



Routledge Frontiers of Political Economy

MARX'S THEORY OF VALUE AT THE FRONTIERS

CLASSICAL POLITICAL ECONOMICS, IMPERIALISM AND ECOLOGICAL BREAKDOWN

Güney Işıkara and Patrick Mokre





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Why do humans produce the things they do, in the way they do it? As this book shows, the classical political economics approach to value and prices has fundamental implications for analyzing the historical trajectory of capitalism.

It demonstrates that the classical political economists' approach to value and prices, which finds its most advanced formulation in Marx, sheds light on the source of profits, exploitation, whether equivalents are exchanged in trade, dynamics of asymmetric and uneven accumulation, and the relationship of production to non-human natures at large. Understanding these phenomena is key to understanding the economic regularities underlying the key issues facing the world in the twenty-first century: imperialism and ecological breakdown. It argues powerfully that deviations between market prices, production prices, and labor values are central to understanding international value transfers due to differential capital compositions and rates of exploitation, as well as the central role of rent and accumulation in capitalism-induced ecological crisis.

The book is structured to provide an understandable introduction to the classical approach to value and prices, and its modern expression in empirical applications making it of great interest to readers in Economics, Political Economy, Politics and Sociology.

Güney Işıkara received his PhD in Economics from the New School for Social Research in 2019. He is currently Clinical Associate Professor of Liberal Studies at New York University. Güney's research focuses on the ecological breakdown and its relation to market mechanisms and alternative ways of organizing production and reproduction.

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To Özlem, Zozan, and Roza.

To Anna and Karla.

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1 Introduction

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This book is about the law of value, a term that captures the processes that make possible the reproduction of capitalist society, which is segmented into private, competing, autonomous, and fragmented economic units on the basis of the private ownership of the means of production. These units are cemented together into a society through the social division of labor and exchange. In the absence of direct regulation of the social division of labor (which could take place through social hierarchies mediated through traditional bonds, kinship, or economic planning in its various forms), its ceaseless adjustment is secured *a posteriori* with reference to signals that become observable through the act of exchange, such as wages, prices, profit rates, and so forth. Products of labor confront each other in the moment of exchange as equivalents, not in terms of their social usefulness but in terms of their values. In a nutshell, the law of value reflects the interactions between these partial processes, which are, in their unity, constitutive of the working of the capitalist mode of production.

The book advances a vision of how to study the economy based on the social relations of production, a vision that marks the work of classical political economists,¹ particularly Karl Marx, and one that has long been marginalized, if

not flatly dismissed, by the contemporary discipline of economics. In its most enhanced form, this vision is captured by Marx's value theory, which denotes the theorization of the law of value as the principal mechanism regulating capitalist commodity production. By implication, this is a book about Marx's value theory, which builds upon the key insights of classical political economists, especially Adam Smith and David Ricardo.

We intend to contribute to the understanding of capitalist commodity production as driven by the socially and environmentally indifferent imperative of accumulation. That imperative is an inherently polarizing, competitive process that pits capitalists against capitalists, capitalists against workers, workers against workers, states against states, and capital against nonhuman natures. Notwithstanding the chaotic, conflictual, and dynamic nature of this process consisting of ceaseless reciprocal interactions of autonomous units, certain quantitative regularities (such as the turbulent equalization of profit rates on new investment or the ultimate regulation of market prices by total labor requirements) emerge and persist, which reflect the relationship between the spheres of exchange and production, lending support to the materialistic understanding of history. The book studies such quantitative regularities in the domain of prices from the broader viewpoint of Marxist value theory.

This book is also a handbook for practitioners. Empirical and computational value analysis has been important in the contemporary revival of classical political economics for decades. Steady development of the methodology and availability of more detailed and more frequent data enabled significant original contributions in recent years. We use a consistent model of values and prices based on the large ecologically enhanced multiregional input-output tables from the EXIOBASE project to analyze not only the regular relationship between market prices, production prices, and direct prices but also regularities in their deviations through the turbulent equalization of market prices around production prices, through international value transfers in relation to imperialism, and through the role of ground rent in the context of the ecological breakdown. We

lay out the theoretical model step by step, explain the structure of the data, and explain our interpretation of the results, not only to corroborate Marxist value theory but also to enable readers to apply the method to their own questions.

1.1 Foundations of the Analysis

The distinctive, characteristic features of the capitalist mode of production constitute our point of departure. The capitalist mode of production is a historically specific form of society in which production decisions are taken, without a priori coordination, by autonomous *and* competing individual firms with the aim of maximizing returns. Their size, location, technology, and tactics vary, and their behavior is strategic and competitive. Yet their goal is the same: to gain maximum profits, accumulate, and invest on a larger scale. Information available to individual capitals is partial, capturing only a snapshot of the complex and ceaselessly changing reality, and it coexists with misinformation. By implication, their actions collide as they compete for market shares, enhancing cost efficiency, and cutting prices. This is *real competition* at work: “antagonistic by nature and turbulent in operation” ([Shaikh 2016](#), 14).

Competition is the central regulating principle of capitalism. Competitive processes and their immediate outcomes can be observed at the firm, industry, and market levels, in both national and international contexts. Analysis of it revolves around profitability and accounts for unit labor costs, the formation of a general rate of profit, investment, employment and unemployment, class struggle between capitalists and workers, competition between capitalists for market share, cutting costs, lowering prices, and more. Any theory of competition, including real competition, must be underpinned by a value theory. Otherwise, the source of revenues accruing to different social classes (among many other things) will remain undetermined.

In this section, we lay out the theoretical foundations of our analysis. We first discuss aspects of Marx's value theory by highlighting some conceptual and

epistemological breaks it constitutes with respect to classical political economics. Then, we turn to real competition, which is fundamental for an understanding of observable market phenomena and the deeper currents regulating them. Finally, we explain why Marx's value theory is essential for understanding real competition by considering some prominent lines of criticism directed at it.

1.1.1 Marx and the Classical Political Economists²

The questions of what the value of a thing is, when exchange is just, and what brings about the prices at which exchange takes place date to ancient times. They were repeatedly raised in subsequent historical contexts about the specifics of the then-dominant mode of production, corresponding to its own distribution and exchange relations. Classical political economics started to gain ground in England and France in the mid-seventeenth century and had its heyday around the first Industrial Revolution, with David Ricardo being its “last great representative” ([Marx 1990](#), 96). This was a time when the capitalist mode of production was sufficiently developed in western Europe for observers to grasp the accumulation of capital as the driving force of economic activity. Furthermore, living in a world of expanding and deepening social division of labor, classical political economists were interested in understanding the mechanisms regulating the closely related processes of specialization, division of labor, and exchange in an impersonal market environment. Therefore, common to the writings of Smith, Ricardo, and others is the question of the principle that regulates exchange ratios of commodities.

The classics started with what they observed—commodity prices, profits, wages, and rent—and studied the formation of those phenomena in the context of capitalist competition. In the absence of barriers to its mobility, the flow of capital toward industries with a higher rate of return accelerates and increases supply relative to demand, undermining the very reason for this flow. The subsequent fall in prices is a result of not only the shift in the ratio of sellers to

buyers but also the increased competition between capitals within the same industry. The same holds for labor and wages, given a sufficient degree of mobility of workers. An average rate of profit emerges through this ceaseless flow of new capital and tends to bring about the *natural price*, containing the average rate of profit on top of the underlying costs of production. The insight that natural prices, which Marx later called prices of production, serve as centers of gravity for the immediately observed market prices became central in Smith's *Wealth of Nations* and remained the conventional concept of equalization up until the 1920s ([Kurz and Salvadori 1997, chapter 1](#)).

For the classicals, the story does not end with the emergence of an average rate of profit and natural prices. They were interested in what the regulating principles behind them are, beginning with prices. While the quest for an answer to this question confused Smith profoundly, [Ricardo \(1970, 11\)](#) postulated that the value of a commodity (by which he meant its relative natural price) depends on the relative quantity of labor embodied in it. Notwithstanding that it was missing important pieces of the puzzle and lacked a clear conceptual distinction between exchange value, value, and natural price, Ricardo's formulation of value theory provided Marx with everything he needed to advance his critique of classical political economics.

A fundamental aspect of this critique is the discovery of surplus value as the source of profit on capital (as well as of interest and ground rent). While the classical economists studied the emergence of the average rate of profit within the context of capitalist competition, they ignored, apart from some formulations in passing, the question of what relations and processes generate surplus. For Marx, surplus labor performed in the production process is the spring of surplus value, which takes on the observable forms of profit, interest, and rent. This is a foundational element of Marx's theory of exploitation, which means that capitalists appropriate a share of the labor the worker performs. Crucially, exploitation is not just the appropriation of value. It is a social relation rooted in the sphere of production, which cannot exist in its capitalist form without

differential class positions.

Another line of the conceptual rupture in Marx's work stems from his understanding of the dual character of labor. Each act of labor has a concrete character; it produces a specific use value. A carpenter makes furniture; a cook prepares meals. However, when the carpenter has lunch at the restaurant where the cook is employed, what is equated is not the useful qualities of their products. It is rather human labor as such, mediated through the socially necessary labor time to finish a piece of furniture and cook a meal and expressed in the monetary equivalent of this labor time but devoid of any concrete content. This is what Marx calls abstract labor and grasps as the substance of value. Moreover, in contrast to Ricardo (and others), for Marx it is not the labor time embodied in an individual commodity but the socially necessary labor time to reproduce a commodity that determines the magnitude of its value. Whether the labor time expended to produce a specific commodity is socially necessary can only be tested in the sphere of exchange, evoking one more time the peculiar, historically specific social form of decentralized coordination *a posteriori*.

One aspect of the epistemological break from classical political economics Marx's work represents concerns the role of abstract labor and socially necessary labor time in his value theory. For abstract labor to fulfill its regulatory function, laborers (as well as capitals) must be somewhat free of extra-economic restrictions and barriers. Only when workers can choose for whom they perform labor can we speak of workers who are on average indifferent to the particular content of the labor they perform and thereby speak of abstract labor devoid of real content. At the same time, workers cannot choose whether they want to perform surplus labor for some capitalist since they do not have another realistic source of income, as they are also free of capital.

Marx combines the dual freedom of the laborer with the dual character of labor, not only as an observation but as a causal relation. Only in this case can the law of value regulate the distribution of total social labor across different branches through the price signals available on the market. Historically, this

went hand in hand with the birth and rise of nation-states, creating and securing private property through civil law and commercial law, regulating conditions of work and competition through labor and competition law, and granting the legal framework for security and the use of force through criminal law ([Satligan 2014](#), 54–55). The same process is preceded or accompanied by violent expropriation and plunder, privatization of the means of subsistence, and employment of slave labor, as we discuss in [chapter 5](#). Therefore, the law of value operates, and Marx's value theory holds, only within the specific historical context of the capitalist mode of production.

This brings us to an important observation: Marx's method is historical. He fiercely criticized the ahistorical character of classical political economics, for taking its object of investigation as a given premise and for conflating the historical forms with eternal, natural forms ([Marx 1972](#), 500–01). Perhaps the most revolutionary aspect of his work was to demonstrate that it is *only under certain conditions* that means of production become capital, labor becomes wage labor, and the social labor process takes the value form in which coordination and regulation of the social division of labor are achieved *a posteriori* through the act of exchange. From this viewpoint, what is usually referred to as Marx's labor theory of value, namely the quantitative aspect of his value theory, can be regarded as a value theory of labor, studying processes in which labor takes the value form ([Bellofiore 2018](#), 31–32).

By breaking with classical political economics conceptually and methodologically, Marx developed an understanding of prices through the quantitative aspect of his value theory, combining the spheres of exchange and production into an integrated framework. Market prices adjust in response to changes in supply and demand, but they are fundamentally subject to the gravitational force of prices of production since changes in supply (relative to demand) are motivated by differences in profitability. Prices of production, on the other hand, are regulated by the socially necessary labor time to reproduce a commodity, usually referred to as its labor value, which manifests itself in

monetary form (as a price) under generalized commodity production. In the next subsection, we incorporate the regulation of market prices through this two-step process into the broader context of real competition, in which regularities are manifested in the form of tendencies.

1.1.2 Real Competition

The understanding of competition as the central regulating mechanism of capitalist commodity production, characterized by turbulent gravitational processes governing prices, profits, and wages, was immanent to classical political economics and especially Marx's writings. The term *real competition* was coined by [Anwar Shaikh \(1978, 1980, 2016\)](#) to refer to the classical concept of competition and mark the stark contrast between the conventional concept of perfect competition—as well as its various satellites constituted through partial imperfections—and the nature of really existing capitalist competition. The former concept depicts harmony, while the latter depicts conflict and collision; the former focuses on equilibrium as a state, while the latter centers on equilibration as a ceaseless turbulent process; the former starts with idealizing abstractions (price-taking firms, hyperrational behavior, perfect information, and so forth), while the latter starts with typifying abstractions (those that focus on real firms, workers, and consumers, identify typical patterns, and seek the underlying forces) ([Shaikh 2016, chapter 1](#)).

At first glance, the reproduction of capitalism seems to be equivalent to the production of commodities. But while the illustration of reproducing the physical means of production—replenishing and growing the capital stock by producing capital goods—is intuitive, reproduction goes far beyond it, representing a fundamentally social process. [Marx \(1990\)](#) noted in volume 1 of *Capital* that “the capitalist just as constantly produces labour-power, in the form of a subjective source of wealth which is abstract; exists merely in the physical body of the worker, and is separated from its own means of objectification and realization; in short, the capitalist produces the worker as a wage-labourer. This

incessant reproduction, this perpetuation of the worker, is the absolutely necessary condition for capitalist production” (716). This is the reason why Marxist theory turns to the social and historical reality of the production process before analyzing the material cycles it sets in motion.

Capitalist production is chaotic, competitive, and coordinated through decentralized decisions. Firms produce commodities while exploiting workers, bid against each other or create niche products to gain market shares, and invest where they expect high-profit rates on new capital. It is, however, organized around stable principles: the production of commodities—goods and services produced for exchange—by workers who do not get a share in the profits and by competing firms. At no point can we reliably predict which firm will have the upper hand next nor which industry will develop the most cost-effective technology. But we know for sure that some will, and the results will set capital in motion. This coexistence of instability and stability “generates powerful ordered patterns that transcend historical and regional particularities” where “the resulting systemic order is generated in-and-through continual disorder” ([Shaikh 2016](#), 5).

On the most abstract level, Marx described a turbulent pattern when dealing with capital accumulation in volume 1 of *Capital*, before introducing differences between industries, firms, or production costs. He noted that the accumulation of capital will go with an increased demand for labor, which might increase wages and diminish profits, up to the point at which accumulation slows down and pulls wages with it ([Marx 1990](#), 770). The extent of turbulent accumulation patterns becomes apparent in volume 3: “If the prices of commodities are below or above the price of production … an equalization takes place by the expansion or contraction of production” ([Marx 1991](#), 489), and “the general rate of profit is determined in fact (1) by the surplus-value that the total capital produces; (2) by the ratio of this surplus-value to the value of the total capital; and (3) by competition, but only in so far as this is the movement through which the capitals invested in particular spheres of production seek to draw equal

dividends from this surplus-value in proportion to their relative size” (489). Emphasis on such turbulent patterns is characteristic of Marx’s analysis of capitalist accumulation.

In *between-industry competition*, firms invest in industries that promise the highest expected profit rate on new investment—that is, the regulating profit rate. Since they are the newest investors, they have the privilege to imitate the most cost-efficient technology in the industry (as long as it is reproducible) that Shaikh called the “regulating capital.” The patterns of between-industry investment bear on the level of the general profit rate since competition motivates investment in fixed capital, tending to increase its ratio to the living labor employed. Profit rates’ movements toward above-normal rates increase supply and competition there, depressing prices and pushing profits toward (or below) the normal rate. The very search for above-average profit rates induces the tendency to equalization of profit rates on new capital. Since different industries employ different vintages of capital (for example, capital turnover will be longer in real estate than in information technology), this tendency to equalization is not only consistent with, but explains, persistent inequalities of average industrial profit rates. At the same time, the moving target of between-industry investment is the result of within-industry competition.

Within industries, firms compete for shares of the same market. Prices tend to equalize within a given market. Differences exist, but bands of prices tend to move together. Each of the firms faces a downward-sloping demand curve and understands that to gain more buyers it must lower the price. And price cutting has a competitive effect beyond attracting deal-savvy customers. If a firm produces at lower cost than its competitors, it can set the price at a level that is still profitable for itself but might be ruinous for its competitors. The cost differential between the lowest-cost regulating capital and the runner-up in that race (called the subdominant capital) is the battlefield of within-industry competition. As the price-setting regulating capital tends to gain the largest market share, normal conditions of production and normal prices shift toward the

standard set by this particular capital. This sets the new normal, and any above-normal profits within the industry it had previously realized diminish. This process is accelerated when new capital enters the industry that creates a cost structure similar to that of the regulating capital and intensifies competition. While within-industry competition creates the moving target for between-industry competition—the regulating profit rate—between-industry competition reshapes the within-industry competitive landscape upon arrival. Within-industry competition tends to equalize prices for the same good in a turbulent manner, as the range of price setting is restricted by competition, and an exodus of capital creates new space to increase prices and profit margins.

The turbulent equalization of profit rates also creates turbulence in wages. Accumulation attracts employment in a one-way causal relationship: “To put it mathematically: the rate of accumulation is the independent, not the dependent variable; the rate of wages is the dependent, not the independent variable” ([Marx 1990](#), 770). But the conditionality of labor on capital is no mathematical question. It is a social relation in which labor is forced to mimic capital: “The competition among workers is only another form of the competition among capitals” ([Marx 1993](#), 651). As a result of competition between workers, wage increases behave turbulently, much like profit rates on new capital, because maximum wage increases are restricted by the profitability of their employers, and more narrowly, by the competitive space between regulating and subdominant capitals ([Botwinick 1993](#), 184–94). These limits to wage increases combine one turbulent component in regulating profit rates and one persistently different component in different ratios of labor cost to total cost. The turbulent equalization of wages follows the turbulent patterns of profitability, and it produces ordered patterns of wage inequality through these processes ([Shaikh, Papanikolao and Wiener 2014](#); [Mokre and Rehm 2020](#)).

A related key concept is the gravitational center of turbulence, which is not a mere property of the turbulent variable (such as a weighted mean that will be over- and undershot) but an expression of economic dynamics themselves. For

example, the general rate of profit expresses the ratio of surplus value produced by unpaid living labor to the value of total capital advanced on the scale of the aggregate economy. It serves as a gravitational center for the investment in new capital, and the fluctuations move the center itself, for example by increasing the ratio of fixed capital to living labor employed.

The framework of real competition revived Marx's theory of competition, first by contrasting the turbulent and antagonistic character of competition developed in *Capital* with ideas of perfect or imperfect competition and then by enhancing it with the description of competitive behavior found in the business literature. The ensuing empirical literature on turbulent equalization³ ([Shaikh 2008](#); [Vaona 2011](#)) and the theoretical extensions of Marx's work represent an alternative to the economics of imperfect competition, which presupposes perfect competition in the first place, and of monopoly capitalism, which abandons competition and the law of value. In addition, it provides a non-eclectic, integrated framework for analyzing multiple facets of the capitalist mode of production at various levels of aggregation.

One turbulent relationship ties back into the fundamental analysis of value theory and the empirical models in this book: the regular relationship between market and production prices ([Shaikh 2016](#), 419). The turbulent formation of the general profit rate is expressed in production prices and added to the variable and fixed capital costs. Capitalists invest in industries with market prices above production prices, implying that the expected rate of profit is above the general one. This pattern of behavior does not only create an ordered relationship between market and production prices but fundamentally regulates the social division of labor in capitalism. Since production prices are ultimately regulated by the underlying direct prices (that is, prices proportional to labor values), and the social form of the production process is defined by capital as a social relation, we turn to the question of why value still matters.

1.1.3 The Significance of Value

The vision of classical political economists and Marx was long ago abandoned by most schools of thought on theoretical and methodological grounds. A close look reveals the political and ideological side of this shift. The conceptualization of competition as a turbulent and antagonistic process with immanent, recurrent crises was replaced by a picture of harmony and stable equilibrium, in which disruptions are accidental and self-correcting and in which only partial, isolated imperfections are allowed for. The shift away from classical political economics concerns much more than how competition is perceived. It is equally concerned with the theory of value and its methodological foundations.

Late-nineteenth-century attempts to relocate economic analysis to a substantially different value-theoretical terrain can be seen as an escape from Marx, at whose hands Ricardo's system became a theory of exploitation and class antagonism (among other things).⁴ The so-called marginalist revolution laid the foundations of a (marginal-)productivity-based theory of distribution, which remains the dominant approach in economics to this day. Within this framework, labor is only an ordinary factor of production like capital and land, each factor is rewarded according to its marginal productivity, and the very possibility of exploitation is assumed away: “Wages are the return to labor; interest the return to capital; rent the return to land” ([Samuelson and Scott 1968](#), 677).

What is at stake here is not a simple technical difference in the perception of production and distribution of income, but completely different visions of social (re)production. Marx's value theory advances the perspective that production, distribution, and consumption reflect and pertain to the social relations between humans as well as humans' relation to nonhuman natures. Its aim is to study how human work (that is, the labor process) produces and reproduces society and social life in a specific historical context. Without disregarding the material-technical content of this process of (re)production, it focuses on its social form since the labor is organized, regulated, and mediated by social relations ([Rubin 1990, chapter 4](#)). The active side of this unity (of the material-technical and

social aspects) is labor, and it takes the value form under capitalist commodity production, in which relations between humans are established *for and through* commodities and mediated by flows of money, which is the most developed expression of value. The confusion of the social relations between workers and capitalists with relations among commodities is what Marx calls commodity fetishism, with the caveat that the latter relations are an integral part of capitalist commodity production, in which ideology not only derives from the underlying material conditions but also materializes and affects social relations.

Samuelson and Scott's formulation of factor rewards is a culmination of this fetishism. It supposes that capital, labor, and land, equipped with independent powers, generate interest, wages, and rent, respectively. This mystification can be avoided through Marx's value-form analysis, in which labor is the only source of value (and surplus value), and capital and land (and other nonhuman natures) constitute its means and conditions of production, so their owners receive their respective revenues as shares of the surplus value produced by labor. That production bonds between people, as owners of commodities, are established only through the commodities they own gives rise to the superstition that things are the agents in the enchanted world of capitalism.

A related aspect of the transformation of (political) economics starting in the 1870s was the overall framing of the object of investigation, shifting the focus from social relations to the relations between things. Some six decades before [Lionel Robbins's \(1932\)](#) prominent definition of economics as “the science which studies human behaviour as a relationship between ends and scarce means which have alternative uses” (15), [William Stanley Jevons \(1871\)](#) had already formulated the economic question as the optimal allocation of a given set of resources: “Given, a certain population, with various needs and powers of production, in possession of certain lands and other sources of material: required, the mode of employing their labour which will maximise the utility of the produce” (255).

Other than dehistoricizing the “given” needs and powers of production, and

naturalizing the possession of the means of production, which assumes away class power and its sources, Jevons's approach reflects the shift from objective to subjective concepts of value. The latter put individuals' utility and preferences at the center and propose a causality running from utility and preferences through demand (relative to supply) to the determination of equilibrium prices. The need for an objective concept of value (be it in the form of embodied or socially necessary labor) serving as an anchor for prices is thereby eliminated. This shift is further supported by the argument that the objective theory of value (and by implication, Marx's value theory) ignores demand and preferences.⁵

The accusation does not hold water. Demand is an integral part of Marx's value theory, as the magnitude of the value of a commodity is determined by the socially necessary labor time required for its reproduction. A key function of the term "socially necessary" in this context is to link the private labor expended on a commodity to the sphere of exchange, where it is validated as social labor to the extent it confronts demand on the market. Furthermore, changes in preferences and tastes, and therefore the willingness to purchase, do have a place in the objective theory of value, which manifests itself through shifts of the distribution of social labor among different sectors of production. The emergence of excess demand for a particular commodity, which leads to an increase in its market price and brings about an above-average rate of profit, triggers an acceleration of new investment into this industry *without* altering the value of the commodity.

For instance, the abrupt increase in the demand for masks and sanitizers following the outbreak of the COVID-19 pandemic raised the market price of these commodities, generating above-average profits for their producers. This reflected an imbalance in the distribution of social labor across industries since a state of balance is established in the hypothetical case in which all industries gain the general rate of profit and therefore no adjustment is called for. The positive deviation of the profit rate in mask and sanitizer production from the average induced an acceleration of investment into the corresponding industries,

leading to a faster expansion of supply (relative to demand) and more fierce competition, ultimately bringing down the products' prices to a level accompanied by a profit rate that was forced back to the average level. Throughout this process, the value of masks and sanitizers did not change unless the productivity of labor in these industries increased (or fell). It is therefore the state of productive forces that determine commodity values ([Rubin 1990](#), chapter 17).⁶

Marx's theory of value (and price) is, in part, about the objective equalization of commodities—it implies the objective equalization of different kinds of labor in the act of exchange. This is why it starts not with different subjective tastes and preferences but with the objective state of productive forces, which ultimately determine costs of production. This gets to the core of another line of criticism, which declares the value-related part of Marx's theory to be redundant. Following the publication of [Steedman's \(1977\)](#) reevaluation of Marxist theory after [Sraffa's \(1972\)](#) groundbreaking work, the neo-Ricardian school passionately argued that the fundamental questions relevant to the study of capitalism can be undertaken on Sraffian grounds, without any recourse to Marx's theory of value, which comes with either logical inconsistencies or useless derivations.⁷ As the argument goes, the Sraffian system is both consistent and sufficient to demonstrate the emergence of a surplus and therefore to study exploitation.

With or without knowing it, neo-Ricardians reduce Marx's value theory to its quantitative aspects, discarding all qualitative insights that follow from it.⁸ The first problem is that without Marx's value-form analysis, it is impossible to derive the concept of commodity fetishism and arrive at the conclusions presented earlier in this chapter. The study of the capitalist economy as a complex structure of social relations can only proceed from the perception of *capital as a social relation*, which is defined by the extraction of surplus value from wage labor. This is a crucial step in understanding capitalism as a mode of production rather than a mode of distribution, which allows for studying a range

of questions within an integrated framework, such as the formal and real subsumption of labor under capital or the built-in tendency of undervaluation (if not nonvaluation) of the forces of nonhuman natures in the context of the looming ecological breakdown.

Second, the study of the social division of labor and its ceaseless reproduction within the historically specific context of capitalism, along with its systemic tendencies (which Marx called laws of motion), can only be studied by a system of abstractions to reveal the essence of this socioeconomic system. This is what Marx's value theory does, starting with the study of the capital-labor relationship in isolation from all other determinations (in volume 1 of *Capital*) and deriving the concept of surplus value as the source of profit, interest, and rent. The alternative offered by the neo-Ricardian school is not much more than a system of equilibrium prices and an analytically consistent theory of income distribution, which is superior to its neoclassical counterpart as revealed by the Cambridge capital controversies but falls short of the depth and scope of Marxist value theory ([Savran 2012](#)).

In contrast, Marx's value theory represents an integrated framework to study a rich set of qualitative and quantitative phenomena peculiar to the historically specific form of capitalist commodity production. This is different from claiming that it theorizes the capitalist mode of production in its totality or that it captures all concrete complexities peculiar to this social form. Part of our aim in this book is to study the law of value and present value theory with an emphasis on its frontiers, highlighting what it sheds light on and why it is significant.

1.2 The Book's Content and Structure

The focus of this book is the operation of the law of value as the fundamental force that draws into its orbit all conceptually linked relationships and tendencies of capitalism. To be more precise, by focusing on the quantitative side of Marx's value theory, we study statistical regularities between (1) observed market

prices, (2) prices of production, which constitute only a tendency reflecting a general profit rate, and (3) direct prices, which are money prices proportional to labor values. These statistical regularities are not restricted to the relationships between price vectors (such as correlations) but extend to statistical regularities in deviations between them.

Capitalists make their decisions based on market prices, which fluctuate in response to changes in the balance of supply and demand and under competitive pressure. The fluctuations do not take place in a vacuum. It is rather a turbulent process in which the prices of production constitute the moving center of gravity. Every deviation in market prices from the underlying center of gravity activates forces that tend to mitigate (or eliminate) this deviation: If the actual market price is above the production price at which the capitalist gains the general rate of profit, the flow of capital to that industry accelerates relative to demand, bringing about a fall in the market price toward the moving center of gravity—and vice versa for market prices below production prices. In the context of real capitalist competition, we would expect to see persistent deviations constituting a statistical regularity between the sets of market and production prices, rather than a coincidence of the two. At the same time, the deviations and their regular patterns matter: Reducing turbulent equalization to static-equilibrium price theory would again rob value theory of its insights on capitalism's structural dynamics.

The same is found in the statistical relationship between prices of production and direct prices: persistent and regular deviations rather than direct coincidence. Prices of production are a theoretical construct reflecting the tendency for the emergence of a general profit rate. That tendency is at the same time a process of redistribution of aggregate surplus value across industries according to total capital advanced, a basic manifestation of capitalist competition.

Market prices are ultimately governed by the monetary expression of labor values (namely, direct prices) through the mediation of prices of production. On both sides of this relationship, deviations (between direct prices and production

prices, on the one hand, and between production prices and market prices, on the other hand) follow from the regular operation of the law of value rather than the malfunctioning thereof. Prices of production deviate from direct prices since constant and variable capital are employed in different proportions between industries (proportions also differ within industries, which is an important competitive mechanism but does not change the relationship between direct and production prices). Market prices deviate from production prices since direct correspondence would only emerge when there is an equilibrium in the distribution of social labor across branches, so that supply and demand are equal and all industries gain the average rate of profit, and factors such as ground rents are absent. However, the distorting factors are persistent features of capitalism, not imperfections that fade over time, as we explain in [chapters 2, 4, and 5](#).

The relationship between these three sets of prices, manifested in the form of regular deviations within a certain quantitative range, can gain additional dimensions as we move from higher to lower levels of abstraction and add more concrete determinations that reflect the complexity of real-world economies. Any theory confronts a growing extent of divergence between its conclusions and real-world observations as the level of abstraction is lowered—that is, as its simplifying assumptions are gradually relaxed, and the analysis is carried over to more concrete terrain.

A real economy, be it approached at the national, regional, or international level, is always more complex than the theoretical construct in which the law of value operates in its pure form: Multiple modes of production coexist in real-world social formations, interacting with the dominant mode of production, namely capitalism; persistent differences in wages (and rates of surplus value) exist with respect to different segments of the population even within countries, not to mention the differences across countries; extra-economic forces, including military power, are not absent from the picture; landed property (and nonreproducible inputs) create zones that are partly insulated from the operation of the law of value, generating peculiar dynamics captured by the concept of

rent; various forms of regulation of prices coexist, including the government's visible hand; and so forth.⁹

These are the frontiers of the law of value, and as such, they can either be integrated into value theory or mark its limits. From a quantitative perspective, they can help explain variations within the deviations between the three sets of prices and track transfers of value. Landed property and rent, for instance, where they are present, modify the functioning of the law of value by partly insulating surplus profits from being redistributed across industries. This does not negate the law of value but helps us explain the source of the modification, which manifests itself in above-average deviations between different sets of prices. In a similar vein, international trade adds a new dimension to the regular functioning of the law of value. Persistent differences in the rate of surplus value across countries can produce an additional channel of value transfers. Combining that channel with other sources of value transfers, it can be demonstrated that certain countries have a substantial upper hand in international trade, constituting a core economic aspect of imperialism.

We study the cases of, first, international trade and imperialism and, second, landed property and rent as two major frontiers of the law of value in [chapters 4](#) and [5](#). Before glancing over the structure of the book, however, we would like to clarify what is *not* part of the analysis we advance.

First, we purposefully leave aside the debates pertaining to the so-called transformation problem and the inconsistency argument targeting Marx's value theory. A lot of ink has been spilled about these issues, and the criticisms have been profoundly addressed. A due treatment of these questions would have been a major digression from our purpose in writing this book. In the same spirit, we prefer to present value theory the way we distill it from the vast relevant literature, without addressing past and present differences in interpreting it. The works of Rubin and Shaikh are the cornerstones for the way we grasp value theory and apply it on empirical grounds. By implication, although the specific interpretation of value theory we advance in this book implicitly reveals our

position in the debates around it, we do not delve into those debates, be they in the domain of value-form theory most prominently associated with [Heinrich's \(2012\)](#) work, the New Interpretation formulated by [Duménil \(1983\)](#) and [Foley \(1982\)](#), or any other contending approach.

Second, the book focuses on the sphere of value, which cannot exist without other forms of labor and use values necessary for reproducing life and society. Although they are implied as part of the overall theoretical approach adopted in the book, which includes use values and useful labor as an integral part, the analysis revolves around capital as a social relation and self-expanding value that takes primacy in regulating the relations outside the sphere of value, too. One aspect of the matter is addressed in [chapter 5](#), in which the ecological breakdown is perceived as the result of the subjugation of all use values to the accumulation imperative, while other crucial aspects of the same totality, such as highly gendered reproductive labor, are not examined in this book.

Third, the relevance of gender and patriarchy are not confined to reproductive labor. Nor is race a simple category of stratification. The capitalist mode of production appropriated, transformed, and used all forms of oppression that it found ready at its inception. Despite the changes they underwent in form and content, these modalities of oppression have been essential features of historical capitalism and still constitute fundamental aspects of its complex reality. This book opens with the highest level of value-theoretical abstraction, in which these concrete features are assumed away. The two steps taken toward carrying over the analysis to a more concrete field are concerned with the ecological breakdown and manifestations of economic imperialism in their relationship to value theory. Accordingly, the book is concerned with these aspects of historical capitalism only in an indirect and rudimentary way. On the flip side, the book lays out the foundations of an integrated and consistent framework with the help of which these more concrete questions can be studied.

This book has five chapters. [Chapter 2](#) lays out the theoretical foundations for the rest of the book. It presents Marx's value theory as a concise and coherent

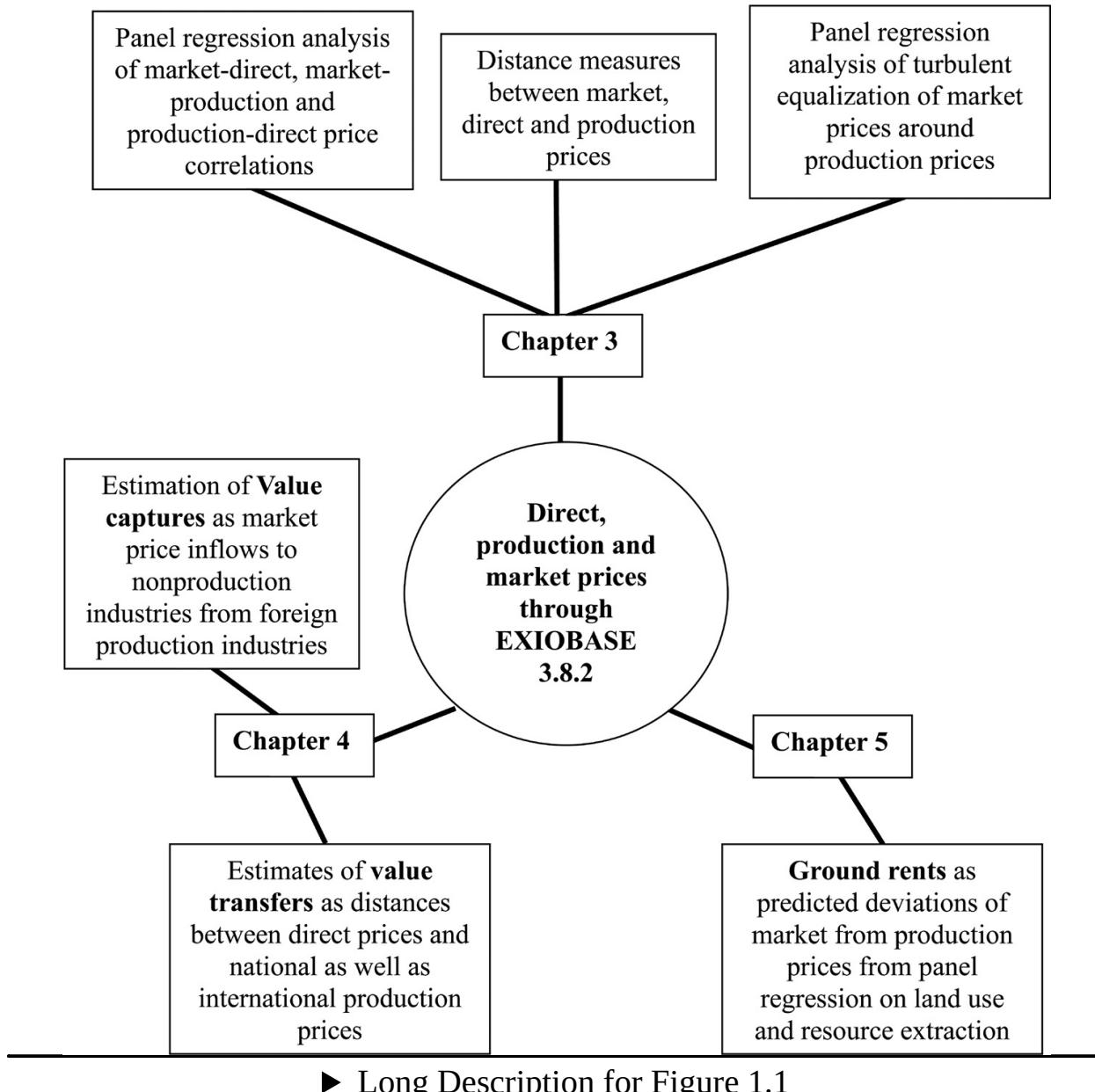
framework, tracing its elements to the work of classical political economists—especially Smith and Ricardo—and emphasizing the ways in which he moved beyond them. A crucial emphasis is put on the fact that Marx's value theory needs to be grasped in its totality, comprising its qualitative and quantitative aspects, which forms the basis of both his critique of classical political economics and his analysis of the capitalist mode of production. Theoretical relations and the corresponding regularities that we expect to observe empirically in terms of labor values, prices of production, and market prices are formulated at the end of the chapter, setting the stage for the remaining three chapters, which focus on the quantitative side of Marxist value theory.

[Chapter 3](#) extends the baseline model introduced in [İşikara and Mokre \(2022\)](#) in multiple ways, most importantly by tracking global production chains rather than only within-country dynamics, including fixed capital flows in the model and the direct analysis of market prices' turbulent equalization around production prices. Following a brief presentation of the theoretical foundations in summary form, we test the empirical relationship between direct prices, prices of production, and market prices for 159 industries in forty-four countries, covering a period of twenty-six years based on the harmonized multiregional input-output tables provided by the EXIOBASE project ([Stadler et al. 2021](#)). Comprising both circulating and fixed capital flows, and distinguishing between production labor (which creates value) and nonproduction labor (which does not create value), the analysis presented in this chapter qualifies as the most comprehensive empirical application of its kind.

We measure the distance between the three sets of prices using different metrics and test the correlation between relevant pairs of prices by means of log-log and level-level regression analysis. Our results solidify the empirical strength and robustness of the labor theory of value. In addition, we open an entirely novel empirical terrain by testing the turbulent fluctuation of several variables around their respective centers of gravity. In 85 percent of the industries we test, which account for 71 percent of gross output, we find evidence for the turbulent

equalization of profit rates, which manifests itself in the turbulent fluctuation of market prices around prices of production. Just as crucial as the evidence for turbulation, the industries without turbulent equalization suggest that ground rent and nonproduction industries play a significant role—in other words, we approach the frontiers of the law of value, not the negation thereof.

Having established the regularities between direct prices, production prices, and market prices in [chapter 3](#), the remaining two chapters revolve around regularities in the deviations and study two domains (international trade and ground rent) that help explain a substantial part of the deviations. On empirical grounds, both chapters build on the baseline model presented in [chapter 3](#), modify or extend it with respect to the new questions raised, and follow suit by working with the EXIOBASE data introduced in the same chapter as illustrated in [Figure 1.1](#).



► Long Description for Figure 1.1

Figure 1.1 Schematic illustration of the empirical models in the book [◀](#)

In [chapter 4](#), we address the question of value transfers in international trade as a key (economic) mechanism of imperialism. At the highest level of abstraction, the law of value assumes a tendency to equalization of wages for equal levels of skill, which presupposes a sufficient level of mobility of workers across industries and regions when faced with significant wage differences. This

assumption cannot be carried over to the international level, at which political barriers (among other things) prevent workers from crowding into high-wage countries, which is a major source of persistent differences in wages. Combined with cross-country differences in the level of development of productive forces, the state of class struggle, the character of political regimes, and so forth, the relative immobility of labor brings about differences in the rate of surplus value across countries. Along with differences in the technical composition of capital, cross-country differences in the rate of surplus value constitute an important channel of value transfers in international trade.

The chapter opens with a critical discussion of the theory of unequal exchange, particularly in its Marxist form, most prominently formulated by [Emmanuel \(1972\)](#) and developed by various other authors. Based on the observation that a significant portion of the empirical literature on value transfers suffers from the lack of a consistent value-theoretical framework, we first identify the channels of international value transfers within a coherent Marxist framework. We then develop an empirical model to estimate between-country transfers of value measured as the deviation between direct prices and international prices of production and to capture transfers resulting from differential value compositions and rates of surplus value separately. We find that aggregate value transfers amounted to roughly 6 percent of global gross production in the period 1995–2020, corresponding to more than seventy trillion euros, with positive net transfers distributed very unequally among a small number of countries.

Aside from studying value transfers resulting from between-industry competition at the international level, we briefly study nonproduction value capture between countries—that is, the appropriation of value created in production industries by nonproduction industries. With the caveat that the empirical magnitudes reported in this context significantly underestimate actual value capture because of data restrictions detailed at the end of the chapter, we find that value capture relates to at least 0.15 percent of global gross production

in the mentioned period.

[Chapter 5](#) revolves around another frontier of the law of value—namely, ground rent and nonreproducible inputs to the production process. The chapter opens by discussing how classical political economists conceptualized rent, then delves into Marx's insights in this domain, which constitute a prime example of his perception of material cycles of production and reproduction on social and historical grounds. After presenting the concepts of absolute, differential, and monopoly rent in some detail, we turn to the role played by landed property in historical and contemporary capitalism. The crucial emphasis here is that rent is not merely a distributional category. It is closely related to the accumulation of capital, and therefore it has to be understood within the context of accumulation dynamics under capitalism. Although landed property brings about a partial insulation of a share of aggregate surplus value from competitive dynamics, it does not negate the law of value. It is a frontier thereof and, as such, internal to it.

That rent is internal to the law of value is reflected by its role in explaining the deviations between production and market prices. In our efforts to empirically capture this role, we extend the baseline model introduced in [chapter 3](#) by incorporating physical bearers of ground rent: land use and resource extraction by industries. We investigate the relationship between the extent of land use and resource extraction in an industry, the presence of above-normal profits, and patterns in the relationship between production and market prices that set apart these industries from others. Our model not only accounts for the role of land use and resource extraction in explaining higher positive deviations in industries engaging with these activities but also traces the downstream impacts of these rent-bearing inputs on the buying industries. The surplus profits in industries capturing ground rents are paid by negative deviations in non-extracting industries proportional to their use of rent-bearing inputs as circulating and fixed capital as the regression analysis in [chapter 5](#) demonstrates. The last part of the chapter ties the theoretical and empirical discussion of rent with some broader

discussions around value theory, dealing with a number of questions ranging from the concept of scarcity to the contradiction between exchange value and use value, metabolic rift and shift, and ecologically unequal exchange.

We believe that readers can benefit the most by reading all chapters. However, given the conceptual and empirical complexities pertaining to [chapters 3–5](#), we chose to include the theoretical foundations (in a brief form) in every single chapter. The same holds for the empirical models, which are developed from scratch in each chapter even though parts of them are also presented in previous chapters. This facilitates reading any individual chapter on its own. A potential drawback is that parts of the chapters can appear repetitive to readers who prefer to read the whole book. We believe that the reiteration of theoretical and empirical foundations solidifies readers' understanding of the material we present, especially in [chapters 3–5](#), where we sail in mostly uncharted waters. We hope that this work extends the scope of empirical analysis on grounds of value theory and opens new avenues of research.

Notes

1. Throughout the book, we use the term *classical political economics* to denote the tradition called *classical political economy* by Marx, who coined the latter term. It relates to the works from Petty and Boisguilbert in the seventeenth century to Ricardo and Sismondi in the early nineteenth century ([Kurz 2022](#)). We do not see Marx as part of this tradition since there are substantial ruptures on conceptual and epistemological grounds setting apart his work from classical political economics, even though he adopted multiple foundational tenets of it. This matter is discussed in more detail in [chapter 2](#).
2. Classical and Marxist value theories are discussed in detail in [chapter 2](#). This section selectively presents certain aspects of the mentioned theories, highlighting some common grounds and substantial differences.
3. The literature on turbulent equalization is vast and extends to the question of regulating profit rates, but we only cite the initial seminal theoretical and methodological contributions here.
4. For a documentation of the deliberate effort to dispose of Marx's theory of exploitation, see [Meek](#)

(1976, 251–52), who provided direct references to economists writing at that time.[↩](#)

5. For a recent formulation of this criticism of Marx's value theory, see [Hornborg \(2011, chapter 6\)](#).[↩](#)
6. Demand does not affect the magnitude of value, namely the socially necessary labor time required to produce a commodity. The causality runs in the other direction: It is the magnitude of value (through its regulating influence on the price of production), combined with demand (which is partly determined by value since the size of income relative to the price of commodities, in addition to tastes and preferences, matters) that determines the volume of production.[↩](#)
7. Such views predate the publication of Steedman's work. Joan Robinson, for instance, described aspects of Marx's value theory as “Hegelian stuff and nonsense” ([1953, 20](#)) and the law of value as a metaphysical belief from which there is nothing to be learned ([1978, 40](#)).[↩](#)
8. In the next chapter, we lay out Marx's value theory in its totality, discussing both qualitative and quantitative aspects.[↩](#)
9. It is therefore crucial to keep in mind that the law of value does not represent the totality of the capitalist mode of production or its economic aspects. Value is rather the transmission belt that coordinates the working processes of autonomous units and spheres of the capitalist society. In addition, elements of the concrete reality mentioned in this paragraph are not alien or external to the capitalist mode of production. On the contrary, they have been an integral part of it since its very inception, as is discussed in [chapters 4](#) and [5](#).[↩](#)

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2 Value and Prices in Classical Political Economics

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The question of value is as old as the exchange economy itself. Notwithstanding all the enrichment and metamorphoses the concept of value has undergone, the main line of demarcation has been between the points of view one adopts to study it: production or exchange? Both perspectives precede classical political economics, as is discussed in what follows. With classical political economics, the focus of attention shifted to the sphere of production, and value theory gained a foothold through more refined formulations by Adam Smith and David Ricardo. With Karl Marx, a more complete picture emerged in which commodity production and capitalism were grasped as historically specific social forms, and their moving contradictions were articulated in value theory. Without claiming to offer a complete history of the concept of value, this chapter aims to provide a coherent representation of classical value theory as a solid foundation for the theoretical and empirical inquiries developed in the rest of the book. The main focus lies on the theoretical developments around and after the birth of industrial capitalism in western Europe since this is when a coherent theory of value suitable for studying the economic regularities peculiar to a capitalist society

emerged.

2.1 Value Theory before Adam Smith

The primary doctrine that characterized the medieval economy in Europe was that of just price. The medieval canonists approached the question of price (and value) from the viewpoint of production and argued that the just price is determined by the costs of production. The latter comprise material costs and a reasonable wage for the craftsman or merchant for effort and risks undertaken. In a relatively static and lethargic world where exchange took place predominantly within self-sufficient communities consisting of small, independent producers, the efforts and expenses could be directly compared, and the just price would emerge out of the transactions between producers and consumers ([Baldwin 1959](#)).

Already in the thirteenth century, however, the growing extent and significance of trade brought about challenges for the theory of just price. The emergence of the merchant, mainly interested in buying cheap and selling dear, was the harbinger of a new type of economy. However, acquiring a gain in this way was regarded as dishonorable by the canonists. Aquinas wrote that such gains could only be justified either by having improved the product during the time between its purchase and sale or by using the gain for an honorable end. The expansion of commerce in the following centuries rendered the just price theory obsolete: goods were now coming from distant places, with the cost of production unknown at their destination; and the impersonal market began to take over the task of regulating prices ([Meek 1976](#), 13–14). Consequently, the relationships between the expansion of markets through trade, the enhancement of division of labor, and the associated increase in returns, and other traits of the emergent world were revealed by [Ibn Khaldûn \(2020\)](#) centuries before Adam Smith, to whom these theoretical innovations are usually attributed.¹

It comes as no surprise that the expansion of trade was accompanied by the

rise of a new approach to the question of value that takes the viewpoint of exchange. The significance of expanding commerce and the need to justify gains from trade as just set the stage for the mercantilist theory of value (and price), which became conventional starting in the sixteenth century. Since most production in western Europe was undertaken either by small producers who owned their means of production or by workers under the control of feudal lords, capitalists (who were primarily merchants) naturally focused on the sphere of exchange as the source of profits. They thus strove to understand the dynamics of prices at which commodities were bought and sold, bringing about their profits ([Hunt and Lautzenheiser 2011](#), 23).

In a world where *profit upon alienation* ([Marx 1969a](#), 41–43)—that is, profit resulting from the difference between the purchase and selling prices—appeared to be the primary source of profit, the following notions pertaining to the price and value of a commodity started to become conventional: first, the value of a commodity is its actual market price; second, this price results from the forces of supply and demand; and third, *intrinsic value* (or utility) is distinct from the *value*, or price, of a commodity ([Meek 1976](#), 15).

As capitalist relations developed and permeated deeper in western Europe, however, the mercantilist paradigm started to be contested and gradually fell from grace starting in the mid-seventeenth century. Several factors are important for understanding this change. First, around the mid-seventeenth century, price differentials between regions or nations were eroding because of expanding commerce and increasing competition. This does not mean that trade monopolies disappeared. In England, for instance, the Navigation Acts (first passed between 1651 and 1662) and state-granted rights helped create monopolies in international trade. These were manifestations of commercial and imperial competition in the mercantile phase of capitalism ([Brewer 2005](#), 135; [Hunt and Lautzenheiser 2011](#), 28).

Second, and closely related, in search of greater control over their gains, merchants extended their influence to the sphere of production, initially in the

form of the putting-out system, which could, according to [Marx \(1991, 452\)](#), never replace the old mode of production by itself. The “really revolutionary way” was the transformation of producers into merchants and capitalists. In the seventeenth century, a class of merchant-employers arose from the ranks of craftsmen. Setting the relative importance of these two avenues of change aside, the relation between production and profit came to light as capitalism developed and profit upon alienation, based on price differences as the merchants found them, diminished ([Dobb 1946](#), 126–34). All in all, while “the first theoretical treatment of the modern mode of production—mercantilism—necessarily proceeded from the superficial phenomena of the circulation process” (because “commercial capital is the first independent mode of existence of capital in general”), modern economics “begins only when theoretical discussion moves from the circulation process to the production process” ([Marx 1991, 455](#)).

The changes in social and economic reality that were reflected in the shift of intellectual attention to the production sphere were by no means smooth and instantaneous, though. The gradual integration of production and commerce captures only part of the story. At least as important was the creation of a class of wage laborers who were deprived of any access to means of production and subsistence. By the end of the seventeenth century, the share of owner-occupiers of cultivable land in England dropped to some 25–30 percent, signifying a massive concentration of land in the hands of landlords, while the number of landless peasants and the proportion of peasants employed as wage laborers increased steadily. As is well documented, the creation of the modern working class in the cradle of capitalism was a conflictual and violent process comprising expropriation and deconstruction of communal and customary rights, coercion and repression, discipline and punishment, and immiseration ([McNally 1993, 11](#)).

2.1.1 Toward Classical Value Theory: The Concepts of Natural Price and Average Rate of Profit

The combination of this transformation in economic practices and social

relations manifested itself in an overall shift of emphasis to the sphere of production, and particularly to human labor as the source of value and cause of wealth. Long before Adam Smith, thinkers such as Ibn Khaldûn in 1377, William Petty in 1680, John Locke in 1689, and Daniel Defoe in 1713, among others, grasped the role of labor in creating wealth and turned their attention to production. It would be a stretch, however, to argue that they came up with an integrated and coherent framework to study the determination of value and prices. What they usually put forward in this context was nothing more than the proposition that value is determined by wages or, put differently, that labor created value by increasing the use value of commodities ([Hunt and Lautzenheiser 2011](#), 33; [Meek 1976](#), 20–24).

The key prerequisite for the birth of classical value theory was the appearance and recognition of profit (on capital) as a general category of income that is separate from rent, interest, and wages. In earlier centuries, the prevailing notion of profit was *profit upon alienation*, which resulted from differences between purchase and selling prices and thus did not appear as a generic type of income associated with the use of capital to hire wage labor. It was not until the second half of the eighteenth century that *profit on capital* became clearly differentiated from other sources of income and called for a new theoretical approach.²

The differentiation of profit on capital from rent and interest came along with the distinction between capital passively used and capital actively used, where the latter brings about a profit above the rate of interest, implying that interest is a derivative form of income paid out of profit. When it comes to the differentiation between wages and profit on capital, the source of confusion was that capitalists, in many cases, arose from the ranks of direct producers and still participated to varying extents in the process of production. This gave rise to the false impression that their net gain was a sort of wage, albeit one superior to the wage of their wage laborers, rather than profit on capital. Over time, however, the deepening social and functional differentiation between wage laborers and capitalists, as owners of means of production who played a supervisory role in

production, became evident. Profit on capital was thereby sufficiently differentiated from wages. Moreover, as capitalist relations advanced and pervaded larger sections of economic activity, and conditions for the mobility of capital between different places and industries of production were established, the stage was set for the *average rate of profit* to become evident to observers.

The main theoretical product of these social changes, aside from the average rate of profit, was the *natural price*. Around the mid-eighteenth century, many authors, including Richard Cantillon, Joseph Harris, and William Temple, were clearly aware of the implications of the mobility of capital toward higher-than-average returns, and they experimented with notions such as *intrinsic value*, as distinct from market price, or *value of brokerage*, corresponding to average profit. By doing so, they anticipated the concept of natural price, which includes an average rate of profit in addition to other costs of production. It was not until Adam Smith's *Wealth of Nations*, however, that an integrated framework was developed to study, first, the full significance of the theoretical and empirical regularities resulting from the recognition of labor as the source of value and, second, the concepts of the average rate of profit and the natural price ([Meek 1976](#), 24–31).

2.1.2 Surplus Product and the Physiocrats

At the same time as these epochal changes in England in both economic practices and the study thereof, a different school of thought emerged in France that was to affect succeeding generations of political economists. The Physiocrats laid the foundations of modern political economy, as they explicitly focused on the question of the origin of surplus value and they decisively shifted the inquiry from the sphere of exchange to the sphere of production.

For Physiocratic thought, agricultural labor is the only *productive* labor since it is the only type of labor the product of which is greater than the sum of the means of subsistence consumed by the worker from one year to another. The possibility of surplus product arises from a certain level of productivity of labor

that allows labor power to create more than it needs to reproduce its own means of subsistence. Taking this level of productivity as a starting point, all surplus product appeared to Physiocrats as a gift of nature. This surplus product appears most palpably in agriculture because of its material and tangible form and the independence of its production and appropriation from the sphere of circulation ([Marx 1969a](#), 44–47).

The main shortcoming of the Physiocratic school was a failure to distinguish between exchange value and use value. The analysis starts with use values, such as a particular harvest, and seeks to explain the surplus value manifested in the net product. Since surplus value is merely a use value for Physiocrats, however, agriculture (and nature) appears to be its sole creator. This results in the perception of landlords and rent as the only forms of capitalists and surplus value, respectively, implying that surplus value is reducible to a material substance. This can still be seen as an advance compared to the zero-sum game of the mercantilist worldview, in which the inquiry into surplus value is confined to profit upon alienation, which is a redistribution of wealth between different parties ([Marx 1969a](#), 62–66).

Despite all these shortcomings, however, the Physiocratic school had profound impacts on subsequent political economists through its distinction between productive and unproductive labor, the emphasis it put on interdependencies between various spheres of the economy, and its notion of circular flows of money and commodities ([Hunt and Lautzenheiser 2011](#), 36). These matters constitute the main focus of François Quesnay's *Tableau économique* (1758), which seeks to put the production and circulation of the surplus at the center of the discussion. This approach was highly appreciated by Marx, who was inspired by Quesnay's economic tables when developing his own schemes of reproduction discussed in volume 2 of *Capital*. The reproduction schemes were further developed by (among others) Wassily Leontief and Piero Sraffa, whose respective concepts of input-output analysis and linear models of production ([Tsoulfidis and Tsaliki 2019](#), 43) are extensively used in the

empirical analyses of the subsequent chapters.

The failure of Physiocrats to grasp *labor in general*, or *abstract labor*, as the source of value can be attributed to the social conditions of production underlying their analysis. Eighteenth-century France was characterized as an agricultural economy in which unceasing social and economic unrest followed from a combination of feudalism and merchant capitalism. Agriculture was still small scale, based on scattered fields, and dominated by feudal relations that hindered the advance of capitalism. For the notion of labor in general to become central in political economy it was necessary that the traditional bonds between an individual and their labor be shattered. The first steps in this direction were taken on the other side of the English Channel by Adam Smith, who published his *Wealth of Nations* in 1776, the same year the influential Physiocrat Anne Robert Jacques Turgot lost the office of comptroller general in France ([Hunt and Lautzenheiser 2011](#), 35; [McNally 1993](#), 11; [Pilling 2010](#), 15).

2.2 Adam Smith

Adam Smith's brilliance lies in treating regularities in the sphere of exchange from the viewpoint of production and in putting the interdependence and competition among producers at the center of an integrated framework. Although not entirely consistent, his abstract model of a capitalist economy aimed to capture the interconnections between social classes, the sphere of exchange, the sphere of production, price formation, growth, and the distribution of income. His magnum opus, *The Wealth of Nations*, opens with a treatment of the division of labor, including its determinants and ramifications ([Smith 1999a](#), chs. 1–4). He was, however, by no means the first to recognize the interdependence of competing commodity producers and the implications of this interdependence and competition. Bernard Mandeville, in *The Fable of the Bees* (1714), explicitly grasped society as a “body politick” in which each individual achieves their ends by laboring for others, each member becomes subservient to

the whole, and the institution of money arises as an acceptable reward for each individual's activities ([Mandeville 1966](#), 348–50). Similarly, as a social division of labor was clearly emerging, and the question of what regulates the exchange of commodities was begging for an answer, other thinkers anticipated a value theory with significant emphasis on labor ([Meek 1976](#), 41).

Smith's journey in the realm of value theory resembles the advances made in this field before him, and it had taken generations of authors to recognize and understand novelties brought about by the capitalist mode of production and correspondingly theorize profit on capital and the average rate of profit. In his Glasgow Lectures of 1763, for instance, in sharp contrast to *The Wealth of Nations*, accumulation of capital seems to play a relatively minor role. Similarly, Smith made no mention of the natural rate of profit. Profit was not grasped in a regular relationship to the quantity of (capital) stock yet.

He did raise in the Glasgow Lectures the central question of what conditions regulate the price of a commodity, though, and argued that market prices fluctuate because of changes in supply and demand, but revolve around a natural price. He linked the natural price of a commodity to the natural price of labor, which provides the worker with the costs of production and a reward to compensate them for the risk taken in their business. Individual producers tend to move into occupations promising the highest incomes, pointing to the regulating function of competition. At this stage, Smith's framework was based on independent workers' activities rather than capitalists who hire wage laborers and control their activities. The differentiation of classes was not clear to him yet, and hence profit on capital did not appear as a distinct source of class income ([Meek 1976](#), 45–53).

Still, eighteenth-century England had a relatively well-developed market. Skepticism toward usury and commerce had become weaker, and even mercantilist writers adopted an anti-government stance, favoring a competitive market. As Mandeville's mentioned work demonstrates, what, to the medieval moralists, had been despicable vices such as selfishness and greed were now

regarded as the greatest virtues of the new era. At the same time, proletarianization was in full swing with the parliamentary Enclosure Acts starting in the 1750s, enforcement of the newly created property rights, and imposed discipline through coercive punishment. A significant number of manufacturing cities emerged where wage laborers were hired to work in capitalist-owned factories, and significant innovations were made in leading industries such as textiles and iron ([Hunt and Lautzenheiser 2011](#), 40–44; [McNally 1993](#), Ch. 1).

In this context, three changes in Smith's thinking depart from the framework of the Glasgow Lectures and constitute the link to *The Wealth of Nations*: first, the recognition of “profits of stock” (that is, profit on capital) as a source of income that is totally different from wages and rent and is “regulated altogether by the value of the stock employed” ([Smith 1999a](#), 151); second, the perception of landlords, workers, and capitalists as the “three great, original and constituent” orders of modern society, the sum of whose revenues represents national income ([Smith 1999a](#), 356); and third, a strong emphasis on the role of accumulation as the prime motive of economic processes.

In what best captures the centrality of accumulation in *The Wealth of Nations*, [Smith \(1999a](#), 443) wrote:

The annual produce of the land and labour of any nation can be increased in its value by no other means but by increasing either the number of productive labourers, or the productive powers of those labourers who had before been employed In either case an additional capital is almost always required When we compare, therefore, the state of a nation at two different periods, and find, that the annual produce of its land and labour is evidently greater at the latter than at the former, that its lands are better cultivated, its manufactures more numerous and more flourishing, and its trade more extensive, we may be assured that its capital must have increased during the interval between those two periods.

Apart from demonstrating the contrast between Smith and the Physiocrats regarding productive labor—Smith used the term in a broader sense than agricultural labor—this discussion shows a grasp of accumulation as *the driving force* of a capitalist economy. In fact, it is the stock of capital employed for the sake of profit that puts into motion and directs the productive labor of a society ([Smith 1999a](#), 357–58). Therefore, profit and accumulation stand out as the prime motive in a capitalist context, and a thorough understanding of the conditions that regulate them is the main task of political economy, which is mainly concerned with enriching both the people and the sovereign ([Smith 1999b](#), Introduction).

What is accumulated needs first to be produced and then distributed, of course. Smith started his discussion of exchange with the “early and rude” state of society, a prehistoric condition in which exchange of commodities among independent producers is regulated by the labor necessary to produce them. Still, in a society characterized by division of labor, exchange is the constituent of society itself. When it comes to the question of what regulates the exchange of commodities, he argued that labor is the only invariant, and hence it is the real measure of the exchangeable value of commodities ([Smith 1999a](#), 136). [Smith \(1999a\)](#) defined the value of a commodity at this point as “the quantity of labour which it enables him to purchase or command” (133) on the market rather than the quantity of labor embodied in it. This is not noticeable at first glance, since labor commanded and labor embodied are practically identical in a context in which commodities are produced by independent producers who labor for themselves.

In the sixth chapter of *The Wealth of Nations*, Smith introduced capitalist relations, in which capital stock has accumulated in the hands of individuals who, with the aim of making profit, hire workers and supply them with means of production ([Smith 1999a](#), 151). The question is what now regulates the “real value” of a commodity—that is, the quantity of labor it would command on the market. Since the worker is no longer working for himself and hence is not

independent, the whole produce of labor does not belong to them. The price of a commodity resolves itself into the rent paid to the landlord, wages paid to workers, and profit appropriated by the capitalist. These three items make up the exchangeable value of a commodity according to Smith.³ Since the worker must now give up parts of the produce of their labor, however, the amount of labor required to produce a commodity is no longer equal to the amount of labor it can buy or command on the market ([Smith 1999a](#), 152). Commodities thus no longer exchange in proportion to the quantity of labor necessary to produce them, which is why many commentators have concluded that Smith abandoned the labor theory of value ([Foley 2006](#), 15) or at least the pure form of it ([Kurz and Salvadori 1997](#), 6–7).

Smith's adding-up approach to value clearly manifests itself in his discussion of the natural price of a commodity, which is different from the commodity's actual price, or market price, which is regulated by supply and demand. The natural price is rather the center of gravity toward which the market price of a commodity continually tends. There might be periods during which the market price remains above or below the natural price for a considerable time. No matter what obstacles are present, however, market prices constantly gravitate toward the natural price in a never-ending process of fluctuation ([Smith 1999a](#), 158–61).⁴

This foundational insight became a central pillar of classical political economics. The question that follows is what factors determine the natural price as the center of gravity for market prices. The natural price, just like any market price, can be resolved into wages, profit, and rent. The difference is that now what is at stake is the *natural levels* of wages, profit, and rent. As Smith defined them, these are the “ordinary or average rate[s]” of wages, profit, and rent, which are regulated by the general circumstances of the society and the particular nature of the specific productive activity ([Smith 1999a](#), 167–68).

If the effective demand for a commodity is greater than its supply, its market price will exceed the natural price. This, however, sets in motion forces that tend

to eliminate the deviation. The excess of the market price over the natural price implies that at least one of the three component parts of the natural price is above its natural level. Consequently, workers, capitalists, and landowners reallocate their resources to benefit from this temporary deviation, thereby activating the built-in mechanism that makes market prices adapt to the natural price. Importantly, a competitive environment and reasonably free mobility of capital and labor must be presupposed for this scheme to work in the described way.

The remaining question is this: If the natural price consists of the natural levels of wages, profit, and rent, how are those levels explained? Although he elaborated on the tendency toward the elimination of profit and wage differentials due to competition across industries, Smith never delivered a theory of natural wages and the natural level of the profit rate. When it comes to the remaining component, namely rent, he grasped it as a monopoly price that is bargained for and appropriated from the profit component. This implies that rent itself is a price that is derived from the price of the commodity produced with the help of the resource rented to the producers. The argument is circular because the natural level of rent, which is supposed to help explain the natural price of a commodity, itself depends on the price of the commodity.

Smith's adding-up theory of value hence reached an impasse. More important than this impasse, however, is the general inconsistency of his value theory, which goes back and forth between commandable and embodied labor and contains a fundamental mistake: Smith believed that the exchange of commodities in proportion to the labor time embodied in them is upset by the fact the value of these commodities is distributed in a different way because capitalists and landlords are in the picture. As [Marx \(1969a, 74\)](#) noted, however, the relationship between the labor time contained in commodities A and B is in no way affected by how the labor time contained in them is appropriated by various people.

What underlies the confusion resulting from the conflation of commandable

and embodied labor is a deeper misconception of the relationship between value, revenue, and price. When [Smith \(1999a](#), 155) wrote that “wages, profit, and rent, are the three original sources of all revenue as well as of all exchangeable value,” he made two substantial mistakes. First, he conflated revenue and prices with value and contradicted his own view that labor is the source of value. Second, it is labor time that creates value, not the price of labor—that is, the wage. The latter represents the portion of value appropriated by the worker. Wages can rise or fall, but this does not change the quantity of value created by a given amount of labor time.

A third defect that haunts Smith's value theory is the definition of labor as the “real measure” of value since the value of labor itself is invariable. However, since he frequently conflated labor with wages, it follows that the value of a product varies with changes in the distribution of income even if there is no change in the conditions of production. Both of these points were attacked later by Ricardo, who argued, first, that the value of labor varies with changes in the prices of food and other essentials required for the reproduction of the worker and, second, that the value of a commodity is independent of the levels of wages, profit, and rent. For Marx, furthermore, the quest for an invariable measure of value is not the task of value theory, as discussed in the following sections.

The deficiencies and incoherence of his approach aside, Smith made invaluable contributions to the theory of value. He clearly recognized that the capitalist's profit originates from the fact that part of the labor embodied in the commodity is not paid for: “The value which the workmen add to the materials, therefore, resolves itself in this case into two parts, of which the one pays their wages, the other the profits of their employer upon the whole stock of materials and wages which he advanced” ([Smith 1999a](#), 151). He did not discuss surplus value as a distinct general category, and hence he conceived it directly in the observable form of profit. However, this does not impair the importance of the implicit recognition of unpaid labor as the source of surplus value and profit ([Marx 1969a](#), 89–91). Most importantly, Smith's overall systematic approach to

the division of labor, exchange, value and prices, accumulation and growth, distribution, trade, and the government represents an exceptional advance in studying the economy and society. This is best appreciated by observing how succeeding generations of political economists built on his work.

2.3 David Ricardo

Just like Smith, Ricardo closely studied practical and political questions, and conceived of accumulation as the key to increasing the wealth of nations. Since accumulation is mainly driven by industrial profits, Ricardo, when building on Smith's legacy, paid much more attention to the question of what laws⁵ affect the distribution of income, guided by the idea that conditions favoring profits over rents would enhance accumulation and wealth ([Ricardo 1980](#), 37 and 41). The fundamental questions of political economy presented themselves to Ricardo in this form in the context of the debates around the Corn Laws. His attempts to develop a consistent value theory were closely related to the endeavor of finding an adequate answer to these questions ([Meek 1976](#), 84–85).

In the years preceding the publication of his *Principles of Political Economy and Taxation* (1817), Ricardo was mostly interested in questions concerning currency, corn prices, rent, and profit. Prompted by Malthus's observation that both the capital stock and rate of profit had been increasing for some decades, as opposed to Smith's argument that the two would move in opposite directions, Ricardo found himself closely studying the role of farmers' profit and rent. This is how he first reached the conclusion that farmers' profit regulates the profits of all other industries, and the former tends to fall with augmented employment of capital on land. Diminishing returns in agriculture imply increased difficulty in obtaining food, thereby putting pressure on profits of all other industries, resulting in a gloomy outlook for capitalist societies ([Dobb 1973](#), 67–69; [Meek 1976](#), 86–94).

In *Principles of Political Economy and Taxation*, Ricardo dropped the notion

that the profit of farmers regulates profits in all other industries. However, as Sraffa ([Ricardo 1970](#), xxxiii) noted in the introduction to Ricardo's collected works, “the more general proposition that the productivity of labour on land which pays no rent is fundamental in determining general profits continues to occupy a central position.” It is through the medium of the general level of the wages that profits “depend on the quantity of labour requisite to provide necessaries for the labourers, on that land or with that capital which yields no rent” ([Ricardo 1970](#), 126). Implicit in this statement is the argument that the values of commodities are determined by the labor embodied in the commodities and that prices (for instance, wages) depend on these values.

The first pages of Ricardo's *Principles of Political Economy and Taxation* are characterized by both an admiration of Smith's contributions to the theory of value and a critique of his mistakes. He opened the first section by positing that the “value of a commodity, or the quantity of any other commodity for which it will exchange, depends on the relative quantity of labour which is necessary for its production, and not on the greater or less compensation which is paid for that labour” ([Ricardo 1970](#), 11). Several points are worth emphasizing. First, what Ricardo called “value” is the relative (natural) price of a commodity.⁶ He identified it as the quantity of any other commodity it will exchange for. Second, embodied labor, and not commandable labor, is conceived as the determinant of value. If the productivity of labor producing a specific commodity doubles, and hence it produces twice the quantity in the same time as before, the product can by no means be exchanged for twice the former quantity ([Ricardo 1970](#), 14). Third, in the sentence quoted above, Ricardo argued that the value of a commodity *depends* on the relative quantity of labor required for its production. He did not write that the two magnitudes are *equal* to each other, which is a conclusion Ricardo reached after pondering this matter for a long time, which we elaborate below.

In a next step, Ricardo attacked Smith's argument that commandable labor is an invariable measure of value. Insofar as the value of labor is affected by its

supply and the demand for it as well as by the price of food and other essential commodities workers consume, it is as variable as the value of gold, silver, or any other commodity ([Ricardo 1970](#), 14–15). The value of a commodity measured in the way Smith suggested would change in response to every change in wages even when there is no change in its conditions of production. Moreover, Smith's adding-up approach ended up being circular because rent itself is a price. Ricardo explicitly excluded nonreproducible commodities from the labor theory of value, and he confined the relevance of the latter to those commodities that can be increased in quantity as a result of human activity ([Ricardo 1970](#), 12).

Ricardo then formulated the argument that the value of a commodity does not depend only on the labor employed directly in its production but on the total (that is, direct and indirect) quantity of labor. Even in the “early and rude state” of society, labor was applied with the help of tools and equipment, and the time and labor necessary to produce the worker's implements (in addition to the direct labor applied in producing the final product) was relevant in determining the value (relative price) of a commodity ([Ricardo 1970](#), 22–23). The embodied-labor approach thus applies to both abstractions, namely with or without a separate class of owners of means of production. Paradoxically, however, Ricardo needed to introduce three “considerable” modifications to this foundation, namely that the value of a commodity is determined by the labor embodied in it.

First, the presence of fixed capital complicates the applicability of the labor theory of value. By means of numerical examples, what could be called simple economic models today, Ricardo showed that relative equilibrium prices (that is, the ratio of two prices with a uniform profit rate) of two commodities are not proportional to the relative amounts of labor embodied in these commodities because of differences in the ratio of capital and labor employed in their production. This is because the amount of profit on the total capital invested in each industry will be different with a given uniform rate of profit.

A formal presentation of Ricardo's argument would be helpful at this point. Following [Shaikh's \(2016](#), 385–86) formulation of the fundamental equation of price, any price can be expressed as follows, in which p stands for unit price, u for unit labor costs, π for gross profits, and m for unit material costs. Since material costs relate to purchased inputs, which are the prices of the outputs of other industries, they can be broken down to the unit labor costs of that industry (u'), the gross profits in that industry (π'), and the unit material costs of that industry (m').

$$\begin{aligned} p = u + \pi + m &= u + \pi + u' + \pi' + m' = u + \pi + u' + \pi' + \\ &\quad + \pi'' + m'' = \dots \end{aligned} \tag{2.1}$$

This is an identity that holds for any price, and one can keep decomposing material costs in the same way. Total (direct and indirect) gross profits and total (direct and indirect) unit labor costs can be expressed as follows:

$$\begin{aligned} \pi^T &= \pi + \pi' + \pi'' + \pi''' + \dots \\ v &= u + u' + u'' + u''' + \dots \end{aligned} \tag{2.2}$$

Based on equations 2.1 and 2.2, we can present the relative natural prices of two commodities as follows:

$$\frac{p_a}{p_b} = \frac{v_a + \pi_a^T}{v_b + \pi_b^T} \tag{2.3}$$

Here, v stands for the vertically integrated (direct and indirect) unit labor

costs, and π^T stands for vertically integrated (direct and indirect) gross profits. Factoring out v_a and v_b from the numerator and denominator, respectively, yields:

$$\frac{p_a}{p_b} = \frac{v_a}{v_b} \left[\frac{1 + \left(\frac{\pi^T}{v} \right)_a}{1 + \left(\frac{\pi^T}{v} \right)_b} \right] = \frac{w_a^T l_a^T}{w_b^T l_b^T} \left[\frac{1 + \left(\frac{r^T K^T}{w^T l^T} \right)_a}{1 + \left(\frac{r^T K^T}{w^T l^T} \right)_b} \right] \quad (2.4)$$

In the last part of this equation, vertically integrated unit labor costs, v_a and v_b , are expressed as the product of vertically integrated wages (w_a^T and w_b^T) and vertically integrated unit labor times embodied (l_a^T and l_b^T). Similarly, the vertically integrated gross profits are the product of the average vertically integrated profit rate (r^T) and vertically integrated capital stocks (K^T). Therefore, relative natural prices can be decomposed into the ratio of vertically integrated unit labor costs $\frac{w_a^T l_a^T}{w_b^T l_b^T}$ and the ratio of vertically integrated profit–wage ratios—that is, the disturbance term in square brackets. The latter ratio can be further decomposed as follows:

$$\frac{p_a}{p_b} = \frac{w_a^T l_a^T}{w_b^T l_b^T} \left[\frac{1 + \left(\frac{r^T K^T}{w^T l^T} \right)_a}{1 + \left(\frac{r^T K^T}{w^T l^T} \right)_b} \right] = \frac{w_a^T l_a^T}{w_b^T l_b^T} \left[\frac{1 + \left(\frac{r_a^T}{w_a^t} \right) k_a^T}{1 + \left(\frac{r_b^T}{w_b^t} \right) k_b^T} \right] \quad (2.5)$$

Since we are interested in natural prices, vertically integrated wages (w_a^T and w_b^T) and profit rates (r_a^T and r_b^T) are taken to be equalized by competition. The disturbance term thus is a function of the vertically integrated capital–labor ratios k_a^T and k_b^T .

Ricardo's general thesis in *Principles* is that relative commodity prices $\frac{p_a}{p_b}$ are primarily determined by relative amounts of total (direct and indirect) labor embodied $\frac{l_a^T}{l_b^T}$. The first modification thus implies that differences in vertically integrated ratios k_a^T and k_b^T will lead to a distortion of the proportionality between relative prices and relative amounts of embodied labor.

The second modification is that even if the capital–labor ratios were the same, differences in the durability of capital goods—their depreciation rates—would upset the proportionality between relative prices and amounts of embodied labor. In addition, differences in turnover times of capital—that is, the amount of time required for production and circulation—can give rise to similar complexities ([Ricardo 1970](#), 38–43). Third, changes in income distribution in the context of differences in capital–labor ratios between industries will generate deviations of relative prices from relative amounts of labor embodied. This is because the capital-intensive industry will suffer a relatively small loss compared to the labor-intensive industry in the case of an increase in wages. Consequently, the profit rates in the two industries will be different, leading to the acceleration and deceleration of investment to and from the capital- and labor-intensive industries, respectively. As a result of the process of profit-rate equalization, the labor-intensive industry will end up with an increased natural price, while the capital-intensive industry will witness a fall in its natural price ([Ricardo 1970](#), 30–38).

Paradoxically, while criticizing Adam Smith's adding-up theory, in which changes in wages (or the income distribution) bring about changes in commodity values, Ricardo ended up modifying his own approach and incorporating the effects of income distribution, along with differences in capital–labor ratios, turnover times, and durability of capital goods, on commodity values (that is, relative prices). He thus concluded that “the accumulation of capital ... introduces a considerable modification to the rule, which is of universal application in the early states of society” ([Ricardo 1970](#), 66). In contrast to

Smith, however, he argued that the value theory still holds since the deviation of relative prices from relative amounts of labor embodied does not exceed 7 percent, which was later dismissively called the “93 percent labor theory of value” ([Stigler 1958](#)). There is, however, considerable evidence from modern economies proving Ricardo right ([Shaikh 2016](#), 398; [Tsoulfidis and Tsaliki 2019](#), 21).

Two final points remain to be emphasized before moving on from Ricardo's contributions to value theory. First, one way to resolve the seeming contradiction between profit-rate equalization and a value theory based on embodied labor was to find an invariable measure of value. Thus, Ricardo was increasingly preoccupied with finding a commodity that is always produced with the average amount of capital per worker (that is, the average capital–labor ratio) and average durability of capital. The value of this commodity would be insensitive to changes in income distribution. Despite all his efforts, he could not find such a commodity, and when he died, an unfinished manuscript titled “The Invariable Standard of Value” was found on his desk ([Foley 2006](#), 70). As is generally known, this matter was picked up by [Sraffa \(1972\)](#).

The second point is closely related to the first one. Parallel to his quest for an invariable measure of value, Ricardo developed the concept of absolute value in his last years. He felt disturbed by the notion that “a thing has increased in natural [absolute] value while it continues to be produced under precisely the same circumstances as before” ([Ricardo 1980](#), 375), and he sought an understanding of value that is independent of changes in factors other than embodied labor. In his letters following the publication of the third edition of *Principles*, he distinguished between exchangeable value, which is the same thing as the relative natural price of a commodity, and its positive (absolute) value. The latter is regulated by the quantity of labor expended, and it regulates exchangeable value ([Meek 1976](#), 113).

One great merit of Ricardo's work over Smith's is the decisive rejection of the notion that once capital starts to accumulate, labor embodied has no explanatory

power over relative prices. His detailed discussion of the complexities arising from the accumulation of capital demonstrates that what is needed is only a modification—a better specification of the functioning of the general rule. Another advance in Ricardo's work is the clear exposition of the conflict between social classes as it is manifested in the antagonistic nature of income distribution. And most importantly, Ricardo was the first political economist to grasp that the starting point for the anatomy of the capitalist system is the determination of value by labor time, and he grasped the extent to which the relations of production and exchange described by political economy correspond to or conflict with this foundation ([Marx 1969b](#), 166). In these ways, Ricardo cleared the way for Marx.

At the same time, however, Ricardo's interest in value remained confined to its magnitude. Just like Smith before him, Ricardo assumed the existence of commodities, wages, capital, profits, and even the average rate of profit included in the natural price. Based on this presupposed state of equilibrium, Ricardo discussed the consequences of a change in wages or of differences in capital-labor ratios. He found that for the profit rate to be equalized again, relative (natural) prices must diverge from proportionality to amounts of embodied labor.

We will see in the next section that instead of assuming a general rate of profit, Marx started with the source of profit, namely surplus value as a general category independent of any form it might take, and then gradually derived the categories of profit, rent, wage, capital, and the average rate of profit. As [Marx \(1969b](#), 174) himself noted, working through these intermediary stages is very different from merely postulating that the complexities only modify the rule. The method Marx suggested entails developing a much more comprehensive approach to the question of value, which classifies all preceding treatments of the question of value as only one side of the whole, namely the quantitative aspect of value. The theory of value finds its most developed expression in Marx's hands.

2.4 Karl Marx

Ricardo did not manage to reach a conclusive result on the sources of (changes in) value. Meanwhile, political economy took a sharp turn following his death in 1823. Based on Ricardo's own conclusions in *Principles*, his opponents, especially Malthus, posited that profit (and value) originated in not only labor but a number of factors. The concept of absolute (or real) value was attacked fiercely. Profit, wages, and rent, which clearly had a common source and stood in an antagonistic relationship to one another according to Ricardo, were now perceived as heterogeneous and independent of each other. The role of supply and demand as well as utility in determining the value of a commodity was emphasized. There was a rapid retreat from the endeavor to develop a coherent value theory in which labor played a central role, and the relations humans enter in the sphere of exchange came to be explained from the viewpoint of their relations in the sphere of production ([Marx 1969b](#), 191; [Meek 1976](#), 122; [Pilling 2010](#), 37–38).

In contrast to Ricardo's opponents—the vulgar school, as Marx called them—Marx was conscious and appreciative of the achievements of classical political economy,⁷ a term he coined to describe the work of generations of thinkers from William Petty through David Ricardo ([Marx 1990](#), 174–75; 1991, 969; [Perelman 2000](#), 1). To Marx, the decisive weakness of political economists was the ahistorical character of their analysis. Classical political economics assumed as given the very phenomena it sought to explain ([Marx 1972](#), 500–01):

Classical economy is not interested in elaborating how the various forms come into being, but seeks to reduce them to their unity by means of analysis, because it starts from them as given premises. But analysis is the necessary prerequisite of genetical presentation, and of the understanding of the real, formative process in its different phases. Finally a failure, a deficiency of classical political economy is the fact that it does not conceive the *basic form of capital*, i.e., production designed to appropriate other

people's labour, as a *historical* form but as a *natural form* of social production.

Marx's work thus distinguishes itself from classical political economy through its focus on not only the content but the historically specific social form. As early as in 1844, [Marx \(1988, 92, 122\)](#) laid strong emphasis on the institution of private property, which is constituent of categories of profit, wage, rent, and capital. These categories represented the point of departure for the classics, for their analysis started with the contemporary results of the process of development already evident to the observer. By means of this analytical method, the study of prices led political economists to determine the magnitude of value. In profit they discovered surplus value; in rent, landownership; and in capital, the means of production. They never asked, however, why this material-technical content of the labor process assumes a given social form, namely the value form at a particular stage of history ([Marx 1990, 168](#)).

To the extent that Marx built on the legacy of Smith, Ricardo, and others classics, there is continuity between the classical tradition and him. There are, however, foundational differences in the general method of analysis, as Marx adopted a dialectical method as opposed to the empiricism that characterized his predecessors. Relations of production constituted the starting point for Marx, as all other relations and economic phenomena are derived therefrom. Thus, the historically specific social form of the material-technical side of production *and* the relationship between that form and that side received as much attention as the material-technical side itself received.

Thus, to avoid a partial, one-sided, and reductionist understanding of Marx's approach, we must present his value theory as a whole. The upcoming sections develop the framework for a complete understanding of value theory, which includes its quantitative aspects—usually referred to as the labor theory of value —presented in [section 2.4.3](#). We start by focusing on value form and the qualitative side of value, and we gradually move toward the quantitative side.

2.4.1 Capitalist Commodity Production and Value Form

A commodity economy can be defined through the following characteristics: First, the individual cells that make up the economy, namely private producers (or enterprises), are *formally* independent from one another. Second, these individual cells are *materially* dependent on each other since each firm is embedded in a thick network of direct and indirect relations with sellers of inputs, raw materials, and means of production as well as buyers of their own products. Third, the direct connection between producers is established in *exchange*, which, in turn, influences their productive activities. In other words, the working activities of the members of society can affect other members of society and their productive activity *only through exchange* ([Rubin 1990](#), 7–10).

Under conditions of generalized commodity production, the combination of private ownership of means of production and autonomy of individual decision-makers fragmentizes society into an incessant, vibrant series of steps taken by independent economic units. Through exchange, producers, who are at the same time consumers, not only exchange commodities and satisfy their needs but become socially related to each other. Exchange and the division of labor regulated by it thus act as the cement that holds together the shattered pieces, which allows for a process of continuous adjustment through prices observed in the market.

This is why the classical political economists began their analysis with prices, wages, profits, and rent, all of which are directly observable outcomes of underlying relations and processes. That all commodities have a common expression in money led the classicals to conceive of those expressions as values, and the study of the regularities of money prices led them to the question of the *magnitude of value*. However, it is precisely this ultimate form of the world of commodities, namely the money form, that conceals the underlying social relations and processes ([Marx 1990](#), 168–69). The commodity form reflects the *social* characteristics of human labor as *objectified, material*

characteristics of the products of labor. Since individual producers do not come into contact until they exchange their products, the relations between their private labors appear not as social relations but as objectified, material relations between persons and social relations between things, which [Marx \(1990, 165–66\)](#) called commodity fetishism.

In the sphere of political economy, commodity fetishism finds its culmination in the “trinity formula,” according to which land produces rent, capital produces interest (and profit), and labor produces wages ([Marx 1991, 956](#)). Land, capital, and labor—that is, three *things*—thus seem to have the power to generate rent, profit, and wages. The three revenue streams, which are directly observable economic categories, are reduced to and identified with the underlying things, or material-technical factors, ignoring all intermediate steps, social relations, and historical specificity. It is only under conditions of capitalist commodity production, however, that means of production take the form of capital, labor becomes wage labor, and land is a monopolized object of purchase and sale ([Marx 1991, 953](#)):

Capital, land, labour! But capital is not a thing, it is a definite social relation of production pertaining to a particular historical social formation, which simply takes the form of a thing and gives this thing a specific social character. Capital is not the sum of the material and produced means of production. Capital is the means of production as transformed into capital, these being no more capital in themselves than gold or silver are money.

The transformation of material-technical factors of production into their historically specific social forms peculiar to the capitalist mode of production is not trivial. Since capitalist commodity production operates through the voluntary interactions of independent participants, their social relations take the form of private interactions. These private interactions are momentary and discrete.⁸ Most importantly, private participants are united only on the occasion of

exchange. Relations among people are thus established *for* and *through* the equalization of their products. Social relations can establish themselves only indirectly through the mediation of their products. Since no one knows whether a particular product will be demanded once brought to the market, it is only knowable *a posteriori* whether private labor is validated as social labor. It is thus the absence of direct regulation, or planning of social production, that makes people's relations with each other assume a material character, established *for* and *through* things. The corollary is that commodity fetishism is not a product of capitalist commodity production but rather an integral part of it; it is not a phenomenon of consciousness, but one of social being ([Rubin 1990](#), 16, 59).

We now have the answer to the question that was so important for Marx: It is under conditions of commodity production that the transhistorical labor process, which is a necessary condition of human existence regardless of its social form, takes on the *value form*. This is because the equalization of products of labor (and the distribution of social labor to various industries) is not directly planned *a priori* but indirectly regulated by means of exchange of things. Humans confront each other as independent commodity producers and owners and relate to each other through the exchange of these commodities. This whole process is made possible by the equalization of their products as values. This is the *qualitative side* of Marx's value theory, which is concerned with the expression of the relations of production among people. The *quantitative side*, on the other hand, relates to the *magnitude of value*, which is concerned with the question of the proportions at which commodities exchange and the question of distribution of social labor among various branches of production. However, the quantitative side can only be grasped within this broader context of the qualitative side. Thus, before turning to the question of the magnitude of value in detail, more elaboration on the qualitative side is needed.

2.4.2 Form and Substance of Value

Once commodity production and exchange becomes the dominant form of social

(re)production, the distinction between the two sides of a commodity—namely, as an article of social usefulness and as a thing possessing value—becomes palpable. This was already addressed by Adam Smith, among others, who distinguished between the *value in use* and *value in exchange* of commodities. The famous diamond-water paradox is no longer a paradox once it is grasped that value in use has barely anything to do with value in exchange ([Smith 1999a](#), 131–32).

Marx, however, was the first to point out that the labor of commodity producers acquires a twofold character in a commodity producing society. It is a type of concrete labor that produces a specific use value. If commodities are to be exchanged, however, then equality between different kinds of labor can only be established when the real, concrete inequality of those kinds of labor is abstracted from. It is not the useful qualities of two commodities that are taken to be equal in exchange, but an excluded third element of both products. This third thing is abstract labor, devoid of any concrete, qualitative specification. All commodities are products of direct and indirect human labor in the abstract ([Marx 1990](#), 127–32).

This distinction was so important to Marx that in a letter written to Engels after the publication of the first volume of *Capital*, he emphasized that “the *two-fold character of labour* according to whether it is expressed in use-value or exchange value” is “fundamental to all understanding of the facts” discussed in the book ([Marx and Engels 2010](#), 407). When commodity owners equate their products in exchange as values, they actually equate, without being aware of it, different kinds of labor as abstract human labor ([Marx 1990](#), 166–67). This abstract labor, or quantities of homogeneous labor congealed and contained in commodities, thus becomes the *substance of value* ([Marx 1990](#), 128).

Two points should be briefly raised with respect to abstract labor being the substance of value. First, if we are to speak of quantities of homogeneous human labor, the question of the relation of skilled and unskilled labor must be addressed. In the opening chapter of *Capital*, Marx confined himself to pointing

out that more complex (skilled) labor is nothing but intensified, multiplied simple (unskilled) labor and that the former is constantly reduced to the latter in a “social process that goes behind the backs of the producers” ([Marx 1990](#), 135). As regards the laws regulating this reduction, Marx then noted that the costs associated with acquiring special skills and dexterity appropriate for a given branch of production are part and parcel of the value of labor power ([Marx 1990](#), 275–76), and skilled labor therefore becomes objectified in a given amount of time in proportionally higher values ([Marx 1990](#), 305). However, it is not the higher wage paid to the skilled worker but the higher value of the skilled labor power that causes the value of the product of skilled labor to be greater. In contrast to Smith (and to a lesser extent to Ricardo), the level of the wage a worker receives does not affect the magnitude of value produced by their labor in any way.

Second, abstract labor is not a physiological category. [Marx \(1990](#), 134) wrote that what is common to two qualitatively different, concrete types of labor, such as tailoring and weaving, is the expenditure of human brain, nerves, and muscles, which is the ultimate source of this confusion. That they are both human labor in general does not imply that abstract labor is a physiological category. The expenditure of physiological labor corresponds to the labor process, which is a transhistorical condition of human existence. It is *not* the labor process and expenditure of physiological energy as a fact of human existence, however, that value theory aims to explain. It is rather the social form this material-technical process takes at a given stage in history, and the regularities resulting therefrom ([Rubin 1990](#), Ch. 4). Marx hence insisted that “not an atom of matter enters into the objectivity of commodities as values” and that commodities’ “objective character as values is therefore purely social” ([Marx 1990](#), 138–39).

In the pages following the distinction between concrete and abstract labor in the first chapter of *Capital*, Marx introduced various examples, building up from simple to complex cases, to demonstrate that exchange value is the necessary

form (of appearance) of value, that the simple commodity form is the germ of the money form, and that money is the special, most advanced form of expression of value. Importantly, when [Marx \(1990, 128\)](#) wrote that exchange value is “the necessary mode of expression, or form of appearance, of value,” he clearly implied that value is *not identical with* exchange value. What is value, then?

The conventional response to this question is that it is the quantity of labor (or amount of labor time) necessary for the (re)production of a commodity. This is certainly *not* what value means, at least from a Marxist viewpoint.⁹ Labor is only the substance of value, as the exegesis above makes clear. We have so far discussed different aspects of value, using the following concepts with references to Marx: substance (or content) of value, form of value, and magnitude of value. When it comes to the question of what value *is*, the answer is that it is the totality of these aspects. The substance or magnitude of value can only be grasped if it is studied in its larger context: the social value form ([Rubin 1990, 111–12](#)).

The rest of this chapter (and the book) is predominantly concerned with questions related to the quantitative side of value and its regulatory role in the determination of empirically observable quantities such as prices. The above presentation of value from a wholistic perspective is, however, foundational for any understanding of a value-theoretical study.

2.4.3 *The Quantitative Side of Value*

That value is a social form acquired by the products of labor within a given social, historical context has direct implications for its quantitative side. The key concept here is *socially necessary labor time*, which distinguishes Marx's value theory from that of classical political economists in various ways. Here we study the quantitative side of value by focusing on each of the following points: (1) the distribution of available social labor among various spheres of production, (2) the dependence of the magnitude of value on the quantity of abstract labor, and

(3) the relationship between commodity values and prices in the context of competition.

As regards the first point, the following section of a letter from Marx to Kugelmann written in 1868, which addresses the criticism that *Capital* did not convincingly explain the relationship between labor and value, is illuminating ([Marx and Engels 1988](#), 68):

Every child knows that a nation which ceased to work, I will not say for a year, but even for a few weeks, would perish. Every child knows, too, that the masses of products corresponding to the different needs require different and quantitatively determined masses of the total labor of society. That this necessity of the distribution of social labor in definite proportions cannot possibly be done away with by a particular form of social production but can only change the form in which it appears, is self-evident. No natural laws can be done away with. What can change, in historically different circumstances, is only the form in which these laws operate. And the form in which this proportional distribution of labor operates, in a state of society where the interconnection of social labor is manifested in the private exchange of the individual products of labor, is precisely the exchange value of these products.

The division of total available social labor among different branches of production is a necessity in any form of society. In the absence of direct organization or planning of production—when decisions are made by private, independent producers—this task is fulfilled through the value form, which represents decentralized coordination *a posteriori*. Here we encounter a major contradiction of commodity production, namely that commodities are produced without *direct* regulation that takes social needs into account. Private producers make their decisions in isolation and without any *a priori* coordination. It is only through the mediation of exchange that a certain amount and type of labor

expended gets validated as socially necessary labor. It is thus precisely through exchange, which takes place at market prices, that available social labor ends up being allocated in specific proportions to various branches of production ([Shaikh 1984](#), 45).

In this sense, socially necessary labor time takes into account the prevailing demand structure. At any given time, if the total amount of labor spent producing a commodity falls short of what is deemed as socially necessary by consumers, which manifests itself in the form of demand, the commodity's market price is expected to rise. Consequently, the flow of capital and social labor to this industry will tend to accelerate relative to demand, scaling up production and adjusting the social division of labor. It is obvious that market prices play a crucial role in the decisions of producers. Before moving on to the question of what regulates market prices according to Marx, however, a few words on competition are necessary since the distribution of available social labor among industries and its continuous adjustment in accordance with the socially necessary labor time take place on the terrain of competition under capitalism. In simple commodity production, the distribution of social labor among various spheres of production does not presuppose capital flows. Under capitalist commodity production, however, the distribution of living social labor takes place through the distribution of capital since it is the latter that commands and puts the former into use in production.

As [Shaikh \(2016\)](#), 259–65) put it, capitalist competition is antagonistic by nature. Each individual capital operates under the imperative of continuous expansion—to convert capital into more capital, profit into more profit. Each capital collides with other capitals trying to do the same thing, sometimes succeeding and sometimes failing. Competition is a war of each capital against all the others. *Within an industry*, competition forces individual capitals to cut costs and prices and expand market share. This can be achieved by cutting wages, increasing the length and intensity of the working day, and developing and adopting new technologies. Competition *within an industry* tends to equalize

selling prices and disequalize profit margins and rates because cost conditions differ. Competition *between industries*, in contrast, implies that new investment accelerates relative to demand in industries with higher rates of profit and decelerates relative to demand in industries with lower rates of profit.¹⁰ Hence, it tends to equalize profit rates of regulating capitals¹¹—that is, best reproducible conditions of production—through the entry, exit, acceleration, and deceleration of capital conditional on profit-rate differentials.

We can now return to points (2) and (3) raised in the opening paragraph of this section, which pertain to the determination of the magnitude of value and the relationship between market prices and socially necessary labor time, respectively. Neither Smith and Ricardo, as shown above, nor Marx disregarded the role played by demand (and its relation to supply) when it comes to understanding day-to-day *changes* in market prices. The question that is not answered by reference to demand, however, is what determines the level of prices when supply and demand balance and prices thereby settle. Let us follow Marx's footsteps in the first volume of *Capital* and momentarily assume that supply and demand are equal, which means that prices are in equilibrium. What determines the level of *this* price? The key here is, once again, socially necessary labor time, now in its second meaning ([Marx 1990](#), 168):

The production of commodities must be fully developed before the scientific conviction emerges, from experience itself, that all the different kinds of private labour ... are continually being reduced to the quantitative proportions in which society requires them. The reason for this reduction is that in the midst of the accidental and ever-fluctuating exchange relations between the products, the labour-time socially necessary to produce them asserts itself as a regulative law of nature.

Socially necessary labor time in this sense “is the labour-time required to produce any use-value under the conditions of production normal for a given

society and with the average degree of skill and intensity of labor prevalent in that society" ([Marx 1990](#), 129). We thereby arrive at the *magnitude of value*, which equals the quantity of the substance of value contained in a commodity. This substance is nothing but labor, and its quantity is measured by its duration—that is, labor time. It is thus the level of development of productive forces (understood as the totality of material and human factors) that governs the socially necessary labor time to (re)produce commodities and thereby the values thereof.

An important digression is in order at this point before we proceed with the question of what regulates the price *level* when supply and demand are in balance: Not all activities of labor are production activities, and not all labor is productive of value from a Marxist perspective. The broad process of social reproduction comprises activities of (1) production (creation or transformation of objects of social use), (2) distribution (transfer of objects of social use from their immediate possessors to intended users), (3) social maintenance and reproduction (using up social use values for the administration, maintenance, and reproduction of the social order), and (4) personal consumption. Although total labor contains activities relating to (1), (2), and (3), only the first one qualifies as *production labor* ([Shaikh and Tonak 1996](#), ch. 2).

Note that the line of demarcation between production and nonproduction labor is *not* the social necessity of the relevant activity—distribution, administration, maintenance, and consumption are as crucial components of social reproduction as production itself is. It is rather a question of whether an activity *directly* results in the creation of new wealth. Activities pertaining to (2) and (3) can therefore be grasped as cases of *social consumption*, in which a portion of the net social product is used up without directly creating new use values or transforming existing objects of social use.

The crucial implication of this categorization is that not all labor is productive of value, and by extension, surplus value. Value is created only in activities of production, and *only in those activities in which labor is capitalistically*

employed—that is, when labor power is hired by capitalists ([Shaikh and Tonak 1996](#), ch. 2). Domestic labor, for instance, produces direct use values and therefore represents an activity of production. However, it does not produce (surplus) value since there is no coincidence of wage labor and capital. By implication, whenever the production of value and surplus value is at stake, the discussion is confined to capitalistically organized production activities on both theoretical and empirical grounds in the rest of the book.

We can now return the question of what determines the price of a commodity when supply and demand are equal, which requires us to consider competition and its ramifications. Competition is *the* reason for different capitals to increase the ratio of invested capital to living labor (or *the organic composition of capital*, defined by Marx as the ratio of constant to variable capital) in order to cut costs. The very reason organic composition differs across industries is hence competition. Throughout the first volume of *Capital*, however, Marx assumed not only that supply and demand are in balance but that the organic composition of capital is uniform across industries. As can be seen in equation 2.5, abstracting from differences in the organic composition of capital allowed him to study the properties of an economy in which commodities sell at prices proportional to their labor values, which we call *direct prices*¹² following [Shaikh \(1977, 1984\)](#).

The meaning of this abstraction can be grasped once we remember that *Capital* was written in a context in which the view that value and profit have various sources was gaining a foothold. Marx thus wanted to demonstrate that surplus value originates from the exploitation of labor power by capital, which does not rest on the assumptions of unequal exchange, imbalance between supply and demand, or differences in the ratio of constant to variable capital. Profit can and does exist in the absence of buying cheap and selling dear, which is equivalent to saying that it is through, rather than in spite of, the much vaunted (formal) freedom and equality attributed to capitalism that exploitation is carried on ([Meek 1976](#), 182).

Now that we have discussed the magnitudes of value (and direct prices) and market prices, there remains only one missing link in Marx's theory of value. After clarifying—in a discussion in which he abstracted from competition—that the source of surplus value (and profit)¹³ is unpaid labor, variations in the organic composition of different capitals, and profit-rate equalization, Marx elaborated both on the incessant and turbulent equalization process of rates of profit and on the emergence of an average rate of profit. What tendentially emerges from “the competition of capitals in *different spheres*” is “the production price that equalizes the rates of profit between those spheres” ([Marx 1991](#), 281), which was called the *natural price* by Smith and Ricardo, as discussed in [sections 2.2 and 2.3](#). Thus, the turbulent process of profit-rate equalization is at the same time the process whereby direct prices are transformed into prices of production.

Prices of production simply comprise the average rate of profit in addition to the cost price of a commodity ([Marx 1991](#), 257). The formation of prices of production is the process of redistributing total surplus value away from industries with lower organic composition of capital, which had produced a quantity of surplus value above the social average, to industries with higher organic composition of capital, which had produced below-average surplus value. Thus, no proportionality to direct prices exists ([Marx 1991](#), 297):

If commodities were sold at their values [at direct prices], however, this would mean very different rates of profit in the different spheres of production, as we have already explained, according to the differing organic composition of the masses of capital applied. Capital withdraws from a sphere with a low rate of profit and wends its way to others that yield higher profit. This constant migration, the distribution of capital between the different spheres according to where the profit rate is rising and where it is falling, is what produces a relationship between supply and demand such that the average profit is the same in the various different spheres, and

values [direct prices] are therefore transformed into prices of production.

Note that the average rate of profit and thereby the prices of production are not empirically observed magnitudes. Moreover, they only exist as a tendency brought about by incessant movements of capital, whereby the social division of labor constantly adjusts and value acts as the regulator of production and distribution of social labor.

All in all, the law of value asserts itself in and through a two-part process. First, it was already established by Adam Smith that market prices gravitate around what we call prices of production following Marx. What Ricardo tried to explain was that relative prices of production (which he called values) are primarily regulated by labor embodied in commodities. In addition to the above-discussed shortcomings of his approach, Ricardo “accepts Smith's confusion or identification of *exchange value* with *cost-price* or *natural price*” ([Marx 1969b](#), 217) and hence fails to distinguish between prices proportional to labor values (direct prices) and prices of production. Second, prices of production are regulated by direct prices or the socially necessary labor time to (re)produce commodities.

Market prices are thus ultimately governed by direct prices and labor values through the mediation of prices of production, which implies that the three sets of prices are never identical. Market prices regularly deviate from prices of production (and direct prices). Crucially, these deviations constitute the mode of operation of the law of value: Every deviation activates counteracting forces that mitigate or reverse it. It is through deviations that market prices serve as a barometer for capitalists trying to get around in a hazy environment ([Marx 1990](#), 476). Thus, deviations help the system regulate itself. Order and disorder are constitutive of each other; they are entwined ([Marx 1991](#), 1020):

Characters of the product as commodity and the commodity as capitalistically produced commodity give rise to the entire determination of

value and the regulation of the total production by value. In this quite specific form of value, labour is valid only as social labour; on the other hand, the division of this social labour and the reciprocal complementarity or metabolism of its products, subjugation to and insertion into the social mechanism, is left to the accidental and reciprocally countervailing motives of the individual capitalist producers. Since these confront one another only as commodity owners, each trying to sell his commodity as dear as possible (and seeming to be governed only by caprice even in the regulation of production), the inner law operates only by way of their competition, their reciprocal pressure on one another, which is how divergences [deviations] are mutually counterbalanced. It is only as an inner law, a blind natural force vis-à-vis the individual agents, that the law of value operates here and that the social balance of production is asserted in the midst of accidental fluctuations.

This passage from Marx reveals the intimate relation between the qualitative and quantitative sides of value theory. In concluding, we emphasize one more time that value theory as developed by Marx pertains to the totality of a historically specific social form, which is defined by the accumulation of capital and which constitutes itself in and through the exchange of commodities ([Foley 2011](#), 19). The mobility of labor and capital, differentiation of the organic composition of capital, tendential equalization of profit rates and wages in the context of competition, emergence of prices of production around which market prices gravitate, and continual adaptation of available social labor to the exigencies of supply, demand, and profitability are all integral parts of this social formation and best understood by value theory.

2.5 Conclusion

The question of value in relation to production and distribution transcends specific modes of production. Thinkers in all ages have observed certain patterns

in exchange and scratched the surface to see whether some deeper-lying elements bring about and regulate such patterns. It is this drive to see the forest, not just the trees, that led to the formulation of value theories in conjunction with the consolidated manifestation of underlying practical, real social and economic relations.

In this chapter we provided a bird's-eye view of the emergence of the value theory associated with classical political economists, most importantly Smith and Ricardo, and Marx, who is viewed as a critical successor by some and a radical disruptor by others. The aim of this presentation, which is certainly incomplete as a history of thought, was to reveal how and why this specific theory of value emerged at the time it did, what the shared features and main contours of continuity are, and how it gradually developed into its most coherent and profound version in the writings of Marx.

We believe that the significance of the unity of the qualitative and quantitative aspects of Marx's value theory cannot be overstated. It is, after all and over all else, a theory of the reproduction of capitalist society, one aimed at studying the invisible cement that holds together the individual pieces of this totality and ceaselessly reproduces the division of social labor into diverse branches and activities. Value is a historically specific relation. Empirical appearances such as prices, interest, and wages orbit around its quantitative manifestations. Exploitation processes, commodity fetishism, and reification of social relations spring from it.

We believe that this chapter's framework for studying certain economic questions has merits in terms of not only its theoretical consistency and the social and historical insights it provides but also its ability to address and explain empirical regularities in contemporary economies. Demonstrating this ability is the main goal we set for ourselves in the rest of this book.

Notes

1. See especially [chapters 4](#) and [5](#), titled “On sedentary civilization, countries, and cities” and “On crafts and ways of making living,” of *The Muqaddimah*, which Khaldūn wrote around 1377.[!\[\]\(dff5b43fbda4b1398db4d45a43470a64_img.jpg\)](#)
2. This is the reason why the discussion in this chapter mainly focuses on western Europe, where classical value theory was formulated in conjunction with the increasing dominance of capitalism over other modes of production.[!\[\]\(1b77878aa60f0af11e65ccca1ea471e1_img.jpg\)](#)
3. Setting aside Smith's confusion of exchangeable value and price and his interchangeable use of labor embodied and labor commanded, any price can be decomposed into its constituent components. This decomposition is a key analytical tool applied later in this book. The application of this method requires a careful differentiation of exchange value from natural prices (prices of production) and market prices since revenues are derived from value but do not constitute value.[!\[\]\(b65676ae2cfe92c982cf6a5d95999648_img.jpg\)](#)
4. This notion of the turbulent gravitational process of equalization is fundamentally different from the conventional notion in modern economics of equilibrium as an established state ([Shaikh 2016](#), 104–05).[!\[\]\(bddf23fe369c10a0fb828fc6653e3e90_img.jpg\)](#)
5. What is at stake when classical political economists write about “laws” that govern certain phenomena is not exact, timeless, and stationary rigidities but rather “regulative principles that exert themselves in and through various countertendencies” ([Shaikh 2016](#), 7).[!\[\]\(482037992ba683985713c0a0cefb5bf7_img.jpg\)](#)
6. When it comes to the relationship between natural and market prices, Ricardo did not have much to add to what Smith put forward before him ([Ricardo 1970](#), 91).[!\[\]\(91f9ca23acede1725165c9c96da47ffc_img.jpg\)](#)
7. Although we prefer the term *classical political economics* over *classical political economy*, we use them interchangeably, especially when making direct references to Marx, who coined the latter. We use both terms in the same sense as Marx did, and contrary to some modern interpretations, we do not adhere to the view that Marx is part of this school of thought.[!\[\]\(33c02f7c354beaace7b4d740d7192085_img.jpg\)](#)
8. The continuity of the overall process is established by repeated, interpenetrating, partially overlapping transactions, which form the links of a chain. The interdependence becomes most clear in times of crises, when there is either a slowdown or an overall break in this continuity, bringing about turmoil.[!\[\]\(aed58e9c7b643501b320fc4a94657b52_img.jpg\)](#)
9. In *Theories of Surplus Value*, [Marx \(1969a\)](#), 361) explicitly criticized William Petty for conflating the magnitude of value with value as the social form of labor.[!\[\]\(7b754f773c4474b63787ce0cc12674fb_img.jpg\)](#)
10. What is at stake here is the rate of return on *new investment*, not the average rate of profit on all vintages. Capital, when choosing the direction of its flow, is interested in the former, not the overall

average rate of profit ([Shaikh 2016](#), 264).[!\[\]\(3416c6e33f8bff04400cced4f04d631b_img.jpg\)](#)

11. [Marx \(1991\)](#) introduced the idea of regulating conditions of production, or regulating capital, in chapter 10 of the third of volume of *Capital*.[!\[\]\(a0d24a15fd73f75baecd507c382b07f7_img.jpg\)](#)
12. Prices must be distinguished from values. All prices are distinct from values since the former represents the monetary expression of value within the sphere of circulation.[!\[\]\(9a032a04562bd61e599b71e226c7fcc8_img.jpg\)](#)
13. Surplus value and profit are not identical categories. In fact, “the treatment of *surplus-value regardless of its particular forms* as profit, interest, ground rent” ([Marx and Engels 2010](#), 407) is what Marx deemed as one of the two best features of *Capital*, as he put it in the aforementioned letter to Engels.[!\[\]\(09b0ec6ceee8ebb179d1a6ae4f4b2dba_img.jpg\)](#)

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3 The Empirical Strength of the Labor Theory of Value

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3.1 Introduction

In capitalism, commodities are produced by competing firms to be exchanged, with the goal of realizing a high profit rate, which translates into a high speed of accumulation. The production of consumption and capital goods follows the same logic and is organized in the same process; reproduction refers to the production of not only circulating and fixed capital, but also wage goods to reproduce the labor power of workers. Furthermore, the social relations of production with many wage-dependent workers and few capital-owning capitalists are reproduced by the level of wages, which in the vast majority of cases will not promote workers to the class of capitalists, and by unpaid labor to support the reproduction of labor power.

Marx's schematic analysis of the reproduction of capitalism in volume 2 of *Capital* begins with simple reproduction: The system produces enough consumption goods for wages to be spent on and capital goods for the production of the same aggregate level of output in the subsequent period. He

then extended the analysis to expanded reproduction, in which consumption and capital output suffice for a higher aggregate level of output. At this level of abstraction, the dynamics of accumulation, competition, and technological change bring about a range of structural tendencies, which Marx calls the *laws of motion* of capitalism and studies through the lens of the law of value.

The empirical estimation and comparison of direct prices (that is, prices proportional to labor values) and production prices, and the market-price dynamics they regulate, begin with Marx's schematic description of capitalist reproduction. The capital and labor inputs entering into production of the commodities can be represented by input-output tables, following the analysis of linear production by [Sraffa \(1972\)](#) and following [Pasinetti's \(1973\)](#) discussion of vertical integration of labor vectors (that is, summing up direct and indirect labor inputs in a Sraffa system). Leontief's pioneering work representing national economies as input-output tables documents the flows of circulating capital, in monetary units, between industries.

We can use labor hours spent in production, combined with data on aggregate production inputs and their corresponding labor inputs, to calculate total (that is, direct and indirect) labor expended for the production of a commodity. To adjust the total labor vector to the notion of socially necessary labor we use within-industry average employment, and to correct for different skill levels, albeit imperfectly, we adjust it by the global between-industry average wage, as detailed in [section 3.4](#). To incorporate the general profit rate and estimate production prices, we multiply the sum of labor and capital inputs by $(1 + r)$, where r stands for the average profit rate in the economy. In the same section we show in more detail that since both outputs and inputs are valued in terms of direct prices or prices of production, we have to use the Leontief inverse matrices $(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1}$ for vertical integration (where \mathbf{A} records between-industry flows of circulating capital and \mathbf{D} captures depreciation of fixed capital), which is trivial if the matrix and its eigenvalues fulfill certain

mathematical properties.

The result is a large database of market, production, and direct prices, as well as other industry-specific information for 159 industries in forty-four countries over twenty-six years based on the EXIOBASE project of harmonized multiregional input-output tables. To our knowledge, this is the largest database of market, production, and direct prices, and one of only a few to investigate the impact of international production chains on labor values. While [Hickel et al. \(2024\)](#) compared embodied labor and realized prices between countries based on the same data source, they do not investigate production prices. [Rotta \(2025\)](#) likewise estimated direct and indirect labor in production, but based on fewer industries and years (fifty-six sectors in forty-three countries in the period 2000–2014).

Since the 1970s, in addition to documenting the strong relationship between market prices and labor values, empirical investigations have examined the mathematical properties of these systems and begun conceptualizing the regularities in price-value deviations (in addition to the regularities observed in the relationship between these price vectors). Our model allows us to evaluate the regularities in the relationship between the three primary price vectors both by calculating measures of deviations (for example, the mean absolute percentage distance) and by using panel regression analysis to understand to what extent price movements over years are explained by the underlying labor values. More importantly, the model can be extended to investigate price-value deviations more deeply or to focus on specific questions such as the dynamics of international value transfers ([chapter 4](#)) or the relationship between rent and the ecological breakdown ([chapter 5](#)).

We find a pattern of correspondence between the market- and production-price vectors. Both correlation analysis through panel regression methods and a battery of distance measures show that production prices are strong predictors for market prices. At the same time, we find persistent differences between the two vectors and argue that this is an expected feature rather than a flaw. Marxist

value theory does not predict a one-to-one correspondence of market and production prices, but deviations that are driven by the fundamental economic processes captured by real competition, as well as the presence of ground rents and international value transfers. Nonetheless, that some deviations are consistent with a regular relationship between prices and values does not mean that deviations by themselves are sufficient to empirically support the presence of the relationship (even though the deviations are remarkably small). The large data set we use and the econometric methods developed in the real-competition literature allow us to test the claim that market prices are turbulent variables and that production prices serve as their gravitational center. This is one of the novel contributions of this book: While investigations of regulating profit rates in the literature corroborate a model that theoretically predicts this specific dynamic of market and production prices, to our knowledge it has not been tested directly.

3.2 Competition, Profit, and Prices

Readers of [chapters 1](#) and [2](#) might find the following summary of Marx's theory of reproduction, the general profit rate, and production prices either redundant or useful as a refresher before we discuss the role of input-output tables and capital-flow matrices in [section 3.3](#), estimation of direct and production prices in [section 3.4](#), and statistical measures of gravitation and deviation in [section 3.5](#), then test for turbulent equalization of market prices around production prices in [section 3.6](#) and conclude in [section 3.7](#).

The key insight of Marxist value theory is that the spheres of exchange and production constitute a unity, where the relationships between humans in the production sphere ultimately govern the relationships that emerge in the exchange sphere. Material conditions of production, manifested in the productivity of labor, determine commodity values, which, in turn, regulate market prices through the mediation of production prices. The reproduction and ceaseless adjustment of the social division of labor takes place through the act of

exchange and market prices, since there is no a priori coordination and planning of production activities in a capitalist society.

Commodity production is carried out in firms that compete with each other. Competition consists of both active, strategic price setting to gain a larger market share at the cost of competitors and cross-investing in other technologies or industries to gain a higher profit rate on new capital ([Moudud 2010](#)). This brings about a dynamic of investors pursuing above-average profit rates, which in turn intensifies competition, leading to lower prices and profit rates and setting in motion a process undermining the initially high profit rates ([Shaikh 1984](#)). As a result, a normal profit rate tends to be established around which actual profit rates of different sectors and firms gravitate. This general profit rate also serves as the gravitational center for the maximum speed of growth in the system; it is the maximum rate at which capital can grow based on retained earnings. Since both the mobilization of previously noncapitalized goods and the credit leveraged with previously saved capital are not only possible but frequently observed features of capitalism, the general rate of profit is not a definite upper bound to the speed of accumulation, though.

The general rate of profit is the key variable for the formation of production prices, which represent the transformed form of direct prices and constitute the center of gravity for the turbulent fluctuations of market prices in the context of capitalist competition. Marx, in volume 3 of *Capital*, was very careful to define production prices *not* as equilibrium prices, but as a feature of the movements of investment: “The general rate of profit … only ever exists as a tendency, as a movement of equalization between particular rates of profit. The competition between capitalists—which is itself this movement of equalization—consists here in their withdrawing capital bit by bit from those spheres where profits are below the average for a long period, and similarly injecting it bit by bit into spheres where it is above this; or, alternatively, in their dividing additional capital between these spheres in varying proportions” ([Marx 1991](#), 488).

Three short digressions are in order at this point before we present the data

and model used to compute the price vectors in [section 3.3](#). First, since the term *turbulence* has become popular in a segment of the literature studying the behavior of profit rates, wages, and prices ([Shaikh 1998, 2016](#); [Tsoulfidis 2015](#); [Scharfenaker and Foley 2017](#); [Mokre and Rehm 2020](#); [Kemp-Benedict 2023](#); [Szepanski 2024](#), 63), it is noteworthy that Marx's discussion of it fits closely with the fluid-dynamics definition of turbulent flows: They are “highly unsteady A plot of the velocity as a function of time at most points in the flow would appear random to an observer unfamiliar with these flows” but contain “coherent structures—repeatable and essentially deterministic events that are responsible for a large part of the mixing”—and “fluctuate on a broad range of length and time scales” ([Ferziger and Perić 2002](#), 265). Other features, such as vortex stretching or mixing by diffusion and ensuing dissipation, have less obvious metaphoric value in economic terms.

Second, the analytical framework used for the calculation of price vectors is worth elaborating on. The direct labor vector represents socially necessary labor spent in production, and total labor values express the sum of direct and indirect labor. As detailed in [chapter 2](#), not all activities of labor produce value from a Marxist perspective. For (surplus) value to be produced, the activity at stake must satisfy two conditions: (1) it must relate to the production or transformation of use values; (2) labor must be capitalistically employed—that is, it must be exchanged against capital. When calculating direct prices, we consider only those industries which satisfy both conditions.

Production prices add the impact of capitalist competition to direct prices—that is, the redistribution of aggregate surplus value across industries—resulting in a tendency toward equalization of profit rates. Marx illustrated the logic of investment and growth in a capitalist system in numerical schemes of reproduction in volume 2 of *Capital* ([Marx 1992](#), chs. 20 and 21) and described the formation of production prices through competition in volume 3 ([Marx 1991](#), ch. 9). [Tsoulfidis and Tsaliki \(2019](#), 68) pointed out that Marx's schemes of reproduction are prototypes of modern input-output tables. In the literature on

value theory, the price-value relationship, and price-value deviations, the bridge between price theory and input-output tables was established following the publication of [Sraffa's \(1972\)](#) work on linear production theory and the Marxist critique of it. Sraffa posited that production of commodities by commodities can be represented as a system of linear (additive) equations, and a magnitude of output commodities is the result of adding up magnitudes of input commodities and labor. He furthermore proposed that when each commodity is represented in one equation, and each input is priced as the result of its corresponding equation, one can determine the relative-price system by using any commodity as the numeraire.

The representation of industry-to-industry accounts has played an increasingly important role in empirical research on value theory, with better and more data becoming available since the second half of the twentieth century ([Sraffa 1972](#); [Steedman 1977](#); [Ochoa 1989](#); [Shaikh 1998](#); [Tsoulfidis and Mariolis 2007](#)). Input-output tables record flows of circulating capital between industries, including aggregate flows within an industry. Socioeconomic-extension accounts (usually obtained from disaggregated national accounts) add information on labor hours, value added, final demand (that is, commodity flows beyond circulating capital), and fixed capital.

In recent years, multiregional input-output tables have harmonized data from different countries and interpolated the tables for years between data collections to represent large parts of the global economy in terms of share in global GDP or share in the global workforce. The most popular multiregional input-output tables, namely the World Input-Output Database, the OECD's Inter-Country Input-Output tables, the environmentally extended multiregional input-output tables known as EXIOBASE ([Stadler et al. 2018](#)), and Eurostat's Full International and Global Accounts for Research in Input-Output Analysis (FIGARO), have large blind spots with regard to underdeveloped countries.¹ The latter are usually aggregated into a small number of “rest of the world” regions (or just one such region), which is more of an accounting identity than an

analytical category. Similarly, socioeconomic accounts have important gaps in areas such as labor hours in China ([Rotta 2025](#), 6). Nevertheless, rapidly improving data quality in multiregional input-output tables as well as extensions of the interpolation techniques to a growing number of countries ([Lenzen et al. 2017](#); [Bjelle et al. 2020](#)) will enable more and more detailed research in the near future.

Third, a short digression is in place here on Sraffa, whose *Production of Commodities by Means of Commodities* (1960) proposed a systematic approach to price theory by reviving the Ricardian model of relative prices. It represents mainly a criticism of both marginalist factor-price models and the foundation of neoclassical theories of growth and distribution. Sraffa wrote and worked at the Department of Economics at the University of Cambridge, which, after Keynes's death, was oriented toward Keynesian economics and classical political economics. The book can be understood as a contribution to the Cambridge capital controversy between his department and the one in Cambridge, Massachusetts, on the other side of the Atlantic.

Since Sraffa's model drew heavily on Ricardo's value theory, it faced criticism from Marxist economists at the time along the lines of Marx's criticism of Ricardo. Meanwhile, Sraffa's explicit criticism of marginalist theories of price and distribution contained an implicit criticism of Marx's labor theory of value as well, which was soon explicitly launched in Steedman's *Marx After Sraffa* ([1977](#)). This fruitful and fascinating debate is not the subject of this book. However, the groundbreaking contributions to linear and joint production theory as well as its application in one standard format to national accounting form the basis of the analysis in this chapter ([Pasinetti 1973](#)).

To recapitulate, Ricardo and Marx distinguished three levels of prices in their respective value theories.² Market prices per unit of output fluctuate around the gravitational center of production prices, which are largely determined by direct prices (that is, prices proportional to total labor values) ([Shaikh 2016](#), 380). Labor values represent the socially necessary labor time required to reproduce a

commodity, comprising both the direct labor employed in the production process and the indirect labor embodied in capital goods and raw materials used up in the process of production. In the absence of competition (and cross-industry differences in the average proportion of constant and variable capital employed), exchange ratios of commodities would be governed by their direct prices, which contain an adjustment of skill differentials.

At a lower level of abstraction, namely when competition between capitals and differences between organic compositions of capital are allowed for, production prices emerge as the new center of gravity, representing the tendential emergence of a general profit rate on capital advanced. Production prices systematically deviate from direct prices (and therefore labor values), reflecting value transfers favoring industries with an above-average ratio of constant to variable capital. Nevertheless, both Ricardo and Marx argued that the movements of production prices are largely governed by changes in labor productivity—that is, the material conditions of production.

Finally, market prices gravitate around production prices in a turbulent manner as new investment in an industry imitates the most productive technology and fights for market shares by cutting prices. This creates a spectrum of differential cost structures and actual prices, of systematic and ubiquitous deviations between market and production prices, while the direction of price movements is still governed by labor productivity. These hypotheses can be tested empirically when direct prices and production prices in monetary units are estimated from input-output tables.

3.3 Data: Input-Output Tables and Fixed-Capital Matrices

Let the square matrix \mathbf{Z} represent the capital inputs from J industries to J industries, where each cell $z_{i,j}$ represents the monetary value of output flowing from industry i to industry j . The row vector \mathbf{z}_i represents the sum of outputs delivered by industry i as circulating capital, and the column vector \mathbf{z}_j

represents the sum of inputs used by industry j . The column vector \mathbf{f} records the final demand for industry outputs, either as finished consumer goods, fixed capital goods, or government purchases. The row sums of \mathbf{Z} added to the final-demand vector \mathbf{f} yield the gross-output vector \mathbf{x} . The row vector \mathbf{va} records value added, composed of wages, profits, capital depreciation, and taxes. The column sums of \mathbf{Z} combined with \mathbf{va} add up to the gross outputs presented in the \mathbf{x} vector.

The \mathbf{Z} matrix captures the sum of inputs and outputs but does not account for industry size. When we normalize \mathbf{Z} by \mathbf{x} we obtain the technical coefficient matrix $\mathbf{A} = \mathbf{Z}\widehat{\mathbf{X}}^{-1}$, which records inputs per euro's worth of output,³ where $\widehat{\mathbf{X}}$ is a square matrix with the \mathbf{x} vector on the diagonal and zero entries off the diagonal. An element of the \mathbf{A} matrix, $a_{i,j}$, represents the monetary value of inputs from industry i for the production of one euro's worth of industry- j output.

Note that the \mathbf{A} matrix records only circulating capital, not fixed capital. We follow [Pasinetti's \(1973, 3\)](#) distinction: circulating capital is used up in one year, whereas fixed capital lasts for more than one year. By implication, part of fixed capital will have to be replaced after one year, which is in turn approximated by the capital-consumption entry in the value-added vector \mathbf{va} . Estimating flows of fixed capital and the fixed capital stock in input-output tables is rather complicated, as an industry's investment flows are usually not directly matched by national statistical agencies to purchases of machinery and buildings. We use [Södersten and Lenzen's \(2020\)](#) estimations based on the EXIOBASE 3.8 release, which algorithmically matches and harmonizes final demand for investment capital with capital consumption. After normalizing for gross output \mathbf{x} , this gives an industry-by-industry estimate of capital depreciation denoted by the \mathbf{D} matrix and makes it possible to estimate the total labor necessary for production of the depreciated capital. Note that the \mathbf{D} matrix does not represent the full capital stock in industry-by-industry resolution, which would require further

estimations that take differential turnover times and changes in investment dynamics over time into account ([Jiang et al. 2023](#)).

In a next step, we retrieve from the socioeconomic accounts the labor vector \mathbf{l} , which records total labor hours employed in one industry and year. Even as newer input-output tables distinguish between skill levels in employment (for example, EXIOBASE records low-, middle-, and high-skill labor and distinguishes by workers' gender and precarious employment), the raw vector \mathbf{l} compares labor hours with potentially vastly different skills between industries and countries. To adjust for differences in skill, we follow a standard procedure: normalizing the labor vector by the deviation of wages in an industry and country from the global average wage ([Shaikh 2012](#), 98; [Rotta 2025](#)). We furthermore retrieve the gross-profit vector \mathbf{p} from gross operating surplus in the value-added section of the input-output tables.

The data recorded in \mathbf{A} , \mathbf{D} , \mathbf{l} , and \mathbf{p} are sufficient to estimate a Sraffian linear production model as well as a Marxist model of production prices. We explain the full empirical procedure in the next section.

3.4 Model: From Labor Values to Production Prices

The square technical coefficient matrix \mathbf{A} and square fixed capital coefficient matrix \mathbf{D} represent technical production coefficients per euro's worth of output under three crucial assumptions: (1) each industry produces the same commodity ([Pasinetti 1973](#), 4; [Miller and Blair 2009](#), 192); (2) technology does not change within the timespan of observation—that is, within the year; and (3) there are constant returns to scale. [Tsoulfidis and Tsaliki \(2019](#), 68–69) summarized some empirical evidence to explain why these assumptions are not as restrictive as they might seem and why the available input-output data are suitable for the analysis of direct, production, and market prices.

The labor vector \mathbf{l} records labor hours of various skills employed in an industry and year. Following [Shaikh \(2012\)](#) and [Shaikh and Glenn \(2018\)](#) on the

classical treatment of skilled labor, we argue that systematic wage differentials can be taken as a proxy for different labor productivities. At this point a discussion of the unit of normalization is in order. In [İşikara and Mokre \(2022\)](#), in which we analyzed price-value deviations within countries, the unit of normalization is the wage sum within one year and country, much like in the previous literature ([Ochoa 1989](#); [Chilcote 1998](#); [Tsoulfidis and Mariolis 2007](#); [Shaikh 2012](#); [Cheng and Li 2019](#); [Basu and Moraitis 2023](#)). [Rotta \(2025, 6\)](#) pointed out that on the global scale, between-country wage inequalities should represent differences in the average industrial skill level between countries, at least under the strict assumption of perfect capital and labor mobility. Even when relaxing this bold assumption, the argument remains that an industry in an imperialist country might not employ the same ratio of skilled and unskilled workers as the same industry in a neocolonial country. We must keep in mind that this is an imperfect way of accounting for skill differentials, and it cannot be interpreted as a causality running from skills to wage levels, especially in the international context, in which persistent wage differentials are brought about by a range of other factors.

Following [Rotta \(2025\)](#), we apply the adjustment at the global level and construct a skill-adjusted labor vector \mathbf{gl} by normalizing the direct labor vector by the global average wage $\bar{w} = \frac{W}{L}$, where W stands for the aggregate wage sum and L for the sum of labor hours at the global level.

Equation 3.1 yields the skill-adjusted direct labor coefficient gl_j for industry $j \in I$, where W_j denotes the global wage bill and X_j the global gross output of industry j , while w_j/\bar{w} represents the approximate skill adjustment:

$$gl_j = \frac{1}{\bar{w}} \times \frac{W_j}{X_j} = \frac{w_j}{\bar{w}} \times \frac{L_j}{X_j} \tag{3.1}$$

Similarly, when comparing relative direct, production, and market prices, the

question of price-vector normalization arises. To compare international inequalities of performed social labor and realized market prices, a normalization at the global scale makes more sense. We discuss these questions in more detail in [chapter 4](#), where we compare the results derived from estimations using price vectors normalized on the national and global levels. For the basic model presented in this chapter, and for the sake of comparison with the literature, we adjust the labor vector at the international level and work with a general profit rate tending to be equalized at the international level but allow for unequal wage rates between countries.

The \mathbf{gl} vector represents skill-adjusted labor in direct production, while the product of \mathbf{gl} by the capital coefficients matrix $(\mathbf{A} + \mathbf{D})$ represents labor required for the production of direct capital requirements,⁴ the product of \mathbf{gl} by $(\mathbf{A} + \mathbf{D})^2$ represents labor required for the production of capital necessary for the production of capital, and so on. The summation formula for the geometric series $\sum a + aq + aq^2 + aq^3 + \dots = \frac{a}{1-q}$ in matrix terms gives the vertically integrated sum of labor inputs: $\mathbf{gl}(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1}$. We show the derivation of the vector of labor values \mathbf{v} from the direct labor vector \mathbf{gl} and capital coefficients matrix $(\mathbf{A} + \mathbf{D})$ in equation 3.2:

$$\begin{aligned}\mathbf{v} &= \mathbf{gl} + \mathbf{v}(\mathbf{A} + \mathbf{D}) \\ \mathbf{v}(\mathbf{I} - \mathbf{A} - \mathbf{D}) &= \mathbf{gl} \\ \mathbf{v} &= \mathbf{gl}(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1}\end{aligned}\tag{3.2}$$

The total (direct and indirect) labor vector \mathbf{v} is measured in labor hours. To compare it with production and market prices, we transform it into monetary terms. We normalize \mathbf{v} by the national average labor value of one euro's worth of output to derive prices proportional to labor values—that is, direct prices \mathbf{dp} —in equation 3.6.

From a technical viewpoint, the Marxist concept of prices of production refers to vertically integrated labor and capital requirements enhanced by the general profit rate r . When calculating production prices per unit of output, we follow [Shaikh \(1998, 229\)](#) and [Tsoulfidis and Tsaliki \(2019, 170\)](#) and express the real wage rate w and profit rate r' as shares in the maximum profit rate R , which is the profit rate with w going to 0. The profit rate r' is therefore given by $r' = \frac{r}{R}$. By implication, we can write $(1 + r)w = (1 - r/R)$, where the maximum profit rate R is established when the wage share $w = 0$.

Finally, using the Leontief inverse, we define the total (direct and indirect) capital coefficients matrix as $\mathbf{H} = (\mathbf{A} + \mathbf{D})(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1}$ and the total (direct and indirect) labor vector as $\mathbf{v} = \mathbf{g}\mathbf{l}(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1}$, where each element of \mathbf{H} and \mathbf{v} expresses the vertically integrated capital and labor requirements, respectively, per euro's worth of output. The construction of prices of production (per unit of output) \mathbf{pp} is given in equation 3.5:

$$\begin{aligned}
\mathbf{pp} &= (1 + r)(w\mathbf{g}\mathbf{l} + \mathbf{pp}(\mathbf{A} + \mathbf{D})) \\
\mathbf{pp} &= (1 + r)w\mathbf{g}\mathbf{l} + \mathbf{pp}(\mathbf{A} + \mathbf{D}) + r\mathbf{pp}(\mathbf{A} + \mathbf{D}) \\
\mathbf{pp}(\mathbf{I} - \mathbf{A} - \mathbf{D}) &= (1 + r)w\mathbf{g}\mathbf{l} + r\mathbf{pp}(\mathbf{A} + \mathbf{D}) \\
\mathbf{pp} &= (1 + r)w\mathbf{g}\mathbf{l}(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1} + r\mathbf{pp}(\mathbf{A} + \mathbf{D})(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1} \\
\mathbf{pp} \left(\mathbf{I} - r(\mathbf{A} + \mathbf{D})(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1} \right) &= (1 + r)w\mathbf{g}\mathbf{l}(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1} \\
\mathbf{pp} &= (1 + r)w\mathbf{g}\mathbf{l}(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1} \left(\mathbf{I} - r(\mathbf{A} + \mathbf{D})(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1} \right) \\
\mathbf{pp} &= \left(1 - \frac{r}{R} \right) \mathbf{v} \left(\mathbf{I} - R \frac{r}{R} \mathbf{H} \right)^{-1}
\end{aligned} \tag{3.3}$$

Both the total labor vector \mathbf{v} (equation 3.2) and relative production prices \mathbf{pp} (equation 3.3) are expressed in the unit of labor time and on the scale of unit of

output. In contrast, market prices in the input-output tables are given in monetary units and on the scale of total output, as the number of units of output \mathbf{Q} is not recorded. To investigate the relationship between direct, production, and market prices, we normalize labor values and production prices by the sum of gross output. This expresses direct prices \mathbf{dp} and production prices \mathbf{pp} in the monetary terms of market prices ([Ochoa 1989](#), 417; [Shaikh 2016](#), 389ff; [Tsoulfidis and Tsaliki 2019](#), 138).

To account for the international mobility of capital and the simultaneous political barriers to labor mobility, we calculate production prices with between-country differences in the wage rate but under the tendential international equalization of profit rates. The profit rate enters the calculation of production prices (in equation 3.3) twice: once to enhance the wage rate $(1 + \mathbf{r}) \mathbf{w}$, which can be expressed as $(1 - \mathbf{r}/\mathbf{R})$, and once to evaluate the vertically integrated capital matrix \mathbf{H} . Assuming that the domestic general rate of profit in country c is \mathbf{r}_c and the global average rate of profit, which emerges as a tendency, is \mathbf{r} , $\frac{\mathbf{r}_c}{\mathbf{R}}$ denotes the average ratio of gross operating surplus to total value added within one country, and $\frac{\mathbf{r}}{\mathbf{R}}$ uses international aggregates for the same calculation, while when R enters the equation as a stand-alone variable (as in the rightmost brackets in equation 3.4), it is calculated from the dominant eigenvalue of the \mathbf{H} matrix:

$$\mathbf{pp} = \left(1 + \frac{\mathbf{r}_c}{\mathbf{R}}\right) \mathbf{gl}(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1} \left(\mathbf{I} - \frac{\mathbf{r}}{\mathbf{R}} \mathbf{RH}\right)^{-1} \quad (3.4)$$

Equation 3.4 depends on a strong assumption: Following the formulation of the wage rate in terms of relative profit shares as in the first line of equation 3.5 ([Tsoulfidis and Tsaliki 2019](#), 169–70), differential profit shares across countries $\frac{\mathbf{r}_c}{\mathbf{R}}$ express differential wage rates under the assumption of the tendency to equalization of profit rates at the international level:

$$\begin{aligned}
(1+r)w &= \left(1 - \frac{r}{R}\right) \\
(1+r)w_c &= \left(1 - \frac{r}{R} - \frac{r_c-r}{R}\right) = \left(1 - \frac{r_c}{R}\right)
\end{aligned} \tag{3.5}$$

To express direct prices and production prices in a unit commensurable with market prices, we adopt the normalization method used in [Ochoa \(1989\)](#), [Shaikh \(1998, 228\)](#), and [Tsoulfidis and Tsaliki \(2019\)](#)—namely, we normalize \mathbf{dp} and \mathbf{pp} over the sum of prices over all industries $j \in J$ within one year t and country c . We estimate R on the global level as the dominant eigenvalue of the \mathbf{H} matrix in each year ([Shaikh 2012](#), 90).

Following the procedures explained in this section, the direct price of industry j 's output in year t and country c is calculated in equation 3.6:

$$dp'_{j,c,t} = v_{j,c,t} \times \frac{X_{j,c,t}}{\sum_{j \in J, c=c, t=t} v_{j,c,t} X_{j,c,t}} \tag{3.6}$$

Similarly, the price of production per unit of industry j 's output in year t and country c is given in equation 3.7:

$$pp'_{j,c,t} = pp_{j,c,t} \times \frac{X_{j,c,t}}{\sum_{j \in J, c=c, t=t} pp_{j,c,t} X_{j,c,t}} \tag{3.7}$$

We express the relative market price of industry j in year t and country c as the share of industrial output X_j in total global output:

$$mp'_{j,c,t} = \frac{X_{j,c,t}}{\sum_{j \in J, c=c, t=t} X_{j,c,t}}$$
(3.8)

We report the share of production and nonproduction industries in global gross production evaluated at all three price vectors (direct, production, and market prices) in [Appendix 3.D](#). A comparison of the average figures for all countries in our sample over the period 1995–2020 ([Table 3.D.1](#)) and only for 2020 ([Table 3.D.2](#)) clearly demonstrates the rise of China in production industries while the United States remained dominant in nonproduction industries. A host of other interesting results can be derived from [Appendix 3.D](#), in which we also provide information on how to interpret the tables.

3.5 Measuring Deviations and Centers of Gravity

[Rubin \(1973\)](#) offered one perspective for looking at Marx's theory of value that focuses primarily on the dynamics of the social division of labor in capitalist commodity production. This brings about a wide range of questions to be investigated, which is in itself a strength of the method rather than a problem. For empirical tests, the choice of the variable of interest and measures of deviation is crucial. Over the past forty years, authors have taken up the quantitative aspects of Marx's value theory in various ways. For example, [Ochoa \(1989\)](#) investigated whether the gap between direct and production prices is smaller than the gap between production and market prices in order to contextualize the importance of values in real-world economies, and he explored whether changes in labor requirements are in the long run the main determinant of price dynamics in order to demonstrate the importance of socially necessary labor time (as opposed to the Sraffian view that labor serves as just one of many possible numeraire goods).

[Petrovic \(1987\)](#) tested the impact of differential capital-labor ratios in the Yugoslavian economy on the deviations between direct and production prices to investigate Ricardo's and Pasinetti's claim that the vertical integration of labor requirements reduces the importance of structural between-industry differentials because of the high degree of interconnection characterizing capitalist economies. [Cockshott, Cottrell, and Michaelson \(1995\)](#) tested direct prices against vertically integrated electricity, oil, iron, and steel use as predictors for market prices to investigate the importance of socially necessary labor against intuitive competitors, in turn to see whether linear production analysis renders the labor theory of value redundant.

[Shaikh \(1984, 1998\)](#) and [Bienefeld \(1988\)](#) investigated the impact of the income distribution (that is, the ratio of wage shares to profit shares) on relative prices and find that the empirical relationship between direct and market prices is left intact in 349 of 355 industries over almost all ranges of the distribution. Based on this result, they rejected the notion of “technological re-switching”—that is, the claim that the presence of nonlinearities in production-price dynamics arising from changes in distribution renders the labor theory of value not only redundant but also inconsistent.

[Chilcote \(1998\)](#) provided a comprehensive study of the labor theory of value at various degrees of empirical complexity, including the impact of using more sophisticated models accounting for fixed capital, turnover time, capacity utilization rates, and depreciation coefficients, as compared to the more widely available circulating capital models. These are only some studies in the relevant literature, with more recent empirical work extending the analysis to larger databases or investigating more detailed questions.

Before presenting our results, it is useful to revisit the economic interpretation of price-value deviations (to be more precise: the deviations between direct, production, and market prices) to relate the results of this chapter to the broader theoretical framework presented in [chapter 2](#). Marxist value theory posits that in a capitalist economy, which revolves around the production of commodities by

competing firms, socially necessary labor requirements govern the deep dynamics of the system, its laws of motion. As individual capitals compete for the most profitable investment of their available funds, market prices change along with total (direct and indirect) labor necessary for the reproduction of a commodity. This brings about a tendency of broad alignment of the movements of market, production, and direct prices.

Between-industry competition forms a general profit rate that applies to every industry, independent of the specific ratio of capital and labor it employs, while the transfers of value between capitals (and industries) lead to the divergence of production prices from direct prices. At the same time, investment in industries with above-normal profit rates on new capital accelerates relative to demand, while investment in industries with below-average profit rates decelerates relative to demand ([Marx 1991](#), 489). Meanwhile, within an industry, the search for below-average costs of production drives technological change: Individual capitals seek to boost labor productivity by investing in more and newer capital. Furthermore, some capitals realize “prices without value” on rent-bearing resources and in unproductive industries ([chapter 5](#)).

Therefore, the complex dynamics of capitalist economies are not defined by the perfect alignment of direct, production, and market prices. Persistent deviations exist, and this is meaningful. While the force of competition turbulently eliminates existing inequalities, it also produces new inequalities. Marx called this the “constant equalization of ever-renewed inequalities” ([Marx 1991](#), 298). In addition, we must be cautious about any idea of the general rate of profit, and, by extension, production prices, as some kind of equilibrium to which the system converges: “It is the equalization brought about in this way, whereby the average market prices of commodities are reduced to their prices of production It appears only in the fluctuations and equalizations that reduce the market prices of commodities to their production prices; not as the direct establishment of an average profit” ([Marx 1991](#), 489).

3.5.1 Distance Measures

The brief summary of the key insights relating to the three sets of prices implies, when applied to empirical analysis or translated into testable hypotheses, that we expect market, production, and direct prices to move in the same direction. In addition, we expect to observe persistent deviations between the three vectors. The idea that persistent price-value deviations, even over large timespans or geographical distances, would require us to reject the labor theory of value is a misunderstanding of Marx's work as an equilibrium price theory.

Traditional measures of distance between price vectors include correlation analysis and, most popularly, the R^2 -statistic in logarithmized linear regression, the mean absolute deviation (MAD) in percentage points in its basic form or weighted by industry output (mean absolute weighted deviation, or MAWD) ([Shaikh 2016](#), 393), the coefficient of variation (CV), and the scale- and numeraire-free Euclidian distance (D):

$$\begin{aligned} \text{MAD} &= \frac{1}{N} \times \sum \frac{|p_1 - p_2|}{p_2} \\ \text{MAWD} &= \frac{1}{\sum X} \times \sum \frac{(X|p_1 - p_2|)}{p_2} \\ \text{CV} &= \sqrt{\sum \frac{((p_1/p_2)/(\bar{p}_1/\bar{p}_2) - 1)^2}{N}} \\ \text{D} &= \sqrt{\sum \left(\frac{p_1/p_2}{||p_1/p_2||} - \frac{1}{\sqrt{N}} \right)^2} \end{aligned} \tag{3.9}$$

The literature consistently finds large correlations between market and production prices as indicated by the R^2 -statistic in a log-log regression and MAWDs between **0.1** ([Shaikh 2016](#), 394) and 0.18 ([İşikara and Mokre 2022](#), 171). The same is true for the correlations between market and direct prices and between production and direct prices.

In mathematical terms, market, production, and direct prices are vectors in an N -dimensional space, where N is the number of industries in the corresponding vectors. Any distance measure is simply a number that is supposed to be greater when two vectors are very different from each other. The mean absolute distance is a very intuitive case: It is just the sum of distances between each entry for the same industries in a given pair of vectors. If relative market and production prices for all industries are close to each other, this measure will be smaller than if, for example, high market prices always go with low production prices.

MAD has two advantages: It is simple to compute and to interpret for the reader. For instance, an MAD of 0.15 means the average difference between two relative-price vectors (where the sum of the elements of each price vector equals one since these are relative prices) is 15 percent. However, there are three major issues with MAD: (1) a tiny industry will have the same impact on the total measure as a large one; (2) a large outlier will significantly increase the value of the measure; and (3) it is scale dependent, meaning that if we compare price vectors normalized on the global and national scales (that is, divided by larger and smaller bases), the results are no longer comparable.

On the other end of the spectrum lies the numeraire-free Euclidian distance, the distance between two vectors in an N -dimensional space. It is immune against most problems of scaling, aggregation, and choice of base, but there is no intuitive interpretation of it. To circumvent this problem, [Mariolis and Tsoulfidis \(2010\)](#) normalized \mathbf{d} by its maximum value such that a normalized \mathbf{d} of 0.15 means that the distance is 15 percent of its maximum possible value.

In this chapter, we report the mean absolute weighted deviation (MAWD) in percentage points with the subscript j indicating industries:

$$MAWD = \frac{1}{\sum (X_j)} \sum \left(X_j \times \frac{MP_j - PP_j}{MP_j} \right) \quad (3.10)$$

We use market prices in the denominator because MP is observed, bringing about a practical advantage: When we use regression analysis to investigate price-value deviations in subsequent chapters, we can multiply the explained part by gross output and arrive at an estimate for aggregate impact in the same unit since the regression will use observed data (denominated in market prices), too. If we instead used production prices or direct prices in the denominator of the fraction in equation 3.10, the deviations would be expressed in terms of theoretical measures. The choice of base is not irrelevant: A small denominator would significantly boost the value of the aggregate distance measure, implying that large deviations in industries with a low market price would be more impactful. Weighting the sum by gross output (that is, summing up deviations over all industries and multiplying their contribution by the share of that industry's output in total gross output) dampens this effect.

In [Table 3.1](#) we present the mean absolute weighted deviation between market and production prices, production and direct prices, and market and direct prices for each country and the whole sample. The number of industries refers to the number of industries within a country with all market, production, and direct prices above zero, which varies between countries because of their different patterns of specialization (for example, most European countries have a zero entry for paddy rice cultivation). The variation is further increased by the fact that EXIOBASE 3.8 has a large number of narrowly defined agricultural sectors that are only viable in certain climates.⁵

Table 3.1 Mean absolute weighted deviations in percentage points 

<i>Industries</i>	$(MP - DP)/MP$	$(MP - PP)/MP$	$(PP - DP)/PP$
[Mean]	14.14	13.20	2.89
AT	121	14.12	13.06
AU	122	13.02	12.47
BE	127	12.64	11.90
BG	119	19.34	18.04
BR	121	15.45	14.82

CA	125	11.29	10.87	2.40
CH	115	10.71	9.50	2.42
CN	118	21.46	18.93	3.72
CY	120	22.35	21.75	3.01
CZ	124	11.46	11.59	2.72
DE	122	11.39	11.35	2.29
DK	124	11.97	11.15	2.47
EE	121	16.55	14.79	2.83
ES	124	14.94	14.64	2.92
FI	118	12.95	12.03	2.48
FR	122	9.57	8.76	2.79
GB	124	11.11	10.50	2.10
GR	120	26.92	26.19	2.80
HR	125	16.71	16.15	2.57
HU	114	12.51	12.21	3.38
ID	111	20.68	21.53	3.18
IE	119	20.22	19.25	3.03
IN	114	19.93	19.50	2.70
IT	126	10.00	9.41	2.62
JP	116	11.94	11.47	3.20
KR	120	13.59	12.76	3.51
LT	124	22.14	21.30	2.53
LU	122	15.93	14.42	3.08
LV	124	21.82	20.59	3.22
MT	116	19.38	18.76	3.24
MX	123	23.13	23.10	3.62
NL	124	16.95	15.89	2.63
NO	117	27.86	27.38	2.04
PL	118	17.02	16.67	2.82
PT	117	13.48	12.92	2.79
RO	122	17.51	17.11	2.68
RU	121	20.54	19.52	2.22
SE	125	11.63	10.70	2.38
SI	123	9.78	9.10	2.56
SK	119	19.59	20.01	3.38
TR	110	24.64	24.57	2.30

TW	120	15.62	14.25	4.27
US	116	8.62	7.90	2.57
ZA	113	11.77	11.76	2.33

Source: EXIOBASE 3.8.2, 1995–2020. Authors' calculations.

Notes: All industries with zero entries for market prices (MP) or production prices (PP) are excluded, and production, market, and direct prices (DP) are normalized to 1 for each country and year. Deviations are denoted in percentage points.

We restrict the sample to production industries, leaving out fictitious industries, state- or nonprofit-dominated industries, and industries that are nonproductive in the Marxist sense (finance, wholesale and retail trade, and so forth). In Appendix [Table 3.A.2](#) we report price-value deviations for these industries and illustrate the structural differences. Note that production industries are not identical with manufacturing industries, as our sample also includes agriculture, mining and extraction, and service industries, in which production in the Marxist sense is also carried out ([Shaikh and Tonak 1996](#)). We report the full industry classification and our industry categories in Appendix [Table 3.C.1](#).

The results presented in [Table 3.1](#) show that the deviations between market and direct prices (as a share of market prices) are in the range of 10–20 percent in almost all countries in the sample, while the deviations between market and production prices are slightly lower (by about 1–2 percentage points) for almost all countries. These figures are in line with the empirical patterns established in the literature, in which the deviations between direct and market prices hover around 15–20 percent ([Shaikh 1984](#), 71–79; [Tsoulfidis and Maniatis 2002](#), 360–61; [Tsoulfidis and Mariolis 2007](#), 428–29; [Shaikh 2016](#), 393–98; [Tsoulfidis and Tsaliki 2019](#), 155–59; [Işıkara and Mokre 2022](#), 170–72; for a bird's-eye view of the empirical literature, see [Cheng and Li 2019](#) 117).

The deviations between direct and production prices, meanwhile, are less than 5 percent in all countries. This lends support to Ricardo's view that

complications brought about by capital accumulation (differences in capital–labor ratios, turnover times, durability of capital goods, and so forth) lead to deviations of relative natural prices (in our case, relative production prices) from the underlying magnitudes of embodied labor (in our case, direct prices), but these deviations are expected to be less than 7 percent.

3.5.2 Regression Analysis

We perform a regression analysis in log-log terms, using a three-way fixed-panel setup that takes year-, country-, and industry-specific effects into account. We run linear regressions of the logarithm of market prices on the logarithm of production prices. The log-log setup ensures the interpretation of the slope coefficient as the percentage change in the dependent variable following a one-unit (that is, 100 percent) increase in the independent variable, which is expected to be close to one. Log-log regressions are a popular form of correlation analysis in the literature since the coefficients indicate by how many percentage points market prices change when production prices change by 100 percent. The intercept coefficient, if significantly different from zero, reflects persistent deviations between market and production prices over all industries. We expect this coefficient to be close to, but significantly different from, zero. The adjusted- R^2 test statistic reflects how much of the variation in the dependent variable is explained by the variation in the independent variable; it is expected to be close to one, too. We also report the alternative level-level regression in [Table 3.3](#) and alternative measures of distance in Appendix [Table 3.A.1](#).

Table 3.2 Logarithmic-regression-based correlation analysis between market, production, and direct prices, only production industries

	$\log(MP)$	$\log(MP)$	$\log(PP)$
Constant	0.0716 (0.0370)	0.0901* (0.0402)	0.0190** (0.0060)
$\log(PP)$	1.0010*** (0.0058)		
$\log(DP)$		1.0025***	1.0016***

		(0.0062)	(0.0008)
SE: clustered	By: year and country and industry	By: year and country and industry	By: year and country and industry
Observations	130,118	130,118	130,118
R2	0.9878	0.9874	0.9998
Adj. R2	0.9878	0.9874	0.9998

Source: EXIOBASE 3.8.2 1995–2020. Authors' calculations.

Notes: *t*-test *p*-values for standard errors clustered for years and countries.

*** $p < 0.001$. ↗

** $p < 0.01$. ↗

* $p < 0.05$. ↗

Table 3.3 Linear-regression-based correlation analysis between market, production, and direct prices, only production industries ↗

	MP	MP	PP
Constant	0.0005 *** (0.0001)	0.0006 *** (0.0001)	0.0000 (0.0000)
PP	0.9411 *** (0.0216)		
DP		0.9362 *** (0.0269)	0.9956 *** (0.0083)
SE: clustered	By: year and country and industry	By: year and country and industry	By: year and country and industry
Observations	130,118	130,118	130,118
R2	0.9554	0.9518	0.9979
Adj. R2	0.9554	0.9518	0.9979

Source: EXIOBASE 3.8.2 1995–2020. Authors' calculations.

Notes: *t*-test *p*-values for standard errors clustered for years and countries.

*** $p < 0.001$. [↳](#)

** $p < 0.01$. [↳](#)

* $p < 0.05$. [↳](#)

Since the dependent and independent variables are log-transformed, we have to exclude all observations with market or production prices of zero and renormalize the entries such that they sum up to one for each country and year. We furthermore exclude observations from the five “rest of the world” regions as well as all nonproduction, nonprofit, or recycling industries. The results are presented in [Table 3.2](#). We apply the same procedure to other pairs of price vectors, running regressions of (1) market prices on direct prices and (2) production prices on direct prices.

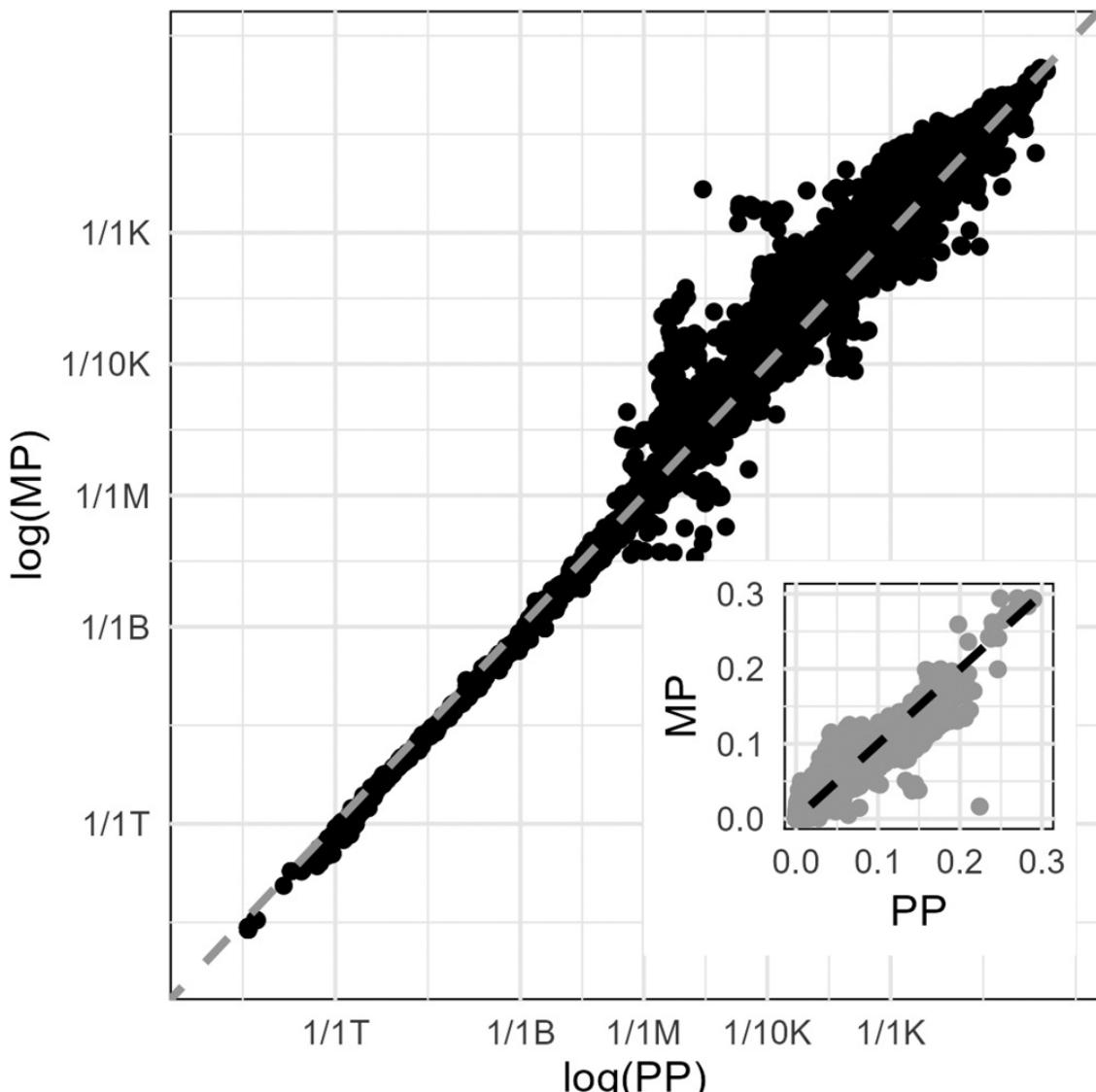
In [Appendix 3.B](#), we gradually add three-way fixed effects step by step to make sure that the relationship holds after controlling for industrial, national, or time-specific features (with fixed effects for industries, countries, and years). This serves two purposes: First, it controls for (and corrects) the possibility that the observed dynamics are not general to the whole data set but driven by outliers with extraordinary properties, and second, it calculates standard errors (important for significance analysis) in the statistically appropriate way. The within-adjusted- R^2 -statistic reports the explanatory power without considering the fixed effects.

In a logarithmic regression, in which both the dependent variable and the independent variables are expressed logarithmically, the coefficient can be interpreted as the percentage change in the dependent variable following a percentage change in the independent variable. A coefficient of one would mean that if production prices increased by 1 percent, so would market prices. The coefficients in [Table 3.2](#) are very close to one, which indicates the close relationship between market and production prices that the labor theory of value suggests. The R^2 -statistic estimates how much of the variation in the dependent variable is explained by the variation in the independent variable. Values close to one show that production prices explain a large part of the movements in market

prices, as do direct prices, and finally direct prices for production prices. At the same time, constant-intercept terms are significantly different from zero in the latter two regression setups, but not for the market-production price relationship. This suggests persistent deviations between the price vectors (which the labor theory of value also predicts) and calls for further investigation of the turbulent relationship between market, production, and direct prices.

The logarithmic regression approach has been the subject of criticism by [Shaikh \(2016](#), 389) for being inappropriate for nondimensionless variables (which should be circumvented by our transformation of direct and production prices in equations 3.6, 3.7, and 3.8; see [Basu and Moraitis 2023](#), 32), for giving a counterintuitive interpretation to the intercept term in logarithms since the expected value of a logarithm does not directly correspond to the expected value of the transformed variable ([Basu and Moraitis 2023](#), 33), and for other reasons. In [Table 3.3](#) we report the results for a level-level regression of market, production, and direct prices. It shows much lower constant-intercept coefficients, which are still significantly different from zero and indicate persistent price-value deviations. The coefficients are notably further away from one, as are the R^2 -statistics, while constant-intercept terms are small but significantly different from zero in the first two regressions, but not for the production-direct price relationship. Still, the results are close to the findings in the literature and do not reject the predictions of the labor theory of value.

Finally, [Figure 3.1](#) illustrates the relationship between market and production prices. The concentration of observations around the forty-five-degree line shows the close relationship between the two vectors, but outliers become more frequent and increase in size with higher price-vector entries (which represent larger shares in global value production).



► Long Description for Figure 3.1

Figure 3.1 Production and market prices, normalized such that they sum up to one in each year and country, both in logarithms (and without log transformation in the inset). EXIOBASE 3.8.2 1995–2020 ↗

3.6 Turbulent Equalization of Market Prices around Production Prices

The quantitative side of Marx's value theory—namely, the labor theory of value—is not an equilibrium price theory, or at least, not in Marx's work. Instead, it is

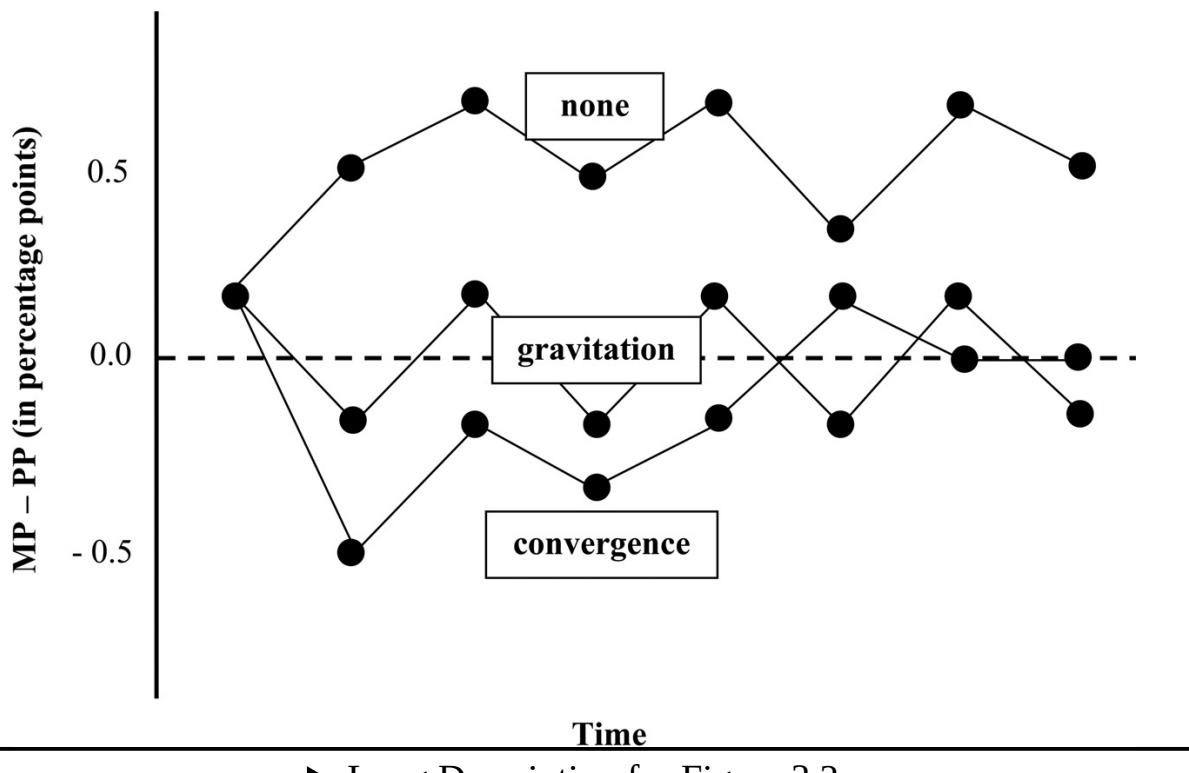
a theory of turbulent equalization, a process in which key variables over- and undershoot a center of gravity. Turbulent dynamics in Marx's and earlier classical political economists' work were revived by [Clifton \(1977\)](#), [Shaikh \(1980\)](#), and [Semmler \(1984\)](#) (among many others) in their discussion of Marxist versus neoclassical concepts of competition. They traced firm-level and industrial profit rates to the general profit rate within the context of real competition, in which capitalists seek the highest possible return on new capital. Since then, turbulent dynamics in market and production prices ([Shaikh 2016](#), 419; [Tsoulfidis and Tsaliki 2019](#), 7; [Işıkara and Mokre 2022](#), 172), wages ([Mokre and Rehm 2020](#); [Shaikh and Jacobo 2020](#)), and interest rates have been uncovered, investigated, and discussed.

As mentioned in the introduction to this chapter, turbulence is a term borrowed from, or at the very least also used in, fluid-dynamics physics. While the economic interpretation does not assume an equivalence between firms and particles, the definition of the concept implies obvious parallels, and the language of [Ferziger and Perić \(2002\)](#) might be helpful: “Turbulent flows are highly unsteady. A plot of the velocity as a function of time at most points in the flow would appear random to an observer unfamiliar with these flows It has been shown in recent years that turbulent flows contain coherent structures—repeatable and essentially deterministic events that are responsible for a large part of the mixing They fluctuate on a broad range of length and time scales” (265).⁶

The center of gravity is itself a subject of economic dynamics; it is not defined merely as a property of the turbulently behaving variable. For example, the production price, which serves as a gravitational center for market prices, is itself an emerging tendency that changes in response to changes in labor productivity, the economy-wide rate of surplus value, and between-industry competition. At the same time, the fluctuations around a center of gravity have an impact on the magnitude of the latter. For example, higher market prices in an industry will attract new investment, possibly bringing about technological

change, which could very well turn out to save labor time and thereby lower the production price ([Marx 1991](#), 488).

In this section we investigate the turbulent behavior of market prices around production prices. We apply the econometric method of [Mueller \(1986\)](#) and [Vaona \(2011\)](#), who tested whether the difference between a variable (in their case, profit rates on new capital) and its gravitational center can be predicted using an intercept term and three dimensions of a time variable ([Figure 3.2](#)). If all coefficients cannot be rejected as nonsignificant, this means that the over- or undershooting is not a property of the industry, and not a deterministic product of time, which they call “gravitation.” If there is a significant time trend, but no clear prediction about which side of the gravitational center the variable will land on (that is, the intercept is nonsignificant), there is “convergence.”



► Long Description for Figure 3.2

Figure 3.2 Turbulent behavior of industries (schematic illustration)

Gravitation and convergence are interpreted as participation in an industry

experiencing turbulent equalization. For industries $j \in J$, periods $t \in T$, and countries $c \in C$, the test for turbulent behavior in some variable \mathbf{x} with an assumed gravitational center $\bar{\mathbf{x}}$ follows the procedure in equation 3.11, with t -tests for coefficient significance as the basis for the evaluation of turbulent behavior:

$$\begin{aligned}\dot{\mathbf{x}} &= \mathbf{x} - \bar{\mathbf{x}} \\ \dot{x}_{j,t,c} &= \alpha + \beta_1 \frac{1}{t} + \beta_2 \frac{1}{t^2} + \beta_3 \frac{1}{t^3} + \epsilon_{j,t,c}\end{aligned}\tag{3.11}$$

To investigate the turbulent behavior of market and production prices, we set $\dot{\mathbf{x}} = \mathbf{mp} - \mathbf{pp}$, with \mathbf{mp} and \mathbf{pp} as relative prices with countries per year as the unit of normalization. Throughout this section, we omit all observations for which market, production, or direct prices are estimated as zero, and we renormalize the price vectors such that each sums up to one within a country and year. We then run a fixed-effects panel regression with varying intercepts and slopes, country-level fixed effects, and standard errors clustered at the country- and industry-level, and we extract the coefficient estimates as well as t -test p -values in equation 3.12. We do not include fixed effects for industry, as the industry-varying intercept expresses the same information, nor a year-level fixed effect, as the t -transformation contains a substantial part of the same information. We argue that with a t -test p -value above or equal to 0.05, a coefficient cannot be rejected as equal to zero.

$$\begin{aligned}t &\equiv \text{year} - \min(\text{year}) + 1 \\ (MP - PP)_{j,c,t} &= \alpha_c + \alpha_j \beta_{1,j} \frac{1}{t} + \beta_{2,j} \frac{1}{t^2} + \beta_{3,j} \frac{1}{t^3} + \epsilon_{j,c,t}\end{aligned}\tag{3.12}$$

The regression results in [Table 3.4](#) suggest gravitating behavior in eighty-five

production industries, converging behavior in a further thirty-three industries, and no evidence for participation in the turbulent equalization of market prices around production prices in eleven industries.⁷ According to the test, more than 90 percent of production industries participate in turbulent equalization of profit rates which produce 75 percent of gross output. At the same time, this is true for only 70 percent of the nonproduction industries.

Table 3.4 Turbulent behavior of production, nonproduction, recycling, and nonprofit industries, calculated using a unified fixed-effects panel regression approach [↳](#)

	Production			Nonproduction			Recycling		Nonprofit		
	N	%	% Output								
Convergence	32	25.00	39.46	3	42.86	32.62					
Gravitation	85	66.41	36.10	2	28.57	14.99	2	100	100	22	100
None	11	8.59	24.44	2	28.57	52.38					

Source: EXIOBASE 3.8.2 1995–2020. Authors' calculations.

We list the nonparticipating industries in [Table 3.5](#). The list includes one agricultural, one extractive, and one extraction-related processing industry; two manufacturing industries; one energy production industry; a number of partially government-dominated industries such as mail and telecommunications, research and development, education, and health and social work. This last point is intuitive since government-dominated industries are not (primarily) organized around the profit motive, or at least, they are not defined by the quest for the maximum rate of return on new investment.

Table 3.5 Production Industries that do not participate in turbulent equalization of market prices around production prices, calculated using a country-wise fixed-effects panel regression approach [↳](#)

	Industry
Production	Cultivation of paddy rice
Production	Extraction of crude petroleum and services related to crude oil extraction, excluding surveying

Production	Petroleum refinery
Production	Chemicals not elsewhere classified
Production	Manufacture of fabricated metal products, except machinery and equipment (28)
Production	Distribution and trade of electricity
Production	Transport via railways
Production	Mail and telecommunications (64)
Production	Research and development (73)
Production	Education (80)
Production	Health and social work (85)
Nonproduction	Wholesale trade and commission trade, except of motor vehicles and motorcycles (51)
Nonproduction	Financial intermediation, except insurance and pension funding (65)
Nonproduction	Public administration and defense; compulsory social security (75)

Source: EXIOBASE 3.8.2 1995–2020.

In [chapter 5](#), we investigate the role of landed and resource-extracting industries (which correspond to the agricultural, mining, and extraction industries in [Table 3.5](#)), as well as industries processing their products (see, for example, energy production and fuel sales), in connection to ground rent; and in [Isikara and Mokre \(2022\)](#), 174) we observed a similar correlation between high price-value deviations and extractive industries. Similarly, the role of nonproduction industries in international value capture, something [Rotta \(2025\)](#) studied, is addressed in more detail in [chapter 4](#). In general, the vast majority of the industries for which we find evidence against the turbulent equalization of market prices around production prices constitute the frontiers of the law of value, where the core patterns associated with the law are modified. These dynamics at the frontiers represent no evidence against Marxist value theory, but constitute an integral part of it, and they are discussed in the next two chapters of this book.

3.7 Conclusion

Our focus in this chapter was the quantitative side of Marx's value theory, commonly referred to as the labor theory of value. Its role within the broader realm of value theory is manifold: It proposes that in a capitalist context, the phenomena observed with respect to prices in the sphere of exchange are regulated (and can be explained) by the material processes characterizing the production of commodities. Nonetheless, for a couple of reasons, this does not mean that observed (market) prices are equal or proportional to the underlying direct prices (that is, prices proportional to commodity values). First, competition between capitals brings about a tendency for profit-rate equalization across industries and thereby prices of production, which mediate between direct and market prices. Second, the law of value asserts itself in and through deviations between the three sets of prices, which reflect differential profit rates and arbitrage opportunities at any given time, enabling the market mechanism to allocate new investment, which is also known as decentralized coordination.

The quantitative side of Marx's value theory is therefore not a theory of equilibrium, but one of turbulent equalization, which needs to be understood as a ceaseless flux in which each step toward equalization creates new inequalities. From an empirical viewpoint, the implication is that we expect to see limited but persistent deviations between direct, production, and market prices. In this chapter, we presented our baseline model containing flows of capital depreciation (in addition to circulating capital flows), direct labor adjusted for skill differentials at the global scale, and indirect labor required for the production of commodities, focusing only on production industries.

In the most comprehensive empirical application of its class, based on the EXIOBASE 3.8.2 harmonized multiregional input-output tables, we measured the deviations between direct, production, and market prices for 159 industries in forty-four countries over twenty-six years. Our results confirm two findings in the literature, namely that direct prices constitute a powerful predictor of

production and market prices, and, similarly, that production prices are a powerful predictor of market prices. The deviations between direct and market prices as well as production and market prices are persistent yet limited in their magnitude. The deviations between direct and production prices, resulting from the redistribution of aggregate surplus value across different industries, hover around 5 percent, lending support to Ricardo's prediction that they would not be greater than 7 percent.

A novel contribution of this chapter is to test the hypothesis that market prices gravitate around prices of production. The results demonstrate that around 91 percent of the production industries in our sample participated in the process of turbulent equalization, and 66 percent exhibited the narrow definition of gravitation of market prices around prices of production. At least as interesting as the share of industries participating in gravitation (and profit-rate equalization) is the story pertaining to the nonparticipating industries. In most cases, the latter pertain to the frontiers of the law of value and accordingly can be studied with the help of Marx's value theory. As briefly outlined in [chapters 1](#) and [2](#), our interest in this book is not confined to studying the regularities between direct, production, and market prices. We are equally interested in studying regularities in the domain of deviations. The next two chapters explore international value transfers and ground rent in relationship to the deviations, thereby underscoring their interiority to the law of value.

Notes

1. We use the term *underdeveloped* in the sense of [Walter Rodney \(1972\)](#), who described underdevelopment as active behavior of the colonial powers to the disadvantage of their colonies. It does not imply backwardness on a linear development scale, but rather the consequences of a combined historical process between the center and the periphery.⁴
2. We use Marx's terminology and formulations since they are more consistent and enhanced compared to those of Ricardo.⁵

3. EXIOBASE data are denominated in euro terms, which is why we present our model in the same currency.[◀](#)
4. We retrieve the circulating capital matrix directly from EXIOBASE 3.8.2 and a fixed capital flow matrix K from [Södersten and Lenzen \(2020\)](#), which we then normalize by gross output such that $D = K(X)^{-1}$. We remove fictitious industries from the matrices before continuing the estimation, but only eliminate nonproduction, nonprofit, and recycling industries afterward, as these sectors participate in the formation of the general profit rate and production prices according to the Marxist approach.[◀](#)
5. After excluding all industries with zero entries, we renormalized the vector such that market price, production price, and direct price sum up to one for each country and year. We calculated distance measures for each country and year, then took the weighted mean per country over all years, with the share of industrial gross output in aggregate gross output X for a year and country as the weight.[◀](#)
6. The quotation omits some features of turbulence in fluid dynamics (vorticity, diffusion, and dissipation) that might be interesting metaphors for the discussion of real competition but go far beyond the scope of this book.[◀](#)
7. We conduct an extended version of the regression analysis and present the results in [Appendix 3.C](#), in which we evaluate separate regressions for each country. While this would allow for a more detailed analysis, the relatively short time span of the sample does not provide sufficient information, in some cases, to analytically estimate all coefficients. For the rest of the sample, more than 83 percent of industries do participate in turbulent equalization of market prices around production prices, which is less than in the unified regression analysis but still corroborates the existence of turbulent equalization in the vast majority of industries we study.[◀](#)

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4 International Trade, Value Transfers, and Imperialism

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4.1 Introduction

Capitalism is the globally dominant mode of production today. Just as its inception in western Europe was fueled by international economic relationships (of trade, plunder, and robbery), its global propagation was a historical process that still shapes the character of international relations. This process was characterized by international inequalities from the beginning, which were deepened and expanded, and new inequalities, which were purposefully (and violently) created. Much like on the national stage, the relentless struggle of capitalists against noncapitalist producers was only surpassed by the relentless struggle of capitals against each other: Competition drives the international expansion of capital accumulation, and the international dimension adds new features to competition.

The global dimension of capital accumulation is characterized by three factors: international trade of commodities, capital exports, and international production chains. In all three domains the law of value applies in a modified

manner. All three are characterized by international movements of value within and between industries, and the movements are systematically expressed in deviations between direct prices, production prices, and market prices. Since the deviations represent both an outcome of international inequalities and the economic basis for their further deepening, there is little reason to believe that these dynamics fuel convergence between countries, let alone some equilibrium without inequalities.

Inequalities in international trade are expressed by value transfers from (1) industries with higher to industries with lower value composition of capital¹ and (2) less productive to more productive firms within the same industry producing the same use value. Cross-country investments can create (3) between-country value capture from production to nonproduction industries (such as finance or wholesale trade). International production chains and activities of multinational corporations can furthermore lead to (4) the realization of surplus value either in an industry and country other than those in which production labor is performed or in an adjacent tax haven (or, absent profit repatriation, control over that value). We use the term *international value transfers* to denote within- and between-industry flow of surplus value across countries due to differential value compositions of capital and rates of surplus value; they are a structural component of real capitalist competition. The term *international nonproduction value capture*, in contrast, is used to denote the appropriation of surplus value generated in production industries in a country by nonproduction industries located in another country. In other words, we distinguish international value transfers from, first, international nonproduction value capture and, second, value capture through capital exports.²

International trade and cross-country investment were discussed in classical political economics, with especially Ricardo modifying his value theory in this context. Marx planned to write a separate volume on international trade and the world market, but he did not manage to. The Marxist understanding of accumulation in an international setting was therefore largely developed after

Marx's death, when authors engaging with his ideas adapted and developed the framework in the face of the conflicts they encountered in the real world. From this rich literature sprung fruitful debate and the building blocks for a value theory of the world market, which we summarize in [sections 4.2–4.5](#).

The quantitative domain of Marxist value theory explains regularities in the relationship between socially necessary labor expended in production and commodity prices, as well as regularities in deviations between different sets of prices. The driving force behind both (the systematic relationship and the regularities in deviations) is the modus operandi of capitalist accumulation, namely competition between independent capitals in search of above-normal profits. The ceaseless interplay and reconfiguration of investment decisions of individual capitals seeking to exploit deviations from the general profit rate generates the turbulent dynamic that brings about the very tendency toward a general profit rate. Value transfers in this context are not a distinctly international phenomenon: They occur (in simpler form) between different industries within the same country, and even between different firms within the same industry through the regular functioning of competition.

Within an industry, a number of production conditions coexist. Yet the price of the commodity reflects the *average* conditions of production and thereby the social value rather than the individual value pertaining to the production conditions of a specific capital. Therefore, if commodities sell at direct prices, firms producing with better conditions will enjoy a transfer of value since they will sell at a social value above the individual value of their commodity.

At the same time, when it comes to investing their profits, capitalists search for the investment with the highest rate of return, which brings about the (tendency toward) equalization of profit rates on new investment between industries. Capitalists in all industries tend to earn, on average, the same profit rate on new investment (capital outlays and labor costs) if they use the most productive, reproducible technology. The combination of direct prices and a general profit rate creates production prices. When commodities sell on average

at production prices, the relative prices for labor-intensive commodities are lower than their relative direct prices. The formation of production prices is therefore based on a value transfer between capitals, flowing from industries with lower average organic composition of capital to industries with higher average organic composition of capital.

Both mechanisms are relevant for the world market, in which commodities tend to sell, and on average are sold, at international production prices with equalized profit rates, and market prices gravitate around international prices of production. We showed empirical evidence for this relationship in [chapter 3](#). In cases in which countries trade similar commodities, capitals employing more productive labor will enjoy an inflow of value and vice versa. In cases in which countries trade different commodities, the tendency toward equalization of profit rates will involve transfers of value from industries with a lower national average value composition of capital to those with a higher national average value composition. The picture is further complicated by the fact that differences in wages and rates of exploitation are rather persistent across countries. By implication, transfers of value that result from differences in industry-level average organic compositions in a national context might well have two sources in an international context: differences in the ratio of the mass of means of production and living labor (that is, the technical composition of capital) and differences in wages and rates of exploitation.

In his groundbreaking work linking international trade to debates around imperialism, which is presented in [section 4.3, Emmanuel \(1972\)](#) distinguished between these two channels, calling them unequal exchange in the broad sense (where the domestic mechanism equally applies to international trade) and in the strict sense (where value transfers stem from differences in wages). Complications for theoretical and empirical studies of international transfers of value arise because these two channels do not necessarily operate in the same direction, not to mention the productivity channel, which brings about an additional layer of transfers.

Transfers of value do not fully explain the deviations between direct prices, production prices, and market prices. Value captures are also relevant, both within countries and in the international context. The division of total surplus value into profits, rent, and interest represents a value capture insofar as parts of it accrue to nonproduction industries earning the average rate of profit, while others gain profits above the general profit rate (for example, ground rent) if they operate with nonreproducible capital.

To establish the net flow of value between countries and the relative weight of the channels mentioned above, we work with the deviations between direct prices, prices of production, and market prices in an international context. We treat these regular deviations as an expression of the law of value as formulated by Marx: They are based in value theory, and their results are compatible with it. We base our analysis on [Rubin's \(1990\)](#) understanding of value theory primarily as an explanation of the social division of labor under capitalist commodity production and apply it to the international division of labor.

The building blocks of the analysis come from historical ideas and debates: from Ricardo's insight that on international markets the same labor is traded at different prices, to Hilferding's and Bukharin's demonstration that capitalists invest in underdeveloped economies to escape falling profit rates and enjoy competitive advantages at the same time, to Emmanuel's understanding that international trade creates flows of value from higher toward lower rates of exploitation. These debates faced the concrete international dynamics of capitalist development of their times as much as the perceived blank spots of value theory. We carve out the components of our model from accounts of those debates in [sections 4.2](#) (on Ricardian trade theory), 4.3 (on Emmanuel's analysis of transfers of value), 4.4 (on extensions of and alternatives to Emmanuel's framework), and 4.5 (on Marxist theories of imperialism). [Section 4.6](#) details our empirical model, then presents and interprets the results.

4.2 The Great Compromise: Ricardian Comparative Costs

A key contribution to the classical political economics of international exchange arose in the early nineteenth century in the form of David Ricardo's theory of comparative advantage. His work intervened in the discussion in Britain on the advantages and disadvantages of importing foreign grains; he posed an approach based on comparative costs as an alternative to Adam Smith's earlier emphasis on the role of absolute advantage. Both Smith and Ricardo argued in favor of free trade as a means of cheapening grains as a key wage good and specializing in other trades, thereby lowering manufacturing wages. The Corn Law debates, in which Ricardo intervened both academically and politically as a member of Parliament, were a key conflict between agricultural- and industrial-capital factions in Britain of the nineteenth century.

David Ricardo's interest in the distribution of the social product among workers, capitalists, and landlords led to the theory of value and relative prices, in which relative "natural" prices are roughly proportional to relative total labor requirements. As detailed in [chapter 2](#), Ricardo was a towering figure in the tradition of classical political economics and his writings were essential to Marx's development of his own value theory. However, the authority of the Ricardian theory of relative prices was already weakening following Ricardo's death—a process that culminated in the marginalization of the classical approach following the so-called marginalist revolution of the 1870s ([Meek 1976](#), 243–47).

One aspect of Ricardo's work stands out as a significant exception to this marginalization: his theory of international trade. [Ricardo \(1970\)](#) himself asserted that the rule that regulates relative natural prices in one country "does not regulate the relative value of the commodities exchanged between two or more countries" (133). Exchange ratios of commodities between countries do not depend on absolute costs of production, or total labor requirements, but comparative costs of production. It would lie outside of our scope to discuss Ricardo's theory of comparative costs in detail. Therefore, in what follows, we

confine ourselves to those aspects and assumptions that bear relevance for our discussion of value transfers and unequal exchange in subsequent sections.

Ricardo illustrated his model with a simple numerical example of the trade of wine and cloth between England and Portugal. The latter country enjoys greater productive efficiency in both branches and therefore has an absolute advantage in both trades. Therefore, trade between the two countries will bring about a trade deficit in England, which will be covered by the shipping of gold to Portugal. Portugal will enjoy a trade surplus and an inflow of gold.

At this point, Ricardo's version of the Quantity Theory of Money steps up to rescue England, which would otherwise suffer persistent trade deficits and the draining of its gold reserves. According to this theory, the outflow of gold (or money) from England brings about a fall in commodity prices in England, while the inflow raises commodity prices in Portugal. Sooner or later, because of this adjustment process, England will become sufficiently competitive in international trade vis-à-vis Portugal. England's advantage will arise in that branch in which its initial disadvantage was the smallest—that is, that in which the productivity gap between the domestic industry and its Portuguese competitor was the narrowest. The adjustment in price levels will continue until England's international competitiveness is sufficiently raised that trade between the two countries is balanced.

The crux of Ricardo's argument is that the international terms of trade between the two countries are necessarily more advantageous than the domestic trade-off each country faces when it comes to the choice between the two branches of production. In other words, the world price of each commodity will be between the two domestic comparative costs, implying that countries as a whole will gain from trade. If a loss exists at all, this will not be an absolute loss but only a relative one pertaining to the unequal distribution of the gains from trade ([Ricardo 1970](#), ch. 7; also see [Shaikh 1979](#) and [Emmanuel 1972](#), x–xxxi for a concise presentation and discussion of Ricardian comparative costs).

Since then, even long after the marginalization of classical political

economics, Ricardian comparative costs have constituted the backbone of the notion that free trade is beneficial to all participating countries. As new countries joined the United Kingdom in the league of advanced capitalist economies by adopting protectionist and proindustrial policies ([Chang 2002](#); [Reinert 2008](#)), economists went on demonstrating, on grounds of comparative costs, the benefits of free trade and harms of protectionism, resulting in a complete divorce between what [Emmanuel \(1972\)](#), xiv) sarcastically called “the rational world of political economy and the crazy world of economic policy.”

A number of remarks are worth making here since they are relevant for the discussion in subsequent sections of this chapter. First, Ricardo's theory of comparative costs is framed in terms of labor requirements rather than money costs, an approach that was discarded in later, modern interpretations of the theory. This was a consequential shift since the very possibility of value transfers and nonequivalent exchange is done away with in the subjectivist value theory. Second, in Ricardo's framework, neither capital nor labor is assumed to be mobile internationally. Wages are fixed and roughly equal in all countries at subsistence levels. Because of the immobility of capital, profit rates across countries are not subject to a tendency of equalization. Third, the model abstracts from growth, and potentially unequal advances, in productivity across countries over time. Fourth, the unit of analysis in Ricardo's chapter on foreign trade is inconsistent. He emphasizes the mindset of capitalists in both countries, which is tied to the question of profitability, but then generalizes his conclusions to the “nation as a whole” without due elaboration ([Satligan 2014](#), 33–35; [Shaikh 1979, 2016](#), 502–05).

Heckscher, Ohlin, and Samuelson's version of Ricardian comparative costs is the workhorse model of neoclassical trade theory. In their model, production costs are determined by the opportunity forgone when producing one specific commodity over the other and not by labor requirements. The basic model traces comparative cost advantages to the national endowments of land, labor, and capital. It must assume full employment of all resources (otherwise opportunity

costs are not meaningful) and identical production functions in trading countries to arrive at the result that comparative (dis)advantages and the resulting international division of labor are solely attributable to factor endowments. By implication, any question of underdevelopment, or of differences in the development of productive forces, is assumed away, too ([Haberler 1961](#); [Amin 1976](#), 138; [Shaikh 1979](#), 290–91).

Ricardo's derivation of comparative cost advantages from labor values has been thereby replaced in neoclassical trade theory. But some version of the Quantity Theory of Money remains as the force to push trade into equilibrium. Quantity Theories of Money derive the value of money from its quantity rather than the other way around. In both Ricardian and neoclassical trade models, the outflow of money from a less competitive economy depreciates its currency up until the point at which its comparatively most competitive commodity becomes the cheapest on the world market. It is therefore the Quantity Theory of Money that enables the “great compromise” in Ricardo's work: the fact that fundamentally different laws govern competition within and between countries.

Still, [Ricardo \(1970](#), 135) highlighted a peculiar aspect of international trade that cannot be found in modern mainstream versions of comparative advantage: “The labour of 100 Englishmen cannot be given for that of 80 Englishmen, but the produce of the labour of 100 Englishmen may be given for the produce of the labour of 80 Portuguese, 60 Russians, or 120 East Indians.” Here, he described a value transfer, the exchange of a given magnitude of labor of a country for a greater or smaller magnitude embodied in the commodities produced in another country. It is striking that he did not pursue this notion in his chapter on foreign trade but did briefly discuss it in one of the last chapters of *Principles*, titled “On Machinery.” Ricardo established that within countries, productivity levels above the industry average yield extra profits to the individual producer until the new machine or method becomes the norm. The same kind of value transfer occurs in between-country trade ([Ricardo 1970](#)): “In making your exchanges with those countries, you might give a commodity which cost two days labour, here, for a

commodity which cost one, abroad, and this disadvantageous exchange would be the consequence of your own act, for the commodity which you export, and which cost you two days labour, would have cost you only one if you had not rejected the use of machinery, the services of which your neighbours had more wisely appropriated to themselves” (397).

To summarize, in the Ricardian model of international trade, exchange and exchange rates are ruled by comparative advantage, whereas in the Ricardian model of competition, exchange and exchange rates are determined by labor embodied in production. The decoupling of within- and between-country competition is made possible by the Quantity Theory of Money. Once a model allows for enduring international debt, the mechanism breaks down. It also presupposes different economic actors: relentlessly competing capitals within countries and a harmonic ideal capital between countries. At the same time, Ricardo's investigation of the contradiction revealed the possibility of international transfers of value based on differential productivities, which remains a key point of departure for the Marxist understanding of international inequalities.

Marx studied the law of value in a national context. The extension of value theory to international trade was fragmented in his writings³ and taken up by subsequent Marxists. He refuted any notion that trade between two countries is kept in balance through automatic adjustments in price levels. The flow of money from one country to the other would not immediately raise the general price level in the latter but would lower the rate of interest ([Marx 1991](#), 710–11). The money capital cumulating in the country with a trade surplus could be lent to the deficit country at a higher interest rate. Therefore, persistent trade deficits, along with the cumulation of foreign debt, are possible.⁴

The international aspects of capital accumulation have remained an open challenge for Marxist theory. We discuss in [section 4.5](#) how during the first few decades of the twentieth century, imperialism became a central topic with the contributions of Luxemburg, Hilferding, Bukharin, and Lenin, among others,

who focused on the ramifications of the expansion of capital accumulation and competition on the international arena. However, only a few authors studied international commodity trade based on Marx's theory of value. [Otto Bauer \(1907, 208–35\)](#) investigated the asymmetric distribution of total surplus value within the Habsburg Empire in proportion to unequal organic compositions of capital employed in industrial and agricultural production. [Henryk Grossman \(2021, 368–77\)](#) analyzed transfers of surplus value resulting from differences in composition of capital prevailing in international trade partners.

This literature identified some of the important features of a Marxist theory of international trade and imperialism: value capture through capital exports, value transfers in the trade of raw materials and commodities, within-country competitive advantage through the exploitation of cheap, globalized cost structures, and between-country competitive advantages through underdevelopment. In the 1960s these questions were taken up in conjuncture with the growing interest in (under)development and imperialism and gained a more prominent place within the Marxist literature, which is detailed in [section 4.5](#). Before that, we turn to laying out the framework necessary for a rigorous understanding and discussion of international transfers of value.

4.3 Unequal Exchange and Imperialism in Emmanuel

Arghiri Emmanuel formalized unequal exchange on the international level with a particular emphasis on transfers of value resulting from cross-country differences in wages. His contributions to the study of value transfers from the neocolonial periphery to the imperialist center, rooted in within- and between-country economic structures, represent the first comprehensive attempt to study the law of value at the global scale. He proposed that the tendency of profit rates to equalize across borders, combined with the lack of the same tendency for wages, creates substantial value transfers from capitals in the periphery to those in the center. While Emmanuel formalized two important channels of

international value transfers, the way he conceptualized unequal exchange is (1) neither sufficient to explain the role of international trade in modifying Marx's value theory formulated at the national level (2) nor consistent with Marx's value theory in general.

The conventional Marxist critique of capitalism is based on the law of value, whereas Emmanuel's framework prioritizes the sphere of exchange over that of production, substitutes so-called factors of production in place of capital as a social relation, and advances an understanding of exploitation as a relation between countries. Still, his attempt to identify and formalize different channels of value transfers in international trade represents a valuable contribution and a solid starting point to study the functioning of the law of value at the international level. At the same time, it is the first attempt to study imperialism without resorting to any imperfection in competition or the necessity of capitalism to expand at the expense of precapitalist modes of production. In this section, we lay out the main contours of Emmanuel's analysis and evaluate it critically. To do so, we reproduce his original numerical examples (our [Tables 4.1](#) and [4.2](#)) and extend them to include the role of within-industry competition and productivity differences, which Emmanuel ignored in his analysis ([Table 4.3](#), [Table 4.4](#), [Table 4.5](#), [Table 4.6](#)).

Table 4.1 International trade with equal rates of surplus value and unequal organic capital. All values are denoted in labor hours ↵

	<i>K Total capital invested</i>	<i>c Constant capital consumed</i>	<i>v Variable capital</i>	<i>m Surplus value</i>	<i>V Value c + v + m</i>	<i>R Production cost c + v</i>	<i>T Rate of profit $\frac{\Sigma m}{\Sigma K}$</i>	<i>f I c P J</i>
A	240	50	60	60	170	110	33.3%	
B	120	50	60	60	170	110	33.3%	
	360	100	120	120	340	220		1

Source: [Emmanuel \(1972\)](#), 58.

Table 4.2 International trade with equal rates of surplus value and unequal organic capital. All values are denoted in labor hours ↵

	<i>K Total capital invested</i>	<i>c Constant capital consumed</i>	<i>v Variable capital</i>	<i>m Surplus value</i>	<i>V Value c + v + m</i>	<i>R Production cost c + v</i>	<i>T Rate of profit $\frac{\Sigma m}{\Sigma K}$</i>	<i>P N c I</i>
A	240	50	100	20	170	150	33.3%	
B	120	50	20	100	170	70	33.3%	
	360	100	120	120	340	220		1

[◀] [▶]

Source: [Emmanuel \(1972\)](#), 60–62).

Table 4.3 Direct prices and prices of production in two countries producing two goods

	<i>K Total capital invested</i>	<i>c Constant capital consumed</i>	<i>V Variable capital</i>	<i>m Surplus value</i>	<i>V Value c + v + m</i>	<i>q Quantity produced</i>	<i>T Ave rat prc $\frac{\Sigma m}{\Sigma K}$</i>	
A	Furnace	240	30	40	40	110	2	18.
	TV	180	30	40	30	100	2	18.
B	Furnace	200	15	40	40	95	1	18.
	TV	150	15	40	30	85	1	18.

[◀] [▶]

Source: Authors' calculations.

Table 4.4 Realizations with additional value transfers resulting from productivity differences ↵

	<i>K Total capital invested</i>	<i>c Constant capital consumed</i>	<i>v Variable capital</i>	<i>m Surplus value</i>	<i>δ Initial value transfer</i>	<i>δ' Secondary value transfer</i>
A	Furnace	240	30	40	40	+3.63
	TV	180	30	40	30	+2.72

B	Furnace	200	15	40	40	-3.63	-23.03
TV		150	15	40	30	-2.72	-20.6

◀ ▶

Source: Authors' calculations.

Table 4.5 Direct prices and prices of production in two countries producing two of surplus value ⬅

		<i>K Total capital invested</i>	<i>c Constant capital consumed</i>	<i>v Variable capital</i>	<i>m Surplus value</i>	<i>V Value $c + v + m$</i>	<i>q Quantity produced</i>	<i>T Ave rat prc $\frac{\Sigma m}{\Sigma K}$</i>
A	Furnace	240	30	40	40	110	2	21.
	TV	180	30	40	30	100	2	21.
B	Furnace	200	15	30	50	95	1	21.
	TV	150	15	25	45	85	1	21.

◀ ▶

Source: Authors' calculations.

Table 4.6 Realizations with additional value transfers resulting from productivity ⬅

		<i>K Total capital invested</i>	<i>c Constant capital consumed</i>	<i>v Variable capital</i>	<i>m Surplus value</i>	<i>δ Initial value transfer</i>	<i>δ' Secondary value transfer</i>
A	Furnace	240	30	40	40	+11.4	+18.12
	TV	180	30	40	30	+8.6	+11.88
B	Furnace	200	15	30	50	-7.1	-18.14
	TV	150	15	25	45	-12.9	-11.86

◀ ▶

Source: Authors' calculations.

Emmanuel had two major issues with the state of international trade theory at the time of his writing. First, he was struck by the lack of endeavor on the part of

Marxists to study the operation of the law of value in the international context. Second, he was frustrated that the conventional approach still used models based on comparative costs, demonstrating the merits of free trade and promising convergence between countries despite all the historical and contemporary evidence pointing in the opposite direction. He set for himself the task of “integrating international value in the general theory of value” ([Emmanuel 1972](#), xxxiv).

In broad terms, [Emmanuel \(1972\)](#), ix) expanded on a Ricardian comparative-cost model but questioned the immobility of factors.⁵ At the time he was writing, capital was characterized by mobility in all its functional forms, namely as commodity capital, money capital, and productive capital. What matters here is not perfect capital mobility or imperfections but whether capital is sufficiently mobile to bring about a *tendency* of profit-rate equalization ([Emmanuel 1972](#), 44, 71). While capital is assumed to be sufficiently mobile, labor is assumed not to be. In addition, Emmanuel rejected the notion that costs of living and wages are roughly equalized across countries on subsistence grounds. Rather, wages substantially vary across countries as a result of institutional factors that safeguard them from competitive equalization. What Emmanuel referred to as “institutional” (or, at times, “political”) factors pertain to trade union activities, government interventions, the division of the world into separate states, limits imposed on the mobility of humans across borders, and so forth. He viewed these factors as accidental (and thereby exogenous), as opposed to structural features of the capitalist mode of production, such as the increase in the average organic composition of capital over time in an industry or the formation of prices of production (116–20, 163–69, 188–93).

Based on the tendency of profit rates to equalize across borders, and the lack of the same tendency for wages, Emmanuel put together the pieces of his unique (and controversial) approach to value theory. He set out by defining capital and labor (and later land, too) as “factors of production,” which correspond to an “established claim to a primary share in society’s economic product” ([Emmanuel](#)

[1972](#), 1).⁶ Most complications in value theory, according to Emmanuel, stem from the fact that capital, labor, and land are employed in varying ratios across industries. This is the reason why there is no proportionality between labor values⁷ and production prices, and why a transformation from the former to the latter necessarily takes place in a capitalist economy.

The crux for Emmanuel lies in *the direction of causality* between factor rewards (wages and profits) and equilibrium prices (prices of production). Since wages are safeguarded from equalization by political and institutional factors, they qualify as the *independent variable* of [Emmanuel's \(1972\)](#), 64–71 framework. It follows that prices of production are determined by factor rewards—most importantly, wages.

Against this background Emmanuel defined the concept of *unequal exchange*. Just as values are transferred between industries within a country in the process of formation of a general profit rate and production prices,⁸ such transfers also exist in international trade. Similar to the within-country level, the mobility of capital generates the tendency of profit-rate equalization. For Emmanuel, such value transfers represent *unequal exchange in the broad sense*, as they pertain to the ordinary operation of the law of value.

[Table 4.1](#) represents two countries trading unique commodities under conditions of complete specialization—that is, countries A and B do not compete to export the same commodity. Their export industries are characterized by a uniform rate of surplus value (100 percent) but different organic compositions of capital. The advanced country A, with greater total capital advanced, operates with a domestic rate of profit of 25 percent, while the figure is 50 percent for the less advanced country B. A general rate of profit of 33.3 percent is formed through capital flows between countries, and the resulting prices of production are 190 hours and 150 hours in countries A and B, respectively. The formation of the general rate of profit therefore results in a value transfer from country B to country A. The ratio of commodity values is $\frac{A}{B} = \frac{170}{170}$ while the ratio of prices

of production is $\frac{A}{B} = \frac{190}{150}$, resulting in the following rate of unequal exchange: $\frac{170A}{170B} > \frac{150A}{190B}$.⁹ Since all value transfer in this example results from differences in the organic composition of capital, [Table 4.1](#) pertains to unequal exchange in the broad sense.

There exists a separate, and qualitatively different, mechanism of value transfers based on international wage disparities, which Emmanuel called *unequal exchange in the strict sense*. In the next step, he assumed that the wages in country A are ten times as high as in B, and the intensity of labor in A is double that in B, implying that the cost of labor power in A is five times that in B. [Table 4.2](#) demonstrates that the amount of value transferred from country B to A significantly increases in this case.

The domestic rate of profit in country A is 8.3 percent, and that in B is 83.3 percent thanks to a rate of surplus value of 500 percent.¹⁰ The formation of a general rate of profit (of 33.3 percent) transfers a substantial amount of value (and profit) from B to A, resulting in the following rate of unequal exchange: $\frac{170A}{170B} > \frac{110A}{230B}$. The difference between these two types of unequal exchange is not a matter of degree but one of kind according to [Emmanuel \(1972, 54–64, 160–69\)](#) since the second mechanism is not an integral part of the law of value.¹¹

Numerous conclusions follow from Emmanuel's analysis, but three of them are particularly relevant. First, since wages go into his framework as an independent variable, Emmanuel grasped development as the effect rather than the cause of high wages. Once established, the latter becomes the driving force of an increasing organic composition of capital and encourages investment through the expansion of the market, thereby enhancing the development of productive forces. He is confident enough to assert that there is not a single case in which high wages failed to lead to economic development or one in which institutionally established wages proved to be too high relative to the possible level of economic development and had to be brought down to promote it ([Emmanuel 1972, 124–28](#)).

Second, in this framework, international trade stands out as a source of positive and negative feedback loops rather than convergence to a between-country equilibrium. Once a country gets ahead, it benefits substantially from unequal exchange (in the strict sense). Thanks to substantial transfers of value, trade partners pay for the high domestic wages. Furthermore, the super-profit derived from unequal exchange promotes a higher rate of accumulation and growth as well as advances in technology and education, further expanding markets, attracting investment, and reinforcing even higher wages. Just as wealth begets wealth in countries with high wages, poverty begets poverty in countries with low wages: A substantial portion of the domestic surplus is transferred to rich countries. These countries are deprived of their means of accumulation and growth and trapped in a state that reinforces a low organic composition of capital ([Emmanuel 1972](#), 130–33).

Unequal exchange implies that underdeveloped countries have to sell the products of a large number of hours of total labor to purchase products of a much smaller amount of total labor from advanced countries, and it becomes a central tenet of modern imperialism. Accordingly, Emmanuel's book is titled *A Study of the Imperialism of Trade*. In a world where classical colonialism has disappeared, and direct plundering is more or less excluded, indirect exploitation of poor countries through unequal exchange is of great significance ([Emmanuel 1972](#), 188). In fact, the meaning he attributed to the concept of exploitation signifies the centrality of unequal exchange: “Exploitation is not a fact of production but of appropriation” (329).

Third, that poor countries pay through unequal exchange a portion of the high wages in rich countries has a crucial political implication for the theory of imperialism. Lenin and Bukharin famously made the argument that part of the working class in advanced countries is corrupted by their bourgeoisie, degenerating into a labor aristocracy. Both of them, however, stressed that this coincidence of interest between capital and labor in imperialist countries was partial and momentary. Emmanuel argued that a slow and steady growth in the

social awareness of the working masses in terms of their belonging to privileged, exploiting nations brings about a de facto united front of the workers and capitalists of these countries, directed against poor nations. This does not suppress the fight over shares of the loot through internal union struggles, but the joint interest in perpetuating the loot is prior to the fight over its distribution. Hence, any possibility of workers' international solidarity to fight imperialism (to the extent it is incorporated into trade) is denied ([Emmanuel 1972](#), 177–84).

Emmanuel's work is simultaneously groundbreaking and controversial in many ways. Since our interest is confined to the question of international value transfers and the theory of imperialism in this chapter, we now turn to the implications of *Unequal Exchange* for these contexts, which will set the stage for an empirical inquiry into value transfers on grounds of Marxist value theory.

4.4 The International Law of Value

The main question that needs to be answered is how the law of value operates in an international context. Since we understand the law of value as the regulating principle of the social division of labor under conditions of capitalist competition and accumulation, we discuss the ceaseless (re)production and global social division of labor under the specific conditions of mobility of capital and relative immobility of labor, and whether this process systematically favors capitals in certain countries at the expense of others. We identify whether value transfers take place between countries and whether they constitute unequal exchange in a qualitatively different way compared to the same process within countries.

The notion that certain countries are structurally disadvantaged in international trade and the global division of labor was popularized in the postwar period by various theoretical strands focusing on international trade in the context of development gaps. Unequal exchange, or non-equivalence in international trade, was a central focus of the literature on dependency theory. Although marked by significant heterogeneity, this literature shares the common

traits of (1) taking a global historical approach, (2) theorizing the polarizing tendencies of capitalism, and (3) focusing on structures of production as well as the constraints peripheral economies face ([Kvangraven 2021](#)).

Building on the works of [Prebisch \(1950\)](#), [Singer \(1950\)](#), and [Furtado \(1956\)](#), the Latin American structuralist tradition analyzed productivity gaps between the center and the periphery, the deterioration of the terms of trade for the latter, and other mechanisms that reinforced the enrichment of the core at the expense of the periphery. Unequal exchange appeared in this framework as a result of differences in income elasticities of demand concerning the exports of the core and periphery, monopolistic structures on the supply side of manufacturing that allowed for markup pricing whereas primary products were subject to competitive pricing, and the like.

Apart from the structuralist literature, the growing interest in studying global capitalism as an asymmetric and polarizing phenomenon manifested itself on Marxist grounds, too. [Baran \(1957\)](#) formulated the thesis that the periphery directly entered the monopoly stage of capitalism, in which surplus extraction is not limited to production. Large firms based in advanced countries were capable of imposing markup prices on their exports because of monopoly power, draining economic surplus from underdeveloped countries through exchange. Repatriation of profits back to advanced countries, foreign debt service, and foreign control of strategic resources through political and military means bring about a persistent flow of economic surplus from the periphery to the core (Baran, chs. 5–7).¹²

Based on the monopoly-capital foundations laid by [Baran \(1957\)](#) and [Baran and Sweezy \(1966\)](#), a neo-Marxist dependency-theory tradition emerged, of which André Gunder Frank, Samir Amin, Ruy Mauro Marini, and Theotonio dos Santos were prominent figures ([Kvangraven 2023](#)). In this framework, global capitalism is studied through the lens of a center-periphery (or metropolis-satellite) structure, in which the hierarchical chain of such relations makes it possible for the few (monopoly) capitalists at the top to expropriate some or all

of the surplus of the many below, which is the main cause of the “development of underdevelopment” ([Frank 1971](#), 6–11). Building on the concept of surplus developed by Baran, and adopting his framework of monopoly capitalism, Frank and Wallerstein delivered detailed historical studies of the relations between the developed and underdeveloped parts of the world.

An essential weakness shared by many studies belonging to this tradition is the lack of consistent economic foundations allowing for treatment of the extraction and distribution of surplus value within an integrated theoretical framework. Emmanuel, Amin, and Marini stand out as exceptions insofar as they explicitly studied the mentioned economic aspects of global capitalism within the framework of an international law of value, while others either discarded the law of value because of its alleged irrelevance in the monopoly stage of capitalism and developed eclectic economic foundations or primarily focused on political aspects of the mechanisms that reproduce underdevelopment ([Emmanuel 1972](#), xxxiv; [Amin 2010](#), 50–53; [Marini, Latimer, and Osorio 2022](#)).

Following the publication of the work of Emmanuel, whose contribution was to broach the role of cross-country wage differentials in value transfers and unequal exchange, the term *unequal exchange* gained popularity in both theoretical and empirical investigations. [Amin \(1976](#), 138–45) applied Emmanuel's concepts of unequal exchange in the broad and strict senses to the export figures of the periphery and concluded that these countries lost about 15 percent of their combined GDP in 1966 because of unequal exchange, significantly blocking their potential to grow and therefore constituting an essential cause of unequal development. [Gibson \(1980\)](#) arrived at similar results concerning the trade between the United States and Peru in 1969, using more sophisticated empirics based on input-output tables.¹³

Since then, numerous authors used variations of Emmanuel's framework to discuss different aspects of what they perceive as unequal exchange, while empirical efforts to coherently operationalize this framework remained rather scant until recently ([Raffer 1987](#); [Higginbottom 2014](#); [Patnaik and Patnaik 2016](#);

[Smith 2016](#), 206–23; [Tsoulfidis and Tsaliki 2019](#); [Carchedi and Roberts 2021](#); [Hickel, Sullivan, and Zoomkawala 2021](#); [Ricci 2021](#); [Hickel, Hanbury Lemos, and Barbour 2024](#); [Rotta 2025](#)). Part of the reason for the sparseness of empirical studies is the prevalent ambiguity about when exchange is equal and unequal, what the conditions for the existence of unequal exchange are, and which mechanisms of value transfers exist in international trade. In the next subsection, we try to clarify these points regarding value transfers, which we distinguish from value capture: The former is an outcome of turbulent capitalist competition and manifested in the transformation of direct prices to production prices, while the latter is the result of the distribution between production and nonproduction industries, manifested in the relationship between production and market prices.

4.4.1 *Channels of Value Transfers in International Trade*

In a national context, there are two mechanisms of value transfers. First, a variety of production conditions coexist *within an industry*, while the price of each commodity in an industry represents the average conditions of production (that is, the socially necessary labor time, or the social value) in the market. Individual capitals operating with better-than-average conditions produce commodities with low individual values. Therefore, if commodities sell at prices proportional to the social value—that is, at direct prices—more productive individual capitals capture a transfer of surplus value produced by workers employed by less productive capitals. This represents the basic structure of within-industry competition, in which the *regulating capital*, operating through the most cost-effective and reproducible conditions of production, is able to cut prices in order to gain a larger market share, and new investment imitates these regulating conditions.

However, commodities on average sell at prices of production, not direct prices. Prices of production add the general profit rate to constant and variable capital costs. This is where the second mechanism of value transfers comes into the picture: Different industries contribute to the total surplus value in proportion

to the variable capital (living labor) employed and exploited but receive surplus value from the pool of aggregate surplus in proportion to the total (constant and variable) capital they advance. There is a transfer of surplus value from industries with an organic composition lower than the social average to those with an above-average organic composition. This between-industry transfer manifests itself in the deviations between direct prices and prices of production. For any individual capital in a national context, these two mechanisms of value transfer operate simultaneously, and the net transfer is the sum of the two effects ([Shaikh 1980](#), 48–49).

The regulation of market prices by production prices, as well as transfers of value within and between industries, continues to operate on the international level. When capitals that produce the same commodity in different countries compete on the international level, a uniform price of production will tend to emerge. This resembles the domestic case, in which individual capitals in a given industry might have their own individual prices of production but the industry as a whole has a singular price of production that serves as the center of gravity for the market price of the commodity. This leads to value transfers of the first type: from more productive to less productive average national production conditions. At the same time, an adjustment mechanism is triggered by transfers of value, resulting in the acceleration or deceleration of domestic investment into a certain industry. If, for example, the IT sector in the United States enjoys net value inflows and thereby a profit rate above the domestic average thanks to its international competitive advantage, investment in that sector will accelerate within the United States and the general profit rate will adjust accordingly.

We can illustrate the emergence of value transfers through this first channel with the help of a simple numerical example in the spirit of Emmanuel. Let us suppose countries A, B, and C produce 60, 50, and 40 units of the same use value in a working day of the same length (8 hours) and intensity. The socially necessary labor time to produce a unit of this commodity is 0.13 hours in A, 0.16

in B, and 0.20 in C. Globally, 150 units are produced in three working days (that is, 24 hours), implying that the international unit value of this commodity is $\frac{24}{150} = 0.16$ hours. If exchange takes place at a price proportional to international value, the labor expended in country B will qualify as universal labor, and the workday in that country will be the universal workday. The workday in A, resulting in the production of 60 units of the commodity with a unit value of 0.13, corresponds to $60 \times 0.16 = 9.6$ universal hours, and that in C corresponds to $40 \times 0.16 = 6.4$ universal hours. By implication, if the universal workday is 8 hours, an ordinary workday in A corresponds to 1.2 universal workdays, and that in C corresponds to 0.8 universal workdays. In this sense, international trade functions as a siphon transferring surplus value from less developed to advanced capitalist economies ([Mandel 1976](#), 371; [Satligan 2014](#), 119–21).¹⁴

For industries in which capitals do not compete on the world market—for example, personal services like hairdressing—no uniform international price of production emerges ([Schoeller 1976](#), 36). This does not mean, however, that these industries are exempt from the tendency for the formation of a general profit rate since the tendency is generated by the international mobility of productive capital. Therefore, the emergence of international prices of production and the second type of value transfers addressed above remain relevant for these industries.¹⁵

As noted above, the mobility of *production capital*¹⁶ across borders brings about the *tendency* of equalization of profit rates and thereby international prices of production. Just as in a national context, industries with a higher composition of capital tend to benefit from this process (and countries hosting them will observe these benefits in their national accounts) since the international price of production will be higher than the national direct price, implying a transfer of value. This is what Emmanuel called unequal exchange in the broad sense—to be distinguished from unequal exchange in the strict sense, which results from

differences in wages and the rate of exploitation.

Emmanuel overlooked, however, a crucial point with respect to the use of the category of organic composition of capital in an international context, namely the fact that the value composition no longer mirrors the changes in the technical composition. There are three major categories of composition of capital in Marx. The *technical* composition reflects the relation between the mass of the means of production and the mass of living labor to employ the former. This is a technical proportion that is unrelated to the sphere of value. The *value* composition of capital is the ratio of the value of the means of production (c) to the value of labor power (v)—that is, the value of the typical consumption basket of a wage earner. Clearly, the technical proportion of the means of production (machines and materials) and labor—that is, the technical composition of capital—is the primary determinant of the value composition, namely $\frac{c}{v}$. [Marx \(1990\)](#) called the value composition of capital “in so far as it is determined by its technical composition and mirrors the changes in the latter, the organic composition of capital” (762).

The (incomplete) tables of transformation of direct prices to prices of production in the third volume of *Capital* refer to a national context and are based on the assumption of a uniform rate of surplus value (and wage rate), ensuring a direct relationship between the technical and value compositions of capital. In an international context with potentially persistent differences in wages and rates of surplus value, this relationship between the technical and value compositions of capital is severed. The value composition of capital $\frac{c}{v}$ can fall with increasing wages, and vice versa, while the technical proportion between living labor and means of production remains the same. Transfers of value originating from differences in the organic composition of capital therefore contain what Emmanuel called unequal exchange in the broad and strict senses simultaneously.

4.4.2 A Numerical Example with Two Commodities and Two Countries

To demonstrate value transfers through international trade with nonspecific commodities, we construct a numerical example in which countries A and B produce and trade both furnaces and TVs.¹⁷ [Table 4.3](#) depicts the formation of direct prices and prices of production for each commodity in countries A and B. Since competition occurs between industries producing the same use value in this example, productivity differences are relevant. Therefore, an additional column is added in which the quantity produced in units of labor time is given.

In this first step, the wage rate is taken to be the same in both countries. It is further assumed that production capital is sufficiently mobile across countries to give rise to the tendency of the rate of profit to equalize. This brings about national prices of production for both commodities in each country. The deviation of these prices from the national social values of the commodities represents a first approximation of the transfer of value (δ) given in the last column of the table. There is, however, more to this story, which escaped Emmanuel's attention because of his assumption of complete specialization.

Capital from different countries producing the same use value do not sell their commodities at national prices of production on average, but international (or social) prices of production, necessitating a further iteration of the price-formation process. To reach international prices of production, we compute the arithmetic mean of national prices of production, where the weight of each national capital is given by its share of total global supply. The national prices of production of furnaces in countries A and B are 113.63 and 91.36, respectively. The total price is therefore 205. A total of three furnaces are produced in this period of production, meaning that the international price of production of a furnace will be $\frac{205}{3} = 68.33$. The same process repeated for TVs yields an international price of production of $\frac{185}{3} = 61.66$.

[Table 4.4](#) is a realization table with the international prices of production calculated above.

As can be seen, differences in productivity resulting from the employment of

different amounts of constant capital¹⁸ generate additional transfers of value in favor of more productive capitals. We call this type of value transfer *secondary* only for analytical purposes to make the contrast between [Tables 4.3](#) and [4.4](#) clear—it does not imply any sequentiality or hierarchy of significance. Note that the average rate of profit before value transfers is 16.7 percent in A and 20 percent in B, while after both types of value transfers are taken into account it is 28.6 percent in A and 5.7 percent in B.

As a last step, we can introduce varying national rates of surplus value by altering wage rates in country B, which suffers from negative value transfers. In our numerical example, the average rate of surplus value has so far been 87.5 percent in both countries. Changes in the wage rate as represented in [Table 4.5](#) boost the rate of surplus value in country B to 126.7 percent, as a result of which the initial rate of profit in this country increases to 27.1 percent and the average international rate of profit goes up to 21.4 percent. Since the ratio of exploitation rates in the two industries in country B is altered compared to that in [Table 4.3](#), the symmetry between industries in terms of transfers of value is upset, as can be seen in the last column. However, this has no implications for our purposes.

To complete the picture, we need to account for value transfers resulting from productivity differences by calculating the international prices of production as the weighted arithmetic means of national prices of production. For furnaces, this will be $\frac{121.43+87.86}{3} = 69.76$, and for TVs it will be $\frac{108.57+72.14}{3} = 60.24$. Based on this information, [Table 4.6](#) presents aggregate transfers of value.

There are some interesting conclusions to be drawn from a comparison between [Tables 4.4](#) and [4.6](#). First, the mass of total value transferred from country B to A does not change as a result of falling wages (and an increasing rate of surplus value) in B. However, this does not imply that the impact of wage differentials is negligible. Individual capitals in both industries of country B experience a significant increase in their rate of profit. That rate increases from

6.67 to 12.38 percent in the furnace industry and from 4.45 to 13.5 percent in the TV industry. Consequently, the national average rate of profit in country B increases from 5.72 to 12.9 percent as a result of the higher rate of exploitation, partly compensating for the overall drain of surplus value from B to A. Capitalists in country B can therefore potentially overcome the disadvantages resulting from productivity differences and the emergence of international prices of production by sufficiently boosting the rate of exploitation, and they even gain the competitive upper hand in certain industries in the global market.

4.4.3 Further Thoughts on Unequal Exchange

The conclusion of the previous subsection does not imply that cross-country wage differences are inconsequential for value transfers and uneven development. It rather suggests that the immobility of labor relative to capital and persistent cross-country differences in the rate of surplus value need to be considered along with other relevant factors (for example, the development of productive forces or differences in labor intensity and productivity). Emmanuel's analysis tends to attribute almost sole importance to wage differences in isolation from other factors, including the state of development of productive forces and various other manifestations of imperialism.

One criticism to be considered is the notion of wages being the independent variable of the system. Although [Emmanuel \(1972, 335–36\)](#) loosened this assumption by stating that “independent” does not mean “extraneous” or “undetermined,” in fact his entire analysis is built on the premise that causality runs from factor rewards to prices. In this framework, prices of production do not represent a transformed form of direct prices, stemming from the uneven development of productive forces across sectors and the increased socialization of production, but result from the adding up of the prices of so-called factors of production. In this sense, Emmanuel's approach is pre-Ricardian, reminiscent of Smith.

Emmanuel's claim that wages are determined institutionally captures only one

side of the story. Wages are the outcome of the interaction of subjective and objective factors. The former corresponds to the state of class struggle, the power of trade unions, laws and regulations resulting from the organized activity of workers and capitalists, and so forth. For Emmanuel, the story ends here. However, there are also the objective factors, namely the state of the development of productive forces representing the ground for the subjective factors. The value of labor power is determined by the productivity of labor in all industries that directly or indirectly go into the average consumption basket of workers. From this perspective, employment and wages are conditioned by profitability and accumulation, and not the other way around. This is not to disregard the role of class struggle but to understand the limits of its potential impact on wages within the context of the capitalist mode of production. Only the dialectics of the two sides give a full picture, saving one from the formalism and reductionism that come along with the search for an independent variable ([Amin 1973](#), 30–34).

Another example of the relationship between wages and the objective factors, which at the same time represents an additional channel of value transfers not discussed so far, is the presence of noncapitalist sectors contributing to the subsistence of workers. In this case, wages can be pushed below the value of labor power, boosting the rate of surplus value in underdeveloped countries as well as the average international rate of profit and thereby increasing the flow of surplus value toward advanced countries.

[Marini \(2022, 121–32\)](#) studied the remuneration of labor power below its value, which he called super-exploitation, with great attention. Confronted with various mechanisms draining value produced in underdeveloped countries, capitalists in these countries employ compensatory mechanisms that boil down to increasing the mass of value produced domestically. This implies resorting to a greater exploitation of labor, which can be achieved by increasing labor intensity (the intensive dimension), prolonging the working day (the extensive dimension), reducing the worker's consumption below its normal limit, or a

combination of the three. All three options help boost the rate of exploitation by making it increasingly more difficult for the worker to replenish their labor power.¹⁹

Crucially, the mechanisms mentioned above motivate and reinforce accumulation through deepened exploitation of the worker rather than through increased labor productivity, and they thereby reproduce the conditions of value drain from underdeveloped to advanced countries. The existence of a vast relative surplus population in the periphery is key to suppressing workers' wages relative to their counterparts in advanced countries, and this is upheld by the suppression of the international mobility of labor notwithstanding the cheery rhetoric of globalization. While capitalists in underdeveloped countries benefit through higher rates of surplus value, capitalists in advanced countries profit in three separate ways: through outsourcing production to low-wage countries, through pocketing part of the surplus value produced in low-wage countries in the form of value transfers, and through a carefully administered, controlled immigration of low-wage workers to advanced countries ([Smith 2016](#), 167–71, 188–89).

The concept of super-exploitation has its roots in Marx's analysis. When discussing how capitalists strive to boost the rate of exploitation, he mentioned a third method in addition to prolonging the working day (absolute surplus value) and altering the division between the necessary and surplus portions of a given working day (relative surplus value). Workers' wages can be pushed below the value of labor power. Given the level of abstraction in the first volume of *Capital*,²⁰ however, [Marx \(1990\)](#) did not include this possibility in further analysis “despite the important part which this method plays in practice” (431). Similarly, when discussing the formation of an average rate of profit in volume 3, he noted that “the distinctions between rates of surplus-value in different countries and hence between the different national levels of exploitation of labour are completely outside the scope of our present investigation” ([Marx 1991](#), 242).

An important methodological caveat to Emmanuel's analysis pertains to the unit of analysis: Marx's approach centers on competition between capitals, within and beyond borders, in contrast to Emmanuel, who saw his subject as the exploitation of one nation by another. Emmanuel arrived ([1972](#)) at the critical claim that "exploitation is not a fact of production but of appropriation" (329). This view gained a foothold also in a segment of recent Marxist literature, in which exploitation is grasped as the unequal exchange of labor. According to this expanded definition, industries are exploited by industries, and countries are exploited by countries in addition to workers being exploited by capitalists ([Cogliano, Veneziani, and Yoshihara 2022, 2024; Rotta 2025](#)).

For Marx, the term *exploitation* has a well-defined, specific meaning rooted in the sphere of production, capturing an essential aspect of class relations. It pertains to all capitalistically employed labor, including nonproduction labor—that is, labor employed in nonproduction industries—and it is manifested in the relation of necessary labor time to surplus labor time ([Shaikh and Tonak 1996](#), 29–31). Therefore, it crucially expresses a class relation necessarily rooted in the process of production, which cannot be substituted by relations between different industries or nations. It would be correct to say that the capitalists of advanced countries gain from the opportunity to exploit not only domestic workers, but those who live in other countries. They are able to claim above-normal profits from the social surplus because of competition on the international level. However, a transfer of surplus value from the pockets of the capitalists in one country into the pockets of the capitalists in another country cannot be designated as the exploitation of the former country by the latter. Similarly, industries cannot be said to exploit each other just because there is a transfer of value from one to another industry.²¹

What do value transfers resulting from persistent cross-country differences in wages and rates of surplus value, including the role played by super-exploitation, imply for imperialism? Reminiscent of Emmanuel's position, albeit with a particular emphasis on super-exploitation, [Higginbottom \(2012\)](#) and [Smith](#)

(2016) argued that it is the only starting point from which a value theory of imperialism can be developed. We turn to the relative importance of different wages, rates of surplus value, and super-exploitation to evaluate the overall role of value transfers in imperialism.

4.5 Imperialism and Transfers of Value

The debate around imperialism within and outside Marxism encompasses a vast literature, which we do not present here.²² Our focus is exclusively on Marxist theories of imperialism, and the following fault lines are helpful to identify commonalities and differences between different Marxist approaches:

- . Does imperialism manifest itself primarily as a rivalry between dominant countries or as a contradiction between dominant and dominated countries?
- . What are the relative weights of economic forms of domination and extra-economic forms?
- . What is the appropriate background to discuss imperialism against: A chronic lack of demand (underconsumption)? The tendency of the rate of profit to fall? Increasing monopolization?
- . Is imperialism inherent to the capitalist mode of production? Does it point to a “new capitalism,” or is it just a stage of capitalism? What political implications (labor aristocracy, workers’ internationalism, protectionism, struggles for national sovereignty, necessary collapse of capitalism, and so forth) follow from it?

The answers to most of these questions go beyond the “either-or” dichotomy. Imperialism is a system of both economic and political power (keeping in mind that clearly demarcating the two is impossible), with rivalries, tensions, and conflicts both within the imperialist blocs and between imperialist and dominated countries. Since its beginnings, the capitalist mode of production has been international, both exploiting ready-found patterns of trade and

colonization and further promoting the internationalization of capital in its various functional forms. The international expansion of capital accumulation rapidly became a defining feature of the capitalist mode of production. In this context, while imperialism presents itself in the form of a relation between countries, reducing the analysis to the between-country level conceals the underlying class relations, which are equally important.

Throughout the twentieth century, the focus of Marxist theories of imperialism continuously shifted, which can best be understood in the context of developments regarding the internationalization of capital and its political and economic repercussions. We, as a starting point, broadly define imperialism as a set of asymmetric power relations between countries, always in motion because of changes in the internationalization of capital, which cannot be reduced to a merely political or merely economic substance. We distinguish between three waves of Marxist theories of imperialism and briefly discuss them against the background of the internationalization of capital in its different functional forms, namely as commodity capital, money capital, and production capital, which are usually lumped together under the term *capital flows* ([Öztürk 2006](#), 273–75).

4.5.1 First Wave of Marxist Theories of Imperialism

The first wave of Marxist theories of imperialism was formulated during the first two decades of the twentieth century.²³ Hilferding, in his pioneering *Finance Capital* (1905), focused on the internal dynamics of accumulation in advanced capitalist countries and highlighted the accelerated concentration and centralization of capital, ultimately leading to the fusion of industrial and financial capital ([Hilferding, Bottomore, and Watnick 1985](#)). Bukharin and Lenin partly built on Hilferding but also partly criticized the latter's framework. [Bukharin \(1917\)](#), writing in 1915, systematized Hilferding's ideas on the centralization and concentration of capital and extended the discussion by adding a second dimension: the contradiction between the nationalization and internationalization of capital. The formation of monopolies and cartels leads to

an increased national intertwining of capital factions within countries and increased competition between national capital blocs, which ultimately clash in the international arena ([Bukharin 1917](#), 80).

Lenin's *Imperialism* is a survey of factual evidence from advanced capitalist countries, supporting most of the analysis put forward by Hilferding and Bukharin to derive political conclusions.²⁴ Although he came close to an underconsumptionist interpretation at times, emphasizing that capitalism had become "overripe" in advanced countries ([Lenin 1970](#), 716), he clearly framed the tendency to a fall of profitability as the dominant force behind capital exports and imperialism. Capital accumulation is an inherently uneven process that creates new inequalities and forces capitals to struggle for spheres of influence and colonies in proportion to their political and economic power (725–26).

Imperialism is, therefore, a stage of capitalism in which competition between capitals becomes dominant in the international arena. This is a crucial distinction of Lenin's perception of monopolies from the subsequent school of monopoly capitalism. For [Lenin \(1970\)](#), monopolies "do not eliminate the latter [competition], but exist above it and alongside it, and thereby give rise to a number of very acute, intense antagonisms, frictions, and conflicts" (736). This is a consequential point since it posits the law of value as the basis of imperialism rather than being negated by the emergence of monopolies.

Rosa Luxemburg diverged from the approach outlined above. She thought there was a logical flaw pertaining to the realization of surplus value in the expanded reproduction schemes Marx presented in the second volume of *Capital*, and she argued that capitalism can only exist in conjunction with its "outside," namely noncapitalist systems.²⁵ Faced with a chronic problem of domestic underconsumption, the capitalist world would permanently seek to absorb noncapitalist economies, introduce commodity relations into them, gain possession of cheap raw materials, and exploit other circumstances in these countries that are absent at home. On the one hand, this process requires the mobilization of force and state power, bringing about imperialist aggression.²⁶

On the other hand, it paves the way for the eventual collapse of capitalism as the noncapitalist territories to be absorbed vanish.

While the emphasis of the first wave of theories of imperialism is mostly on either capital exports or realization problems, Henryk Grossman's contribution is particularly relevant for the purposes of this book. Discussing the tendency of capitalism to break down addressed by Bukharin, Lenin, and Luxemburg, [Grossman \(2021, 368–77\)](#) drew attention to the transfer of surplus value from less developed to more developed countries through unequal exchange as a factor moderating and weakening the periphery. This approach, discussed above in [section 4.4.1](#) and formalized in [section 4.6.1](#), is the only attempt within the first wave of imperialism theories (along with Bauer's discussion of the same topic) to outline an economic mechanism of imperialism explicitly based on the law of value.

The theories of imperialism formulated in the early twentieth century focused on the rivalry between advanced capitalist countries, manifested in conflicts over territory, raw materials, spheres of influence, and capital exports, eventually leading to wars *between empires* ([Brewer 2002, 88–89](#)). National conflicts were understood within the context of class relations and systemic economic tendencies of capitalism.²⁷ A substantial shift of emphasis took place with the second wave of imperialism theories formulated in the aftermath of WWII.

4.5.2 Second Wave of Marxist Theories of Imperialism

Interest in the theory of imperialism revived in the postwar period. The context was significantly different from the early 1900s: Classical colonialism was pushed back through decolonization, while great effort was made to integrate the new, formally independent countries into the international capitalist bloc. Thanks to the new international institutional architecture, the internationalization of capital in all three forms—credit, trade, and direct investment—gained pace. Paradoxically, countries that gained formal independence found themselves in a state of deepening economic (and therefore political) dependence, which made

[Kwame Nkrumah \(1976\)](#),²⁸ the Marxist theorist and president of Ghana after its decolonization from Britain, coin the term “neo-colonialism” to refer to the last stage of imperialism.

Advanced capitalist economies in the 1960s and 1970s mostly adopted Keynesian policies to moderate business cycles and embraced a set of welfare-state practices, while many underdeveloped countries tended toward import substitution and other strategies to promote domestic accumulation. For [Walter Rodney \(2018\)](#), underdevelopment was not a state of the mode of production in the neocolonies, but a historical process of subjugation under imperialist powers. The specific questions and contradictions arising from this framework gave rise to the concept of (and literature on) development, which represents the broader context of the second wave of Marxist theories of imperialism ([Öztürk 2006](#), 282–85).

The thinkers gravitating around the *Monthly Review* journal, building on the framework briefly introduced in [section 4.4](#), developed a rich body of work highlighting various aspects of imperialism ([Baran and Sweezy 1966](#); [Foster and McChesney 2012](#); [Foster 2014](#)). They argued that the chronic lack of demand due to the restricted purchasing power of workers is a key contradiction of what they call monopoly capitalism. Since monopolies invest less domestically, military expenditures (among other wasteful expenditures) turn out to be an effective way of absorbing the surplus without necessarily contradicting the interests of powerful factions of the ruling class ([Baran 1957](#), 119). This framework allows for a rich characterization of various aspects of imperialism, such as the control of key resources, the race for the expansion of political and military spheres of influence, the maintenance of a global reserve army of labor and exploitation of cheap labor power, and even unequal exchange. For the *Monthly Review* school, monopoly is the negation of competition in the classical sense, implying that the law of value is no longer a significant regulating mechanism at this stage of capitalist development.

While the *Monthly Review* tradition primarily focused on advanced capitalist

economies, another tradition that gained influence in the same period, namely dependency and underdevelopment, and partly builds on the conceptual framework of monopoly capitalism, chooses to study so-called third world countries in more detail. The main focus in this tradition is on the mechanisms that bring about and reproduce the conditions of underdevelopment and dependency. For our purposes, Emmanuel's and especially Amin's contributions to this area are prominent. The significance of Emmanuel is that he did not grasp the mainspring of imperialism as monopoly or imperfect competition, but rather as the regular functioning of international trade in a capitalist setting. Despite all its defects and shortcomings discussed above, his approach allows for the development of a theory of imperialism based on the law of value.

This task was taken up by Amin, whose work is located in the intersection of the dependency and *Monthly Review* traditions, also feeding from classical Marxism. He critically appropriated Emmanuel's study of international prices of production and combined the analysis of unequal exchange with unequal specialization, thereby investigating exchange and production within an integrated framework. The ultimate source of underdevelopment of the periphery is the superior competitive strength of the imperialist core. In his attempt to develop the law of worldwide value, he emphasized that the class contradictions must be looked at on the world scale since class struggle no longer takes place between the workers and capitalists of each country in isolation but between the global working class and global capitalist class. Labor power has a single global value,²⁹ determined by the level of development of productive forces globally, yet it is remunerated at different rates, giving rise to different rates of exploitation and resulting in unequal exchange. [Amin \(2010, 83–94\)](#) carefully outlined the layered and fragmented character of the two main global classes, differentiating them with respect to their position in the global division of labor and relative positions of power.

From a broader perspective, although the literature on dependency and underdevelopment initially arose as a critical reaction to the mainstream

paradigm of development, it barely managed to escape the dichotomy of development and underdevelopment. The shift in the conceptual framework compared to classical Marxism (and the first wave of theories of imperialism) is remarkable: In place of the mode of production, which comprises both the relations of production and productive forces, we find a one-sided focus on the development of productive forces, especially from a quantitative perspective. Class contradictions take a back seat to conflicts between the center and the periphery, where the unit of analysis is the nation-state. Notwithstanding these shortcomings, the second-wave theories of imperialism made significant contributions to a deeper understanding of states and the study of global capitalism from the perspective of underdeveloped countries.

4.5.3 Third Wave of Marxist Theories of Imperialism

The period since the late 1970s witnessed important modifications in the balance of power between labor and capital in individual countries as well as globally, while the internationalization of capital underwent certain qualitative changes. The secular decline in profitability in the decades following WWII in advanced capitalist countries brought about a series of crises and dead ends, eventually resulting in a powerful backlash starting in the late 1970s ([Shaikh 2016](#), 729–40; [Roberts 2018](#); [Smith and Butovsky 2018](#)). The power of organized labor was rapidly undermined in one country after the other, while many countries were incorporated into global markets for commodities and money through a combination of political pressures, so-called structural adjustment reforms, and military coups. With China's shift toward market orientation and dissolution of the Soviet Union, capital found itself in conditions adequate for its true universalization. This period is therefore marked by an explosion in the flows of capital, especially in its money form, but not confined to the latter. An unprecedented growth of the reserve army of labor took place at a global scale through liberalization and integration of markets and through the increasing mobility of productive capital ([Öztürk 2006](#), 291–93).

The third wave of theories of imperialism was formulated against the background of “globalization” narratives. [Prabhat Patnaik \(1990\)](#) prominently criticized the silence of Marxists in the West on imperialism during a period when capital, as a social relation, became truly global. In his subsequent work with Utsa Patnaik, they frame imperialism as “a coercive relationship exercised by the capitalist sector on the ‘outside’ world to ensure, first, that it obtains the products that it needs from this ‘outside’ world and second, that it does so at nonincreasing prices” ([Patnaik and Patnaik 2016](#), 86). Commodities produced on what they call the tropical landmass are inevitable for continued accumulation in the imperial core (and stagnating wages there), and a set of economic and extra-economic factors ensure that their supply prices do not increase (33–39).

Harvey condemned this approach as crude environmental determinism and replaces it by one centered on the quest of capital for spatial fixes to its fundamental problem of overaccumulation. Following the restructuring of the world economy after the 1970s, increased flows of capital led to the deindustrialization of many metropolitan countries and the simultaneous industrialization of certain sites in the underdeveloped world. Combined with his claim that the net drain of wealth from the East to the West has largely reversed in recent decades, [Harvey's \(2017, 171; 2018\)](#) argument is in favor of abandoning the concept of imperialism and replacing it by a more fluid notion of shifting hegemonies within global capitalism.

The conclusion Harvey reached is surprising, given how his earlier work provided a rich framework to understand certain aspects of imperialism as arising “out of a dialectical relation between territorial and capitalistic logics of power” ([Harvey 2005](#), 183), which are tightly interwoven but not reducible to one another. Following Luxemburg, Harvey conceptualized accumulation as a dual process of expanded reproduction (exploitation) and accumulation by dispossession (176). Albeit drawing attention to an important point, Harvey reproduced the false understanding that accumulation based on predation, fraud, and violence plays no role in the Marxist conception of capitalism (144). Marx

illustrated the interdependency of profit from production and alienation in *Capital*, with examples of the never-ending endeavor of capitalists to infringe, violate, disregard, or modify laws, regulations, and ownership structures, implying that he never saw these processes as external to capital.

According to [Smith \(2016\)](#), 199–202), Harvey's attempt to extend the debate on imperialism by adding a spatial dimension crucially fails precisely because he ignores the spatial implications of immigration controls and the consequent global wage arbitrage. Putting together the fragmented hints spread out to the three volumes of *Capital*, he identified super-exploitation as a third source of surplus value, which plays a crucial role as a factor counteracting the tendency for a fall of the rate of profit. The global labor arbitrage, resulting from the suppression of the mobility of labor power in a world in which capital and commodities can relatively freely circulate, represents the simultaneously economic *and* political nature of capital. As a crucial mechanism of value transfers, it is an essential component of imperialism in the twenty-first century ([Smith 2016](#)).

[Carchedi and Roberts \(2021\)](#) took up the question of value transfers as the fundamental economic mechanism of modern imperialism from an empirical perspective. Like [Smith \(2016\)](#), they studied imperialism against the backdrop of the tendency for a long-term fall in profitability. Economic imperialism is understood in their framework as the appropriation of surplus value by high-technology companies from low-technology companies. By implication, imperialist countries are those with a persistently higher number of high-technology companies, which translates into persistently higher national average organic compositions of capital ([Carchedi and Roberts 2021](#), 32–35). They identified four channels of value transfers from neocolonial to imperialist countries—currency seigniorage, income flows from capital investments, unequal exchange through trade, and changes in exchange rates—and presented one of the few empirical frameworks to capture the flow of surplus value to imperialist countries through trade.³⁰

All in all, just like previous attempts to theorize imperialism, the third wave of Marxist theories of imperialism varies the relative importance attached to political (or extra-economic) and economic processes defining imperialism, whether or not the law of value (and value theory in general) is approached as a relevant factor. Maintaining the position that imperialism cannot be reduced to merely political or economic processes, or rather that the two can only be grasped as intertwined aspects of the capitalist totality, we turn our attention to empirically studying value transfers and value capture as key economic aspects of imperialism and a structural component of global capitalism.

4.6 Modeling Transfers of Value

4.6.1 *The Theoretical Model*

Regardless of their source, transfers of value are structurally manifested in differences between direct prices and prices of production. Recent empirical analyses of the subject focus on the difference between direct prices (or embodied labor) and market prices ([Hickel, Hanbury Lemos, and Barbour 2024](#); [Rotta 2025](#)) or a combination of deviations between a currency's dollar and purchasing-power-parity exchange rates and the gap between the monetary value and real value of a country's exports and imports ([Ricci 2021](#), ch. 6). Notwithstanding that exchange takes place at market prices, leaving production prices out of the picture omits the structural dynamics that characterize the redistribution of aggregate surplus value between capitals, which expresses capitalist competition. Market prices can considerably fluctuate with day-to-day changes in demand, as well as political and economic factors. The realization at market prices therefore does not necessarily reflect the underlying structural determinants of the redistribution of surplus value, namely differences in capital composition and rate of surplus value. In this book, we study value transfers as differences between direct and production prices, value captures as flows from production to nonproduction industries, and rents as increases of the industrial

profit rate or differences between production and market prices. The distinction among locations of redistribution allows us not only to analyze each category individually, but also to locate it as a structural feature of capitalist production, subject of political power, or (as in most cases in political economics) both.

The analysis conducted in the preceding sections can be generalized with the help of a simple analytical model.³¹ Direct prices (dp) are the sum of constant capital consumed (c), variable capital (v), and surplus value (s). For any country j , the difference between the vector of international prices of production (pp^*) and national average direct prices yields the transfers of value in industries subject to international trade:

$$\delta = pp^* - dp \quad (4.1)$$

Here, δ , pp^* , and dp are $(n \times 1)$ vectors with n industries. In any industry i in country j , the international price of production is linked to the tendency to formation of a general rate of profit across industries and economies:

$$pp_{i,j}^* = (1 + r^*) (c_{i,j} + v_{i,j}) \quad (4.2)$$

The general rate of profit (r^*) is calculated as the ratio of total surplus value (S) to the sum of total constant (C) and variable capital (V) invested:³²

$$r^* = \frac{S}{C + V} = \frac{S/V}{\frac{C}{V} + 1} = \frac{E}{1 + \sigma} \quad (4.3)$$

E stands for the average international rate of surplus value, and σ represents

the average international value composition of capital.³³

Combining equations 4.1 and 4.2, the transfer of value concerning industry i in country j can be formulated as:

$$\begin{aligned}\delta_{i,j} = & \left(1 + r^*\right) (c_{i,j} + v_{i,j}) - (c_{i,j} + v_{i,j} + s_{i,j}) = r (c_{i,j} + v_{i,j} \\ & - s_{i,j})\end{aligned}\tag{4.4}$$

Consider the following definitions along with equation 4.3:

$$s_{i,j} \equiv e_{i,j} v_{i,j}\tag{4.5}$$

$$c_{i,j} \equiv \sigma_{i,j} v_{i,j}\tag{4.6}$$

Plugging the definitions given in equations 4.3–4.6 into 4.4 yields:

$$\begin{aligned}\delta_{i,j} = & \frac{E}{1 + \sigma} (\sigma_{i,j} v_{i,j} + v_{i,j}) - e_{i,j} v_{i,j} = v_{i,j} \left(\frac{E}{1 + \sigma} \right) (\sigma_{i,j} + \\ & - e_{i,j}) = v_{i,j} \left(E \frac{1 + \sigma_{i,j}}{1 + \sigma} - e_{i,j} \right)\end{aligned}\tag{4.7}$$

If the domestic rate of exploitation $e_{i,j}$ is equal to the world average E , value transfers are generated by the difference between the average value composition of capital in industry i in country j —that is, $\sigma_{i,j}$ —and the average international value composition σ . Therefore, what Emmanuel called unequal exchange in the broad sense is expressed as:

$$\delta_{i,j} = v_{i,j} E \left(\frac{1 + \sigma_{i,j}}{1 + \sigma} - 1 \right) \quad (4.8)$$

Emmanuel's unequal exchange in the strict sense exists in its pure form when the national average value composition of capital in industry i in country j —that is, $\sigma_{i,j}$ —equals the international average σ . It is proportional to the product of the national aggregate wage sum and the difference between the national rate of exploitation and the global one. Capitals in countries with a lower-than-average rate of exploitation will experience positive transfers of value.

$$\delta_{i,j} = v_{i,j} (E - e_{i,j}) \quad (4.9)$$

Note, however, that any change in the average national wage rate in industry i and country j , and thereby in the rate of surplus value, will alter the value composition of capital, too. Therefore, even if, as a special case, equality between the value compositions in the national industry and world as a whole is assumed to hold initially, this equality will be severed unless wages maintain the initial cross-country proportion. By implication, unequal exchange in the broad sense always permeates unequal exchange in the strict sense, rendering the existence of the latter in its pure form almost impossible ([Satlighan 2014](#), 175–76).

Equation 4.9 gives the transfers of value due to differential rates of exploitation, under the assumption of equal value compositions of capital across countries and industries. The difference between value transfers in the strict and broad senses can be attributed to differences in national average capital compositions. As defined at the beginning of this subsection following [Tsoulfidis and Tsaliki \(2019\)](#), transfers of value pertaining to an industry are

equivalent to the difference between international production prices and national direct prices, equivalent to $\delta_{i,j} = pp_i^* - dp_{i,j}$.³⁴ Remember that when capitals producing the same use value in different countries compete, a singular international production price for that industry will emerge, as demonstrated by the numerical examples in the previous subsection, in which $pp_{i,j}^* = pp_i^*$ holds. This brings about the productivity channel of value transfers neglected by Emmanuel.

4.6.2 The Empirical Model

On the national level, value transfers between industries resulting from differential capital compositions are expressed in the difference between relative production prices and direct prices. Our task is to extend this logic to international trade, calculate international prices of production, and capture transfers of value between countries, which are manifested in the difference between relative international production prices and direct prices.

To calculate direct prices, we account for labor skill differences across industries and countries to estimate socially necessary labor time in each industry. Drawing on [Shaikh and Glenn's \(2018\)](#) argument that occupational wage differences represent a proxy for differential costs of reskilling, we correct the direct labor vector \mathbf{l} by normalizing it by the global wage average $\bar{w} = \frac{W}{L}$, where W is the global sum of employee compensation in all countries in a year and L stands for aggregate employment in hours. The skill-adjusted direct labor coefficient for the j th sector gl_j is therefore:

$$gl_j = \frac{1}{\bar{w}} \times \frac{W_j}{X_j} = \frac{w_j}{\bar{w}} \times \frac{L_j}{X_j} \tag{4.10}$$

W_j and X_j are the global wage bill and global gross output of the j th sector,

respectively. The term $\frac{w_j}{\bar{w}}$ expresses the wage rate in the j th sector relative to the average global wage rate and therefore serves as an approximate index of relative skill. Crucially, this is an imperfect approximation of skill differentials, and the relationship between skills and cross-industry wage differences cannot be interpreted as a causal one in the strict sense, especially in an international context.

In the next step, we obtain the $n \times 1$ total (direct and indirect) labor vector \mathbf{v} through the Leontief inverse of circulating and fixed capital in all sectors. Circulating capital is denoted by \mathbf{A} , which is an $n \times n$ matrix with a_{ij} recording the output of industry i used in the production of one euro's worth of commodity j . Similarly, \mathbf{D} is an $n \times n$ matrix of depreciation, obtained by normalizing the fixed capital-flow matrix³⁵ \mathbf{K} by the gross-output vector \mathbf{X} . Consequently, the matrix $(\mathbf{A} + \mathbf{D})$ stands for the circulating and fixed capital requirement for one euro's worth of output of each commodity, and the vertical integration of the globally skill-adjusted labor vector \mathbf{gl} with this matrix yields the total labor vector \mathbf{v} , which is expressed in labor hours (or full-time employment, depending on the data source):

$$\begin{aligned}\mathbf{v} &= \mathbf{gl} + \mathbf{v}(\mathbf{A} + \mathbf{D}) \\ \mathbf{v}(\mathbf{I} - \mathbf{A} - \mathbf{D}) &= \mathbf{gl} \\ \mathbf{v} &= \mathbf{gl}(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1}\end{aligned}\tag{4.11}$$

When calculating production prices, we follow [Sraffa \(1972\)](#), 22) in expressing the real wage rate w and profit rate r' as shares in the maximum profit rate. We define the profit rate as $r' = \frac{r}{R}$, which implies $(1 + r)w = 1 - \frac{r}{R}$, where the maximum rate of profit R is established when the wage share $w = 0$. Finally, using the Leontief inverse, we define the total (direct and indirect) capital coefficients matrix as $\mathbf{H} = (\mathbf{A} + \mathbf{D})(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1}$ and the total

(direct and indirect) labor vector as $\mathbf{v} = \mathbf{gl}(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1}$, where each element of \mathbf{H} and \mathbf{v} expresses the vertically integrated capital and labor requirements per euro's worth of output, respectively. The vector of prices of production \mathbf{pp} can be constructed in the following way:

$$\begin{aligned}
\mathbf{pp} &= (1 + r)(wgl + pp(A + D)) \\
\mathbf{pp} &= (1 + r)wgl + pp(A + D) + rpp(A + D) \\
\mathbf{pp}(\mathbf{I} - \mathbf{A} - \mathbf{D}) &= (1 + r)wgl + rpp(A + D) \\
\mathbf{pp} &= (1 + r)wgl(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1} + rpp(A + D)(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1} \\
\mathbf{pp}\left(\mathbf{I} - r(A + D)(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1}\right) &= (1 + r)wgl(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1} \\
\mathbf{pp} &= (1 + r)wgl(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1}\left(\mathbf{I} - r(A + D)(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1}\right) \\
\mathbf{pp} &= \left(1 - \frac{r}{R}\right)\mathbf{v}\left(\mathbf{I} - R\frac{r}{R}\mathbf{H}\right)^{-1}
\end{aligned} \tag{4.12}$$

Both the total labor vector \mathbf{v} and the production-price vector \mathbf{pp} are measured in labor hours per euro's worth of output. We adjust both vectors to make sure they are expressed in money prices. To calculate $\mathbf{dp}'_{j,c,t}$, the direct price of industry j 's output in year t and country c , we use the average global value–price ratio (the cross-country and cross-industry average total labor requirement corresponding to one euro's worth of output). We divide the total labor requirement per euro's worth of output $\mathbf{v}_{j,c,t}$ by the average global value–price ratio, which corresponds to multiplying it by the industrial output measured in euros $\mathbf{X}_{j,c,t}$, and then dividing it by the global sum of the product of labor requirements and industrial gross output.

$$\mathbf{dp}'_{j,c,t} = v_{j,c,t} \times \frac{\mathbf{X}_{j,c,t}}{\sum_{j \in J, c=c, t=t} v_{j,c,t} X_{j,c,t}}$$

(4.13)

We apply the same normalization process to prices of production:

$$pp'_{j,c,t} = pp_{j,c,t} \times \frac{X_{j,c,t}}{\sum_{j \in J, c=c, t=t} pp_{j,c,t} X_{j,c,t}}$$

(4.14)

After we obtain the vectors of direct prices \mathbf{dp} and domestic prices of production \mathbf{pp} , we turn to the calculation of international production prices and transfers of value.

The novelty of our contribution lies in separating international value transfers due to differences in capital compositions and transfers due to differences in rates of surplus value. The profit rate enters the calculation of production prices (equation 4.12) twice: once as a transformation of the profit-rate-enhanced wage rate $(1 + r) w$, which can be expressed as $(1 - r/R)$, and once to evaluate the vertically integrated capital matrix \mathbf{H} . Assuming that the domestic general rate of profit in country c is r_c and the global average rate of profit, which emerges as a tendency, is r , the equalization differential $r_c - r$ will be positive for countries with above-average profit rates due to below-average capital compositions or above-average rates of surplus value.

We develop four scenarios with respect to the emergence of international prices of production. These are cases in which (1) profit rates and wage rates tend to equalize at the domestic level in each country; (2) profit rates tend to equalize internationally but wages equalize domestically; (3) profit rates equalize at the domestic level but wages equalize at the international level; and (4) both rates equalize at the international level. The schematic illustration in [Table 4.7](#) summarizes the relationship between profit- and wage-rate equalization, as well as the four sets of production prices.

Table 4.7 Schematic illustration of the relationship between profit and wage

rate equalization, and the corresponding sets of production prices [◀](#)

	<i>No wage rate equalization</i>	<i>Wage rates equalized nationally</i>	<i>Wage rates equalized internationally</i>
No profit rate equalization	dp		
Profit rates equalized nationally		$pp1$	$pp3$
Profit rates equalized internationally		$pp2$	$pp4$

In equation 4.15, **$pp1$** , **$pp2$** , **$pp3$** , and **$pp4$** denote the vectors of prices of production according to scenarios (1), (2), (3), and (4), respectively, and **dp** is the vector of direct prices. Note that for the empirical analysis, we apply the normalization given in equations 4.13 and 4.14 to the direct-price and production-price vectors, and we denote the normalized vectors **dp'** , **$pp1'$** , **$pp2'$** , **$pp3'$** , and **$pp4'$** .

$$\begin{aligned}
 pp1 &= \left(1 + \frac{r_c}{R}\right) gl(I - A - D)^{-1} \left(I - \frac{r_c}{R} RH\right)^{-1} \\
 pp2 &= \left(1 + \frac{r_c}{R}\right) gl(I - A - D)^{-1} \left(I - \frac{r}{R} RH\right)^{-1} \\
 pp3 &= \left(1 + \frac{r}{R}\right) gl(I - A - D)^{-1} \left(I - \frac{r_c}{R} RH\right)^{-1} \\
 pp4 &= \left(1 + \frac{r}{R}\right) gl(I - A - D)^{-1} \left(I - \frac{r}{R} RH\right)^{-1} \\
 dp &= gl(I - A - D)^{-1}
 \end{aligned} \tag{4.15}$$

The production-price vectors in equation 4.15, in which unequal wage rates are expressed as differential profit rates applied to the labor vector, depend on a strong assumption: Following the formulation of the wage rate in terms of

relative profit shares as in the first line of equation 4.16 ([Tsoulfidis and Tsaliki 2019](#), 169–70), differential profit shares across countries $\frac{r_c}{R}$ express differential wage rates under the assumption of the tendency for equalization of profit rates at the international level.

$$\begin{aligned}(1+r)w &= \left(1 - \frac{r}{R}\right) \\ (1+r)w_c &= \left(1 - \frac{r}{R} - \frac{r_c-r}{R}\right) = \left(1 - \frac{r_c}{R}\right)\end{aligned}\tag{4.16}$$

We then define transfers of value resulting from differential capital compositions $\delta\mathbf{1}$ as the difference between $\mathbf{pp2}'$ and \mathbf{dp}' , where the former vector denotes international prices of production with profit rates tending to equalize at the international level while wage rates vary between countries. To capture transfers of value resulting from differential rates of surplus value $\delta\mathbf{2}$, we take the difference between $\mathbf{pp2}'$ and $\mathbf{pp4}'$, where the latter vector represents a hypothetical case with both profit and wage rates tending to equalize at the international level. The total transfer of value resulting from the emergence of international prices of production δ is the sum of these two effects.

$$\begin{aligned}\delta\mathbf{1} &= \mathbf{pp2}' - \mathbf{dp}' \\ \delta\mathbf{2} &= \mathbf{pp2}' - \mathbf{pp4}' \\ \delta &= \delta\mathbf{1} + \delta\mathbf{2}\end{aligned}\tag{4.17}$$

Note that $\delta\mathbf{1}$ contains both the domestic difference $(\mathbf{pp1}' - \mathbf{dp}')$ and the international difference $(\mathbf{pp2}' - \mathbf{pp1}')$. The former results from the within-country equalization of profit and wage rates and expresses value transfers from industries with low to high organic composition of capital. In a closed economy, it sums to zero. Since our model accounts for the between-country trade of

circulating capital, and thereby value produced abroad, and works through the multiregional capital requirement matrix \mathbf{H} , the equations contain commodities produced under differential capital intensities. Within-country value transfers therefore no longer necessarily sum to zero; rather, positive transfers are induced by the use of circulating capital produced through higher value compositions of capital. The terms $(\mathbf{pp1}' - \mathbf{dp}')$ and $(\mathbf{pp2}' - \mathbf{pp1}')$ express the same mechanism of international value transfers due to differences in value compositions of capital, but only when analyzing country aggregates. In the alternative analysis of industry-aggregate international value transfers, a further decomposition of foreign and domestic contributions to domestic value transfers would be necessary.

[Table 4.8](#) reports international value transfers—total, induced by value composition of capital, and induced by rate of surplus value—for the top and bottom five countries in net value transfers. Appendix [Table 4.A.1](#) contains the full list of all countries in the EXIOBASE 3.8.2 sample, aggregated over the period 1995–2020, except for the five rest-of-the-world regions. In addition, we report countries' shares in aggregate global production to express a country's size relative to international gross output in production industries, evaluated in production prices.

Table 4.8 Share of (1) total, (2) variable-composition-of-capital-induced (VCC), and (3) rate-of-surplus-value-induced (RSV) value transfers in global gross production in production prices, with profit rates equalized internationally and wage rates equalized nationally, as well as (4) share of domestic value production in global gross production in production prices ↵

Country	Total	VCC	RSV	PP
[Sum Positive]	5.90	3.01	2.90	100.00
JP	2.67	1.33	1.34	13.90
US	1.09	0.31	0.78	23.03
CN	0.90	0.90	0.01	17.50
IT	0.35	0.17	0.19	4.31

GB	0.33	0.10	0.23	4.00
BR	-0.45	-0.23	-0.22	1.93
KR	-0.47	-0.20	-0.27	2.40
RU	-0.50	-0.26	-0.24	1.61
ID	-0.55	-0.28	-0.26	0.53
MX	-1.11	-0.53	-0.58	0.99

Source: EXIOBASE 3.8.2 1995–2020. Authors' calculations.

Notes: Five countries with the largest positive, and five with the largest negative, total international transfers as shares of global gross value production. Aggregated and averaged over the period 1995–2020. Only production industries. Full country list in Appendix [Table 4.A.1](#).

International value transfers are substantial, corresponding to 5.9 percent of annual global output in production industries during the period. When we understand the cumulative nature of value transfers (with total international transfers amounting to more than seventy trillion euros over the mentioned period), this translates into a significant gain for the receiving economies. They are very unequally distributed and concentrated in only a few countries: Japan, the United States, and China receive over 75 percent of positive transfers; beyond them, only Italy, Britain, France, and Sweden receive more than 0.1 percent of yearly global value production. The figures are expressed as yearly shares of global gross value production, aggregated and averaged over twenty-five years. Total transfers amount to more than seventy trillion euros, marking the importance of value transfers for structural international inequalities.

At the bottom of the list, we find Mexico, Indonesia, Russia, South Korea, and Brazil as the largest net givers of value. Negative transfers are distributed among a larger number of countries, with the total effect remaining below -0.1 percentage points of global gross production for Spain, Türkiye, Germany, Poland, Australia, Greece, India, Czechia, Norway, Romania, the Netherlands, and Ireland. The presence of Germany in the latter group is counterintuitive, as the country is among the largest exporters of manufactured goods and

machinery. At the same time, the presence of a large low-wage sector, combined with an old capital stock in the newly capitalized states of eastern Germany in the 1990s, may have created a downward pull on international transfers without interfering with the trade surplus in production industries. [Rotta \(2025\)](#), too, found that Germany is among the countries (along with France, Britain, and Japan) that lose value on international grounds. However, Rotta merged international value transfers and value capture into a single category—value capture—while our results isolate value transfers due to differential capital compositions and rates of surplus value from the role of capital exports and value capture through financial and commercial capital abroad (which we analyze separately below).

In terms of the composition of aggregate transfers, transfers induced by value composition of capital and rate of surplus value point in the same direction in almost all cases (when averaging over the whole period), but magnitudes vary significantly between countries. The United States receives more than two times more transfers induced by rate of surplus value than value composition of capital, while China receives substantial transfers induced by value composition of capital but has a very small rate-of-surplus-value effect. Among the large net receivers, we observe value-composition-of-capital and rate-of-surplus-value effects of similar size only in Japan and Italy, while for Britain and France (all net receivers), rate-of-surplus-value effects are almost twice the effects of organic composition of capital. All large net losers (Mexico, Indonesia, Russia, South Korea, and Brazil) are characterized by an outflow of value of approximately equal size through both channels.

Although this might look counterintuitive, higher wages do not necessarily mean a lower rate of surplus value. Wages can be high in advanced countries by virtue of mechanization, a higher intensity of labor, and cheapening of consumer goods. This means that the *average* rate of surplus value in the periphery might be lower than its counterpart in the imperialist core—something that Marxist dependency thinkers such as [Amin \(1977\)](#), 129–30) clearly recognized. At the

same time, the export industries in the periphery can attain a higher-than-average rate of surplus value especially if they are dominated by foreign capital and equipped by advanced technology. The results presented in [Table 4.8](#) reflect this.

For comparison, [Table 4.9](#) presents the shares of value transfers in domestic gross production and indicates the importance of value transfers for the national economies for the five biggest receivers and givers of total value transfers, respectively (the full list is in [Appendix 4.A.3](#)), while [Table 4.8](#) illustrates their international position as compared with other countries. The results go in the same direction, but they underline just how important value transfers are for the top receiving countries (and how disadvantageous they are for the bottom five economies, with Mexico and Indonesia transferring out half of the value created in their production industries). Importantly, even over the whole period, in which China started in a subdominant position, value transfers in the country are more important than in the United States, almost solely because of transfers induced by value composition of capital.

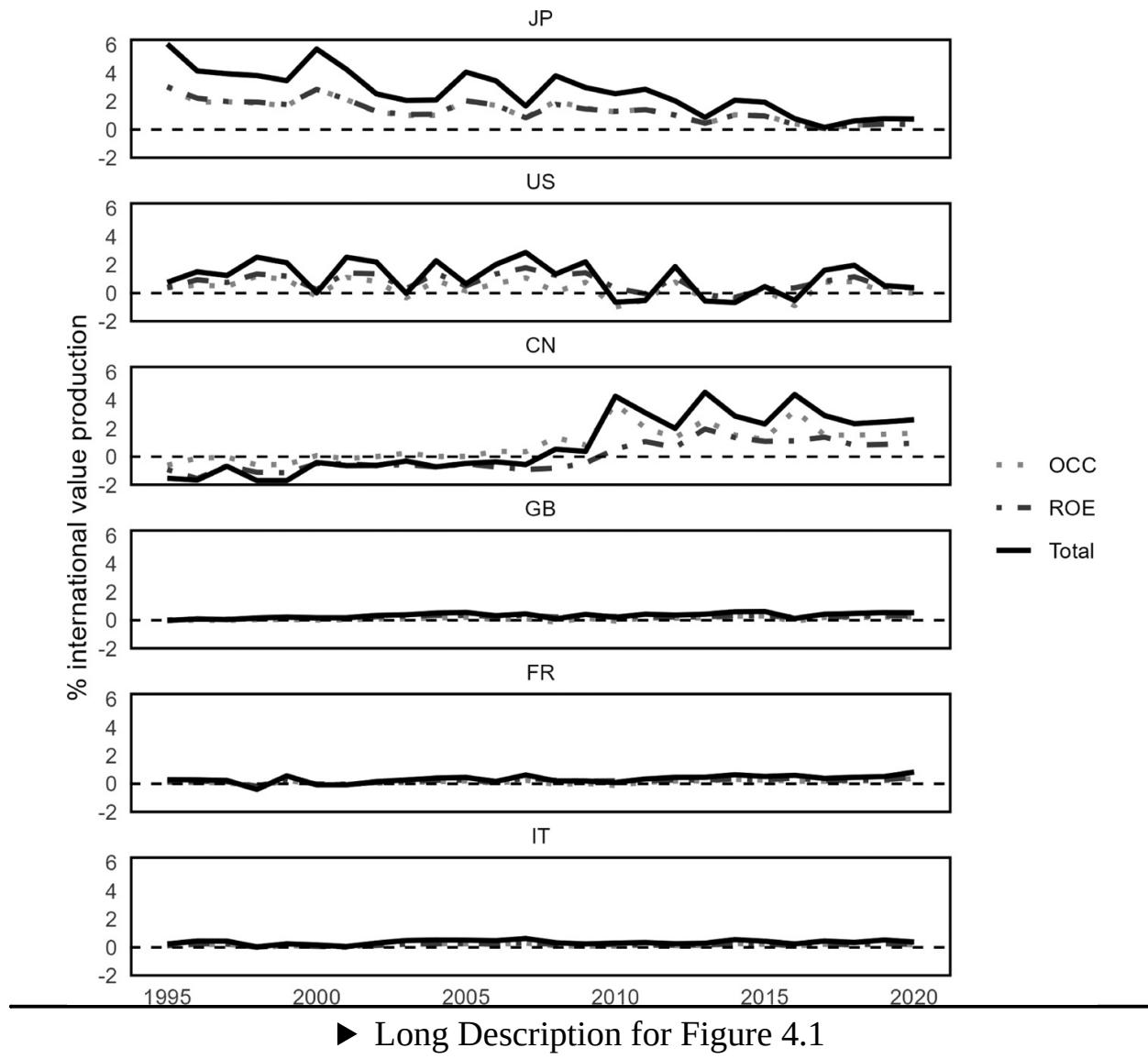
Table 4.9 Share of (1) total, (2) variable-composition-of-capital-induced (VCC) rate-of-surplus-value-induced (RSV) value transfer in domestic production in production prices with profit rates equalized internationally wage rates equalized nationally, as well as (4) total transfers as share of gross production and (5) domestic production as share of global production in production prices ↴

Country	Total/(Total +PP)	VCC/(Total +PP)	RSV/(Total +PP)	Total
JP	16.13	8.02	8.11	2.67
US	4.52	1.30	3.22	1.09
CN	4.90	4.88	0.03	0.90
IT	7.60	3.59	4.01	0.35
GB	7.72	2.32	5.40	0.33
BR	-18.93	-9.62	-9.30	-0.45
KR	-16.32	-6.82	-9.50	-0.47
RU	-23.62	-12.16	-11.47	-0.50
ID	-50.91	-26.48	-24.43	-0.55
MX	-53.06	-25.27	-27.79	-1.11

Source: EXIOBASE 3.8.2 1995–2020. Authors' calculations.

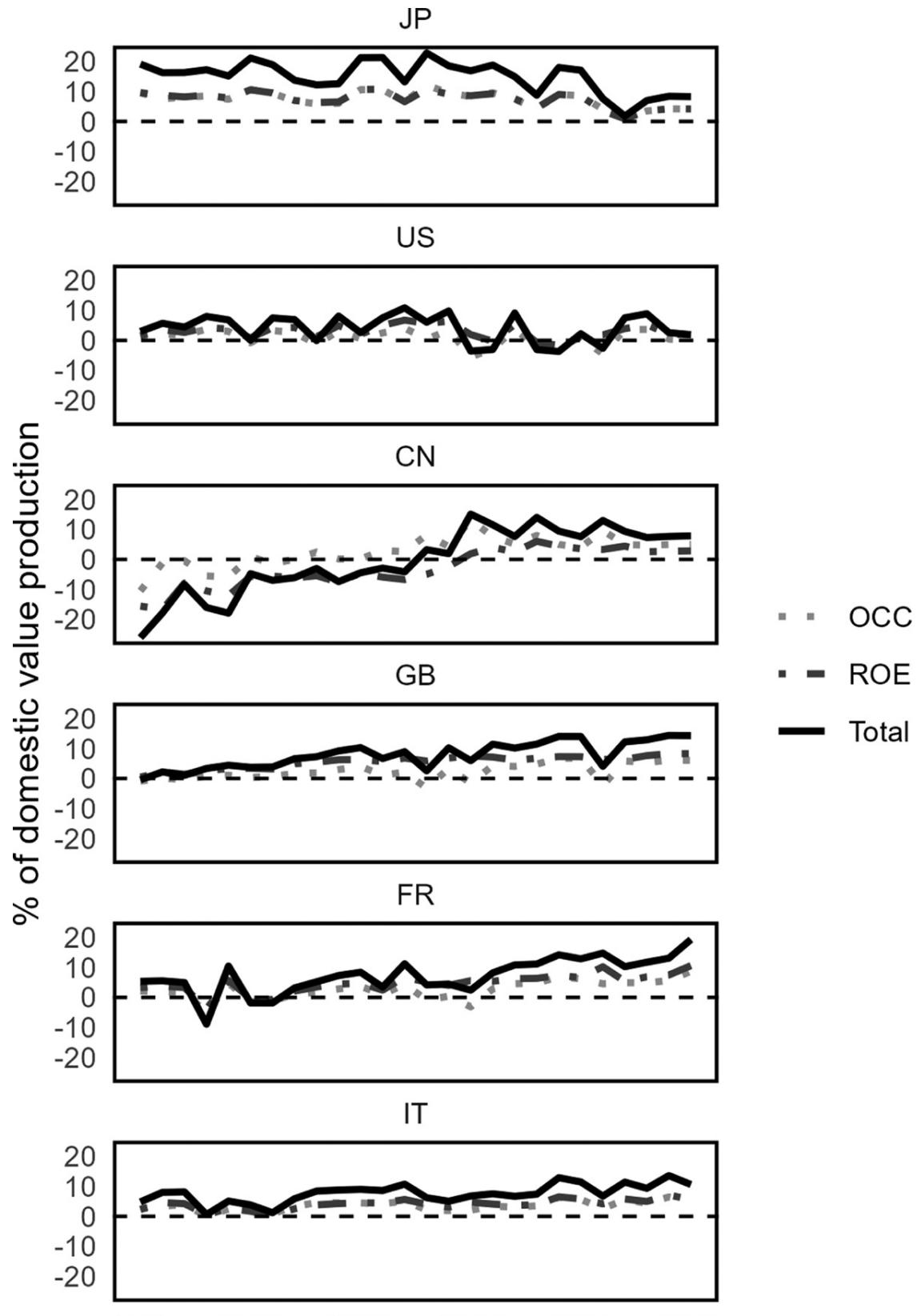
Notes: Five countries with the largest positive, and five with the largest negative, total international transfers as shares of global gross value production. Aggregated and averaged over the period 1995–2020. Only production industries. Full country list in Appendix [Table 4.A.3](#).

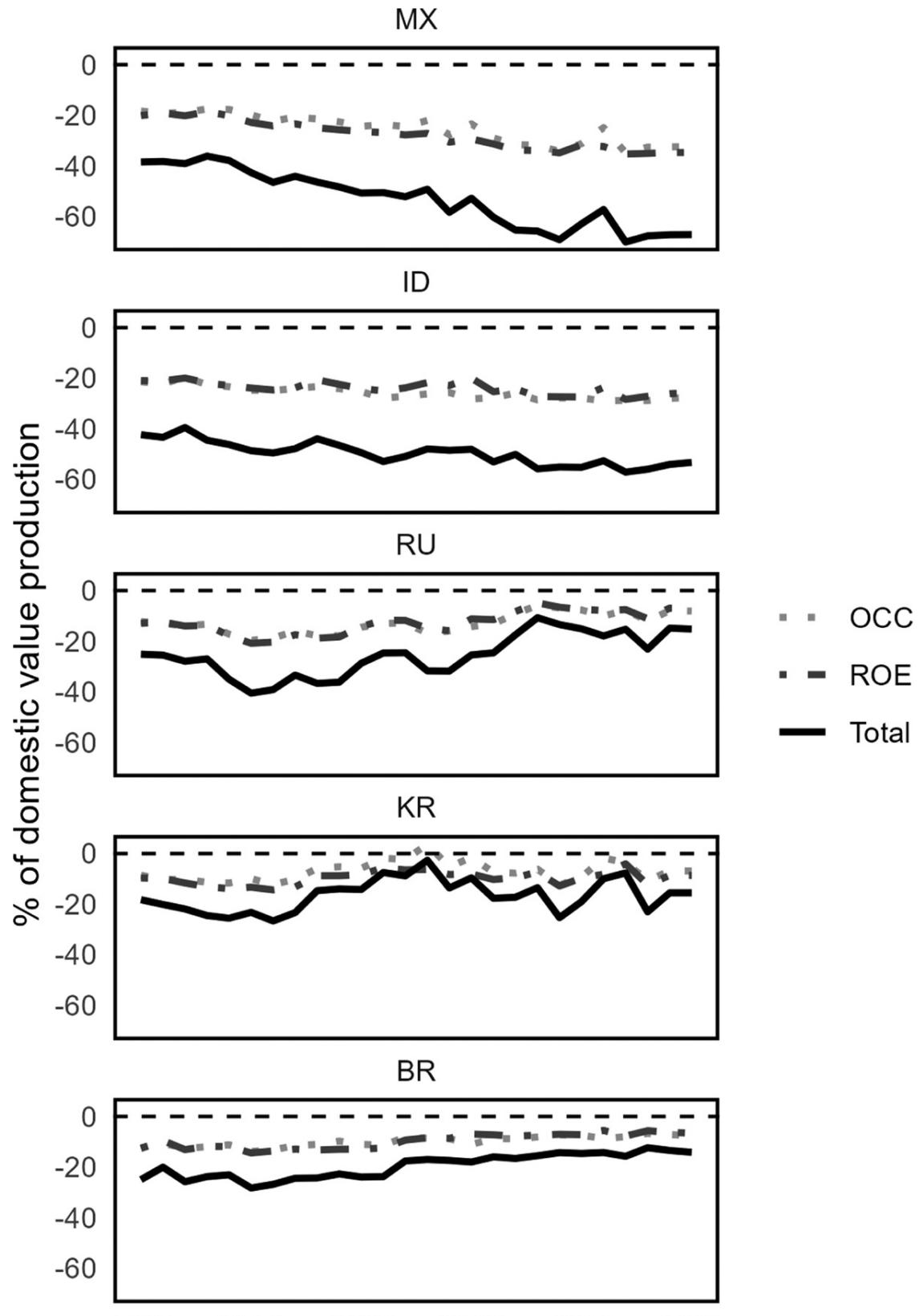
All values in [Tables 4.8](#) and [4.9](#) are denoted in percentage points and averaged over the 1995–2020 period. Denoting the table in national shares in annual global output of production industries allows us to circumvent any distortion by changing monetary bases between countries. However, the average over the entire period does not reflect changes in a country's position in international trade over time. To account for the latter, we present in [Figure 4.1](#) transfers related to value composition of capital and rate of surplus value as well as net value transfers for China, France, Britain, Japan, and the United States over the period 1995–2020. While [Figure 4.1](#) depicts value transfers as a share of global value created in that year (in production industries), [Figure 4.2](#) presents transfers as shares of domestic production to demonstrate the meaning of transfers from the perspective of the domestic economy. Furthermore, we report the full list of value-transfer recipients and givers for 2020 only (the most recent year in the sample) in appendix [Table 4.A.2](#).



► Long Description for Figure 4.1

Figure 4.1 Global importance: Value transfers for the six biggest receiving countries. EXIOBASE 3.8.2. 1995–2020. Authors' calculations [\[1\]](#)





► Long Description for Figure 4.2b

Figure 4.2 (a) Relative importance: Value transfers for the six biggest receiving countries in shares of domestic production (sum of production prices). EXIOBASE 3.8.2. 1995–2020. Authors' calculations; (b) Relative importance: Value transfers for the five biggest giving countries in shares of domestic production (sum of production prices). EXIOBASE 3.8.2. 1995–2020. Authors' calculations [↳](#)

The most noticeable effect is China's switch from negative to positive transfers around the time of the Great Financial Crisis, between 2005 and 2010. This result is qualitatively different from the established position in the literature, according to which China is among the dominated countries or suffers from value drain in international trade. This result only pertains to value transfers in production industries (omitting other economic aspects of imperialism), and, accordingly, it is in itself not evidence that China is now an imperialist power. However, it is safe to say that China's position in international value transfers has qualitatively changed over the past twenty-five years and that it should not any longer be flatly excluded from the bloc of countries benefiting from value transfers—an important aspect of economic imperialism. The switch began with the value-composition-of-capital channel between 2000 and 2005 and was enhanced about ten years later when the rate-of-surplus-value effect turned positive. We observe a falling trend for the United States starting in the same period, and figures have gone below and above the zero line since then. For the United States, the value-composition-of-capital effect seems to be particularly weak over the period when it was positive (prior to 2009) and has hovered around zero since then, indicating a relative loss on grounds of capitalization. Furthermore, Japan (the largest net receiver of value transfers over the whole period) experienced a nosedive between 2010 and 2015 (and a slow recovery afterward), as did Britain.

[Figure 4.2a](#) illustrates the substantial importance of value transfers for the large receivers: For France and Britain, net value transfers as a share of the

country's gross production (denominated in market prices) surpassed 20 percent toward the end of the sample, something that the United States also enjoyed roughly between 2005 and 2010. [Figure 4.2b](#) illustrates the dynamic for the top five value givers—Mexico, Indonesia, Russia, South Korea, and Brazil—clearly demonstrating the devastating impact of economic imperialism on countries suffering from international value transfers.

[Figure 4.3](#) illustrates the relatively stable international importance of value transfers between production industries in the 1995–2020 period. It also demonstrates that transfers induced by value composition of capital and rate of surplus value are of similar size, lending no support to any interpretation of unequal exchange in which the effect of differences in capital composition is qualitatively surpassed by differential rates of surplus value.

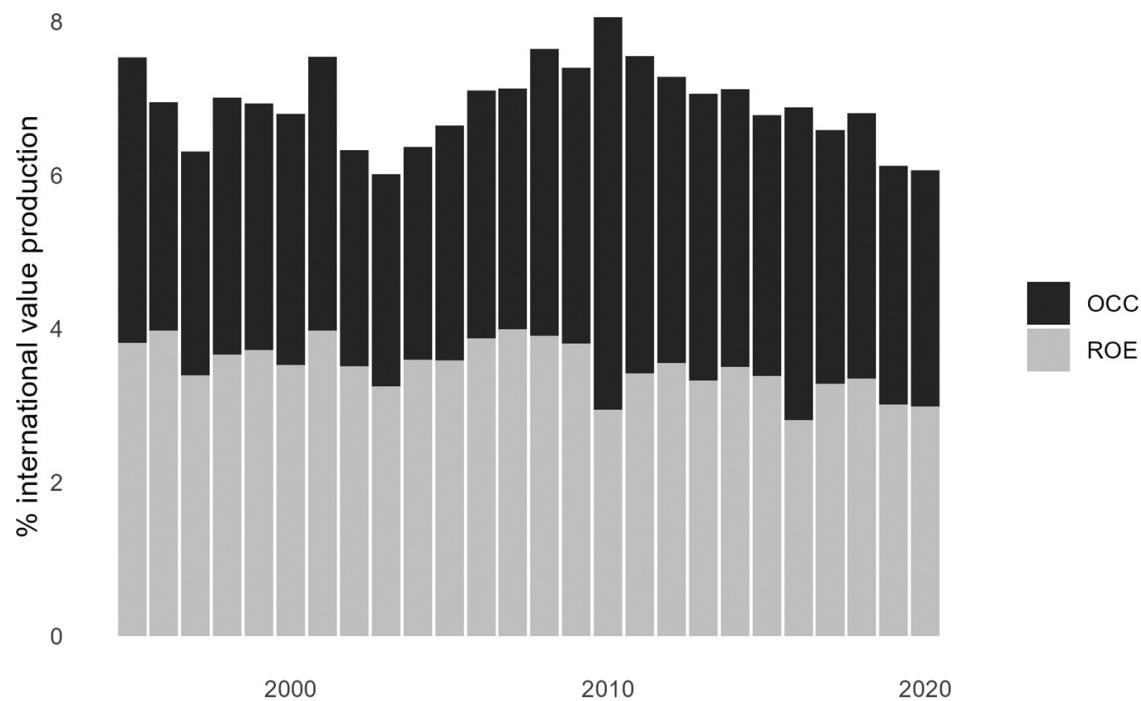


Figure 4.3 Sum of positive value transfers as shares of global value production. Only production industries. The figure shows variable-composition-of-capital- and rate-of-exploitation-induced transfers where total value transfers are positive. The figure omits positive variable-

composition-of-capital effects if they are outweighed by negative rate of exploitation effects and vice versa. EXIOBASE 3.8.2 1995–2020. Authors' calculations [⊕](#)

4.6.3 Nonproduction Industries' Value Capture

Our analysis so far has been concerned with international value transfers between production industries, which arise from differential value compositions of capital and rates of surplus value in the formation of international production prices. International value transfers, however, represent only one dimension of structurally unequal dynamics between countries and relations of economic imperialism.

We use the term *nonproduction value capture* to denote the international flows of surplus value from production to nonproduction industries, which represent a different channel of international value flows based on distinct causal mechanisms. Capital exports from imperialist countries fall under this category, which occupy a central role in Marxist theories of imperialism because of their capacity to counteract the tendency for a fall of the profit rate. Capital exports (from nonproduction as well as production industries) not only extend the material basis for surplus value production, but also serve to reduce workers' bargaining power in the exporting country by expanding the reserve army of labor and intensifying competition among workers.

Likewise, the role of nonproduction industries—especially financial and insurance activities ([Rotta 2025](#))—in transferring surplus value from one country to another in the form of fees and interest is subsumed under the category of *nonproduction value capture*. Net lending can be understood as a form of financial capital exports, and counterpoising interest payments as the resulting value capture. The same is true for foreign direct investment through multinational corporations, which export capital to countries with above-average rates of surplus value (a dimension which we do not investigate empirically in this book).

In sum, while international value transfers and international value capture are components of the same big picture of economic imperialism, they represent distinct mechanisms operating through different causal channels. Rather than treating them as one joint category of transfer, we distinguish between international value transfers (discussed in the previous subsection) and between-country flows from production to nonproduction industries (nonproduction value capture).

The empirical analysis of nonproduction value capture is complicated by the structure and availability of data. Capital exports are not directly recorded in input-output matrices, and neither are the payments in the opposite direction. Interest payments would be collected in social accounting matrices, and while ownership data for multinational corporations exist in an input-output framework related to the OECD's Inter-Country Input-Output tables ([Cadestin et al. 2018](#)), the industry resolution is lower and the covered time span shorter than that of the EXIOBASE data we use in this book. Input-output tables do record payments from production to nonproduction industries, but for financial intermediation services these represent financial intermediation services indirectly measured (FISIM)—an implicit fee for financial intermediation between lenders and borrowers. For wholesale and retail trade, the flows express trade margins.³⁶ Given all these drawbacks related to data, an estimation of nonproduction value capture can reflect certain tendencies characterizing international redistribution of surplus value, but it will significantly underestimate the magnitude of these flows.

Keeping in mind that nonproduction value capture will be underestimated because of the absence of interest payments in input-output tables, we calculate (1) inflows to nonproduction sectors in one country from production sectors in other countries; (2) inflows to nonproduction sectors in one country from gross fixed capital formation in production sectors of other countries; and (3) the estimated share of value added in nonproduction industries from foreign industries. We denote the total between-country nonproduction value capture as

npvc, the inflow to nonproduction industries from foreign production industries for circulating capital **ifnp**, the inflow to nonproduction industries from between-country gross fixed capital formation as **npgfcf**, total inflow from gross fixed capital formation from foreign capitals as **gfcff**, value added as **va**, the value added from foreign production industries captured by domestic nonproduction industries **vafnp**, the capital coefficient matrix **A**, the between-country capital coefficient matrix **A^F**, the market price vector **mp**, the indicator vector for production industries **ep**, and the indicator vector for nonproduction industries **enp**. **1** is a column vector of ones of the same length as the **A** matrix. Post-multiplying **A** by **1** yields the row sums of the matrix—that is, the vector of payments to the industry represented by the row. In the calculation of **vafnp**, $\frac{\sum_{c=c,t=t} (A^F \widehat{mpenp}) 1ep}{\sum_{c=c,t=t} (A \widehat{mpenp}) 1ep}$ represents the share of foreign inflows to nonproduction industries out of total inflows to nonproduction industries, an approximation of how much nonproduction value added can be assigned to foreign production industries. A caret above a vector symbolizes a diagonal matrix with the vector on the diagonal and zeros on all off-diagonal entries.

$$\begin{aligned}
 ifnp &= (A^F \widehat{mpenp}) 1ep \\
 npgfcf &= (gfcff \widehat{enp}) 1 \\
 vafnp &= va \cdot \widehat{enp} \frac{\sum_{c=c,t=t} (\widehat{A^F} \widehat{mpenp}) 1ep}{\sum_{c=c,t=t} (A \widehat{mpenp}) 1ep} \\
 vafnp_{c,t} &= (va_{c,t} \widehat{enp}) \frac{((A^F \widehat{mpenp}) 1ep)_{c,t}}{((A \widehat{mpenp}) 1ep)_{c,t}} \\
 npvc_{c,t} &= ifnp_{c,t} + npgfcf_{c,t} + vafnp_{c,t}
 \end{aligned} \tag{4.18}$$

Our estimate of between-country nonproduction value capture departs from

the literature in two ways. In contrast to [Rotta \(2025\)](#), we isolate between-country flows of value from production to nonproduction industries, and we present all three channels of inflows recorded in input-output tables—namely, intermediate consumption, gross fixed capital formation, and value added. Nonetheless, the estimation has three main weaknesses: (1) It underestimates the income of financial sectors because it only takes into account payments for financial intermediation services indirectly measured rather than total financial flows; (2) we do not deduct between-country outflows from production to nonproduction industries from the inflows; and (3) we do not account for the overlap between inflows from circulating capital and gross fixed capital formation, on the one hand, and value added, on the other.

Finally, we eliminate the rest-of-world regions from the data before estimating flows, as the grouping of low-tax financial centers (for example, in the Bahamas, Singapore, or the Cayman Islands) with other countries would require much deeper investigation. The empirical literature on profit offshoring ([Zucman 2014](#)) estimates, for example, that in 2012, 20 percent of US profits were offshore with only a small share repatriated, which substantially distorts national-accounts data on financial income. EXIOBASE covers some of the most important destinations explicitly (Luxembourg, Ireland, Switzerland, and the Netherlands) but summarizes others—such as Singapore and the Bermudas—in the rest-of-world regions.

Nevertheless, the conservatively estimated results in [Table 4.10](#), corresponding to equation 4.18, show a clear order for aggregate value capture by country, with Britain, Germany, and the United States at the top of the list. At the same time, the magnitude (0.15 percent of global gross production in total) is more than twenty times smaller than the effects of value transfers in [Table 4.8](#). We express value capture in shares of global gross production and average it over the period 1995–2020, which means the entry for Britain in the first row indicates that the country received an average of 0.01 percent of gross global production as nonproduction value capture from foreign production industries,

while the British economy produced an average of 3.93 percent of global gross product in market prices in the same period.

Table 4.10 Top 12 countries with the largest nonproduction value capture (as a share of global gross production) from foreign production industries, composed of (1) inflows through the intermediate consumption matrix (circulating capital), (2) inflows through gross fixed capital formation, and (3) foreign share in nonproduction industries' value added (aggregated and averaged over the period 1995–2020) ↪

	<i>Foreign circulating capital</i>	<i>Foreign gross fixed capital formation</i>	<i>Value added from abroad</i>	<i>Total nonproduction value capture</i>	<i>MP</i>
Sum	0.1499	0.000122	0.000584	0.1506	88.93
GB	0.0135	0.000004	0.000058	0.0135	3.93
DE	0.0123	0.000014	0.000037	0.0124	5.26
US	0.0117	0.000003	0.000033	0.0117	23.54
IE	0.0101	0.000003	0.000042	0.0102	0.42
IT	0.0095	0.000012	0.000017	0.0096	3.33
CH	0.0095	0.000003	0.000033	0.0095	0.93
NL	0.0091	0.000015	0.000042	0.0092	1.19
BE	0.0079	0.000008	0.000022	0.0079	0.78
FR	0.0067	0.000003	0.000016	0.0067	3.79
JP	0.0051	0.000001	0.000010	0.0051	9.77
CN	0.0043	0.000003	0.000017	0.0043	12.22
PL	0.0042	0.000006	0.000043	0.0043	0.64

Source: EXIOBASE 3.8.2 1995–2020. Authors' calculations.

Note: Market prices **mp** do not sum to 100 percent because the rest-of-world regions are omitted and shares are presented as means over the sample time span 1995–2020.

The table reports the 12 largest receivers of value capture, while we provide the full results in Appendix [Table 4.B.1](#). Appendix [Table 4.B.2](#) reports the results only for 2020 rather than the whole sample time span 1995–2020. The sum of

value captures increased marginally from 0.15 to 0.16 percent over the period, and Ireland surpassed all other receiver countries, while Luxembourg also moved up the list substantially. The United States also surpassed Britain and Germany to reach second place. As detailed above, the estimation of nonproduction value capture based on input-output tables omits an important part of financial flows and profits of multinational corporations because of data restrictions.³⁷ Nonetheless, it still seems that nonproduction value capture has not replaced value transfers based on differential value compositions of capital and rates of surplus value as the main component of overall international value flows—at the very least, the latter are still empirically relevant.

[Table 4.11](#) reports value capture as a percentage of domestic gross production in market prices, demonstrating the meaning and impact of nonproduction value capture for national economies. As can be seen in the fourth column, inflows of value captured from foreign production industries do not have a significant impact for the top 12 receivers except for Ireland and Luxembourg. Note, once again, that these figures underestimate the full magnitude of nonproduction value capture significantly because of the data restrictions discussed above. Appendix [Table 4.B.3](#) reports the figures for the full list of countries included in our sample.

Table 4.11 Nonproduction value capture as share of domestic gross production in market prices in the top 12 countries (ordered by total value capture as share in global gross production), composed of (1) inflows through the intermediate consumption matrix (circulating capital), (2) inflows through gross fixed capital formation, and (3) foreign share in nonproduction industries' value added [!\[\]\(22dfb51dac4ca5425565da9fca4aa746_img.jpg\)](#)

	<i>Circulating capital</i>	<i>Gross fixed capital formation</i>	<i>Value added</i>	<i>Total nonproduction value capture</i>	<i>MP</i>
GB	0.3429	0.000109	0.001481	0.3445	3.93
DE	0.2338	0.000265	0.000697	0.2348	5.26
US	0.0495	0.000013	0.000141	0.0497	23.54
IE	2.4182	0.000775	0.010071	2.4291	0.42

IT	0.2856	0.000366	0.000513 0.2865	3.33
CH	1.0170	0.000358	0.003592 1.0209	0.93
NL	0.7659	0.001256	0.003560 0.7707	1.19
BE	1.0080	0.000987	0.002832 1.0118	0.78
FR	0.1766	0.000070	0.000421 0.1771	3.79
JP	0.0526	0.000015	0.000100 0.0527	9.77
CN	0.0353	0.000026	0.000141 0.0355	12.22
PL	0.6585	0.000906	0.006696 0.6661	0.64
LU	4.0007	0.000779	0.031615 4.0331	0.11

Source: EXIOBASE 1995–2020. Authors' calculations.

4.7 Conclusion

The expansion of the capitalist mode of production was achieved through military power, colonialism, and international trade. From the beginning, the international dimension of capital accumulation was based on inequalities, which were deepened by the resulting economic relationships. Much as competition in one country favors large and profitable capitals, turbulent competition between industries in different countries (largely) benefits capitals in the imperialist center. This is apparent in the economic relationships that were established in the structure of the capitalist mode of production on the world stage. The inequalities are expressed in value transfers between industries and countries and in value capture induced by trade and capital exports.

[David Ricardo \(1970, 397\)](#) was the first to conceptualize (in embryonic form) the effects of price formation on the world market under differential labor requirements between countries—that is, value transfers between countries. At the same time, his theory of comparative advantage in international trade rejected the notion that prices are regulated by labor embodied in commodities—the mechanism he proposed for price formation in a national context—indicating a decoupling between his perception of competition at the national and international levels. As Ricardo's model of comparative costs became the

building block for neoclassical trade theory, critique of it became the vantage point for the Marxist analysis of international trade. However, except for contributions by [Bauer \(1907\)](#) and [Grossmann \(2021\)](#) in the early twentieth century, the central role of international trade for capital accumulation was not substantially attended to in the Marxist literature.

Only in the second half of the twentieth century did [Arghiri Emmanuel \(1972\)](#) formulate a theory of unequal exchange favoring the imperialist center at the expense of the neocolonial periphery. While Emmanuel modeled how the formation of international production prices expresses value transfers because of differential compositions of capital as well as differential wage rates, his overall framework suffered from theoretical and conceptual inconsistencies with Marxist value theory. In this chapter, we added within-industry competition and productivity differentials to Emmanuel's theoretical model, and we distinguished between the channels of capital composition and rate of surplus value in value transfers. In our empirical analysis, we found that both effects are empirically relevant for international value transfers at an average of 5.9 percent of global gross production per year (rejecting Emmanuel's claim that wage differentials constitute the main channel), that the gains from it are very unequally distributed (favoring a very small number of countries), and that the transfers are significant for receiving and giving economies, with Mexico and Indonesia transferring out more than 50 percent of the value they produce.

Before value transfers and unequal exchange were incorporated into the unequal-development literature in the second half of the twentieth century, the international expansion of capital accumulation was addressed in the debates on imperialism. We distinguished three waves of Marxist theories of imperialism: Discussions around the turn of the twentieth century focused on capital exports' circumvention of falling profit rates in imperialist countries and the ensuing dynamic of imperialist rivalries and wars. Second-wave theories, formulated in the decades following WWII, investigated the persisting dependency of formally independent countries and the structures reproducing underdevelopment actively

perpetuated by imperialist powers. Monopoly-capital and dependency theories were the prominent approaches to the question of imperialism at this time, and Marxists in the latter tradition took up Emmanuel's study of unequal exchange and value transfers. A third wave developed toward the end of the twentieth century at a time of rapidly increasing money capital flows, inclusion of neocolonies in the world market, and integration of the former socialist bloc into the global capitalist system.

In addition to value transfers through between-industry competition at the international level, Marxist theories of imperialism investigated value capture through capital exports—in the form of both productive capital and nonproduction capital (in finance and trade). Although income flows to financial institutions (relevant for nonproduction value capture) and multinational corporations (relevant for value capture through capital exports) are either not available or not fully represented in the multiregional input-output tables that form the foundation of our model, we put forward an empirical estimation of nonproduction value capture. We found that the magnitude in our data set is less than a tenth that of value transfers (0.15 percent of gross global production as compared to 5.9 percent). We also found that the biggest receivers of nonproduction value capture are Britain, Germany, and the United States, often considered as core imperialist powers.

In this chapter, we critically examined the literature on unequal exchange and imperialism from the vantage point of and with an emphasis on Marxist value theory. We put forward a coherent framework to estimate value transfers due to differential value compositions of capital under equalized profit rates and, distinct from them, transfers due to differential rates of surplus value under non-equalized wage rates. The results suggest that in contemporary capitalism, differential capital intensities still play a dominant role within the overall flows of value between countries, while differential rates of surplus value can be an equally important factor for individual countries. Financial capital exports, and, more broadly, nonproduction value capture, play a minor role compared to value

transfers, though data restrictions impose a significant limitation on the estimation of the latter.

In both domains, our results indicate that value-transfer and value-capture gains are distributed very unequally between countries, with Japan, the United States, and China as the largest recipients of value transfers and Britain, Germany, and the United States as the biggest recipients of nonproduction value capture. Furthermore, we find that China's role in the world economy qualitatively changed in the period 1995–2020 from a net payer to a net recipient of value transfers, while its position in terms of nonproduction value capture did not change to the same extent.

Value transfers and value capture are located at the frontier of Marxist value theory, neither refuting nor negating it. While the law of value operates in and through the deviations between direct, production, and market prices, international inequalities in competition partially explain these systematic deviations. The empirical analysis of value transfers and value capture advanced in this chapter is deeply embedded in Marxist value theory and concerned with real capitalist competition. The main contribution of the chapter is the study of international inequalities from the perspective of the operation of the law of value, manifested in and through deviations between direct, production, and market prices, and thereby the study of the turbulent patterns of competition within and between industries.

It is clear that this can only represent an intermediate step, if not a starting point, for the investigation of imperialism based on real competition and within Marxist value theory. The limitations we encountered in developing the analysis in this chapter indicate the need to combine data on nonproduction income from both input-output tables and social accounting matrices, compile and use the available data on multinational corporations' capital exports, and incorporate the important role of global value chains and foreign production in the formation of production prices. We hope this chapter provides researchers with a coherent theoretical approach and a solid methodology to take up investigations of this

sort.

Notes

1. The reason for employing the concept of value composition of capital instead of the organic composition is explained in section 4.4.1.[↩](#)
2. This is also distinct from the terminology of value capture or international exploitation in the recent literature ([Cogliano, Veneziani, and Yoshihara 2022; 2024; Rotta 2025](#)), which lumps together all between-country value flows.[↩](#)
3. In addition to the four planned volumes of *Capital*, his grand project included separate volumes on ground rent, wage labor, the capitalist state, foreign trade, and the world market and crises ([Rosdolsky 1969](#), 27). He did not manage to finish even the first book, namely *Capital*. The extension of his value theory to international trade therefore remained only as an intention, with some scattered hints and potentially contradictory statements left behind.[↩](#)
4. The discussion here is confined to the gold standard and the level of abstraction of direct prices for the sake of remaining in conformity with the frameworks of Ricardo and Marx. For a more comprehensive and detailed critique of various forms of the Quantity Theory of Money, and an alternative on grounds of the Marxist value theory, see [Shaikh \(1979, 1980\)](#).[↩](#)
5. From a Marxist point of view, Ricardo's Quantity Theory of Money, which is necessary for the conversion of competitive advantage to comparative advantage, is the fundamental problem of the model.[↩](#)
6. As [Barrientos \(1988](#), 97, 181) pointed out, Emmanuel treated capital and labor as incommensurable factors of production and thereby omitted the labor content of capital commodities in price formation and refers to factor rewards instead. Furthermore, from a Marxist perspective, land and capital do not represent factors of production in addition to labor. They rather constitute means and conditions of production, with the help of which human labor engages in production. As a corollary, land and capital do not have their own productivity and self-constituted rewards.[↩](#)
7. It is worth reminding the reader that what Emmanuel called "labor values" are money prices proportional to labor values, which we refer to as direct prices throughout the book.[↩](#)
8. Emmanuel disregarded transfers of value that emerge in the formation of social value within a given

branch. Such transfers are conditioned by differences in the productivity of labor employed by individual capitals.⁴

9. The international prices of production of the commodity produced in countries A and B are 190 and 150, respectively. That these commodities bear the same labor value (of 170) illustrates unequal exchange.⁵
10. If the model is extended to distinguish between consumption and capital goods, a transformation problem arises. As [Barrientos \(1988\)](#) pointed out, Emmanuel was initially unconcerned with this, as he “from the beginning, completely rejected the use of the labour theory of value under capitalism on the grounds of the incommensurability of labour and capital” (81). In this example, no commodity is used as a capital good in subsequent production, so the classical transformation problem does not arise. A full trade model, as documented in multiregional input-output tables, requires vertical integration of values and prices to arrive at price-value deviations as well as value transfers.⁶
11. [Emmanuel \(1972\)](#), 63–64) used a third numerical example, which we do not reproduce here, in which the total capital advanced (K) is equal in the two countries. He thereby demonstrated that the wage disparity alone brings about a substantial value transfer.⁷
12. The framework of monopoly capitalism developed by Baran and Sweezy entails a discussion of political and military manifestations of imperialism, too, which we do not reproduce here since our focus is on transfers of value primarily through international trade.⁸
13. Amin's figures are based on the relative shares of advanced and backward industries in the exports of underdeveloped countries, as well as a back-of-the-envelope calculation of the potential value of the same products if they were produced using methods in advanced countries. Gibson relied on input-output tables to compute prices of production, and he compared the import-export bundles of specific countries at these prices with the figures at current prices. One of Gibson's main arguments is, however, that the labor theory of value has fettered our understanding the capitalist society. Following [Steedman \(1977\)](#), he rejected prices proportional to labor values and based the whole analysis on equilibrium prices.⁹
14. Emmanuel's framework fully neglects this first channel of value transfers since it assumes complete specialization across countries, implying that they trade unique commodities.¹⁰
15. Most empirical analyses of the price-value relationship on the international level use multiregional input-output tables to estimate prices of production based on capital good streams. With regard to

capital goods, international competition prevails in most sectors and the empirical difference between national and international prices of production will be small.¹⁶

16. Capital first gained international mobility in its commodity and money forms. This internationalization of the sphere of circulation brought about only limited manifestations of the law of value at the international scale such as a tendency for equalization of interest rates. It is through the international mobility of productive capital that the law of value acquires a truly international character, playing a role (along with other factors) in the reproduction of an international division of labor.¹⁷
17. To avoid complications related to the transformation problem, we assume that furnaces (and TVs) are consumption goods and do not enter subsequent stages of the production process in either country.¹⁸
18. These differences are manifested in total capital invested (K).¹⁹
19. The presence of value transfers is not a necessary condition for capitalists to resort to these methods. The mechanisms discussed here can also be used in advanced countries to counter the tendency of the rate of profit to fall. In this book, however, we are primarily interested in their role as a mechanism to compensate for international transfers of value.²⁰
20. See [chapter 2](#) for a discussion of why Marx began his analysis at this level of abstraction, namely under the assumption that commodities, including labor power, exchange at prices proportional to their values.²¹
21. Value can be transferred from one industry to another because of different capital compositions even in the absence of exploitation of workers by capitalists. Accordingly, if the expanded definition is adopted, exploitation can exist even when aggregate surplus value equals zero, which is absurd from a Marxist perspective.²²
22. Some reviews can be found in [Brewer \(2002\)](#), [Marcuzzo and Sen \(2018\)](#), and [Wolfe \(1997\)](#).²³
23. [Marx \(1991](#), 572), albeit writing in an era of limited internationalization of capital (only in its commodity form), grasped that the world market is inherent in the *concept* of capital and that the credit system, rapidly developing during the second half of the nineteenth century, was serving this aim. The first wave of theories of imperialism, developed by Hilferding, Bukharin, Lenin, and Luxemburg, among others, reflected on a world where the international mobility of money and productive capital was rapidly increasing. [Hobson's \(1902\)](#) work, although not formulated from a Marxist perspective, was foundational for these Marxists as well as subsequent theorists of

imperialism, particularly Paul Baran.[!\[\]\(bf43035df69ea22be0369ac35ea687c3_img.jpg\)](#)

24. *Imperialism* should be regarded primarily as a polemic against Kautsky and his theory of ultra-imperialism rather than a work of theoretical refinement, as [Lenin \(1999\)](#), 673–77 himself made clear in his preface to the French and German editions, written in 1920.[!\[\]\(4e6d23ed1a2b82aaff6e393a94773dd5_img.jpg\)](#)
25. Although the first section of *Accumulation of Capital* revolves around this problem, the economic core of [Luxemburg's \(2003\)](#), 309–27 argument is most clearly presented in chapter 25.[!\[\]\(72f35f9c9754ee410fe17ca85a10f7b5_img.jpg\)](#)
26. “Imperialism is the political expression of the accumulation of capital in its competitive struggle for what remains open of the non-capitalist environment” ([Luxemburg 2003](#), 426).[!\[\]\(797ddeeffa7537849078865da3bf7f03_img.jpg\)](#)
27. Although economic reductionism appears as an intrinsic risk here, it is by no means inevitable. Lenin stands out as a political leader in this period who grasped the significance of the national question and integrated the revolutionary potentials of the proletariat and oppressed nations.[!\[\]\(156a6c24aea8ab1f6444b00eab319e7c_img.jpg\)](#)
28. Nkrumah was deposed through a military coup in 1966—a fate that would be shared by many governments and political leaders aiming to detach their country from the global capitalist order or refusing to abide by the rules thereof.[!\[\]\(dd50e820d5f521573909016e74460628_img.jpg\)](#)
29. We disagree with this claim primarily on grounds of the historical and moral element determining the value of labor power in a given country.[!\[\]\(e58d5fc89bda7db8d81776756a7405c1_img.jpg\)](#)
30. The emphasis Carchedi and Roberts put on systematic value transfers and extra-economic forces necessary to stabilize and consolidate the corresponding international relations is shared by many contemporary theorists ([Higginbottom 2019](#); [Kadri 2019](#); [Smith 2019](#))[!\[\]\(3ad05ae98527be08a5f8a60133d58038_img.jpg\)](#)
31. The model amends and extends those of [da Silva \(1987\)](#) and [Tsoulfidis and Tsaliki \(2019\)](#), 299–301.[!\[\]\(21bbad82dad1bf8a3704c9eb2553a579_img.jpg\)](#)
32. C would represent constant capital *consumed* (with a turnover time of unity) in a circulating capital model. In our model, it stands for total capital *invested*, accounting for both fixed and circulating capital.[!\[\]\(73976666980fcfc886b33d06dbec6c76_img.jpg\)](#)
33. Since the relationship between the technical composition of capital and value composition of capital loosened through cross-country differences in the rate of surplus value, the category of the organic composition of capital is no longer the appropriate one.[!\[\]\(4d879bb38ee2c3e2332cd36937a51c0c_img.jpg\)](#)
34. [Tsoulfidis and Tsaliki \(2019\)](#), 303 used production prices and labor values and denote the definition of value transfers as $\delta_i = p_j^* - \lambda_{i,j}$.[!\[\]\(4174cebc36982d84a1a88935e3b7c890_img.jpg\)](#)
35. Note that capital flows estimate the amount of fixed capital goods that flow from one industry i ,

through gross fixed capital formation, to the consumption of fixed capital in production of industry j . The sum of A and D gives total production requirements in production ([Södersten, Wood, and Hertwich 2018](#)). This approach estimates not total fixed capital stock, but rather fixed capital used in production, conditional on capital turnover ([Jiang et al. 2023](#)).[!\[\]\(7e82f783f603dc19983b78e1798071fe_img.jpg\)](#)

36. EXIOBASE follows the ESA95 classification as the benchmark for supply and use tables and harmonizes non-EU sources ([Wood et al. 2015](#), 142), and it estimates financial intermediation services indirectly measured as an implicit fee on lenders and borrowers distinct from interest rates ([European Commission 1996](#)), a measure that would be available in more comprehensive social accounting matrices (European Commission. Joint Research Centre. 2018. Social accounting matrices :basic aspects and main steps for estimation. Luxembourg: Publications Office of the European Union.). For wholesale and retail trade, also part of our category of nonproduction sectors, ESA records trade margins as input-output flows.[!\[\]\(e751104ba384815aa4e587601e49d110_img.jpg\)](#)
37. Even a more comprehensive estimation of value capture using a different data source would exhibit similar drawbacks because of holes in the data on multinational corporations, profit offshoring, and so forth.[!\[\]\(f684fbd48bd457d2b822fff9b25e9d23_img.jpg\)](#)

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5 Ecological Breakdown, Ground Rent, and the Law of Value

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5.1 Introduction

We have so far studied the theory of value—which grasps value as a social relation in the context of the reproduction of capitalist society—mostly in its quantitative aspects, focusing on the coordination and regulation of the processes of production and exchange through the law of value. Value serves as the belt transmitting the motion in various processes and subsystems of the capitalist economy to the others, thereby providing coherence of its totality. In this chapter, we turn to one of the frontiers of the law of value, namely rent, and its significance in studying the relationship of social production and reproduction to nonhuman natures.

From a Marxist perspective, rent is a key category to understand the economic relations underlying the ecological breakdown. In the domains we study in this chapter, rent is paid out of profits—social surplus value—and appropriated privately by landowners. With the increasing penetration of capitalism into all aspects of production, rentiers start behaving like capitalists—profit-seeking and

capital-accumulating entrepreneurs—without necessarily exploiting labor themselves. The roles of the capitalist and landowner are increasingly expressed by the same persons and firms.

In global capitalist production, land is used and accumulated like capital, and rent is treated like profit. At the same time, rent appropriated by landlords in agriculture, fossil fuel extraction, mining, real estate, and certain other industries is in most cases not a monetary expression of surplus value produced in those same industries, pointing to certain value-mediated relations between those who exploit wage labor and those who appropriate surplus profits. In addition, insofar as rent-extracting activities contribute to the ecological breakdown, surplus profits in the form of rent renew and deepen the commitment to such destruction.

Rent represents a surplus profit for landowners and landed capitalists, which translates into a sectoral profit rate above the general profit rate. In a simple analysis of the relationship between market prices, production prices, and direct prices as presented in the preceding chapters, we expect to find significant structural deviations in extractive industries—that is, industries with substantial use of landed property. Since surplus profits are paid out of the monetary expression of aggregate surplus value, the surplus profit accruing to extractive industries implies a lower profit for the others, which has been empirically observed. [Carchedi and Roberts \(2023\)](#), 17–18), for instance, established the negative effect of oil and raw material prices on the average profit rate, while an earlier investigation of price-value deviations revealed a high correlation between energy industries' share in gross output and deviations between market and direct prices ([Işıkara and Mokre 2022](#)).

In what follows, we take a glance at classical political economists' take on rent, then discuss in detail Marx's approach to the issue. [Section 5.2](#) introduces different types of rent (absolute, differential, and monopoly rent) and concludes with a discussion of more recent debates on Marxist rent theory as well as changes in the role of landed property and rent in contemporary capitalism. In [section 5.3](#), we develop an empirical model to capture quantitative regularities

supporting our main thesis, which is that the presence of nonrenewable and nonreproducible resources helps explain systematic deviations between direct prices, prices of production, and market prices rather than negating the law of value. Rent therefore represents a frontier of the law of value, not an external phenomenon or exception to it. [Section 5.4](#) concludes the chapter by linking the discussion of rent with the theories of metabolic rift and shift, along with offering some further thoughts on value-theoretical debates.

5.2 Rent Theory in Classical Political Economics and Marx

The notion of land rent was discussed prominently in classical political economics before Marx. The class contradiction between landed nobility and other landlord rentiers, on the one hand, and capitalists, on the other, was central at this time, and Adam Smith, John Stuart Mill, David Ricardo, and others treated it accordingly. Their analysis of rent is centered around landownership in general and agriculture in particular. This is a trait common to their time, when a new world was revealing itself to the classical political economists, and the discussion of a number of issues from fluctuations in corn prices to the implications of the Corn Laws, the role of landed property, competition, accumulation, and the long-term tendencies of the emerging system attracted a great deal of attention ([Bina 1989](#), 82–83). The term *ground rent* hence became an important element in the vocabulary of political economists from [Smith \(1999](#), ch. 14) through [Malthus \(1815\)](#) and [Ricardo \(1970](#), chs. 2, 3, 24, 32) to [John Stuart Mill \(1848\)](#).

Classical political economists were very interested in the contemporary fluctuations in food (particularly corn) prices, which led them to the study of production processes that include special inputs such as land. [Adam Smith \(1999\)](#) devoted a whole chapter in *The Wealth of Nations* to the question of rent, which he defined “as the price paid for the use of land” (247). The tenant retains what is sufficient to replace the seed, pay the workers, and maintain the cattle

and other means of production, and the landlord endeavors to retain the remaining part of the product's price as the rent of land. According to Smith (247–48), the latter portion is the natural rent of land, which, along with the natural level of wages and profit, makes up the natural price of the commodity in his “adding up” approach.¹

Insofar as the level of rent is regulated not by what the landlord laid out to “produce” or improve the land but by what the farmer can afford to pay, Smith argued that it is naturally a monopoly price. As such, rent is conditioned by demand, which must always be sufficiently high to bring about a price that allows the farmer to pay the rent. Smith thereby concluded that rent “enters into the composition of the price of commodities in a different way from wages and profit. High or low wages and profit are the causes of high or low price; high or low rent is the effect of it” ([Smith 1999](#), 249). The rest of Smith's discussion of rent bears the stamp of the inconsistency resulting from the back-and-forth between the commanded- and embodied-labor approaches to value: Rent is at times perceived as the surplus over the natural price of the commodity, and at other times as a component of the natural price.

David Ricardo presented a more systematic approach to land rent organized around numerical examples. He explained that a settlement will work the most promising piece of land first, moving to less desirable plots with increasing population and increasing demand for food, inevitably leading to diminishing productivity of labor. Ricardo thereby introduced the crucial distinction between average and regulating conditions of production. The best reproducible conditions of production regulate prices and investment in other branches of production. However, since any particular set of production conditions is generally not reproducible in agriculture, prices are regulated “by the most unfavorable circumstances, the most unfavorable under which the quantity of produce required, renders it necessary to carry on the production” ([Ricardo 1970](#), 73).

Ricardo's analysis crucially depends on the assumption of the gradual

movement to inferior plots of land, which is the reason behind increasing agricultural prices. Accordingly, his analysis is restricted to a special case of differential rent upon soil of decreasing qualities. The increase in prices as land of inferior quality is put into use is the source of rent paid for the use of superior lands. “It is only, then,” [Ricardo \(1970\)](#) concluded, “because land is not unlimited in quantity and uniform in quality, and because in the progress of population, land of an inferior quality, or less advantageously situated, is called into cultivation, that rent is ever paid for the use of it” (70).

A crucial difference between Smith and Ricardo is that the latter maintained a more consistent approach to the question of value, in which embodied labor is the determinant of a commodity's value regardless of the level of wages, profit, and rent: “The value of corn is regulated by the quantity of labour bestowed on its production on that quality of land, or with that portion of capital, which pays no rent. Corn is not high because a rent is paid, but a rent is paid because corn is high” ([Ricardo 1970](#), 74). Still, Ricardo's explanation of rent appeals to the technical conditions and natural laws governing soil fertility, which is the ground upon which Marx based his critique and developed his theory of rent pertaining to the capitalist mode of production.

5.2.1 The Significance of Social Form in Marx

It is worth outlining the broad characteristics of Marx's rent theory² and its place in his overall analysis of capitalism before delving into the details. Marx endeavors to grasp the social relations underlying specific forms of appearance. His critique of political economy does not derive from physical forms, material qualities, and use values but from historically specific social relations. In the context of rent, Marx's approach is based not on differential qualities of land but on social relations that follow from the monopolization of the use of soil, in different qualities, in the form of private property ([Murray 1977](#); [Bina 1989](#)).

To avoid the fetishistic belief that social and economic categories (in this case, rent) are generated by things (land), it is necessary to start with the distinction

between use value and value as developed in detail in [chapter 2](#). The use of land is common to all epochs of human history—it is transhistorical. Land as space, a basis for all human activities, can be considered here with its shape, dimensions, location, and other material attributes that condition its social usefulness. In addition, all accumulation under the capitalist mode of production, be it in agriculture or not, is mediated through nonhuman natures providing inputs and the general climatic conditions of production, and serving as a sink for waste ([Vlachou 2002](#), 175). This use value of nonhuman natures becomes most visible in the moment of breakdown, when storms force plant closures or disruptions in the production of input goods disturb global production chains.

Under the capitalist mode of production, the distinctive use value of land is its utilization in the creation of surplus value. In rent-extracting industries, nature plays a role beyond the mediation of production as such: It is used as capital with the help of which commodities are produced, and surplus value is created by human labor. This transformation of land into capital brought about additional and historically specific use values of land. The most important is the separation of producers (peasants and workers) from their conditions and means of production, thereby transforming them into wage laborers. By expropriating the right to use the land from what would become the working class, the Enclosure Acts, foundational to English capitalism, granted this monopolized right to landowners. The monopoly right granted to certain people “of disposing of particular portions of the globe as exclusive spheres of their private will to the exclusion of all others” ([Marx 1991](#), 752) is “a historical precondition for the capitalist mode of production and remains its permanent foundation” (754).

[Marx's \(1991\)](#), 751–52) detailed discussions of rent are confined exclusively to the application of capital in agriculture, leaving aside other capitalist uses of land.³ The latter uses can better be understood through the distinction between land actively used for production and extraction, on the one hand, and land simply used as space, on the other. Use values contained in land, such as minerals, can be extracted, others can be mobilized as productive forces of

nature (hydropower, for instance) or utilized as the basis for continuous reproduction (agriculture, forestry). As [Harvey \(2018, 334\)](#) argued, the first two sets of use values can be designated as *conditions* or *elements of production*, while in the special case of agriculture in the third set, land is also an *instrument* or *means of production* insofar as it contains the very production process within the soil, rather than serving merely as a reservoir of nutrients, seeds, and so forth.

Marx's analysis is built on the assumption that agriculture is fully controlled by dynamics of capital accumulation, which implies that it is not exempt from the tendency to equalization of profit rates resulting from the mobility of capital, albeit in a modified and restricted manner. When agriculture is fully controlled by the dynamics of capital accumulation, it contributes to the formation of the general profit rate. This tendency to equalization of profit rates results from the mobility of capital. As the force regulating and restricting the mobility of capital into its own sphere, however, landed property creates the basis of rent extraction even under full-fledged capitalist production. In this sense, Marx's approach is closer to that of Smith, who emphasized the role of monopoly ownership of land, than Ricardo, who derived rent from the physical attributes of land.

In fact, Marx was careful to avoid the illusion that profit and rent spring from different physical conditions of production. The “enchanted worldview” of commodity fetishism identifies social conditions with physical things ([Marx 1991, 969](#)). It inverts the subject-object relation between humans and capital: It appears that instead of humans producing capital, capital's physical form commands human labor. The fetishistic view of ground rent would start with the use values of natural resources and identify these with the source of rent. In contrast, Marx (755) emphasized that capitalism transforms landed property and agriculture in a very peculiar way by *completely* separating land as a condition of labor from landed property itself. For the landowner, land is a monetary assessment collected from the capitalist, namely the farmer. Neither the use value of land nor its private ownership is in any way related to the production of

(surplus) value and profit, out of which rent is appropriated. The ownership of land merely enables the landowner to “coax” part of the surplus value out of the pocket of the capitalist-farmer, a surplus profit. Accordingly, “it is not the cause of this surplus profit's creation, but simply of its transformation into the form of ground-rent” (786).

As with other spheres of social production, activities based on the use of nonrenewable and nonreproducible resources relate to the rest of the system through the relationship between use value, exchange value, and value. Land, however, is not the product of labor, and hence, it does not have value within the framework of Marxist value theory. Where there is no value, one would not expect to see a price, which is value expressed in money terms. Land and other resources, which are not products of labor, however, do have a price, which is capitalized rent. Landownership enables the appropriation of a portion of total surplus value, which can be capitalized, and once this relationship is established, it starts to appear as the price of land itself ([Marx 1991](#), 786–87).⁴

Since the price of land is not regulated by the socially necessary labor time required to reproduce it, this price reflects a social relation distinct from the production relation linking commodity producers with one another. The appearance in the form of exchange is the same, albeit with a different content. Mobility of capital undermines profit-rate differentials and drives the tendency to equalization of profit rates across industries. In agriculture, this fundamental capitalist law is modified by the fact that accumulation depends not only on the profitability of capitalist farming but also on the obligation to pay rent to the landowner. Landed property hence acts as a barrier to investment in agriculture as well as accumulation within the industry by creating the conditions of *permanent* surplus profits.

As rent is located within the larger, socially dominant context of capital accumulation, it cannot be understood from a static viewpoint. In its historically specific, capitalist form, rent is distinguished from all its previous forms in several ways: First, property rights can be bought and sold. Second, the

landowner is no longer an active agent in production. When landowners operate on their own land, rent extraction from social profits and profit upon exploitation are united within the same person. Third, the landowner no longer appropriates rent directly from agricultural labor. It is rather received as a monetary payment from the capitalist-farmer. Fourth, a crucial use value of land in this context is its role in the production of surplus value and accumulation ([Murray 1977](#), 113–15).

Rent therefore relates to *both* distribution *and* accumulation, or circulation and production. Under capitalism, these spheres are linked through the empirically observable form of money prices, which are a manifestation of the underlying value relations, as detailed in [chapter 2](#). Production on landed property is partially insulated from the economic dynamics of competition between industries, as the social form of landed property inhibits free investment ([Murray 1977](#), 119), especially since the reproduction of the most profitable conditions of production is not possible. This does not change the fact that the capitalist form of landed property is a product of the capital relation and contained in the latter as a historical component. This relative insulation is the cause of the modification of the law of value in the context of nonrenewable or nonreproducible resources.

Finally, the fact that landed property is a relative barrier to the flow of new investment to industries using nonreproducible or nonrenewable resources does not mean that it stands in conflict with capital accumulation. The revolutionary force of capitalism did not sweep away landed property but rather incorporated landownership socially, by transforming land into capital, and economically, by including rent as a component of social surplus value: “Landed property has nothing to do with the actual production process. Its role is limited to transferring a part of the surplus-value produced from capital's pocket into its own. Yet the landowner does play his role in the capitalist production process, not only by the pressure that he exerts on capital and not simply by the fact that large landed property is a premise and condition of capitalist production, but particularly by the way that he appears as the personification of one of the most

essential conditions of production” ([Marx 1991](#), 960).

Three points can be derived: First, the separation of workers from land as a means and condition of production is both a historical and a continual social basis for capitalism to exist. Second, private property in land must be understood within the general context of private property in the means of production. A partial negation of this condition, namely an exclusion of land from this overall ownership structure, can easily cast doubt on other forms of private property. Third, the last sentence in the quoted paragraph is interpreted by some authors as referring to a function attributed to landed property in the proper capitalist allocation of capital to land ([Harvey 2018](#), 361–62).

It will be easier to grasp the specifics of Marx's theory of rent with the general remarks made in this subsection. Marx distinguishes three forms of rent: absolute, differential and monopoly. Regardless of its form, he discusses rent through a comparison between the conditions in agriculture and those in industry. He is interested in exploring how the laws that apply to other spheres are modified by the presence of landed property.

5.2.2 Absolute Rent

Absolute rent is the basic form of rent: a surplus profit extracted by all landowners based on the simple fact of private ownership and nonreproducibility of land. Even when no other mechanism generates rent on the land in question—that is, when differential rent equals zero—the landowner will still not allow its use without charging rent. This point presupposes collective action on the part of landed property owners—namely, not leasing other plots of land until absolute rent is paid for the plot in question. Since owners of every plot of land receive absolute rent once such collusion is established, their class interest is the *basis* of absolute rent. [Marx \(1993\)](#) pointed to the material basis for this collective action: “This assumption [no rent being charged on the worst-quality land] would mean abstracting from landed property, it would mean abolishing landed property, whose very existence is a barrier to the investment of capital and its unrestricted

valorization on the land—a barrier that in no way collapses in face of the farmer's mere reflection that the level of corn prices would enable him to obtain the customary profit on his capital by exploiting land of type A [worst-quality land], as long as he did not pay any rent" (884).

Depending on its use in production and depending on the state of demand for the commodity produced upon it relative to its supply, the same plot of land commands different amounts of absolute rent: The rent per square kilometer is different between agriculture, fossil fuel industries, and mineral mining operations. By disallowing the flow of *new capital* on *new* (that is, formerly *uncultivated* and *unleased*) *land* without paying *absolute rent*, landed property forces the market price of the produce of land above its price of production.

Marx discussed absolute rent under the assumption of an organic composition of capital in agriculture that is lower than the social average, which implies that the value of agricultural commodities is above their price of production. As discussed in detail in [chapter 2](#), different sectors contribute to the creation of total surplus value in proportion to the variable capital (living labor) they employ but receive surplus value from this pool in proportion to the total capital (constant and variable) they advance. If the organic composition of capital in a sector is lower than the social average (that is, if it employs more living labor relative to constant capital compared to the social average ratio), then the value of its product stands above its price of production, meaning that part of the surplus value produced by labor power in this sector is redistributed to other sectors in the process of the equalization of profit rates ([Marx 1991](#), 892–93). This presumes that competition between capitals is not prevented by any barriers. Landed property, however, represents one such barrier:

If the opposite occurs, i.e. capital comes up against an alien power that it can overcome only partly or not at all, a power which restricts its investment in particular spheres of production, allowing this only under conditions that completely or partially exclude that general equalization of

surplus-value to give the average profit, it is clear that in these spheres of production a surplus profit will arise, from the excess of commodity value above its price of production, this being transformed into rent and as such becoming autonomous vis-à-vis profit. And it is as an alien power and a barrier of this kind that landed property confronts capital as regards its investment on the land, or that the landowner confronts the capitalist.

(896)

Absolute rent as an outcome of *intersectoral competition*, arising from this excess of value over the price of production, is therefore nothing but a portion of agricultural surplus value snatched by the landlord and thereby converted into rent ([Marx 1991](#), 898). This is the *source* of absolute rent. Hence, according to this formulation, the difference between the commodity's value and its price of production represents the upper limit of absolute rent that can be extracted.

Two aspects of this framework have been questioned. First, the assumption of a relatively low organic composition of capital in agriculture was not justified by Marx himself historically or logically. If the source of absolute rent is the relative backwardness of agriculture, one would then expect that it would disappear at a certain point of capitalization of this sector. In fact, [Marx \(1991, 899\)](#) argued that absolute rent in this sense would disappear if the average composition of agricultural capital equaled that of the average social capital. The second objection is related to the first one: If absolute rent is the result of the collective action of landowners using their monopoly power to charge rent even on the worst plot of land, why should the value of the product represent an upper limit to the market price? In this case, the market price could be increased beyond the value of the commodity, and according to some authors, the concept of absolute rent would become altogether obsolete, as it could no longer be distinguished from monopoly rent.⁵

These issues continue to cause controversies on the origin and level of absolute rent in the more recent Marxist literature. Maintaining Marx's original

formulation of the source and basis of absolute rent, [Fine \(1979\)](#) argued that entry barriers allow agriculture to realize the extra surplus value that results from the industry's relatively low organic composition of capital, while [Ball \(1980, 319\)](#) derived absolute rent only from the withholding of land from cultivation until rent is paid on land where no other kind of rent is generated. In the latter case, both the difference between the price of production and the value of the commodity and the organic composition of capital in agriculture are irrelevant. [Basu \(2018a, 14\)](#) traced absolute rent to agriculture's ability to retain surplus profit within the industry because of its lower organic composition of capital, while in a later reformulation he claimed that absolute rent cannot exist after capitalist production has taken full hold of agriculture ([Basu 2022](#)). [Ramirez \(2009\)](#), on the other hand, claimed that it is the social relation of monopolized landownership that allows for persistent extraction of absolute rent. Furthermore, a general surplus profit in agriculture has also been related to access to cheap, precarious, and often immigrant labor. This is, however, quite distant from Marx's basic definition of absolute rent as a payment that the capitalist has to make to the landowner to gain access to even the worst plot of land.

What are the implications of absolute rent and the controversies related to it? Is the tendency to equalization of profit rates eliminated or suppressed by nonreproducible inputs in the presence of rent? Capital is still in search of surplus value, and it is invested in a particular sphere if and only if it expects to earn *at least* the normal rate of profit. Assuming both conditions mentioned by Marx, namely a relatively low organic composition of capital and collective action on the part of landed property, are satisfied, the modification brought about by landed property is that part of the surplus value produced in agriculture is either in part or fully insulated from the general principle of redistribution of surplus value across industries. In this case, the level of absolute rent depends on the relationship between supply and demand ([Marx 1991, 896](#)) and on the class struggle between landed property and capitalists.

The question of the possibility of absolute rent when the organic composition

of capital is not relatively low, and whether it is possible to distinguish absolute rent from monopoly rent, will be revisited in [sections 5.2.4 and 5.2.5](#). At this point, it suffices to note that it would be a false generalization to attribute absolute rent solely to monopoly ownership of the underlying resources and thereby consider it the same thing as monopoly rent. *All rent* is derived from monopoly conditions, and a reference to the latter does not help distinguish between different forms of rent.

5.2.3 Differential Rent

Beyond absolute rent, landed property bears two forms of differential rent. While all landowners can extract absolute rent provided that the necessary conditions are satisfied, differential rents are surplus profits based on the combination of variations in the fertility of land⁶ and variations in the amount of capital invested across different plots of land. What Marx later called differential rent of the first kind (DR-I) was described by David Ricardo in the chapter on rent in his *Principles*, and the latter work is often cited to illustrate decreasing marginal productivity of capital in neoclassical production models.⁷ Ricardo's emphasis—contra vulgar economists—on the link between rent and price formation is crucial. No matter what modifications landed property brings about, the value of agricultural products is still regulated by the quantity of labor bestowed on their production on that plot of land that pays no rent.⁸ The price of corn, still regulated by the underlying production conditions, is not high because rent is paid; rather, rent can be paid precisely because the price of corn is high, which is to be explained on value-theoretic grounds ([Ricardo 1970](#), 67–75).

In the same chapter, Ricardo introduced one of his greatest contributions to classical political economy, namely the distinction between *average* and *regulating conditions of production*. His illustration opens with the best available (most fertile) land, which is cultivated first. At this point, the costs of production on this land will determine the natural price⁹ of the agricultural commodity, and the regulating (best) and average conditions of production will coincide.

Progress of society and increases in its population will, however, increase the demand for agricultural products and raise market prices. Sooner or later, the next-best land will start being cultivated to meet demand. At this point, the market price will be sufficiently elevated to cover the higher natural price associated with the second plot of land of lower quality, and more importantly, the regulating conditions will now move to the inferior land, implying that the new center of gravity for market prices will be the higher natural prices resulting from the last plot of land cultivated. Since the market price will be uniform, the capitalist working on the superior plot will earn profits greater than normal. Gradual movement to plots of worse quality will continue over time with the increase of population, thereby increasing the gap between the regulating (worst) and average conditions of production and bestowing excess profits on all lands but the worst. It is this permanent excess profit that is captured as differential rent by the landowner.

Marx's theory of rent incorporates Ricardo's analysis and numerical examples as the first kind of differential rent. As production increases, the distance between average and regulating cost prices widens, and the total rent appropriated in the whole industry grows. This is where the intervention of landed property modifies *the transformation of value into prices*—to be more precise, the transformation of direct prices into production prices—a step that is fundamentally amiss in Ricardo, who did not distinguish between constant and variable capital. When the worst production conditions regulate new investment, market prices gravitate around the prices of production arising from these conditions. The capitalist-farmer working on the worst land needs to make the normal profit rate if they are to stay in business.

Still, the determination of market prices (and prices of production) is a social act based on the exchange value of the products and not upon the material attributes of the soil determining its fertility ([Marx 1991](#), 799). Here, Marx went beyond Ricardo's extensive margin, as differential rent does not arise from differential fertilities of land but from the historically specific form of capitalist

agriculture. Identification of the relations of production with the physical properties of land as capital is a fetishistic reversal of the subject-object relation: “The natural force is not the source of the surplus profit, but simply a natural basis for it, because it is the natural basis of the exceptionally increased productivity of labour. Use-value is altogether the bearer of exchange-value but not its cause” (786).

In the opening paragraphs of his chapter on rent, [Ricardo \(1970](#), 67) defined rent as “that portion of the produce of the earth, which is paid to the landlord for the use of the original and indestructible powers of the soil.” Reflecting on this statement, [Marx \(1969](#), 245–46) rejected the notion that land has indestructible or original properties. He emphasized the role of other productive forces in transforming land in capitalist production. The fertility of soil is *always* the product of both a historical and a natural process, and once this is admitted, it is evident that the sequence of types of soil to be cultivated can proceed from better to worse or worse to better ([Marx 1991](#), 790). In other words, even under the assumption that equal amounts of capital are applied to different plots of land with varying levels of fertility, Marx still rejected the law of diminishing returns in agriculture.

The insight that capitalism transforms ownership structures, competition, and finally production technologies in agriculture took Marx to the second kind of differential rent. He noted the increasing capitalization of the industry through the use of industrial fertilizers and machinery. Much as in manufacturing, capitalist-farmers can increase labor productivity through advanced technology and realize surplus profits. Marx described these surplus profits as differential rent of the second kind (DR-II). DR-II resembles the productivity-based surplus profits accruing to the regulating capital in non-rent-extracting industries, in which boosting productivity through increased capital investment is a foundational competitive strategy, and this strategy serves the function of decreasing production costs and production prices when newer technologies are imitated throughout the industry. At the same time, capitalization can

persistently transform (improve) the land and bring about differential rent of the first kind.

Differential rents of the first and second kinds are thus intimately intertwined. Considering DR-II, Marx insisted that “its basis and point of departure, not only historically but as far as it concerns movement at any given point in time, is differential rent I, i.e. the simultaneous cultivation alongside one another of lands of different fertility and location, the simultaneous application alongside one another of different components of the total agricultural capital to tracts of land of differing quality” ([Marx 1991](#), 814). When the normal case is the application of unequal capitals to plots of unequal fertility, and when fertility is as social and economic a phenomenon as it is natural, DR-I and DR-II cannot be understood as additive components of the general category of rent. They constitute each other's grounds and limits.

If DR-I and DR-II could be considered in isolation from one another, identifying rent quantitatively would be relatively simple. It would boil down to determining the worst land in the case of DR-I, and the normal capital in the case of DR-II. However, since (1) the two forms of rent always coexist, (2) the level of rent associated with a particular plot of land can change even if no new investment accrues to that land,¹⁰ (3) the productivity of new investment can be higher than, lower than, or equal to the average level, and (4) the regulating price of production can consequently rise, fall, or remain the same, Marx ran through every possible scenario with the help of numerical examples.¹¹

Several important conclusions follow from Marx's study of various scenarios.

First, what Ricardo considered a necessity—namely that diminishing productivity of new investment leads to a rise in the regulating price of production, whereby the rent share increases and squeezes the profit share—is only a special (and rather unlikely) case. There is no predetermined, necessary relation between changes in rent and changes in profit in this dynamic context.¹²

Second, the sequence of movement from better to worse plots of land is not a necessity, either. It is just a special case among various possibilities, not justified

as an a priori assumption as in Ricardo.

Third, Marx thereby departed from both Ricardo and the greater shadow of Malthusianism. Diminishing returns (and scarcity) derived from the material conditions and attributes of soil need to be always considered in the context of the historically specific social form of production. Marx's framework allows for the exhaustion or destruction of certain properties of soil (diminishing returns) as a result of the accumulation imperative as well as increasing returns brought about by fertilizers, advanced machinery, and so forth ([Fine 2019](#), 411–12).

Fourth, the issue of formation and appropriation of rent is not a question of distribution only. The whole discussion of rent presupposes both the tendency to equalization of profit rates under capitalist competition and the formation of prices of production as the center of gravity for market prices. Rent is paid after regulating profit rates between industries are equalized and after prices of production without rent are established. This is why we insist that rent does not negate the law of value. It rather constitutes a frontier that is contained in that law. The historical and contemporary relevance of landed property and the rent relation can be understood only in this context, which is discussed in [section 5.2.6](#).

5.2.4 *Monopoly Rent*

Absolute rent and differential rent are results of the historical genesis of capitalist production in England and the violent monopolization of land throughout the domain of its propagation. Their continued existence emphasizes the foundational role of landownership for capitalist accumulation. Rent can exist, apart from this, on the basis of a “genuine monopoly price, which is determined neither by the price of production of the commodities nor by their value, but rather by the demand of the purchasers and their ability to pay” ([Marx 1991](#), 898). Like absolute and differential rent, monopoly rent is based on restricted, monopolized ownership over means of production (in this case, portions of land) as a social relation. The term *monopoly price* is hence not

helpful when it comes to distinguishing between different forms of rent—in this case, distinguishing monopoly rent from the “normal” forms of rent—unless the mechanisms by which rent is created and appropriated are specified.

The Marxist notion of monopoly rent specifically relates to surplus profits due to *persistent* imbalances between supply and demand. At first sight, it might seem difficult to distinguish monopoly rent from absolute rent. [Marx \(1993, 910\)](#) strove to clarify the mechanisms underlying the formation of a monopoly price by distinguishing between two cases:

It is necessary to distinguish whether the rent flows from an independent monopoly price for the products or the land itself, or whether the products are sold at a monopoly price because there is a rent. By monopoly price here we mean any price determined simply by the desire and ability of the buyer to pay, independently of the price of the product as determined by price of production and value. A vineyard bears a monopoly price if it produces wine which is of quite exceptional quality but can be produced only in a relatively small quantity. By virtue of this monopoly price, the winegrower whose excess over the value of his product is determined purely and simply by the wealth and the preference of fashionable wine-drinkers can realize a substantial surplus profit. This surplus profit, which in this case flows from a monopoly price, is transformed into rent and accrues in this form to the landowner by virtue of his title to the portion of the earth endowed with these special properties. Here, therefore, the monopoly price creates the rent. Conversely, the rent would create the monopoly price if corn were sold not only above its price of production but also above its value, as a result of the barrier that landed property opposes against the rent-free investment of capital on untilled land.

The first case pertains to resources of very special quality. There will be some wealthy wine drinkers who are willing and able to pay a high price, giving rise to

a surplus profit that will accrue to the landowner in the form of monopoly rent. Here, it is still the monopoly price that creates the rent, and the persistent obstacle keeping supply below effectual demand cannot be eliminated by paying the rent. The second case derives from the collective power and actions of landowners. If the latter collectively refuse to lease the unused land unless such a high rent is paid, the market price is pushed above the value of the agricultural product. In this case, it is the collective power of landowners that is formative of rent, and it is the rent charged that is formative of the monopoly price ([Marx 1991](#), 910–11).

Regardless of the mechanism underlying the formation of monopoly price, the latter implies that the market price is above both the price of production and the value of the commodity, meaning that a portion of the surplus value created in other industries is being annexed ([Marx 1991](#), 971 and 1001). Surplus value produced elsewhere in the economy accrues to the capitalist in the form of profit if the reason for the price being above the commodity's value (and price of production) is the relatively high organic composition of capital in the industry in question. Otherwise, this surplus value accrues to monopolized ownership in the form of rent. We thus believe that while the first case described by Marx in the paragraph quoted above genuinely represents monopoly rent, the second case represents absolute rent in its form (because of the mechanism pushing the price above the value) and monopoly rent in content (because of the appropriation of surplus value produced in other industries, too).¹³

Marx believed that the role of monopoly rent is limited *in agriculture* because of its narrow applicability ([Marx 1991](#), 906).¹⁴ More generally, to the extent that monopoly rent that derives from underlying extraordinary conditions or exceptional qualities (such as in the case of trade in antiques or artworks) is of peripheral importance for the study of generalized commodity production since the latter presumes reproducibility ([Harvey 2018](#), 350). In other domains, however, such as the study of house and land rents (and prices) in densely populated areas as well as a host of other phenomena discussed below, we

believe that rent theory (and monopoly rent) is of utmost importance for the study of contemporary capitalism ([Figure 5.1](#)).

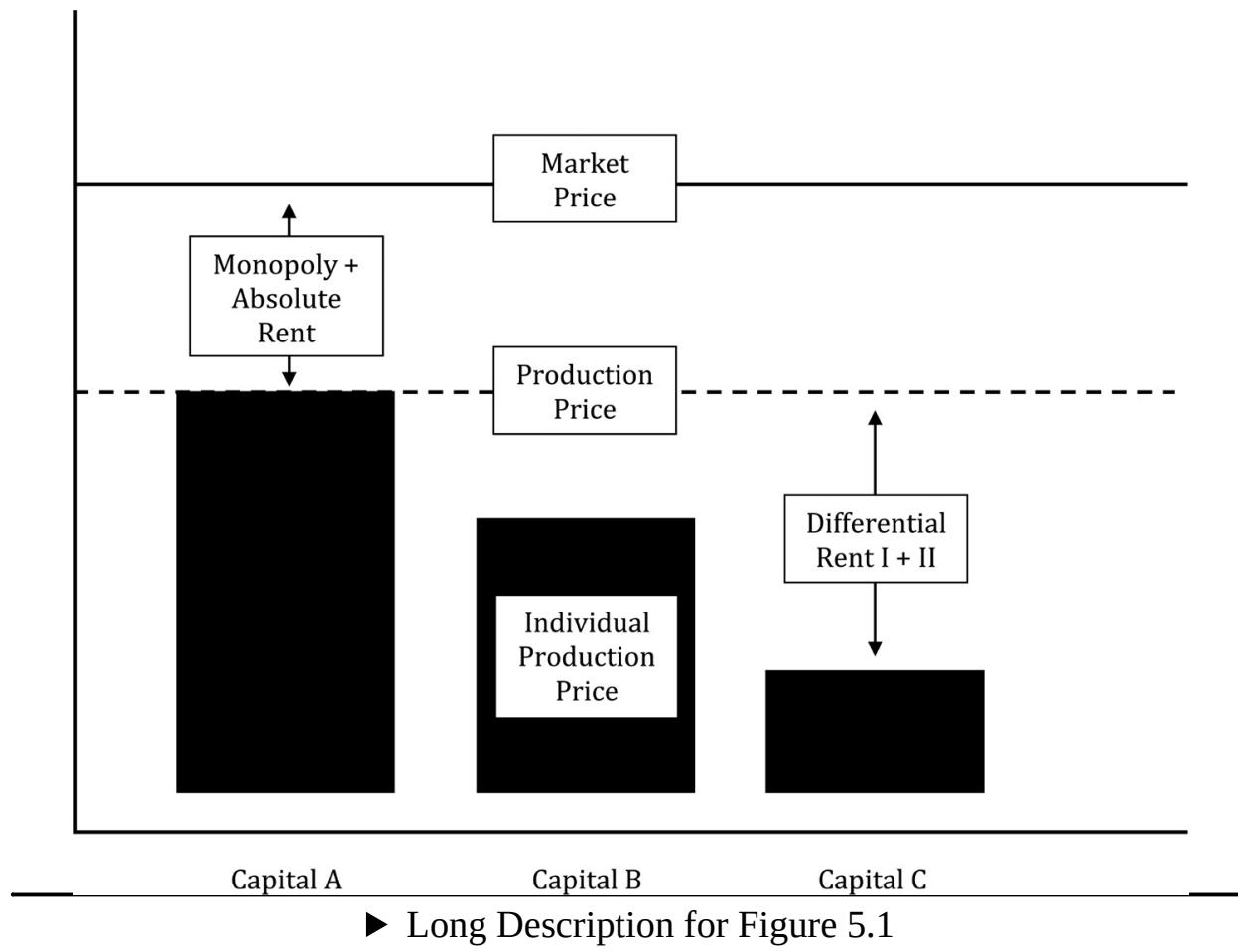


Figure 5.1 Absolute, differential and monopoly rents [◀](#)

5.2.5 Some Discussions on Rent Theory

Rent, regardless of its specific form, is for Marx ultimately a portion of social profits and paid from aggregate surplus value, be it produced by agricultural or industrial workers. This aspect of Marx's rent theory came under fierce attack, particularly from a neo-Ricardian viewpoint that maintains that Marx's transformation of values into prices of production is problematic and that Marx's value theory is, apart from being flawed, redundant because one can reach most of its conclusions by starting with prices of production.

[Arghiri Emmanuel \(1972\)](#), 216–26), for instance, underlined that all of Marx's numerical examples are based on the premise that agricultural (market) prices are governed by value, and he claimed that this premise must be abandoned because the existence of landownership does away with the competition of capitals. Emmanuel concluded that only the monopoly of landownership enables the transfer from the capitalist to the landowner, and value does not represent an upper limit to the price of the commodity because it is irrelevant in the context of landownership.

Emmanuel's target here is the concept of absolute rent, which is, according to Marx's original formulation, limited to the difference between the value of the commodity and its price of production. Echoing [Bortkiewicz \(1911\)](#), Emmanuel asked why landed property, endowed with the capacity to withdraw landed means of production from capitalists' use, should reach a limit once market prices hit labor values. In accordance with their bargaining power, landowners should strive to push prices beyond values by charging a higher rent. Emmanuel argued rent is solely a question of monopoly power and monopoly prices, regulated by the forces of supply and demand.

For Marx, the first essential difference between absolute and monopoly rent is concerned with their origins. Absolute rent results from the nonreproducibility of production conditions and conversion of part of the agricultural surplus value into rent, while monopoly rent absorbs part of the surplus value produced in other sectors. If the price of the commodity exceeds its value—as put forward by Bortkiewicz and Emmanuel—rent is greater than the underlying agricultural surplus value. The mechanism that transforms the surplus value (produced in both agriculture and other industries) to rent is not changed by this adjustment: It is still landed property's prohibition of new investment in uncultivated land without paying an absolute rent. We hence argue that this rent resembles absolute rent in its form and monopoly rent in its content, at least insofar as part of the surplus value appropriated is generated in other industries.¹⁵

The second essential difference between the two types of rent relates to the

nature of adjustment brought about by their presence. In this respect, the question raised by Bortkiewicz and Emmanuel—why the market price of the commodity cannot be raised to arbitrarily high levels—was explicitly addressed by [Marx \(1969, 322–23\)](#) when he reiterated that rent is not a negation of the law of value but a frontier to it:

But, it may be asked: If landed property gives the power to sell the product *above* its cost-price [price of production], *at* its value, why does it not equally well give the power to sell the product *above* its value, at an arbitrary monopoly price? On a small island, where there is no foreign trade in corn, the corn, food, like every other product, could unquestionably be sold at a monopoly price, that is, at a price only limited by the state of demand, i.e., of *demand backed by ability to pay*, and according to the price level of the product supplied the magnitude and extent of this effective demand can vary greatly. Leaving out of account exceptions of this kind—which cannot occur in European countries; even in England a large part of the fertile land is *artificially* withdrawn from agriculture and from the market in general, in order to raise the value of the other part—landed property can only affect and paralyse the action of capitals, their competition, in so far as the competition of capitals modifies the determination of the *values of the commodities*.

Because competitive pressures operate deep below the surface, the market price of agricultural commodities cannot be arbitrarily increased through the withholding of land by landowners. The presence of a monopoly price is conditioned by a persistent (artificial) scarcity of land in this context. Absolute rent is the price paid by capitalists to remove the artificial scarcity imposed by landed property. When capitalists pay the amount of (absolute) rent demanded by landed property, the obstacle is removed, and new plots of land are taken into cultivation. This mechanism ensures that the total land under cultivation

coincides with the amount necessary to meet effectual demand under normal conditions (that is, yielding a normal profit for the capitalist) ([Fratini 2018](#), 980–81). In the case of a genuine monopoly price, which creates monopoly rent, it is not possible to remove the obstacle, for the latter is beyond the control of landed property. The supply of wine of extraordinary quality or of an apartment next to a park in the city center cannot be increased by paying additional rent. This is a crucial distinction between the concepts of absolute and monopoly rent, which is not impaired by the objections raised by Bortkiewicz and Emmanuel in any way.

To summarize, rent as a general category modifies the law of value but does not eliminate it. The defining features of capitalist production—namely, the tensions between use and exchange values and between concrete and abstract labor, and the subordination of use values (to exchange values) and concrete labor (to abstract labor)—are not obliterated by landownership and are still present in industries with landed property. The social division of labor, and the allocation of social labor between firms and industries, is still governed by the distribution of private capitals to various sectors, which is itself regulated by profitability. The tendency to equalization of profit rates is still the beating heart of capitalist competition, encompassing all sectors, including those in which rent must be paid to the monopoly owners of relevant resources. No capitalist would invest in those sectors if they were not to expect normal profits after paying rent.

The relative (and limited) insulation of industries in which nonreproducible and nonrenewable resources are used brings about modifications in the transformation of values into prices—just as variations in the organic composition of capital across industries do relative to a state in which commodities exchange at prices proportional to values. We expect to see greater and more persistent deviations between values, prices of production, and market prices in the presence of rent. It is still contained in value theory, however, insofar as the surplus value insulated from redistribution across capitalists is nothing but a part of the total surplus value produced through capitalist processes of production and appropriated by a social class whose existence and function is

conditioned by capital itself. To the extent that prices of production are essential for the study of rent-generating sectors, the underlying processes of (surplus) value creation and distribution—and hence, value as a real abstraction—are indispensable to understanding the dynamics of the capitalist production process as a whole, including its frontiers in which the rent relation operates.¹⁶

An important question that remains to be addressed concerns the role of landed property and rent relation in general. Below we tackle this question both in the historical context of landownership, which lay at the center of the discussion for classicals and Marx, and in the context of contemporary capitalism with diverse manifestations of the rent relation. We have so far seen that in agriculture, landed property (and the rent relation) is the expression of the contradiction between the use value of land as a condition and means of production, on the one hand, and the value form taken by commodities produced with the help of land, on the other. In addition to the material attributes and cyclical temporality of land, which impose constraints on the turnover time of capital and thereby slow down accumulation, the institutional form of landed property, too, hampers capital accumulation by appropriating part of surplus value and excess profits in agriculture and limiting the flow of capital to this sector.

5.2.6 Three Shifts Incorporating Landed Property in Capitalism

In its historical development, capital attempted to escape the fetter imposed by landed property in multiple ways while transforming landownership into a capitalist relation. As landed property has prevailed through all of capitalist history since its formative role in enclosure, it was assimilated into its capitalist form by turning land into capital and incorporating landownership into capital accumulation. The first and most obvious shift was spatial: to expand to new, uncultivated areas of the globe, unoccupied lands, wetlands, or former forests, or to expand through colonization. The combined motivation to reduce rent on old lands, become a landlord and rent extractor, and exploit cheap wage labor or

precapitalist forms of labor is part of what constitutes the immanent geographical expansion of the capital relation.

A second shift was the real subsumption of landownership—an institutional transformation to turn farmers into landowners in order to create owner-occupied lands. In addition to financial difficulties related to the purchase of land and its aftermath (such as access to the credit system, high debt, and an interest burden) that restrict new investment and increase the individual price of production ([Marx 1991](#), 944), the farmer, as soon as they buy the land and become an owner-occupier, occupies the position of a rent recipient, who is interested in *both* applying capital to their land *and* limiting the flow of new capital to the sector. Therefore, capital, as a contradiction in motion, ends up only temporarily escaping—or avoiding—the problem and reproduces it on a larger scale ([Murray 1978](#), 13–20).

A third shift was the significant increase in the amount of capital invested per acre of land (and sectors related to agriculture) to diminish the role of fertility differentials in the overall process. This increase comprised the use of advanced means of production (such as tractors), elimination of natural interruptions and increase in turnover time (through greenhouses, irrigation, artificial sunlight, fertilizers, artificial climate conditions, improved transportation, refrigeration), increase in yields (through soil nutrients, pesticides to control disease), and so forth. The resulting tremendous increase in agricultural productivity experienced in advanced capitalist countries in the twentieth century did bring about a decrease in the *relative* significance of rent as the share of rent in agricultural income fell.

Nonetheless, all such shifts—all attempts at avoiding the manifestation of a capitalist contradiction—have their limits. The first reason is that, especially in the case of owner-occupied lands, the change in the form of rent into interest paid to banks must be noted. Second, contradictions associated with landed property and rent are reproduced in other countries through a continuous adjustment of the international division of labor ([Murray 1978](#), 22–28). And

third, rent remains relevant as rent extraction is extended to other sectors and the relative economic importance of rent-extracting sectors in fossil fuel extraction and rare earth mining increases.

In light of the first and third points, the special character of land and rent and their similarity to interest-bearing capital must be emphasized. What is bought, within a capitalist context, is not the land itself but the title to the stream of rents it will potentially generate, implying that there is always a speculative, fictitious element to the trade in land (and to rent-generating titles in general) ([Marx 1991](#), 944):

The price of land is nothing but the capitalized and thus anticipated rent. If agriculture is pursued on a capitalist basis, so that the landowner simply receives the annual rent and the farmer pays nothing for the land besides this, it is obvious that the capital which the landowner himself invests in purchasing land ... has nothing at all to do with the capital invested in agriculture itself [I]t procures a title for the purchaser to receive the annual rent, but it has absolutely nothing to do with the production of this rent.

This is the ultimate in the capitalist form of rent and landownership. Capital invested in land is no different from investments in government bonds or other financial instruments. It is a claim on future revenues—that is, future profits and labor ([Marx 1991](#), 945–46; [Harvey 2018](#), 347–48). The price of land depends primarily on the rent it is expected to afford, which itself is based on the profit that is expected to be made using land. The buyer is making a bet on future revenues, and accordingly, rent is a *first derivative* of real capital. Financial derivatives such as futures, options, and collateralized debt obligations are *second derivatives*, whose value is determined by the future price of some underlying asset. There can be derivatives of third and fourth degrees, and so forth, arising by creating new financial derivatives based on existing derivatives.

The end result is an inverted pyramid with real profits at the base and ever-widening volumes of financial assets stacked upon it ([Shaikh 2016](#), 231). Rent, therefore, no matter its specific form and origin, is ultimately conditional on the extraction of surplus value, albeit having its own autonomous speculative dynamics.

The role played by landed property (and the rent relation in general) can be reconsidered in light of its perception as a special case of fictitious capital. A pervasive form of financial derivative of the second degree is represented by the financialization of owner-occupied property mortgages. Two different rents are at stake here, namely the rent for the building (be it a house, warehouse, factory, dock, and so on) and that for the land. In the context of housing rents, a large portion of the rent is likely to derive from monopoly rents given the increasing demand for shelter in densely populated areas and given that the rate of increase in the stock of buildings (that is, the source of new surplus value generated within this sector) is rather low ([Marx 1991](#), 908).

At the same time, landed property might be interested in fostering accumulation. In the case of British coal mining, for instance, landowners were committed to fixed investments in the soil (and what lay underneath) to attract capitalists and gain higher royalties. Landowners hence cannot be said to be irrelevant to the generation of surplus value upon their premise ([Fine 2019](#), 454).

The parallel drawn between rent relation and fictitious capital implies that the depiction of the former as a purely parasitic and mischievous endeavor is one-sided and deficient. A similar attitude is found in the large bulk of the financialization literature studying the characteristic evolution of economies over the past few decades. Numerous financialization studies focusing on various countries document the fall in the wage share, increase in so-called rentier income, increase in personal income inequality, decrease in real investment and job creation, rise in housing poverty, rise in household indebtedness, and sacrifice of long-term productivity gains and growth.¹⁷ What is overlooked is that fictitious capital does boost current revenues by securitizing prospective

revenues and labor and through the transformation of formerly public domains (privatization of pension and welfare rights, housing, and urban spaces; land grabs). Accordingly, financialization is a contemporary form of so-called original accumulation.¹⁸ Original accumulation, in its various forms, has always coexisted with the predominant form of capital accumulation through the exploitation of living labor power in the process of production ([Mandel 1976, 46](#); [Moore 2015](#)).

From a political perspective concerned with society at large or the working classes, the picturing of activities associated with rental income, or financialization for that matter, as purely parasitic could perhaps be understood. Nonetheless, from the viewpoint of capital accumulation, their overall role seems rather ambiguous. Just as interest-bearing capital seizes part of aggregate surplus value in the form of interest and hence hampers capital accumulation but also amplifies capital accumulation by reducing the turnover time and boosting aggregate demand, the circulation of capital in search of rent might help coordinate investments for the sake of current and future surplus value production and appropriation. In accordance with the nature of capital, this whole process is rife with its own contradictions such as intensified speculation, formation of bubbles, distortion of the financial system, and even systemic crises as in the aftermath of 2007–2008, not to mention the social and environmental implications of expanded reproduction of capital. From the perspective of this book, these are not curious outcomes or irrational tendencies conflicting with the disposition of capital but rather internal moments of the rationality of capital as a complex of moving contradictions.

In the next section, we discuss the role of rent within the law of value from an empirical perspective building on our baseline model introduced in [chapter 3](#), which captures the deviations between direct prices, prices of production, and market prices. Rent is approached as one of the key sources of systematic deviations between prices of production and market prices. In addition, we aim to demonstrate the specific function of rent in the dynamics of accumulation and

reproduction of social division of labor, linking up with the specific ways capitalism has brought about the ecological breakdown.

5.3 Empirical Model and Results

Ground rent modifies the law of value in capitalist economies, meaning that its existence distorts the social division of labor according to production prices *without* fundamentally negating the relationship between production prices and market prices. The presence of ground rent adds a new layer to the regular price-value relationship, a pattern of systematic deviations. Empirically, this implies that the deviations between market and production prices can be explained with a statistical model: Ground rent creates positive deviations between production prices and market prices (or it diminishes negative deviations, which is statistically equivalent).

Ground rent is surplus profits for landed capital, paid out of social surplus value. Our model is based on multiregional input-output tables that record flows of circulating and fixed capital between industries. We observe the part of social surplus value taking the form of ground rent, which is a flow within the category of aggregate firm profits. This does not mean, however, that rent cannot originate from other sources. It can originate from personal income (in the case of consumer price surcharges) or a wage rate systematically lower than the average, made possible by limitations on the outward mobility of labor (as with precarious farm labor). We argue that part of absolute rent in agriculture is generated by low wages of precarious workers, often with insecure legal status.¹⁹

Attempting to empirically estimate ground rent, especially in its different forms, is nontrivial because of two complications: (1) the distinct character of ground rent from value transfers between or within industries in the context of the law of value; and (2) the interplay of within-industry and between-industry competition when using data aggregated at industry level.

As regards the first point, regular within-industry value transfers from less to

more productive capital and regular between-industry value transfers from lower to higher organic compositions of capital (in the process of forming the general profit rate) operate within the law of value as does DR-II, which is itself a consequence of capitalization. It is difficult, however, to empirically separate the lasting impact of capital use on the fertility of nonproduced goods used as capital, such as agricultural land, resulting in DR-I.

Regarding the second point, ground rent is the outcome of the interplay of within- and between-industry competition. Absolute rent expresses the nonreproducibility of the dominant production condition of a commodity, bringing about a modification of between-industry competition by inhibiting cross-industrial investment. Differential rents of the first and second kind express differences in the production conditions of the same commodity, which are not fully subject to tendential and turbulent equalization, again because of the nonreproducibility of land.²⁰

Multiregional input-output tables, and available data from most national accounts, reflect only the between-industry dimensions of this complex picture. At the same time, we have industry-level data on land use and extraction quantities, and land used and extracted resources are the physical bearers of ground rents. Therefore, in what follows, we do not empirically distinguish between absolute and differential rents of the first and second kind. We rather estimate the extent to which deviations between market prices and production prices—both positive for landed producers and negative for downstream purchasers of landed producers' products used as circulating or fixed capital—are explained by land use and mining/extraction quantities. This allows us to robustly estimate ground rents and demonstrate that their impact on price-value deviations is significant but volatile.

5.3.1 Empirical Model for Measuring Price-Value Deviations

The fixed capital model of direct prices, production prices, and market prices introduced in [chapter 3](#) represents the point of departure in our analysis of

ground rent. Direct prices correspond to the relative monetary price of the total (direct and indirect) labor time socially necessary to reproduce a commodity. To calculate direct prices, in a first step we account for labor skill differences across industries to estimate socially necessary labor time in each industry. Drawing on [Shaikh and Glenn's \(2018\)](#) argument that occupational wage differences correspond to differential costs of reskilling, we correct the direct labor vector \mathbf{l} by normalizing it by the global wage average $\bar{w} = \frac{W}{L}$, where W is the global sum of employees' compensation and L is aggregate hours of employment. The skill-adjusted direct labor coefficient for the j th sector gl_j is therefore

$$gl_j = \frac{1}{\bar{w}} \times \frac{W_j}{X_j} = \frac{w_j}{\bar{w}} \times \frac{L_j}{X_j} \quad (5.1)$$

where W_j and X_j are the wage bill and gross output of the j th sector, respectively. The term $\frac{w_j}{\bar{w}}$ expresses the wage rate in the j th sector relative to the average wage rate and therefore serves as an approximate index of relative skills.

To calculate the $n \times 1$ vector \mathbf{v} of total (direct and indirect) labor, we use the Leontief inverse matrix of circulating and fixed capital in all sectors. Circulating capital is denoted by \mathbf{A} , which is an $n \times n$ matrix with a_{ij} representing the output of industry i used in the production of one euro's worth of commodity j .^{[21](#)} Similarly, \mathbf{D} is an $n \times n$ matrix of depreciation, obtained by normalizing the fixed-capital-flow matrix^{[22](#)} \mathbf{K} by the gross-output vector \mathbf{X} . Consequently, the matrix $(\mathbf{A} + \mathbf{D})$ stands for the circulating and fixed capital requirement for one euro's worth of output, and vertical integration of the skill-adjusted-labor vector with this matrix yields the total labor vector \mathbf{v} , which is expressed in labor hours or full-time employment depending on the data source:

$$\begin{aligned}
\mathbf{v} &= \mathbf{gl} + \mathbf{v}(\mathbf{A} + \mathbf{D}) \\
\mathbf{v}(\mathbf{I} - \mathbf{A} - \mathbf{D}) &= \mathbf{gl} \\
\mathbf{v} &= \mathbf{gl}(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1}
\end{aligned}$$

(5.2)

The total labor vector \mathbf{v} reflects the fact that a commodity, as a product of labor, can be exchanged for any other commodity, equally the product of labor. The underlying exchange value does not depend on physical properties, such as mass or aesthetics, nor on personal preferences. Furthermore, capitalist commodity production is carried out in firms that compete with each other under the imperative of capital accumulation. At the highest level of abstraction (that is, in the absence of nonproduced capital goods, and under conditions of perfect mobility of capital and labor across borders), new investment will flow toward industries with above-normal profit rates while investment in industries with below-average profit rates will decelerate. Both cross-investing and reinvesting capitalists look for the highest profit rate, so they adopt the production technologies of the most profitable producers. Investment flows are regulated by the highest reproducible profit rate on new capital in an industry, but increased competition depresses prices and subsequently profitability. The constant acceleration and deceleration of investments create a pattern of turbulent equalization of profit rates on new capital ([Shaikh 2016](#)). This turbulent pattern generates a tendency toward a general rate of profit—the normal profitability on which capitalists base investment decisions. Consequently, market prices fluctuate around production prices that combine total labor requirements and the general rate of profit.

When calculating production prices, we follow [Sraffa \(1972\)](#), 22) in expressing the real wage rate w and profit rate r' as ratios to the maximum profit rate. We define the profit rate as $r' = \frac{r}{R}$, which implies $(1 + r)w = 1 - \frac{r}{R}$, where the maximum rate of profit R is established when the wage share $w = 0$.

Finally, using the Leontief inverse, we define the coefficient matrix of total (direct and indirect) capital as $\mathbf{H} = (\mathbf{A} + \mathbf{D})(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1}$ and the vector of total (direct and indirect) labor as $\mathbf{v} = \mathbf{g}\mathbf{l}(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1}$, where each element of \mathbf{H} and \mathbf{v} expresses the vertically integrated capital and labor requirements per euro's worth of output, respectively. Against this background, the vector of prices of production \mathbf{pp} can be constructed in the following way:

$$\begin{aligned}
\mathbf{pp} &= (1 + r)(wgl + \mathbf{pp}(\mathbf{A} + \mathbf{D})) \\
\mathbf{pp} &= (1 + r)wgl + \mathbf{pp}(\mathbf{A} + \mathbf{D}) + rp(\mathbf{A} + \mathbf{D}) \\
\mathbf{pp}(\mathbf{I} - \mathbf{A} - \mathbf{D}) &= (1 + r)wgl + rp(\mathbf{A} + \mathbf{D}) \\
\mathbf{pp} &= (1 + r)wgl(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1} + rp(\mathbf{A} + \mathbf{D})(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1} \\
\mathbf{pp}(\mathbf{I} - r(\mathbf{A} + \mathbf{D})(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1}) &= (1 + r)wgl(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1} \\
\mathbf{pp} &= (1 + r)wgl(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1}(\mathbf{I} - r(\mathbf{A} + \mathbf{D})(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1})^{-1} \\
\mathbf{pp} &= (1 - \frac{r}{R})\mathbf{v}(\mathbf{I} - R\frac{r}{R}\mathbf{H})^{-1}
\end{aligned} \tag{5.3}$$

Both the total labor vector \mathbf{v} and the production-price vector \mathbf{p} are measured in labor hours per euro's worth of output. To compare these magnitudes with market prices, we first need to transform them to the same unit as the latter—that is, euros of gross output. We adopt the normalization method in [Ochoa \(1989\)](#) and [Tsoulfidis and Tsaliki \(2019\)](#) and normalize over the sum of prices over all industries $j \in J$ within year t and country c . We define the market price $mp'_{j,c,t}$ of industry j in year t and country c as the share of industrial output X_j (in euros) in total global output:²³

$$mp'_{j,c,t} = \frac{m_{j,c,t}X_{j,c,t}}{\sum_{j \in J, c=c, t=t} m_{j,c,t}X_{j,c,t}} = \frac{X_{j,c,t}}{\sum_{j \in J, c=c, t=t} X_{j,c,t}} \tag{5.4}$$

The market price of a commodity is conventionally perceived as the money price of a unit of output. However, industry-by-industry input-output tables only report the money value of the gross output of an industry, and not the quantity of output corresponding to that money value, which might be very difficult to define because an industry might well produce a variety of commodities. Luckily, this issue does not pose a problem for the construction of relative prices as long as we are able to transform total labor requirements and production prices into a unit commensurable with market prices.

To calculate $dp'_{j,c,t}$ —that is, the direct price of industry j 's output in year t and country c —we use the average global value–price ratio (the cross-country and cross-industry average total labor requirement corresponding to a euro's worth of output). We divide the total labor requirement per euro's worth of output $v_{j,c,t}$ by the average global value–price ratio, which corresponds to multiplying it by the industrial output measured in euros, namely $X_{j,c,t}$, and then dividing it by the global sum of the product of labor requirements and industrial gross output:

$$dp'_{j,c,t} = v_{j,c,t} \times \frac{X_{j,c,t}}{\sum_{j \in J, c=c, t=t} v_{j,c,t} X_{j,c,t}} \quad (5.5)$$

We apply the same normalization process to prices of production:

$$pp'_{j,c,t} = pp_{j,c,t} \times \frac{X_{j,c,t}}{\sum_{j \in J, c=c, t=t} pp_{j,c,t} X_{j,c,t}} \quad (5.6)$$

What we obtain through this procedure is, strictly speaking, gross output evaluated at (1) direct prices (that is, prices proportional to labor values), (2)

prices of production, and (3) market prices. In [chapter 3](#), we investigated the relationship between these three vectors. Production prices represent a transformation of direct prices, and the distance between the vectors increases with the profit rate and the ratio of constant capital to variable capital. The deviations are rather small when compared at the national level. On the global scale, we encounter larger and regular deviations between the three vectors. At the same time, production prices represent the gravitational center for market prices. They can predict the dynamics of market prices very well in an almost-linear relationship, while small but significant deviations remain.

In this chapter, we propose the percent deviation between market prices and production prices as the measure of deviation for each observation (that is, each unique combination of year, country, and industry). When we calculate deviations as a percentage share of market prices (rather than normalizing by production prices), multiplication by relative market prices quantifies the deviations in the same unit as in the input-output data. At the same time, this measure expresses the deviations in terms of observed units (that is, market prices) as shown in equation 5.7, rather than in terms of predictions (of production prices). The deviation measures are not symmetrical in the case of industries with very low predictions of production prices (for example, in fictitious heavily subsidized or speculative industries in which little labor is expended), which produce extreme outliers when deviations are normalized by production prices.

$$\mathbf{PPMP} = \frac{(mp' - pp')}{mp'} \tag{5.7}$$

5.3.2 The Role of Land Use and Resource Extraction

Ground rent brings about modifications of within- and between-industry

competition in the capitalist mode of production. Between-industry competition is modified because of the nonproduced and nonreproducible nature of land. Within-industry dynamics of price equalization are (partially) decoupled from the most profitable production conditions, especially when the source of differential rent of the first kind cannot be imitated solely by investment. As a consequence, landed property can attract accelerated capitalization, either to realize differential rent of the second kind or to gain a claim to absolute rent.

While classical political economists, and Marx in particular, restricted their analysis of ground rent to agriculture, the underlying economic mechanisms apply to other types of landed property, too, such as property for mining or hydroelectric power generation—as both Marx and later authors clarified. In all these cases, there is a relationship between the physical mass of capitalized land and its differential physical properties—for example, fertility. It is, however, necessary to distinguish between types of land: One square mile of mining land will not bear the same amount of ground rent as one square mile of farmland. We therefore study ground rent in relation to the underlying specific land use.

We define a vector \mathbf{e} , the elements of which estimate land use or extraction in physical units (square kilometers and metric tons) for each category of land use and resource extraction. To distinguish the recipients and origins of ground rent, for each category of land use and resource extraction we estimate (1) the direct land use or resource extraction, or \mathbf{e}_0 ; (2) land use or resource extraction embodied in direct inputs, or $\mathbf{e}_1 = \mathbf{e}_0(\mathbf{A} + \mathbf{D})$; and (3) indirect land use and resource extraction embodied in inputs, or $\mathbf{e}_2 = \mathbf{e}_0(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1} - \mathbf{e}_0(\mathbf{A} + \mathbf{D}) - \mathbf{e}_0$. For the calculation of \mathbf{e}_2 , the matrix-series sum

$$\mathbf{e} + \mathbf{e}(\mathbf{A} + \mathbf{D}) + \mathbf{e}(\mathbf{A} + \mathbf{D})^2 + \mathbf{e}(\mathbf{A} + \mathbf{D})^3 + \dots$$

(if the largest absolute eigenvalue of the matrix $(\mathbf{A} + \mathbf{D})$ is smaller than 1). We use this definition to estimate indirect rent-bearing inputs as the difference between total use, on the one hand, and direct

use plus direct production, on the other. The distinction is relevant to identify recipients and payers of ground rent in the distribution of social surplus. The calculation of **e1** and **e2** for use of crop land, pasture land, forestland, infrastructure land, and other land as well as coal, gas, oil, metal ores, and nonmetallic-mineral extraction is described in equation 5.8. The meaning of **e0** and **e2** is straightforward: The former is an expression of landed property's presence in an industry, while the latter is an indicator of the extent to which products of landed property are contained, directly and indirectly, in one euro's worth of the industry's output. **e1** is less intuitive. It captures only the direct use of rent-bearing inputs as circulating and fixed capital in production. Therefore, it is expected to be high in industries processing raw products.

$$\begin{aligned} \mathbf{e1} &= \mathbf{e0}(\mathbf{A} + \mathbf{D}) \\ \mathbf{e2} &= \mathbf{e0}(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1} - \mathbf{e0}(\mathbf{A} + \mathbf{D}) - \mathbf{e0}. \end{aligned} \tag{5.8a}$$

We normalize all indicators to the share of total global use/extraction in one year:

$$\begin{aligned} \mathbf{e0}'_{j,c,t} &= \frac{\mathbf{e0}_{j,c,t}}{\sum_{j \in J, c \in C} \mathbf{e0}_{j,c,t}} \\ \mathbf{e1}'_{j,c,t} &= \frac{\mathbf{e1}_{j,c,t}}{\sum_{j \in J, c \in C} \mathbf{e1}_{j,c,t}} \\ \mathbf{e2}'_{j,c,t} &= \frac{\mathbf{e2}_{j,c,t}}{\sum_{j \in J, c \in C} \mathbf{e2}_{j,c,t}}. \end{aligned} \tag{5.8b}$$

To estimate ground rents and their relationship to deviations between market and production prices, we conduct a panel regression analysis. As we discussed

in [chapter 3](#), a fixed-effects panel regression, given in equation 5.9, is the appropriate econometric model. It controls for idiosyncratic effects of time and countries and isolates the effects of land use. We adopt a simple linear model with $e0'$ and $e1'$ and $e2'$ and production as well as market prices normalized at the international level, which means, representing the corresponding share in global gross production denoted in different value bases. We restrict the panel to production industries (see Appendix [Table 3.C.1](#) for the list for industries in EXIOBASE 3.8.2) and exclude the five rest of the world-regions from the sample.

$$\mathbf{PPMP} = \alpha_t + \alpha_c + \beta_0 e'{}_0 + \beta_1 e'{}_1 + \beta_2 e'{}_2 + \varepsilon \quad (5.9)$$

Finally, we use the coefficient estimates $\hat{\beta}$ to estimate the impact of ground rent on deviations between market and production prices. The regression coefficient is our statistical estimation of how much price-value deviations change, when $e0'$, $e1'$, or $e2'$ increases by one unit (the marginal effect), which in this case means 100 percentage points of global land use or resource extraction in a year. We multiply the coefficient with the actual share observed for an industry. The result is our estimation of rent received or paid, which we report in Appendix [Tables 5.B.1](#) (aggregated by country) and 5.B.2 (aggregated by industry). Importantly, this is not the same as the regression's predicted values: The fixed effects of time and country and industry, and any other controls, have no relation with ground rents, so we do not include them. In the same spirit, the goodness-of-fit statistic R^2 indicates how much of the variation in price-value deviations is explained by the full regression (including fixed effects), while the within- R^2 indicates how much is explained by $e0'$, $e1'$, or $e2'$. In equation 5.10, we distinguish between ground rents $GR0$, direct effects $GR1$, and indirect effects $GR2$, which sum up to the total estimated effect GR_{Total} of ground rent on deviations between market prices and

production prices. By implication, predictions lose explanatory power with increasing aggregation, as positive and negative effects cancel out.

$$\begin{aligned}
 \widehat{PPMP}_{GR,0} &= \widehat{\beta}_0 \times e0' \\
 \widehat{PPMP}_{GR,1} &= \widehat{\beta}_1 \times e1' \\
 \widehat{PPMP}_{GR,2} &= \widehat{\beta}_2 \times e2' \\
 \widehat{PPMP}_{GR,TOTAL} &= (e0' + e1' + e2')\widehat{\beta}
 \end{aligned} \tag{5.10}$$

5.3.3 Data and Results

In our model's primary data source, EXIOBASE 3.8.2, we find detailed records of industrial land use and resource extraction organized into fifteen categories. They are denoted in square miles for land use and kilotons for coal, gas, oil, metals, and nonmetallic ores. We aggregate diverse crops into one cropland category, and we do the same with different pasture land types, as land type would otherwise identify specific agricultural industries. For direct fossil fuel extraction, EXIOBASE only provides an aggregate category, namely “fossil fuel: total,” but it disaggregates unused domestic extraction into nine categories. Supporting information file S5 in [Stadler et al. \(2018\)](#) explains that unused domestic extraction is simply calculated as domestic extraction discounted by a resource-specific factor.²⁴ Since we transform physical units of land use and resource extraction into shares of global use, used and unused domestic extraction has the same effect in the analysis.

Over twenty-six years and forty-four countries, we have almost 110,000 observations of market, production, and direct prices as well as land use and resource extraction. More than half of the industries do not use any land—not even the residual “other land” category. [Table 5.1](#) illustrates the differences between industries. The average deviation between production prices and market

prices is -0.15 percent over all industries, while it is substantially lower, -19 percent, in industries without landed production. At the same time, the average deviation for land use lies between 32 and 83 percent. We find a different picture for resource extraction: Coal-extracting industries have an average deviation of 20 percent, gas extraction 22 percent, oil extraction only 1.66 percent, nonmetallic ore extraction 27 percent, and metallic ore extraction even a negative deviation of -44 percent.

Table 5.1 Summary statistics of mean absolute weighted deviations in percent market prices and production prices for industries relying on land use extraction 

	N	(MP-PP)/MP	% Positive	% Negative	Mean positive %
Total	118,729	-0.15	78.72	21.28	58.44
None	65,255	-19.28	75.48	24.52	55.96
1 Forest land	9068	46.30	86.69	13.31	64.74
2 Crop land	21,928	32.66	86.12	13.88	67.40
3 Other land	562	63.56	100.00	0.00	63.56
4 Pasture land	78	83.04	100.00	0.00	83.04
5 Coal	2739	20.00	77.25	22.75	57.09
6 Gas	3045	22.29	87.68	12.32	63.19
7 Oil	906	1.66	80.57	19.43	58.91
8 Metallic ores	6666	-43.73	69.22	30.78	41.83
9 Nonmetallic ores	8482	27.01	78.96	21.04	58.78

  Source: EXIOBASE 3.8.2, 1995–2020. Authors' calculations.

Land use alone does not automatically cause positive price-value deviations. Two key points can be made with reference to [Table 5.1](#): (1) The relationship between production and market prices is substantially different in the presence of land use and resource extraction; and (2) different categories of land use and

resource extraction behave heterogeneously with regard to above-normal profits.²⁵ The results in [Table 5.1](#) only illustrate the differences with respect to **e0'**, while the statistical investigation of the simultaneous presence of **e0'**, **e1'**, and **e2'** (which is the case in some industries as demonstrated in Appendix [Table 5.B.2](#)) shows more complicated channels of causality. While the presence of ground rent does not simply manifest itself in positive price-value deviations for landed industries, it does change the distribution of market- and production-price deviations between industries. Ground rents can cause a shift of the whole distribution to the right if the underlying dynamics remain the same, or they can bring about a different distributional form altogether if some industries experience a modified dynamic.

In [Figure 5.2](#) we plot the distribution of industry-level deviations between market prices and production prices as a share of market prices $\frac{MP' - PP'}{MP'}$, conditional on land use or resource extraction **e₀**. The black curve for industries without any source of ground rent shows a slightly left-skewed and unimodal distribution, with a mode close to zero. We highlight the distributions for two types of land-using or resource-extracting industries to illustrate how the relationship between market and production prices can be modified by the presence of ground rents. The highlighted landed-property categories—namely pasture land and crop land use—represent distributions deviating from the standard case. Both imply above-average deviations between market and production prices. Industries using pasture land have a unimodal distribution, with a pronounced shift of the mode to the right and a steep fall after the mode. This suggests that there is a general surplus profit for most capitals in those industries, that many industries realize positive price-value deviations of similar magnitude, and that these are located at the very top of the distribution. Industries with above-median use of cropland show no strong deviation of the mode, but a pronounced right tail. This suggests that a few industries realize large positive deviations of market price from production price, while the rest of

the industries remain largely unaffected.

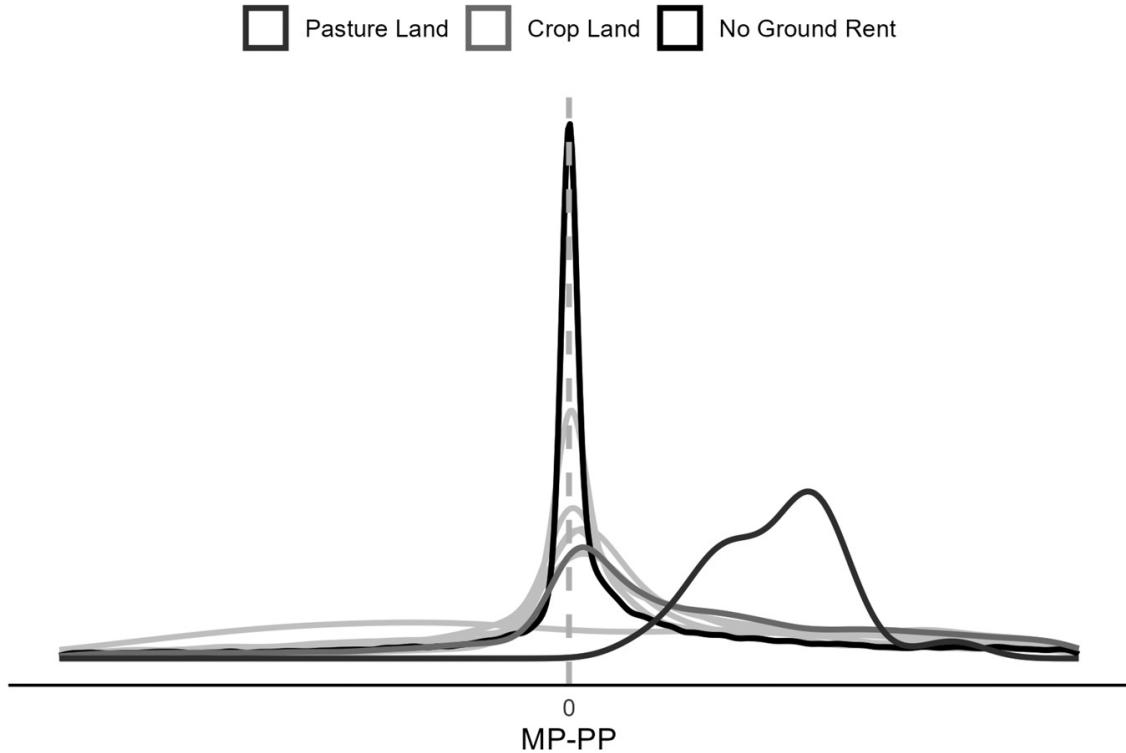


Figure 5.2 Differentials between market and production prices, in shares of gross global production, by type of rent extraction in industries. EXIOBASE 3.8.2 1995–2020, authors' calculations [✉](#)

Beyond these descriptive statistics, we run a panel regression with percent deviations between market and production prices $\frac{MP' - PP'}{MP'}$ as the dependent variable. Using equation 5.9, we estimate the impact of land use and resource extraction on deviations between market and production prices, with $t \in T$ years, $c \in C$ countries, and $j \in J$ industries in a two-way fixed-effects panel regression.²⁶ We interpret e_0' as a proxy for ground rent, e_1' as direct use of ground-rent-bearing inputs in production (in the form of circulating and fixed capital), and e_2' as total use—that is, ground rent from circulating and fixed capital streams. We normalize all impact factors (e_0 , e_1 , and e_2) by the total physical use (or extraction) of the same factor in that year such that a higher

factor e implies a higher share in land use or resource extraction to $e0'$, $e1'$, and $e2'$. Corresponding to the idea that ground rent is paid from aggregate social surplus value ([Marx 1991](#), 777, 882–83) and from the profits accruing to non-ground-rent-earning capitals, $e0'$ coefficients would be positive, $e1'$ positive or zero, and $e2'$ negative.²⁷

[Table 5.2](#) presents the coefficients of $e0'$, $e1'$, and $e2'$, as well as significance levels with clustered standard errors for each category of land use and resource extraction. The full regression table is provided in [Appendix 5.A](#). As presented in the first column of [Table 5.2](#), land use and resource extraction have a positive and significant impact on price-value deviations (with the exceptions of pasture land use, with a negative coefficient, and coal and nonmetallic ore extraction, with nonsignificant coefficients)—that is, they generate positive deviations between direct and market prices through surplus profit above the general profit rate. Direct use of their products as circulating capital (most likely in processing) shows mixed signs in the second column, and downstream use in the third column has a positive impact for cropland use and negative impact for gas, metallic ore extraction, and nonmetallic ore extraction (with no significant coefficients for forestland, pasture land, coal, and oil).

Table 5.2 Coefficients and significance levels from two-way fixed-effects estimation of the impact of land use and resource extraction on deviations between market prices and production prices 

	e_0	e_1	e_2	
Forest land	2.7922	*	-3.8017	*
Crop land	7.2685	*	-7.3716	*
Pasture land	-0.4943	*	-1.1718	-0.7639
Coal	0.0562		-14.1699	*
Gas	1.7916	*	26.219	*
Oil	1.9977	*	12.5682	*
Metallic ores	2.1814	*	6.2433	*
Nonmetallic ores	-0.1056		1.1205	-13.5496
N:	118,729	Within- R^2	0.1762	

Source: EXIOBASE 3.8.2, 1995–2020. Authors' calculations.

Notes: $e_0 = e$, $e_1 = e(\mathbf{A} + \mathbf{D})$ and $e_2 = e(\mathbf{I} - \mathbf{A} - \mathbf{D})^{-1} - e(\mathbf{A} + \mathbf{D}) - e$.

t-test *p*-values for standard errors clustered for years and countries.

****p* < 0.001.

***p* < 0.01.

**p* < 0.05. ↪

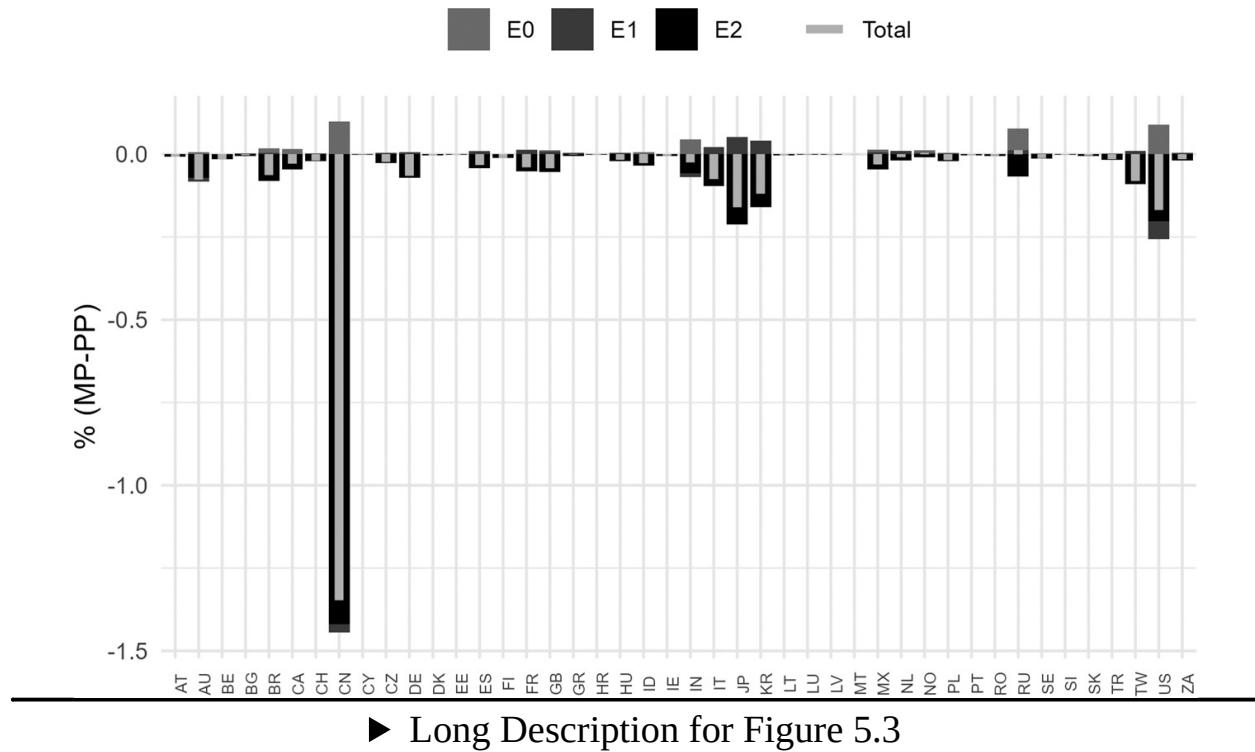
The positive effects of rent extraction range widely in magnitude. If land use or resource extraction in an industry was to increase by the amount of *total* global use—that is, by 100 percent of global use—the deviations between market and production prices would increase by 50–700 percentage points. The negative indirect effects of using circulating capital produced using rent-bearing commodities show larger coefficients: The negative marginal effect of indirect metallic ore use is 505 percentage points of deviation per percentage point increase in global share; for gas it is an even higher 1,067 percentage points. Indirect use is notably distributed far more widely between industries than is production or processing. Crucially, the significant adjusted within- R^2 of 0.18 indicates that the model explains a significant and substantial part of the dynamics of price-value deviations.

The regression analysis emphasizes the meaningful role ground rents play in explaining deviations between market and production prices. Not only do the panel regressions illustrate the impact of land use and resource extraction on deviations, but they also indicate that these surplus profits are paid from negative deviations in non-extracting industries. The substantial within- R^2 value indicates that the proxy we use for ground rents explains a significant portion (but not the largest part) of deviations between production prices and market prices.

The regression results represent only an intermediate step in our analysis to estimate ground rents and compare them to gaps between market and production

prices in absolute monetary terms. As in equation 5.10, we multiply the regression estimators with the underlying land-use and resource-extraction magnitudes to calculate immediate ground rents and direct and total use as circulating and fixed capital for each industry, year, and country.

[Figure 5.3a](#) illustrates the distribution of ground rents paid and received between countries, and [Figure 5.3b](#) shows the same distribution across industries. Gray bars indicate total net rents, with the three components stacked on top of each other. They are summed for every country or industry and represented as the average value over all years.²⁸ Gray lines represent total predicted rent payments (positive minus negative).



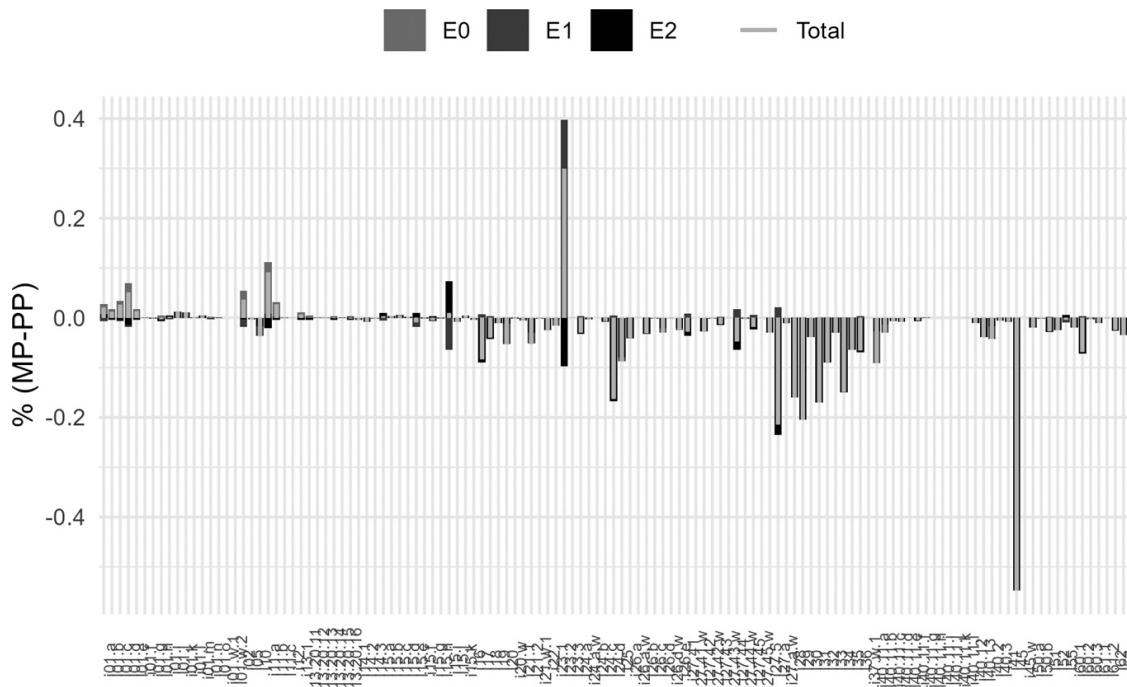


Figure 5.3 (a) Predicted market-price/production-price deviations per country, in shares of gross global production, for production industries only. EXIOBASE 3.8.2 1995–2020. Authors' calculations; (b) predicted market-price/production-price deviations per industry, in shares of gross global production, for production industries only. EXIOBASE 3.8.2 1995–2020. Authors' calculations [✉](#)

The figure illustrates what the fixed-effects estimation suggests: The sum of ground rents received and paid predicts significant aggregate price-value deviations in some industries. The figure suggests that rents received are the highest in the primary sectors in the left-hand quarter of the panel (agricultural, mining, and quarrying industries). The net effect is negative in almost all manufacturing and service industries (with the exceptions of petroleum processing and energy production), which we also document in Appendix [Table 5.B.2](#). The figure only gives an overview, as industries from all countries and all years are aggregated, but it illustrates both the power of the method and which industries rent plays a larger role in.

Appendix [Table 5.B.1](#) shows the aggregate results for each country. Land use induces between-country ground rent flows of 0.45 percent of global gross production, while direct use of their products induces positive ground rents corresponding to 0.25 percent (from the positive coefficients in extraction industries) but also negative rents—that is, rent payments—that sum to 0.13 percent. Finally, downstream use accrues 2.4 percent of global gross production in rent payments. The results are averages over the whole timespan in the sample from 1995 to 2020. Estimated rent payments outweigh rent received, and therefore the net between-country rent flow is negative, which is an artifact of the regression setup, in which a greater share of land use and resource extraction e'_0 is constant over time compared to the indirect use e'_2 and therefore more likely to be captured by country fixed effects.

The list in Appendix [Table 5.B.1](#) is ordered by total rent, and only Russia, India, Norway, Greece, and Malta receive a net positive rent sum. China and the United States receive large ground rents of more than 0.1 percent of global gross production reported in the first column but pay many times that much for direct use of agricultural goods (in the second column) and for downstream use of extracted resources (third column). Together with Japan, Korea, and Taiwan they are the biggest net payers of ground rents.

Appendix [Table 5.B.2](#) shows larger between-industry payments, but in the same order of magnitude: We find 0.45 percent of global gross production in positive payments to landed capitals (and -0.0003 percent of negative rents), 0.55 percent positive rents for direct use of extracted commodities in production, -0.43 percent of negative rents for processing agricultural goods, 1.11 percent of positive rent for downstream users, and -2.51 percent of rents paid by those industries. The two industries that receive the largest net rents are refining and extraction of petroleum. Some agricultural, forestry, and animal husbandry industries receive positive net rents, as do metal mining industries. The complexity of ground rents is illustrated by the fact that hotels and restaurants and some renewable energy producers are on the list of net rent receivers. The

highest rent payments come from construction, heavy manufacturing, and electricity production by coal. The two tables illustrate that rent payments are significant modifiers of the market-price/production-price relationship in single cases but do not invalidate the underlying relationship. They also show how ground rents are distributed unequally between countries but flow through almost every industry.

5.4 Capitalism, the Law of Value, and Ecological Breakdown

As discussed in [chapters 2](#) and [3](#), the Marxist theory of value is not primarily a rigorous theory of prices or rational resource allocation as understood in modern bourgeois economics. Rather, it aims to understand the capitalist mode of organization of human working activity with its qualitative aspects and quantitative manifestations; it is a study of value as a social form, the production relations upon which day-to-day interactions take place, and the ceaseless rearrangement of the social division of labor ([Rubin 1973](#), 67–78). Thus, landed property must be understood in the way it modifies the law of value through its foundational role in defining capitalist social relations and its impact on the social division of labor—for example, by moving more capital into the agricultural sector, or by directing enhanced technologies toward the extraction and combustion of fossil fuels to support the corresponding surplus profits.

5.4.1 Scarcity, Rent, and Modifications to the Law of Value

Capitalism emerged as a mode of production through violence, expropriation, and a forcible legal framework. Landed property is a key moment of this process of original accumulation. Enclosures and settler colonialism monopolized landownership by expropriating and expelling future wage laborers. This was not a uniquely English phenomenon. In volume 1 of *Capital*, Marx traced the earlier manifestations of a capitalist mode of production to Italian city-states, and this mode presupposed the dissolution of serfdom, thereby creating a “free”

proletariat. In the context of the genesis of industrial capitalism, he assigned “the different moments of primitive accumulation … to Spain, Portugal, Holland, France and England, in more or less chronological order. These different moments are systematically combined together at the end of the seventeenth century in England; the combination embraces the colonies, the national debt, the modern tax system, and the system of protection” ([Marx 1990](#), 915).

It is in the same process that land is transformed into capital. Landed property is thus a foundational element of capital as a social and economic category. It is crucial that [Marx \(1990](#), 874) grasped this not as only a one-time historical provision but as a lasting condition that has to be renewed and reproduced on a permanent basis: “The capital relation presupposes a complete separation between the workers and the ownership of the conditions for the realization of their labour. As soon as capitalist production stands on its own feet, it not only maintains this separation, but reproduces it on a constantly extending scale.”²⁹

Within this historical context, the working class became free in a dual sense. On the one hand, it is not legally bound to an employer or landlord; the workers' legal freedom to choose employment enables the mobility of labor, which is a crucial aspect of capitalist competition. On the other hand, workers are “free of capital.” They do not own means of production. This compels them to sell their labor power and allows capital to access exploitable labor. By paying workers only what corresponds to a historically acceptable standard of living, which is subject to class struggle, and not enough to buy capital of their own, the producers are kept separated from means of production, reproducing and expanding capital as a social relation thanks to ceaseless original accumulation. In addition, freed from traditional bonds, and compelled to serve as wage laborers to survive, workers became indifferent to the specific qualities of labor required in different branches of production, bringing about *abstract labor* as the substance of value. This is a *necessary condition* for the law of value to function as a foundation for the social division of labor.

The enclosure of common lands and expropriation of subsistence farmers and

indigenous populations in the colonies transformed land to be used as capital and forced the masses to become proletarians. This historical and social foundation for ground rent is not merely a precapitalist holdover but the very genesis of capital. Furthermore, expropriation and monopolization are an integral part of capital accumulation as a ceaseless process—for example, in the form of neocolonial land grabbing, privatization of national lands, or redivision of international waters once oil and gas reserves are found. The race to the Arctic, where the US Geological Survey suspects up to 22 percent of undiscovered oil and gas reserves lie ([Bird et al. 2008](#)), is another instance of the enclosure movement of the twenty-first century.

Landed property is not a suspension of capitalist competition and accumulation. Rather, it is a form of accumulation under modified conditions of capitalist competition. It represents the monopolization of nonreproducible means and conditions of production, which acts as a barrier to cross-industrial mobility of capital. This modifies the patterns of capital accumulation that follow the highest profit rates on new capital. However, landed property is no historical anachronism to be overcome by the development of the capitalist mode of production.

On the contrary, today, landed property and ground rent are key factors beyond agriculture, operating in crucial domains such as mining, fossil fuel extraction, and housing. This was already evident to classical political economists, and Marx in particular, who remarked that the analysis of agricultural ground rent applies to other forms of landed property, especially mining. These sectors hold an even more crucial place in today's production chains than in the nineteenth century. Fossil fuels still constitute the bedrock of the global energy infrastructure; the mining of rare earth metals is a necessary condition for the semiconductors on which modern information technology is based; and most importantly, soaring levels of resource extraction are expected as a result of mainstream energy-transition scenarios ([International Resource Panel 2024](#)).

The capitalist form of extraction on landed property and its modification of accumulation patterns and impacts on the nonhuman environment are a property of the mode of production rather than any specific technology. This is even true with regard to the prevalent and, for questions of global warming, dominant issue of fossil fuels. The partial fadeout of oil- and gas-based energy through renewable energies requires large amounts of minerals such as copper, zinc, lithium, cobalt, and rare earths ([IEA 2022](#)). The mining of these metals, minerals, and rare earths on landed properties has intensified in countries on the periphery and created conflicts between capital accumulation and access to human necessities such as drinking water or fertile lands, which gave rise to the term “post-fossil extractivism” ([Tittor 2023](#)).

In these sectors, ground rent modifies the patterns of competition and thereby forms of accumulation. The struggle between capitals to enter these sectors is driven by the search for surplus profits. This creates a paradox: While investment in landed-property industries faces barriers, capital accumulation within these sectors can even exceed the normal level corresponding to a normal profit rate. In landed-property industries, capitalists can invest extensively in new land or intensively by increasing the capitalization of existing lands. The barriers posed to extensive investment by limited landed property become manifest in DR-I, and they drive intensive investment, which in turn becomes manifest in DR-II. At the same time, the capitalist use of the forces of nature, be it in the form of a “free gift” or commodified inputs, has adverse ecological impacts, altering the relations among organisms and between organisms and physical environments.³⁰

DR-II is a specifically capitalist form of ground rent as detailed in [section 5.2.3](#). The logic of capital accumulation and competition impels DR-II-seeking behavior, which can also increase DR-I by increasing the fertility of land. DR-II resembles surplus profits made in industry, where the regulating capital applies a more cost-efficient technology while selling at a price corresponding to the normal sectoral cost structure.³¹

Rent brings about a modification of the law of value and prevalent accumulation patterns, which manifests itself in three major ways:

- . The presence of rent fuels the capitalization of the sector at stake. Investment accelerates beyond the speed corresponding to a normal profit rate, as capitalists can earn (but have to share with landlords) both the normal profit rate and DR-II.
- . Ceaseless expropriation and expanding privatization of land create an exceptionally sharp class divide in the countryside. The expropriation of subsistence and small farmers pushes masses of people into the lowest-paid segments of the working class. At the same time, labor in agriculture is paid below-average wages in many parts of the world. Oftentimes groups with precarious status, such as noncitizens and seasonal and migrant workers, are overexploited in agriculture and mining in the periphery. The increased rate of exploitation allows for surplus profits in these sectors.
- . The extraction of input commodities from nonhuman natures for the production process governed by the imperative of accumulation creates a temporal contradiction between the replenishment of nonhuman natures and the accelerating turnover time of capital. Capital tends to subjugate all use value to the extraction of surplus value and accumulation, resulting in ecological disruptions.

The monopolized use of land as a nonreproducible condition and means of production lies at the heart of the phenomena discussed in this chapter. In modern economics, the lens of scarcity is used to study these relationships. Scarcity of land, however, is not a physical or natural condition in the first place. It rather follows from capitalist social relations. [Marx \(1990, 894\)](#) demonstrated this in the context of the genesis of capitalism, when fertile lands were de-cultivated and depopulated in favor of ground rent. It is striking that Marxist theory came to be attacked for an alleged ignorance of scarcity, while the entire

theory of rent deals with this issue, albeit from a different viewpoint.

In most of his work, Marx considered the role and nature of scarcity in great detail. Nevertheless, the criticism that *The Communist Manifesto* (Marx and Engels 1998) is unreservedly optimistic about the subjection of nature to human will and that it celebrates the capitalist development of productive forces without much environmental concern is common even among eco-socialists ([Löwy 1998](#)). This line of criticism has been extended by many thinkers to the full body of Marx's work, who insist that nature as such, or at least the notion of scarcity of "natural resources,"³² was totally ignored by Marx ([Samuelson 1957](#), 894; [Benton 1989](#), 76; [Nove 1989](#), 15–16; [1990](#); [Schumacher 1989](#)). But Marx both dealt with contemporary discussions of scarcity and presented his own analysis of the matter using a fundamentally different approach compared to both the authors of his time and contemporary thinkers.

What is usually lumped together under the naturalized, ahistorical notion of scarcity needs to be articulated as an interrelation between material conditions at a given point in time, on the one hand, and contemporary social relations, on the other: "Wherever natural forces can be monopolized and give the industrialist who makes use of them a surplus profit, whether a waterfall, a rich mine, fishing grounds or a well-situated building site, the person indicated as the owner of these natural objects, by virtue of his title to a portion of the earth, seizes this surplus profit from the functioning capital in the form of rent" ([Marx 1991](#), 908). In a time when Malthusian notions of scarcity were almost dominant, however, Marx often avoided the explicit use of terms such as scarcity, shortage, and depletion, which suggest a framing of the issue as either an eternal curse or something that can be resolved only through better technologies ([Perelman 1993](#)). Scarcity in capitalism is not found in nonhuman natures as such. It is rather socially produced by the dominant class relations ([O'Connor 1988](#), 15).³³

Capital itself is similarly scarce, in a social sense, by its definition and historical genesis, when it was monopolized and the working classes were excluded from owning means of production. The reproduction of capitalism and

capital as a social relation is a complex process that ensures again and again that a sufficient number of people feel the pressure to sell their labor power. The ceaseless reproduction of the social scarcity of capital (and land as a means of subsistence) is therefore an imperative, while, as a matter of internal determination, the accumulation imperative brings about an overproduction of capital in its various forms and its destruction and devaluation through recurrent crises. This simultaneous reproduction of scarcity and overproduction of capital follows from the fact that capitalist production is undertaken for the sake of profit and accumulation rather than use values. This is why capitalist development is, as both a concept and a real process, itself a contradiction: Rather than satisfying human needs, so-called development under capitalism creates more scarcity and destroys critical social and material foundations of human life through overproduction ([Mészáros 2012](#), 304).³⁴

The contradiction between use value and exchange value, between wealth and accumulation, therefore constitutes the kernel of socially and ecologically destructive tendencies of capitalist production. We now turn to the relation of capitalist social structures to nonhuman natures.

5.4.2 Metabolic Rifts and Shifts

Nature evolves by producing and consuming itself in a ceaseless process of *natural metabolism*, which comprises multiple complex processes.³⁵ From the beginning, humans, and communities and societies formed by them, have been part of this broader metabolism. Humans belong to nature, and labor power is a natural force. This is the *identity* between human beings and nature: “Man lives on nature—means that nature is his body, with which he must remain in continuous interchange if he is not to die. That man's physical and spiritual life is linked to nature means simply that nature is linked to itself, for man is a part of nature” (Marx and Engels 1975, 276).

At the same time, in the specific ways humans reproduce themselves, there is a ceaseless flow of energy and matter between them and nonhuman natures. This

is the *social metabolism*, which is regulated by humans' social forms of organization. The quantity, quality, and composition of what they produce and consume; the social and ecological character of the production process and its outcomes; the distribution and cost of the products—all are regulated through the underlying social relations. This is the *non-identity* of, or distinction between, human beings and nature.

The distinction is analytical rather than ontological: Society, and social metabolism for that matter, is part and parcel of the universal metabolism of nature. All production depends on nonhuman natures as much as it depends on labor ([Vlachou 2002](#)). Nonhuman natures are not outside the labor process but constitutive of it ([Moore 2015](#), 45–46). However, social relations of production, and thereby the social metabolism, have an autonomous character. They can self-regulate in two modalities: indirect coordination of independent, profit-maximizing capitalist producers, or conscious and purposeful coordination based on various sets of political principles. The modalities give rise to different patterns of flux and exchange between nonhuman natures and society. The powerful assertion of the autonomous character of the social metabolism turns it into a historical force capable of causing intended and unintended changes in the natural metabolism. Such changes are brought about and regulated by the social metabolism. Furthermore, our knowledge of the natural metabolism and changes in it are also mediated by social institutions, which reinforces the crucial role of social relations.³⁶ Therefore, the identity of humans and nature coexists with their non-identity ([Engel-Di Mauro 2019](#); [Saitō 2022](#), 119–20).³⁷

All production, and therefore capital accumulation, is mediated by nonhuman natures that provide the spatial and climatic conditions of production, the means of reproduction for labor power, and raw materials and other inputs to the production process. [Marx \(1990](#), 283) grasped the labor process (independent of its social form) primarily as the mutual conditioning of the social and natural metabolisms:

Labour is, first of all, a process between man and nature, a process by which man, through his own actions, mediates, regulates and controls the metabolism between himself and nature. He confronts the materials of nature as a force of nature. He sets in motion the natural forces which belong to his own body, his arms, legs, head and hands, in order to appropriate the materials of nature in a form adapted to his own needs. Through this movement he acts upon external nature and changes it, and in this way he simultaneously changes his own nature.

Each mode of production (or socioeconomic formation) generates its own social metabolism, which in turn regulates the ways social and natural metabolisms interact and interpenetrate ([Mészáros 1995](#)). To understand how the capitalist social metabolism works and its ecological ramifications, we must resort to the foundational distinction (and contradiction) between use and exchange value.

Nonhuman natures possess a variety of use values. A river, for instance, is useful for recreation, swimmers' daily exercise, peace of mind for people who like to stare at moving water, or a cool breeze on a hot summer evening. From an ecological perspective, a river is home to countless populations of plants, fishes, insects, and other organisms, making it a crucial component of a freshwater ecosystem. A river is also useful in capital accumulation through its role in the transport of commodities, the extraction of hydroelectrical power, or the provision of cooling water for factory plants. It is through a social process that the river is turned into a so-called natural resource.

While some of the useful properties of nonhuman natures are not the product of human labor, most such properties must be processed and cultivated by humans in one way or another. The exchange value of such natural inputs, however, does not reflect the underlying set of use values, even from the narrow viewpoint of capital accumulation. The logic of capital accumulation (and the threat of being outcompeted if an individual capital does not follow this logic

fully) demands that capitals minimize production costs and maximize profits, including by exploiting nonhuman natures to the fullest extent. Hence the built-in tendency of capital toward nonvaluation and appropriation of forces of nature as free gifts.

The logic of capital—that is, the imperative to accumulate—reduces all useful properties to the production of surplus value. In mobilizing nonhuman natures' useful properties for production, other use values are degraded, degenerated, and eliminated. With the outflow of cooling water from factory plants comes wastewater and stinking pipes, for example, so the river no longer provides a safe recreational ground. More importantly, its role in sustaining biodiversity, revitalizing the water cycle, and recycling natural waste can be seriously impeded. The capitalist social metabolism, fully determined by the (socially and ecologically ignorant) dictates of capital as self-expanding value, which asserts itself irrespective of the possible consequences, poses a threat to humans as well as nonhuman natures.

The tendency of capital to subsume all use value under the extraction of surplus value is no coincidence. Nor is it a problem of incentives or externalities. It is rooted in the *concept of capital* as self-expanding value—that is, the immanent imperative of capital to permeate, seize, and restructure all aspects of social metabolism as well as the natural metabolism—and the emergent *totality* of the capitalist mode of production.³⁸ Within this totality, all use value of the physical environment is increasingly subjugated to the expansion of exchange value, which becomes the dominant motive regulating the modification of natural environments, and biophysical cycles are increasingly forced to keep pace with capital accumulation.

The totality of capitalism is irreducible to the law of value. The capitalist production process is the unity of the labor process and the process of value creation ([Marx 1990](#), 300–04). Value, as argued in [chapter 2](#), is a purely social form acquired by commodities produced by a certain social form of labor, and it does not contain even a single atom of matter. The labor process, a

transhistorical metabolic interaction between humanity and nonhuman natures that produces use values, takes the form of value creation under capitalism; and value creation is not achieved for its own sake but for the sake of valorization and accumulation. Although value creation is a purely social process, it is made possible by and operates on the basis of not only wage labor but a ceaseless process of expropriation and appropriation.

Since the early days of capitalism, extra-economic processes have been foundational in locating, appropriating, and channeling unpaid (or cheap) energy, food, raw materials, and labor into the circuit of capital. Value is created by commodified labor power, but it is predicated upon a double movement of exploitation and appropriation ([Moore 2015](#), ch. 2). Accumulation of capital thus impels continuous geographical expansion,³⁹ conquest and depopulation, appropriation of the gifts of nature and unpaid labor (housework, affective care, child-rearing), universalization of precarity, and reproduction of racialized, gendered oppression and marginalization. *This* is the totality of capitalism: a multiplex of interacting and autonomous domains marked by intertwined contradictions, one in which the so-called economic sphere and the law of value dominate in organizing and coordinating the material reproduction of life.

As capital expands as a social relation and deepens its reach in diverse facets of planetary life, capitalist refashioning of the environment asserts itself in an increasingly powerful manner while being shaped by reconfigurations of biophysical conditions ([Moore 2017](#)). On the one hand, not only is land modified for capitalist agriculture, with monoculture farming adopted to boost profits, but streets and towns are organized around the circulation of commodities, shaping capitalist geographies. Large-scale sealing of the soil surface with concrete and asphalt modifies groundwater systems. Global information systems change the migration routes for birds, the noise from merchant ships changes the habitats of whales, and the fishing industry changes whole water and seabed ecosystems. On the other hand, capital accumulation is conditional on certain biophysical conditions. Construction depends on weather patterns and, more importantly, the

replenishment of forests and of clay and sand reservoirs. Most large-scale industry is only possible because, for now, emitting toxins into the air dilutes them into less dangerous concentrations. The cooling of server farms presupposes lower average temperatures in core countries and readily flowing cool river water in the rest of the world; both conditions seem to be eroding, albeit slowly, with global warming and increasing droughts.⁴⁰

The capitalist social metabolism and universal natural metabolism follow different temporal and spatial logics. The reduction of nonhuman natures' various use values to those that are useful in surplus value production, and the subsequent disruption in biophysical cycles, makes this contradiction painfully obvious. For example, the systematic cultivation of forests for construction wood destroyed large areas of primeval forests and seriously impaired biodiversity. As an example of the spatial contradiction, Marx discussed how the separation of humans from the soil feeds a growing urban population. The increasing concentration of workers in cities leads to an ever-growing demand for products of the soil; combined with the use of inputs and techniques aimed at maximizing profits in the short run, this leads to soil depletion. The contradiction manifests itself even within the narrow perspective of capital accumulation itself: The use of fossil fuels as an energy source follows a turnover time of capital measured in years, while the reproduction of coal, oil, and gas takes millennia, leading to the depletion of fossil fuels.

Nonhuman natures tend to reproduce themselves and evolve, while capital tends to diffuse, deepen, and shorten its turnover time for the sake of accumulation. The totalizing tendency of capital does not abolish the non-identity of humans and nonhuman natures. As capital intensifies its attempts to overcome biophysical barriers to the ceaseless process of accumulation, the contradiction escalates, which manifests itself in explosive ecological crises, in which the rift becomes increasingly visible, painfully experienced, and more and more formidable to shrink. Sometimes referred to as the unity of continuity and break, this dialectical identity of identity and non-identity provides the

foundation for a Marxist theory of the capitalism-driven ecological breakdown.

A large body of literature discusses such explosive crises as manifestations of the underlying *metabolic rift*, expanding on [Marx's \(1993, 949\)](#) observation that “large landed property reduces the agricultural population to an ever decreasing minimum and confronts it with an ever growing industrial population crammed together in large towns; in this way it produces conditions that provoke an irreparable rift in the interdependent process of social metabolism, a metabolism prescribed by the natural laws of life itself.”⁴¹

The metabolic rift theory starts by situating human activity within the universal metabolism of nature and proceeds to demonstrate how the capitalist social metabolism degrades and disrupts this broader metabolism and thereby generates a rift between humanity and nature ([Foster 2000](#); [Foster, Clark, and York 2010](#); [Burkett 2014](#); [Foster and Burkett 2016](#); [Saitō 2017](#)). This goes beyond an analysis of ecologically adverse effects of capitalist industrial production. The metabolic rift is a social condition, as exemplified by Marx's direct reference to the genesis of capital in original accumulation, the geographic and demographic changes that took place following the dictates of accumulation, and the increasing demand for products of landed property to feed the working classes and fuel capital accumulation.

The metabolic rift, which Marx discussed in the context of capitalist agriculture, poses a threat to the reproduction of capital ([O'Connor 1988](#)). This is most visible where the reliance of accumulation on nonhuman natures is most immediate, but it applies to all capital accumulation when seen in light of the totality of capitalism. However, in its own way of shifting and overcoming its contradictions, capital managed to produce powerful countertendencies to mitigate the ecologically conditioned frictions in the process of accumulation.

Capital's attempts to overcome soil depletion in the early nineteenth century represent a prime example of such countertendencies. The extraction of guano—that is, ossified bird excrement—became a booming industry in this period, sparking an international contest to colonize islands with rich guano deposits.

Tens of thousands of Chinese “coolies” were coerced, kidnapped, and shipped by European powers from Macao and Hong Kong to Peru to dig into mounds of excrement under slavery-like conditions and extract guano, which in turn was shipped to imperial centers ([Clark and Foster 2009](#)).

Such countertendencies, however, end up either intensifying existing contradictions or shifting them, and they can therefore be conceptualized as “metabolic shifts” ([Foster, Clark, and York 2010](#), ch. 2). Following the depletion of guano and nitrate deposits, the introduction of synthetic fertilizers to boost fertility led to soil acidification and to groundwater and air pollution, thus only delaying and shifting the rift. Metabolic shifts reflect the elasticity of capital—that is, its capacity to deal with a crisis, often only in the short term, and in a way that gives rise to other crises. Such shifts can assume technological forms (for instance, the industrial mass production of ammonia used in mass production of fertilizers) as well as spatial (the race for guano described above, or the disposal of toxic waste in neocolonies) or temporal (for example, the time lag between emissions and increasing temperatures indicates a shift of problems into the future) forms. A current example is the effort to partially phase out oil- and gas-based energy through a clean-energy transition, which, within the capitalist mode of production, is organized in the form of post-fossil extractivism ([Tittor 2023](#)). The subsequent amelioration of the contradiction between energy production and pollution creates a new contradiction, again shaped by the dynamics of extraction on landed property. Such forces are distinct from solutions, as they reproduce the underlying contradictions on a wider scale ([Saitō 2022](#), 14, 29–34).

The metabolic rift is originally located on three levels: (1) the material disruption of cyclical processes under the regime of capital, (2) the antagonistic spatial relationship between town and country, and (3) the temporal rift between slower natural replenishment and faster capital-accumulation cycles. To circumvent the negative consequences of metabolic rifts for capital accumulation, capital reorganizes the labor process technologically and socially,

albeit only to create new contradictions. These metabolic shifts can also be presented in three categories: (1) technological shifts to replace the functions of destroyed use values, (2) the shift of the town-country contradiction to the global level, and (3) the conscious use of a temporal shift to extract profits before ecological conditions deteriorate ([Saitō 2022](#)).

The increasing grip of capital over all aspects of social production and reproduction asserts itself in various ways. Processes outside of the immediate sphere of capital accumulation operate conditional on and relative to capital accumulation. For example, subsistence farming is conditioned by prices of agricultural commodities, or at the very least of agricultural tools, which are in turn determined by the law of value. The division of unpaid labor in private households is conditioned on wage differentials between family members, among other dimensions of patriarchal structures. So-called development and underdevelopment, representing divergent social, spatial, and ecological dynamics of accumulation, are nothing but intertwined moments of the totality of global capitalism. Seemingly extra-economic processes of cost shifting and environmental robbery, expropriation, and appropriation constitute the mirror image of the exploitation of wage labor. The latter is predicated on the former, and the former are reiterated and reconfigured in accordance with the needs of the latter. The law of value therefore has primacy in the organization and coordination of the material reproduction of life under capitalism. This is contested by various critics of Marxist value theory, including adherents to the concept of *ecologically unequal exchange*, which we briefly discuss next.

5.4.3 Ecologically Unequal Exchange and the Law of Value

Unequal exchange,⁴² within Marxist value theory, refers to transfers of value in which one party receives more objectified labor than they give. The inequality reflects divergences in commodities' production conditions. A more recent literature alleges that the Marxist theory of trade, much like mainstream theories of international trade, focuses exclusively on labor values and thereby conceals

the flow of matter and energy embodied in commodities. They introduce the concept of *ecologically unequal exchange* to highlight asymmetric flows of raw materials, energy, land, and space embodied in traded commodities ([Hornborg 2011, 2019](#); [Hornborg and Martinez-Alier 2016](#)).

Based on a long tradition of thought from early Marxists to Emmanuel, Frank, Prebisch, Wallerstein, and others concerned with structural asymmetries in trade, this argument follows the spirit of world-system analysis developed by [Stephen Bunker \(1988, 23\)](#), who introduced the term *mode of extraction* as the counterpart of *mode of production* and emphasized their integral interdependence. International trade operates asymmetrically not only because of wage differentials—something that [Emmanuel \(1972\)](#) highlighted and that we discuss in [chapter 4](#)—but also because of the transfer of natural values from the periphery to the center ([Bunker 1988, 45](#)). Starting in the 1990s, diverse indicators such as ecological footprint (which aims to capture the quantity of eco-productive land surface per capita), embodied land, embodied footprints, material-flow analysis, and physical trade balances were introduced ([Fischer-Kowalski and Haberl 1993; Fischer-Kowalski 1998; Hornborg 1998](#); Jorgenson 2003; [Jorgenson and Rice 2005](#)).

In a more recent, comprehensive formulation of ecologically unequal exchange, [Hornborg \(2011, 18–20, 102–09\)](#) depicted the structural polarization manifested in asymmetric transfers of resources from the periphery to the core as the thermodynamics of imperialism. Industrial capitalism brings about the unequal exchange of not only embodied labor but embodied land. Hornborg was critical of Marxist value and trade theory for ignoring embodied land and suggests conceptualizing technology as *time-space appropriation*. Within his framework of a zero-sum game, an increase in productive potential of the imperial core through new technologies (that is, local saving of time and space in the core) is made possible by the expenditure or loss of time and space elsewhere in the global system (that is, colonies or the periphery).

Processes ascribed to ecologically unequal exchange certainly capture

important aspects of global capitalism. However, contra the charges made, they are part and parcel of the Marxist analysis of the capitalist mode of production *as a totality*. In fact, it was [Marx \(1990\)](#) who first adopted the idea of a “system of robbery” from Liebig, referring to the deterioration of soil conditions in the countryside in favor of the emerging industrial capitalism in towns. He extended this to colonial relations by noting that “it must not be forgotten that for a century and a half England has indirectly exported the soil of Ireland, without even allowing its cultivators the means of replacing the constituents of the exhausted soil” (Marx 1990, 860).

The meaning of asymmetric flows of matter and energy within the broader totality of capitalism is best understood by the dual system of use values and exchange values. Circulation in the quantitative domain of exchange values—that is, flows of commodities based on their labor values, or prices of production—and market prices coexists with the mirroring circulation in the qualitative domain of use values, including flows of matter and energy.⁴³ They are equally important components of a commodity, which represents the unity of the two. The quantitative side is historically specific to the current social form of organization, the capitalist mode of production. The qualitative side captures the transhistorical dimension of production, and it is a vital condition of the material reproduction of life: “Labour is *not the source* of all wealth. *Nature* is as much the source of use values (and it is surely of such that material wealth consists!) as labour, which itself is only the manifestation of a force of nature, human labour power” (Marx and Engels 1989, 81).

However, the qualitative side—that is, the natural-material sources—of wealth is subjugated to the extraction of surplus value. The pattern of geographical flows of resources, and matter and energy, is not self-constituted. Rather, it follows from the underlying dynamics of accumulation with its own structures of property and power within and across countries. This does not imply that the distribution of matter, energy, space, or waste is insignificant. A similar conflict between priorities and causal direction arises in the distribution of income. In

fact, for most workers, questions of income distribution are more important than relations of production in an immediate sense. However, as discussed in [chapter 2](#), the point of Marxist value theory is that patterns of distribution directly follow from the underlying relations of production.

Theories of ecologically unequal exchange are chiefly concerned with outcomes in the domain of use values. They can certainly add to our knowledge, particularly in an empirical sense, of the material enrichment of the imperial core at the expense of the working classes and peasants in the periphery. The mapping of asymmetries in resource appropriation and waste disposal is particularly important for the politics of working-class environmentalism and anti-imperialism. Nonetheless, without a broader, coherent theory of capital as a social relation and of capitalism as a totality, which also implies a theorization of imperialism, it remains a descriptive tool that fails to *explain* the patterns it studies ([Ajl 2023](#)).

The conflation of causes and effects, and the failure to analytically highlight the primacy of exchange value and accumulation within the broader totality of capitalism, follows from a blurry conceptualization of value. Many critics of value theory confuse *value as the principle of regulation and coordination* in capitalist production and *value as a norm*, or an evaluation of social worth. [Hornborg \(2011, 77–78; 2015, 199\)](#) complained that Marxist value theory is inevitably normative, as it claims that the more labor is embodied in a commodity, the greater its value in an objective sense. Therefore, Marx was setting up a norm by which value is supposed to be measured, rather than leaving it to the cultural preferences of consumers.⁴⁴ [Bunker \(1988\)](#) suggested supplementing labor values with “natural values” accounting for the role of nature in value creation. [Haraway \(2008, 46\)](#) suggested augmenting Marx's value theory by adding a third dimension on top of exchange and use value, namely “encounter value,” which is supposed to account for the effects of cross-species interactions. In a similar fashion, failing to grasp the distinction between doing useful labor and the specifically capitalist social form of value creation, [Kallis](#)

[and Swyngedouw \(2018\)](#), 38–40) insisted that nonhuman work (for instance, work done by horses, bees, and fossil fuels) is as constitutive of value as human work.

Forces of nonhuman nature *are* part of productive forces; they help increase the productivity of labor power and mediate the accumulation process. For instance, the use of energy stored in fossil fuels dramatically increased the productivity of labor and thereby decreased the socially necessary labor time for completing a given task. Similarly, bees do useful work, without which honey could not be produced. However, this does not mean that they *create* value, as bees' labor is not *abstract labor*. Human labor under capitalism, free from traditional bonds, is indifferent to the specific qualitative traits of individual branches of work, and it thereby becomes fluidized, abstract labor—the substance of value. It is in this sense that the *law of value* refers to the coordination and organization of the social division of labor in a capitalist context, and *value theory*, which is the theorization of the law of value, primarily studies human working activity from the viewpoint of its social form ([Rubin 1990](#), 32–34).

Some ecological criticisms of Marxist value theory charge it with anthropocentrism for not attaching any value to nonhuman natures and their work. This stems from a fundamental misunderstanding. Rather than focusing on the value we attribute to things as moral norms, the Marxist theory of value analyzes how capitalism functions. Marx was primarily concerned with the abolition of the social form of value, not approving or defending it. It is the actual daily practice of capitalism rather than Marxist theory that does not recognize the value (in the ethical sense) of nonhuman natures.

5.5 Conclusion

The law of value mainly refers to reproducible commodities and conditions of production when used to study quantitative regularities pertaining to processes of

production and exchange, including the ceaseless regeneration and reorganization of the social division of labor. Starting from this observation, most thinkers, including some Marxists, conclude that nonreproducible conditions of production, and therefore scarcity, are a blind spot of the law of value. The corollary is that Marxist theory, at least in its orthodox version, is not capable of providing insight into the social and economic dynamics underlying the ecological breakdown.

In this chapter, we delivered a detailed and integrated account of Marx's theory of rent. The discussion reveals that nonreproducible inputs and conditions of production are neither ignored by the law of value nor incompatible with it. It is worth reiterating that the law of value operates in and through deviations between direct prices, prices of production, and market prices. This is the guiding principle that regulates and coordinates the decisions of individual capitalists possessing only local knowledge of the state of the system. Insofar as rent is one of the factors explaining the systematic deviations between the three sets of prices and bringing about modifications in the functioning of the law of value in the relevant industries, it is internal to the law of value. Accordingly, it is not an exception to or negation of the latter but a frontier to it.

Our discussion reveals the role of landed property as a precondition and permanent foundation of the capitalist mode of production, as well as showing the relationship between ownership, competition, and various kinds of rent in the context of the dynamics of capital accumulation. This links with the persistent surplus profits in, and channeling of enhanced technologies toward, rent-extracting industries, including the extraction of fossil fuels, rare earths, and other commodities with particular importance for the ecological breakdown.

We can trace the source of surplus profits from ground rents in an empirical model as the impact of land use and resource extraction on deviations between market and production prices. We used environmentally enhanced multiregional input-output tables from the EXIOBASE 3.8.2 database to trace circulating and fixed capital in the production of commodities. This allowed us to measure labor

hours in the production of commodities and the capital necessary for their production (in monetary terms, direct prices) and combine them with the general profit rate in order to compare the production prices with market prices. We were also able to identify not only the material basis for ground rent—land use and resource extraction—but the direct and total use of their products of land as circulating and fixed capital. The model shows that land use and the processing of land's products leads to positive deviations between market and production prices, while indirect use leads to negative deviations on average. This illustrates the significant role of ground rents in explaining price-value deviations, and it furthermore shows that ground rents are paid from the profits of nonlanded capitals.

The dynamics of the social metabolism peculiar to the capitalist mode of production, and the contradictions between that mode and the universal natural metabolism, are evaluated within the framework of metabolic rift and shifts, founded upon the fundamental distinction between use value and exchange value of a commodity in a capitalist context. The latter, mostly ignored or underappreciated by critics, represents the key strength of the Marxist theory of value in explaining diverse phenomena such as the dynamics of exploitation and appropriation; the tendency to undervaluation of the forces of nonhuman natures; the uneven distribution of costs, matter, and energy; and the overall primacy of capital accumulation in regulating “non-economic,” or qualitative, dimensions of social and planetary life.

Notes

1. Smith's back-and-forth between the adding-up and embodied-labor approaches is discussed in detail in [chapter 2](#).⁴
2. Marx's treatment of land rent is laid out in volume 3, part 6 of *Capital* ([Marx 1993](#), 752–950), volume 2 of *Theories of Surplus Value* ([Marx 1969](#)) and section I of the “Chapter on Capital” chapter in *Grundrisse* ([Marx 1993](#), 250–56, 275–81). His analysis of rent, landed property, and the relationship

of social production to nonhuman natures is incomplete and not systematically integrated into his critical study of the capitalist mode of production. Still, the overall approach and analysis put forward in these writings do provide a sound framework to build upon, especially if understood within the broader context of value theory as an endeavor to explain the organization of social production from the standpoint of its historically specific, capitalist social form. It serves as a solid point of departure for our discussion of the law of value in landed property, in which we center the division of social labor as the key terrain for the law of value.⁴

3. This might be due to his motivation to critique (and build upon) the work of classical political economists, whose rent analysis was centered around agriculture. At the same time, Marx pointed to the applicability of ground rent to all forms of landed property. In volume 3, chapter 37 of *Capital*, he maintained that “we therefore confine ourselves exclusively to the investment of capital in agriculture proper, i.e. in the production of the main plant crops on which a population lives. We can take wheat, since this is the major means of sustenance for modern, capitalistically developed nations. (Instead of agriculture, we might equally well have taken mining, since the laws are the same” (Marx [1894] 1993, 752). In the same volume, in chapter 45 on absolute rent, he stated that “this absolute rent plays a still more important role in extractive industry proper, where one element of constant capital, raw material, completely disappears, and where, with the exception of branches for which the portion consisting of machinery and other fixed capital is very significant, the lowest composition of capital invariably prevails” (Marx [1894] 1993, 907). In volume 2 of *Theories of Surplus Value* (Marx 1969, 245), he discussed land as an element of production (in which capital is invested), a condition of production (either as a mere space, or building site, or as the free productive powers of nature, such as wind or water power), and reservoir containing use values such as mines for extraction.⁵
4. In section 5.2.5, we argue that the price of land can be treated similarly to elements of fictitious capital, in which the price is derived from the securitization of future streams of potential rent generated by land.⁶
5. We return to this question in section 5.2.4 in our discussion of monopoly rent in and controversies about Marx's theory of rent.⁷
6. Variation in the fertility of different plots of land should not be understood as a merely natural phenomenon, as we argue in detail below.⁸
7. In Marxist theory, there is no such thing as productivity of capital. One can only speak of labor

productivity, which can be enhanced by the employment of more or better capital equipment, more fertile land, and favorable conditions of production. It is neoclassical theory, with its production-factors approach, that equips all factors (that is, land, labor, and capital) with distinct productivities to justify their factor incomes (that is, rent, wages, and profits).⁴

8. There are significant differences between Ricardo's embodied-labor approach and Marx's concept of socially necessary labor time. See [chapter 2](#) for details.⁵
9. We stick with the term *natural price* while discussing Ricardo's approach to be consistent with his terminology. As explained in previous chapters, this corresponds to the price of production in Marx's framework.⁶
10. In the dynamic context of accumulation, even the rents associated with plots without new investment can change if the worst (that is, highest) price of production changes as a result of new investment ([Ball 1977](#), 307–09).⁷
11. A cross-tabular presentation of the scenarios discussed by Marx was provided by [Murray \(1977](#), 105).⁸
12. For instance, rent can increase both in level and as a share if the productivity of new investment is higher than the average and the regulating price of production remains constant.⁹
13. This is an extension of Marx's theory of absolute rent beyond what is presented in section 5.2.2. For the most part, Marx argued that absolute rent derives from the portion of surplus value resulting from a below-average organic composition of capital that is withheld from redistribution in the equalization of profit rates. According to this definition, the price of the commodity lies between its value and its price of production ([Marx 1991](#), 898). The paragraph quoted above explicitly allows the market price to move beyond the commodity's value, bringing about a hybrid of absolute and monopoly rent.¹⁰
14. He held the same view of absolute rent in the context of a relatively low organic composition of capital in agriculture, which cannot be plausibly expected to remain the case forever.¹¹
15. [Ball \(1980](#), 320) proposed to call it absolute rent when market price is below value, and monopoly rent II when market price is forced above value.¹²
16. It is usually forgotten that there are multiple prices of production within an industry even if the rent relation is absent. This is because the dynamics of competition will bring about a spectrum of methods of production in active use, which, in turn, result in differences in cost structures and prices of production. There will be only one *regulating* price of production, though, which will generally be

different from the average price of production. Since market prices will gravitate toward regulating prices of production, nonregulating capitals with higher or lower prices of production will have profit rates above or below the normal rate ([Shaikh 2016](#), 221).[!\[\]\(c677bf1d4bc2f7abaedea1f9ccb3b31f_img.jpg\)](#)

17. The literature on financialization is vast, and we refrain from citing it here. An overview can be found in [Palley \(2013\)](#) and [Sawyer \(2022\)](#).[!\[\]\(81d309668ffa59c05127c748f5a5f4fd_img.jpg\)](#)
18. [Harvey \(2005\)](#) used the term *accumulation by dispossession* to capture this process. [Moore \(2015](#), ch. 2) engaged in a more systematic study of the double movement of *exploitation and appropriation*, forming an organic whole under capitalism.[!\[\]\(e5a0b969eb2db84baf470f4f0c8f8a9e_img.jpg\)](#)
19. Either this workforce is not available to other sectors, as some countries allow especially low wages in agriculture or exempt agricultural companies from immigration controls, or, as a more interesting case, while firms in other sectors might face competitive pressure to lower their prices as a consequence of lower wages, the nonreproducibility of agricultural land inhibits increased competition and allows capitalists to pocket the higher profit margin—thereby increasing the gap between market and production prices without increasing market prices for circulating capital.[!\[\]\(9e66ca71934dbb629a354a48b6f67f5b_img.jpg\)](#)
20. [Basu \(2018b\)](#) demonstrated that absolute and differential rent can be distinguished by first determining absolute rent as the difference between the production price on the least fertile plot of land, then determining the sum of DR-I and DR-II as the surplus profit beyond that on more fertile plots.[!\[\]\(80c9d12ac23724fad4b85dcd938a492b_img.jpg\)](#)
21. EXIOBASE data are denominated in euro terms, which is why we present our model in the same currency.[!\[\]\(bddef77ef2a4da064df432debb7bec87_img.jpg\)](#)
22. Capital flows estimate the amount of fixed capital goods that flow from industry i , through gross fixed capital formation, to the consumption of fixed capital in production of industry j . The sum of \mathbf{A} and \mathbf{D} gives total production requirements in production ([Södersten, Wood, and Hertwich 2018](#)). This approach estimates not the total fixed capital stock but fixed capital used in production, conditional on capital turnover ([Jiang et al. 2023](#)).[!\[\]\(d6efd70643242a0ab60c7f61ff4ac430_img.jpg\)](#)
23. When applying the model, we also calculate shares in national output to compare our results with those in the existing literature, as well as conducting a number of other robustness checks.[!\[\]\(5441eb5da8cb81e3dc71d715c31f853c_img.jpg\)](#)
24. [https://onlinelibrary.wiley.com/action/downloadSupplement?
doi=10.1111%2Fjiec.12715&file=jiec12715-sup-0005-SuppMat-5.pdf](https://onlinelibrary.wiley.com/action/downloadSupplement?doi=10.1111%2Fjiec.12715&file=jiec12715-sup-0005-SuppMat-5.pdf).[!\[\]\(0cd28f4ea150f31ec88b8d6bfe516a53_img.jpg\)](#)
25. One documented example is [Puty's \(2021\)](#) finding that the dynamic of production price and market

price for the oil industry in the United States from 1857 to 2009 is fundamentally different from that in all other industries, hardly ever moving with the business cycle and especially not downward.[✉](#)

26. We express the deviations as a share of market prices rather than production prices to be able to compare predicted values from the regressions with observed market prices.[✉](#)
27. For nine categories of land use or resource extraction, e' is a vector with 3×9 length.[✉](#)
28. The mean weighted by gross output is proportional to the sum of monetary rents, on a smaller scale.[✉](#)
29. This is why part 8 of volume 1 is titled “So-Called Primitive [Original] Accumulation,” containing polemics arguing that (1) what is at stake is not a one-time, historical occurrence and (2) original accumulation is not a tale of a diligent and intelligent individual accumulating capital but a tale of violent expropriation. Marx polemicized against such depoliticized depictions of the emergence of capitalism, which he likened to the role of original sin in theological lore. He investigated the role of the plunder of India, the Opium Wars in China, the colonization of the West Indies and North America, and enclosure in Australia as ways of funding capital accumulation within the empire: “The treasures captured outside Europe by undisguised looting, enslavement and murder flowed back to the mother-country and were turned into capital there” ([Marx 1990](#), 918).[✉](#)
30. Following [Engel-Di Mauro \(2021\)](#), 33), we use the terms *environmental* and *biophysical* interchangeably. Two subset domains are covered by these terms: ecology (relations among organisms, and between organisms and their environment) and physical (social radiation, wind, wave action, and so forth).[✉](#)
31. Nonetheless, the story of DR-II goes beyond that. The capitalization in landed property is partially fueled by rent-paying capitalists seeking to equalize differential fertilities.[✉](#)
32. Except when referring to its use in mainstream economics (and beyond), we avoid the term *natural resources* because of its de-historicized content. Things are not resources unto themselves but are articulated and employed as resources within given social contexts. The categorical definition of nonhuman natures as “natural resources” exports the contradictions of capitalism to external constraints, where the ahistorical specter of scarcity reigns ([Moore 2015](#), 43).[✉](#)
33. Land is transformed into capital by monopolization. Still, this does not necessarily mean that all plots of land with sufficient productivity will be used to generate both a normal profit rate and absolute rent. In *Capital's* volume 3, chapter 45, on absolute rent, [Marx \(1991](#), 884–85) explained that no landlord will allow the cultivation of their land without the payment of rent, which would render

fertile lands unprofitable: “The fact that the farmer could valorize his capital at the customary profit if he paid no rent is in no way a reason for the landlord to lease out his land to the farmer for nothing, and be so philanthropic to his client as to extend him a credit gratuit. This assumption would mean abstracting from landed property, it would mean abolishing landed property, whose very existence is a barrier to the investment of capital and its unrestricted valorization on the land.” Scarcity is inherent to the social reality of landed property and capitalism in general.[\[4\]](#)

34. “To expect from productive advancement, arising from ‘technical progress’ in ‘advanced industrial society,’ to move humanity in the direction of eliminating scarcity is to ask for the impossible. The same kind of impossibility as expecting that the capitalist should set a limit to his appetite for profit on the ground that he has enough profit already” ([Mészáros 2012](#), 304).[\[5\]](#)
35. In this subsection, we do not present a comprehensive picture of the Marxist literature on ecological breakdown. In addition, we are aware of the controversies between adherents of different theoretical frameworks discussed in the following pages. However, we confine ourselves to presenting a concise and coherent approach suited for this book's purposes.[\[6\]](#)
36. Although we sympathize with non-anthropocentric concerns, we oppose the redistribution of agency to nonhuman natures as represented by concepts such as actants ([Latour 2004](#); [Bonneuil and Fressoz 2017](#); [Barca 2020](#)). Biophysical chains of causality and complex relations nested in nonhuman natures are crucial for a proper understanding of social and natural metabolisms. However, our argument is that capitalist social relations, in their totalizing tendency, subsume all biophysical reality that contacts the law of value, which is a purely social relation. This does not imply reducing natural and social metabolisms, and the relation between the two, to the law of value, but means that these interpenetrating domains are regulated, organized, and reproduced in line with the dictates of accumulation.[\[7\]](#)
37. The concepts of identity and distinction (non-identity) and their unity are found in the first section of [Hegel's \(2010\) *Science of Logic*](#). Its impact on Marx's thought and method is visible throughout Marx's work ([Marx 1993](#), 98–100; see also Marx and Engels 1857, 28–37, where he explicitly referred to himself as a Hegelian because he grasped the relation between identity and distinction).[\[8\]](#)
38. The category of totality implies “the all-pervasive supremacy of the whole over the parts” ([Lukács 1972](#), 27). From this perspective, diverse manifestations of *capital as contradiction in motion* cannot be grasped in a fragmented way even though the totality asserts itself through the manifold partial and

seemingly isolated interactions and contradictions ([Mészáros 1995](#), 328). For example, a worker is not a worker only because they sell their labor power to produce surplus labor but because their very function in social production corresponds to the production of surplus value through wage labor. This is true even if their wages are not paid, if they are on sick leave, or if they are excluded from wage labor as part of the unemployed reserve army.[!\[\]\(6b54fdb36131e5f4012a2cbbb1fc7ac4_img.jpg\)](#)

39. The term *commodity frontiers* was proposed to capture the ceaseless expansion of capital into new zones, providing the increased and cheap flow of raw materials, and furthering class formation. This process is socially and environmentally transformative by its nature ([Moore 2000](#)).[!\[\]\(0fd6916e39d7e463a8637328cd23dd31_img.jpg\)](#)
40. [O'Connor \(1988, 1998\)](#) conceptualized this tendency as the *second contradiction of capitalism*, after the conventional Marxist notion of the contradiction between the relations of production and productive forces.[!\[\]\(982927ba96a49dfb747c79852fba3abd_img.jpg\)](#)
41. For our purposes, it is crucial that in the original manuscript of volume 3 of *Capital*, the sentence reads: “In this way it produces conditions that provoke an irreparable rift in the interdependent process of social metabolism and natural metabolism prescribed by the natural laws of the soil” (cited in [Saitō 2022](#), 53). Marx spoke of two distinct metabolisms—the social and the natural—and an irreparable rift emerging between the two as a result of the development of capitalist agriculture.[!\[\]\(ca7d6954c3e1ee8ebee7e3f928da7da6_img.jpg\)](#)
42. Theories of unequal exchange, especially the Marxist approach to transfers of value, are discussed in detail in [chapter 4](#).[!\[\]\(b85a870a9d5e2415ebb584007665e759_img.jpg\)](#)
43. As the magnitude of value is a quantitative property, while use values are qualitative and incommensurable, the term *mirroring* cannot be understood as a proportionality.[!\[\]\(e64b3b1519c7ef2c0185db1d4cf7bccf_img.jpg\)](#)
44. Hornborg's confusion on value goes beyond this point. He confused both accumulation and exploitation with unequal exchange, whereas within the framework of Marxist value theory, neither process necessarily depends on unequal exchange ([Hornborg 2011](#), 77; [2019](#), 29; [2022](#), 79).[!\[\]\(2eaa566c7746386f4d81605098cb9e17_img.jpg\)](#)

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Appendices

Appendix 3.A Distance Measures

Table 3.A.1 Mean absolute deviations, mean absolute weighted deviations (both in percentage points), coefficients of variation and normalized Euclidian distances between market- and production-price vectors, production industries [◀](#)

<i>Industries</i>	<i>Mean absolute deviation, MAD</i>	<i>Mean absolute weighted deviation, MAWD</i>	<i>Coefficient of variation</i>	<i>Normalized Euclidian distance</i>
[Mean]	0.18	0.13	0.29	0.19
AT	119	0.20	0.28	0.20
AU	120	0.16	0.21	0.16
BE	123	0.18	0.26	0.19
BG	116	0.22	0.33	0.24
BR	119	0.12	0.17	0.12
CA	123	0.12	0.15	0.11
CH	113	0.14	0.19	0.14
CN	114	0.26	0.37	0.26
CY	112	0.35	0.42	0.29
CZ	120	0.17	0.31	0.20
DE	118	0.14	0.21	0.15
DK	120	0.16	0.25	0.18
EE	117	0.23	0.31	0.22

ES	121	0.17	0.15	0.25	0.18
FI	112	0.19	0.12	0.30	0.22
FR	119	0.16	0.09	0.34	0.22
GB	121	0.15	0.10	0.23	0.17
GR	117	0.31	0.27	0.35	0.25
HR	123	0.21	0.16	0.42	0.25
HU	110	0.18	0.12	0.26	0.19
ID	108	0.44	0.22	1.13	0.44
IE	113	0.28	0.19	0.57	0.35
IN	112	0.17	0.20	0.24	0.17
IT	122	0.16	0.09	0.24	0.17
JP	114	0.13	0.12	0.24	0.17
KR	116	0.35	0.13	1.14	0.48
LT	118	0.23	0.21	0.31	0.22
LU	112	0.19	0.15	0.26	0.19
LV	119	0.25	0.21	0.35	0.25
MT	110	0.32	0.19	0.34	0.24
MX	118	0.20	0.23	0.28	0.20
NL	122	0.21	0.15	0.30	0.22
NO	115	0.29	0.28	0.66	0.41
PL	116	0.22	0.17	0.31	0.23
PT	115	0.18	0.13	0.27	0.20
RO	117	0.21	0.17	0.27	0.20
RU	119	0.16	0.20	0.21	0.15
SE	122	0.18	0.10	0.25	0.18
SI	121	0.19	0.09	0.27	0.20
SK	116	0.23	0.19	0.33	0.24
TR	108	0.26	0.25	0.32	0.23
TW	117	0.23	0.14	0.54	0.28
US	114	0.11	0.08	0.14	0.10
ZA	111	0.15	0.12	0.19	0.14

Source: EXIOBASE 3.8.2 1995–2020. Authors' calculations.

Table 3.A.2 Mean absolute weighted deviations in percentage points, industry
outputs for market or production prices excluded [↗](#)

entries for market or production prices excluded [\[—\]](#)

	<i>Production</i>			<i>Nonproduction</i>			<i>Recycling</i>			<i>1</i>
	<i>(MP – DP)/MP</i>	<i>(MP – PP)/MP</i>	<i>(PP – DP)/DP</i>							
[Mean]	14	13	3	15	15	3	29	29	4	2
AT	14	13	3	12	13	2	46	44	5	2
AU	13	12	2	17	16	3	15	13	2	2
BE	13	12	3	7	8	2	7	9	6	1
BG	19	18	3	16	17	4	11	8	7	5
BR	15	15	3	23	22	3	20	16	3	2
CA	10	10	2	8	8	2	47	37	7	1
CH	11	10	2	14	14	2	11	15	4	1
CN	21	19	4	31	32	7	45	44	4	4
CY	22	20	3	50	48	2	48	85	17	5
CZ	11	12	3	11	12	3	11	8	7	2
DE	11	11	2	10	9	3	9	8	2	2
DK	12	11	3	12	11	3	28	31	6	1
EE	16	14	3	13	13	3	9	8	6	1
ES	15	14	3	16	17	3	7	12	6	2
FI	13	12	3	8	9	3	25	24	4	1
FR	10	9	3	8	8	3	8	5	4	1
GB	11	11	2	11	11	2	47	35	9	1
GR	26	25	3	21	21	2	12	15	9	5
HR	17	16	3	18	18	2	5	7	3	1
HU	12	12	3	12	11	3	4	4	3	2
ID	20	21	3	37	35	3	37	34	2	6
IE	20	20	3	16	15	2	38	39	3	2
IN	19	19	3	17	17	4	11	12	2	5
IT	10	10	3	11	11	2	10	10	1	1
JP	12	11	3	17	16	4	16	20	3	1
KR	14	13	4	27	27	4	99	99	1	2
LT	22	21	3	18	18	3	22	22	5	2
LU	24	19	8	17	11	9				5
LV	21	20	3	13	13	3	33	31	2	2
MT	19	19	3	29	29	3	34	31	4	2
MX	23	23	4	20	22	5	22	22	2	5

NL	17	16	3	13	13	3	8	6	5	2
NO	27	26	2	23	21	2	14	14	3	2
PL	17	17	3	29	31	4	4	7	5	5
PT	13	13	3	14	14	3	12	9	5	3
RO	18	17	3	29	27	4	28	30	4	3
RU	21	20	2	32	32	2	6	6	2	3
SE	12	11	2	11	11	3	9	9	5	1
SI	10	9	3	8	9	3	7	7	5	2
SK	19	20	3	14	16	4	28	28	1	3
TR	25	25	2	27	27	3	5	9	5	4
TW	15	15	5	22	24	9	18	15	3	4
US	8	8	3	8	8	2	5	4	2	1
ZA	16	15	3	25	24	5	18	12	8	4



Notes:

Production, market and direct prices are normalized to 1 for each country and year. Deviations denoted in percentage points.

Columns four through twelve report the same distance measures as columns one, two and three, column headings are omitted.

Source: EXIOBASE 3.8.2, 1995–2020. Authors' calculations.

Appendix 3.B Alternative Regression Setups

Table 3.B.1 Results of the linear fixed-effects panel regression of logarithmized market prices on logarithmized production prices with fixed effects for years, countries, and industries (only production industries)

	log(MP)			
Constant	0.0716 (0.0370)			
log(PP)	1.0010*** (0.0058)	1.0010*** (0.0058)	1.0009*** (0.0058)	1.0120*** (0.0058)
Fixed-Effects	—	—	—	—
Year	No	Yes	Yes	Yes
Country	No	No	Yes	Yes

Industry	No	No	No	Yes
SE: clustered	By: year and country and industry	By: year and country and industry	By: year and country and industry	By: year and country and industry
Observations	130,118	130,118	130,118	130,118
R2	0.9878	0.9878	0.9880	0.9911
Within R2	—	0.9878	0.9878	0.9773

Source: EXIOBASE 3.8.2, 1995–2020. Authors' calculations.

Notes: *t*-test *p*-values for standard errors clustered for years and countries.

*** $p < 0.001$. [↳](#)

** $p < 0.01$.

* $p < 0.05$.

Table 3.B.2 Results of the linear fixed-effects panel regression of logarithmized market prices on logarithmized direct prices with fixed effects for years, countries, and industries (only production industries)

	log(MP)			
Constant	0.0901*	(0.0402)		
log(DP)	1.0025*** (0.0062)	1.0025*** (0.0062)	1.0025*** (0.0062)	1.0141*** (0.0061)
Fixed-Effects	—	—	—	—
Year	No	Yes	Yes	Yes
Country	No	No	Yes	Yes
Industry	No	No	No	Yes
SE: clustered	By: year and country and industry	By: year and country and industry	By: year and country and industry	By: year and country and industry
Observations	130,118	130,118	130,118	130,118
R2	0.9874	0.9874	0.9876	0.9907
Within R2	—	0.9874	0.9874	0.9765

Source: EXIOBASE 3.8.2, 1995–2020. Authors' calculations.

Notes: *t*-test *p*-values for standard errors clustered for years and countries.

*** $p < 0.001$. [↳](#)

** $p < 0.01$.

* $p < 0.05$. [↳](#)

Table 3.B.3 Results of the linear fixed-effects panel regression of logarithmized production prices on logarithmized direct prices with fixed effects for years, countries, and industries (only production industries)

	log(PP)			
Constant	0.0190** (0.0060)			
log(DP)	1.0016*** (0.0008)	1.0016*** (0.0008)	1.0017*** (0.0008)	1.0023*** (0.0006)
Fixed-Effects	—	—	—	—
Year	No	Yes	Yes	Yes
Country	No	No	Yes	Yes
Industry	No	No	No	Yes
SE: clustered	By: year and country and industry	By: year and country and industry	By: year and country and industry	By: year and country and industry
Observations	130,118	130,118	130,118	130,118
R2	0.9998	0.9998	0.9998	0.9998
Within R2	—	0.9998	0.9998	0.9995

Source: EXIOBASE 3.8.2, 1995–2020. Authors' calculations.

Notes: *t*-test *p*-values for standard errors clustered for years and countries.

*** $p < 0.001$. [↳](#)

** $p < 0.01$. [↳](#)

* $p < 0.05$.

Appendix 3.C Industry List

Table 3.C.1 Industries in EXIOBASE 3.8.2 [↳](#)

<i>Code</i>	<i>Name</i>	<i>Category</i>
i01.a	Cultivation of paddy rice	Production
i01.b	Cultivation of wheat	Production
i01.c	Cultivation of cereal grains nec	Production
i01.d	Cultivation of vegetables, fruit, nuts	Production
i01.e	Cultivation of oil seeds	Production
i01.f	Cultivation of sugar cane, sugar beet	Production
i01.g	Cultivation of plant-based fibers	Production
i01.h	Cultivation of crops nec	Production
i01.i	Cattle farming	Production
i01.j	Pigs farming	Production
i01.k	Poultry farming	Production
i01.l	Meat animals nec	Production
i01.m	Animal products nec	Production
i01.n	Raw milk	Production
i01.o	Wool, silk-worm cocoons	Production
i01.w.1	Manure treatment (conventional), storage and land application	Production
i01.w.2	Manure treatment (biogas), storage and land application	Production
i02	Forestry, logging and related service activities (02)	Production
i05	Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing (05)	Production
i10	Mining of coal and lignite; extraction of peat (10)	Production
i11.a	Extraction of crude petroleum and services related to crude oil extraction, excluding surveying	Production
i11.b	Extraction of natural gas and services related to natural gas extraction, excluding surveying	Production
i11.c	Extraction, liquefaction, and regasification of other petroleum and gaseous materials	Production
i12	Mining of uranium and thorium ores (12)	Production
i13.1	Mining of iron ores	Production
i13.20.11	Mining of copper ores and concentrates	Production
i13.20.12	Mining of nickel ores and concentrates	Production
i13.20.13	Mining of aluminum ores and concentrates	Production
i13.20.14	Mining of precious metal ores and concentrates	Production

i13.20.15	Mining of lead, zinc and tin ores and concentrates	Production
i13.20.16	Mining of other non-ferrous metal ores and concentrates	Production
i14.1	Quarrying of stone	Production
i14.2	Quarrying of sand and clay	Production
i14.3	Mining of chemical and fertilizer minerals, production of salt, other mining and quarrying not elsewhere classified	Production
i15.a	Processing of meat cattle	Production
i15.b	Processing of meat pigs	Production
i15.c	Processing of meat poultry	Production
i15.d	Production of meat products not elsewhere classified	Production
i15.e	Processing vegetable oils and fats	Production
i15.f	Processing of dairy products	Production
i15.g	Processed rice	Production
i15.h	Sugar refining	Production
i15.i	Processing of Food products not elsewhere classified	Production
i15.j	Manufacture of beverages	Production
i15.k	Manufacture of fish products	Production
i16	Manufacture of tobacco products (16)	Production
i17	Manufacture of textiles (17)	Production
i18	Manufacture of wearing apparel; dressing and dyeing of fur (18)	Production
i19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear (19)	Production
i20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (20)	Production
i20.w	Re-processing of secondary wood material into new wood material	Production
i21.1	Pulp	Production
i21.w.1	Re-processing of secondary paper into new pulp	Production
i21.2	Paper	Production
i22	Publishing, printing and reproduction of recorded media (22)	Production
	Manufacture of coke oven products	Production

i23.1		
i23.2	Petroleum Refinery	Production
i23.3	Processing of nuclear fuel	Production
i24.a	Plastics, basic	Production
i24.a.w	Re-processing of secondary plastic into new plastic	Production
i24.b	N-fertilizer	Production
i24.c	P- and other fertilizer	Production
i24.d	Chemicals not elsewhere classified	Production
i25	Manufacture of rubber and plastic products (25)	Production
i26.a	Manufacture of glass and glass products	Production
i26.a.w	Re-processing of secondary glass into new glass	Production
i26.b	Manufacture of ceramic goods	Production
i26.c	Manufacture of bricks, tiles and construction products, Production in baked clay	Production
i26.d	Manufacture of cement, lime and plaster	Production
i26.d.w	Re-processing of ash into clinker	Production
i26.e	Manufacture of other non-metallic mineral products not elsewhere classified	Production
i27.a	Manufacture of basic iron and steel and of ferro-alloys and first products thereof	Production
i27.a.w	Re-processing of secondary steel into new steel	Production
i27.41	Precious metals production	Production
i27.41.w	Re-processing of secondary precious metals into new precious metals	Production
i27.42	Aluminum production	Production
i27.42.w	Re-processing of secondary aluminum into new aluminum	Production
i27.43	Lead, zinc, and tin production	Production
i27.43.w	Re-processing of secondary lead into new lead, zinc and tin	Production
i27.44	Copper production	Production
i27.44.w	Re-processing of secondary copper into new copper	Production
i27.45	Other non-ferrous metal production	Production
i27.45.w	Re-processing of secondary other non-ferrous metals into new other non-ferrous metals	Production
i27.5	Casting of metals	Production

i28	Manufacture of fabricated metal products, except machinery and equipment (28)	Production
i29	Manufacture of machinery and equipment not elsewhere classified (29)	Production
i30	Manufacture of office machinery and computers (30)	Production
i31	Manufacture of electrical machinery and apparatus not elsewhere classified (31)	Production
i32	Manufacture of radio, television and communication equipment and apparatus (32)	Production
i33	Manufacture of medical, precision and optical instruments, watches and clocks (33)	Production
i34	Manufacture of motor vehicles, trailers and semi-trailers (34)	Production
i35	Manufacture of other transport equipment (35)	Production
i36	Manufacture of furniture; manufacturing not elsewhere classified (36)	Production
i37	Recycling of waste and scrap	Recycling
i37.w.1	Recycling of bottles by direct reuse	Recycling
i40.11.a	Production of electricity by coal	Production
i40.11.b	Production of electricity by gas	Production
i40.11.c	Production of electricity by nuclear	Production
i40.11.d	Production of electricity by hydro	Production
i40.11.e	Production of electricity by wind	Production
i40.11.f	Production of electricity by petroleum and other oil derivatives	Production
i40.11.g	Production of electricity by biomass and waste	Production
i40.11.h	Production of electricity by solar photovoltaic	Production
i40.11.i	Production of electricity by solar thermal	Production
i40.11.j	Production of electricity by tide, wave, ocean	Production
i40.11.k	Production of electricity by Geothermal	Production
i40.11.l	Production of electricity not elsewhere classified	Production
i40.12	Transmission of electricity	Production
i40.13	Distribution and trade of electricity	Production
i40.2	Manufacture of gas; distribution of gaseous fuels through mains	Production
i40.3	Steam and hot water supply	Production

i41	Collection, purification and distribution of water (41)	Production
i45	Construction (45)	Production
i45.w	Re-processing of secondary construction material into aggregates	Production
i50.a	Sale, maintenance, repair of motor vehicles, motor vehicles parts, motorcycles, motor cycles parts and accessories	non-production
i50.b	Retail sale of automotive fuel	Production
i51	Wholesale trade and commission trade, except of motor vehicles and motorcycles (51)	non-production
i52	Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods (52)	non-production
i55	Hotels and restaurants (55)	Production
i60.1	Transport via railways	Production
i60.2	Other land transport	Production
i60.3	Transport via pipelines	Production
i61.1	Sea and coastal water transport	Production
i61.2	Inland water transport	Production
i62	Air transport (62)	Production
i63	Supporting and auxiliary transport activities; activities of travel agencies (63)	Production
i64	Post and telecommunications (64)	Production
i65	Financial intermediation, except insurance and pension funding (65)	non-production
i66	Insurance and pension funding, except compulsory social security (66)	non-production
i67	Activities auxiliary to financial intermediation (67)	non-production
i70	Real estate activities (70)	fictitious
i71	Renting of machinery and equipment without operator and of personal and household goods (71)	Production
i72	Computer and related activities (72)	Production
i73	Research and development (73)	Production
i74	Other business activities (74)	Production
i75	Public administration and defense; compulsory social	non-profit

	security (75)	
i80	Education (80)	Production
i85	Health and social work (85)	Production
i90.1.a	Incineration of waste: Food	Non-profit
i90.1.b	Incineration of waste: Paper	Non-profit
i90.1.c	Incineration of waste: Plastic	Non-profit
i90.1.d	Incineration of waste: Metals and Inert materials	Non-profit
i90.1.e	Incineration of waste: Textiles	Non-profit
i90.1.f	Incineration of waste: Wood	Non-profit
i90.1.g	Incineration of waste: Oil/Hazardous waste	Non-profit
i90.2.a	Biogasification of food waste, including land application	Non-profit
i90.2.b	Biogasification of paper, including land application	Non-profit
i90.2.c	Biogasification of sewage sludge, including land application	Non-profit
i90.3.a	Composting of food waste, including land application	Non-profit
i90.3.b	Composting of paper and wood, including land application	Non-profit
i90.4.a	Waste water treatment, food	Non-profit
i90.4.b	Waste water treatment, other	Non-profit
i90.5.a	Landfill of waste: Food	Non-profit
i90.5.b	Landfill of waste: Paper	Non-profit
i90.5.c	Landfill of waste: Plastic	Non-profit
i90.5.d	Landfill of waste: Inert/metal/hazardous	Non-profit
i90.5.e	Landfill of waste: Textiles	Non-profit
i90.5.f	Landfill of waste: Wood	Non-profit
i91	Activities of membership organization not elsewhere classified (91)	Non-profit
i92	Recreational, cultural and sporting activities (92)	Non-profit
i93	Other service activities (93)	Non-profit
i95	Private households with employed persons (95)	Fictitious
i99	Extra-territorial organizations and bodies	Fictitious

Source: EXIOBASE 3.8.2 1995–2020. Categories defined by authors.

Appendix 3.D Production, Nonproduction, Nonprofit, and Recycling Industries

Appendix [Tables 3.D.1](#) and [3.D.2](#) give summary statistics for market, direct, and production prices in different industry categories and countries. The price sums are expressed in percentages of gross global production evaluated at direct, production, and market prices, adding up to 100 percent within each price-vector category. For illustration, in the first row (for the global sum of prices), production industries command 79.48 percent of global production in production prices but 80.47 percent in market prices. While the presentation might seem counterintuitive at first, it allows us to directly compare industries in each country as a share in gross global production and to highlight the differences arising from the use of different price bases. For example, the market-price column in the production supercolumn shows that in the period 1995–2020, the United States was by far the largest producer worldwide. The same is true for nonproduction industries in trade and financial services. Finally, the last column shows the share of nonproduction market prices in the aggregate of production and nonproduction industries, a simple measure of the relative significance of nonproduction industries in a national economy. Inspecting the table, we see a significant degree of heterogeneity between countries, with the United States significantly above and China significantly below the international average ratio of nonproduction industries to the aggregate of production and nonproduction industries. Single countries such as Switzerland and Luxemburg show even higher ratios, pointing to their status as large financial centers or trading hubs.

Figures presented in [Table 3.D.1](#) are averages over the period 1995–2020, which comes with some loss of information on economic dynamics of this period, which many would argue brought about substantial shifts in China and the former Eastern Bloc countries. [Table 3.D.2](#) has the same structure but is restricted to 2020, when China overtook the United States as the global leader in production industries but still lagged behind in nonproduction industries. Also,

Britain lost a substantial share in production industries but expanded its importance in nonproduction when compared to the mean of the whole period. The data show no increased overall importance of nonproduction industries, while the EXIOBASE data does not include balance-of-payment accounts.

Table 3.D.1 Shares in gross global production by country and industry category, market prices, and (3) direct prices, as well as the size ratio of nonpr

	Production			Nonproduction			Nonprofit		
	PP	MP	DP	PP	MP	DP	PP	MP	DP
Sum	79.48	80.47	78.88	9.18	7.53	9.46	11.23	11.89	11.56
US	18.39	17.11	18.55	4.07	3.22	4.19	3.38	3.21	3.50
CN	10.08	10.98	9.44	0.52	0.43	0.53	0.49	0.77	0.50
JP	9.11	8.21	9.05	0.68	0.53	0.70	1.07	1.02	1.12
DE	4.43	4.37	4.46	0.36	0.30	0.37	0.58	0.58	0.59
GB	3.34	3.15	3.37	0.30	0.25	0.31	0.52	0.53	0.53
FR	3.23	3.12	3.24	0.26	0.22	0.27	0.44	0.45	0.46
WA	2.70	2.73	2.69	0.20	0.17	0.21	0.68	0.58	0.69
IT	2.80	2.67	2.78	0.20	0.17	0.20	0.46	0.50	0.46
WM	1.86	2.25	1.88	0.24	0.22	0.25	0.24	0.28	0.25
WL	1.96	2.23	1.96	0.18	0.16	0.19	0.30	0.35	0.31
KR	1.73	1.96	1.67	0.11	0.09	0.11	0.13	0.18	0.13
IN	1.65	1.86	1.63	0.15	0.12	0.16	0.20	0.22	0.20
BR	1.50	1.73	1.51	0.24	0.23	0.25	0.20	0.26	0.21
ES	1.56	1.65	1.55	0.11	0.09	0.11	0.17	0.20	0.18
CA	1.57	1.52	1.57	0.33	0.27	0.34	0.35	0.32	0.35
WF	1.14	1.32	1.15	0.10	0.09	0.10	0.14	0.18	0.15
RU	1.20	1.25	1.21	0.16	0.12	0.16	0.21	0.29	0.22
MX	0.98	1.23	0.99	0.08	0.07	0.08	0.11	0.16	0.12
AU	1.18	1.21	1.18	0.11	0.10	0.11	0.23	0.23	0.23
NL	0.90	0.95	0.90	0.09	0.08	0.09	0.15	0.16	0.15
ID	0.46	0.76	0.46	0.05	0.05	0.05	0.03	0.06	0.03
TR	0.53	0.75	0.53	0.04	0.04	0.04	0.07	0.12	0.07
TW	0.70	0.75	0.67	0.06	0.05	0.06	0.08	0.10	0.08
CH	0.74	0.69	0.74	0.04	0.04	0.05	0.18	0.20	0.18
BE	0.63	0.63	0.63	0.05	0.04	0.05	0.10	0.11	0.10

SE	0.62	0.60	0.63	0.03	0.03	0.03	0.07	0.07	0.07
PL	0.42	0.51	0.41	0.03	0.03	0.03	0.05	0.10	0.05
AT	0.46	0.47	0.46	0.04	0.03	0.04	0.06	0.07	0.07
NO	0.39	0.42	0.39	0.03	0.03	0.03	0.04	0.05	0.05
WE	0.46	0.42	0.45	0.03	0.03	0.03	0.06	0.06	0.06
DK	0.40	0.36	0.41	0.03	0.03	0.03	0.06	0.05	0.06
ZA	0.28	0.35	0.27	0.09	0.08	0.09	0.07	0.07	0.07
IE	0.31	0.34	0.31	0.02	0.02	0.02	0.05	0.07	0.05
FI	0.33	0.32	0.33	0.02	0.02	0.02	0.03	0.03	0.03
CZ	0.26	0.29	0.25	0.02	0.01	0.02	0.03	0.04	0.03
PT	0.27	0.28	0.27	0.02	0.02	0.03	0.04	0.04	0.04
GR	0.18	0.25	0.18	0.04	0.03	0.04	0.03	0.04	0.03
RO	0.15	0.17	0.15	0.01	0.01	0.01	0.01	0.01	0.01
HU	0.16	0.17	0.15	0.01	0.01	0.01	0.02	0.02	0.02
SK	0.08	0.10	0.08	0.01	0.01	0.01	0.01	0.01	0.01
SI	0.06	0.06	0.06	0.00	0.00	0.00	0.01	0.01	0.01
LU	0.04	0.04	0.04	0.00	0.00	0.00	0.05	0.06	0.04
BG	0.05	0.06	0.05	0.00	0.00	0.00	0.01	0.01	0.01
HR	0.06	0.06	0.06	0.01	0.00	0.01	0.01	0.01	0.01
LT	0.03	0.04	0.03	0.00	0.00	0.00	0.00	0.01	0.00
LV	0.02	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00
EE	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00
CY	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00
MT	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00



Source: EXIOBASE 3.8.2 1995–2020. Categories defined by authors.

Table 3.D.2 Only 2020: Shares in gross global production by country and industry, prices, (2) market prices, and (3) direct prices, as well as the share of nonmarket production by industry [\[link\]](#)

	<i>Production</i>			<i>Nonproduction</i>			<i>Nonprofit</i>		
	<i>PP</i>	<i>MP</i>	<i>DP</i>	<i>PP</i>	<i>MP</i>	<i>DP</i>	<i>PP</i>	<i>MP</i>	<i>DP</i>
Sum	79.27	80.73	78.82	11.04	11.64	11.27	9.56	7.51	9.78
CN	17.72	20.75	17.05	1.04	1.71	1.06	1.25	1.00	1.28

US	16.67	14.95	16.85	3.21	2.90	3.29	3.82	2.88	3.90
JP	5.40	4.63	5.37	0.65	0.56	0.68	0.48	0.35	0.49
DE	3.47	3.36	3.48	0.45	0.42	0.46	0.28	0.23	0.29
WA	3.48	3.33	3.49	0.81	0.70	0.82	0.33	0.25	0.33
IN	2.57	2.82	2.56	0.33	0.35	0.35	0.27	0.20	0.28
WM	2.33	2.66	2.35	0.34	0.37	0.34	0.34	0.29	0.35
GB	2.56	2.22	2.58	0.43	0.40	0.44	0.23	0.18	0.23
FR	2.48	2.20	2.50	0.34	0.33	0.35	0.23	0.18	0.23
KR	1.88	2.10	1.84	0.16	0.24	0.15	0.14	0.12	0.14
WL	1.77	1.97	1.78	0.27	0.34	0.27	0.20	0.17	0.20
IT	1.96	1.79	1.96	0.29	0.29	0.29	0.14	0.11	0.15
WF	1.41	1.52	1.42	0.20	0.22	0.20	0.13	0.11	0.13
BR	1.29	1.41	1.30	0.18	0.23	0.18	0.22	0.20	0.23
RU	1.39	1.29	1.40	0.27	0.31	0.27	0.20	0.15	0.21
ES	1.20	1.23	1.20	0.16	0.17	0.16	0.09	0.07	0.09
CA	1.34	1.23	1.35	0.31	0.28	0.32	0.30	0.24	0.31
AU	1.10	1.09	1.10	0.22	0.21	0.22	0.12	0.10	0.12
ID	0.66	1.06	0.66	0.03	0.05	0.04	0.08	0.08	0.08
MX	0.80	1.01	0.80	0.08	0.14	0.08	0.06	0.05	0.06
NL	0.73	0.74	0.74	0.13	0.14	0.13	0.08	0.06	0.08
TW	0.57	0.69	0.55	0.05	0.09	0.05	0.06	0.05	0.06
TR	0.60	0.64	0.60	0.11	0.13	0.12	0.03	0.03	0.03
CH	0.66	0.62	0.66	0.16	0.16	0.16	0.04	0.03	0.04
PL	0.44	0.56	0.44	0.05	0.09	0.05	0.04	0.03	0.04
BE	0.53	0.50	0.52	0.09	0.09	0.09	0.04	0.03	0.04
IE	0.46	0.48	0.45	0.07	0.09	0.07	0.02	0.01	0.02
SE	0.47	0.44	0.48	0.06	0.06	0.06	0.03	0.02	0.03
WE	0.43	0.41	0.42	0.06	0.07	0.06	0.04	0.03	0.04
AT	0.41	0.40	0.41	0.06	0.06	0.06	0.03	0.02	0.03
NO	0.32	0.33	0.33	0.04	0.04	0.04	0.03	0.02	0.03
CZ	0.28	0.30	0.27	0.04	0.04	0.04	0.02	0.02	0.02
ZA	0.17	0.28	0.16	0.06	0.06	0.06	0.08	0.07	0.08
DK	0.33	0.26	0.33	0.06	0.05	0.06	0.03	0.02	0.03
FI	0.29	0.26	0.29	0.03	0.02	0.03	0.02	0.02	0.02

PT	0.22	0.20	0.22	0.03	0.03	0.03	0.02	0.01	0.02
RO	0.18	0.20	0.18	0.02	0.02	0.03	0.02	0.01	0.02
HU	0.16	0.16	0.16	0.02	0.02	0.02	0.01	0.01	0.01
GR	0.13	0.15	0.13	0.03	0.03	0.03	0.01	0.01	0.01
SK	0.09	0.12	0.09	0.01	0.01	0.01	0.01	0.01	0.01
LU	0.05	0.05	0.05	0.06	0.08	0.05	0.00	0.00	0.00
BG	0.06	0.07	0.06	0.01	0.01	0.01	0.01	0.00	0.01
SI	0.06	0.05	0.06	0.01	0.01	0.01	0.00	0.00	0.00
HR	0.05	0.05	0.05	0.00	0.01	0.00	0.01	0.00	0.01
LT	0.04	0.04	0.04	0.01	0.01	0.01	0.00	0.00	0.00
LV	0.03	0.03	0.03	0.00	0.01	0.00	0.00	0.00	0.00
EE	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00
CY	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
MT	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00

Source: EXIOBASE 3.8.2 2020. Categories defined by authors.

Appendix 4.A Value Transfers

Table 4.A.1 Share of (1) total, (2) VCC-, and (3) RSV-induced value transfer global gross production, in production prices, with profit rates equalized internationally and wage rates equalized nationally, as well as (4) domestic shares of global gross production in production prices. Only production industries. Aggregated and averaged over the period 1995–2020 ↪

Country	Total	VCC	RSV	PP
[Sum Positive]	5.90	3.01	2.90	
[Sum Negative]	-5.90	-3.01	-2.90	
JP	2.67	1.33	1.34	13.90
US	1.09	0.31	0.78	23.03
CN	0.90	0.90	0.01	17.50
IT	0.35	0.17	0.19	4.31
GB	0.33	0.10	0.23	4.00
FR	0.33	0.12	0.21	4.19
	0.12	0.05	0.07	0.88

SE				
DK	0.06	0.02	0.04	0.55
CA	0.03	0.00	0.03	2.23
CH	0.01	0.00	0.01	1.00
SI	0.00	0.00	0.00	0.09
EE	0.00	0.00	0.00	0.04
HR	0.00	0.00	0.00	0.09
MT	0.00	0.00	0.00	0.01
CY	-0.01	0.00	0.00	0.02
LV	-0.01	0.00	0.00	0.03
BE	-0.01	0.00	0.00	0.85
LU	-0.02	-0.01	-0.01	0.05
LT	-0.02	-0.01	-0.01	0.04
PT	-0.02	-0.01	-0.01	0.36
TW	-0.02	0.01	-0.03	1.13
FI	-0.03	-0.02	-0.01	0.44
BG	-0.03	-0.01	-0.01	0.06
HU	-0.03	-0.02	-0.02	0.23
AT	-0.05	-0.03	-0.02	0.64
SK	-0.06	-0.03	-0.03	0.10
ZA	-0.08	-0.03	-0.05	0.43
IE	-0.10	-0.05	-0.05	0.38
NL	-0.11	-0.07	-0.04	1.01
RO	-0.11	-0.06	-0.06	0.19
NO	-0.12	-0.07	-0.05	0.46
CZ	-0.12	-0.05	-0.07	0.35
IN	-0.13	-0.07	-0.06	2.87
GR	-0.14	-0.07	-0.06	0.18
AU	-0.18	-0.08	-0.09	1.49
PL	-0.27	-0.13	-0.13	0.52
DE	-0.32	-0.24	-0.08	6.15
TR	-0.41	-0.22	-0.19	0.69
ES	-0.45	-0.23	-0.22	2.06
BR	-0.45	-0.23	-0.22	1.93

KR	-0.47	-0.20	-0.27	2.40
RU	-0.50	-0.26	-0.24	1.61
ID	-0.55	-0.28	-0.26	0.53
MX	-1.11	-0.53	-0.58	0.99

Source: EXIOBASE 3.8.2 1995–2020. Authors' calculations.

Table 4.A.2 Share of (1) total, (2) VCC-, and (3) RSV-induced value transfers in global gross production, in production prices, with profit rates equalized internationally and wage rates equalized nationally, as well as (4) domestic shares of global gross production in production prices. Only production industries. Only 2020 ↴

Country	Total	VCC	RSV	PP
[Sum Positive]	6.06	3.08	2.99	
[Sum Negative]	-6.06	-3.08	-2.99	
CN	2.62	1.67	0.95	30.71
FR	0.83	0.37	0.45	3.45
JP	0.74	0.37	0.37	8.21
GB	0.53	0.22	0.31	3.19
US	0.38	0.01	0.37	19.61
IT	0.37	0.18	0.20	3.15
CA	0.22	0.09	0.13	1.97
SE	0.16	0.07	0.09	0.71
DK	0.11	0.05	0.06	0.49
FI	0.06	0.02	0.03	0.42
AT	0.01	0.01	0.01	0.60
SI	0.01	0.00	0.01	0.10
PT	0.01	0.00	0.00	0.30
HU	0.01	0.00	0.00	0.25
EE	0.00	0.00	0.00	0.05
HR	0.00	0.00	0.00	0.07
CY	-0.01	0.00	0.00	0.01
MT	-0.01	0.00	0.00	0.01
BG	-0.02	-0.01	-0.01	0.09
LV	-0.02	-0.01	-0.01	0.03
LU	-0.03	-0.01	-0.01	0.05

LT	-0.03	-0.01	-0.01	0.05
BE	-0.03	-0.02	-0.02	0.70
NL	-0.03	-0.02	-0.01	0.83
NO	-0.04	-0.02	-0.01	0.40
SK	-0.07	-0.03	-0.04	0.12
CH	-0.09	-0.04	-0.05	0.84
IN	-0.09	-0.07	-0.03	4.62
IE	-0.09	-0.05	-0.04	0.68
ZA	-0.10	-0.04	-0.06	0.24
GR	-0.11	-0.06	-0.06	0.11
CZ	-0.13	-0.06	-0.07	0.39
RO	-0.15	-0.07	-0.07	0.23
TR	-0.22	-0.12	-0.10	0.91
AU	-0.24	-0.12	-0.12	1.29
BR	-0.28	-0.15	-0.13	1.69
ES	-0.29	-0.15	-0.14	1.57
PL	-0.30	-0.15	-0.15	0.54
DE	-0.31	-0.20	-0.11	4.76
RU	-0.35	-0.18	-0.16	1.92
TW	-0.45	-0.20	-0.25	0.76
KR	-0.46	-0.21	-0.26	2.52
ID	-0.84	-0.43	-0.40	0.73
MX	-1.28	-0.62	-0.66	0.63

Source: EXIOBASE 3.8.2 1995–2020. Authors' calculations.

Table 4.A.3 Share of (1) total, (2) VCC- and (3) RSV-induced value transfers in domestic gross production in production prices with profit rates equalized internationally and wage rates equalized nationally, as well as (4) domestic shares of global gross production in production prices. Only production industries. Aggregated and averaged over the period 1995–2020 ↗

Country	Total(Total + MP)	VCC(Total + MP)	RSV(Total + MP)	PP
JP	16.13	8.02	8.11	13.90
US	4.52	1.30	3.22	23.03

CN	4.90	4.88	0.03	17.50
IT	7.60	3.59	4.01	4.31
GB	7.72	2.32	5.40	4.00
FR	7.29	2.61	4.68	4.19
SE	11.97	5.21	6.77	0.88
DK	9.84	3.90	5.94	0.55
CA	1.30	-0.12	1.42	2.23
CH	0.75	0.13	0.61	1.00
SI	3.03	1.06	1.97	0.09
EE	-0.76	-0.74	-0.01	0.04
HR	-0.61	-1.95	1.34	0.09
MT	-16.50	-7.86	-8.64	0.01
CY	-22.52	-12.69	-9.83	0.02
LV	-19.05	-9.52	-9.54	0.03
BE	-0.99	-0.42	-0.58	0.85
LU	-26.11	-14.15	-11.96	0.05
LT	-33.67	-17.98	-15.69	0.04
PT	-5.72	-3.21	-2.51	0.36
TW	-1.92	0.85	-2.77	1.13
FI	-5.59	-3.44	-2.15	0.44
BG	-30.59	-14.74	-15.85	0.06
HU	-12.56	-6.13	-6.44	0.23
AT	-6.86	-4.31	-2.55	0.64
SK	-35.85	-16.71	-19.14	0.10
ZA	-15.51	-5.86	-9.65	0.43
IE	-20.27	-10.57	-9.70	0.38
NL	-9.56	-5.88	-3.68	1.01
RO	-37.50	-18.89	-18.61	0.19
NO	-20.37	-11.51	-8.85	0.46
CZ	-25.24	-11.19	-14.06	0.35
IN	-4.48	-2.46	-2.02	2.87
GR	-43.14	-22.63	-20.52	0.18
AU	-10.57	-4.93	-5.64	1.49
PL	-34.06	-17.03	-17.04	0.52
DE	-5.01	-3.74	-1.27	6.15

TR	-37.35	-19.70	-17.64	0.69
ES	-17.80	-8.98	-8.82	2.06
BR	-18.93	-9.62	-9.30	1.93
KR	-16.32	-6.82	-9.50	2.40
RU	-23.62	-12.16	-11.47	1.61
ID	-50.91	-26.48	-24.43	0.53
MX	-53.06	-25.27	-27.79	0.99

Source: EXIOBASE 3.8.2 1995–2020. Authors' calculations.

Appendix 4.B Value Capture

Table 4.B.1 Nonproduction value capture from foreign production industries, composed of (1) inflows through the intermediate consumption matrix (circulating capital), (2) inflows through gross fixed capital formation, and (3) foreign share in nonproduction industries' value added as shares of global gross production. Aggregated and averaged over the period 1995–2020 ↪

	<i>Circulating capital</i>	<i>Gross fixed capital formation</i>	<i>Value added</i>	<i>Total nonproduction value capture</i>	<i>MP</i>
Sum	0.1499	0.000122	0.000584	0.1506	88.93
GB	0.0135	0.000004	0.000058	0.0135	3.93
DE	0.0123	0.000014	0.000037	0.0124	5.26
US	0.0117	0.000003	0.000033	0.0117	23.54
IE	0.0101	0.000003	0.000042	0.0102	0.42
IT	0.0095	0.000012	0.000017	0.0096	3.33
CH	0.0095	0.000003	0.000033	0.0095	0.93
NL	0.0091	0.000015	0.000042	0.0092	1.19
BE	0.0079	0.000008	0.000022	0.0079	0.78
FR	0.0067	0.000003	0.000016	0.0067	3.79
JP	0.0051	0.000001	0.000010	0.0051	9.77
CN	0.0043	0.000003	0.000017	0.0043	12.22
PL	0.0042	0.000006	0.000043	0.0043	0.64
LU	0.0042	0.000001	0.000033	0.0042	0.11
CA	0.0040	0.000007	0.000007	0.0040	2.12

AU	0.0040	0.000004	0.000010	0.0040	1.54
SE	0.0038	0.000005	0.000013	0.0038	0.71
RU	0.0037	0.000001	0.000038	0.0038	1.66
AT	0.0031	0.000004	0.000012	0.0031	0.57
ES	0.0031	0.000003	0.000013	0.0031	1.94
KR	0.0022	0.000001	0.000010	0.0023	2.24
FI	0.0018	0.000001	0.000006	0.0018	0.38
DK	0.0016	0.000001	0.000004	0.0016	0.44
MX	0.0014	0.000006	0.000009	0.0014	1.46
NO	0.0014	0.000002	0.000005	0.0014	0.50
BR	0.0014	0.000001	0.000007	0.0014	2.22
IN	0.0014	0.000000	0.000004	0.0014	2.19
HU	0.0013	0.000001	0.000003	0.0013	0.20
PT	0.0011	0.000001	0.000004	0.0011	0.34
CZ	0.0011	0.000002	0.000003	0.0011	0.34
SK	0.0009	0.000002	0.000005	0.0009	0.12
TR	0.0007	0.000001	0.000006	0.0007	0.91
BG	0.0004	0.000000	0.000002	0.0004	0.07
ID	0.0004	0.000000	0.000003	0.0004	0.87
GR	0.0004	0.000000	0.000005	0.0004	0.32
ZA	0.0004	0.000000	0.000001	0.0004	0.50
TW	0.0003	0.000000	0.000002	0.0003	0.90
CY	0.0003	0.000000	0.000002	0.0003	0.03
SI	0.0003	0.000000	0.000001	0.0003	0.07
MT	0.0003	0.000000	0.000001	0.0003	0.01
EE	0.0002	0.000000	0.000001	0.0002	0.03
HR	0.0002	0.000000	0.000001	0.0002	0.07
LT	0.0002	0.000000	0.000002	0.0002	0.05
LV	0.0002	0.000000	0.000001	0.0002	0.03
RO	0.0002	0.000000	0.000001	0.0002	0.20

Source: EXIOBASE 3.8.2 1995–2020. Authors' calculations.

Table 4.B.2 Nonproduction value capture from foreign production industries, composed of (1) inflows through the intermediate consumption matrix (circulating capital), (2) inflows through gross fixed capital

штатик (circulating capital), (2) штатикова груса пакета капитала formation, and (3) foreign share in nonproduction industries' value added as shares of global gross production. Only 2020 ↪

	<i>Circulating capital</i>	<i>Gross fixed capital formation</i>	<i>Value added</i>	<i>Total nonproduction value capture</i>	<i>MP</i>
Sum	0.1607	0.000108	0.000583	0.1613	87.55
IE	0.0197	0.000012	0.000075	0.0197	0.58
US	0.0150	0.000001	0.000039	0.0150	20.74
GB	0.0137	0.000006	0.000048	0.0138	2.80
DE	0.0129	0.000012	0.000030	0.0130	4.01
LU	0.0117	0.000001	0.000070	0.0118	0.14
NL	0.0105	0.000009	0.000044	0.0106	0.94
FR	0.0092	0.000001	0.000022	0.0092	2.71
CH	0.0076	0.000002	0.000021	0.0076	0.82
PL	0.0072	0.000012	0.000063	0.0073	0.69
BE	0.0070	0.000005	0.000018	0.0071	0.62
IT	0.0054	0.000007	0.000010	0.0054	2.20
AU	0.0050	0.000005	0.000010	0.0050	1.40
RU	0.0042	0.000001	0.000045	0.0043	1.74
SE	0.0042	0.000005	0.000013	0.0042	0.52
AT	0.0033	0.000004	0.000010	0.0033	0.49
ES	0.0030	0.000003	0.000009	0.0030	1.47
JP	0.0026	0.000001	0.000004	0.0026	5.55
DK	0.0025	0.000001	0.000005	0.0026	0.33
CA	0.0025	0.000005	0.000005	0.0025	1.74
HU	0.0021	0.000002	0.000003	0.0021	0.19
CZ	0.0012	0.000002	0.000003	0.0013	0.36
PT	0.0012	0.000001	0.000003	0.0012	0.25
FI	0.0010	0.000001	0.000003	0.0010	0.30
SK	0.0008	0.000002	0.000004	0.0008	0.14
BG	0.0007	0.000001	0.000003	0.0007	0.08
NO	0.0006	0.000001	0.000003	0.0007	0.39
BR	0.0006	0.000000	0.000003	0.0006	1.83
TR	0.0006	0.000001	0.000001	0.0006	0.80
IN	0.0005	0.000000	0.000001	0.0005	3.37

CN	0.0005	0.000000	0.000003	0.0005	23.53
MT	0.0005	0.000000	0.000002	0.0005	0.02
LT	0.0004	0.000000	0.000003	0.0004	0.05
SI	0.0004	0.000000	0.000001	0.0004	0.06
EE	0.0003	0.000000	0.000001	0.0003	0.04
GR	0.0003	0.000000	0.000001	0.0003	0.19
CY	0.0003	0.000000	0.000001	0.0003	0.02
ZA	0.0002	0.000000	0.000001	0.0002	0.42
RO	0.0002	0.000000	0.000000	0.0002	0.24
KR	0.0002	0.000000	0.000001	0.0002	2.46
LV	0.0002	0.000000	0.000001	0.0002	0.04
MX	0.0001	0.000000	0.000002	0.0002	1.20
HR	0.0001	0.000000	0.000000	0.0001	0.06
TW	0.0001	0.000000	0.000001	0.0001	0.84
ID	0.0001	0.000000	0.000000	0.0001	1.19

Source: EXIOBASE 3.8.2 1995–2020. Authors' calculations.

Table 4.B.3 Nonproduction value capture as share of domestic gross production in market prices in the top 12 countries (ordered with respect to

total value capture as shares in global gross production), composed of (1) inflows through the intermediate consumption matrix (circulating capital), (2) inflows through gross fixed capital formation, and (3) foreign share in nonproduction industries' value added. Aggregated and averaged over the period 1995–2020 [✉](#)

	<i>Circulating capital</i>	<i>Gross fixed capital formation</i>	<i>Value added</i>	<i>Total nonproduction value capture</i>	<i>MP</i>
GB	0.3429	0.000109	0.001481	0.3445	3.93
DE	0.2338	0.000265	0.000697	0.2348	5.26
US	0.0495	0.000013	0.000141	0.0497	23.54
IE	2.4182	0.000775	0.010071	2.4291	0.42
IT	0.2856	0.000366	0.000513	0.2865	3.33
CH	1.0170	0.000358	0.003592	1.0209	0.93
NL	0.7659	0.001256	0.003560	0.7707	1.19

BE	1.0080	0.000987	0.002832	1.0118	0.78
FR	0.1766	0.000070	0.000421	0.1771	3.79
JP	0.0526	0.000015	0.000100	0.0527	9.77
CN	0.0353	0.000026	0.000141	0.0355	12.22
PL	0.6585	0.000906	0.006696	0.6661	0.64
LU	4.0007	0.000779	0.031615	4.0331	0.11
CA	0.1893	0.000326	0.000323	0.1900	2.12
AU	0.2586	0.000281	0.000617	0.2595	1.54
SE	0.5383	0.000668	0.001795	0.5408	0.71
RU	0.2253	0.000052	0.002279	0.2276	1.66
AT	0.5373	0.000746	0.002044	0.5401	0.57
ES	0.1588	0.000161	0.000647	0.1596	1.94
KR	0.1002	0.000044	0.000441	0.1007	2.24
FI	0.4679	0.000327	0.001526	0.4697	0.38
DK	0.3717	0.000192	0.000969	0.3729	0.44
MX	0.0962	0.000413	0.000633	0.0973	1.46
NO	0.2807	0.000394	0.001016	0.2821	0.50
BR	0.0626	0.000025	0.000324	0.0630	2.22
IN	0.0627	0.000015	0.000162	0.0629	2.19
HU	0.6283	0.000702	0.001413	0.6304	0.20
PT	0.3237	0.000272	0.001116	0.3251	0.34
CZ	0.3162	0.000512	0.000868	0.3176	0.34
SK	0.7087	0.001518	0.004022	0.7143	0.12
TR	0.0801	0.000113	0.000651	0.0808	0.91
BG	0.6465	0.000664	0.002980	0.6502	0.07
ID	0.0480	0.000022	0.000360	0.0483	0.87
GR	0.1178	0.000071	0.001579	0.1195	0.32
ZA	0.0734	0.000024	0.000220	0.0736	0.50
TW	0.0380	0.000015	0.000179	0.0382	0.90
CY	1.2678	0.000378	0.007026	1.2752	0.03
SI	0.4421	0.000274	0.001345	0.4437	0.07
MT	1.7683	0.000433	0.007197	1.7759	0.01
EE	0.8439	0.000804	0.003077	0.8478	0.03
HR	0.3238	0.000102	0.001289	0.3252	0.07
LT	0.4613	0.000380	0.004612	0.4663	0.05

LV	0.5113	0.000179	0.002750	0.5143	0.03
RO	0.0826	0.000014	0.000702	0.0833	0.20

Source: EXIOBASE 3.8.2 1995–2020. Authors' calculations.

Appendix 5.A Regression Tables

Table 5.A.1 Coefficients and significance levels from two-way fixed-effects estimation of the impact of land use and resource extraction on deviations between market prices and production prices

<i>Dependent Var.</i>	$(MP - PP)/MP$
Forestland	2.79*** (0.28) -3.80*** (0.88) 2.68 (3.52)
Cropland	7.27*** (0.74) -7.37** (2.24) 46.73** (13.34)
Pasture land	-0.49* (0.22) -1.17 (1.40) -0.76 (8.25)
Coal	0.06 (0.09) -14.17* (5.85) 109.67 (57.17)
Gas	1.79*** (0.09) 26.22*** (3.12) -106.73*** (13.78)
Oil	2.00*** (0.18) 12.57*** (0.77) 16.19 (8.48)
Metal ores	2.18*** (0.13) 6.24*** (0.88) -50.49** (15.81)
Nonmetallic ores	-0.11 (0.11) 1.12 (1.58) -13.55** (4.82)
Fixed-Effects	
Year	Yes

Country	Yes
SE: clustered	By: Year
Observations	118,729
R2	0.35
Within-R2	0.18

Notes: *t*-test *p*-values for standard errors clustered for years and countries.

*** $p < 0.001$. [↳](#)

** $p < 0.01$. [↳](#)

* $p < 0.05$. [↳](#)

Appendix 5.B Rents Received and Paid

Table 5.B.1 Predicted rent received and paid per country, in percentages of global gross production. Only production industries. Aggregated and averaged over the period 1995–2020 [↳](#)

	<i>e0</i>	<i>e1</i>	<i>e2</i>	<i>Total</i>
[Sum Positive]	0.4551	0.2475	0.0000	0.0636
[Sum Negative]	0.0000	-0.1266	-2.4098	-1.8973
RU	0.0795	0.0121	-0.0497	0.0420
IN	0.0558	-0.0150	-0.0265	0.0143
NO	0.0094	0.0049	-0.0076	0.0068
GR	0.0001	0.0048	-0.0043	0.0005
MT	0.0000	0.0001	-0.0004	-0.0004
CY	0.0000	0.0003	-0.0008	-0.0004
LU	0.0000	0.0002	-0.0009	-0.0007
HR	0.0000	0.0005	-0.0012	-0.0007
EE	0.0000	0.0001	-0.0013	-0.0012
LV	0.0000	0.0004	-0.0018	-0.0014
SI	0.0000	0.0001	-0.0015	-0.0014
PT	0.0000	0.0013	-0.0033	-0.0019
LT	0.0000	0.0015	-0.0037	-0.0022
BG	0.0000	0.0015	-0.0039	-0.0024
DK	0.0001	0.0002	-0.0031	-0.0028

	<i>e0</i>	<i>e1</i>	<i>e2</i>	<i>Total</i>
SK	0.0000	0.0010	-0.0044	-0.0033
NL	0.0002	0.0106	-0.0142	-0.0035
IE	0.0000	0.0003	-0.0038	-0.0035
RO	0.0002	0.0008	-0.0045	-0.0036
AT	0.0000	0.0012	-0.0071	-0.0058
FI	0.0002	0.0009	-0.0102	-0.0091
TR	0.0019	0.0015	-0.0129	-0.0094
SE	0.0004	0.0010	-0.0116	-0.0101
ZA	0.0007	0.0036	-0.0160	-0.0116
BE	0.0000	0.0005	-0.0129	-0.0124
HU	0.0001	0.0045	-0.0186	-0.0140
PL	0.0007	0.0031	-0.0179	-0.0141
CH	0.0000	0.0019	-0.0180	-0.0161
CA	0.0192	0.0003	-0.0358	-0.0164
MX	0.0109	0.0062	-0.0340	-0.0169
ID	0.0077	0.0001	-0.0268	-0.0191
CZ	0.0000	0.0040	-0.0241	-0.0201
ES	0.0016	0.0092	-0.0348	-0.0239
FR	0.0020	0.0134	-0.0441	-0.0287
GB	0.0048	0.0088	-0.0476	-0.0340
BR	0.0165	0.0046	-0.0683	-0.0472
DE	0.0008	0.0061	-0.0606	-0.0537
IT	0.0009	0.0235	-0.0804	-0.0560
AU	0.0079	-0.0127	-0.0619	-0.0667
TW	0.0000	0.0115	-0.0805	-0.0689
US	0.1099	-0.0613	-0.1361	-0.0875
KR	0.0002	0.0448	-0.1426	-0.0976
JP	0.0021	0.0560	-0.1880	-0.1299
CN	0.1210	-0.0375	-1.0821	-0.9986

Source: EXIOBASE 3.8.2 1995–2020. Authors' calculations.

Table 5.B.2 Predicted rent received and paid per industry, in percentages of global gross production. Only production industries. Aggregated and averaged over the period 1995–2020 ↪

	<i>e0</i>	<i>e1</i>	<i>e2</i>	<i>Total</i>

[Sum Positive]	0.4555	0.5536	0.4770	1.1059
[Sum Negative]	-0.0003	-0.4327	-2.4623	-2.5152
Petroleum refinery	0.0002	0.4494	-0.0856	0.3640
Extraction of crude petroleum and services related to crude oil extraction, excluding surveying	0.1294	0.0089	-0.0152	0.1231
Cultivation of vegetables, fruit, nuts	0.0857	-0.0055	-0.0079	0.0722
Processing of food products not elsewhere classified	0.0001	-0.0749	0.1279	0.0531
Forestry, logging, and related service activities (02)	0.0658	-0.0188	0.0015	0.0485
Cultivation of cereal grains not elsewhere classified	0.0410	-0.0032	0.0007	0.0385
Extraction of natural gas and services related to natural gas extraction, excluding surveying	0.0324	0.0041	-0.0006	0.0360
Cultivation of paddy rice	0.0242	-0.0077	0.0168	0.0334
Hotels and restaurants (55)	0.0000	-0.0112	0.0370	0.0258
Pigs farming	0.0003	-0.0004	0.0216	0.0214
Cultivation of oil seeds	0.0211	-0.0010	0.0012	0.0213
Poultry farming	0.0006	-0.0013	0.0211	0.0203
Cultivation of wheat	0.0206	-0.0021	0.0017	0.0202
Manufacture of fish products	0.0000	-0.0004	0.0161	0.0157
Mining of iron ores	0.0112	0.0013	-0.0003	0.0123
Processing of meat poultry	0.0000	-0.0004	0.0124	0.0120
Processing of meat cattle	0.0000	-0.0073	0.0182	0.0110
Animal products not elsewhere classified	0.0000	-0.0009	0.0105	0.0096
Cattle farming	0.0007	-0.0034	0.0120	0.0092
Processing of meat pigs	0.0000	-0.0002	0.0089	0.0087
Production of meat products not elsewhere classified	0.0000	-0.0001	0.0085	0.0083
Raw milk	0.0030	-0.0022	0.0063	0.0071

Processing of dairy products	0.0000	-0.0025	0.0092	0.0068
Meat animals not elsewhere classified	-0.0003	-0.0001	0.0057	0.0052
Mining of copper ores and concentrates	0.0037	0.0009	-0.0002	0.0044
Cultivation of sugar cane, sugar beet	0.0011	-0.0002	0.0030	0.0039
Wool, silk-worm cocoons	0.0000	0.0000	0.0038	0.0038
Mining of precious metal ores and concentrates	0.0030	0.0011	-0.0004	0.0038
Mining of lead, zinc, and tin ores and concentrates	0.0007	0.0004	0.0025	0.0037
Manure treatment (conventional), storage, and land application	0.0000	0.0000	0.0036	0.0036
Manure treatment (biogas), storage, and land application	0.0000	0.0000	0.0036	0.0036
Reprocessing of secondary precious metals into new precious metals	0.0000	0.0000	0.0035	0.0035
Production of electricity by solar thermal	0.0000	0.0000	0.0035	0.0035
Production of electricity by tide, wave, ocean	0.0000	0.0000	0.0035	0.0035
Production of electricity by solar photovoltaic	0.0000	0.0000	0.0035	0.0035
Reprocessing of secondary construction material into aggregates	0.0000	0.0000	0.0035	0.0035
Reprocessing of secondary other nonferrous metals into new other nonferrous metals	0.0000	0.0000	0.0034	0.0034
Production of electricity by geothermal	0.0000	0.0000	0.0034	0.0034
Sugar refining	0.0000	-0.0017	0.0051	0.0034
Production of electricity by	0.0000	0.0006	0.0028	0.0034

biomass and waste				
Extraction, liquefaction, and regasification of other petroleum and gaseous materials	0.0000	0.0008	0.0026	0.0034
N-fertilizer	0.0000	0.0001	0.0033	0.0034
Mining of nickel ores and concentrates	0.0003	0.0004	0.0027	0.0034
Mining of aluminum ores and concentrates	0.0001	0.0000	0.0032	0.0033
Production of electricity by wind	0.0000	0.0000	0.0032	0.0032
Reprocessing of secondary glass into new glass	0.0000	0.0000	0.0032	0.0032
Reprocessing of secondary lead into new lead, zinc, and tin	0.0000	0.0000	0.0031	0.0031
Processing of nuclear fuel	0.0000	0.0000	0.0031	0.0031
Mining of uranium and thorium ores (12)	0.0000	-0.0001	0.0032	0.0031
Production of electricity not elsewhere classified	0.0000	0.0000	0.0030	0.0030
Cultivation of plant-based fibers	0.0009	0.0000	0.0021	0.0030
Mining of other nonferrous metal ores and concentrates	0.0015	0.0015	-0.0001	0.0029
Inland water transport	0.0000	0.0000	0.0027	0.0027
Reprocessing of ash into clinker	0.0000	-0.0001	0.0027	0.0026
Cultivation of crops not elsewhere classified	0.0052	-0.0010	-0.0018	0.0025
Manufacture of bricks, tiles, and construction products, in baked clay	0.0000	0.0000	0.0021	0.0022
Reprocessing of secondary wood material into new wood material	0.0000	0.0002	0.0019	0.0021
Reprocessing of secondary paper into new pulp	0.0000	0.0000	0.0021	0.0021
Reprocessing of secondary aluminum into new aluminum	0.0000	0.0000	0.0019	0.0019
Mining of chemical and fertilizer	0.0000	-0.0001	0.0019	0.0018

minerals, production of salt, other mining and quarrying not elsewhere classified				
Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing (05)	0.0000	0.0000	0.0016	0.0016
Reprocessing of secondary plastic into new plastic	0.0000	0.0002	0.0013	0.0015
Manufacture of beverages	0.0000	-0.0053	0.0068	0.0015
Reprocessing of secondary copper into new copper	0.0000	0.0001	0.0013	0.0014
Processed rice	0.0000	-0.0087	0.0096	0.0009
Transport via pipelines	0.0000	0.0002	0.0006	0.0008
Quarrying of stone	0.0000	0.0000	0.0003	0.0003
Manufacture of tobacco products (16)	0.0000	-0.0016	0.0017	0.0001
Steam and hot water supply	0.0000	0.0001	-0.0014	-0.0012
Production of electricity by petroleum and other oil derivatives	0.0000	0.0013	-0.0029	-0.0016
Pulp	0.0000	-0.0031	0.0010	-0.0021
P- and other fertilizer	0.0000	0.0014	-0.0035	-0.0021
Production of electricity by nuclear	0.0000	-0.0002	-0.0021	-0.0023
Processing vegetable oils and fats	0.0003	-0.0211	0.0185	-0.0023
Quarrying of sand and clay	0.0000	0.0002	-0.0032	-0.0029
Collection, purification, and distribution of water (41)	0.0000	0.0003	-0.0034	-0.0031
Production of electricity by hydro	0.0000	0.0000	-0.0035	-0.0035
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness, and footwear (19)	0.0000	-0.0004	-0.0039	-0.0043
Sea and coastal-water transport	0.0000	0.0002	-0.0051	-0.0049
Transmission of electricity	0.0000	0.0001	-0.0058	-0.0057

Reprocessing of secondary steel into new steel	0.0000	0.0000	-0.0068	-0.0068
Lead, zinc, and tin production	0.0000	0.0016	-0.0092	-0.0076
Manufacture of coke oven products	0.0000	-0.0117	-0.0003	-0.0120
Other nonferrous metal production	0.0000	0.0049	-0.0176	-0.0127
Transport via railways	0.0000	0.0004	-0.0142	-0.0138
Manufacture of other nonmetallic mineral products not elsewhere classified	0.0000	-0.0039	-0.0135	-0.0174
Publishing, printing, and reproduction of recorded media (22)	0.0000	-0.0001	-0.0173	-0.0174
Air transport (62)	0.0000	0.0013	-0.0193	-0.0180
Aluminum production	0.0000	0.0001	-0.0208	-0.0207
Plastics, basic	0.0000	0.0031	-0.0244	-0.0213
Precious metals production	0.0000	0.0077	-0.0292	-0.0215
Manufacture of medical, precision and optical instruments, watches and clocks (33)	0.0000	0.0002	-0.0223	-0.0221
Manufacture of ceramic goods	0.0000	0.0007	-0.0233	-0.0226
Casting of metals	0.0000	0.0003	-0.0237	-0.0234
Manufacture of cement, lime, and plaster	0.0000	-0.0092	-0.0147	-0.0239
Production of electricity by gas	0.0000	v0.0175	-0.0084	-0.0259
Supporting and auxiliary transport activities; activities of travel agencies (63)	0.0003	-0.0011	-0.0255	-0.0262
Manufacture of wearing apparel; dressing and dyeing of fur (18)	0.0000	0.0041	-0.0322	-0.0281
Manufacture of office machinery and computers (30)	0.0000	0.0000	-0.0284	-0.0284
Manufacture of glass and glass products	0.0000	0.0001	-0.0308	-0.0307
Distribution and trade of electricity	0.0000	0.0000	-0.0309	-0.0308

Mining of coal and lignite; extraction of peat (10)	0.0000	-0.0214	-0.0102	-0.0316
Manufacture of gas; distribution of gaseous fuels through mains	0.0001	-0.0269	-0.0125	-0.0393
Copper production	0.0000	0.0163	-0.0558	-0.0395
Paper	0.0000	-0.0259	-0.0208	-0.0467
Manufacture of other transport equipment (35)	0.0000	0.0002	-0.0526	-0.0525
Manufacture of furniture; manufacturing not elsewhere classified (36)	0.0000	0.0038	-0.0566	-0.0528
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (20)	0.0001	-0.0479	-0.0071	-0.0549
Other land transport	0.0002	0.0036	-0.0620	-0.0583
Manufacture of textiles (17)	0.0000	0.0068	-0.0716	-0.0648
Manufacture of rubber and plastic products (25)	0.0000	-0.0094	-0.0559	-0.0653
Manufacture of radio, television, and communication equipment and apparatus (32)	0.0000	0.0003	-0.0733	-0.0730
Production of electricity by coal	0.0001	-0.0680	-0.0196	-0.0876
Chemicals not elsewhere classified	0.0001	0.0045	-0.1297	-0.1251
Manufacture of motor vehicles, trailers, and semi-trailers (34)	0.0000	0.0013	-0.1298	-0.1285
Manufacture of fabricated metal products, except machinery and equipment (28)	0.0000	v0.0003	-0.1397	-0.1394
Manufacture of electrical machinery and apparatus not elsewhere classified (31)	0.0000	0.0006	-0.1472	-0.1465
Manufacture of machinery and equipment not elsewhere classified (29)	0.0000	0.0008	-0.1776	-0.1767
Manufacture of basic iron and steel	0.0001	0.0165	-0.2073	-0.1907

and of ferro-alloys and first
products thereof

Construction (45)	0.0008	-0.0021	-0.4733	-0.4747
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Source: EXIOBASE 3.8.2 1995–2020. Authors' calculations.