikh and Tonak (1994: 51, 249) divide real estate into trade (building rent) and royalties (ground rent). However, to retain consistency over the time period, I take all FIRE industries as royalty. Similarly, I assume sports and recreation as royalties because before 2007 it was bundled with gambling. In more recent tables, the ABS added categories of services to production industries, e.g. services to mining. I included those services as part of the production industries. The detail of Australian industries distinguished into Marxian productive and unproductive are presented in Table A.1 and Table A.2.

Variable capital is the employee compensation for productive labour, the definition of which is discussed in Section 2.2. First, I use the “compensation of employees” line in IO tables to get the EC in production industries. This value includes the EC of the economy’s productive workers but also a portion of unproductive labour. To calculate the EC of only productive workers, the EC of production industries should be multiplied by the ratio of productive workers in those industries. The data for this part is provided in the ABS’s quarterly detailed labour force data (ABS 2023b), which offers the number of workers and hours worked in professions in different industries. For the ratio of productive workers, I divided the total hours worked by workers in productive professions in productive industries and divide it by the total number of hours worked in those industries. I use hours of work instead of number of workers because it does not depend on the full-time or part-time form of work. The productive/unproductive categorisation of occupations is presented in Table A.1.

The source of the data on fixed capital stock and depreciation is Capital Stock, by Industry (Table 580) of the Australian System of National Accounts (ABS 2023a). I use the current price measures of consumption of fixed capital (depreciation) and the net stock of capital. I calculate the RP using all four variants that were introduced in the previous section. In the graphs that follow, I present the detailed RP as DRP, the simplified Marxian as SMRP, the average RP as ARP, and the simplified average RP as SARP.

Figure 4.1 compares Australia’s profit rates based on the four definitions. The detailed definition uses the smallest denominator, because it only uses productive advanced capital. It also has the largest numerator because it only deducts the EC of productive workers instead

of the entire workforce. That is why, as expected, the  $RP^D$  is the largest rate. The  $RP^A$  is smaller than the  $RP^{SA}$  because it uses the NOS instead of GOS in the numerator, i.e. deducts depreciation from the numerator of the RP. The  $RP^{SM}$  is like the  $RP^D$  in terms of the trend, because it distinguishes productive labour. However, its magnitude is closer to the  $RP^A$  and  $RP^{SA}$  because it uses operating surpluses of the production and trade industries. For comparison, Figure 4.2 presents different estimates of profit margins. As expected, profit margins are quite different from their profit rate counterparts in terms of both trends and magnitude. Figure 4.3 compares the trends of all profit rates by normalising them on their 1963 levels, i.e. the value of all RP datapoints are divided by the value of the corresponding RP in 1963. As the figure shows, the general trends of the profit rates are quite similar. The similarity is more pronounced between the  $RP^{SM}$  and  $RP^D$  and between the  $RP^A$  and  $RP^{SA}$ . This division highlights the impact of productive labour distinction on the trend of the RP. However, the trend differences are not substantial. Hence, the rates can act as each other's proxies in terms of trend. The following analysis of the US's RPs reinforces this assumption.



*Figure 4.1: Australia's profit rates*

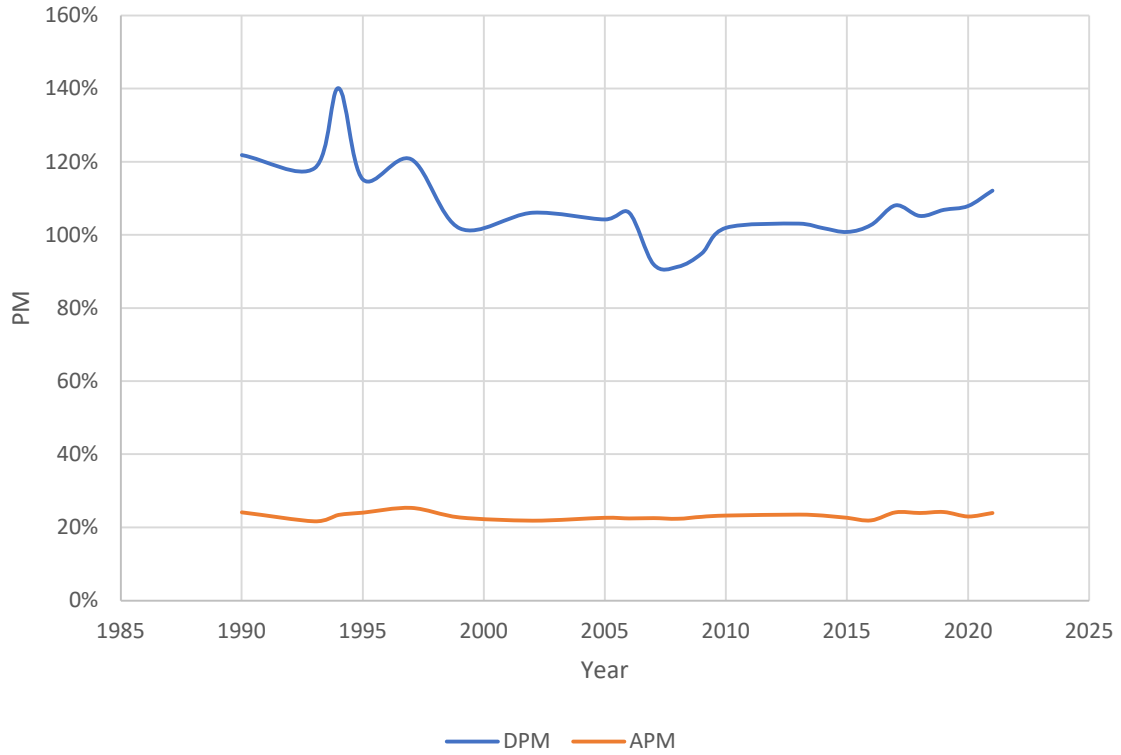


Figure 4.2: Australia's profit margins

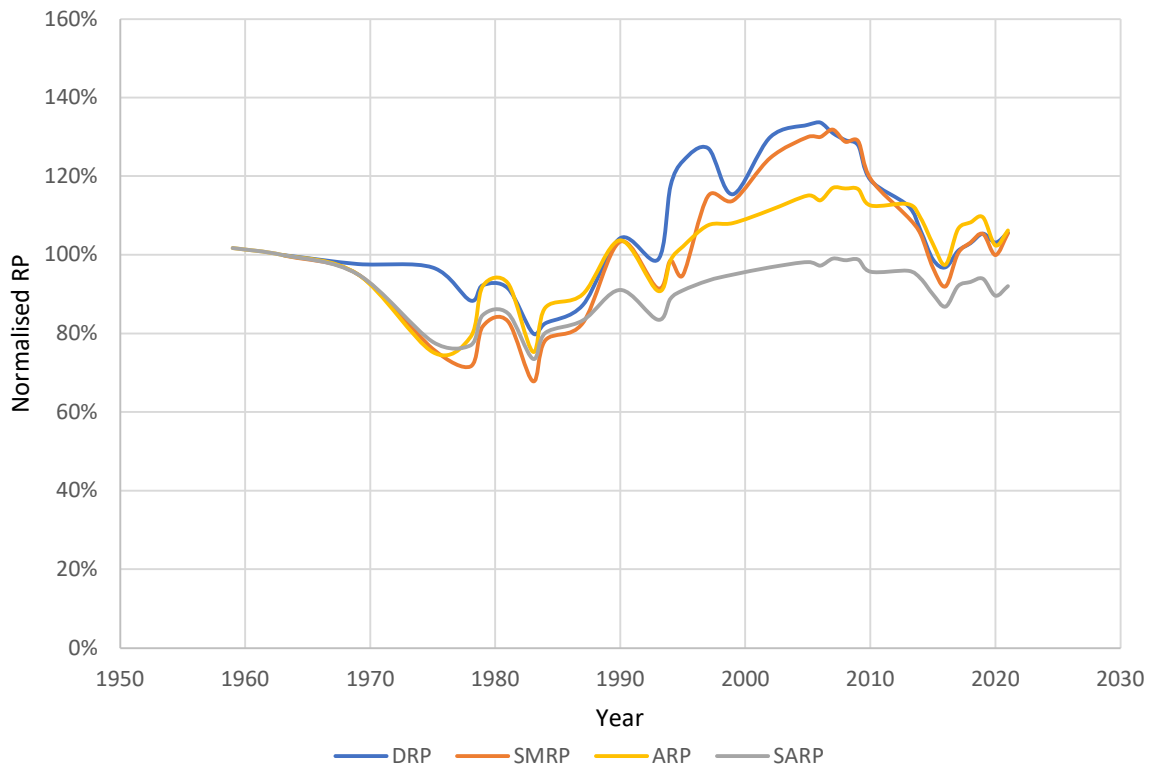


Figure 4.3: The trends of Australia's profit rates (normalised on 1963 levels)

To calculate the US's RP, I follow a similar procedure as for Australia's rate. I use the Bureau of Economic Analysis's (BEA) use-side IO tables from 1947 to 2021 (BEA 2022b). Like the ABS's, the number and definition of industries in these tables have changed over the years. However, the general mapping to the Marxian categories is presented in Table A.4. The source of the data on fixed capital is NIPA's *Fixed Assets Accounts Tables* (BEA 2022a).

The calculation of variable capital requires distinguishing productive workers in different industries. To do so, I use employment by industry and occupation data provided by the Bureau of Labor Statistics' (BLS) CPS17 tables (BLS 2023). The BEA and BLS naming conventions are slightly different, but still close enough to enable mapping. For instance, I equated the BEA's "Arts, entertainment, recreation, accommodation, and food services" and "Government" to the BLS "Leisure and hospitality" and "Public Administration", respectively. Using the employment-occupation data (CPS17), I calculate the proportion of workers in productive occupations (see Table A.2) in productive industries (see Table A.4).

Then, I multiply the ratios by the total compensation of employees, NIPA Table 6.2D (BEA 2022b), in the respective industries and use the total as the EC of productive workers. This number is the variable capital of the economy. The main issue here is that the details of workers by occupation and industry go back only to 1997, and the classification of occupations has also changed since 2003. That is why I calculate one RP based on workers in productive occupations and industries for 2003 to 2021 and base the other rates on all workers in productive industries.

Figure 4.4 compares two estimates of the  $RP^D$ s. One  $RP^D$  is based on the narrowest measure of productive workers, i.e. working in productive industries and occupations, and is identified as "Narrow Definition" in the figure. The other rate uses the broad measure, i.e. working in productive industries irrespective of occupation. As expected, the level of the RP is higher for the narrow estimate because the deduction from value added is smaller and so the numerator is larger. However, the trends of both rates are almost identical, as shown in Figure 4.5, in which both rates are normalised to their 2003 levels.

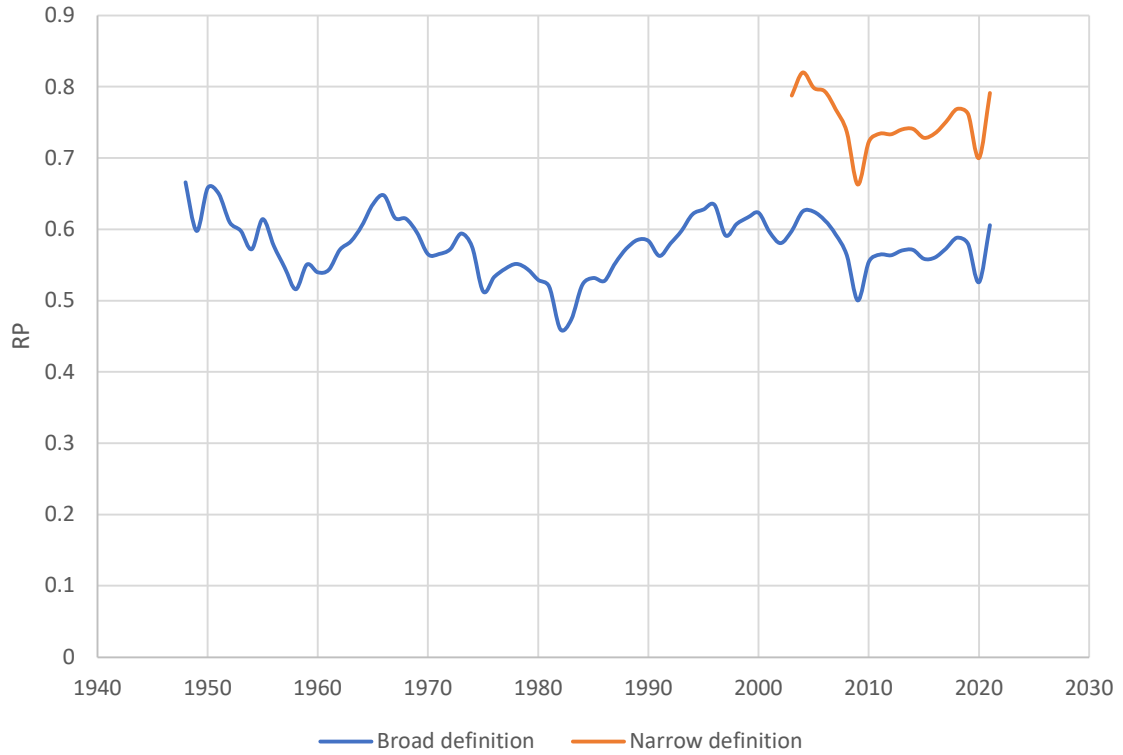


Figure 4.4: The US's  $RP^D$ s using the narrow and broad definitions of productive workers

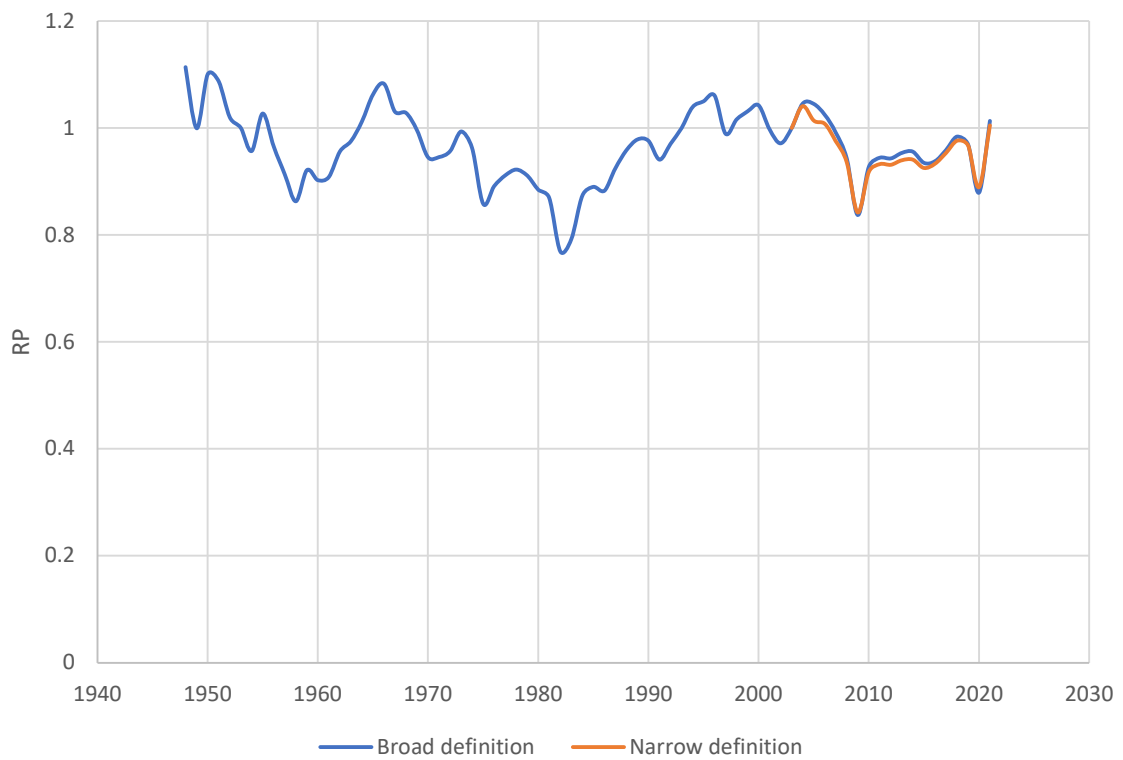
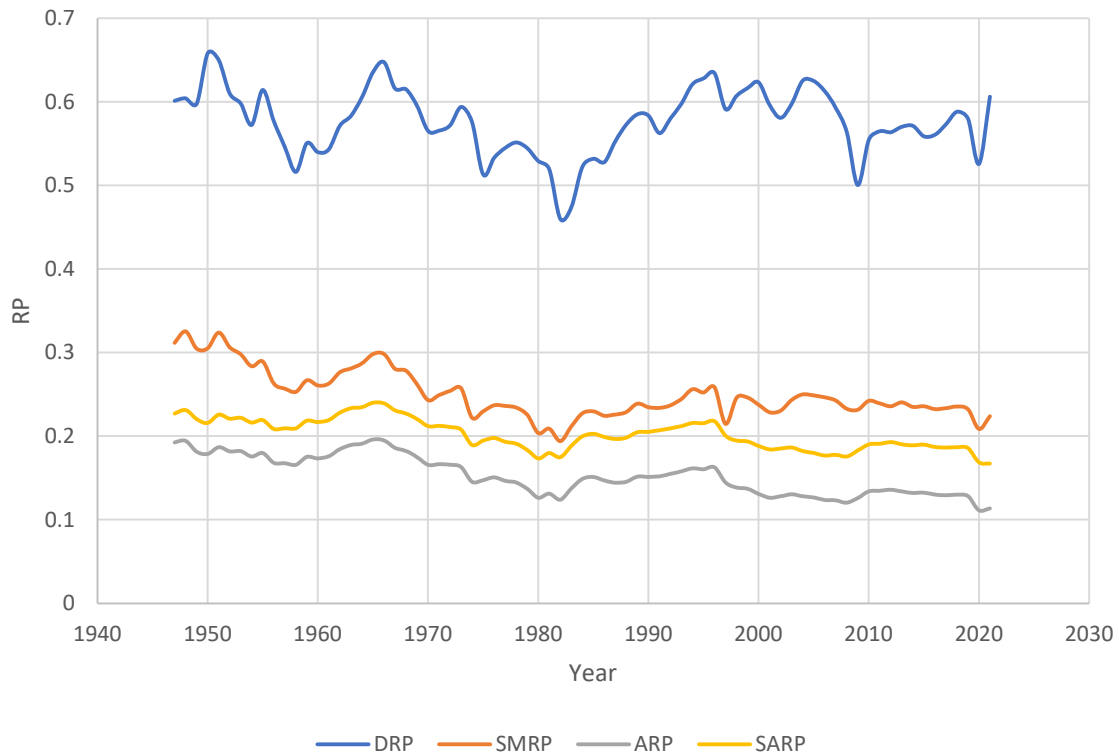


Figure 4.5: The US's narrow and broad  $RP^D$ s (normalised on 2003 levels)

The calculation of the  $RP^A$  requires the estimates of GOS, taxes, and depreciation. IO tables available online record taxes only from 1997, which means elements of value added, such as GOS, are not explicitly provided. For 1947 to 1996, I assume the tax estimates are included in total value added. With that assumption, VA minus EC is equal to GOS plus taxes, which can be used for calculating the  $RP^A$  and the  $RP^{SA}$ . It is worth noting that the impact of taxes varies over the years. During the years in which details are available, the impact of taxes on the RP varies between 2% (2020) to 9% (2008).

The four versions of the RP are presented in Figure 4.6 and the profit margin estimates are in Figure 4.7. To isolate the trends, profit rates are normalised to their 1947 levels and presented in Figure 4.8. Like Australia, the RP and PM show different magnitudes and trends because their denominators are entirely different.



*Figure 4.6: The US's rates of profit*

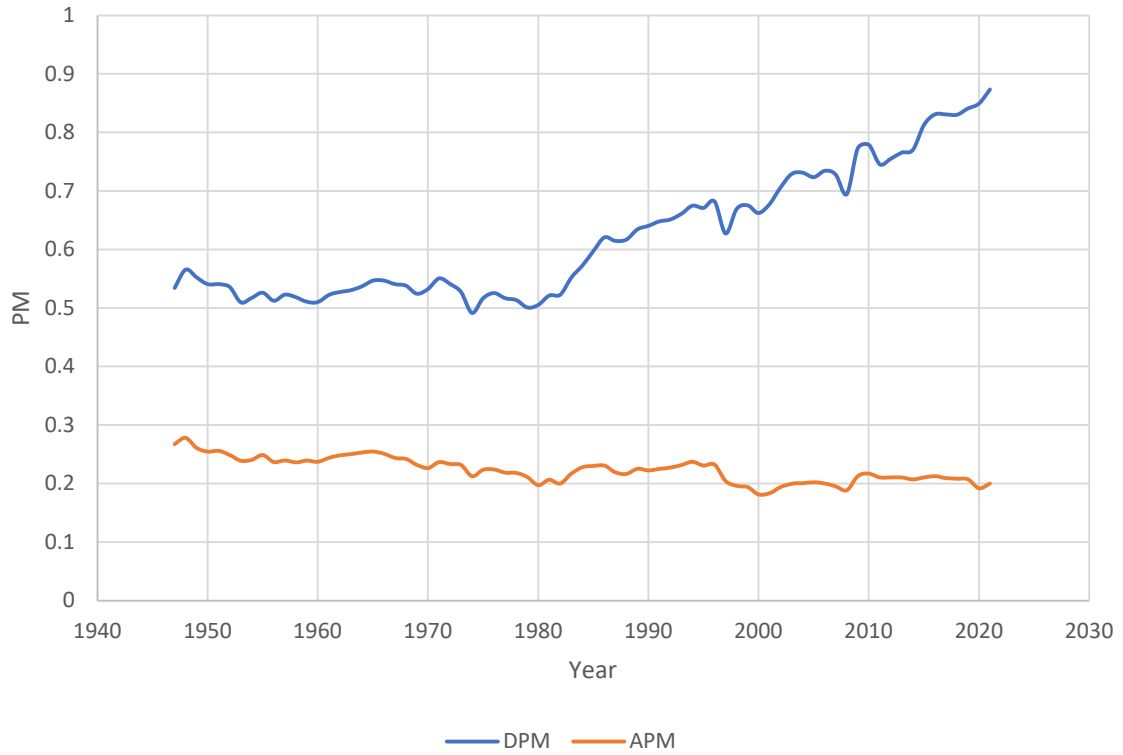


Figure 4.7: The US's profit margins

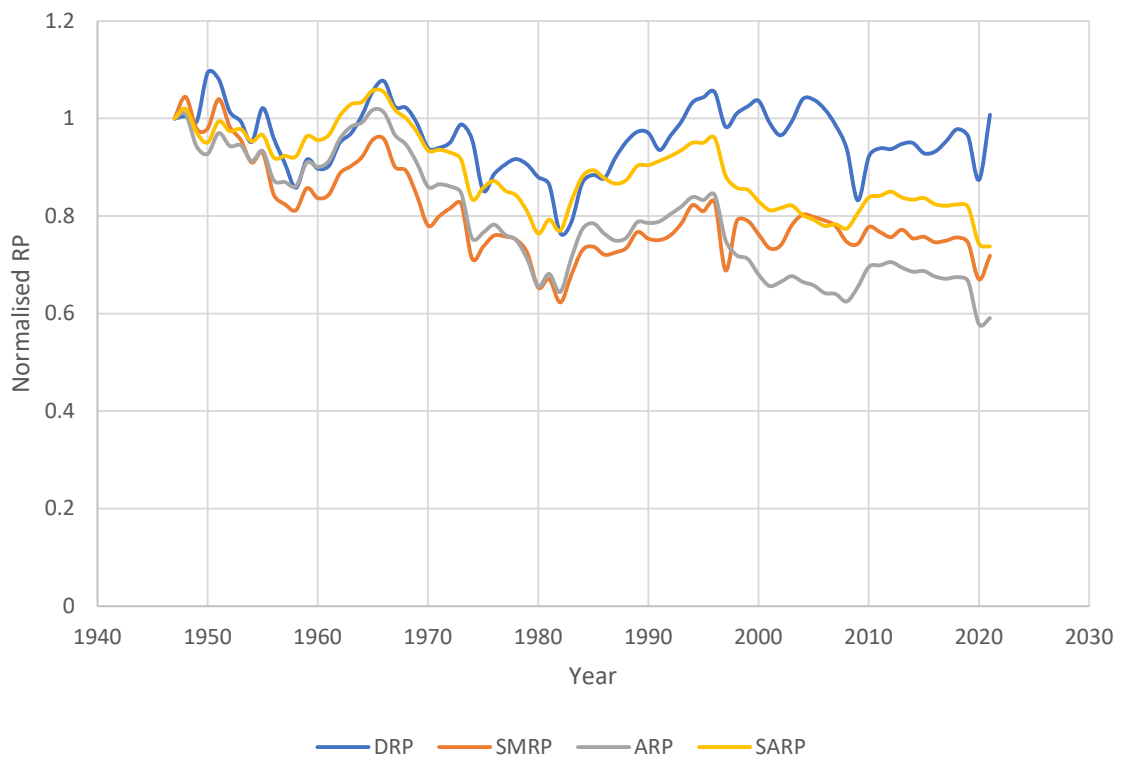
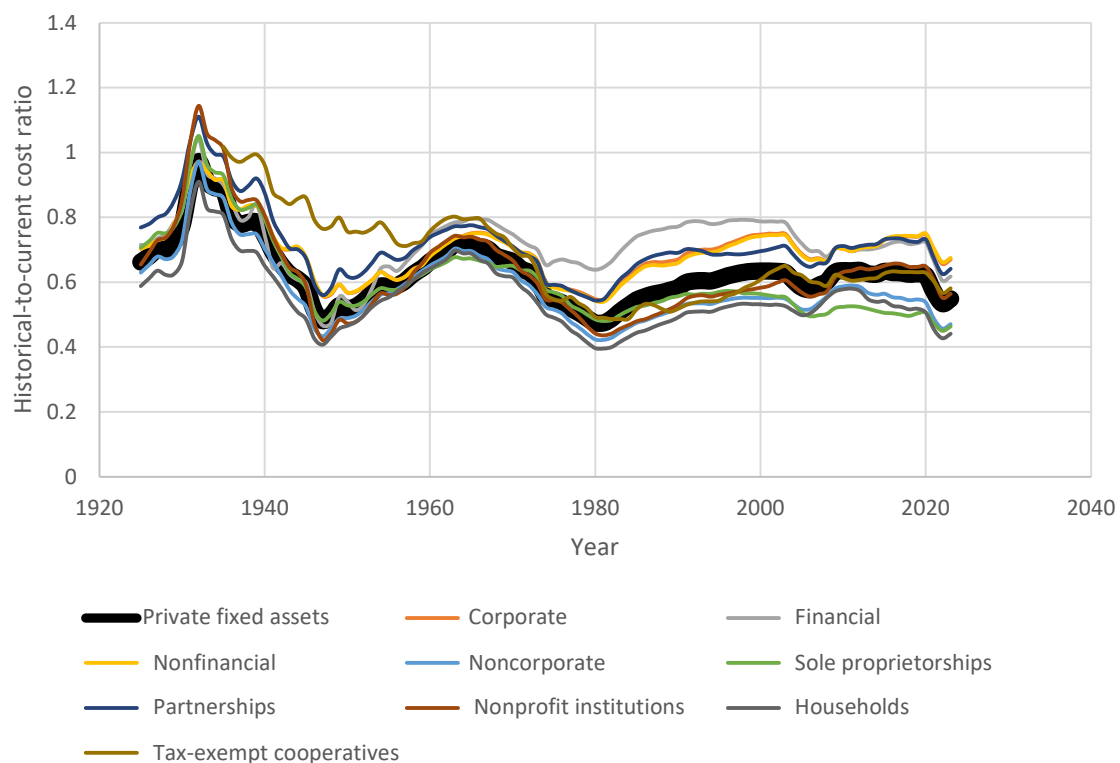


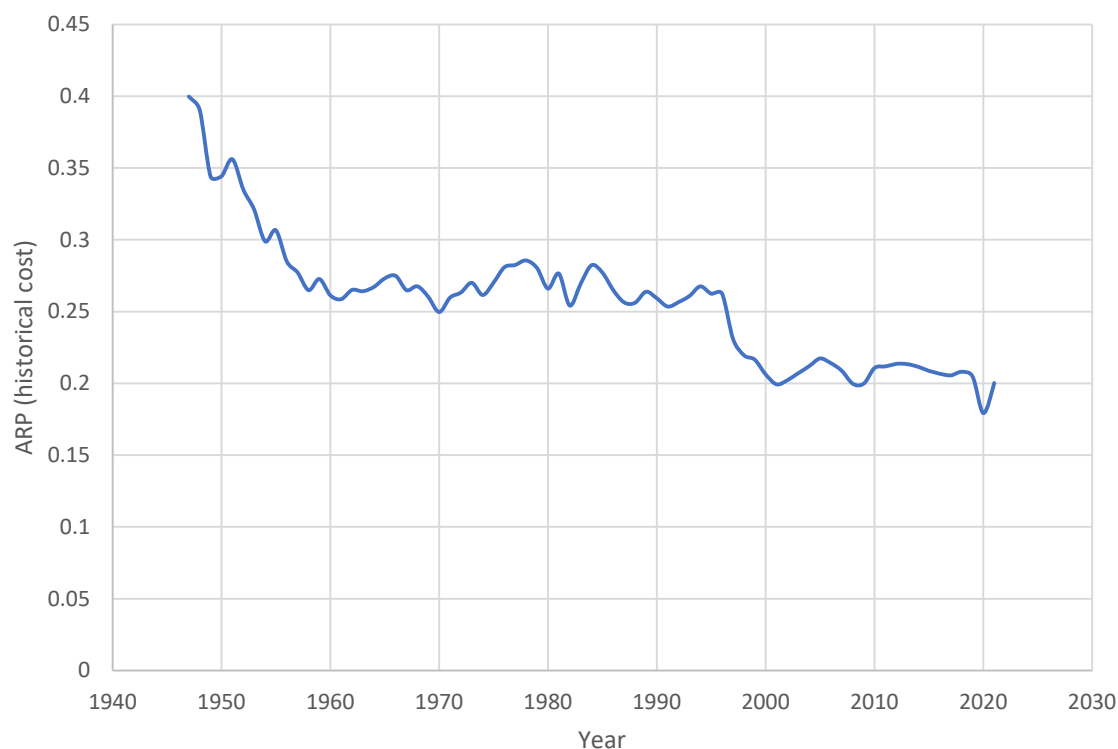
Figure 4.8: The trends of the US's profit rates (normalised on 1947 levels)

The profit rates calculated so far use the current cost method. The US also offers historical cost estimates of capital stock. Figure 4.9 presents the ratio of historical to current cost estimates of different categories of capital stock. There is a general agreement in trends between these categories. The ratio for the private fixed assets rises till 1932, drops till 1947, recovers till 1964, falls again till 1981, slightly recovers to the early 2000s, demonstrates a small dip during the 2007-9 financial crisis, but overall remains almost constant during the two decades, and shows a sudden but notable drop during the Covid-19 pandemic.



*Figure 4.9: Historical-to-current cost ratio of different US capital stock*

The trend of the historical to current cost ratio of private fixed assets has similarities with the trend of the RP. Both show a peak in the mid-1960 and a trough in the early 1980s. By dividing current cost RP to the historical-to-current ratio, we obtain the historical cost RP. This rate has a more pronounced downward trend compared to the current cost RP. After a sharp fall from 1947, it remains almost constant between 1960 and the mid-1990s. It then falls until 2000, remains almost constant over the following two decades, and shows dip over the Covid-19 pandemic. The general trend presented here resembles the findings by Kliman (2012: 83) and Basu and Vasudevan (2013: 68, 71, 75).



*Figure 4.10 - The US average rate of profit (historical-cost stock)*

To sum up, this section presented different RPs of Australia and the US using the official national accounts. The results show that the three variants of RPs have close similarities in trend, despite the  $RP^D$  having a higher magnitude. Profit margins have different magnitudes and  $PM^D$  also has a different trend. The rates calculated in this section will be used as benchmarks for the assessment of world data sources in the next section.

#### **4.2.2. Assessment of the sources of world data**

In this section, I assess different sources of world economic data. I use as benchmark the official national accounts' data, presuming that they are more reliable than, and are likely to be the underlying source of, other databases. As is discussed, most sources lack detailed information and only provide aggregate variables. In other words, they can only accommodate the calculation of the  $RP^A$  and the  $RP^{SA}$ .

##### **Extended Penn World Table (EPWT)**

The EPWT dataset includes data on some key economic metrics, such as GDP, the labour share, and capital stock, on a large number of countries. Here, I test two versions of this dataset,

version 4 (Marquetti 2012) and version 7 (Marquetti, Miebach & Morrone 2021). Both versions only include aggregate measures for the entire economy and do not offer industry-level detail. That is why the  $RP^A$  and the  $RP^{SA}$  are the only rates that can be applied to this dataset. Both versions already have columns for RPs. The version 4's RP is the  $RP^{SA}$  because it is defined as  $[(1 - \text{wage share}) \times \text{output-capital ratio}]$ . Version 7 offers three RPs, based on how variables are priced: current national, constant 2017 national, and constant 2017 purchasing power parity (PPP) prices. All three align with the  $RP^A$ , defined as  $[(1 - \text{wage share}) \times \text{output-capital ratio}] - \text{depreciation}$ .

Figure 4.11 and Figure 4.12 compare the current national prices RPs by EPWT v7, the  $RP^A$  calculated using EPWT v4, and the benchmark Australia and US rates, respectively. For EPWT v4, the  $RP^A$  is calculated by subtracting depreciation rate from the provided  $RP^{SA}$ . All profit rates are normalised to their 2005 levels because that is the year all sources have in common.

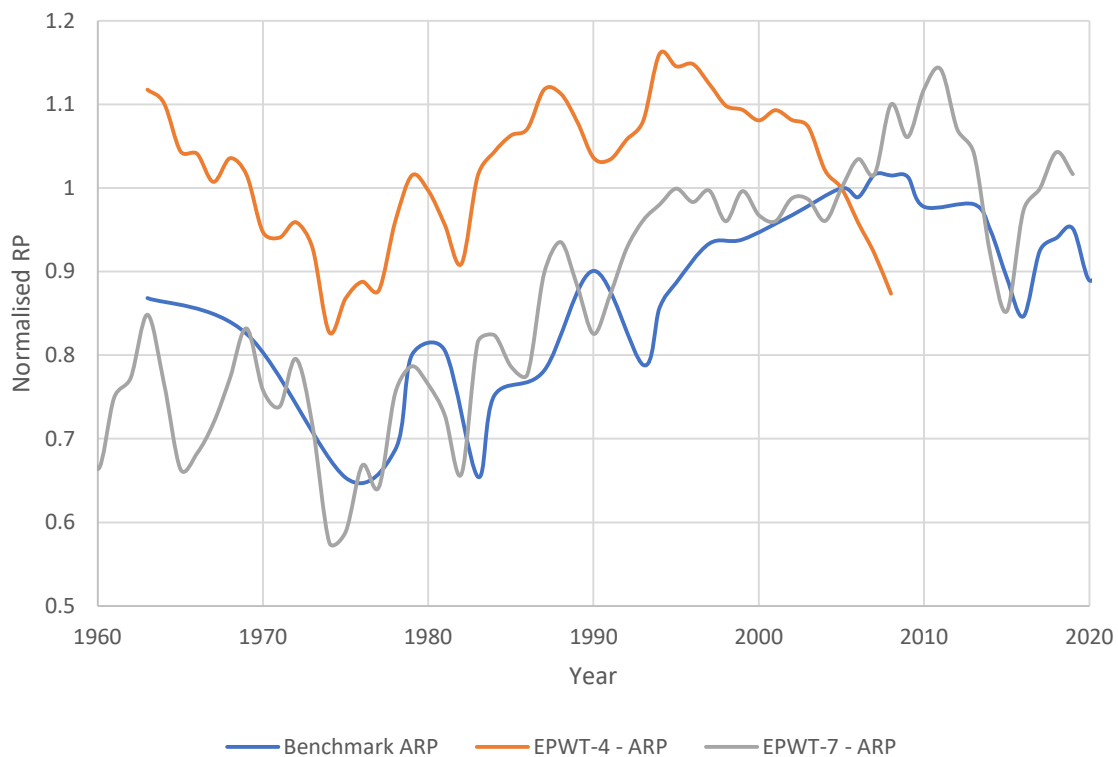
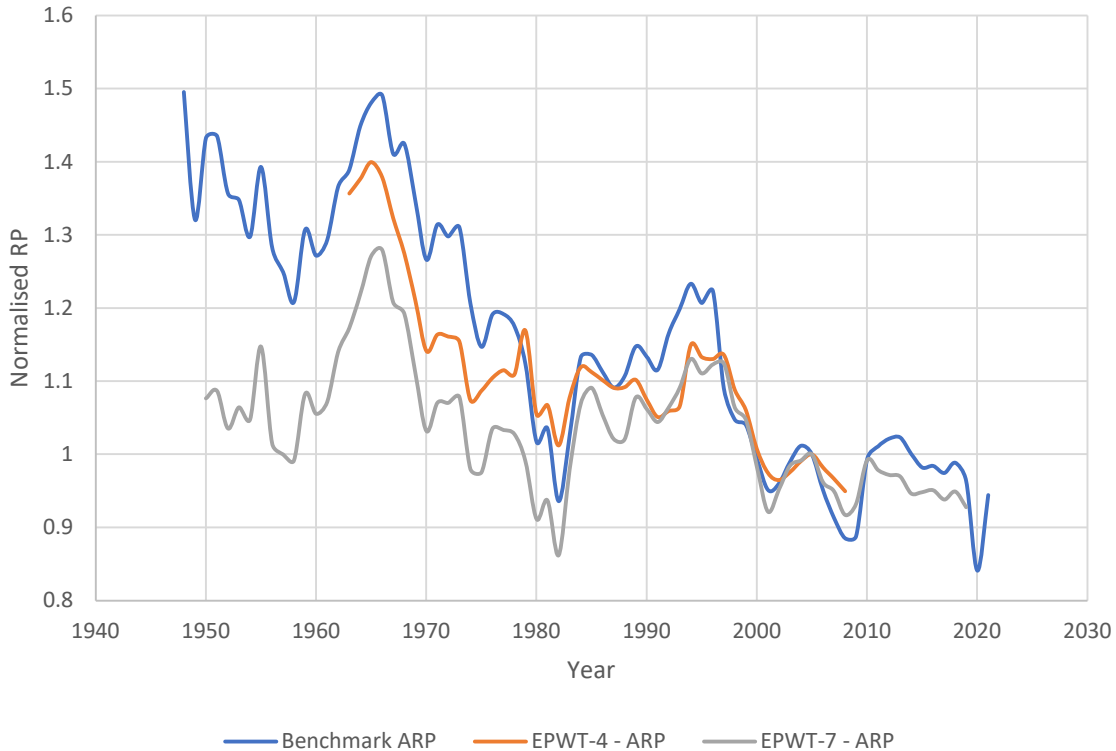


Figure 4.11: Assessment of Extended PWT – Australia (normalised on 2005 levels)

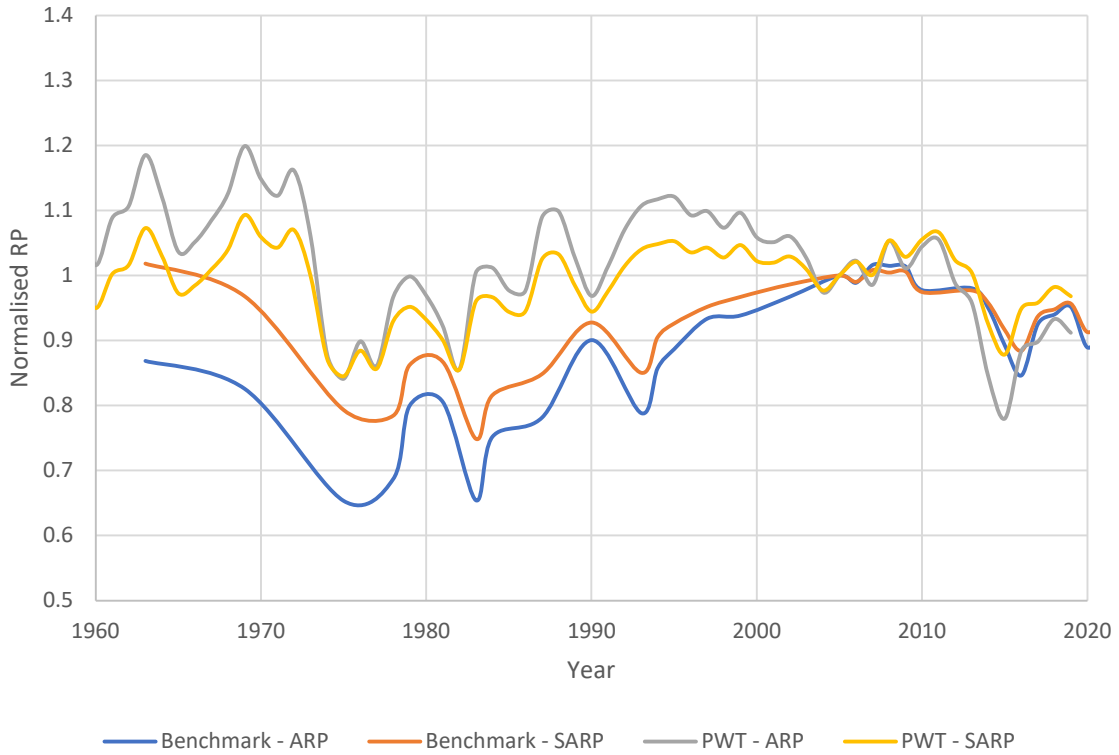


*Figure 4.12: Assessment of Extended PWT – the US (normalised on 2005 levels)*

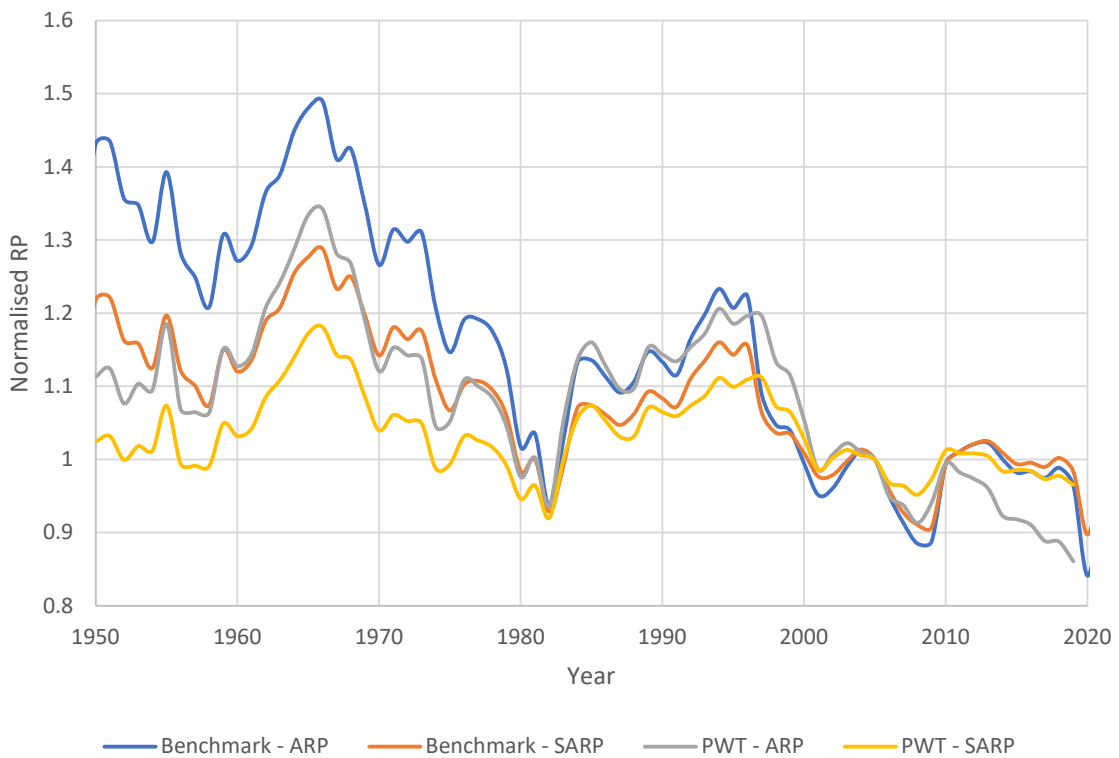
All rates show close resemblance when applied to the US data. However, EPWT v4 shows a different trend when applied to Australia. Although it has a similar trend to EPWT v7 up to 1995, it has a different level overall and a different trend after 1995. This result rules out the use of EPWT v4 as the source of data. Moreover, the difference between the two versions of the same database highlights the need for further investigation. That is why I also assess the underlying source for EPWT.

### **Penn World Table (PWT)**

Penn World Table (PWT) is the main source of EPWT, whose version 10.01 offers aggregate economic data on 183 countries, from 1950 to 2019 (Feenstra, Inklaar & Timmer 2015). The indicators are often in USD, but exchange rates and price indexes are provided that help transform data to current prices. In Figure 4.13 and Figure 4.14, I use current prices in local currencies to compare benchmarks  $RP^A$ s and  $RP^{SA}$ s with PWT rates. Overall, the PWT rates are quite close to the benchmark rates in terms of trends and that is why I use this source for analysing the WRP (Chapter 5).



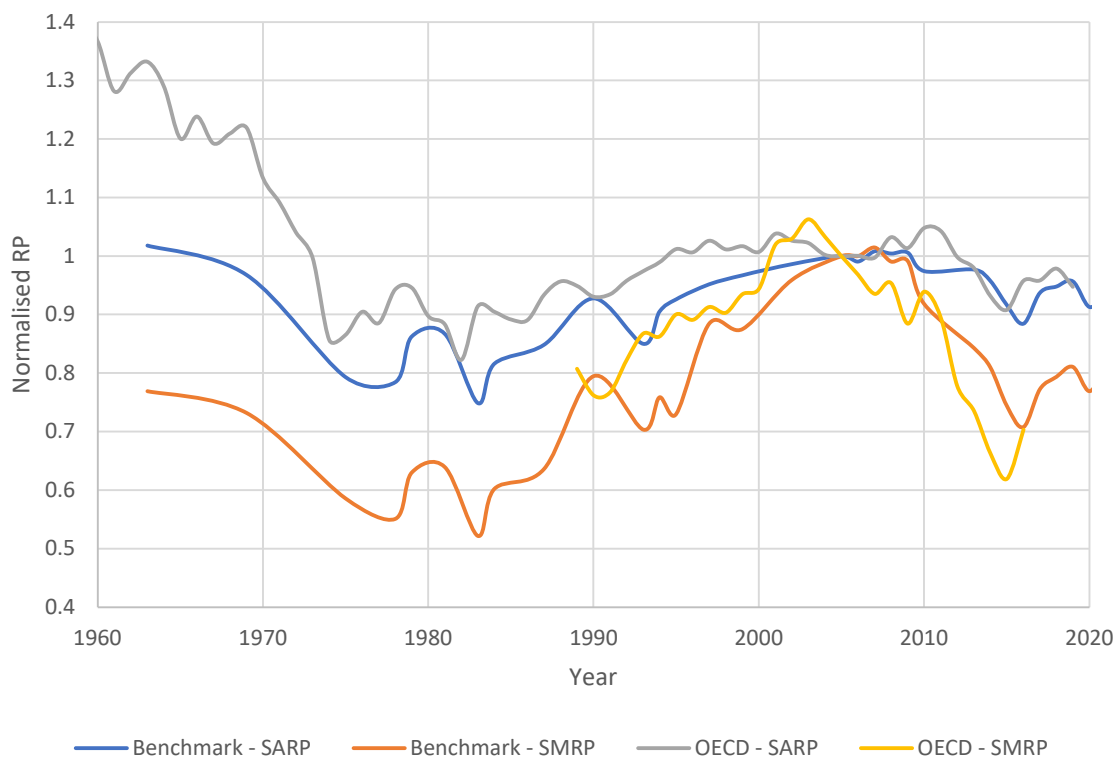
*Figure 4.13: Assessment of PWT – Australia (normalised on 2005 levels)*



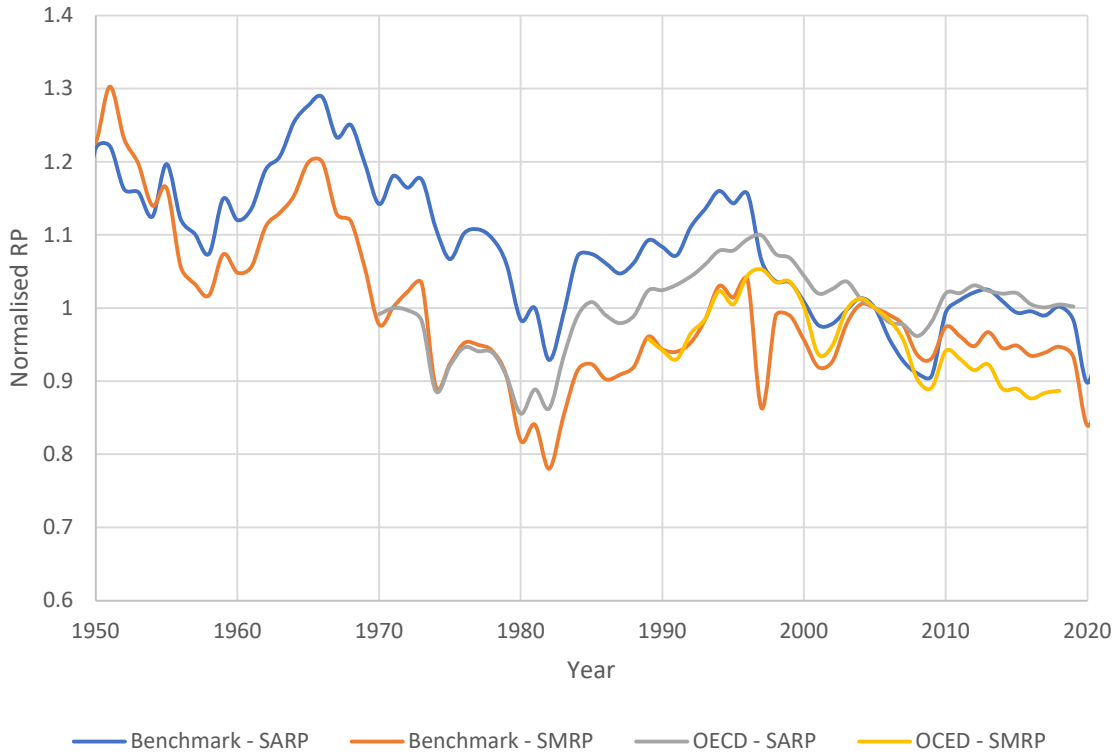
*Figure 4.14: Assessment of PWT – the US (normalised on 2005 levels)*

## The Organisation for Economic Co-operation and Development (OECD)

The OECD System of National Accounts (SNA) (OECD 2023) offers data on its members but also other selected countries. The availability of data varies across indicators and countries. For instance, the aggregate data on the Australian economy dates to 1959 but on the US to 1970. Its data at the industrial aggregate level is more limited in terms of the covered years and countries. It does offer input–output data, but the coverage is quite sporadic and short-term. That is why I only calculate the  $RP^{SM}$  and  $RP^{SA}$  using OECD data. The trends of the RPs using the OECD database are compared with the benchmarks in Figure 4.15 (Australia) and Figure 4.16 (the US), by normalising rates to their 2005 levels.



*Figure 4.15: Assessment of OECD – Australia (normalised on 2005 levels)*



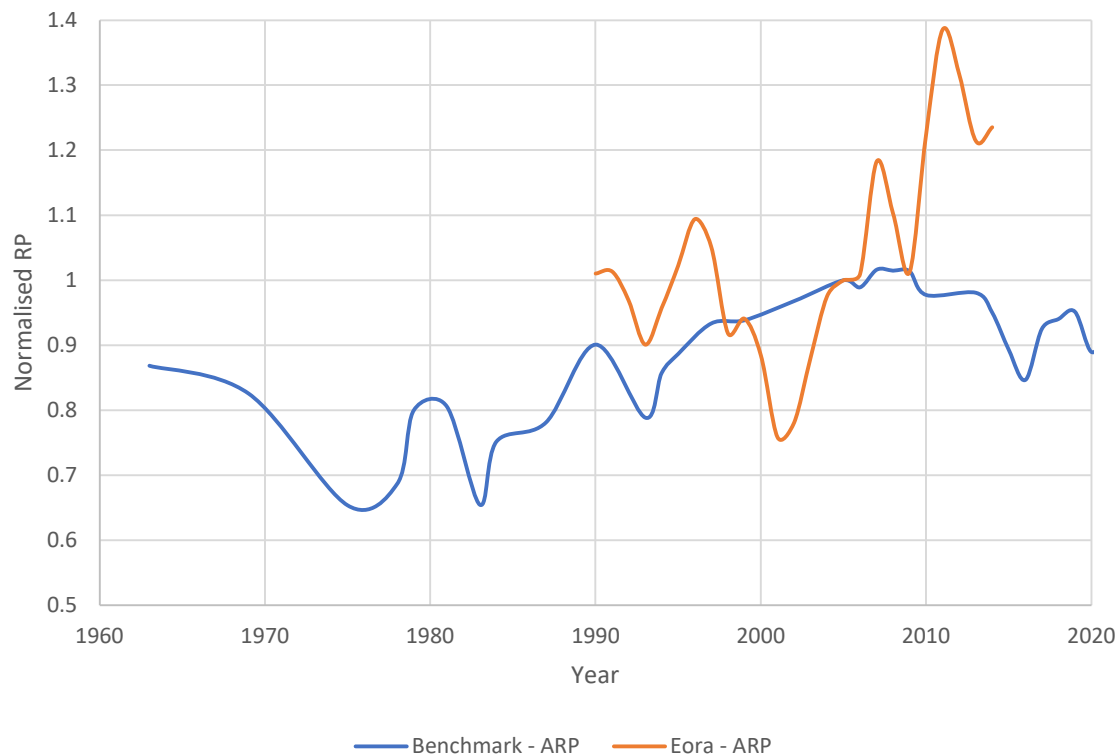
*Figure 4.16: Assessment of OECD – the US (normalised on 2005 levels)*

Overall, as the figures show, the trends of the RPs calculated using the OECD are quite close to those using the ABS and the BEA sources. This result makes the OECD a good candidate for the source of world data. The main limitation of this source is the low number of covered countries and years compared to sources such as the PWT and EPWT. Nevertheless, I use this source to calculate the simplified Marxian and the simplified average versions of the WRP (Chapter 5) to control for the effects of the source of data and definition of the RP on the results.

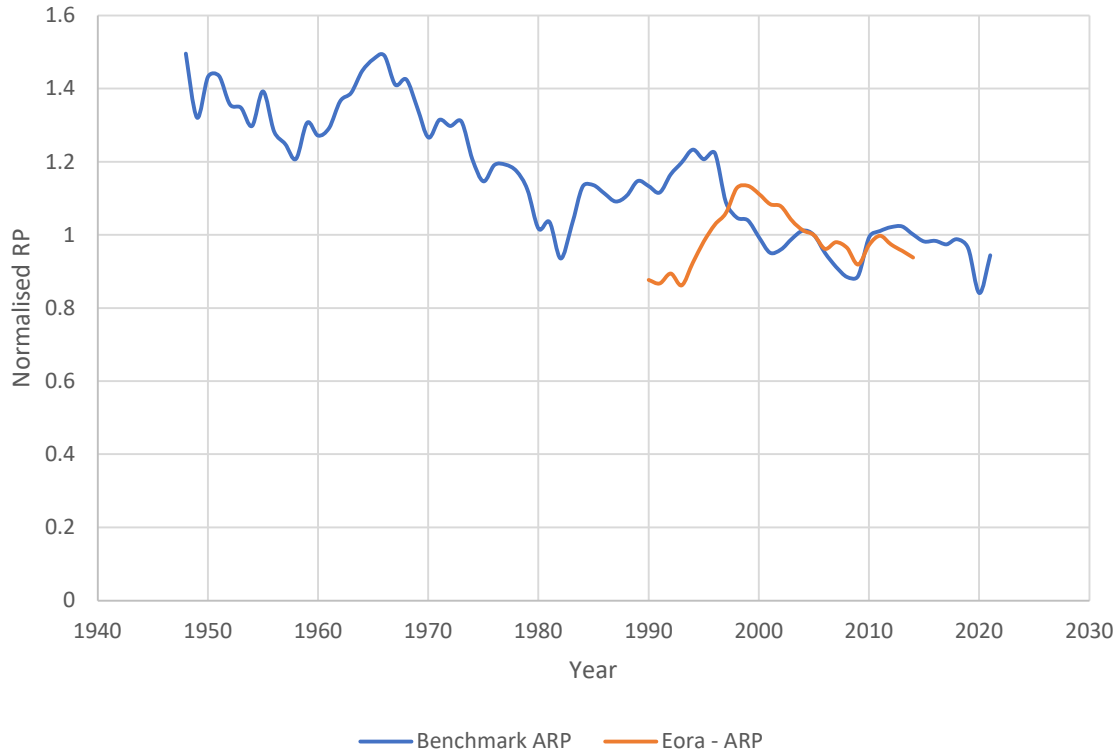
### **The Eora Global Supply Chain Database**

The Eora Global Supply Chain Database offers a multi-region input–output table (MRIO) including 190 countries from 1990 to 2022, with the years till 2015 being publicly accessible (Eora 2024; Lenzen et al. 2012; Lenzen et al. 2013). It has industrial details as well as fixed capital formation and gross fixed capital consumption. However, it lacks the stock of fixed capital. To test the data, I calculated value added and wages based on Eora data and used the ABS and the BEA databases for the stock of fixed capital.

The trends of Eora RPs are compared with those of Australia and the US in Figure 4.17 and Figure 4.18, respectively. The rates are normalised on their 2005 levels. The US rates show some similarity in trend, but Australia rates are entirely different. This result questions the suitability of the source for the current analysis. Moreover, the covered period is rather short, and the calculation of the RP should rely on other sources of capital stock data. For these reasons, I do not use this source for the analysis of the trend of the WRP.



*Figure 4.17: Assessment of Eora – Australia (normalised on 2005 levels)*



*Figure 4.18: Assessment of Eora – the US (normalised on 2005 levels)*

### **The World Input–Output Database**

The WIOD (Timmer et al. 2015) offers industry-level IO data on 43 countries from 2000 to 2014. Compared to Eora, it has the advantage of offering data on the stock of fixed capital. The results of comparing  $RP^D$ s show that the WIOD rates align closely with both benchmark rates (see Figure 4.19 and Figure 4.20). Being able to accommodate the detailed approach and showing close alignment with the benchmark databases give this source a unique advantage over all the others. Unfortunately, the time coverage is too short for the analysis of the long-term trend of the WRP. Therefore, this source is also excluded from the WRP analysis.

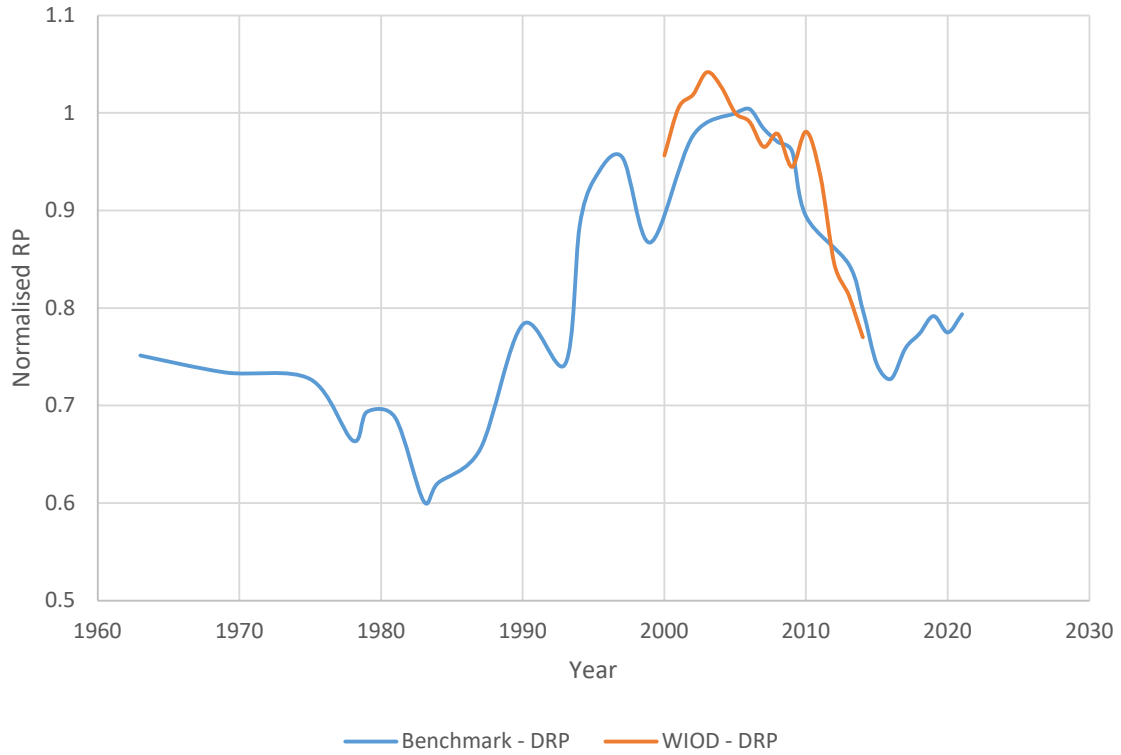


Figure 4.19: Assessment of the WIOD – Australia (normalised on 2005 levels)

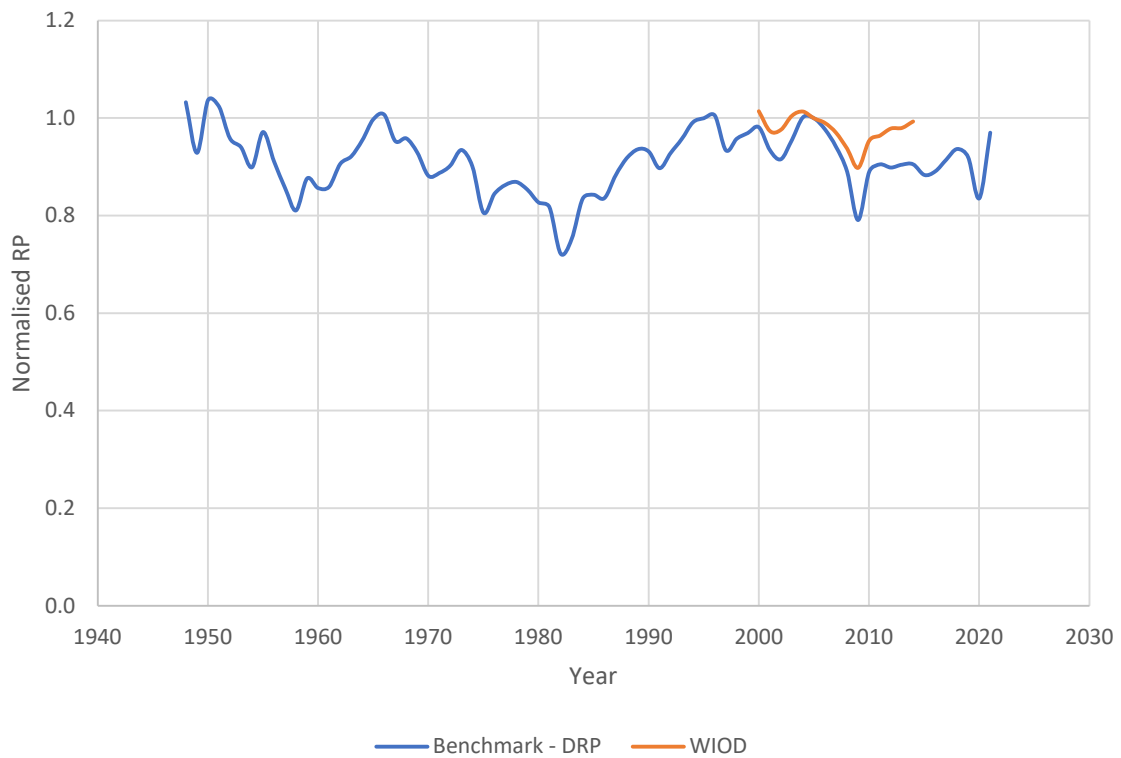


Figure 4.20: Assessment of the WIOD – the US (normalised on 2005 levels)

### 4.3. Conclusion

This chapter outlined three broad definitions of the RP and illustrated the techniques to map them to conventional national accounts. The detailed definition distinguishes productive and unproductive activities to the level of professions and industries. This approach is the closest to an ideal Marxian rate. However, the level of detail it requires is not available for many countries over the long-term. The other two definitions, the simplified Marxian and the average, can address this limitation because they require data only at more aggregate levels, i.e. industries and the entire economy, respectively.

The sources of data are ultimately national accounts. Accounting frameworks and techniques vary across countries. To avoid the risk of inconsistencies, it is best to use sources that have harmonised world data. Six data sources were assessed in this chapter. The WIOD provides enough detail for all three definitions and with a quality that most closely resembles the benchmark sources (ABS, BEA, BLS). However, it only covers the 2000–2014 period. The Eora offers industry-level data for a longer period but lacks capital stock information. The OECD's detailed national accounts offer enough detail to calculate the simplified Marxian and the average RPs for the 1989–2017 period. The OECD's aggregate accounts, PWT, and EPWT can only accommodate the average approach. Because PWT is the base of EPWT and the latter has inconsistencies between versions, the next chapter uses the PWT for the long-term analysis.

## Chapter 5: ANALYSING THE WORLD RATE OF PROFIT

This chapter presents estimates of the world rate of profit (WRP) based on the approaches introduced in the previous chapter. The presented profit rates include a detailed rate of profit (RP) for a group of 43 countries over the 2000–2014 period, a simplified Marxian RP for a bundle of 10 countries over the 1989–2017 period, a simplified average RP for a panel of seven countries over the 1971–2019 period, and one average RP for a group of 32 countries over the 1952–2019 period.

To assess the trend of the RP and its impacting factors, Section 5.2 focuses on the last two profit rates due to their longest timeframes. It shows that the WRP fell from 1952 to 2019 but did undergo a period of partial recovery between 1982 and 1997. Technological change, as reflected in the output-to-capital ratio (OCR) and capital-to-wages ratio, has been the main driver of the fall. The profit share (PS) and the profits-to-wages ratio, i.e. the rate of surplus value (RSV), have been the drivers of the recovery phase.

The growth rate of working hours, the share of productive hours in total worked hours, and the growth rate of the monetary equivalent of labour-time have declined over the period with available data. From a labour theory of value perspective, the trends of these factors indicate a slowing pace of value generation. Moreover, the rate of depreciation (D) has accelerated, which has imposed a growing cost of production and deduction from the value added. The increasing rate of depreciation is the reason why the decline of the labour share (LS) has not translated into a growth in the profit share.

This chapter also considers the profit rates of individual countries. It shows that most countries, irrespective of their development status, have declining profit rates due to technological change. Development is inversely related to the level of RP. Developing countries tend to have higher profit rates compared to developed countries. Despite the declining weight of the US in the global capital stock, the trend of the WRP has close resemblance to that of the US.

## 5.1. The world rates of profit

In this section, I use the World Input–Output Database (WIOD) to calculate a detailed rate of profit ( $RP^D$ ) and compare it with a simplified average rate of profit ( $RP^{SA}$ ). I calculate a simplified Marxian rate ( $RP^{SM}$ ) using the detailed accounts by the Organisation for Economic Cooperation and Development (OECD). I use its aggregate accounts to calculate the  $RP^{SA}$  for three panels of countries. Then, I calculate the average rate of profit ( $RP^A$ ) for four panels of countries using the Penn World Table (PWT).

The reason for using different panels is that the historical data varies across countries and indicators. For instance, in the PWT, the first GDP datapoint for the US is in 1950, for China in 1952, for Bulgaria in 1970, and Armenia in 1990. The results of choosing different panels are compared to demonstrate that, as long as the largest economies are included, the number of countries does not substantially impact the trend of the RP.

### The World Input–Output Database

The WIOD world consists of 43 countries. For each country, I calculate the  $RP^D$  using current national currencies. Because the WIOD offers industry-level data in current USD, I convert the stock of capital data to USD to calculate the  $RP^D$ . To do so, I use the PWT's exchange rates. To calculate the WRP, each country is given a weight based on its share of total stock of capital. This approach is similar to Li, Xiao and Zhu (2007: 41) and Basu et al. (2022: 3) but contrasts with Maito (2014: 15; 2018: 156) and Roberts (2012: 4), who use relative GDP or aggregate production as assigned weights. Although the two methods are likely to have similar results, the use of the stock of fixed capital is directly rooted in the definition of the RP. The share of each country is equal to its national stock over the total world stock, both in USD. Then, the WRP is calculated by summing up the multiplication of each country's weight and its RP (see Eq. 5.1 and Eq. 5.2). Table A.6 lists the countries and their weights in the panel. The WRPs calculated by this method are presented in Figure 5.1 and their normalised versions in Figure 5.2.

$$w_i = \frac{K_i \times xr_i}{\sum K_i \times xr_i} \quad \text{Eq. 5.1}$$

$$WRP = \sum w_i \times RP_i \quad \text{Eq. 5.2}$$

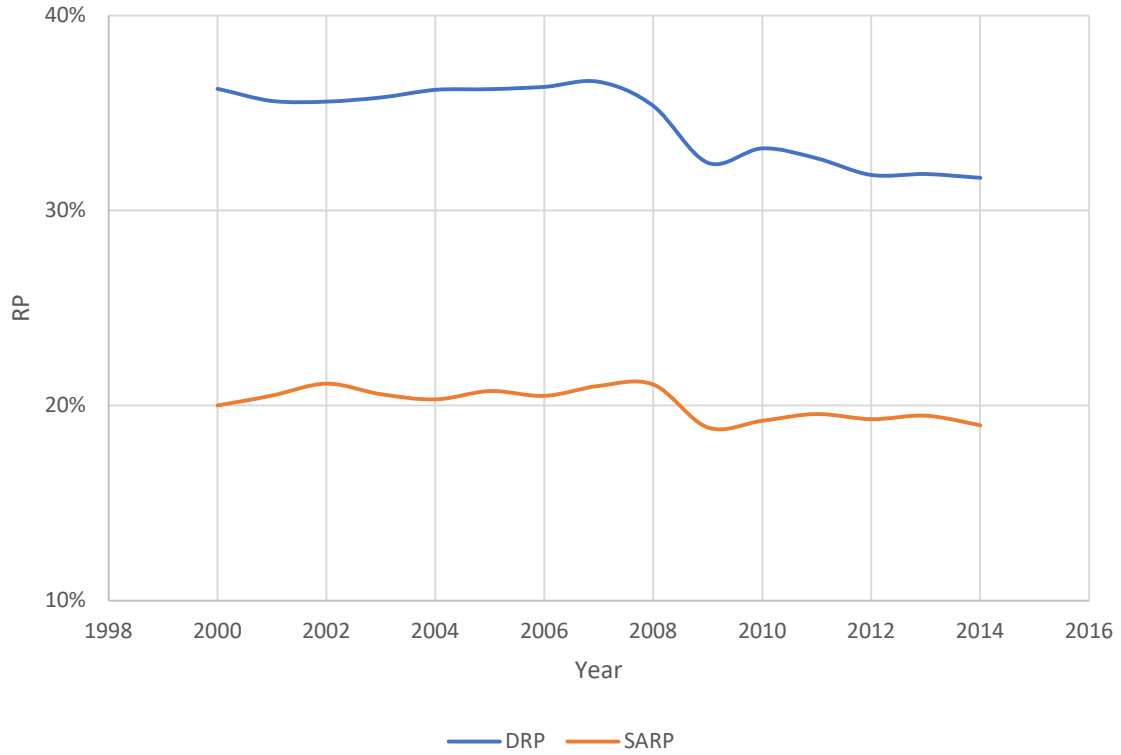


Figure 5.1: World RPs using WIOD data

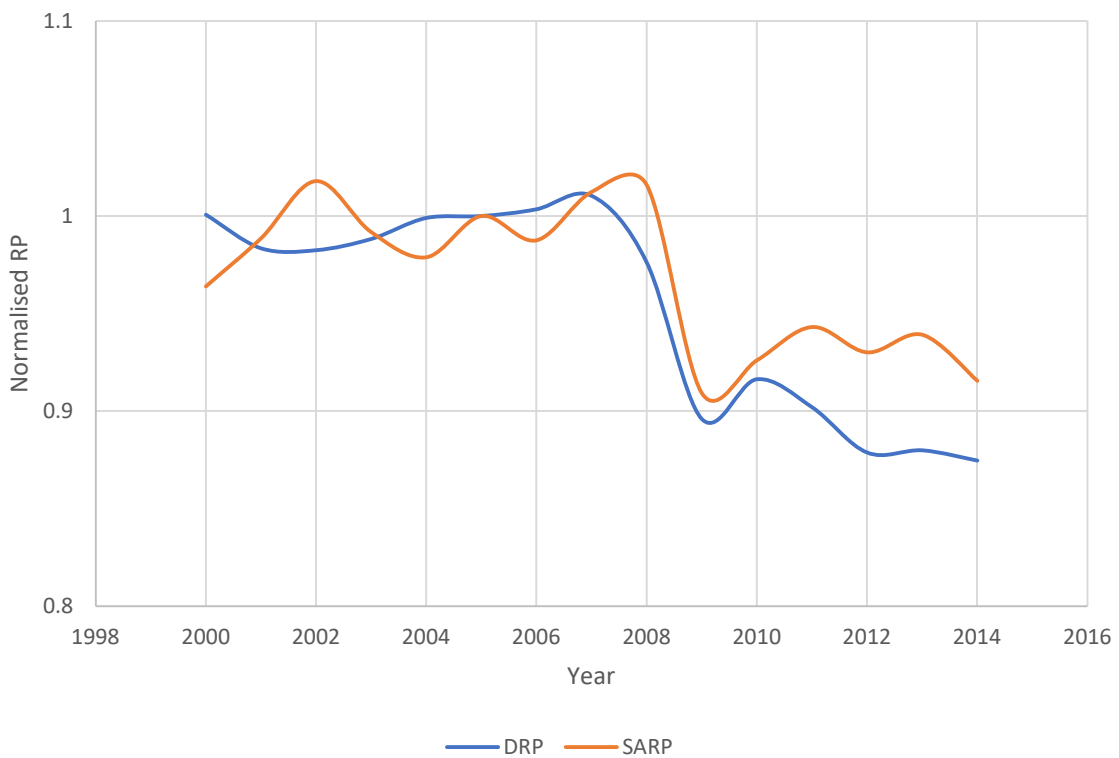


Figure 5.2: World RPs using WIOD data (normalised on 2005 levels)

The two rates are almost parallel and have similar trends. The  $RP^D$  has a higher magnitude, which is because of restricting the compensation of employees (EC) and advanced capital (K) to productive workers and industries. The similarities of trends between the two rates in the case of the world, Australia, and the US indicate the possibility that the results of the assessment of the  $RP^A$  and  $RP^{SA}$  could be applicable to the  $RP^D$ . In the following, I use OECD and PWT sources, which offer longer history of data but not enough detail for the calculation of the  $RP^D$ .

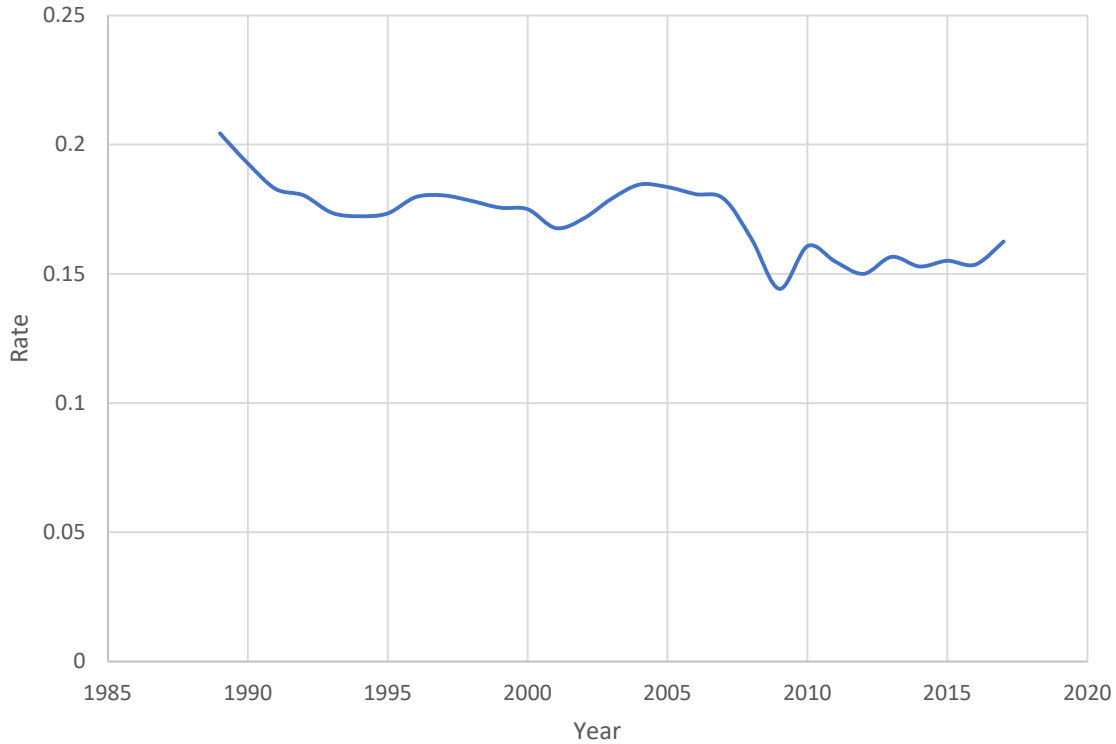
### **The Organisation for Economic Cooperation and Development**

The OECD offers detailed and aggregate economic data, which can accommodate different definitions of the RP. However, the coverage of indicators varies across countries and years. For instance, capital stock and GDP data for Australia are from 1959 but for France, from 1978 and 1950, respectively. To have consistency, different panels of countries have been chosen as constructs of the world. For each panel, all datapoints necessary for the calculation of the RP are available over the covered period. Three panels are used for the  $RP^{SA}$  and one panel for the  $RP^{SM}$ . The number of countries in each panel and the years covered are presented in Table 5.1.

*Table 5.1: The coverage of years and countries in the OECD's panels*

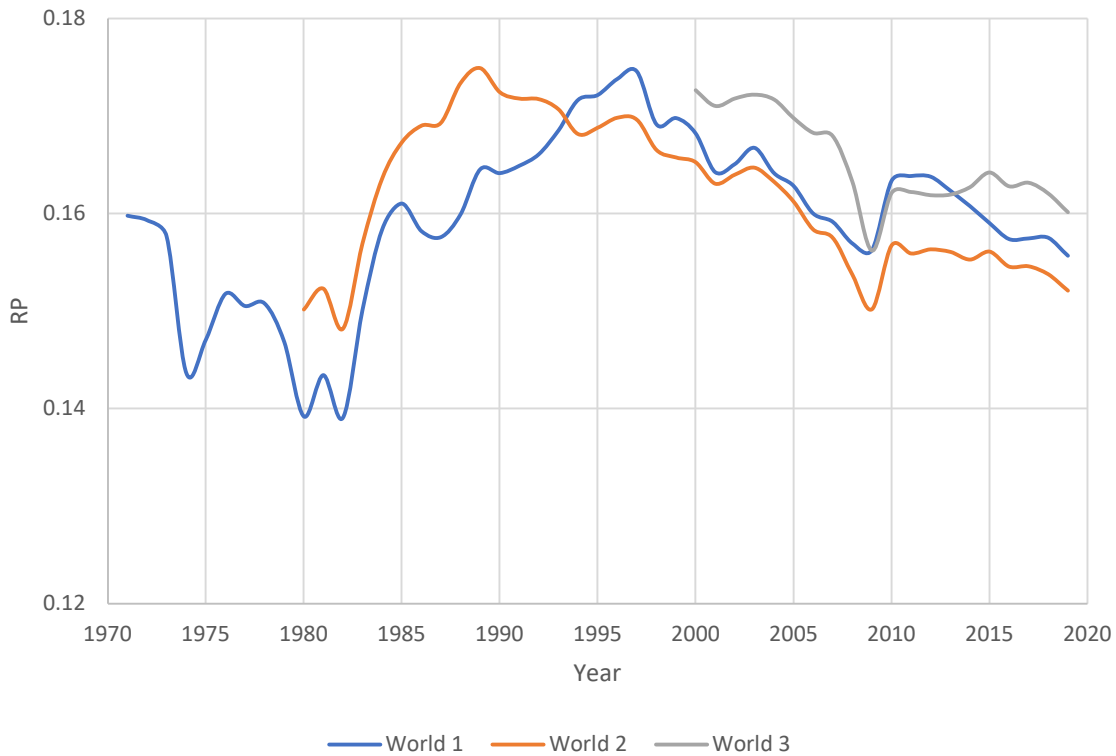
	<b><math>RP^{SM}</math> World</b>	<b><math>RP^{SA}</math> World-1</b>	<b><math>RP^{SA}</math> World-2</b>	<b><math>RP^{SA}</math> World-3</b>
Years covered	1989–2017	1971–2019	1980–2019	2000–2019
Number of countries	10	7	10	31

The simplified Marxian RP differentiates between the productive and unproductive industries but works only with operation surpluses. Figure 5.3 presents the simplified Marxian WRP from 1989 to 2017 for a panel of 10 countries. The countries are listed in Table A.7. During the period, the RP has a downward trend, with a notable dip during the most recent global economic crisis (2007–2009), like WIOD's  $RP^D$ .



*Figure 5.3: Simplified Marxian RP using OECD data*

For each country,  $RP^{SA}$  is calculated using the current-cost estimate of parameters and the net estimate of capital stock, all in national currencies. The calculation of the WRP follows the same procedure as described before for WIOD’s WRP. I use the OECD’s table of historical exchange rates to convert local currencies to USD. The availability of historical data varies across countries and parameters. That is why I create three panels of countries, i.e. “worlds”, within which historical data is consistently available for all countries. The list of the countries and their weights in the constructed worlds are presented in Table A.7 and the results can be seen in Figure 5.4.



*Figure 5.4: World RPs using OECD data*

Despite differences in magnitude and slopes, all three  $RP^{SA}$ s have downward trends as  $RP^{SM}$  with a notable dip around the 2007–2009 crisis and a partial recovery till 2010. The two worlds with longer history show that the decline starts around the late 1980s to mid-1990s. Both rates rise in the 1980s and World-1's RP shows that there is another decline before that. Overall, during this period, the WRPs of World-1 and World-2 reach the same level in 2019 as they have in 1971. World-3's RP has an overall downward trend. Despite differences in magnitude and slopes,  $RP^{SA}$ s and  $RP^{SM}$  indicate a downward trend, particularly since the 1990s.

### **The Penn World Table**

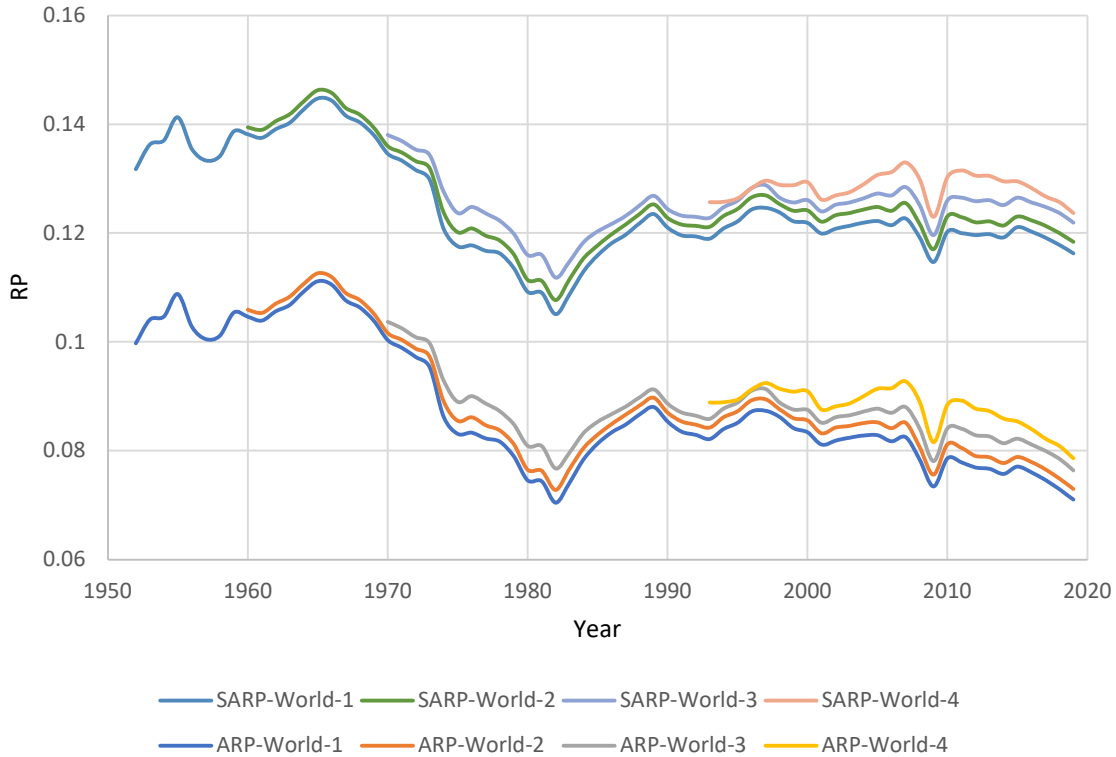
From the PWT database, I use GDP and the stock of capital in national currencies. The EC is calculated by multiplying the labour share and GDP. For constructing the WRP, each country's RP needs to be multiplied by its share of the world stock of capital. To calculate the weights, it is possible to use the PPP estimates of the stocks or use USD. PPP measures tend to distort the data (Freeman 2009a). That is why I use the exchange rates provided in PWT to convert national currency stocks to USD values.

Like the OECD databases, the PWT's coverage of economic indicators varies across countries and years. For instance, it provides data necessary for the calculation of the RP of Australia from 1950 but for Albania from 1970. Based on the availability of historical data, four different panels have been chosen as the constructs of the world. The number of countries and years covered by these panels are presented in Table 5.2. Table A.8 presents the average weight of countries in each "world".

*Table 5.2: PWT worlds' years and number of countries*

	<b>World-1</b>	<b>World-2</b>	<b>World-3</b>	<b>World-4</b>
Years covered	1952–2019	1960–2019	1970–2019	1993–2019
Number of countries	32	48	65	128

PWT offers the depreciation data, which enables the calculation of the  $RP^A$  as well as the  $RP^{SA}$ . For all constructed "worlds", I calculate both these rates. The results are shown in Figure 5.5. As can be seen, both definitions and all four panels lead to similar trends. There is a slow growth in the RP in the 1950s to the mid-1960s, followed by a sharp decline to the early 1980s. Then, the rate recovers in the rest of the 1980s and peaks by the second half of the 1990s. The main difference between the two sets is that in the case of the  $RP^A$ , the recovery in the 1980s is completely diminished by 2019 but the  $RP^{SA}$  is still higher in 2019 than in its trough of 1982. Assuming a linear trend for RPs over the available period, OECD's World-1 and World-3 have upward trending rates while World-2's trends downward. In the case of PWT, all "worlds" have negatively sloped  $RP^A$ s, and in terms of the  $RP^{SA}$ , only World-4 has a small upward linear trend. Looking at individual countries, in the OECD database 17 countries had upward trending rates and 14 downward trending. Among PWT countries, 57 have upward  $RP^A$ s and 80 downward, while 67 have upward  $RP^{SA}$ s and 70 downward.



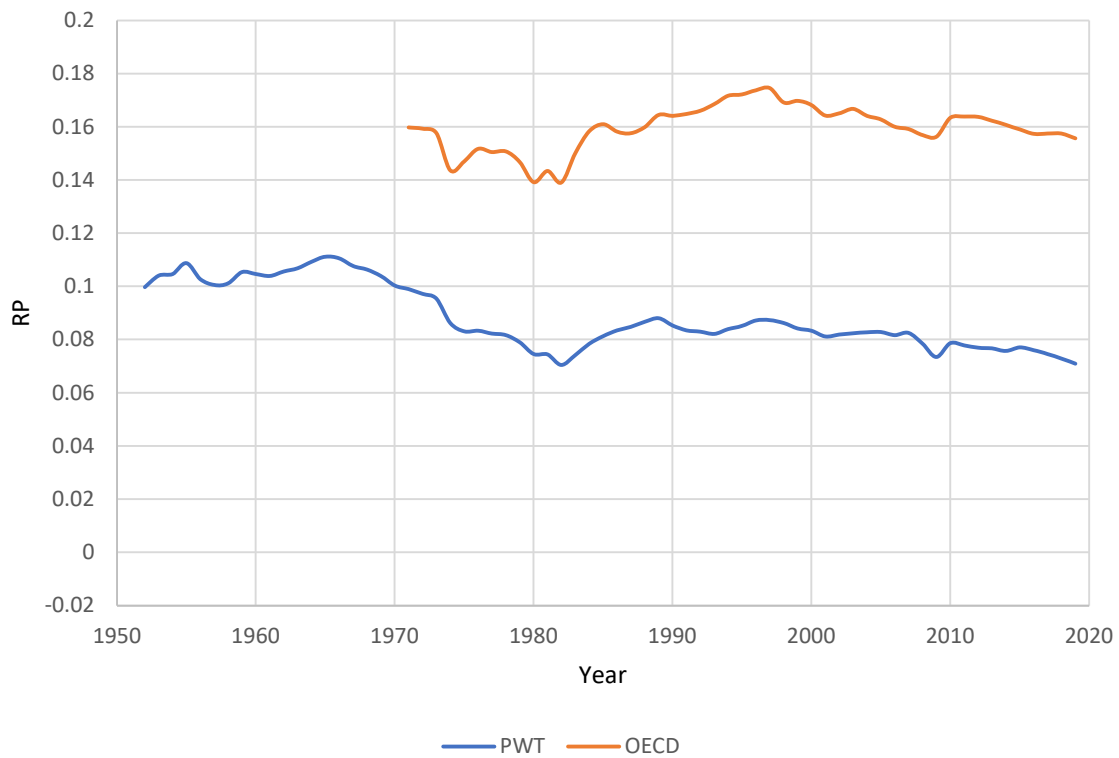
*Figure 5.5: The world  $RP^A$ s and  $RP^{SA}$ s using PWT data*

However, the assumption of a linear trend is not appropriate for the RP because of its arguably cyclic nature. Comparison of the level of subsequent peaks or troughs is a better indication of the overall trend. The history of the data is not long enough to compare troughs. In the case of PWT World-1 and World-2, the two subsequent peaks occur in 1966 and 1989 ( $RP^A$ ) and 1996 ( $RP^{SA}$ ). The second peaks are clearly lower, indicating the overall downward trend of the WRP in the past 70 years. The next section explores the movement of the rate of profit in more detail and assesses its phases and driving forces.

## 5.2. Discussion

In this section, I use PWT and OECD World-1s because they have the longest historical data within each group. The compromise here is a smaller number of countries, 32 countries in PWT World-1 and seven in OECD World-1. For OECD, I use the  $RP^{SA}$  definition because it is the only one possible. For PWT, the  $RP^A$  is used because it is exclusive of depreciation in the numerator and thus a better indicator of profitability. As can be seen in Figure 5.6 and Figure 5.7, the two rates are almost parallel with quite similar movements in the growth rates. The

OECD's rate has a higher magnitude due to the inclusion of depreciation. I use a 5-year moving average trend line for the PWT's curve to smooth out short-term noises. In the discussion that follows, the focus is more on PWT World-1 because of its longest history and the use of RP<sup>A</sup>. The main reason I keep OECD results here is to control for the effects of data sources and definitions. Whenever those effects lead to any important difference, e.g. in the case of wage share, I discuss them explicitly. Focusing on the PWT World-1, the rate falls from an all-time high of 11% in 1966 to 7% in 2019. The overall falling trend of the RP is similar to the findings by Maito (2014), Maito (2018), Li, Xiao and Zhu (2007), and Basu et al. (2022).



*Figure 5.6: PWT World-1's and OECD World-1's RPs*

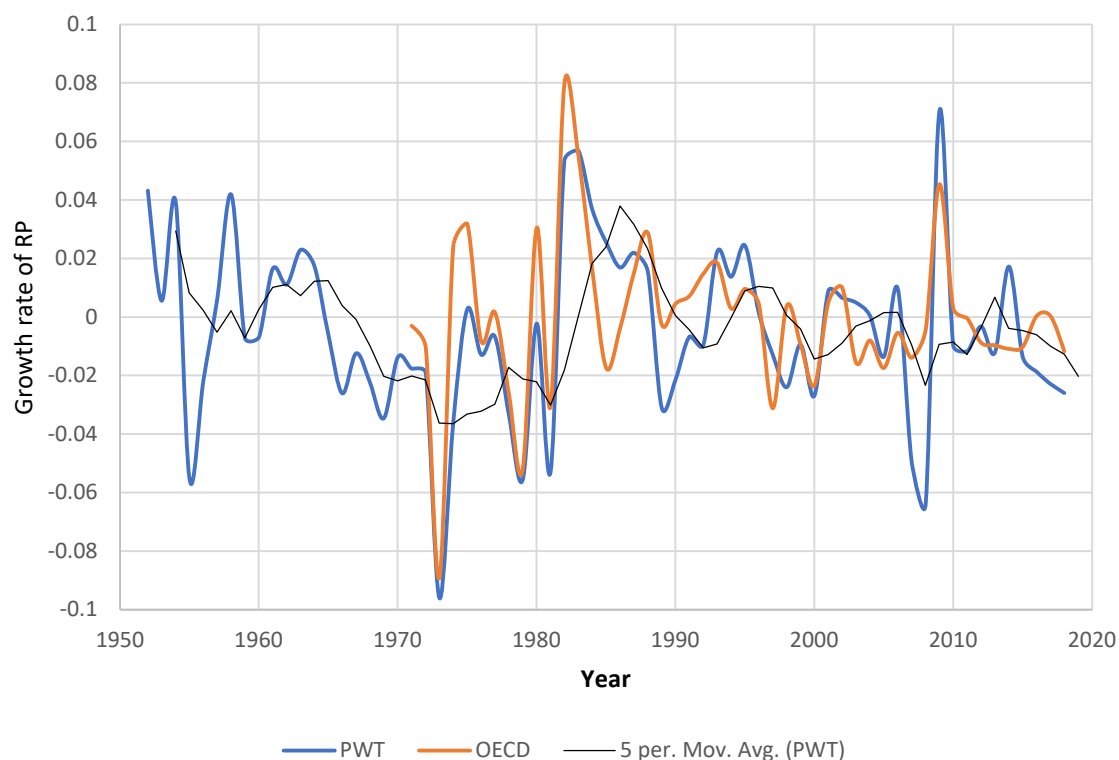


Figure 5.7: Growth rate of the WRP

Presenting the downward trend of the RP, one could be tempted to project the trend and forecast when the RP reaches zero. For instance, Maito (2014: 18; 2018: 158) forecasts such a point based on the trend of the RP in 1919, 1932, 1944, 1955, 1970, 1980, and 2010. The results vary from 2024 for the 1919 projection to 2064 for the 2010 projection. Although this is a statistically interesting exercise, its empirical and real-world significance is unclear. First, as Maito also admits, the rate cannot reach zero and capitalism would go into serious trouble when it reaches low levels of profitability. Second, the RP does not follow a strictly linear pattern. Third, capitalism is adaptive, and it is possible to assume its RP could reach a steady state at a low but positive magnitude. Fourth, as theorised by Marx and demonstrated in my research and many others, countertendencies can prevent falling profitability and even boost it. There is no *a priori* reason to assume they would stop working altogether, contrary to Grossman (1929) and Maito (2014: 18).

Based on these figures, the period of 1952 to 2019 can be divided into four stages:

1. 1952–1965: the RP has a slight upward trend, reaching its highest peak in the overall period. This stage is only available on the PWT World-1 curve.
2. 1965–1982: the RP declines steadily and reaches the only trough within the period.

3. 1982–1997: the RP undergoes recovery but at a slower pace than when it fell in the last phase. It reaches its second peak in 1997, which is still lower than the peak of 1965.
4. 1997–2019: the RP declines again but at a slower pace compared to the previous cycle. In the case of the RP<sup>A</sup> (PWT World-1), it loses almost all the gains in the last stage. The RP<sup>SA</sup> (OECD World-1) ends up at a higher level in 2019 than in 1982. This difference between the two rates is due to the impact of depreciation, which will be discussed in more detail later. The crisis of 2007–2009 can be seen in both curves as a local trough, as part of the longer downward path starting from 1997.

The subsequent rise and fall phases indicate a cyclic pattern in the movement of the RP. The length of cycles seems to be about 30–35 years, based on half cycles and the peak-to-peak difference (1965 and 1997). Although the timeframe of the calculated WRP is not long enough to reach a definitive assessment of the cyclic pattern, the finding aligns with previous research on national and global RPs. Li, Xiao and Zhu (2007: 47) acknowledge the lack of a fully formed theoretical framework supporting the long-wave pattern of profitability. Their results suggest 40–45-year cycles. Assessing the US's RP, Moseley (1991), Shaikh and Tonak (1994: 122-125), and Jones (2021: 172-178) also identify a cyclical pattern. Reuten (2004: 163, 175-176) argues that Marx's law of the tendential fall in the rate of profit (LTFRP) is about the cyclic nature of the RP, not a secular long-term decline, and thus would be better termed "theory of the rate of profit cycle". However, the finding in my research points to both a cyclic pattern and an overall, long-term fall.

Economic crises are arguably related to the movement of the RP. One view, as argued by Kliman (2012: 17) following Farjoun and Machover (1983: 163-166), is that a period of sustained low profitability renders businesses vulnerable and a sudden drop can trigger the domino effect of bankruptcies and subsequently mass unemployment. The results above confirm that such a pattern did occur prior to the crises of the 1970s and 2007–09. Similar results were reported for the WRP by Roberts (2015: 6-8), although in an earlier publication and for a smaller bundle of countries he reported a stagnating rate prior to the crisis (Roberts 2012: 4).

By contrast, Basu and Vasudevan (2013: 83) and Duménil and Lévy (2011: 21, 267) argue that the "crisis of neoliberalism" and the "Great Recession" followed a period of profit restoration.

Although relevant, the trend of the RP was not a determinant of the latest global crisis. Duménil and Lévy (2011: 21) argue that the crisis of 2007–2009 and the Great Depression were the results of financial and class hegemonies pushing economic boundaries beyond sustainability. However, Basu and Vasudevan (2013: 84) note a key difference between the two crises. Prior to the Great Depression both profitability and capital productivity increased. However, capital productivity declined before the crisis of neoliberalism.

In terms of data analysis, it is true that linear regression, presented in Duménil and Lévy's (2011: 270) US's RP graph, shows an upward trend since the 1980s. However, looking closer, we can observe a local peak in the mid-1990s followed by a lower one in the early 2000s. These are consistent with my findings. However, because Duménil and Lévy's data does not extend beyond 2008, the peaks appear as temporary fluctuations and not the peak of a cycle. However, if recent years are included, as in Figure 5.6, it is clear that the RP peaked in the mid-1990s and fell ever since.

Jefferies (2023: 284) also argues that the US's RP had been rising rapidly immediately before the crisis. His method of measuring advanced capital, however, is entirely different from what underlies the data used in my research or the other publications cited here. Instead of using the national accounts' opportunity-cost method, he applies the Internal Revenue Service Depreciable Assets Less Depreciation method, arguing it offers a more accurate measure of advanced capital. This method is different from the method used by available world data sources. Because of this difference, the results of this thesis and Jefferies' are not comparable.

Another observation is that not only the WRP began to fall prior to the 2007–09 crisis, but it continued afterwards. Although there was a quick bounce-back in 2010, there is no sign of overall recovery. One main driver of recoveries after crises is the destruction of capital, usually in the form of bankruptcies and devaluation of capital. It seems the policies that saved large businesses from bankruptcies with the aim of containing the contagion of the crisis prevented large-scale destruction of capital. As a result, the recovery phase has not started yet.

To interpret the evolution of the rate over time, it is necessary to disentangle the factors whose superimposition determines the trend of the WRP. The most important factors include: labour including total and productive worked hours, technological change, distributional effects, depreciation, and individual countries' RPs and weights in the world. The next sections cover these factors.

### 5.2.1. Labour

The analysis of the driving forces of the long-term downward pattern of the rate and its temporary recoveries can be done at different levels. At the top level, without considering the decompositions (Section 2.1.2), the RP is the ratio of profits to the stock of capital. The trends of the two are compared in Figure 5.8, in which both parameters are normalised to their 1952 levels. The stock of fixed capital has been growing faster than profits. In 2019, it was 124 times its nominal value in 1952. By contrast, profits rose only 88 times over the same period. The growth rates of both factors have followed a similar pattern. They rose from 1952 to the early 1970s but have fallen since (See Figure 5.9).

Worked hours are critical to the growth and productive capacity of the system. Figure 5.10 shows the number of hours actually worked in PWT's World-1 countries. Worked hours have been calculated as the product of the number of working people and average annual worked hours. Due to data limitations, the starting year is 1970, and Costa Rica and South Africa have been removed from the sample. A one-year gap (2014) in Taiwan's worked hours has been filled with the average of one year before and after.

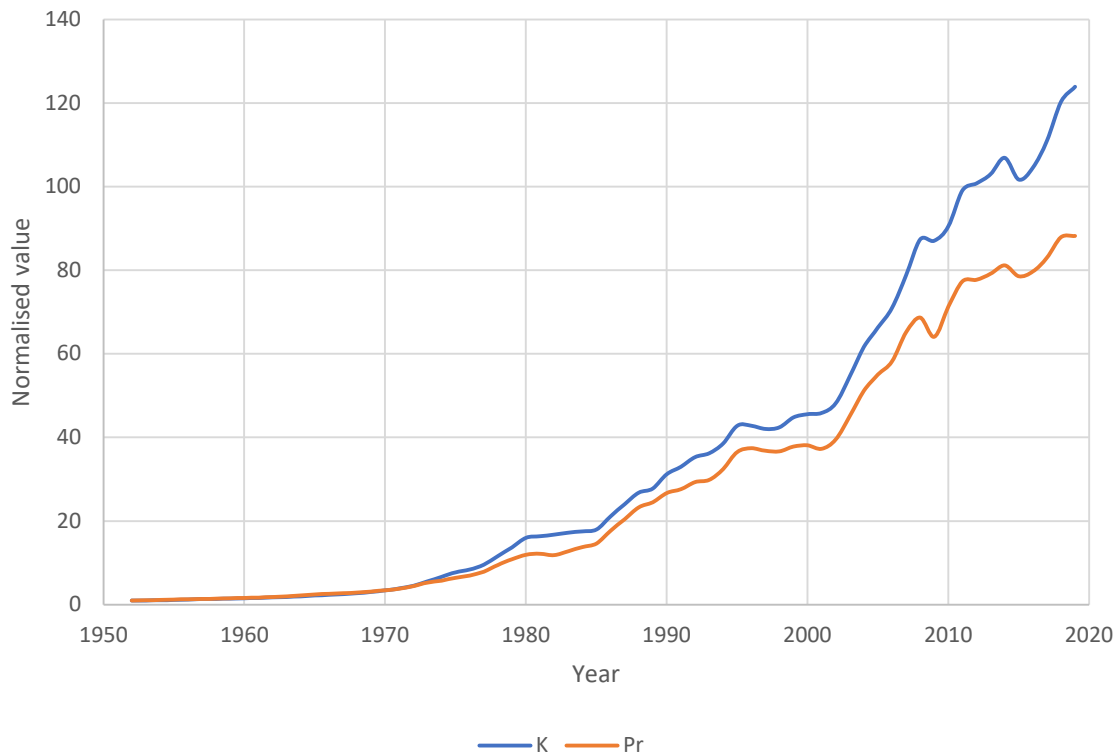


Figure 5.8: Historical trends of capital stock and profits (normalised on the 1952 levels)

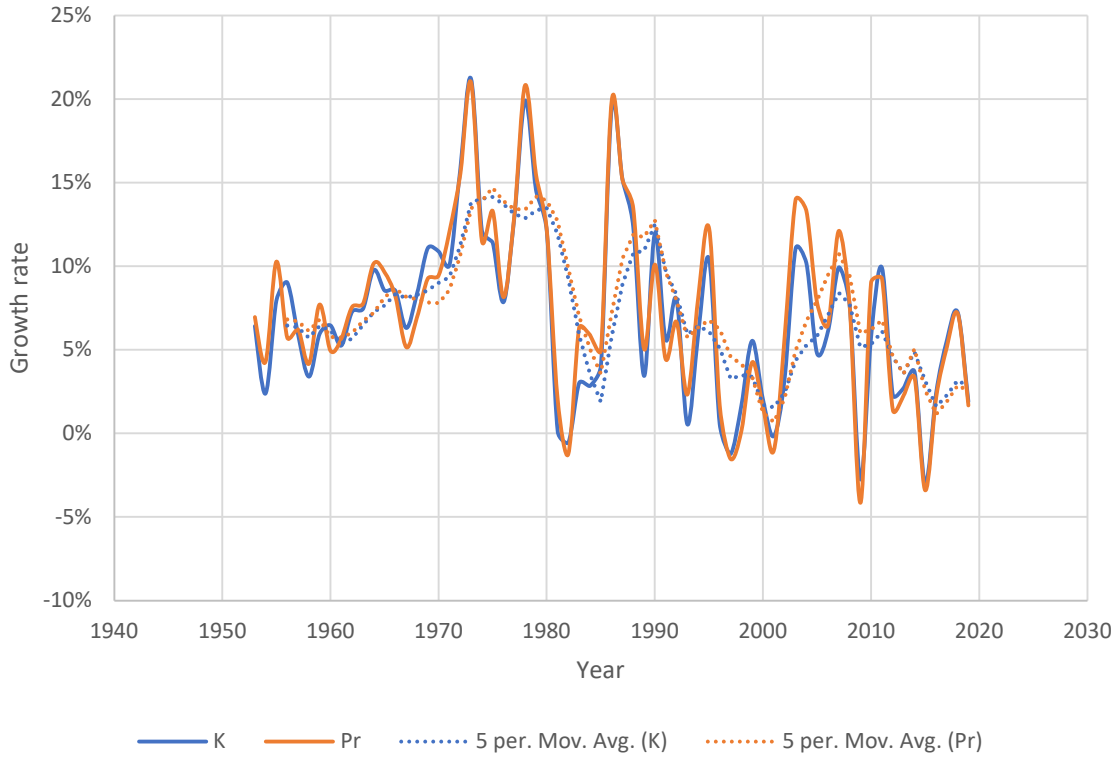


Figure 5.9: Growth rate of capital stock and profits

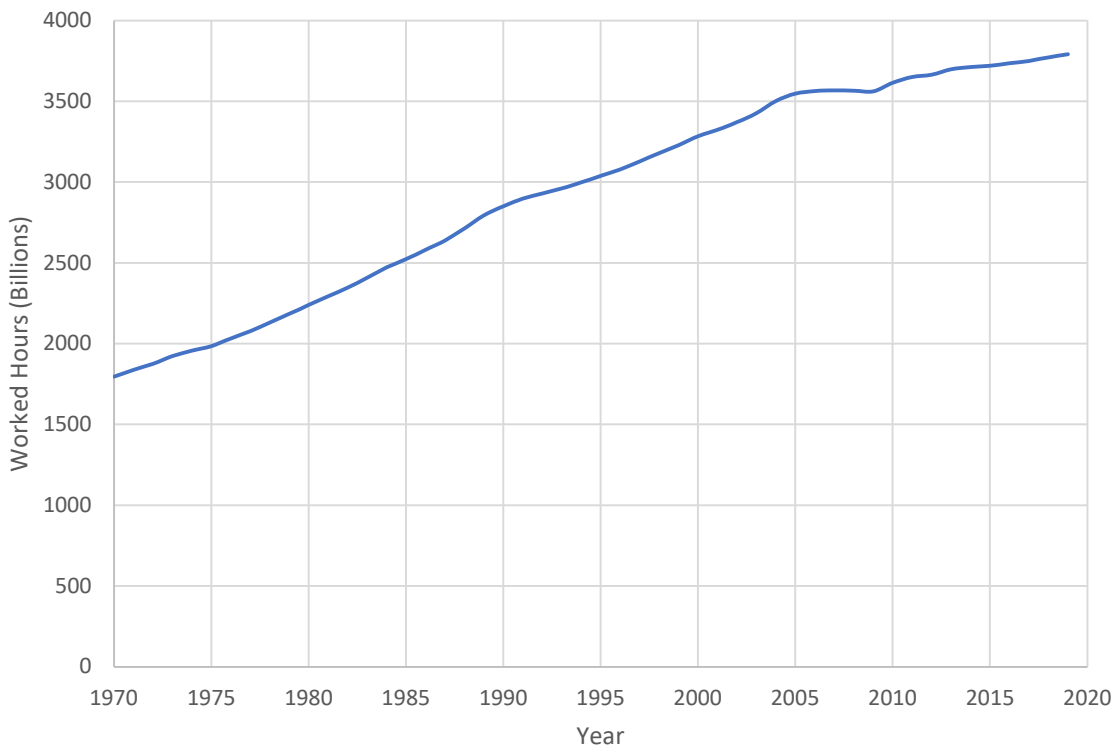
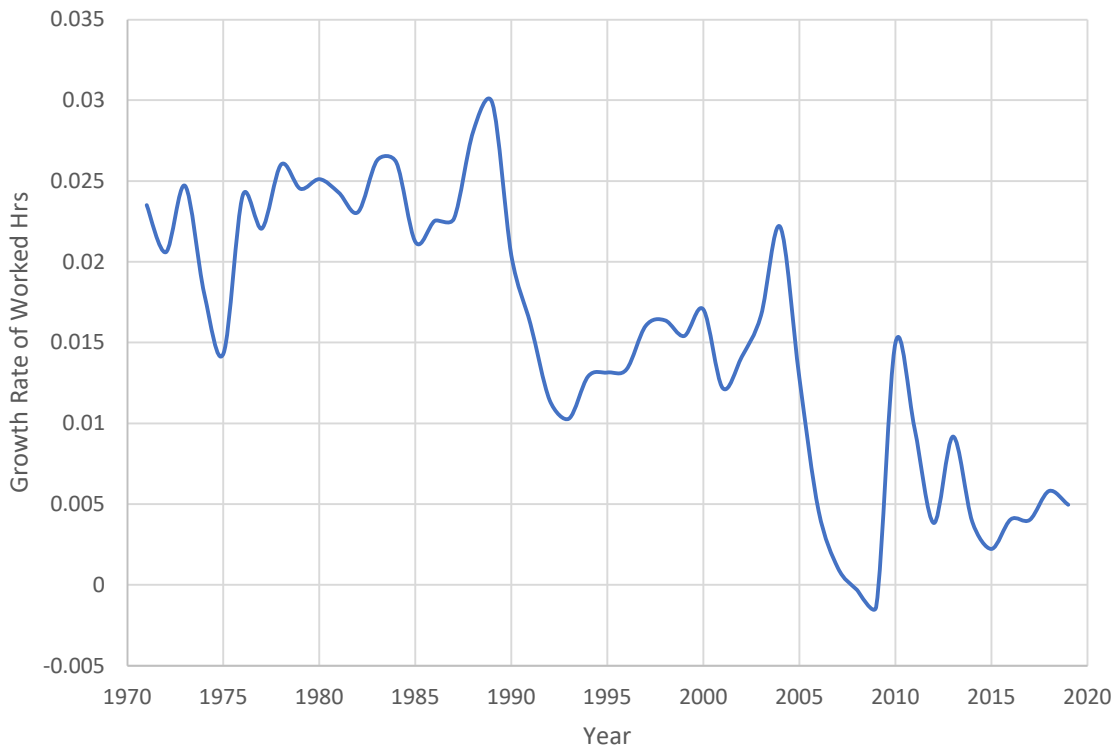


Figure 5.10: World's actual worked hours

The annual worked hours have risen continuously since 1952. However, the slope of the curve has notably flattened, particularly since the mid-2000s. Figure 5.11 presents the growth rate of worked hours. The graph shows an overall downward trend but in three stages. Until the 1990s, the growth rate is around 2.5%, then it drops to 1.5% and remains around that level until 2005. Then, the annual growth rate falls further to about 0.5%.



*Figure 5.11: Growth rate of world's actual worked hours*

From a Marxian perspective, productive hours are the labour-time that directly produces surplus value. Figure 5.12 shows the trend of total and worked hours in the 43 countries covered by WIOD. Both have increased since 2000 but more rapidly since 2011. Figure 5.13 presents the ratio of productive to total hours. It has a downward trend from 2000 to 2009, at which point the latest economic crisis leads to a sharp drop followed by a sharp bounce-back. Using the OECD STAN, Figure 5.14 presents the ratio of productive to total hours for the ten countries that constituted the RP<sup>SM</sup> panel (see Table A.7). Due to the data limitations, the productive/unproductive distinction is made at the sector level. Among the four sectors Agriculture, Construction, Industry, Manufacturing and Services, only the latter is considered unproductive. The results show a clear downward trend for the ratio from 1999 to 2022.

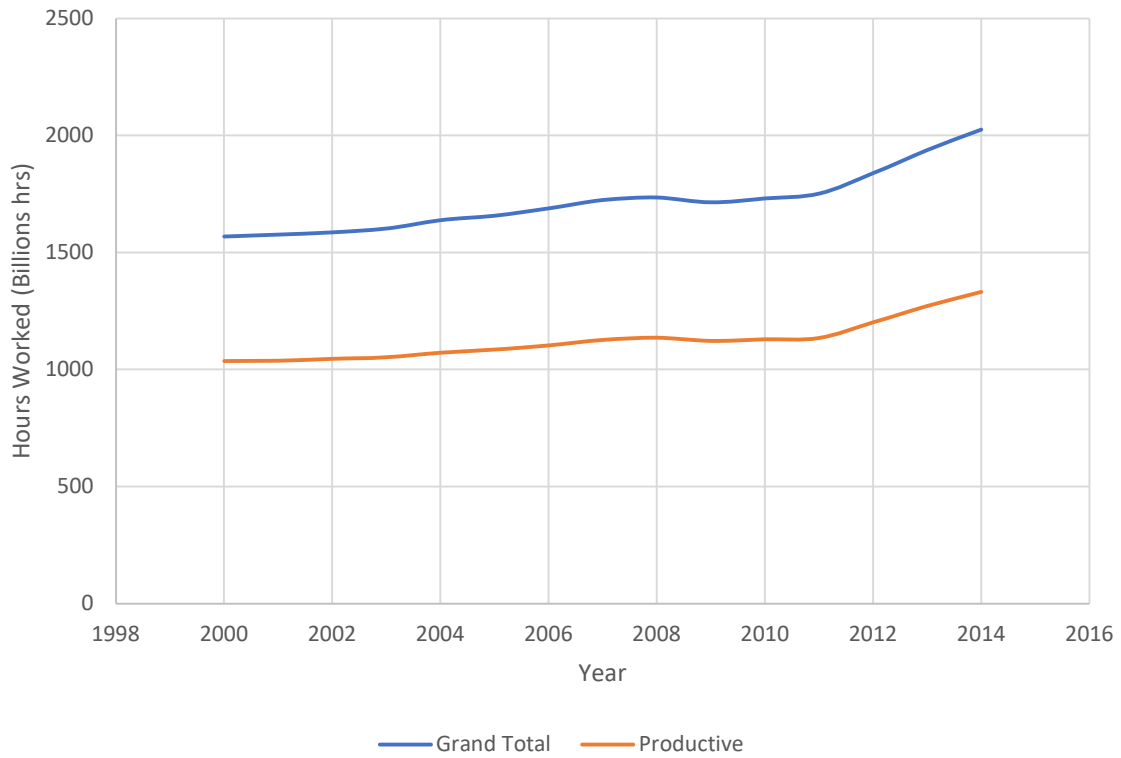


Figure 5.12: Evolution of total and productive hours (WIOD)

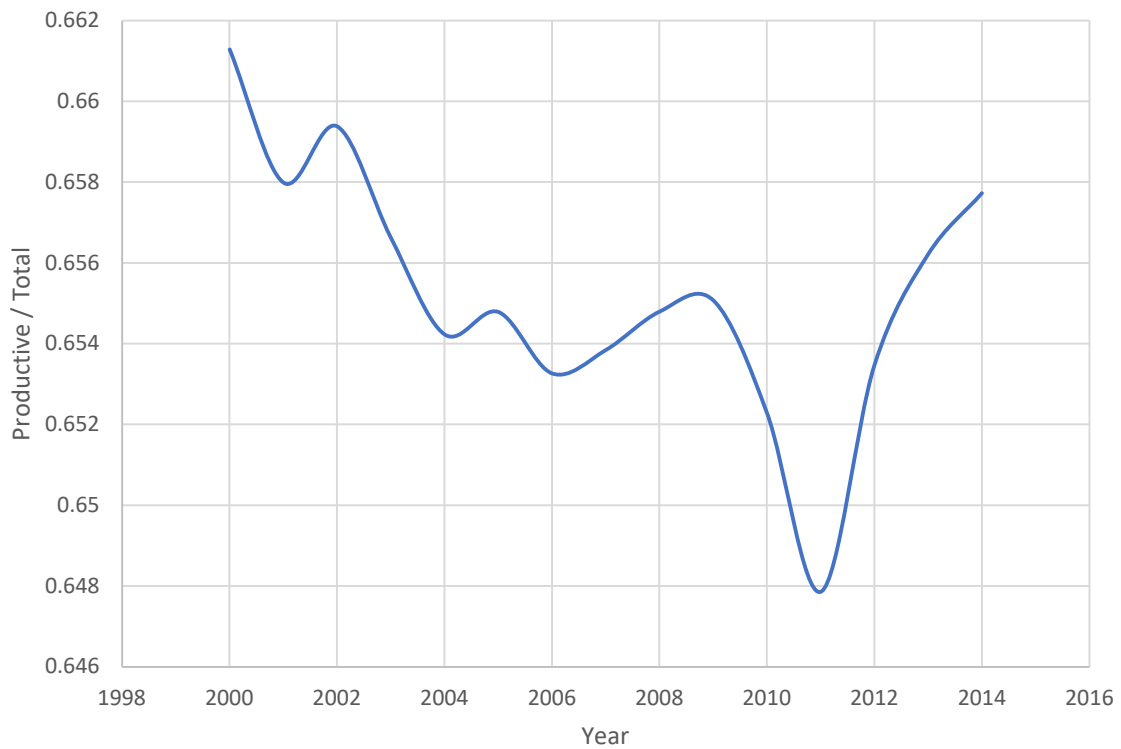
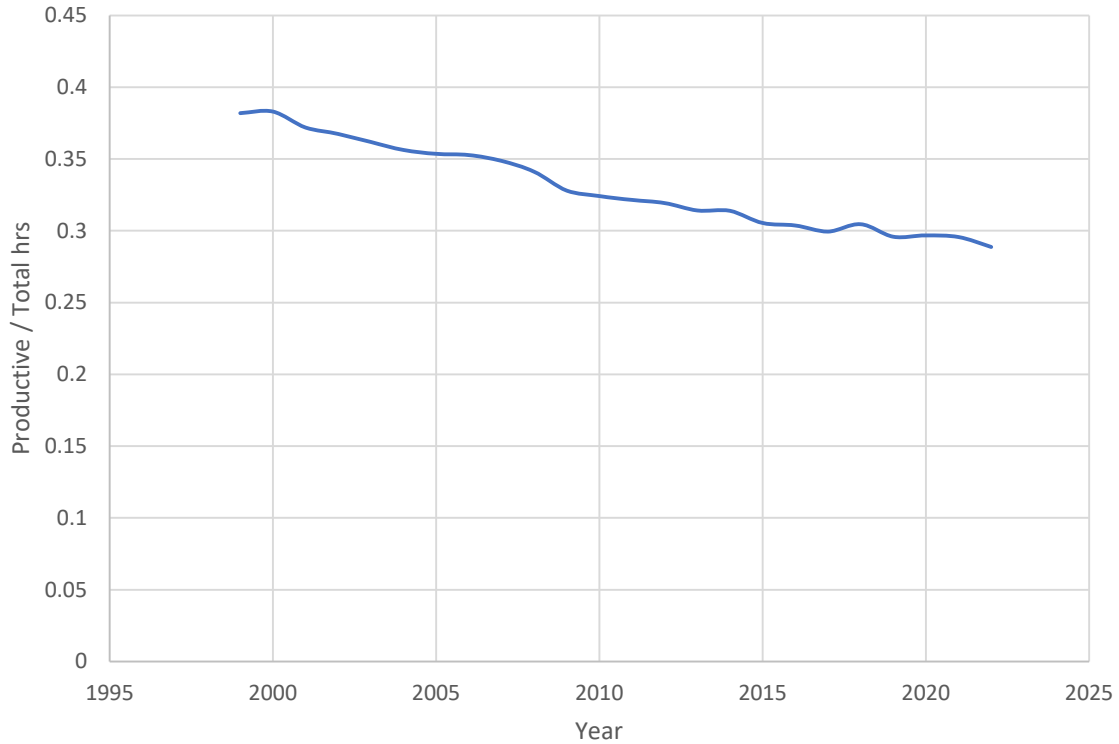
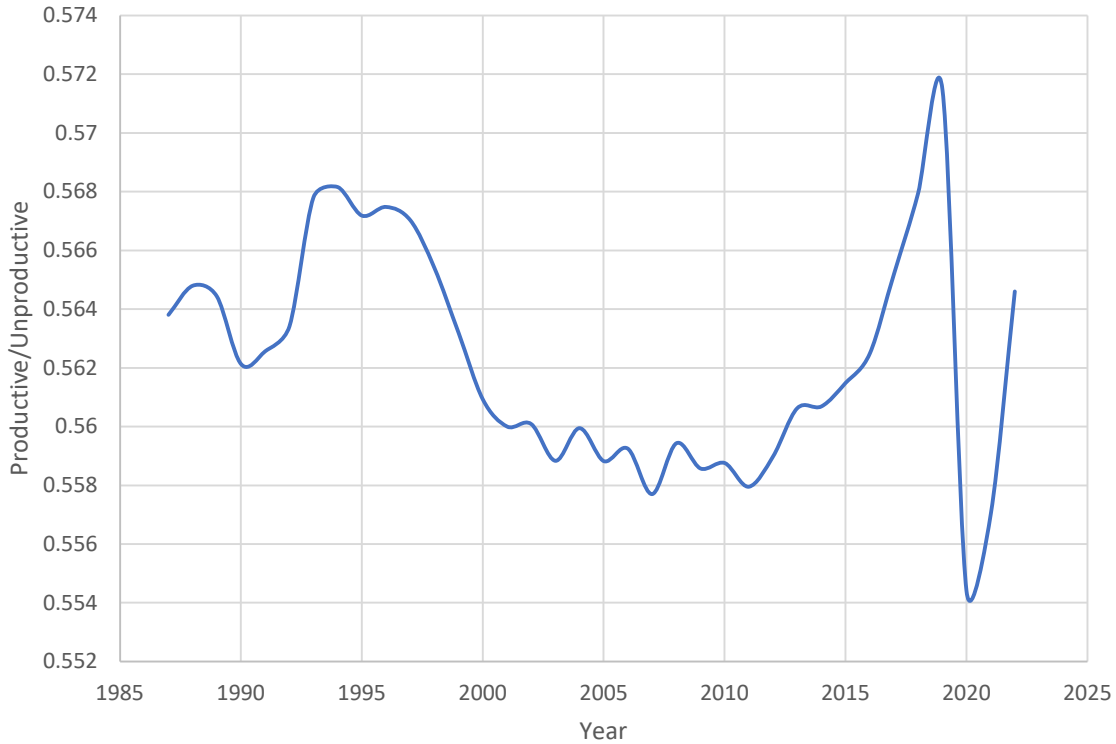


Figure 5.13: Ratio of productive to total worked hours (WIOD)



*Figure 5.14: Ratio of productive to total worked hours (OECD)*

Figure 5.15 shows the evolution of the productive working hours ratio since the late 1980s in the US, using the BLS (2023) data. The mapping of Marxian to mainstream categories are presented in Table A.9. The figure shows a downward trend from the early 1990s to the early 2010s. However, it rose sharply from 2011 to before the Covid-19 pandemic. The rise could be related to the US–China rivalry and the result of the attempt to bring production back to the US.



*Figure 5.15: The growth of the US’s productive worked hours as a share of total (BLS)*

The relationship between worked hours and the growth of the system can be studied via the monetary equivalent of labour time (MELT). It is defined as value added per hours of work (Eq. 5.3). Ideally worked hours should only include productive labour’s hours. However, as discussed before, that category cannot be distinguished in the PWT data. I calculate the MELT as net domestic product divided by total actually worked hours. Figure 5.16 shows the overall upward trend of the MELT, with periods of stagnation in the early 1980s and the late 1990s to the early 2000s. The growth rate of the MELT over this period is presented in Figure 5.17, which shows an overall downward trend. In other words, the amount of value added per worked hour tends towards a steady state.

$$MELT = \frac{NDP}{Hr} \quad Eq. 5.3$$

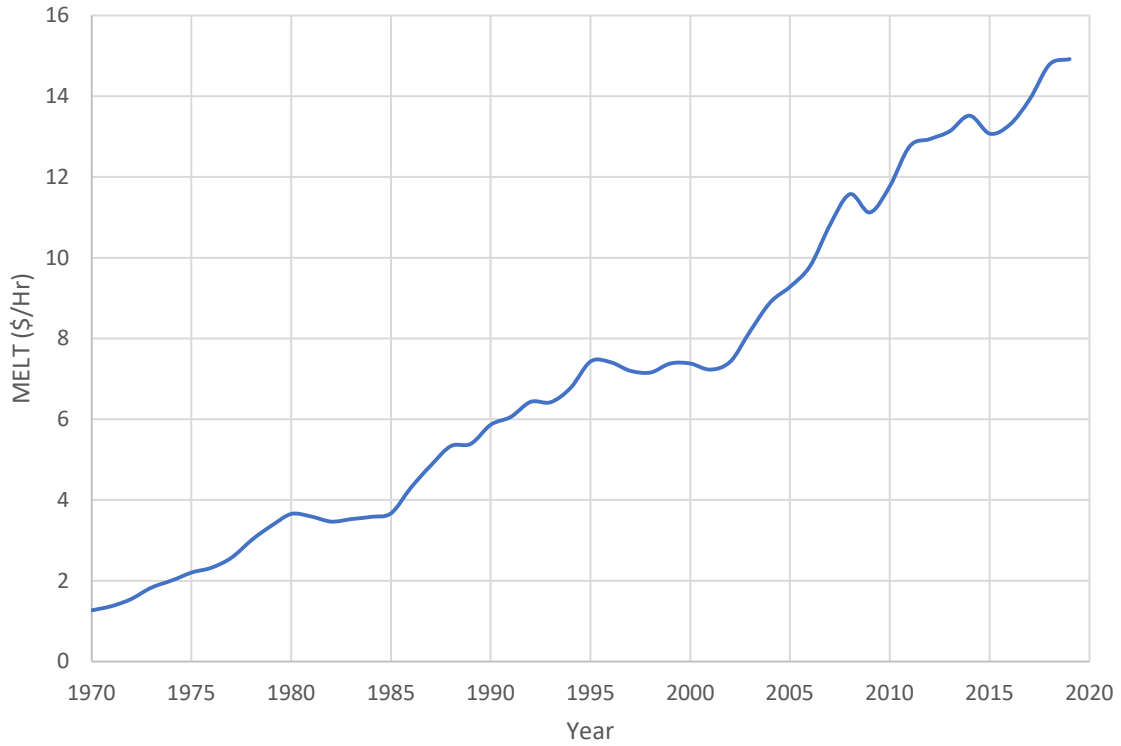


Figure 5.16: Historical trend of world MELT

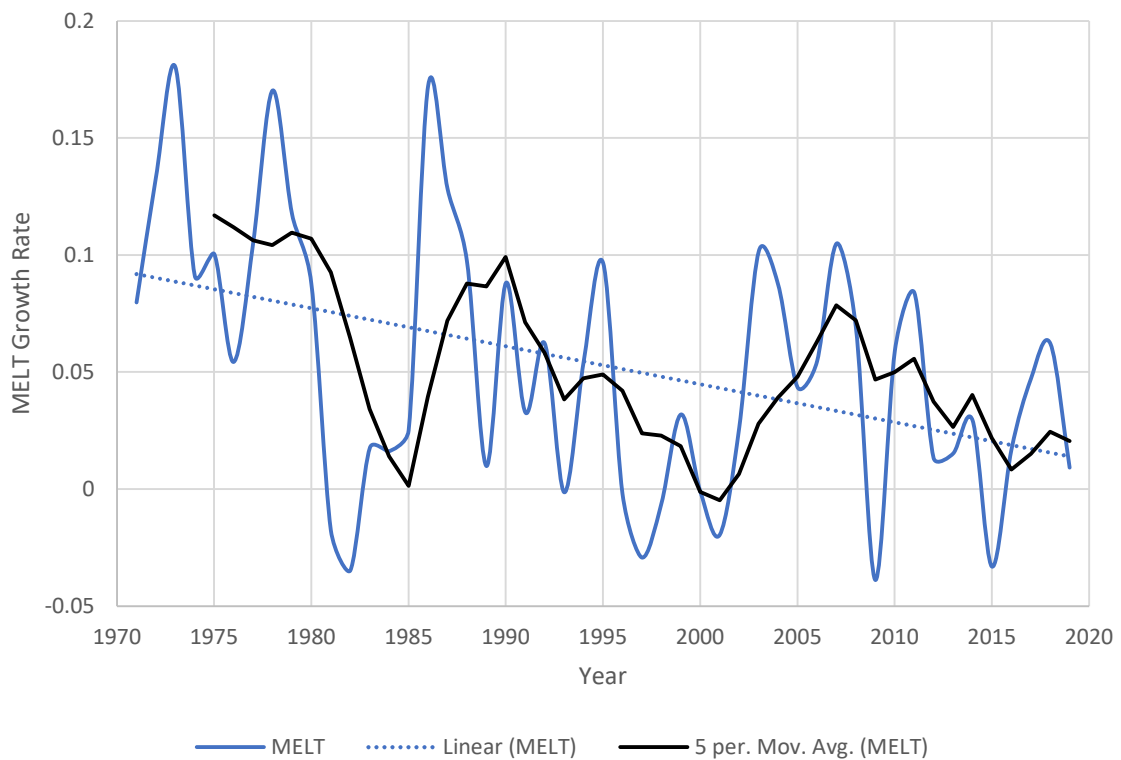


Figure 5.17: Growth rate of MELT (PWT)

The results show that the WRP has fallen since 1952, i.e. capital stock has risen faster than profits. Since the 1970s, the growth rates of worked hours and MELT as well as the share of productive labour in total worked hours have declined. These indicators point to a slower growth of value generation. To nuance these observations and gain a better understanding of what drives the downward trend of the WRP, in the next section I will consider the impacts of technological change and the division of VA between capital and labour.

### **5.2.2. Technological change and distributional effects**

As discussed in Section 2.1.2, the two common decompositions of the RP are:

- RSV and value composition of capital (VCC), for which I use Pr/EC and K/EC as proxies. They are proxies because they are not strictly Marxian variables but resemble those. Others, e.g. Kliman (2012: 131), have used similar approaches before. Pr/EC relates to the distributional effects and K/EC to technological change.
- PS and OCR, which I calculate as Pr/GDP (distributional) and GDP/K (technological).

The ratio of profits to the compensation of employees (Pr/EC) has risen over the 1952–2019 period (see Figure 5.18). Unlike most other graphs in this section, the PWT and OECD curves are not quite parallel here. This difference is due to the role of depreciation, which is deducted from profits in the  $RP^A$  (PWT) but not from the  $RP^{SA}$  (OECD). The impact of depreciation is further discussed in Section 5.2.3. Here, I mainly focus on the PWT curve. Figure 5.19 presents the growth rate of the Pr/EC ratio. I use a 5-year rolling average to better present the PWT curve. It shows that the growth rate has mostly been positive. The longest period of negative growth is in the late 1960s and early 1970s. Another period of negative growth is after 2010. During these two periods, Pr/EC has a negative impact on the growth of the RP.

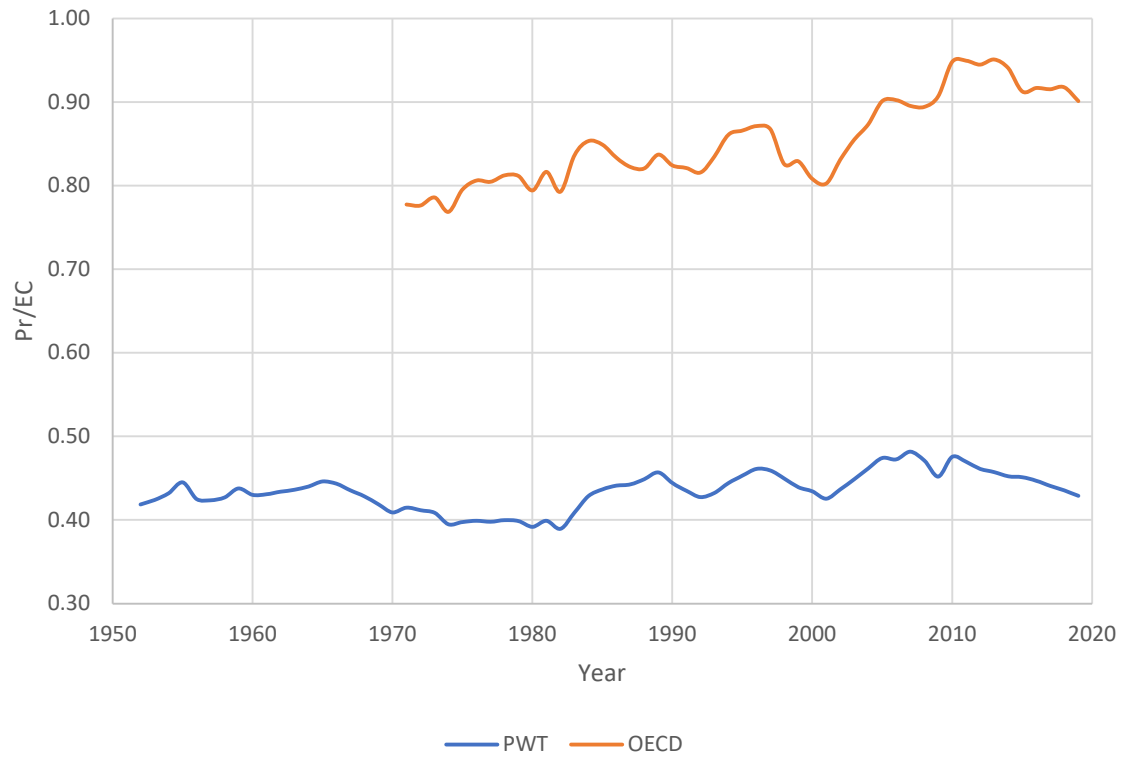


Figure 5.18: Profits to employee compensation ratio as a proxy for RSV

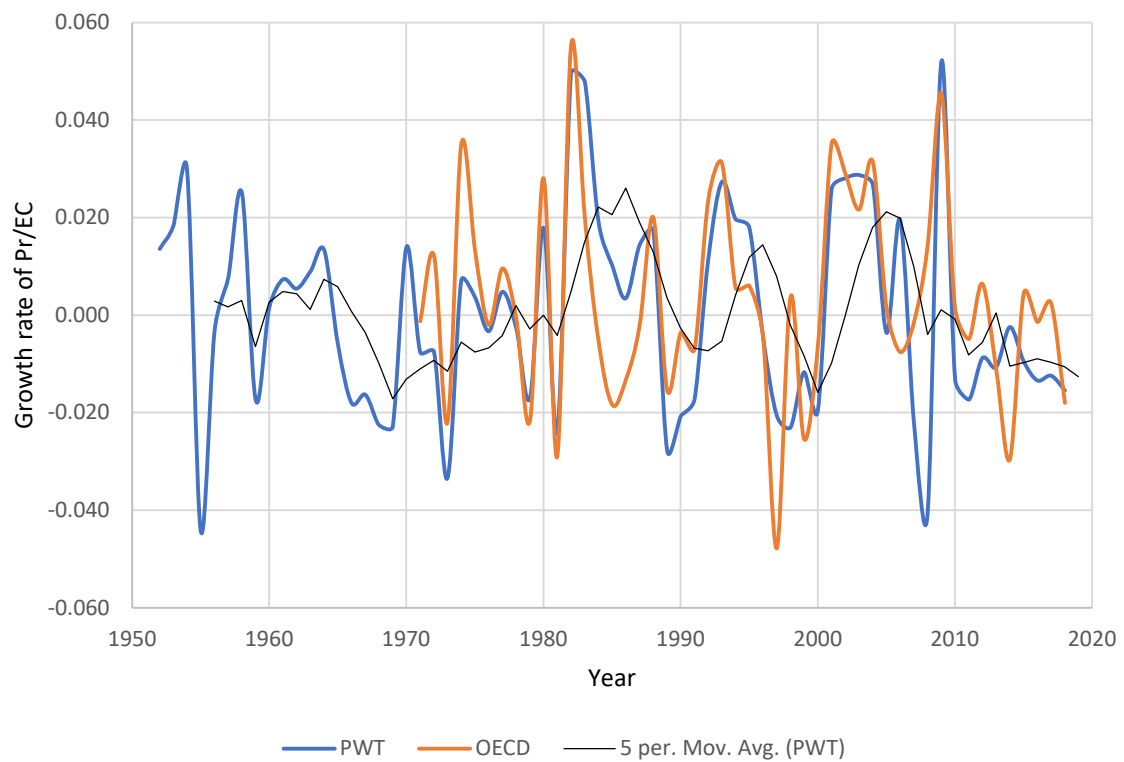


Figure 5.19: Growth rate of of Pr/EC

I use the ratio of the stock of capital to the consumption of employees (K/EC) as a proxy for VCC. This ratio has also risen over the studied period but with different pattern and magnitude from the Pr/EC ratio's (see Figure 5.20 and Figure 5.21). From the early 1950s to the mid-1960s, the rate slightly falls, and its growth rate is mostly negative. During this time Pr/EC slightly rises, which adds to the positive impact of the declining K/EC and together they raise the RP. From the mid-1960s to the early 1980s, the trends of both rates reverse and, as a result, the RP falls. In the 1990s, the trends reverse again and the RP recovers, but at a slower pace than its fall in the previous decade. From the mid-1990s, Pr/EC and K/EC begin to work against each other. During the 2000s, both have positive growths. However, the K/EC ratio has a greater impact and forces the RP to decline. Since 2010, K/EC is mostly constant while Pr/EC declines and drives the RP downward.

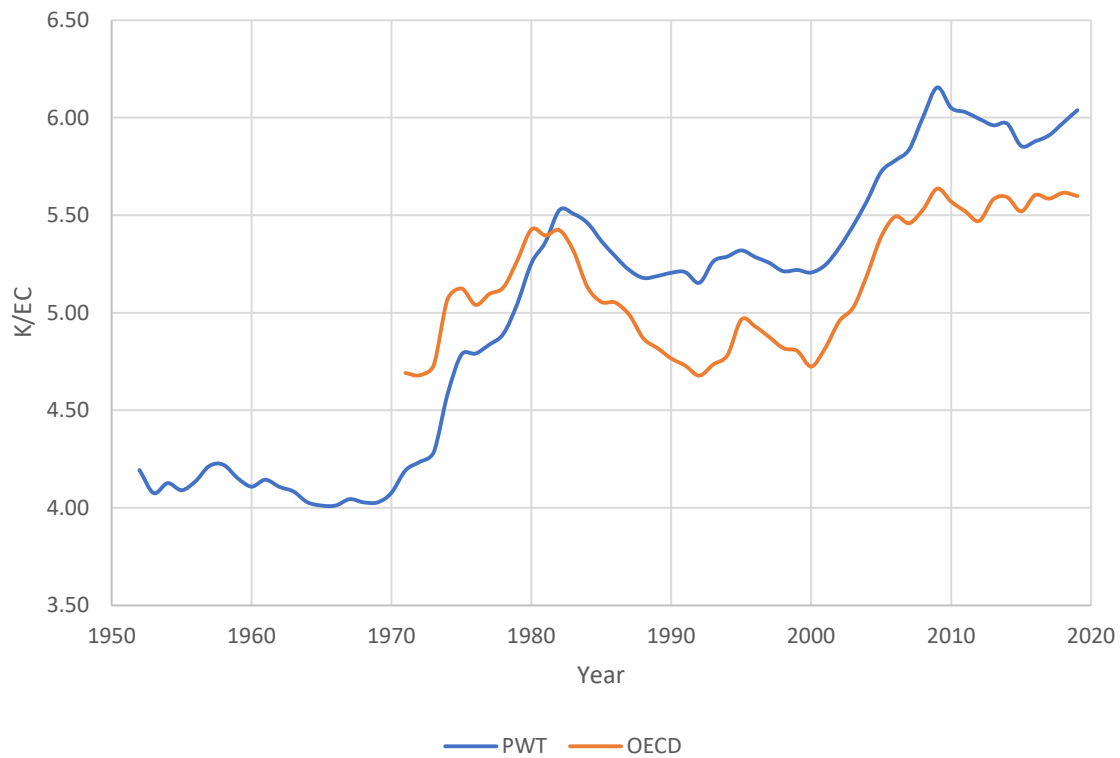
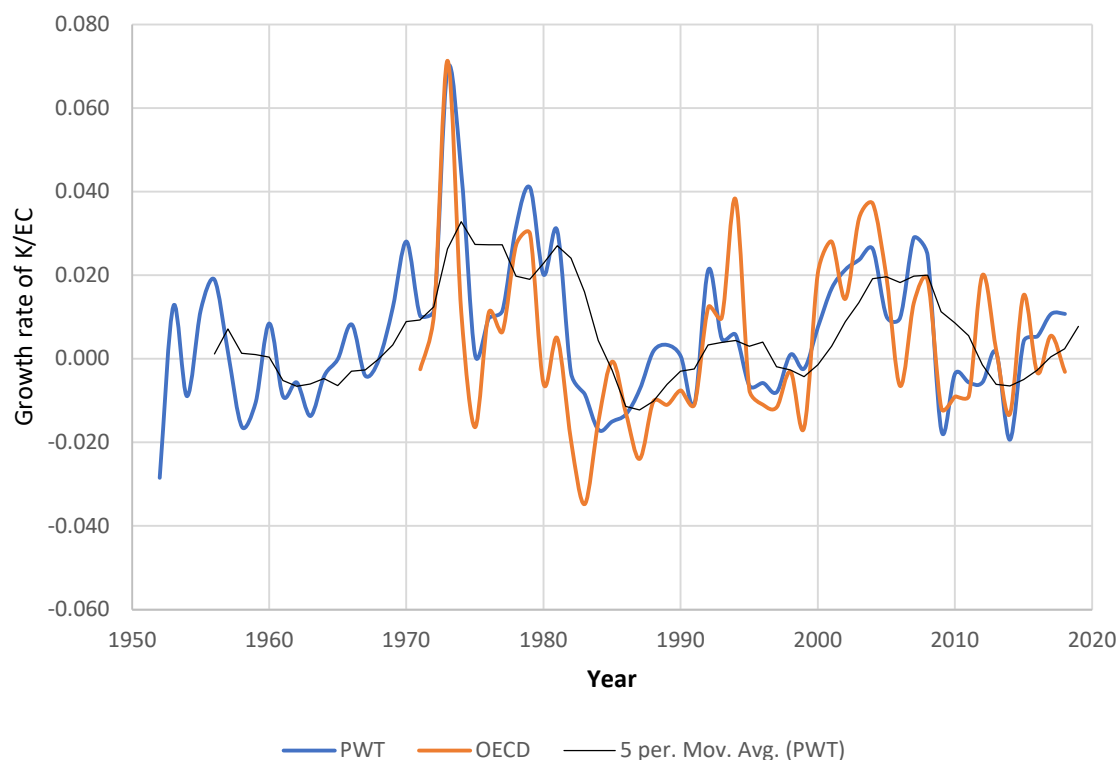


Figure 5.20: Capital to employee compensation ratio as a proxy for VCC



*Figure 5.21: Growth rate of of K/EC*

Both trends of Pr/EC and the reverse of K/EC resemble that of the RP. However, the resemblance is more pronounced between K/EC and the RP, presenting similar peaks and troughs. The similarity indicates the size of the impact of each ratio. A better way to assess the impacts of these variables is via examining their total growth over the year and how much they contributed to the RP's. The average annual growth rates of Pr/EC and K/EC are 0.001 and 0.006, respectively. In other words, the total growth of K/EC is almost ten times that of Pr/EC. These two parameters impact the RP in reverse. Thus, even if the two had worked in the opposite direction entirely over the 1952–2019 period, still K/EC would lead to a declining rate of profit. However, as discussed, they worked in tandem particularly up to the 1990s. That is why the fall and rise of the RP up to that point are steeper than in the 21st century.

Table 5.3 delves deeper into the impacts of Pr/EC and K/EC over the identified phases of the RP evolutions. It shows that during each phase, both parameters worked in tandem and impacted the movement of the RP the same way. In 1952–1964, Pr/EC had about 30% higher impact. In the stagflation of the 1970s, the rise of capital, reflected in K/EC, had almost three times the impact of Pr/EC. This relation was reversed in the recovery period of 1982–1996, during which Pr/EC had more than three times the impact. This result indicates that the global

neoliberal attack on labour did partially restore profitability. However, it was accompanied by destruction of capital, perhaps through declining investment compared to rising depreciation. Nevertheless, by 1997, this tactic lost its momentum, Pr/EC began its decline, and the rising K/EC has once more taken the leading role in driving the RP down.

*Table 5.3: Average annual growth rates of Pr/EC and K/EC*

<b>Period</b>	<b>Growth of Pr/EC</b>	<b>Growth of K/EC</b>
1952–1965	0.005	-0.003
1965–1982	-0.008	0.019
1982–1997	0.011	-0.003
1997–2019	-0.003	0.006
1952–2019	0.001	0.006

Another way of investigating the growth of the RP is via its decomposition into PS and OCR, sometimes referred to as capital productivity (CP), defined as Pr/GDP and GDP/K, respectively. As Figure 5.22 shows, the world's PS is almost constant between 1952 and the mid-1960s. It drops till 1970, then rises till 2010 and declines slowly after that. There are two local and short-lived dips in PS in the early and late 1990s, which can also be seen in Figure 5.23 where the growth rate becomes negative. PS curves, similar to Pr/EC curves, are not parallel. The reason is the role of depreciation, which is discussed later in this section.

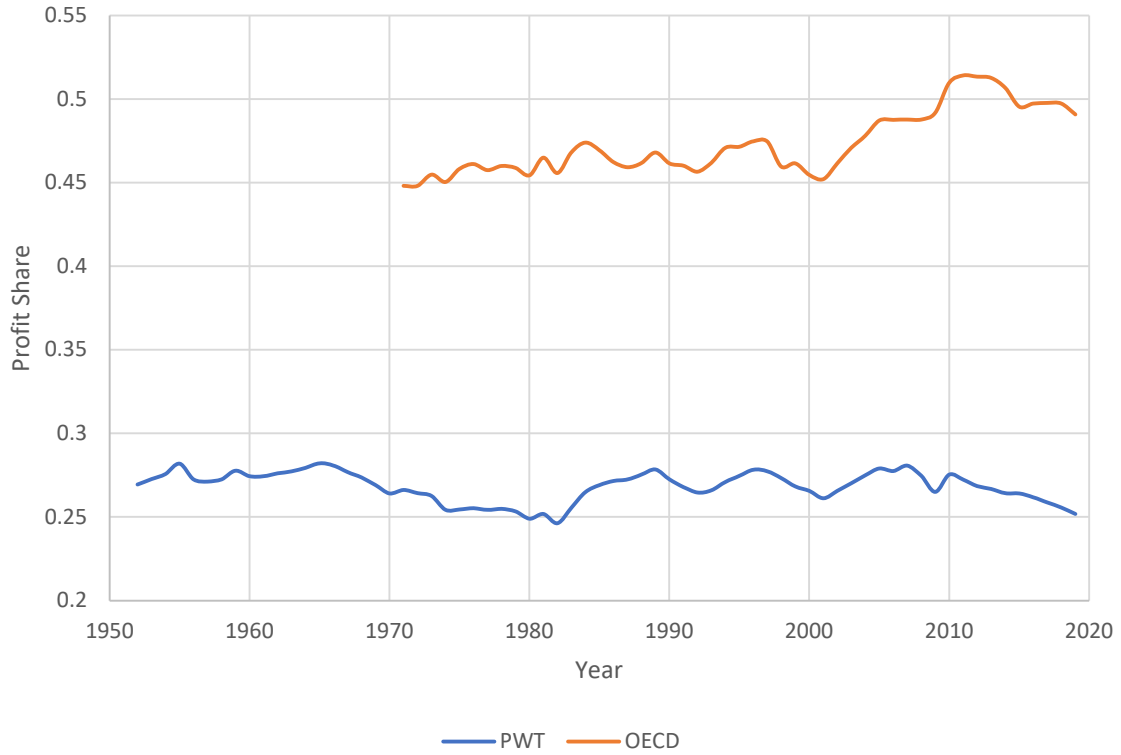


Figure 5.22: Profit share (Pr/GDP)

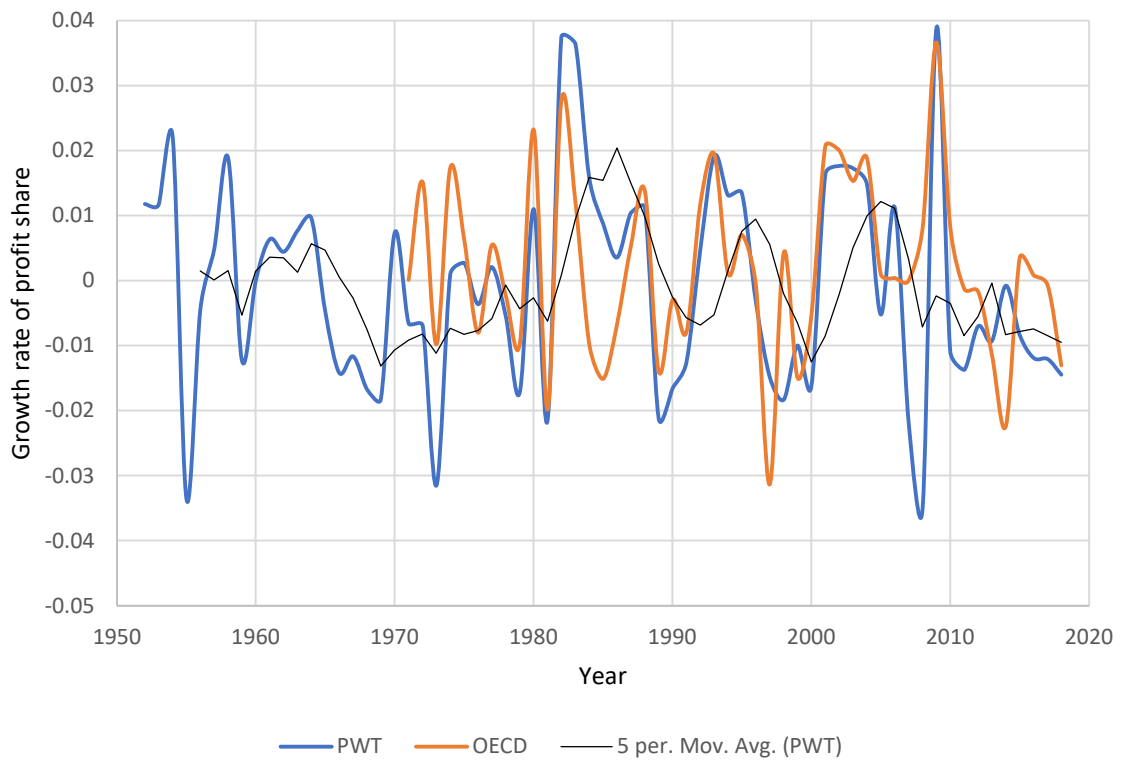
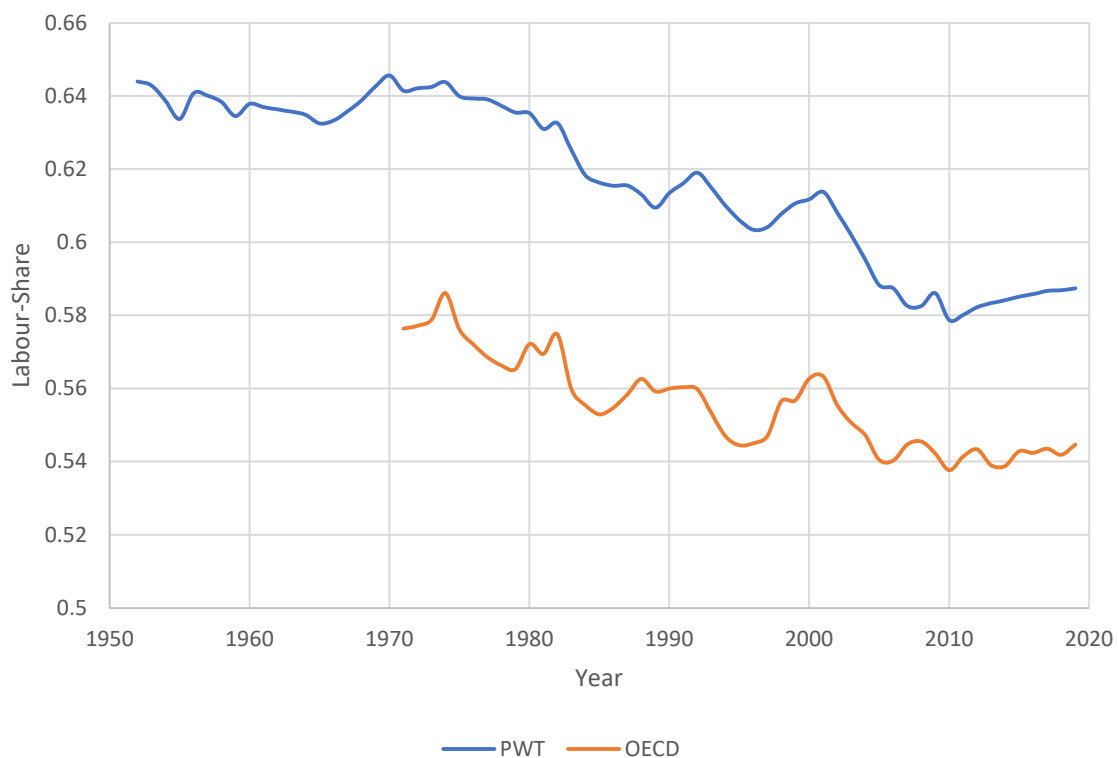


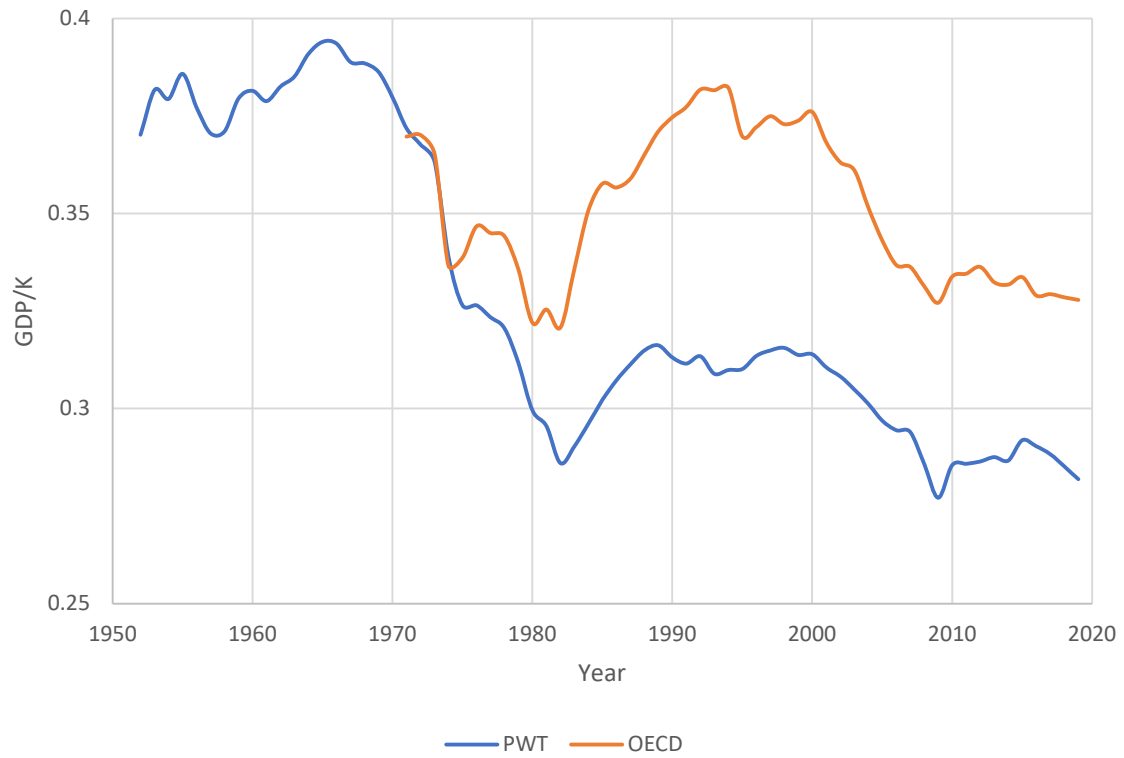
Figure 5.23: Growth rate of the profit share

A closely related variable to the profit share is the labour share, defined as  $EC/GDP$ . It is another metric that relates to the distribution of value added between labour and capital. Assuming zero depreciation, LS is equal to  $(1 - PS)$  and its curve a mirror opposite of PS's. Figure 5.24 shows the evolution of LS since 1952. This period can be divided into three phases: until 1970 LS remains almost constant, declines till 2010, and slowly rises after that. There are two local peaks in the beginning and end of the 1990s. Because depreciation does not affect LS, unlike PS, here the PWT and OECD curves are almost parallel again.

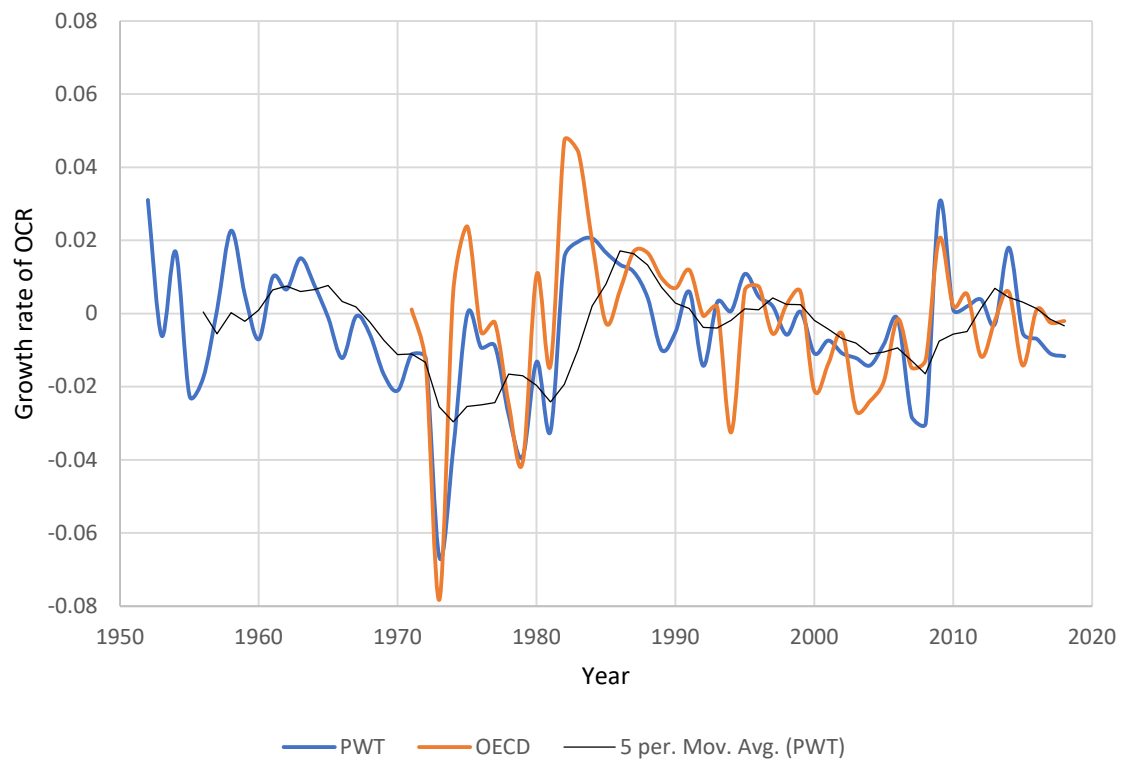


*Figure 5.24: Labour share (EC/GDP)*

Figure 5.25 presents the evolution of the OCR. It increases between 1952 to the mid-1960s, then drops sharply until the early 1980s, rises slightly till the mid-1990s, without completely recovering its loss during the last period. It then declines till late 2000s, losing all its gain in the previous phase. Despite a short but temporary recovery after the 2009 crisis, the rate continues its decline. The evolution of the growth rate of the OCR is presented in Figure 5.26.



*Figure 5.25: Output-to-capital ratio (GDP/K)*



*Figure 5.26: Growth rate of OCR*

The trend of the OCR is similar to that of the RP. Its peaks (mid-1960s and early 1990s) and trough (early 1980s) occur at the same time as RP's. The same is not true for the trend of PS. This difference indicates the stronger impact that capital productivity has had on the evolution of the RP compared to the PS. The assessment of this claim can be done by considering how much each part contributed to the growth of the RP.

As Table 5.4 shows, average annual growth rates of the OCR and PS over the period of 1952–2019 are -0.001 and -0.004, respectively. In other words, the impact of the OCR on the decline of the RP is more than four times that of PS's. In all four phases, the OCR and PS affected the RP in the same direction, with the OCR having a higher impact in all phases except in 1982–1996.

*Table 5.4: Average annual growth rates of PS and the OCR*

<b>Period</b>	<b>Growth of Pr/GDP</b>	<b>Growth of GDP/K</b>
1952–1965	0.004	0.005
1965–1982	-0.008	-0.019
1982–1997	0.008	0.006
1997–2019	-0.004	-0.005
1952–2019	-0.001	-0.004

Figure 5.27 compares the trends of employee compensation with profits including and excluding depreciation, which, in national accounts terms, are gross operating surplus (GOS) and net operating surplus (NOS), respectively. The magnitudes are normalised on the 1952 levels to facilitate comparison. The trend of EC shows a closer proximity to net profits, indicating how depreciation consumes a notable part of value added, making it inaccessible to either capital or labour. The graph is another expression of why the PS is not an exact mirror of wage share. Other than this impact, the growth rates of profits (both measures) and wages have followed a closely similar path over the past seven decades (see Figure 5.28).

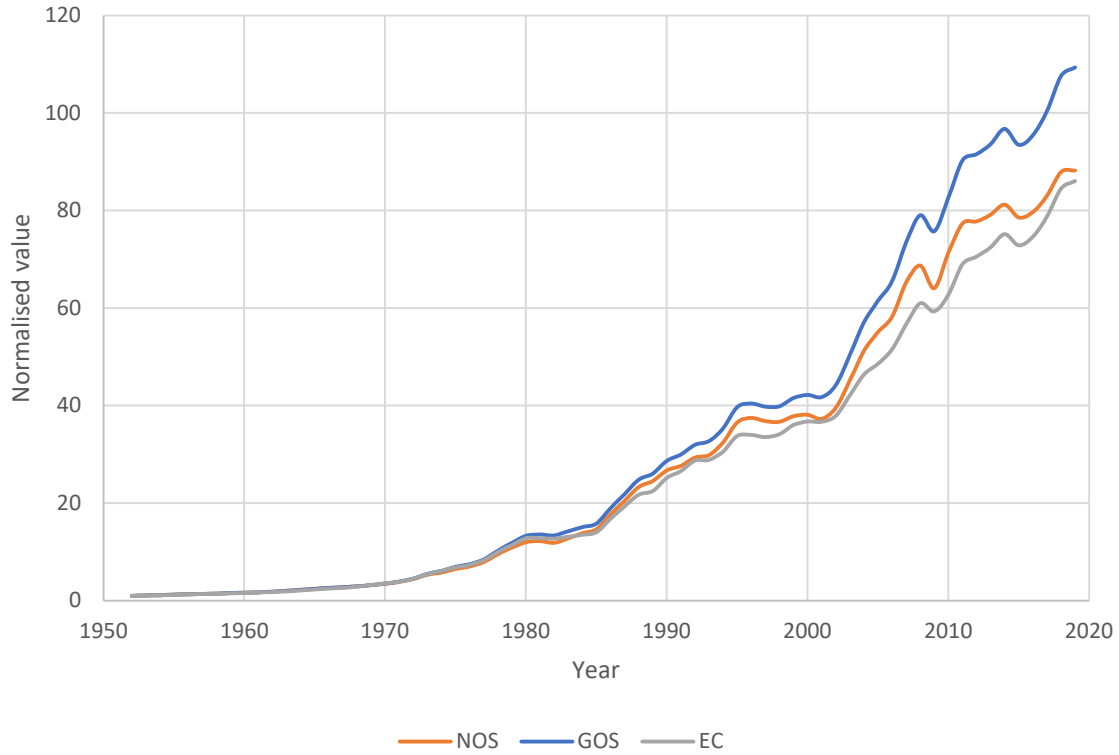


Figure 5.27: Profits and employee compensation (normalised on the 1952 levels)

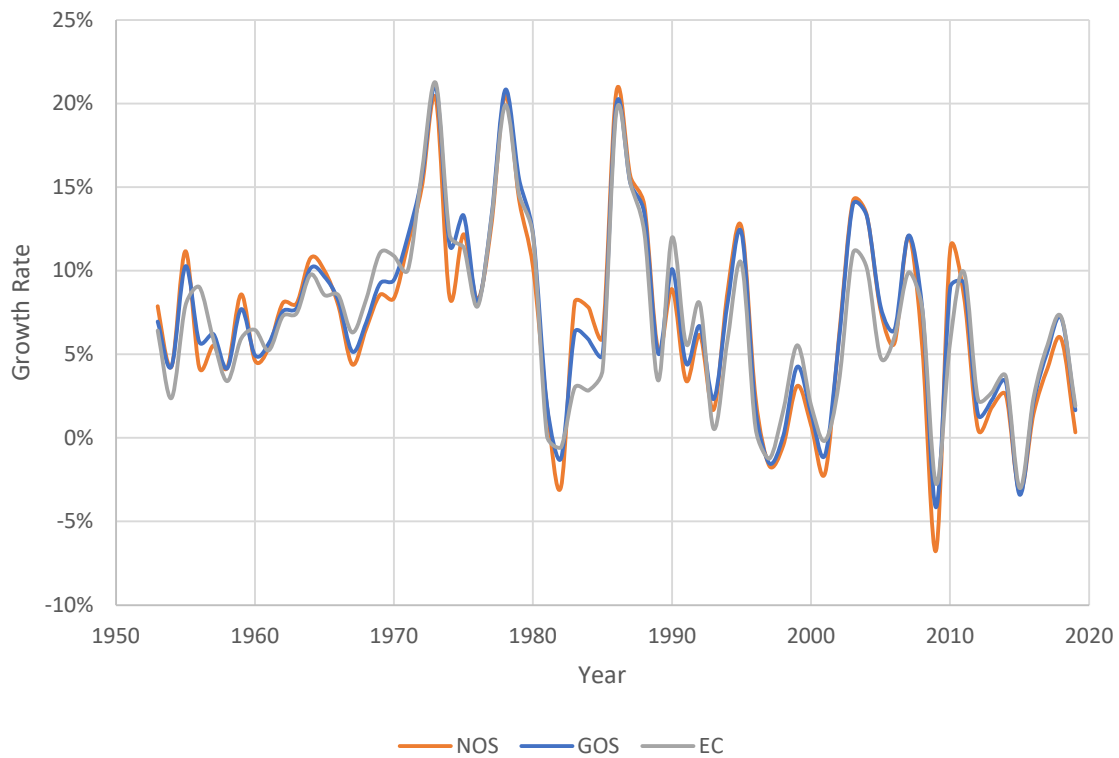


Figure 5.28: The growth rates of profits and the compensation of employees

The discussion above shows that irrespective of the choice of the decomposition of the RP, technological change has had a stronger impact on the trend of the RP compared to the distributional effects. This finding is similar to Basu et al. (2022) and Roberts (2012; 2015). By contrast, Li, Xiao and Zhu (2007: 46) associate the trend of the world RP to the rise of the cost of labour and taxation. They reject the role of technological change as the main driver of the fall of the RP. The findings in this thesis do not support their argument.

Basu et al. (2022: 1, 23) find that from 1960 to 2019 the WRP fell, and technological change has been the driving force. They divide the period into 1960–1980 and 1981–2019 and note that technological change has played the same role in both sub-periods. Although the findings in this thesis generally support their conclusion, their choice of dividing the period into two conceals the role of countertendencies. As I presented here, during 1952–1965 and 1982–1997, the P/EC as a proxy for the RSV has been the driving force of the upward trend of the RP. Nevertheless, over the entire period the impact of EC/K has been much stronger than P/EC, leading to an overall decline of the WRP.

The factors discussed in this section, technological change, and the distributional effects, are the most important determinants of the trend of the WRP. However, the rate is influenced by other factors, most importantly depreciation. Moreover, the WRP is the weighted average of national economies' RPs. The individual RPs have different trends and impact the world rate differently. These factors are discussed in the next sections.

### **5.2.3. Depreciation and investments**

When the stock of capital grows faster than profits the RP falls. Considering the PWT World-1 sample, whose RP fell during the 1952–2019 period, the average growth rate of capital stock over has been 7.6%. However, the average growth rates of GOS and NOS, the measures of profits in the  $RP^{SA}$  and  $RP^A$ , have been 7.4% and 7.1%, respectively. The difference between GOS and NOS is depreciation, whose accelerating growth is reflected in the faster growth of GOS. This issue is visualised in the divergence between the GOS and NOS curves in Figure 5.27.

Figure 5.29 and Figure 5.30 show that not only has depreciation rate risen steadily over the studied period, but its growth rate has also increased since the early 1980s. The accelerating growth means that an element of the cost of production has been rising, which, *ceteris*

*paribus*, reduces profits and profitability. Figure 5.31 presents the contribution of EC, NOS, and depreciation to the value added. It shows that the share of EC has consistently declined since 1952, NOS has remained almost constant, while depreciation has increased.

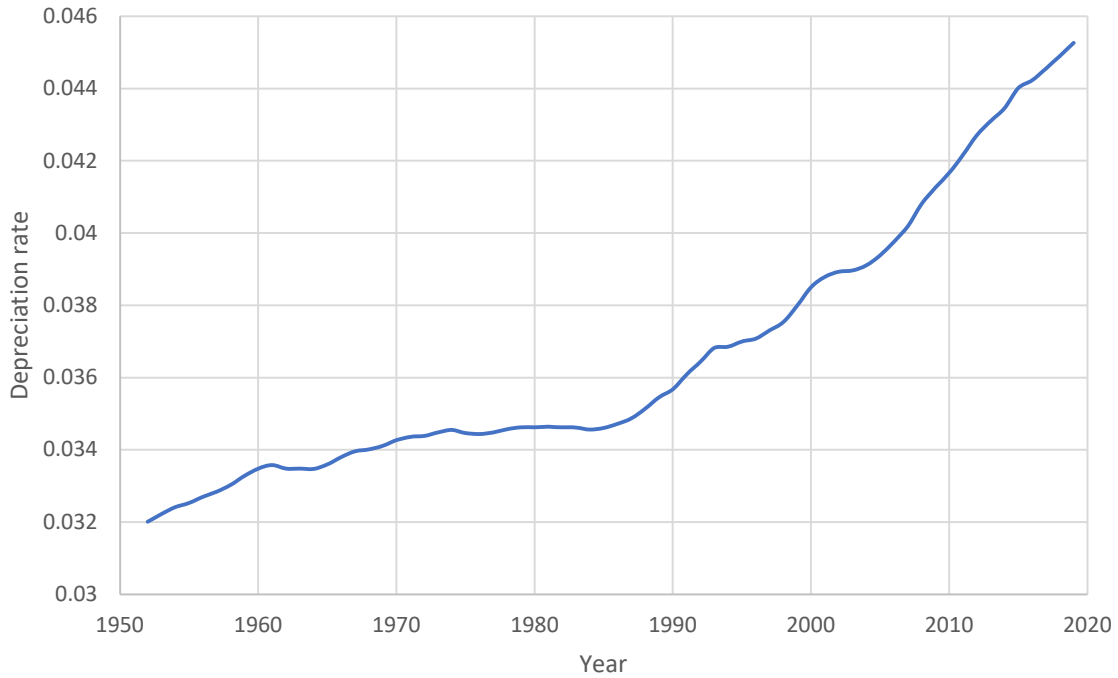


Figure 5.29: Evolution of depreciation rate ( $D/K$ )

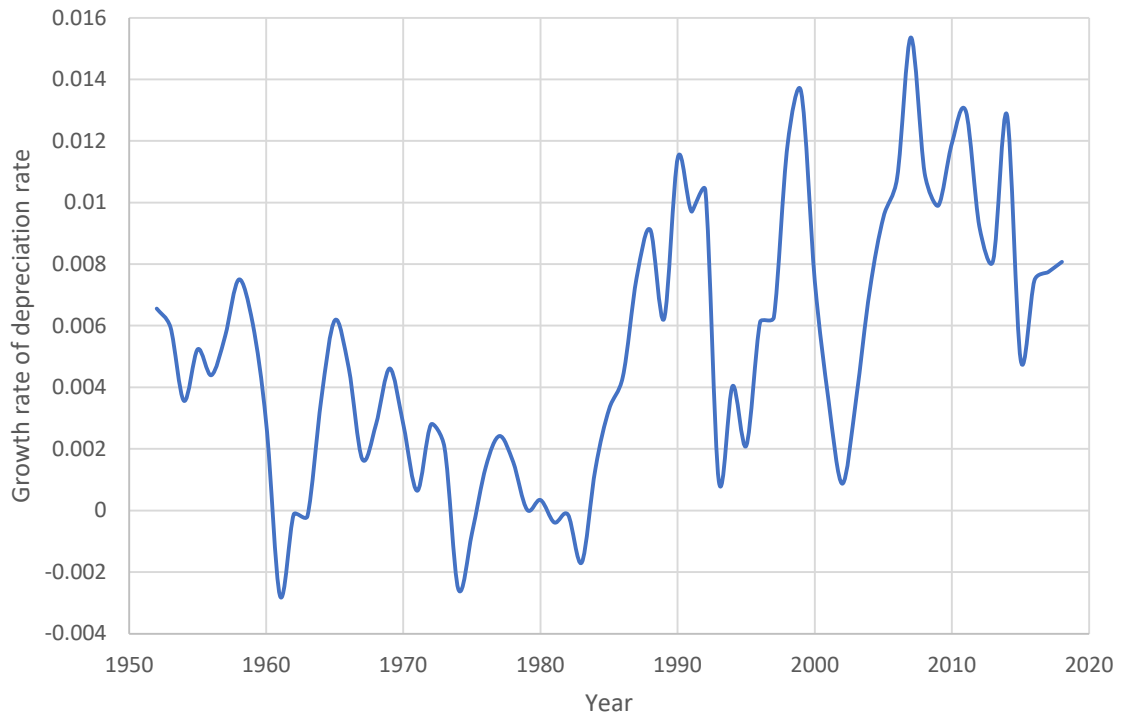
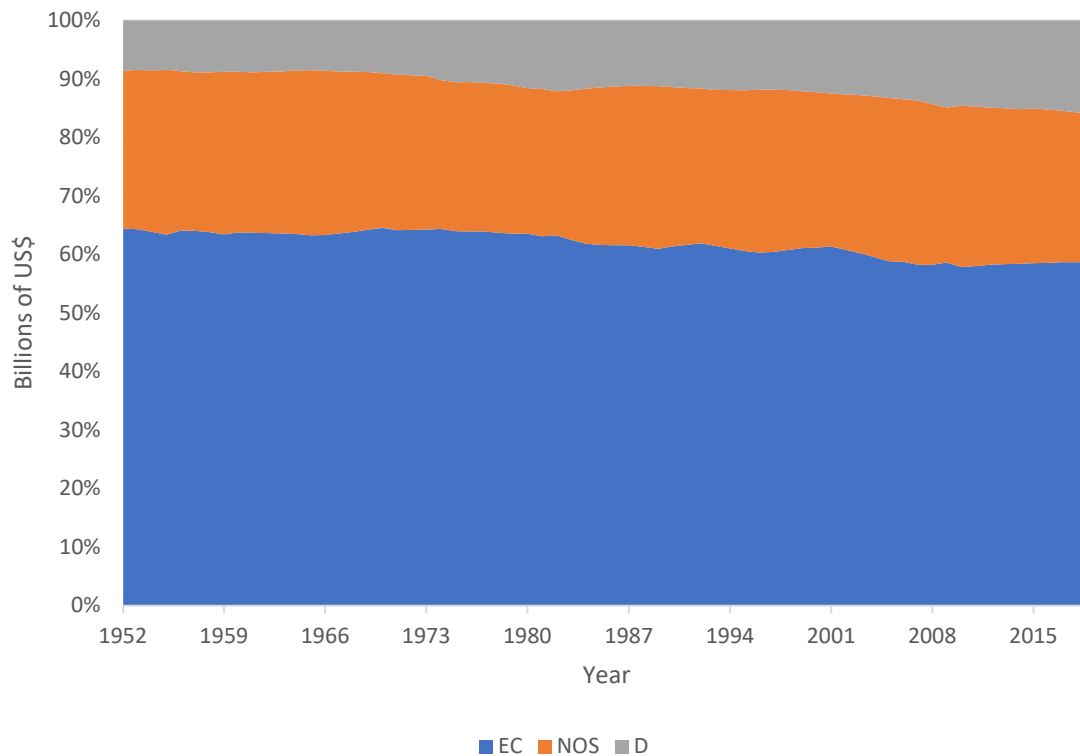


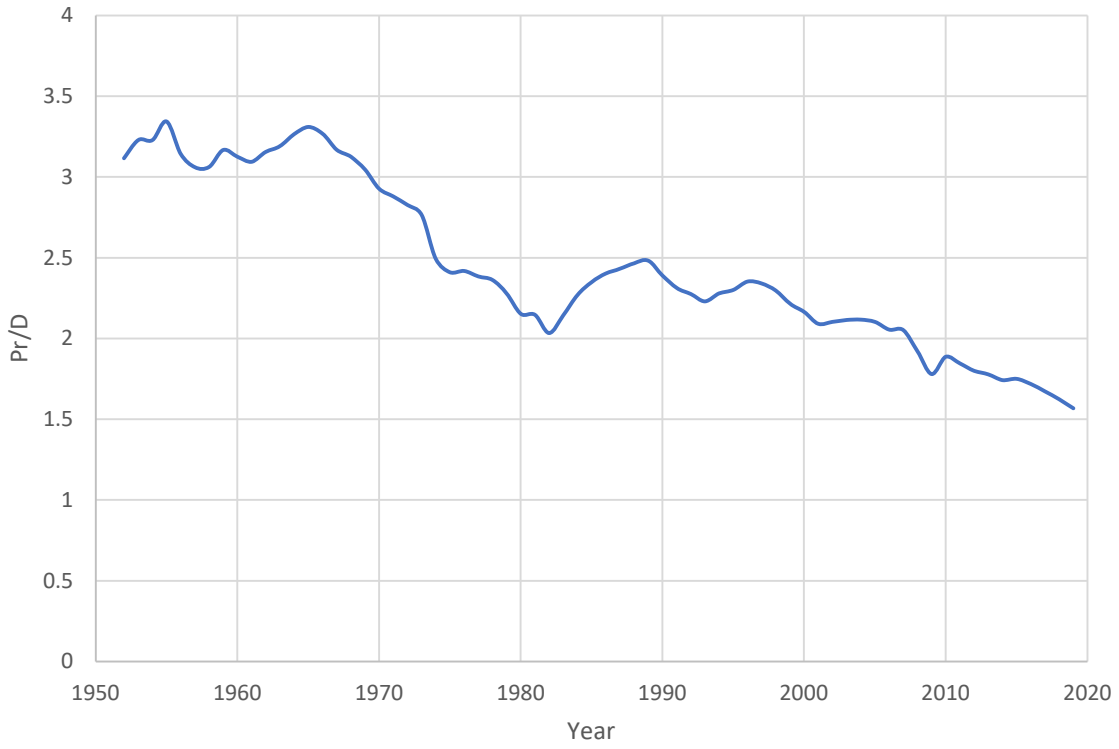
Figure 5.30: Growth rate of depreciation rate



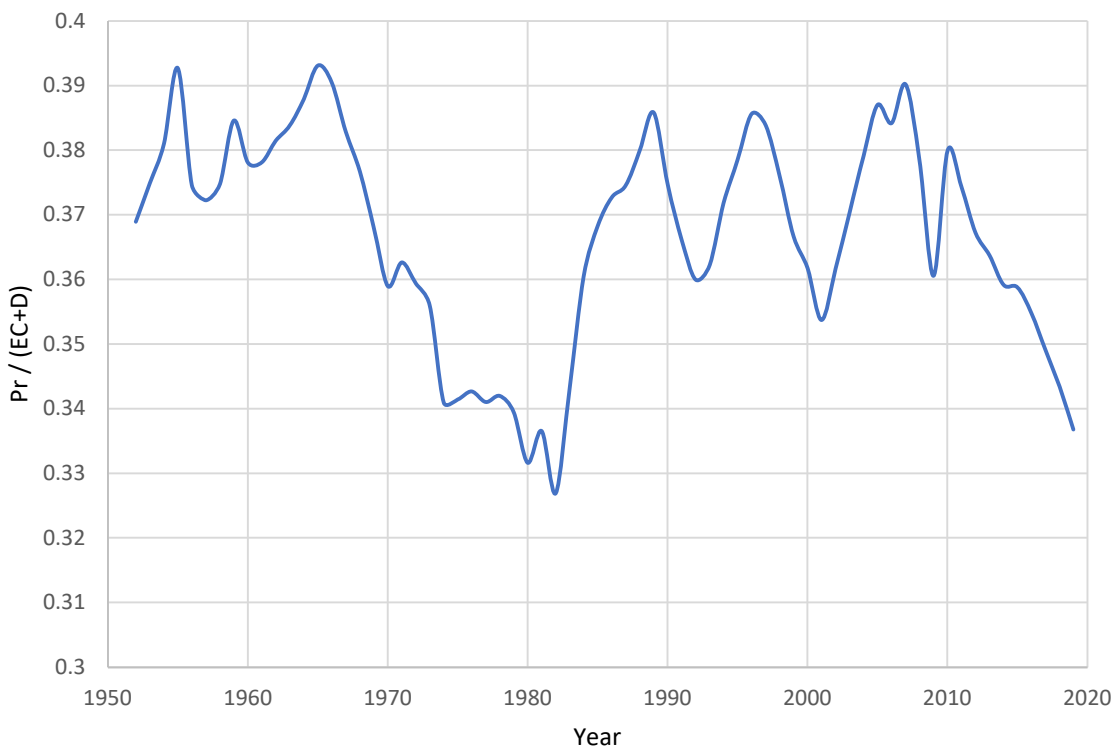
*Figure 5.31: The contribution of wages, profits, and depreciation to the value added*

Depreciation is the reason why the PWT's and OECD's PS (see Figure 5.22) and Pr/EC (see Figure 5.18) curves are not parallel like in other figures. As mentioned before, the OECD rate is  $RP^{SA}$ , i.e. depreciation is not deducted from the numerator. But PWT's  $RP^A$  is exclusive of depreciation. Depreciation is also why, in the case of PWT, PS (see Figure 5.22) is not a mirror of LS (see Figure 5.24). Without depreciation, these two parameters add up to one and their patterns are mirrored. This is the case with OECD curves.

Figure 5.32 shows the profits (depreciation-exclusive) to depreciation (Pr/D) ratio using the PWT data. Considering that Pr rises over the period, the downward trend of the rate highlights the depreciation growth outpacing profit growth. This ratio somewhat resembles  $PM^A$ , i.e. the ratio of profits to the flow of capital including intermediate inputs, depreciation, and wages. A closer measure would be the ratio of profits to wages and depreciation. This ratio is presented in Figure 5.33. Although it is an entirely different ratio from the  $RP^A$ , there are some similarities including the trough of 1982 and the declining trend after 2010.



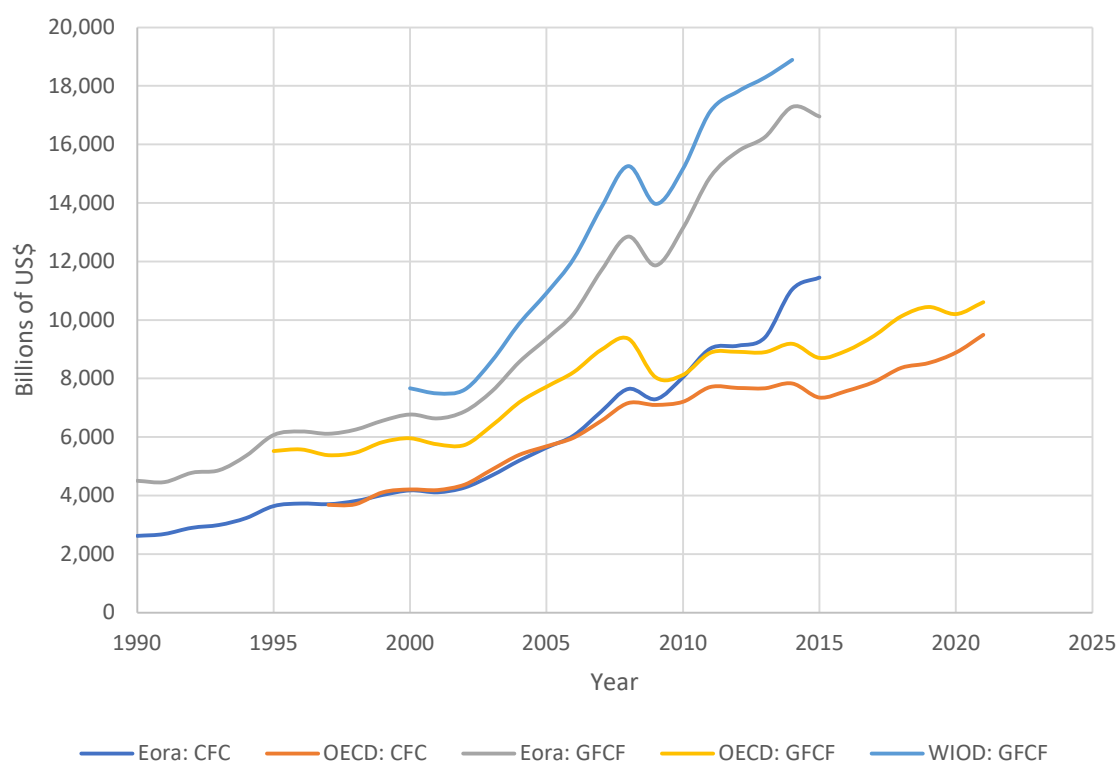
*Figure 5.32: Profits to depreciation ratio*



*Figure 5.33: The ratio of profits to depreciation and employee compensation*

To further explore the drivers of the depreciation growth, I consider industrial shares of world depreciation. As discussed before, at the time of writing, only three databases offer world data at the industrial level: the Eora, WIOD, and OECD. These sources have limitations. First, timescales vary among the three and all are too short to investigate the cause of increasing pace beginning in the 1980s. The Eora covers 1990 to 2015, WIOD 2000 to 2014, and OECE 1995 to 2021 for investment and 1997 to 2021 for depreciation. Second, the numbers and definitions of industries vary among them. Third, WIOD does not offer depreciation measures. That is why investment figures are also examined and presented in Table A.10, Table A.11, and Table A.12. At the level of industries, investment figures differ substantially from depreciation numbers. The largest industry in terms of investment is construction (both for the world and OECD countries, based on all three sources). In terms of depreciation, the largest sector, in the Eora terms, is Financial Intermediation and Business Activities, and in the Eora is Real Estate. Manufacturing is the second sector both in terms of investment and depreciation. The Financial Intermediation and Business Activities sector includes finance, insurance, real estate, and business activities, including computers and research and development (Lenzen et al. 2013: 30; United Nations 1990: 50-51). Using OECD data, it is evident that among these industries, real estate has the largest share of depreciation.

At the aggregate level (see Figure 5.34), total investments and total depreciations have almost parallel trends, but investments tend to be slightly larger. That is why investment numbers can act only as a rough proxy for depreciation and only at the aggregate level. The notable magnitude difference between the OECD and the Eora curves is at least partly due to the absence of countries such as China and India in the former. The graphs follow a similar trend until 2009. The change afterwards points to a shift in capital investment and consumption in OECD countries versus non-OECD countries.



*Figure 5.34: World investment and depreciation by different sources*

The average growth rate of aggregate parameters are summarised in Table 5.5 and presented in Figure 5.35 and Figure 5.36 for the OECD and Eora samples, respectively. For the world (based on the Eora), the average growth rate of depreciation over the past three decades (6.2%) is higher than that of investment (5.6%). The result is a slowing growth rate of capital accumulation. For OECD countries (based on OECD), both average growth rates of depreciation (4.1%) and investment (2.7%) are lower than the world rates. The difference between the two rates is higher than the difference for the world. In other words, the pace of capital accumulation is slower for OECD countries. Both growth rates have downward sloping trends for these countries.

*Table 5.5: Growth rates of world investment and depreciation*

<b>Parameter</b>	<b>Eora</b>	<b>OECD</b>	<b>WIOD</b>
Depreciation – Annual Average	6.2%	4.1%	-
Depreciation – Linear Slope	0.15%	-0.14%	-
Investment – Annual Average	5.6%	2.7%	6.9%
Investment – Linear Slope	0.08%	-0.02%	-0.18%

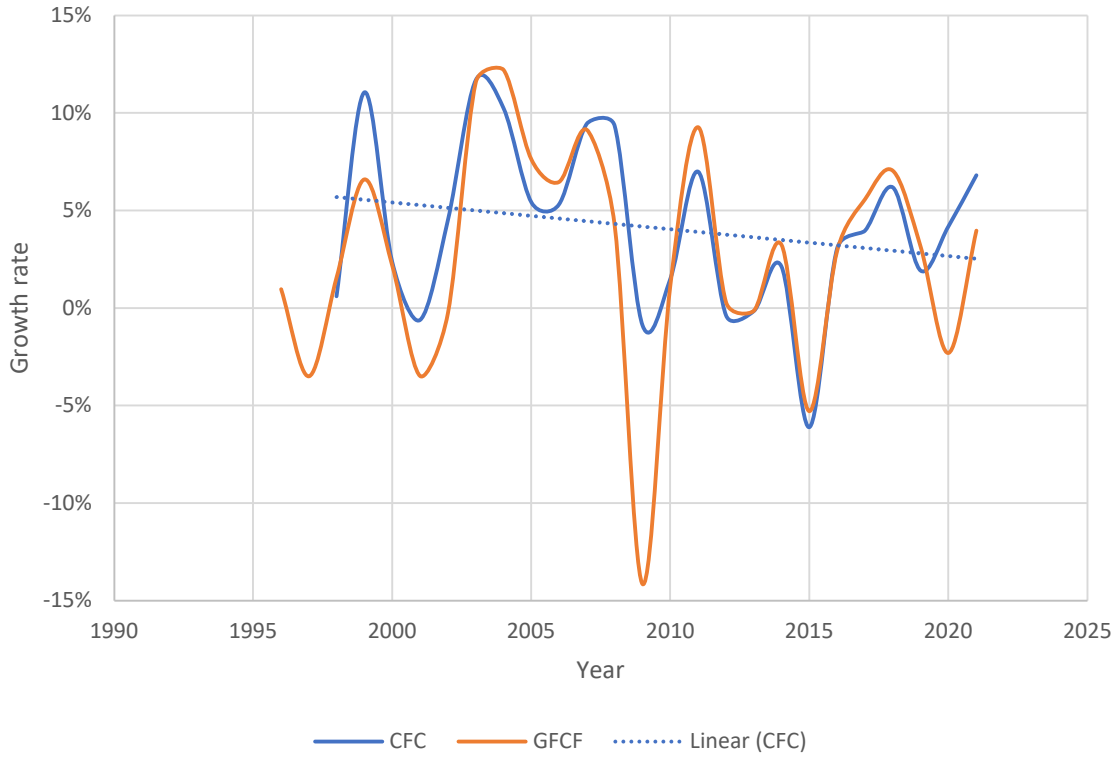


Figure 5.35: Growth rates of investments (GFCF) and depreciation (CFC) (OECD)

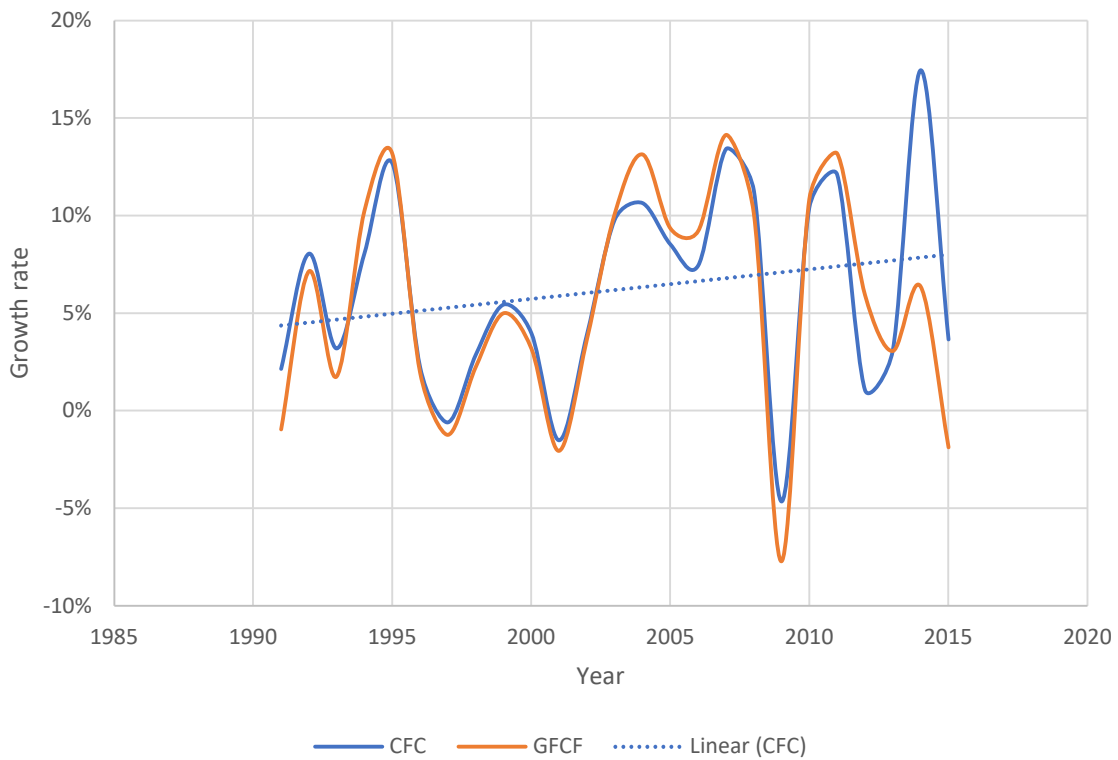
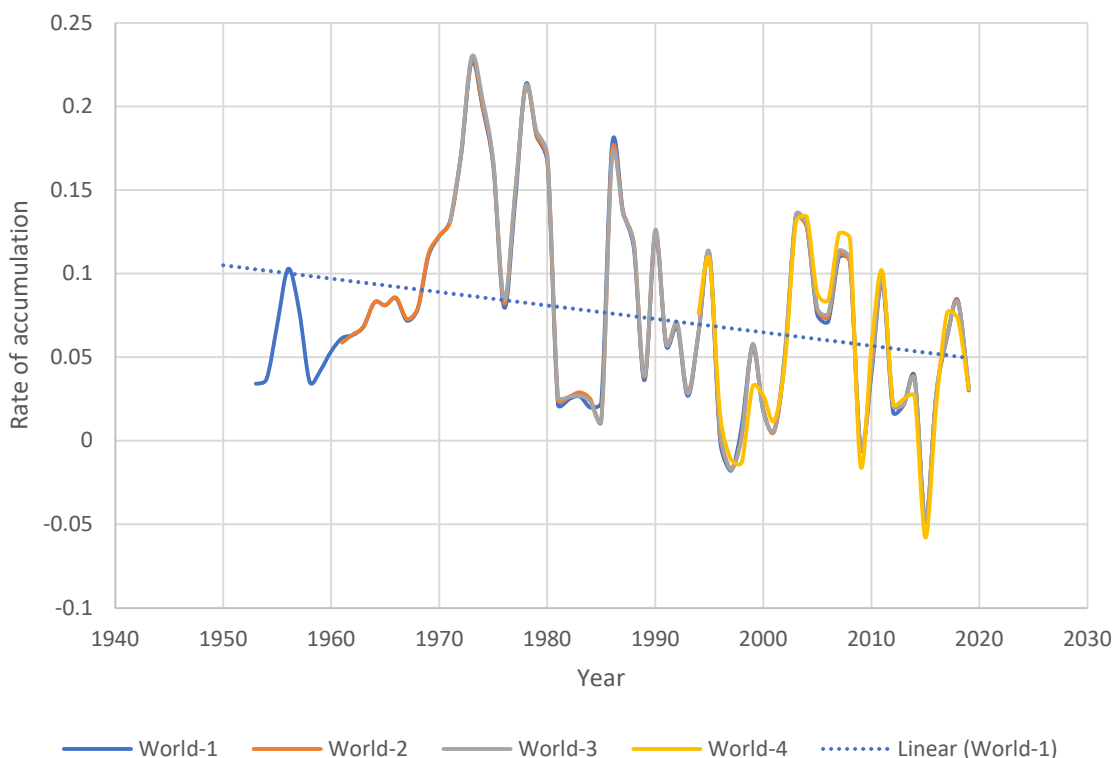


Figure 5.36: Growth rates of investments (GFCF) and depreciation (CFC) (Eora)

Figure 5.37 presents the world's capital stock growth rate, i.e. the rate of accumulation, using PWT data. All four world samples show downward trends, indicating that world capital stock is growing more slowly as time passes. At several points, e.g. 1997, 2009, and 2015, the growth rate became negative. In those years, depreciation outpaced investment and the magnitude of world capital stock fell compared to the previous years. The almost identical curves show that the trend is irrespective of the size of the samples, particularly because the major economies in terms of capital stock, e.g. the US, China, and Japan, are part of all four samples.



*Figure 5.37: The world's rate of accumulation (PWT)*

An important aspect of the movement of the WRP is that it is an aggregate of several national RPs. It is expected that some countries have more impact on the movement of the WRP compared to others. The next section explores this aspect.

#### **5.2.4. Individual countries' RPs**

This section focuses on the countries comprising the PWT World-1 and assesses the trends of their RPs. The impacts of technological and distributional effects are also noted for each country. The relationship between the trend of the RP and development status, based on the

United Nations (2022) classification,<sup>1</sup> is also explored. Moreover, the evolution of the weight of countries in the constructed world is considered for selected countries to demonstrate how individual countries' RPs can influence the trend of the WRP. The results demonstrate that the majority of countries have downward trending RPs, driven by the technological change. While the trend of the RP is independent from the development status, developing countries tend to have higher RPs than the world average.

Table 5.6 summarises the results of country analyses. Assuming a linear trend for the RP, only five of the 32 countries in this sample have RPs with positive slopes: Canada, Kenya, Netherlands, Nigeria, and Norway. In other words, about 84% of countries, irrespective of their development levels, have experienced declining profitability. The driving force of the downward trend of the RP has been technological change. The only exception is the Philippines, whose rising RSV has hindered its profitability.

Comparing the average RPs over the 1952–2019 period, 19 countries had RPs higher than the WRP: China, Colombia, Costa Rica, Egypt, India, Italy, Kenya, Morocco, New Zealand, Paraguay, Philippines, South Africa, Spain, Sri Lanka, Sweden, Taiwan, Thailand, United Kingdom, and United States. The countries whose RPs are on average lower than the WRP are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Japan, Netherlands, Nigeria, Norway, and Switzerland. In short, all developing countries, except Nigeria, had RPs higher than the world's. By contrast, only seven of 19 developed countries' RPs are higher than the WRP. In short, developing countries' profit rates are more likely to be higher than the WRP. Maito (2014; 2018) reports similar results for core and periphery countries.

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<sup>1</sup> The United Nations (2021) notes that the developed/developing classification was introduced in 1996 only for statistical purposes and has been eventually removed from its publications. Nevertheless, this thesis uses this distinction as a comparison tool due to its vast use in academic publications.

Table 5.6: Details of the RPs and determining factors of countries in PWT World-1

Country	UN Classification	Average RP <sup>A</sup>	Average Growth			Slope of linear trend			RP Tendency	Dominant factor	ARP compared to World
			RP (%)	RSV (%)	VCC (%)	RP (%)	RSV (%)	VCC (%)			
Australia	Developed	7%	-0.10	0.60	0.80	-0.01	0.25	4.56	Fall	VCC	Lower
Austria	Developed	8%	-0.30	0.00	0.40	-0.05	0.05	4.14	Fall	VCC	Lower
Belgium	Developed	8%	-0.20	0.10	0.60	-0.01	0.06	1.61	Fall	VCC	Lower
Canada	Developed	7%	0.40	1.20	0.80	0.04	0.34	3.29	Rise	RSV	Lower
China	Developing	14%	-1.10	-0.40	1.00	-0.12	-0.06	2.86	Fall	VCC	Higher
Colombia	Developing	17%	-0.70	-0.20	0.60	-0.12	-0.16	2.28	Fall	VCC	Higher
Costa Rica	Developing	20%	0.20	-0.10	0.20	-0.10	-0.13	0.86	Fall	VCC	Higher
Denmark	Developed	8%	-0.10	0.00	0.20	-0.04	-0.09	1.16	Fall	VCC	Lower
Egypt	Developing	41%	-0.10	0.30	1.10	-0.16	0.25	1.91	Fall	VCC	Higher
Finland	Developed	8%	-0.60	0.80	1.50	-0.05	0.28	6.20	Fall	VCC	Lower
France	Developed	7%	-0.60	-0.10	0.60	-0.05	0.04	4.26	Fall	VCC	Lower
Germany	Developed	7%	-1.10	-0.20	1.00	-0.09	-0.02	4.96	Fall	VCC	Lower
India	Developing	13%	-0.20	1.40	1.80	-0.06	0.76	6.49	Fall	VCC	Higher
Italy	Developed	12%	-0.70	0.20	0.90	-0.12	0.20	7.02	Fall	VCC	Higher
Japan	Developed	9%	-0.50	-0.10	0.60	-0.13	-0.11	7.77	Fall	VCC	Lower
Kenya	Developing	13%	1.00	1.60	1.00	0.07	0.49	2.35	Rise	RSV	Higher
Morocco	Developing	17%	-0.30	-0.20	1.10	-0.23	-0.25	4.88	Fall	VCC	Higher
Netherlands	Developed	7%	0.50	0.90	0.60	0.00	0.34	4.49	Rise	RSV	Lower

Country	UN Classification	Average RPA	Average Growth			Slope of linear trend			RP Tendency	Dominant factor	ARP compared to World
			RP (%)	RSV (%)	VCC (%)	RP (%)	RSV (%)	VCC (%)			
New Zealand	Developed	11%	-0.50	0.20	1.00	0.00	0.30	2.82	Fall	VCC	Higher
Nigeria	Developing	2%	-15.00	-6.80	2.00	0.14	1.01	3.25	Rise	VCC	Lower
Norway	Developed	9%	0.60	1.00	0.50	0.10	0.73	1.93	Rise	RSV	Lower
Paraguay	Developing	18%	-0.30	0.10	1.20	-0.16	0.02	4.68	Fall	VCC	Higher
Philippines	Developing	22%	-0.40	-0.40	0.10	-0.12	-0.18	1.65	Fall	RSV	Higher
South Africa	Developing	13%	-0.20	0.00	0.70	-0.03	0.16	1.82	Fall	VCC	Higher
Spain	Developed	10%	-0.70	0.10	1.00	-0.14	-0.06	6.16	Fall	VCC	Higher
Sri Lanka	Developing	31%	-0.90	0.00	1.70	-0.25	0.37	4.12	Fall	VCC	Higher
Sweden	Developed	9%	-0.50	-0.10	0.40	-0.03	0.14	3.48	Fall	VCC	Higher
Switzerland	Developed	4%	0.80	0.20	-0.10	-0.01	-0.05	-0.34	Fall	VCC	Lower
Taiwan	Developed	11%	-0.20	0.20	0.80	-0.14	-0.03	3.05	Fall	VCC	Higher
Thailand	Developing	11%	-0.60	-0.30	0.70	-0.18	-0.25	2.95	Fall	VCC	Higher
United Kingdom	Developed	15%	-1.30	-0.50	0.90	-0.15	-0.33	2.10	Fall	VCC	Higher
United States	Developed	9%	-0.30	0.00	0.30	-0.03	0.01	1.78	Fall	VCC	Higher
World		9%	-0.50	0.10	0.60	-0.05	0.06	3.37	Fall	VCC	-

To delve deeper in the differences between the trends of developing and developed countries' RPs, I choose three countries with the highest weights from each group (see Table A.8). They are China, India, Nigeria, Germany, Japan, and the US. Figure 5.38 shows the weights of the selected countries in the world stock of fixed capital over the studied period. The US's share falls sharply till 1980 and fluctuates around 30% after that. Japan's share rises sharply till the mid-1990s but then falls with almost the same pace. Germany's share rises till the mid-70s, remains around the same level for about two decades and then falls. The share of India rises consistently from the mid-1990s, but its level remains small. Nigeria has a notable increase in the share of the world capital in the 1970s till the mid-1980s. Its share falls sharply in the second half of the 1980s and remains around the same level after the 1990s. China's share of the stock of capital begins its sharp increase in the mid-1990s. Between 1994 and 2019, its weight in the world's stock of capital rises almost 20-fold from 1% to more than 19%.

Figure 5.39 and Figure 5.40 compare the RPs of developed and developing countries with the world's, respectively. The level and trend of the WRP closely resembles that of the US, with almost the same peaks and troughs. All developed countries and China have overall downward-trending RPs. Both India's and Nigeria's rates fell from 1950 to the mid-1980s and rose afterwards. China's and India's rates are consistently higher than the WRP. Japan's RP is notably higher than the WRP till the mid-1970s but is consistently below that since the 1990s. Germany's profit rate is lower than the WRP for most of the studied period. Nigeria's RP has a significant and sharp rise between the mid-2000s to the mid-2010s and a similarly sharp fall after that.

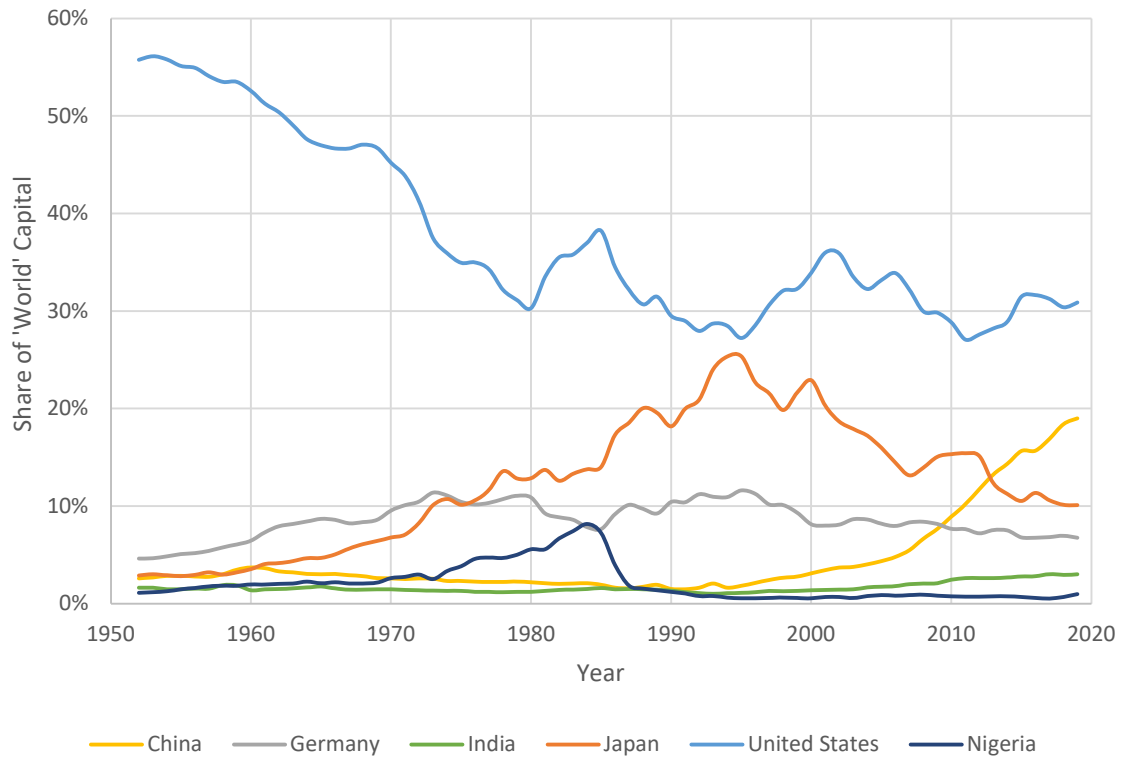


Figure 5.38: Share of countries of the World-1's stock of capital

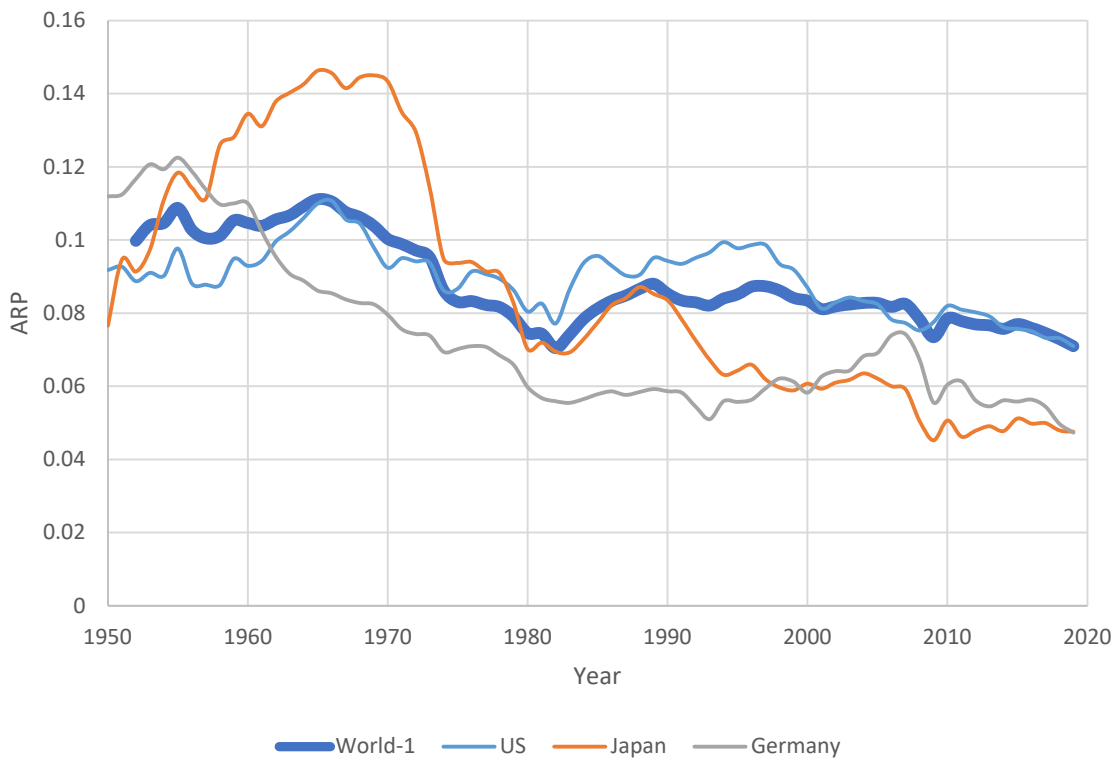
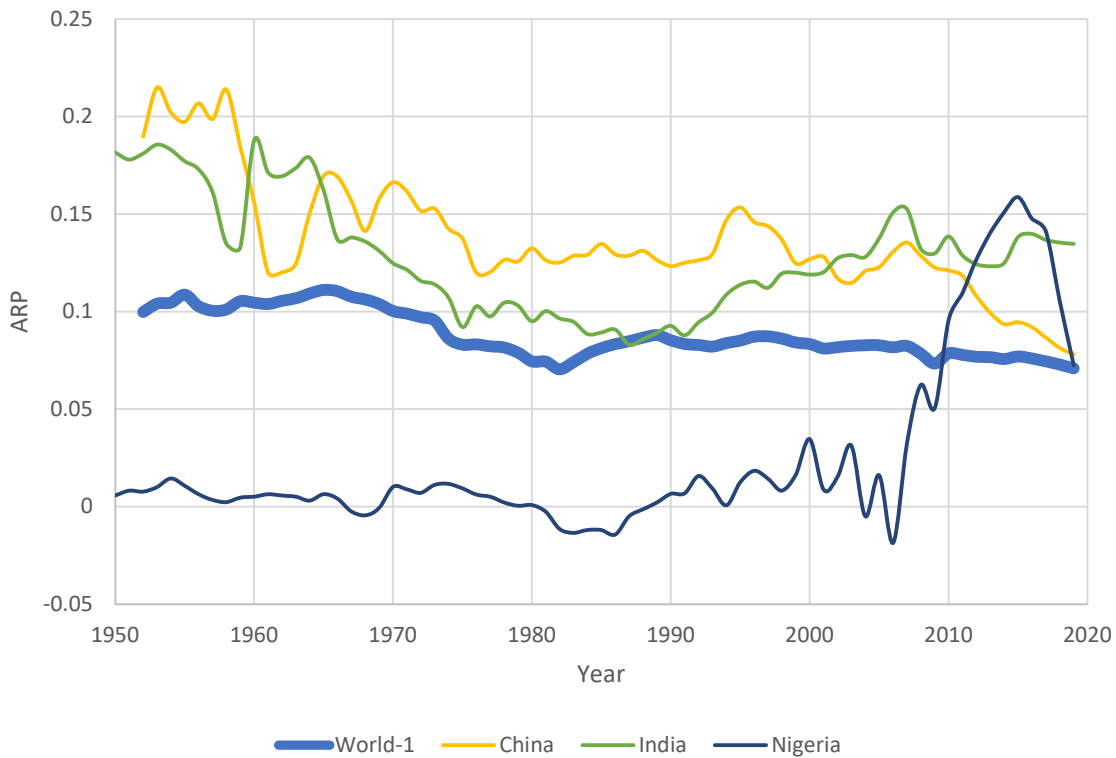


Figure 5.39: PWT World-1 vs developed countries

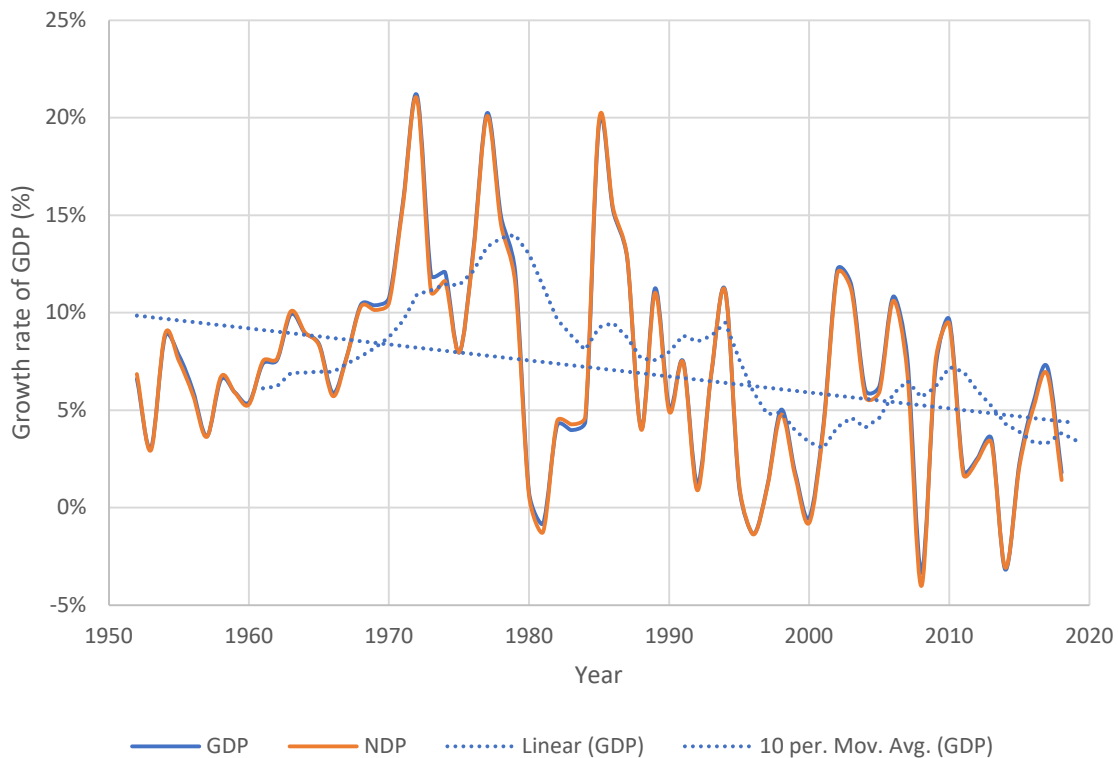


*Figure 5.40: PWT World-1 vs developing countries*

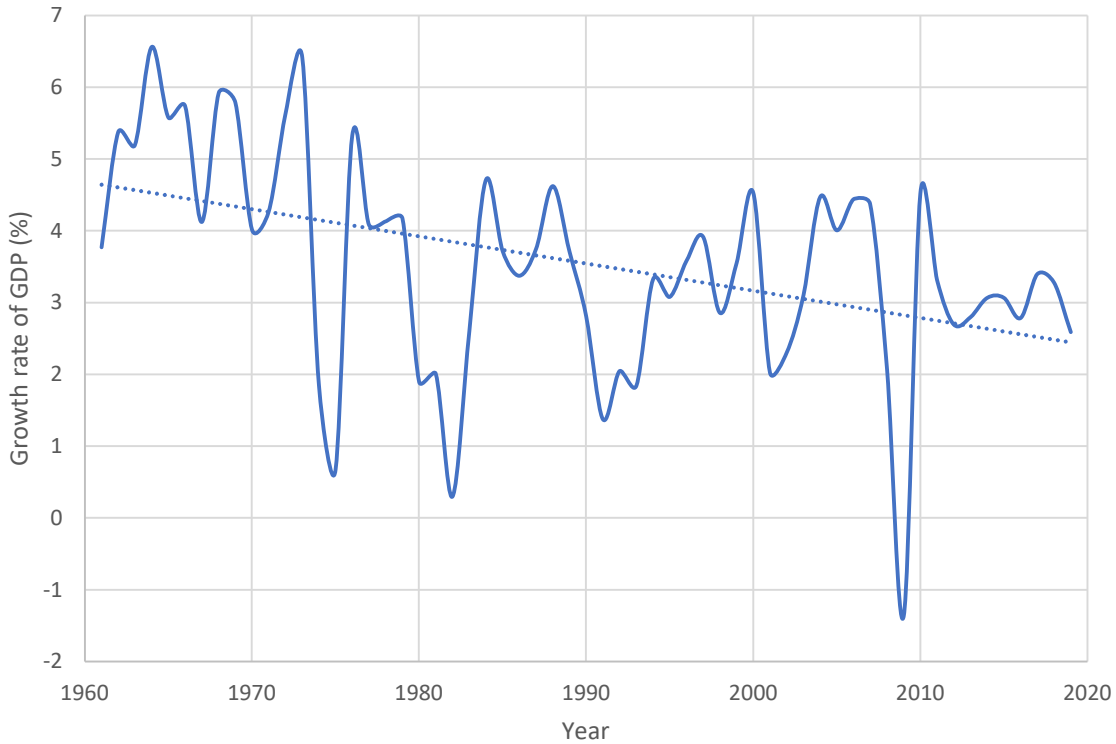
Nigeria is an exception case. Its currency was pegged to the USD until 1971 (0.713). It declined to 0.547 in 1980 but has risen exponentially since then, particularly from 1985 (0.894) to 1993 (22.065) and from 1998 (21.886) to 2022 (425.979) (PWT 2023; World Bank 2024b). The substantially turbulent exchange rate is the main cause of the unusual valuation of its stock of capital when transformed to USD and consequently its curves of the weight of the country's stock of capital in the world.

The close similarity of the WRP to advanced countries' RPs can be related to the impact of economic development, the integration of individual countries in the global economy, the equalisation of RPs across borders, and value transfer. In particular, the WRP closely aligns with the US's rate. The US has the largest share of total capital in the world. However, this share has been around 30% since 1980. In other words, it is not just the size of the stock of capital that is driving the alignment of the WRP and the US's RP. It is more likely that this resemblance is due to the US's hegemony since World War II and its impact on the global economy via value transfer, trade, investment, and migration.

World GDP has fallen since the mid-twentieth century. Figure 5.41 presents the world's GDP growth rate using the PWT and Figure 5.42 using the World Bank database. For the PWT World-1, GDP growth rate falls overall between 1952 and 2019. It rises till the mid-1970s and falls sharply till the early 1980s. After a quick bounce-back, it falls again until 2000, rises modestly till the mid-2000s and continues to fall afterwards. The graph using the World Bank data shows a similar downward trend.



*Figure 5.41: Growth rate of GDP (PWT World-1)*



*Figure 5.42: Growth rate of GDP of the world (World Bank 2024a)*

Using a 10-year moving average method to smooth the GDP growth curve, Figure 5.43 shows that the peaks and troughs of the RP and GDP growth correspond, with about 10-year lags. The RP's peaks are in 1965 and 1997 and GDP growth peaks in 1974 and 2005. Their troughs are in 1982 and 1996, respectively. The correlation between the two data series is not quite strong. If we shift the normalised moving average GDP growth 10 years back and consider different possible trendlines, the regression coefficient ( $R^2$ ) value is about 0.6 using different methods (linear = 0.58, logarithmic = 0.56, exponential = 0.61, polynomial (order of 2) = 0.62, power = 0.60). GDP has a closer correlation with the stock of capital. As Figure 5.44 demonstrates, both measures follow an almost identical path, demonstrating similar peaks and troughs at the same magnitude.

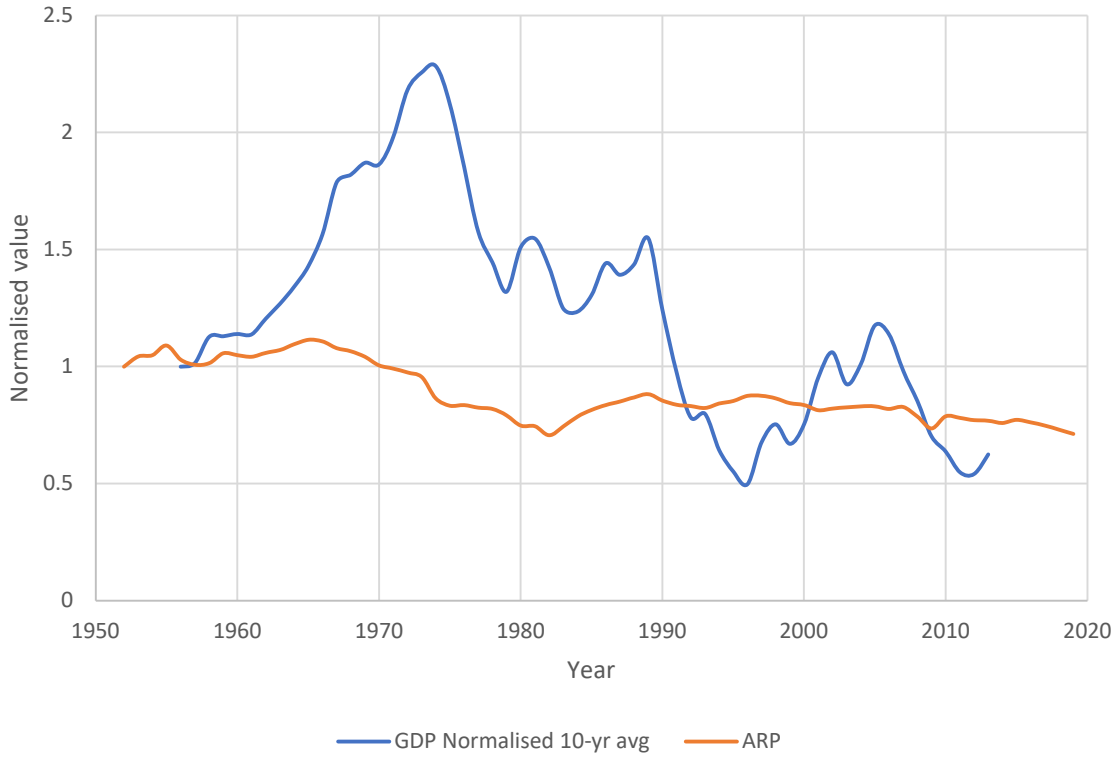


Figure 5.43: RP vs growth rates of GDP (PWT)

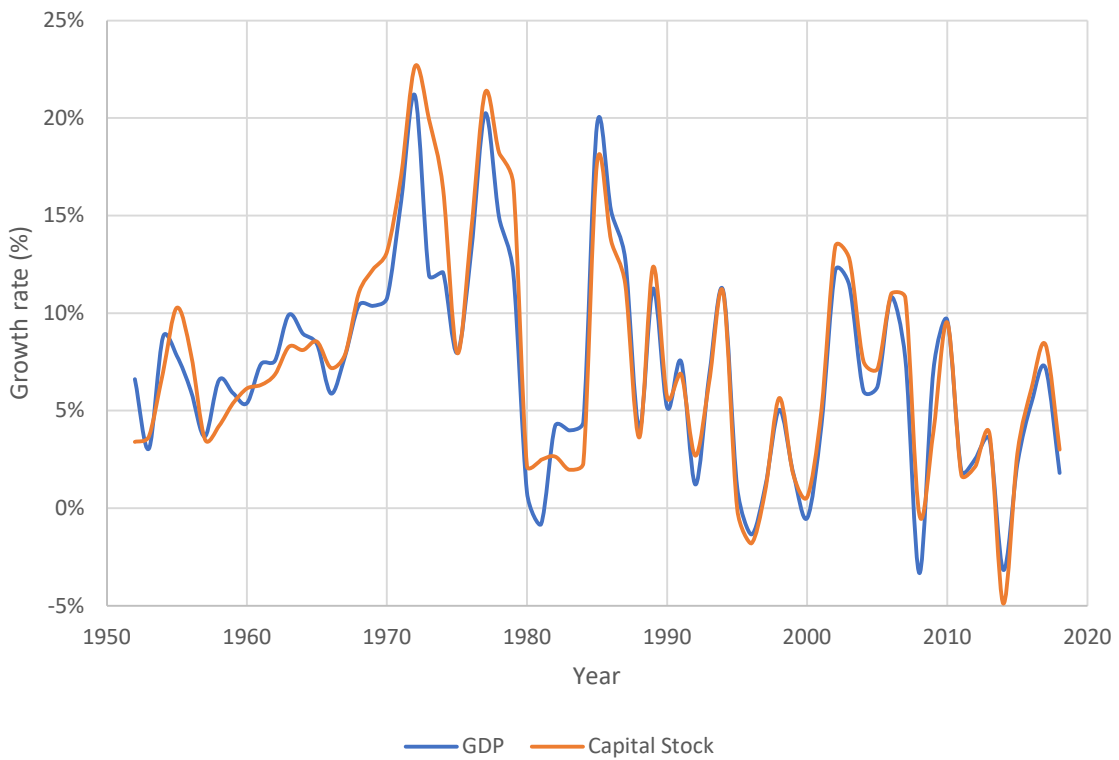


Figure 5.44: Growth rate of GDP vs capital stock

### 5.3. Conclusion

This chapter presented different measurements of the WRP and used two rates covering the longest timeframes for the analysis. Although the two WRPs are based on different data sources and included different numbers of countries, they follow the same trend. It shows that the WRP rises slowly during 1952–1965, falls sharply between 1965 and 1982, recovers partially over 1982–1997, and falls after 1997. Two peaks are observed in 1965 and 1997 and one trough in 1982. The first peak is higher than the second, which indicates a downward trend.

To assess the driving forces behind the movement of the RP, I used decompositions that were discussed in Section 2.1.2,  $K/EC$  (a proxy for VCC) and  $GDP/K$  (capital productivity) are indicators of the role of technological change.  $Pr/EC$  (a proxy for RSV), the profit share, and the labour share show the impact of the distribution of value added between capital and labour. It was shown that technological change has a more pronounced impact on the development of the WRP over the studied period. Nevertheless, in periods, such as in the 1970s, both factors work in the same direction and accelerate the movement of the RP. The recovery in the 1980s seems to be driven mainly by a rising RSV and supported by a slightly declining VCC.

The WRP is the weighted average of individual countries' RPs. The US has had the largest impact on the trend of the WRP, despite its declining share of total world capital. Although the magnitude of the RP varies among countries, about 84% of countries in the constructed world (PWT World-1) have downward trending RPs. The development level of a country is not related to its RP's downward trend but to its level compared to the world average. Within PWT World-1, developed countries are more likely to have downward trending rates and developing countries are more likely to have RPs higher than the WRP.

Overall, the WRP tends to fall over the long-term, following a cyclic pattern of 30–40 years. The main driver of the fall is technological change, but a rising RSV can temporarily lift the rate. The majority of the studied national RPs, whether advanced or developing, have the trend and driver. In short, the empirical results strongly support Marx's law of the tendential fall in the rate of profit.

## Chapter 6: CONCLUSION

This thesis finds that the law of tendential fall in the rate of profit (LTFRP) applies well to the global economy between 1952 and 2019. During this period, the world rate of profit (WRP) declined because of a contradictory mechanism inherent in capitalism. Competition forces incentivise investment in productivity-enhancing technologies. However, in the long-term, profits fail to increase as rapidly as invested capital and hence the rate of profit (RP) falls. Nevertheless, the results of this study support the argument that countertendencies, such as the rising rate of surplus value, can temporarily reverse the decline of the WRP.

This study has been motivated by the argument that the law of the tendential fall in the rate of profit (LTFRP) needs to be approached as an empirical law or hypothesis rather than a theoretical proposition, deduced from other axioms<sup>1</sup>. As an empirical hypothesis, it should be assessed at the world level because of the essentially global nature of capitalism and the presence of transnational mechanisms, such as value transfer. Yet, most studies have approached the question at the level of single countries, particularly the US.<sup>2</sup> However, the geographical coverage has recently expanded to other countries, including Australia, Greece, the UK, South Korea, and Brazil.<sup>3</sup> Moreover, the definitions of the RP and its elements vary among available studies and even Marx's works (Basu & Vasudevan 2013; Kliman 2012: 95-96).

These studies, whether on single countries or the world, have reached different and sometimes contradictory conclusions. For instance, most find a downward trend in the RP but Jefferies (2023: 269) concludes that the US's RP has risen since 1964. Also, most studies attribute the decline of the RP to technological impacts and the rise of the composition of capital. However, Moseley (1991; 2003) puts forward the rise of unproductive activities as the main driver of the decline of the RP, while Li, Xiao and Zhu (2007) and Li (2020) argue that the

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<sup>1</sup> Foley (2009: 135); Jones (2021: 17, 20); Kliman et al. (2013: 3); Trofimov (2018: 83-84).

<sup>2</sup> Basu and Manolacos (2012); Basu and Vasudevan (2013); Duménil and Lévy (2002); Duménil and Lévy (2011); Freeman (2009b); Jefferies (2023); Jones (2021); Kliman (2012); Moseley (1991); Moseley (2003); Shaikh (2011); Shaikh (2016); Shaikh and Tonak (1994).

<sup>3</sup> Alexiou (2022); Maniatis and Passas (2013); Maniatis and Passas (2018); Mohun (2003); Patidis (2016) Jeong and Jeong (2020); Marquetti, Maldonado Filho and Lautert (2010).

rise of wages and taxation are the main cause. Moreover, the WRP studies have assessed only a few impacting factors. For instance, none has incorporated the Marxian concept of productive labour. Only one study (Li 2020) discusses depreciation but only for four countries separately.

To address these limitations, this study took an empirical and global approach to the LTFRP. To improve the reliability of the results, it covered more countries than other WRP studies and assessed a wider range of factors. It applied four definitions of the RP, which map conventional national accounts to Marxian categories. Because the definition of industries and economic measurement techniques vary among countries, only the sources of data were assessed that have homogenised national data. Among those, four sources were found to fit the purpose of this thesis: the Penn World Table (PWT) (Feenstra, Inklaar & Timmer 2015), the aggregate accounts by the Organisation for Economic Cooperation and Development (OECD 2023), the OECD's Structural Analysis (STAN) Database (OECD 2024), and the World Input–Output Database (WIOD) (Timmer et al. 2015).

The sources' coverage of countries, economic indicators, and years vary significantly. The WIOD offers consistent economic data for all included countries for all the covered years. However, the coverage of data by the other sources is more sporadic. For instance, the PWT provides the necessary data for the calculation of the RP of Australia from 1950 but for Albania from 1970. The OECD's capital stock data for Australia, Finland, and France starts from 1959, 1980, and 1978, respectively. Its GDP and wages data for the three countries starts from 1959, 1970, and 1950, respectively. As a result, the RP time-series for these countries can only start from 1959, 1980, and 1978, respectively.

One solution to this limitation is to use other national or international sources to fill the gaps in time series. However, even if such data exists and is in an accessible format, without rigorous assessment and homogenisation of the new data, this option could compromise the integrity, consistency, and accuracy of the results. That is why this solution was not pursued in this study.

Instead, to overcome the inconsistencies in data coverage, this study took groups of countries as constructs of the world economy. The main criterion for each group was the availability of all necessary datapoints to calculate the RPs of all included countries consistently. For instance, using the PWT, a panel of 32 countries was chosen and named PWT World-1. The

database provides GDP, capital stock, wages, and depreciation datapoints for all those countries and all the years between 1952 and 2019.

This thesis is the first study that applies the Marxian notion of productive labour to the analysis of the WRP. To that end, it uses two definitions of the RP that map conventional national accounting data to the Marxian categories of productive and unproductive labour. The detailed Marxian approach distinguishes the Marxian notion of productive labour at the level of industries and professions (occupations). It requires inter-industry data, which is usually offered by the national accounts input–output databases. The WIOD is the only source that contains such level of detail with an accuracy on par with the benchmarks, i.e. the US's and Australia's national accounts. Although its sample of 43 countries is large enough as a construct of the world economy, it only covers 2000–2014. Because of this short timeframe, the demonstrated downward trend of the detailed method RP could not be taken as the long-term trend of the RP.

To tackle this limitation, the simplified Marxian approach was also used, which distinguishes between productive activities but only at the industry level. This approach does not require detailed inter-industry data and only uses industries' operating surpluses. The OECD's STAN database provides the necessary data for this method. Using that source, a panel of 10 countries was chosen as a construct of the world over the 1989–2017 period. The resulting WRP also showed a downward trend. However, this timeframe was still insufficient for a long-term analysis.

To circumvent data limitations, two other definitions, the average and the simplified average methods, were also used. The four definitions result in different magnitudes of the RP. The differences are almost definitional and irrespective of the source of data. The detailed and simplified Marxian RPs use the stock of private productive capital as the denominator of the RP but the average and simplified average use the total stock of capital. More importantly, they all use different numerators. The detailed approach deducts the value of labour-power (VLP) of productive workers in production industries from the Marxian value added to obtain the numerator of the RP. The simplified Marxian approach uses the net operating surplus of production and trade sectors as the numerator. The simplified average method follows the average method in using operating surplus of the entire economy but does not deduct depreciation and works with the gross estimate. The detailed method leads to the highest

magnitude because its denominator and the deduction from the value added are small. By ignoring depreciation, the simplified average method always leads to a larger RP than the average method, except in the hypothetical situation where depreciation is zero.

Applying these definitions to the national accounts data of the US and Australia showed the trend of the detailed method RP is closer to the simplified Marxian RP and the trend of the average RP is similar to the simplified average RP. This finding highlights the impact of productive labour on the RP. Yet, the benchmark results also showed that all definitions lead to a generally similar trend. The same was observed for the WRP. These observations led to the decision to employ the average and simplified average methods to enable a longer-term analysis of the WRP.

The average RP was applied to four different panels of countries using the PWT and the simplified average method was applied to three panels using the OECD aggregate database. Comparing the results of different panels of each data source controlled for the impacts of the definition and source. The results showed that constructing panels with different number of countries resulted in similar trends if the countries with the largest capital stock, e.g. the US and China, were included. In other words, after including the countries with largest capital stocks, the impact of the number of countries on the trend of the WRP is negligible. This result justified the decision to sacrifice the number of countries in favour of a longer timeframe.

Among the PWT panels, one consisting of 32 countries and covering 1952–2019 was chosen for trend and parametric analysis due to its long timeframe. Compared to other Marxian research on the WRP, this panel included the largest number of countries, and covered the longest period for a sample with a similar size. To control for the effects of data source and definition, the results were compared with the analysis of a panel of seven countries covering 1971–2019 using the OECD aggregates data source and the simplified average RP approach.

The LTFRP has been interpreted as arguing for a secular downward trend as well as a cyclic pattern of the RP (Reuten 2004). The demonstrated overall decline of the WRP over the period of 1952–2019 supports the secular downward interpretation. Moreover, other than temporary fluctuations, the calculated WRP presented four stages: a rise till 1965, a sharp decline till 1982, a partial recovery till 1997, and another downward phase afterwards. These phases seem to support the cyclic interpretation, indicating 30–40-year cycles. However, this

support is rather weak because the timeframe, although the longest possible, is insufficient for a thorough assessment of a cyclic pattern.

This issue highlights a key challenge for this study: the availability of high quality, consistent data over a long-term period. The necessary information for the analysis of the WRP is primarily collected by nation-states, which incorporate different theoretical frameworks, definitions, and methods. Moreover, not all national accounting data is publicly available or has been homogenised internationally. Fortunately, more researchers and international organisations have focused on the collection, homogenisation, and presentation of global data. More available data will enable the expansion of the temporal and geographical extent of this study. Nevertheless, one major limitation will always remain: that the collection and publication of official national accounts began only about a century ago. The US prepared its first national income and product accounts of 1929–32 in 1934 (Lequiller & Blades 2014: 373); Leontief published the first US input–output table in 1936 (Raa 2017: 9, 34); the first version of the United (League of) Nation’s System of National Accounts was published in 1953 (United Nations 2024); and Australia’s first official national accounts was released in 1945 (ABS 2021: 24). That is why the extension of the assessment of the WRP beyond a century would require sources other than official national accounts.

Another data-related challenge is that although conventional national accounts have been inspired by Marx, in their current form they are not readily conducive to a Marxian analysis. This issue requires substantial effort dedicated to identifying relevant data sources, retrieving as many datapoints as possible, assessing the integrity and consistency of the collected data, and translating it to Marxian categories. An open-source, publicly accessible database, which hosts data relevant to Marxian analyses, could alleviate this challenge. Studies, like the current one, can refer to it as a starting point and potentially contribute to its enhancement. There are two Marxian examples of this idea, which are not open-source: the Extended Penn World Tables (Marquetti 2012; Marquetti, Miebach & Morrone 2021) and the World Profitability Dashboard (Basu et al. 2022), which has been built on the former. These initiatives could be enhanced by encouraging more contribution and improving centrality and consistency. There will be technical and governance challenges, e.g. regarding homogenisation, hosting, and access provision, but nothing intrinsically insurmountable.

Returning to this study, during the 1952–2019 period, the main driver of the decline of profitability has been technological change. The size of fixed capital and profits increased in absolute terms, but the former grew faster than the latter. This relation is equivalent to the faster increase of the value composition of capital compared with the rate of surplus value. This result supports Marx's formulation that, in the long term, the growth of the investment in technological innovation overcomes the impact of rising productivity and the RSV, leading to the decline of profitability. This finding is similar to Zachariah (2009), Maito (2014; 2018), Roberts (2012; 2015), Trofimov (2018), and Basu et al. (2022). However, it contrasts with Li, Xiao and Zhu (2007) and Li (2020: 7) who do not find any general trend in the output–capital ratio and attribute the downward trend of the RP to wages and taxation.

Marx's LTFRP does not suggest a straight and linear downward trend. It involves countertendencies, such as rising labour exploitation or cheapening constant capital, that can temporarily reverse the falling trend and raise the RP. This study found that between 1982 and 1997, the RSV acted as a strong countertendency, overcame the impact of the rise of the technical composition of capital, and drove the recovery of the WRP.

This study extended the analysis to the national level and assessed the long-term trend of the RPs of the countries that constituted the largest panel (PWT World-1). It showed that most national profit rates, like the WRP, fell during the studied period due to the rising capital-to-wages ratio. To facilitate comparison, the UN's classification of developed and developing countries was adopted due to its wide adoption. It was shown that the trend of the RP is independent of a country's development status. However, the level of the RP is inversely related to development status. Averaged over the studied period, most developing countries, e.g. India, Kenya, or Sri Lanka, had profit rates larger than the WRP. The average rates of profit of most developed countries, such as Australia, Germany, and France, were lower than the world's. The prevalence of the falling trend of the RP and the dominant impact of technological change across countries irrespective of their wealth or development status point to a systemic mechanism, which is largely independent of national particularities.

The WRP and its decomposition parameters were calculated as the weighted average of individual national countries' variables. The weights were based on the national shares of the world stock of capital. These weights, and hence the national impacts on the trend of world parameters, have changed over time. The United States (US) has had the largest share of the

world capital, although it dropped significantly from more than 50% in the early 1950s to about 30% in the mid-1990s and remained around that level till 2019. By contrast, China's share of the world capital has risen dramatically from 1% in the mid-1990s to about 19% in 2019, becoming the second largest capital. The third country is Japan, whose capital stock rose to 25% of the world's stock in the mid-1990s but has since declined.

Although the neoclassical one-commodity model suggests countries with higher invested capital should have lower profit rates, Joan Robinson uses the example of the US as a counterexample (Cohen & Harcourt 2003: 209). This study also finds the US to be an important exception. Unlike other developed economies, the US's RP has not been lower than the world average during the 1952–2019 period. In fact, the trend and magnitude of the two remained close over the entire period. The similarity until the 1980s is almost definitional because the US owned almost half of the world capital stock. In recent decades, however, the share of the US in the world stock of fixed capital has fallen to almost 30%, yet its RP has not deviated from the WRP. The same does not apply to other countries, such as China, Japan, or Germany, which have owned large portions of the world capital.

The similarity of the RP for the US to the WRP despite its declining share in the world capital raises the question of hegemony and its impact on profitability. The US has been the world hegemon and the centre of capitalism since the Second World War. Its hegemony is multifaceted and reflected in its impact on international trade and conflicts, foreign investments, and transnational organisations, such as the WTO, the IMF, and the World Bank. Further research could assess and articulate whether the US's hegemony has made it the centre of gravity for the WRP even after the 1980s. Quantifying hegemony could be an interesting step towards that assessment.

The higher RP for the US compared to other developed countries could be due to value transfer facilitated by the dominance in international trade. By adopting a global perspective, this study circumvented the analytical complexities of cross-border value transfers. Nevertheless, the phenomenon does impact the equalisation of profit rates and might have impacted the US's RP, via mechanisms such as unequal exchange, monopoly powers, or wage arbitrage. Although the field includes many studies, e.g. Smith (2016), Cope (2019), Suwandi (2019), and Carchedi and Roberts (2021), it would benefit from more empirical analyses and theoretical consolidation.

As discussed before, the interpretations of the element of the RP vary among Marxian studies. This thesis presented the justification for the interpretations used. Nevertheless, some interpretations have been excluded only because there is not enough data; they represent phenomena out of the scope of this research; or they do not fit the general approach of this thesis. One example is the definition and measurement of fixed capital and its depreciation. As discussed, conventional national accounts use estimation methods to calculate the stock of fixed capital. These methods have the benefit of circumventing potential data manipulation for tax purposes. However, they fundamentally rely on the assumption of perfect, functioning markets, which has been widely criticised by heterodox economists. It was argued that the most appropriate measure of the stock of fixed capital for the denominator of a Marxian RP should be actually measured, in gross, historical terms, and adjusted for inflation. Such measure presents the stock of fixed capital actually advanced for production and effectively addresses the arguments put forward by those like Jefferies (2023: 267-270), Shaikh (2016: 801-803), and Kliman (2012). Such a measure has not been offered by any of the sources of world data. A historical-cost RP was calculated for the US, which demonstrated a long-term downward trend. This RP did not show the same clear recovery as the current-cost RP in the 1980s and 1990s. Instead, it plateaued between 1970 and the mid-1990s. Due to the close similarities between the world and the US's rates of profit and the large share of the US in the world capital stock, it is likely that a historical-cost RP for the world would have a similar trend as the US's RP. However, using the accountants' method to actually measure capital stock could alter the trend of the RP entirely, as is evident in the difference between the profit rates reported by Jefferies (2023) and Kliman (2012). That is why, due to the absence of such data for the world, no speculation was made about the WRP using the ideal measure of capital stock.

Similarly, it is possible to define the Marxian concept of productive labour in different ways. This thesis is the first study of the WRP that has incorporated this concept in calculations. It has used the capitalist-production interpretation, which is more common in the empirical studies of the Marxian RP and more directly supported by Marx's work. However, productive labour could be defined differently to highlight the role of various social relations. Such an approach did not align with the purpose of this study and hence was not tested. However, other research could employ it to expand our understanding of profitability.

Profitability is arguably correlated with economic booms and crises. This study showed that the WRP fell in the years preceding the economic crises of the 1970s and 2007–2009. This finding supports the hypothesis that a sustained low profit rate over a sufficiently long time paves the way for an economic crisis. It also undermines arguments that the “crisis of neoliberalism” was not rooted in profitability but followed a period of profit restoration (Basu & Vasudevan 2013: 83; Duménil & Lévy 2011: 21).

The latest downward phase of the WRP began in the mid-1990s and continued after the crisis of 2007–2009 until the end of the studied period. The RP can be restored rapidly via large-scale destruction of capital, e.g. wars, or devaluation of capital, e.g. mass bankruptcies or the obsolescence of a large portion of capital by novel technologies. The absence of these factors has obstructed the reversal of the downward trend of the WRP even after the latest crisis.

Since the mid-1980s, the growth of depreciation rate has been accelerating. That is why the decline of the labour share has not translated into a rising profit share. Excluding taxes, total value added is the sum of net operating surplus (profits), wages, and depreciation. Because depreciation is rising faster than the other two factors, it imposes increasingly larger costs on production and deductions from the value added and puts downward pressure on the shares of both labour and capital from the produced value.

The economic impact of the continuous fall of the WRP since the mid-1990s and the accelerating rise of depreciation since the mid-1980s has been accompanied by other factors. Since the 1970s, the growth rate of total worked hours has slowed. Moreover, since then, a larger portion of worked hours has been dedicated to unproductive activities. In other words, a smaller portion of worked hours is spent on activities that produce surplus value. The superimposition of these forces is reflected in the slowing growth of capital accumulation and GDP over the past decades. The persistence of these factors makes a reversal of profitability and economic growth unlikely in the short-term.

Yet, we cannot be hasty in making general conclusions. Slow growth is not degrowth. Even under low profitability and slow growth, the world economy keeps expanding and the global wealth increases. Whether that wealth translates into a better standard of living for all is a different question. Nevertheless, the main risks of low profitability in this context are heightened competition, more bankruptcies, and intensified pressure on workers to produce more surplus value.

There has been speculation about when the WRP reaches zero and its implications for global capitalism. For instance, Maito (2014: 17-18) projects the linear trend of the WRP to assert the “inevitable historical transience” of capitalism. Although the projected zero-intercept varies depending on the year chosen for the beginning of projection, it is more likely to be around the mid-twenty-first century. Maito associates this trend to Grossman’s (1929) prediction that eventually the impacts of countertendencies fade, and capitalism approaches its “final form of an absolute collapse”. I fully acknowledge the historical nature of capitalism, that it is not a natural phenomenon and has a beginning and an end. However, I would argue against extending the demonstration of the long-term downward trend of the RP to a prediction of when it reaches zero and to a deterministic conclusion about global capitalism. First, the WRP seems to follow a cyclic pattern. Although it is currently in a downward phase, it could rise again, as in the 1980s and the early 1990s. Second, this thesis, like Maito’s article, mainly relied on an average WRP to demonstrate the long-term trend. Despite trend similarities, the average RP is, by definition, lower than the detailed and simplified Marxian RPs. A projected zero-intercept of the former is not necessarily the same for the latter. Third, the dynamic and adaptive nature of capitalism makes predicting its long-term trajectory difficult. Low profitability over a long time could lead to the rearrangement of the processes of production on a large-scale. It could encourage innovations that render a substantial portion of current technologies obsolete, i.e. decrease the denominator of the rate, or sharply raise productivity and the rate of surplus value, i.e. increase the numerator.

In short, this thesis contributes to the Marxian understanding of world profitability by addressing some technical issues. It conducts the analysis at the global level, which is the most appropriate scope for the assessment of the LTFRP. While other Marxian studies of the WRP only use one definition of the RP, this study applies four definitions and demonstrates that the observed trend is independent of the differences between these definitions. By using four data sources separately, it demonstrates that the long-term trend is not substantially impacted by this factor. The findings support the argument that the downward trend of the RP is driven by technological change, reflected in the rising composition of capital. By demonstrating a declining trend in the labour share, this study rejects the argument that the fall in the RP is driven by rising wages. Yet, the fall in the labour share has not been translated into a significant rise in the profit share because of the accelerating rise of depreciation. Most

countries within the sample also have downward trending profit rates due to the same drivers. This finding supports the hypothesis that the falling trend is a systemic mechanism, which is not limited to advanced countries.

## Appendix

*Table A.1: Productive/Unproductive distinction of Australian occupations*

<b>Occupation</b>	<b>Productive/Unproductive</b>
Managers	Unproductive
Professionals	Unproductive
Technicians and Trades Workers	Productive
Community and Personal Service Workers	Unproductive
Clerical and Administrative Workers	Unproductive
Sales Workers	Unproductive
Machinery Operators and Drivers	Productive
Labourers	Productive

*Table A.2: Productive/Unproductive distinction of the US occupations*

<b>Occupation</b>	<b>Productive/Unproductive</b>
Executives	Unproductive
Professionals	Unproductive
Technicians	Productive
Sales	Unproductive
Admins	Unproductive
Household	Unproductive
Other Services	Unproductive
Precision production	Productive
Machine operations	Productive
Transport	Productive
Handlers	Productive
Farm and forestry	Productive
Construction	Productive
Installation	Productive
Production	Productive

Table A.3: Mapping Australian industries to sectors

Industry	Sector <sup>1</sup>
Sheep, grains, beef and dairy cattle	P
Poultry and other livestock	P
Other agriculture	P
Aquaculture	P
Forestry and logging	P
Fishing, hunting and trapping	P
Agriculture, forestry and fishing support services	P
Coal mining	P
Oil and gas extraction	P
Iron ore mining	P
Non-ferrous metal ore mining	P
Non-metallic mineral mining	P
Exploration and mining support services	P
Meat and meat product manufacturing	P
Processed seafood manufacturing	P
Dairy product manufacturing	P
Fruit and vegetable product manufacturing	P
Oils and fats manufacturing	P
Grain mill and cereal product manufacturing	P
Bakery product manufacturing	P
Sugar and confectionery manufacturing	P
Other food product manufacturing	P
Soft drinks, cordials and syrup manufacturing	P
Beer manufacturing	P
Wine, spirits and tobacco	P
Textile manufacturing	P
Tanned leather, dressed fur and leather product manufacturing	P
Textile product manufacturing	P
Knitted product manufacturing	P
Clothing manufacturing	P
Footwear manufacturing	P
Sawmill product manufacturing	P
Other wood product manufacturing	P
Pulp, paper and paperboard manufacturing	P
Paper stationery and other converted paper product manufacturing	P
Printing (including the reproduction of recorded media)	P
Petroleum and coal product manufacturing	P
Human pharmaceutical and medicinal product manufacturing	P
Veterinary pharmaceutical and medicinal product manufacturing	P
Basic chemical manufacturing	P

<sup>1</sup> Table 4.3 outlines the notation used for sectors.

<b>Industry</b>	<b>Sector<sup>1</sup></b>
Cleaning compounds and toiletry preparation manufacturing	P
Polymer product manufacturing	P
Natural rubber product manufacturing	P
Glass and glass product manufacturing	P
Ceramic product manufacturing	P
Cement, lime and ready-mixed concrete manufacturing	P
Plaster and concrete product manufacturing	P
Other non-metallic mineral product manufacturing	P
Iron and steel manufacturing	P
Basic non-ferrous metal manufacturing	P
Forged iron and steel product manufacturing	P
Structural metal product manufacturing	P
Metal containers and other sheet metal product manufacturing	P
Other fabricated metal product manufacturing	P
Motor vehicles and parts; other transport equipment manufacturing	P
Ships and boat manufacturing	P
Railway rolling stock manufacturing	P
Aircraft manufacturing	P
Professional, scientific, computer and electronic equipment manufacturing	P
Electrical equipment manufacturing	P
Domestic appliance manufacturing	P
Specialised and other machinery and equipment manufacturing	P
Furniture manufacturing	P
Other manufactured products	P
Electricity generation	P
Electricity transmission, distribution, on selling and electricity market operation	P
Gas supply	P
Water supply, sewerage and drainage services	P
Waste collection, treatment and disposal services	P
Residential building construction	P
Non-residential building construction	P
Heavy and civil engineering construction	P
Construction services	P
Wholesale trade	T
Retail trade	T
Accommodation	P
Food and beverage services	P
Road transport	P
Rail transport	P
Water, pipeline and other transport	P
Air and space transport	P
Postal and courier pick-up and delivery service	P
Transport support services and storage	P
Publishing (except internet and music publishing)	P

<b>Industry</b>	<b>Sector<sup>1</sup></b>
Motion picture and sound recording	P
Broadcasting (except internet)	P
Internet service providers, internet publishing and broadcasting, web search portals and data processing	P
Telecommunication services	P
Library and other information services	P
Finance	R
Insurance and superannuation funds	R
Auxiliary finance and insurance services	R
Rental and hiring services (except real estate)	R
Ownership of dwellings	R
Non-residential property operators and real estate services	R
Professional, scientific and technical services	R
Computer systems design and related services	P
Employment, travel agency and other administrative services	R
Building cleaning, pest control and other support services	R
Public administration and regulatory services	G
Defence	G
Public order and safety	G
Primary and secondary education services (including pre-schools and special schools)	P
Technical, vocational and tertiary education services (including undergraduate and postgraduate)	P
Arts, sports, adult and other education services (including community education)	P
Health care services	P
Residential care and social assistance services	P
Heritage, creative and performing arts	P
Sports and recreation	R
Gambling	R
Automotive repair and maintenance	P
Other repair and maintenance	P
Personal services	H
Other services	R
Total Intermediate Use	M
Compensation of employees	W
Gross operating surplus & mixed income	VA
Taxes less subsidies on products	VA
Other taxes less subsidies on production	VA
Complementary imports	VA

Table A.4: Mapping US industries to sectors

Industry	Sector
Agriculture, forestry, fishing, and hunting	P
Mining	P
Utilities	P
Construction	P
Manufacturing	P
Wholesale trade	T
Retail trade	T
Transportation and warehousing	P
Information	R
Finance, insurance, real estate, rental, and leasing	R
Professional and business services	R
Educational services, health care, and social assistance	P
Arts, entertainment, recreation, accommodation, and food services	P
Other services, except government	T
Government	G
Scrap, used and second-hand goods	T
Personal consumption expenditures	C
Private fixed investment	I
Change in private inventories	I
Exports of goods and services	X

Table A.5: WIOD industry mapping

Industry	Sector
Crop and animal production, hunting and related service activities	P
Forestry and logging	P
Fishing and aquaculture	P
Mining and quarrying	P
Manufacture of food products, beverages and tobacco products	P
Manufacture of textiles, wearing apparel and leather products	P
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	P
Manufacture of paper and paper products	P
Printing and reproduction of recorded media	P
Manufacture of coke and refined petroleum products	P
Manufacture of chemicals and chemical products	P
Manufacture of basic pharmaceutical products and pharmaceutical preparations	P
Manufacture of rubber and plastic products	P
Manufacture of other non-metallic mineral products	P
Manufacture of basic metals	P
Manufacture of fabricated metal products, except machinery and equipment	P
Manufacture of computer, electronic and optical products	P

<b>Industry</b>	<b>Sector</b>
Manufacture of electrical equipment	P
Manufacture of machinery and equipment N.E.C.	P
Manufacture of motor vehicles, trailers and semi-trailers	P
Manufacture of other transport equipment	P
Manufacture of furniture; other manufacturing	P
Repair and installation of machinery and equipment	P
Electricity, gas, steam and air conditioning supply	P
Water collection, treatment and supply	P
Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services	P
Construction	P
Wholesale and retail trade and repair of motor vehicles and motorcycles	T
Wholesale trade, except of motor vehicles and motorcycles	T
Retail trade, except of motor vehicles and motorcycles	T
Land transport and transport via pipelines	P
Water transport	P
Air transport	P
Warehousing and support activities for transportation	P
Postal and courier activities	P
Accommodation and food service activities	P
Publishing activities	P
Motion picture, video and television programme production, sound recording and music publishing activities; programming and broadcasting activities	P
Telecommunications	P
Computer programming, consultancy and related activities; information service activities	R
Financial service activities, except insurance and pension funding	R
Insurance, reinsurance and pension funding, except compulsory social security	R
Activities auxiliary to financial services and insurance activities	R
Real estate activities	R
Legal and accounting activities; activities of head offices; management consultancy activities	R
Architectural and engineering activities; technical testing and analysis	P
Scientific research and development	P
Advertising and market research	R
Other professional, scientific and technical activities; veterinary activities	R
Administrative and support service activities	T
Public administration and defence; compulsory social security	G
Education	P
Human health and social work activities	P
Other service activities	T
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	H
Activities of extraterritorial organizations and bodies	ROW

Table A.6: Weights of countries in the WIOD's panel of countries

Country	Average weight
Australia	2.1%
Austria	0.9%
Belgium	0.8%
Bulgaria	0.1%
Brazil	2.6%
Canada	1.5%
Switzerland	0.9%
China	13.2%
Cyprus	0.0%
Czech Republic	0.6%
Germany	5.8%
Denmark	0.6%
Spain	2.6%
Estonia	0.0%
Finland	0.4%
France	2.5%
United Kingdom	4.6%
Greece	0.3%
Croatia	0.1%
Hungary	0.3%
Indonesia	1.5%

Country	Average weight
Ireland	0.3%
Italy	3.3%
Japan	13.7%
Republic of Korea	3.3%
Lithuania	0.1%
Luxembourg	0.1%
Latvia	0.1%
Mexico	3.3%
Malta	0.0%
Netherlands	1.1%
Norway	0.7%
Poland	0.6%
Portugal	0.4%
Romania	0.4%
Russian Federation	3.1%
Slovakia	0.3%
Slovenia	0.1%
Sweden	0.9%
Türkiye	1.6%
Taiwan	1.1%
United States	21.0%

Table A.7: Weights of countries in OECD panels of countries

<b>Country</b>	<b>RP<sup>SM</sup> World</b>	<b>RP<sup>SA</sup> World-1</b>	<b>RP<sup>SA</sup> World-2</b>	<b>RP<sup>SA</sup> World-3</b>
Australia	5.0%	5.1%	3.4%	2.7%
Austria	2.0%			1.1%
Belgium				1.0%
Canada		4.8%	3.1%	2.3%
Czech Republic				0.6%
Denmark	1.0%	1.9%	1.2%	0.8%
Estonia				0.0%
Finland	1.0%		0.9%	0.6%
France	5.0%		9.2%	6.2%
Germany				8.6%
Greece				0.6%
Hungary				0.4%
Ireland				0.5%
Israel				0.4%
Italy				5.2%
Japan	33.0%		23.5%	14.7%
Korea	5.0%	3.7%	2.9%	2.9%
Latvia				0.1%
Lithuania				0.1%
Luxembourg				0.1%
Netherlands				1.9%
New Zealand	1.0%	0.6%	0.4%	0.3%
Norway	2.0%	1.7%	1.1%	0.8%
Poland				0.5%
Portugal				0.6%
Slovak Republic				0.3%
Slovenia				0.1%
Spain				3.6%
Sweden				1.1%
United Kingdom				4.2%
United States	47.0%	82.3%	54.2%	37.8%

Table A.8: Weights of countries in the PWT panels of countries

<b>Countries</b>	<b>World-1</b>	<b>World-2</b>	<b>World-3</b>	<b>World-4</b>
Argentina				0.566%
Armenia				0.013%
Aruba				0.005%
Australia	2.236%	2.193%	2.140%	1.952%
Austria	0.773%	0.773%	0.783%	0.714%
Bahamas				0.014%
Bahrain				0.030%
Barbados				0.006%
Belgium	1.064%	1.014%	0.956%	0.738%
Benin				0.009%
Bermuda				0.005%
Bolivia (Plurinational State of)				0.017%
Bosnia and Herzegovina				0.010%
Botswana				0.013%
Brazil				1.745%
Burkina Faso		0.009%	0.008%	0.007%
Burundi				0.002%
Cabo Verde				0.003%
Cameroon		0.048%	0.048%	0.029%
Canada	3.010%	2.815%	2.608%	2.178%
Cayman Islands				0.004%
Central African Republic				0.003%
Chad		0.008%	0.008%	0.006%
Chile				0.218%
China	4.541%	4.584%	4.704%	6.153%
China, Hong Kong SAR		0.329%	0.363%	0.436%
China, Macao SAR				0.021%
Colombia	0.418%	0.388%	0.357%	0.318%
Costa Rica	0.031%	0.030%	0.029%	0.029%
Côte d'Ivoire		0.033%	0.035%	0.024%
Croatia				0.084%
Cyprus				0.036%
Czech Republic				0.385%
Denmark	0.666%	0.649%	0.628%	0.514%
Djibouti				0.001%
Dominican Republic			0.055%	0.057%
Ecuador		0.093%	0.098%	0.090%
Egypt	0.137%	0.126%	0.115%	0.118%
Estonia				0.032%
Eswatini				0.004%
Fiji				0.003%
Finland	0.538%	0.537%	0.536%	0.434%
France	6.613%	6.414%	6.209%	5.008%

<b>Countries</b>	<b>World-1</b>	<b>World-2</b>	<b>World-3</b>	<b>World-4</b>
Gabon		0.031%	0.032%	0.022%
Germany	8.526%	8.709%	8.591%	6.914%
Greece			0.671%	0.578%
Guatemala			0.045%	0.042%
Guinea				0.006%
Honduras			0.019%	0.017%
Hungary			0.222%	0.185%
Iceland				0.033%
India	1.649%	1.598%	1.564%	1.584%
Indonesia			0.607%	0.727%
Iran (Islamic Republic of)		0.775%	0.828%	0.625%
Iraq			0.071%	0.068%
Ireland			0.231%	0.270%
Israel				0.269%
Italy	4.149%	4.223%	4.287%	3.704%
Jamaica			0.046%	0.033%
Japan	12.378%	13.190%	14.413%	13.718%
Jordan				0.032%
Kazakhstan				0.176%
Kenya	0.057%	0.054%	0.050%	0.036%
Kuwait				0.065%
Kyrgyzstan				0.008%
Lao People's DR				0.006%
Latvia				0.059%
Lebanon			0.057%	0.056%
Lesotho				0.003%
Lithuania				0.053%
Luxembourg			0.061%	0.056%
Malaysia		0.202%	0.211%	0.233%
Malta				0.009%
Mauritania				0.012%
Mauritius			0.011%	0.011%
Mexico				1.741%
Mongolia				0.012%
Morocco	0.152%	0.139%	0.137%	0.121%
Mozambique				0.010%
Namibia				0.009%
Netherlands	1.588%	1.630%	1.664%	1.380%
New Zealand	0.277%	0.261%	0.238%	0.203%
Nicaragua				0.016%
Niger		0.019%	0.018%	0.012%
Nigeria	2.080%	2.100%	2.049%	0.575%
North Macedonia				0.015%
Norway	0.663%	0.652%	0.639%	0.566%
Oman				0.047%

<b>Countries</b>	<b>World-1</b>	<b>World-2</b>	<b>World-3</b>	<b>World-4</b>
Panama			0.030%	0.032%
Paraguay	0.035%	0.034%	0.035%	0.033%
Peru				0.140%
Philippines	0.271%	0.246%	0.223%	0.200%
Poland				0.405%
Portugal			0.417%	0.422%
Qatar			0.059%	0.074%
Republic of Korea		1.108%	1.232%	1.621%
Republic of Moldova				0.017%
Romania				0.161%
Russian Federation				3.242%
Rwanda		0.003%	0.004%	0.004%
Saudi Arabia			0.449%	0.420%
Senegal		0.037%	0.031%	0.019%
Serbia				0.083%
Sierra Leone				0.002%
Singapore		0.183%	0.206%	0.252%
Slovakia				0.103%
Slovenia				0.076%
South Africa	0.516%	0.499%	0.471%	0.346%
Spain	2.184%	2.244%	2.378%	2.354%
Sri Lanka	0.051%	0.046%	0.041%	0.042%
Sudan				0.034%
Sweden	1.377%	1.310%	1.188%	0.879%
Switzerland	1.257%	1.246%	1.223%	0.978%
Taiwan	0.367%	0.387%	0.433%	0.523%
Thailand	0.310%	0.320%	0.342%	0.383%
Togo				0.005%
Trinidad and Tobago			0.028%	0.022%
Tunisia				0.061%
Türkiye				0.654%
U.R. of Tanzania: Mainland		0.066%	0.065%	0.039%
Ukraine				0.538%
United Kingdom	4.498%	4.322%	4.066%	3.560%
United States	37.589%	34.306%	30.629%	25.227%
Uruguay				0.050%
Uzbekistan				0.040%
Venezuela (Bolivarian Republic of)				0.573%
Zambia				0.029%
Zimbabwe		0.019%	0.014%	0.010%

Table A.9: Mapping of BLS sectors to the Marxian categories

<b>Sector</b>	<b>Productive/Unproductive</b>
Accommodation and food services	Productive
Administrative and support and waste management and remediation services	Unproductive
Agriculture, forestry, fishing and hunting	Productive
Arts, entertainment, and recreation	Productive
Construction	Productive
Educational services	Productive
Finance and insurance	Unproductive
Government	Unproductive
Health care and social assistance	Productive
Information	Productive
Management of companies and enterprises	Unproductive
Manufacturing	Productive
Mining	Productive
Other services (except public administration)	Productive
Professional, scientific, and technical services	Unproductive
Real estate and rental and leasing	Unproductive
Retail trade	Unproductive
Transportation and warehousing	Productive
Utilities	Productive
Wholesale trade	Unproductive

Table A.10: Share of industrial depreciation and investment (Eora)

Industry	Depreciation (CFC)	Investment (GFCF)
Agriculture	3%	1%
Fishing	0%	0%
Mining and Quarrying	3%	0%
Food & Beverages	3%	0%
Textiles and Wearing Apparel	1%	0%
Wood and Paper	2%	0%
Petroleum, Chemical and Non-Metallic Mineral Products	5%	0%
Metal Products	2%	1%
Electrical and Machinery	5%	19%
Transport Equipment	2%	7%
Other Manufacturing	1%	1%
Recycling	0%	0%
Electricity, Gas and Water	4%	0%
Construction	4%	47%
Maintenance and Repair	0%	0%
Wholesale Trade	3%	3%
Retail Trade	4%	2%
Hotels and Restaurants	2%	0%
Transport	4%	1%
Post and Telecommunications	4%	1%
Financial Intermediation and Business Activities	33%	8%
Public Administration	5%	5%
Education, Health and Other Services	7%	1%
Private Households	0%	0%
Others	1%	0%
Re-export & Re-import	0%	0%

Table A.11: Share of industrial depreciation and investment (OECD)

Industry	Depreciation (CFC)	Investment (GFCF)
Accommodation and food service activities	1%	1%
Administrative and support service activities	3%	3%
Agriculture, forestry and fishing	2%	2%
Arts, entertainment and recreation	2%	2%
Construction	2%	2%
Education	4%	2%
Electricity, gas, steam and air conditioning supply	4%	4%
Financial and insurance activities	4%	4%
Human health and social work activities	3%	3%
Information and communication	7%	7%
Manufacturing	18%	15%
Mining and quarrying	3%	3%
Other service activities	1%	1%
Professional, scientific and technical activities	4%	4%
Public administration and defence; compulsory social security	10%	12%
Real estate activities	20%	23%
Transportation and storage	5%	5%
Water supply; sewerage, waste management and remediation activities	1%	1%
Wholesale and retail trade; repair of motor vehicles and motorcycles	5%	5%

Table A.12: Share of industrial investment (WIOD)

Industry	Investment (GFCF)
Accommodation and food service activities	0%
Activities auxiliary to financial services and insurance activities	0%
Activities of extraterritorial organizations and bodies	0%
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	0%
Administrative and support service activities	0%
Advertising and market research	0%
Air transport	0%
Architectural and engineering activities; technical testing and analysis	2%
Computer programming, consultancy and related activities; information service activities	4%
Construction	48%
Crop and animal production, hunting and related service activities	0%
Direct purchases abroad by residents	0%
Education	0%
Electricity, gas, steam and air conditioning supply	0%
Financial service activities, except insurance and pension funding	0%
Fishing and aquaculture	0%
Forestry and logging	0%
Human health and social work activities	0%
Insurance, reinsurance and pension funding, except compulsory social security	0%
International Transport Margins	1%
Land transport and transport via pipelines	1%
Legal and accounting activities; activities of head offices; management consultancy activities	1%
Manufacture of basic metals	0%
Manufacture of basic pharmaceutical products and pharmaceutical preparations	0%
Manufacture of chemicals and chemical products	0%
Manufacture of coke and refined petroleum products	0%
Manufacture of computer, electronic and optical products	5%
Manufacture of electrical equipment	2%
Manufacture of fabricated metal products, except machinery and equipment	1%
Manufacture of food products, beverages and tobacco products	0%
Manufacture of furniture; other manufacturing	1%
Manufacture of machinery and equipment N.E.C.	8%
Manufacture of motor vehicles, trailers and semi-trailers	6%
Manufacture of other non-metallic mineral products	0%
Manufacture of other transport equipment	3%
Manufacture of paper and paper products	0%
Manufacture of rubber and plastic products	0%
Manufacture of textiles, wearing apparel and leather products	0%

<b>Industry</b>	<b>Investment (GFCF)</b>
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0%
Mining and quarrying	1%
Motion picture, video and television programme production, sound recording and music publishing activities; programming and broadcasting activities	1%
Other professional, scientific and technical activities; veterinary activities	0%
Other service activities	0%
Output at basic prices	0%
Postal and courier activities	0%
Printing and reproduction of recorded media	0%
Public administration and defence; compulsory social security	0%
Publishing activities	1%
Purchases on the domestic territory by non-residents	0%
Real estate activities	2%
Repair and installation of machinery and equipment	1%
Retail trade, except of motor vehicles and motorcycles	1%
Scientific research and development	1%
Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services	0%
taxes less subsidies on products	2%
Telecommunications	0%
Value added at basic prices	0%
Warehousing and support activities for transportation	0%
Water collection, treatment and supply	0%
Water transport	0%
Wholesale and retail trade and repair of motor vehicles and motorcycles	0%
Wholesale trade, except of motor vehicles and motorcycles	4%

Table A.13: WIOD industry mapping

Industry	Sector
Crop and animal production, hunting and related service activities	P
Forestry and logging	P
Fishing and aquaculture	P
Mining and quarrying	P
Manufacture of food products, beverages and tobacco products	P
Manufacture of textiles, wearing apparel and leather products	P
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	P
Manufacture of paper and paper products	P
Printing and reproduction of recorded media	P
Manufacture of coke and refined petroleum products	P
Manufacture of chemicals and chemical products	P
Manufacture of basic pharmaceutical products and pharmaceutical preparations	P
Manufacture of rubber and plastic products	P
Manufacture of other non-metallic mineral products	P
Manufacture of basic metals	P
Manufacture of fabricated metal products, except machinery and equipment	P
Manufacture of computer, electronic and optical products	P
Manufacture of electrical equipment	P
Manufacture of machinery and equipment N.E.C.	P
Manufacture of motor vehicles, trailers and semi-trailers	P
Manufacture of other transport equipment	P
Manufacture of furniture; other manufacturing	P
Repair and installation of machinery and equipment	P
Electricity, gas, steam and air conditioning supply	P
Water collection, treatment and supply	P
Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services	P
Construction	P
Wholesale and retail trade and repair of motor vehicles and motorcycles	T
Wholesale trade, except of motor vehicles and motorcycles	T
Retail trade, except of motor vehicles and motorcycles	T
Land transport and transport via pipelines	P
Water transport	P
Air transport	P
Warehousing and support activities for transportation	P
Postal and courier activities	P
Accommodation and food service activities	P
Publishing activities	P

<b>Industry</b>	<b>Sector</b>
Motion picture, video and television programme production, sound recording and music publishing activities; programming and broadcasting activities	P
Telecommunications	P
Computer programming, consultancy and related activities; information service activities	R
Financial service activities, except insurance and pension funding	R
Insurance, reinsurance and pension funding, except compulsory social security	R
Activities auxiliary to financial services and insurance activities	R
Real estate activities	R
Legal and accounting activities; activities of head offices; management consultancy activities	R
Architectural and engineering activities; technical testing and analysis	P
Scientific research and development	P
Advertising and market research	R
Other professional, scientific and technical activities; veterinary activities	R
Administrative and support service activities	T
Public administration and defence; compulsory social security	G
Education	P
Human health and social work activities	P
Other service activities	T
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	H
Activities of extraterritorial organizations and bodies	ROW

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