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PRODUCTIVE STAGNATION AND UNPRODUCTIVE ACCUMULATION IN THE UNITED STATES, 1947-2011

A Dissertation Presented

by

TOMÁS N. ROTTA

Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
of the requirements for the degree of

DOCTOR OF PHILOSOPHY

September 2014

Economics

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Approved as to style and content by:

_____
David Kotz, Chair

_____
Gerald Epstein, Member

_____
Deepankar Basu, Member

_____
Thomas Roeper, Outside Member

_____
Michael Ash, Department Chair
Economics

TO MY PROFESSORS,

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ABSTRACT

PRODUCTIVE STAGNATION AND UNPRODUCTIVE ACCUMULATION IN THE UNITED STATES, 1947-2011

SEPTEMBER 2014

TOMÁS N. ROTTA

B.A., UNIVERSITY OF SÃO PAULO

M.A., UNIVERSITY OF SÃO PAULO

PH.D., UNIVERSITY OF MASSACHUSETTS AMHERST

Directed by: Professor David Kotz

My doctoral research addresses the question of how productive and unproductive forms of capital accumulation interact in the United States. My contribution is to first develop a new understanding of the labor theory of value in order to better explain how financial and rentier forms of revenues relate to the wealth created in productive activities. Second, I offer an innovative analysis of historical trends regarding unproductive accumulation in the postwar United States economy. For that purpose, I propose a new methodology to estimate Marxist categories from conventional input-output matrices, national income accounts, and employment data. A core feature of my methodology is the idea that the production of knowledge and information is an unproductive activity. Third, I employ time series econometric techniques to formally evaluate the coevolution between productive and unproductive forms of capital accumulation. My methods therefore consist of a combination of theoretical arguments, descriptive empirical analysis, and econometrics.

The way in which productive and unproductive capitals interact has changed substantially throughout the postwar period in the United States. The accumulation pattern observed during the 1947-1979 phase, which prioritized productive accumulation, gave way after the 1980s to a contrasting pattern prioritizing unproductive accumulation. Unproductive activity has been growing significantly in terms of incomes, fixed assets, and employment. Among all forms of unproductive activity, finance and the creation of knowledge and information have constituted a rising share of total unproductive income and capital stock. Furthermore, productive stagnation and unproductive accumulation have been closely related to greater exploitation of productive workers and to overall income inequality.

The objective of my econometric study is to answer two questions: Does unproductive accumulation hinder or induce productive accumulation, in terms of both short- and long-run effects? Conversely, does productive stagnation lead to faster unproductive accumulation? I provide an econometric assessment of a question that other scholars have so far considered mostly through verbal or descriptive approaches. The main results are as follows. First, productive and unproductive forms of accumulation share no common trend or no stable long-run equilibrium relationship. There is, hence, no self-correcting mechanism that brings these two forms of capital accumulation back into a stable long-run equilibrium. Second, productive and unproductive forms of accumulation tend to be mutually reinforcing in the short term. Despite consuming the surplus from productive endeavors, unproductive accumulation still has a net positive effect on productive accumulation. Third, I find evidence of an absolute crowding-in effect (or positive level effect) coupled with a relative crowding-out effect (or negative share effect) between productive and unproductive forms of capital accumulation. The total value produced in productive activities grows faster when the unproductive capital grows, but slows down when the unproductive capital stock grows faster than the productive capital stock. Fourth,

I find evidence of reverse causality indicating that the share of unproductive capital stock grows faster when there is a slowdown in the total value produced in productive activities.

The combination of theoretical analysis and empirical findings in this study provides a new assessment of how unproductive accumulation and productive stagnation have been core features of the postwar United States economy. Predicated on the concepts of knowledge-rent and of autonomization, I offer a theoretical explanation of unproductive growth that builds on and expands Marxist political economy and the Marxist labor theory of value. The concept of knowledge-rent reveals that the commodification of knowledge expands rentier capitalism. The principle of autonomization uncovers how unproductive activities have a tendency to generate abstract forms of wealth that are increasingly separated from the production of surplus value in productive activities. Even though unproductive accumulation occurs together with rising levels of exploitation of productive workers, capitalism in the United States is an economic system that generates unproductive incomes that gradually obscure the source of new wealth in the exploitation of labor.

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INTRODUCTION

In this dissertation I provide an innovative analysis of capital accumulation in the United States economy from 1947 to 2011. I develop a new theoretical and empirical framework to analyze the coevolution of unproductive and productive forms of accumulation. To develop the theoretical approach I build on and extend Marxist political economy. The combination of theoretical analysis and empirical findings in this study provides a new assessment of how unproductive accumulation and productive stagnation have been core features of the postwar United States economy.

I employ the term *unproductive accumulation* to indicate the growth either in the flow of income or in the stock of capital of unproductive activities. The distinction between productive and unproductive relies directly on the concept of surplus value and, as such, is predicated on the idea that value needs to come from somewhere. In no way does unproductive mean unnecessary, or less important, and it is not a derogatory term. There is also no connection between productive and tangible, since services and intangible commodities can be the output of productive activities.

A *productive activity* is any economic activity that produces surplus value. To be productive of surplus value an activity must have workers (either employed by capitalists or self-employed) creating useful commodities with value for sale[1]. Other activities comprising all ef-

[1] According to Marxist theory, wageworkers belong to the capitalist mode of production while self-employed workers belong to a different mode of production. Most of the Marxist literature views pro-

forts to create new use-values or recirculate existing use-values, but not commodities with value, are considered to be *unproductive*. Unproductive activities create new use-values or recirculate existing use-values without adding any new surplus value to the economy. This implies that the profits of unproductive activities represent flows of income drawn out of the surplus value generated in productive activities. While productive activities create and also consume the surplus, unproductive activities only consume it.

In the first volume of *Capital*, Marx introduced his theory of the capitalist production of wealth and developed his theory of wealth accumulation predicated on his insights on the production sphere. In the second volume of *Capital*, Marx introduced his theory of the circulation of wealth and developed his theory of wealth accumulation predicated on his insights on the production and circulation spheres. In the third volume of *Capital*, Marx introduced his theory of unproductive activity through the concepts of merchant capital, interest-bearing capital, rent-bearing capital, and fictitious capital. However, because of his unfortunate death, Marx was unable to develop a theory of wealth accumulation that combined his insights on production, circulation, and unproductive activity. My objective in this study is to offer theoretical arguments and empirical

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ducers who both do the labor and own the means of production as "simple (or independent) commodity producers" and views a mode of production based on them as a non-class mode of production called "simple (or independent) commodity production" in which there is no surplus appropriation. In most of the Marxist literature it is assumed that some modes of production are not class-based, including primitive communism, simple commodity production, and communism. Contrary to this tradition, Resnick and Wolff (2006; 1987) interpret self-employed workers as belonging to the "ancient mode of production" in which the producers individually appropriate the surplus they produce. According to Resnick and Wolff, every mode of production has its own concept of surplus and therefore its own class structure. The concept of productive labor derives from the concept of surplus, which in turn derives from the concept of mode of production. Each mode of production, they claim, has its own type of surplus and therefore its own criterion of productive labor. In any case, wageworkers and self-employed workers can both produce commodities with value. In my analysis of productive labor I therefore prefer to combine the capitalist and the simple commodity production (or ancient) modes of production. Most current self-employed workers actually produce commodities with value and in many cases self-employment is just disguised capitalist exploitation. Many workers are not hired as workers but as unincorporated businesses because the true capitalists want to avoid payroll taxes and social security.

evidence from the Unites States economy that in the future could lead to a more complete theory of capital accumulation in its productive and unproductive aspects.

My contribution is to first develop a new interpretation of the labor theory of value in order to better explain how financial and rentier forms of revenues relate to the wealth created in productive activities. Second, I provide an innovative analysis of historical trends regarding unproductive accumulation in the postwar United States economy. For that purpose, I propose a new methodology to estimate Marxist categories from conventional input-output matrices, national income accounts, and employment data. A core feature of my methodology is the idea that the production of knowledge and information is a form of unproductive activity. Third, I employ time series econometric techniques to formally evaluate the coevolution between productive and unproductive forms of capital accumulation.

The way in which productive and unproductive capitals interact has changed throughout the postwar period. The accumulation pattern observed during the 1947-1979 phase that prioritized productive accumulation gave way after the 1980s to a contrasting pattern prioritizing unproductive accumulation. Unproductive activity has been growing at a fast pace in terms of incomes, fixed assets, and employment. Among all forms of unproductive activity, my approach places special attention on how the production of knowledge and information has constituted a rising share of total unproductive income and capital stock. Additionally, productive stagnation and rapid unproductive accumulation have been intrinsically related to greater exploitation of productive workers and to overall income inequality.

Predicated on the concept of autonomization, I offer a theoretical explanation of unproductive growth that builds on and expands Marxist political economy and the Marxist labor theory of value. The principle of autonomization reveals how unproductive activities have a tendency to create ever more abstract forms of wealth that are increasingly separated from the production

of surplus value in productive activities. Even though unproductive accumulation occurs in tandem with rising levels of exploitation, capitalism in the United States is an economic system that generates financial and rentier incomes that gradually obscure the source of new wealth in the exploitation of labor.

In the chapters that follow I provide both theoretical and empirical arguments to assess the joint evolution of productive and unproductive forms of accumulation. In Chapter 1 I address the question of how unproductive activities should be incorporated into the labor theory of value. To approach this analytical problem I offer a new interpretation of Marx's *Capital* and a new way to relate unproductive activity with productive accumulation. In Chapter 2 I offer an empirical analysis of unproductive accumulation in the United States economy from 1947 to 2011. I develop a new methodology to compute Marxist categories predicated on the idea that the production of knowledge and information belong to unproductive activity. In particular, I provide empirical estimates to uncover the shifting balance between productive and unproductive forms of accumulation. In Chapter 3 I present a formal econometric assessment of two questions that other scholars have considered mostly through verbal or descriptive approaches. First, I check whether unproductive accumulation hinders or fosters productive accumulation. Second, I check if productive stagnation leads to faster unproductive accumulation. Finally, in the Appendix I explain in detail my methodology of estimating Marxist categories for the postwar United States economy using publicly available information.

In sum, this dissertation provides analytical and empirical elements towards a new theory of capital accumulation. In particular, it emphasizes the dynamic relationship between productive and unproductive forms of economic activity. This study builds on and expands Marxist Political Economy in order to reveal the close association between greater exploitation of productive workers, faster unproductive accumulation, and greater inequality. It therefore offers a new diagnosis of the United States as an advanced capitalist economy that has been increasing the exploi-

tation of its workers while obscuring this rising exploitation through the rapid expansion of unproductive revenues.

CHAPTER 1

THE AUTONOMIZATION OF ABSTRACT WEALTH: NEW INSIGHTS ON THE LABOR THEORY OF VALUE

1.1 Introduction

The standard interpretation of the value system in Capital posits that Marx gradually progressed from the most abstract toward the most concrete levels of analysis. It understands Marx's method as a method of 'successive approximations' in which the most abstract concepts are successively enriched with new concrete determinations. This interpretation became dominant in the Marxian tradition and has appeared in the works of major scholars.

In this chapter we re-conceptualize the labor theory of value in the Marxist system and propose a different understanding of the larger project in *Capital* in a way that challenges the dominant tradition. Our interpretation posits that Marx developed a system of categories that evolve from more concrete toward more abstract forms of wealth, which progressively separate from and obscure labor exploitation. Our procedure therefore replaces the dominant interpretation of successive approximations.

**Author's note:* This chapter is co-authored with Rodrigo Teixeira, and for this reason I employ the personal pronoun 'we' throughout the text.

While we grant that Marx progressed from more abstract to more concrete concepts, we argue that the dominant interpretation is incorrect because it does not rightfully capture the dialectical method that Marx learned from the Hegelian tradition. The introduction of each new value form does not negate or replace the concepts that were introduced earlier, but rather incorporates and reinterprets them. The dominant interpretation is also inadequate since it does not incorporate the opposite and complementary progression from more concrete to more abstract forms of value. The movement toward more concrete analysis is also a movement toward more abstract value forms.

The term 'abstract' has two concurrent but different meanings in Marxian analysis. In the standard interpretation, 'abstract' refers solely to the distance between the level of analytical abstraction and the concrete complexity of the object of analysis. In our approach, 'abstract' also refers to the distance between the forms of value and the source of value, namely the exploitation of productive labor. Abstract forms of value are forms of value separated from value-producing labor by increasing layers of mediation. Even though all value derives from the exploitation of productive labor, individual capitalists can still generate new forms of abstract wealth that gradually separate from and obscure the source of value.

We present textual evidence to offer a new account of the structure of Marx's writings over the three volumes of *Capital* and also in his earlier works and drafts, such as the 1861-63 *Theories of Surplus Value*, the 1857-58 *Grundrisse*, and the *1861-63 Economic Manuscripts*. In our approach we explicitly define and identify the meaning of each concept in the theoretical structure. This procedure then allows us to incorporate in a new way the monetary, financial, and rentier forms of wealth into the Marxist labor theory of value. Compared to the standard interpretation, we provide a clearer and broader account of the inner connections present in Marx's chain of concepts.

The relevance of the interpretation that we develop is twofold. First, it allows the Marxian tradition to overcome an inadequate understanding of how the Marxist value system operates. Second, it potentially opens a new research agenda on contemporaneous forms of capital valorization that explicitly incorporates the dynamics of abstract wealth in advanced capitalist economies.

1.2 Successive Approximations vs. Autonomization

Marx's unique combination of English and German philosophies in the nineteenth century inaugurated a long tradition of debates about the proper framework for doing political economy. In the late 1920s Henryk Grossman (1992, p.12) originally developed the idea of 'approximations to reality' from the abstract to the concrete, an approach later buttressed by the publication of Rosdolsky's 1968 path-breaking *The Making of Capital*. Grossman's insight found resonance in several major publications thereafter. Maurice Dobb and Paul Sweezy were among its most fervent supporters. For example:

> Marx believed in and practiced what modern theorists have called the method of 'successive approximations', which consists in moving from the more abstract to the more concrete in a step-by-step fashion, removing simplifying assumptions at successive stages of the investigation so that theory may take account of and explain an ever wider range of actual phenomena. […] [T]he results achieved in Volume 1 … undergo a more or less extensive modification on a lower level of abstraction, that is to say, when more aspects of reality are taken into account. (Sweezy, 1970, pp.11-18)

Although widely accepted, the 'successive approximations' interpretation is inaccurate. As a description of the world, Marx's analysis moves from highly simplified abstractions to a more complex, richly detailed, concrete level of analysis. For Grossman and his followers (among whom we find Sweezy, Dobb, Ronald Meek, Bohm-Bawerk, Bortkiewicz, and modern Sraffians), Marx's method consists of moving from unrealistic mental constructs toward greater consistency with concrete reality, as if over and over Marx were making claims that he knew to be false. But

in no way does Marx correct his supposedly false assumptions as he moves toward greater concreteness. Contrary to the idea that "stage by stage, the investigation as a whole draws nearer to the complicated appearances of the concrete world and becomes consistent with it" (Grossman, 1992, p.12), Marx never claimed his assertions to be inconsistent with reality at any point of his analysis.

Capital is a work in the Hegelian tradition of systematic dialectics. Each category in the system establishes a structure that incorporates the structures of previous categories and is then incorporated into the structures of subsequent categories (Smith, 1993, p.155). Marx's system is therefore constructed as a chain of internal logical relations, a totality in which categories at different levels of abstraction are meaningful only in their relationship to one another (Arthur, 1996, p.194). Even though *Capital* progresses from the more abstract to the more concrete, the 'successive approximations' interpretation does not correctly capture that progress since there is no logical or conceptual motivation for the transitions.

In addition, as we demonstrate in this chapter, at the same time that Marx's analysis moves toward the more concrete, the object of analysis – the forms of wealth – become increasingly more abstract, more separated from the generation of value by productive labor. The progression in the system toward more abstract forms of wealth is therefore structured in direct opposition to the concomitant progression toward higher concreteness of those same analytical categories. The double inaccuracy of the standard framework stems, first, from a misunderstanding of the idea of levels of abstraction in the Hegelian tradition and, second, from not incorporating the organizing principle of concrete and abstract forms of wealth at each of these varying levels of conceptual abstraction.

We define *autonomization* as the progression of value forms toward higher levels of abstraction – and this is the progression of the analysis through the three volumes of *Capital*. The

source of all value lies in the exploitation of productive labor. Autonomization then labels the progressive separation of the forms of value from its source through the gradual introduction of new layers of mediation between value forms and labor exploitation. Marx himself originally employed the German word *Verselbstständigung* to mean 'transition to independence', 'gaining own momentum', or simply 'autonomization'. More strikingly, he indicated that capital comprises both autonomization and class relations:

> Capital, as self-valorizing value, does not just comprise class relations, a definite social character that depends on the existence of labor as wage-labor. It is a movement, a circulatory process through different stages ... Hence it can only be grasped as a movement, and not as a static thing. Those who consider the *autonomization [Verselbstständigung] of value* as a mere abstraction forget that the movement of industrial capital is this *abstraction in action*. Here *value passes through different forms*, different movements in which it is both preserved and increases, is valorized. (Marx, 1992, p.185 – emphasis added)

In this very illuminating passage it is possible to note three crucial ideas on the dynamics of the forms of wealth: that valorization occurs together with the autonomization of value; that the autonomization of value forms is not just a conceptual abstraction but objective abstraction in action; and that value passes through different forms across its valorization circuit.

The term 'concrete' originates from the Latin word *concretus*, the past participle of the verb *concrescere*. '*Con*' means together, and '*cretus*' means grown. Thus concrete means 'grown together' or 'formed by aggregation'. That is what Marx meant when stating in the 1857-1858 introduction to the *Grundrisse* that "[t]he concrete is concrete because it is the synthesis of multiple determinations, hence unity of diversity" (Marx, 1973, p.101). A concrete object – which need not be tangible – is concrete as long as it is present with all of its particular determinations (color, time, location, smell, texture, usefulness, physical attributes, conceptual attributes etc.). The abstract is the opposite of the concrete. From the Latin word *abstractus* and the verb *abstrahere*, abstract means 'drawn away' or 'separated by force'. The abstract draws away from the specificity of the concrete. An abstraction occurs when a certain characteristic of a concrete ob-

ject is isolated from the other determinations. Even though they affect each other, the abstract and the concrete co-exist as two differentiable determinations of the same object.

Drawing from Marx, we employ the term *value* to designate *abstract wealth*, and the term *use-value* to designate *concrete wealth*. Concrete and abstract wealth are not two types of wealth but rather the two co-existing determinations of the same wealth produced in capitalism. Concrete wealth is qualitative wealth in its specific and particular aspect; it exists through use-values, the particular qualitative usefulness of tangible and intangible goods and services. Abstract wealth is quantitative wealth present with only one of its multiple determinations. In capitalism one particular quantitative aspect, namely the value of such useful concrete use-values is then forcefully isolated (abstracted) from the qualitative aspects. Concrete wealth can then be priced and evaluated in monetary terms, implying that concrete wealth becomes evaluated and measured through abstract wealth.

Adam Smith ingeniously posited that the source of monetary, or priced wealth is labor. Smith was the first to understand that human labor creates not just concrete wealth (particular useful use-values) but also abstract wealth (value). He also understood that it was abstract wealth that allowed concrete wealth to be measured as well as traded in markets. Even more, Smith traced the origin of monetary prices to the values produced by labor. But it was only almost a hundred years later with Marx that the origin and magnitudes of monetary profits in capitalism were adequately connected to the values produced by a socially specific form of labor, and not just human labor in general.

Marx then began to theorize the different distributions of value (industrial profit, merchant profit, money-dealing profit, rent, interest, capital gains etc.) while connecting them too to value-creating activities. However they differ from one another, all forms of abstract wealth, including the contemporary ones such as financial derivatives and higher-order securities, always

share one common aspect: they can be priced and traded. This means they have an expression in monetary (and therefore abstract) terms that entitles them to place claims on produced values.

Even though only productive labor produces new value, the system in its totality creates new and co-existing forms of abstract wealth that gradually separate from and hence obscure the source of new value. Compared to the pricing of simple commodities, the pricing of complex financial derivatives represents many more layers of mediation in relation to labor exploitation.

The concept of autonomization, however, does not hypostatize labor exploitation per se without the actual mediations that give form to the material production of new value. The creation of value through the exploitation of productive labor already presupposes the complex forms of value that develop in capitalism because the creation of value is always mediated by all of the many value forms. As our interpretation of Marx's theory incorporates forms of value that are successively more separated from labor exploitation, it gradually gives a fuller account of the actuality of value creation in the capitalist mode of production.

The proposed concept of autonomization thus makes explicit the paradox of wealth accumulation in capitalism: from an aggregate perspective surplus value expansion depends on labor exploitation, yet individual capitalists maintain the ability to produce financial and non-financial revenues in ways that increasingly obscure both labor exploitation and the creation of surplus value.

1.3 The Marxist System: Logic vs. History

The logical analysis derives the forms of wealth in a progression from the commodity form to more and more abstract forms. The drive toward increasing autonomization has its origin in the double determination of wealth produced in capitalism as concrete and abstract wealth (or as use-value and value). Because capital progressively subjugates use-value to value, the system

will gradually favor the abstract generality to the detriment of the concrete particularities. The contradiction that begins as the paradoxical relationship inherent to the commodity form between value and use-value then unfolds into more complex and developed forms such as rent-bearing capital, interest-bearing capital and fictitious capital – the term Marx employed to conceptualize the creation and pricing of financial assets. Capital therefore develops different contradictions at different levels of abstraction.

Marx's method consists of showing that capital can never solve its contradictions. Capital displaces its contradictions to higher and more generalized levels when attempting to solve them (Fausto, 1997, 1987a, 1987b; Paulani, 2011; Dussel, 2001; Harvey, 2010, 2006). Autonomization takes place as capital resolves its contradictions at one level of abstraction only by displacing the contradictions to a higher level, gradually adding new mediations and hence separating the forms of abstract wealth from the source of value. Autonomization is not a mere subjective movement that the thinking mind undertakes but rather the objective development of the forms of value within capitalism. The more capital develops concretely the more abstractions it creates.

History proceeded differently. Marx wrote *Capital* in a logical, not historical order. The components of the analysis exist simultaneously in fully developed capitalism, but history introduced those components in an order different from the order of Marx's exposition. Money, usury capital, and fictitious capital chronologically preceded the spreading of the commodity form; but they do not precede commodities in the logical presentation. Marx is clear about this point:

> It would therefore be unfeasible and wrong to let the economic categories follow one another in the same sequence as that in which they were historically decisive. Their sequence is determined, rather, by their relation to one another in modern bourgeois society, which is precisely the opposite of that which seems to be their natural order or which corresponds to historical development. (Marx, 1973, p.107)

We can synthesize capital's conceptual formation as a chain of abstractions. Each value form is a further step in the progressive autonomization of abstract wealth from labor exploita-

tion: exchange-value is autonomized value; money is autonomized exchange-value; capital is autonomized money; profit is autonomized surplus value; interest-bearing capital, rent-bearing capital, and fictitious capital are forms of autonomized capital. Money, capital, rent-bearing capital, interest-bearing capital and fictitious capital are all higher forms of autonomization:

> [T]hese different parts of surplus-value acquire an independent form, because they accrue to different people, because the titles to them are based on different elements, and finally because of the *autonomy with which certain of these parts of surplus-value confront the production process as its conditions*. From parts into which value can be divided, they become *independent elements* which constitute value. (Marx, 1971, p.927 – emphasis added)

The higher the stage of autonomization the greater are the layers of mediation that separate the form of value from its source. However many layers of mediation intervene, autonomization is never complete. No single form of value can acquire complete independence from the other forms in the system or from the exploitation of labor.

1.4 Stages of Autonomization: Re-Conceptualizing the System of Value Forms

In this section we develop our re-conceptualization of Marx's broader project. We explicitly demonstrate how a novel interpretation of his writings reveals capital as expanding value that gradually separates from and obscures the sources of value creation. We divide the stages of autonomization into three conceptual phases: (a) autonomization of value from use-value, or the constitution of money; (b) autonomization of money from commodity circulation, or the constitution of capital; (c) autonomization of capital from labor exploitation, or the constitution of unproductive activities.

1.4.1 Autonomization of Value from Use-Value: The Constitution of Money

Marx proceeds stepwise in his system of chained abstractions. The starting point of autonomization is the commodity form, as presented in the very first chapter of *Capital I*. The commodity form is the starting point as it is the conceptual, or logical stem cell of the contradictions of the other value forms in the system. We employ the term contradiction, as Marx did, to indicate a relation whose elements are concomitantly complementary and opposite.

The contradictions of capital find their initial logical source in the relationship between the two constituents of the commodity form: value and use-value. The origin of the relation between value and use-value lies in the differentiation between abstract and concrete labors, itself a differentiation created by the historical opposition between privatized relations of production (private ownership) and socialized forces of production (social reproduction). The co-evolution of value and use-value is a key aspect of the formation of capital and of its initial autonomization.

Use-value is created by concrete labor. Whether commodities are tangible or not, goods or services, their use-values are the particular qualitative bases for values in capitalism. Without use-value, production and consumption could not expand; accumulation cannot proceed if what is being produced is not useful. Value, on the contrary, is created by abstract labor. It is the general quantitative dimension whose quantum is determined by the socially necessary abstract labor time needed to reproduce the commodities. Determined by social conditions of production and consumption, value is inherently a relational property. Value and use-value are, at the same time, both complementary and antagonistic dimensions to each other. They are complementary because concrete and abstract labors are not two kinds of labor but rather the two inseparable and co-existing determinations of the same commodity-producing labor; and antagonistic because while value refers to the social generality, use-value refers to the concrete particularity. In capitalism

two contradictory measures are in play: the heterogeneous measure of concrete usefulness and the homogeneous measure of abstract labor time.

The commodity therefore experiences an inherent problem: it is a privately produced good or service that only acquires ex post validation socially when exchanged for other commodities or for money. The particular commodity needs to be socially accepted by the market: a commodity's particular use-value cannot be a particular use-value unless it becomes a social value through trading. Vice-versa, the value embodied in the commodity cannot be realized in the market if the commodity is not a useful use-value for private individuals.

The market cannot solve the contradiction that constitutes the commodity form. When a commodity is exchanged, the other circulating commodities also face the same paradox: one's value finds its validity in another's use-value. The relation between value and use-value is the contradiction between the social form and its own material basis, and it is also the very first logical source of endogenous capitalist business cycles. Social validation occurs a posteriori, after commodities are produced. If market validation does not occur the individual capitalist faces a problem. If non-validation becomes systemic then capitalism faces a crisis with increasing piles of unsold inventories.

Marx gets to this point of the analysis without yet introducing money, so he is still conceptually referring to barter exchanges. But a barter-based market cannot overcome the contradiction that constitutes the commodity form. Money then finds its logical place. In a very illuminating passage on the conceptual emergence of money, the principle of autonomization starts to take shape:

> Money necessarily crystallizes out of the process of exchange, in which different products of labor are in fact equated with each other, and thus converted into commodities. The historical broadening and deepening of the phenomenon of exchange develops the opposition between use-value and value which is latent in the nature of the commodity. The need to give an external expression to this opposition for the purposes of commercial

> intercourse produces the *drive towards an independent form of value*, which neither finds rest nor peace until an independent form has been achieved by the differentiation of commodities into commodities and money. (Marx, 1990, p.181 – emphasis added)

The first independent form of value that Marx refers to is the exchange-value, the relation or ratio at which commodities are traded and itself the embryo of money. The independent exchange-value is what Marx names the 'general equivalent'. The general equivalent is, therefore, autonomized exchange-value. It is a relational property that becomes itself an external object, a thing – a social relationship that takes the particular independent form of grains, salt, gold, or silver. The abstract character of wealth (value) becomes something objective that confronts the particularities (use-values) from which it emerged:

> But in what way are gold and silver distinguished from other forms of wealth? Not by magnitude, for this is determined by the amount of labor embodied in them. But rather as *autonomous embodiments and expressions of the social character of wealth*. This social existence that it has thus appears as something beyond, as a thing, object or commodity outside and alongside the real elements of social wealth. … [T]*he social form of wealth exists alongside wealth itself* as a *thing.* (Marx, 1994, pp.707-708 – emphasis added)

The money form emerges when the general equivalent completes its autonomization by becoming a pure formal use-value: a commodity whose use-value is its social ability to be an independent form of value. In its origin as an independent exchange-value, money is autonomized value that now stands astride the multifarious world of commodities as the *one* general equivalent. The logical origin of the money form, not its historical origin, lies therefore in the increasing independence of value from particular use-values.[2] Money, this autonomous representative of value, owes its existence to the separation of abstract from concrete wealth:

[2] David Graeber's (2011) recent book-length contribution and also Keith Hart's (1986) article on the hybrid existence of money have challenged the idea that money has historically evolved from barter to commodity currency and then credit relations. Still, they agree that money has always been a hybrid entity that takes on aspects of both object and social relation. This latter acknowledgement is what matters to us in this chapter, namely that money is at the same time an external object and a social relation. Their historical findings indeed corroborate Marx's concept of money.

> The product becomes a commodity; the commodity becomes exchange value; the exchange value of the commodity is its immanent money-property; this, its money-property, separates itself from it in the form of money, and achieves a general social existence separated from all particular commodities and their natural mode of existence (Marx, 1973, pp.146-147).

> It is the foundation of capitalist production that money confronts commodities as an *autonomous form of value*, or that exchange-value must obtain an *autonomous form* in money (Marx, 1994, pp.648-649 – emphasis added).

Money is objectified social labor – abstract wealth that has been autonomized from particular concrete particularities. While commodities circulate because of their individual and specific use-values, money circulates because it is "the abstract-autonomous form of exchange value or of general wealth" (Marx, 1973, p.345). Marx clearly relates the concept of money to the objectification of abstract wealth:

> Money is the independent existence of exchange value. Viewed from the angle of its quality, it is the *material representative of abstract wealth*, the *material existence of abstract wealth*. To make money by means of money is the purpose of the capitalist production process — the increase of *wealth in its general form*, of the quantity of *objectified social labor* which is, as this labor, expressed in money. Whether the existing values figure merely as money of account in the ledger, or in whatever other form, as tokens of value, etc., is initially a matter of indifference. Money appears here only as the *form of independent value* (Marx 1988, p.99 – emphasis added).

The contradiction between value and use-value cannot be solved, for in capitalism the market validates production only ex post. Money allows production and consumption to be more flexible through time and space, helping traders cope with the difficulty of producing commodities requiring ex post market validation. But in doing so, money displaces the contradiction to a higher and more generalized level. Monetary crises can then occur independently of productive crises exactly because a relational property (value) exists as a thing (money) external to those same relations from which it is derived:

> As long as the *social* character of labor appears as the *monetary existence* of the commodity and hence as a *thing* outside actual production, monetary crises, independent of real crises or as an intensification of them, are unavoidable (Marx, 1994, p.649 – emphasis in the original).

The conceptual origin of money lies therefore in the autonomization of value from use-values. The next step is to understand how money, in turn, faces its own autonomization.

1.4.2 Autonomization of Money from Commodity Circulation: The Constitution of Capital

Marx developed a unique and powerful monetary theory, unfortunately widely misread even by Marxists. Our approach, influenced by the works of Fausto (1997, 1987a, 1987b), Paulani (2011), Dussel (2001) and Rosdolzky (1989), draws attention to the important conceptual distinction between "money as coin" (or "money as currency") and "money as money". This distinction is crucial to understanding the contradiction of money. Money has four determinations. First, it is a measure of the value of commodities and thus a standard for prices. Second, it is a means of exchange of commodities. Third, it is a means of hoarding (store of value). Fourth, it is a means of payment (commercial credit). The first two determinations (measure of value and means of circulation) constitute what Marx called "money as coin" or "money as currency" while the last two determinations (money as hoarding and means of payment) constitute what Marx called "money as money".

Money as coin, or money as currency, is money that provides the common measure for commodity values, provides a standard for prices, and facilitates circulation. It does so as a simple intermediary: its circuit is C–M–C. Money (M) lies in the middle while the objective of the circuit is to trade different commodities (C). Even though autonomized value, money is here only a passive link connecting the desires of buyers and sellers of concrete use-values.

Money as coin already allows for the first autonomization of money, for it enables value-less symbols to displace commodity currencies as means of circulation. The money form of value can detach from the tangible matters – like gold, silver, grains, and salt – that might come to bear it. The exclusive use of commodity currencies like gold and silver constrains the circulation of

means of exchange to be proportional to commodities' values. But with the introduction of non-commodity currency the circulation of means of exchange becomes more independent from the values of the produced commodities. Non-commodity currencies do not circulate as embodied values, as is the case with gold and silver. The direct connection between the supply and value of the currency, on one side, and the values of the produced commodities, on the other, fades away through the de-materialization of the means of exchange. As non-commodity currency — paper currency, electronic currency or as plastic debit cards — value is represented by mere valueless symbols of itself. Even when replaced by valueless symbols of itself, money is never valueless. By definition money is objectified value:

> The fact that money can, in certain functions, be replaced by mere symbols of itself, gave rise to that other mistaken notion, that it is itself a mere symbol (Marx, 1990, p.185).

It is an error therefore to speak either of "valueless money," "commodity money," or "non-commodity money." As our framework demonstrates, money is never a commodity: money is money, a category distinct from the concept of commodity. A currency can be a commodity or not — hence the correct language is to speak of "commodity currency" and "non-commodity currency" as we did in the above paragraphs.

Money as money, contrary to money as coin or currency, is no longer a mere intermediary that facilitates trade. It becomes instead the end of circulation. As hoarding (store of value) and as means of payment (commercial credit), money has a new circuit: M–C–M. It starts and closes the circuit. Commodities become instead intermediaries in the process of money circulation. Money as money therefore does the opposite of money as coin. Money as money and money as coin contradict each other; they are concomitantly complementary and opposite. Money is contradictory because it is at the same time the intermediary and the end of the circulation circuit. It is an object with two opposing circuits occurring juxtaposed:

> Money in its third quality, as something which autonomously arises out of and stands against circulation, therefore still negates its character as coin. […] Money is the negation of the medium of circulation as such, of the coin. But it also contains the latter at the same time as an aspect, negatively, since it can always be transformed into coin (Marx, 1973, pp.226-228).

The crucial point is that of money becoming an end in itself: "Instead of being merely a way of mediating the metabolic process, this change of form becomes an end in itself" (Marx, 1990, p.228). The passage from the C–M–C to the M–C–M circuit constitutes the second autonomization of money. More logical mediations now separate money circulation from commodity circulation; more logical mediations thus separate the circulation of values from the circulation of use-values. Partially independent of consumption and production conditions, money starts to develop its own autonomized circuit. Not the use-values of commodities but money itself becomes the objective of value circulation:

> [M]oney, the independent form of exchange-value, is the starting-point, and the increase of exchange-value the independent purpose. Commodity exchange itself, and the operations that mediate it — separated from production and performed by non-producers — becomes simply a means of increasing wealth, and not just wealth, but wealth in its general social form as exchange-value (Marx, 1994, p.443).

Autonomization proceeds even further with monetary forms. In the money as money circuit, M–C–M, the money trader is trading money for money without making a profit, a meaningless exchange in capitalism. The circuit of money then becomes M–C–M', in which money dealers profit (M' minus M) from their activities. M–C–M' is precisely what Marx calls the circuit of capital. The circuit of capital springs conceptually from the circuit of money as money. When money becomes the end of circulation it then paves the way for the origin of capital, of "autonomous exchange value (money) as a process" (Marx, 1973, p.305).

In the conceptual discourse, capital emerges out of the contradictions of money. Marx states clearly that the circuit of capital, or of 'dynamic value' is a higher stage of autonomization because this form of value is more detached from use-values. The positing of money as an end in

itself allows abstract wealth to become the aim of circulation, and concrete wealth to take on a subordinate role. With the capital form, the circulation of use-values becomes merely a support of the system of value circulation:

> [Capital] is not only an independent expression of value as in money, but dynamic value, value which maintains itself in a process in which use-values pass through the most varied forms. Thus *in capital the independent existence of value is raised to a higher power than in money* (Marx, 1989, p.318 – emphasis added).

We have here uncovered capital's logical origin in the autonomization of money. It is then necessary to theorize the contradictions that constitute the capital form and how capital faces its own specific autonomization.

1.4.3 Autonomization of Capital from Labor Exploitation: The Constitution of Unproductive Activities

The money-as-money circuit, M-C-M, is senseless if it cannot be converted into the circuit of capital, M-C-M' with M' greater than M. This can happen only if labor power is available in commodity form. Labor power is the sui generis commodity that has the use-value of creating more value for its buyer. The value that labor power then creates beyond its own is defined as surplus value.

When capital matches with the doubly-free labor force it develops its full monetary circuit: M–C…P…C'–M'. The …P… phase represents production, extraction of surplus value, or simply labor exploitation. The production of new use-values (C') is subjugated to the objective of making more money (M') out of money (M). As any other use-value, labor power will also be subjugated to the expansion of value, hence M and M' represent respectively the beginning and the purpose of the circuit. Both production and labor exploitation appear as intermediaries in the general process of value expansion:

> [I]t is the exchange-value, not the use-value, that is the decisive inherent purpose of the movement. It is precisely because the money form of value is its independent and palpable form of appearance that the circulation for M…M', which starts and finishes with actual money, expresses money-making, the driving motive of capitalist production, most palpably. The production process appears simply as an unavoidable middle term, a necessary evil for the purpose of money-making. (This explains why all nations characterized by the capitalist mode of production are periodically seized by fits of giddiness in which they try to accomplish the money-making without the mediation of the production process). (Marx, 1992, p.137)

The first autonomization of capital occurs with the transformation of surplus value into profit. The concept of surplus value still maintains visible its direct connection with the labor component of capital. But once surplus value is presented as profit and hence as the compensation for the total capital invested, including both of its labor (variable) and non-labor (constant) components, the origin of surplus is further obscured:

> [T]he relation between surplus value and the variable part of capital is an organic one. In fact it expresses the secret of the formation and growth, of the existence of capital as capital. This organic relation is extinguished in the relation between profit and capital. Surplus value obtains *a form in which the secret of its origin is no longer hinted at with the slightest trace*. Since all parts of capital equally appear as the basis of the newly created value, the capital-relation becomes a complete mystification. (Marx, 1991, p. 70 – emphasis added)

> [S]urplus-value *denies its own origin* in this, its transformed form, which is profit; it loses its character and becomes unrecognizable. (Marx, 1994, p.267 – emphasis added)

The second autonomization of capital then occurs with the distributions of gross profit. Prior to the conceptual emergence of surplus value in the chain of abstractions, autonomization took place only in the sphere of circulation. After the proper logical constitution of productive capital and the effective existence of surplus value, Marx formally introduced the distinction between productive activities (that generate surplus value) and unproductive activities (that consume the surplus value generated in productive activities). He was then able to theorize how capitals engaged in unproductive activities, such as commercial capital and money-dealing capital, develop their own circuits and thus autonomize themselves from productive activities:

> In commercial and money-dealing capital, rather, the distinctions between industrial capital as productive capital and the same capital in the sphere of circulation attain *autonomy* in the following way: the specific forms and functions that capital temporarily assumes in the latter case come to appear as *independent forms* and functions of a part of the capital that has separated off and become completely confined to this sphere. (Marx, 1994, p.440 – emphasis added)

The activities (not actually 'spheres' as Marx put it) that consume surplus value become gradually independent from the activities that generate surplus value, even though the creation of value is the pre-condition for its consumption. The autonomization process thus continues with the separation of unproductive activities from the source of new value in productive activities:

> Despite the autonomy it has acquired, the movement of commercial capital is never anything more than the movement of industrial capital within the circulation sphere. But by virtue of this autonomy, *its movement is within certain limits independent of the reproduction process* and its barriers, and hence it also drives this process beyond its own barriers. This *inner dependence* in combination with *external autonomy* drives commercial capital to a point where the inner connection is forcibly re-established by way of a crisis. (Marx, 1994, p.419 – emphasis added)

The same reasoning of 'inner dependence' combined with 'external autonomy' applies to money-dealing capital, for it takes over part of the productive capital as its own specific and independent movement: a "definite part of the total capital now *separates off and becomes autonomous* in the form of money capital … in the course of its reproduction process" (Marx, 1994, p.431 – emphasis added).

Among the vast array of unproductive activities that capitalists can engage in, Marx gives special attention to three of them. The first type of unproductive activity employs interest-bearing capital, comprising all those activities that consume surplus value through interest payments. Interest payments occur whenever the owners of money or production inputs lend their resources to other parties. *Interest* is the payment for any borrowed sum of value, be it in money or commodity form. The second type of unproductive activity employs rent-bearing capital, comprising all those activities that consume surplus value through rent payments. Rent payments occur whenever a party has to pay a sum of money to the owners of monopolized resources not reproducible by

human labor – such as land, oil, licensed knowledge, and patented information. *Rent* is the payment for the use only, not for the transfer of ownership, of any monopolized resource not reproducible by labor. The third and last type of unproductive activity employs fictitious capital, comprising those activities that consume surplus value through the creation, pricing, and trading of financial assets. The formation of a fictitious capital occurs whenever a security or financial asset is created – such as stocks, debt bonds, insurances, and derivatives. We now turn to each of these three types of unproductive activities in more detail.

Interest-bearing capital emerges when any sum of value is lent, entitling the owner of the advanced sum of value to receive interest payments from the borrower. Marx distinguishes two cases. The first is when the sum of lent value is in monetary form, as in the advancement of credit. In this case, interest-bearing capital exists whenever money itself is bought and sold in credit markets. However, it is only the use-value of money that is transferred, not its ownership, and interest is the payment for this use-value of money. Interest-bearing capital is then money with the use-value of having a claim on more value. The second case happens when the lent sum of value takes the form of commodities, as when a capitalist borrows productive inputs such as machines or other forms of fixed capital from another capitalist. The borrower then pays back interest to the original owner of the inputs. Once again, what gets transferred is the right of use, not the right of ownership. Both lent money and lent inputs share in common the feature that they are lent sums of value:

> [M]oney – taken here as the independent expression of a sum of value, whether this actually exists in money or in commodities – can be transformed into capital. (Marx, 1994, p.459)

The full circuit of interest-bearing capital then becomes M–M–C…P…C'–M'–M', but to the owner of money it is just M–M'. Autonomization has thus made an additional step as the unproductive M–M' circuit represents an extra level of separation of capital from the productive or surplus value-producing circuit M–C…P…C'–M'. More layers of mediation now separate inter-

est from the source of value, even though all interest payments are deductions from the total surplus value produced:

> All that we are concerned with here is the *independent form of interest-bearing capital* and the way that *interest acquires autonomy vis-à-vis profit*. (Marx, 1994, p.480) The general question of how gross profit is differentiated into interest and profit of enterprise comes down simply to the question of how a part of the gross profit is invariably ossified and *autonomized as interest*. (p.499 – emphasis added)

The specific external autonomy of interest payments for individual capitalists in the M…M' circuit confronts the general internal dependence of all capitalists together in relation to the existing surplus value, since the "*autonomization* of the two parts of gross profit, as if they derived from two separate sources, must now be fixed for the entire capitalist class and the total capital" (Marx, 1994, p.498 – emphasis added). Even more, interest-bearing capital, to be considered as such, does not necessarily have to be directed toward productive activities. Even though interest payments are a deduction from the total surplus value generated in the economy, interest can be charged from any stream of income, be it from workers' wages, non-financial corporations' profits, or from the government budget.

The crucial aspect is that interest as a form of abstract wealth introduces a new layer of mediation in relation to the exploitation of productive labor:

> The division of profit into profit of enterprise and interest (not to speak of the intervention of commercial profit and money-dealing profit, which are founded in the circulation sphere and seem to derive entirely from this, and not from the production process itself at all) completes the *autonomization of the form of surplus-value*, the ossification of its form as against its substance ... One portion of profit, in contrast to the other, *separates itself* completely from the capital relation as such and *presents itself as deriving not from the function of exploiting wage-labor* […] [P]rofit still retains a memory of its origin which in interest is not simply obliterated but actually *placed in a form diametrically opposed to this origin*. (Marx, 1994, p.968 – emphasis added)

An analogous interpretation applies to the rent-bearing capital form (Marx, 1994, p.806-817). Rents accrue to the owners of resources not reproducible by labor, therefore valueless, such as urban and rural land, patented information, and licensed knowledge (Teixeira and Rotta, 2012).

Unlike interest, rents appear when valueless resources are traded, leased, or licensed. But like interest, rents accruing to unproductive activities represent a deduction from the total surplus value generated in the economy. Rent then bears extra layers of mediation in relation to productive activities:

> If ... 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, … this being *transformed into rent and as such becoming autonomous vis-à-vis profit*. (Marx, 1994, p.896 – emphasis added)

Autonomization finally reaches its most advanced stage with the formation of fictitious capital. Marx introduced the concept of fictitious value at the end of *Capital III* to demonstrate how the creation, pricing, and trading of financial assets represent a new level of separation of abstract wealth that obscures even more the source of surplus value. The trading of securities, debt bonds, stocks, derivatives, and financial assets in general introduce more layers of mediation between the forms of value and the productive activities generating new value. When mainstream economists suspect that 'asset prices do not reflect the fundamentals of the system' (Shiller, 2005) they are noticing fictitious accumulation.

What characterizes fictitious values is the capitalization of future streams of income: "The formation of a fictitious capital is called capitalization" (Marx, 1994, p.597). The capitalization of value applies to any financial asset whose market price is influenced by expectations of and speculations on future profitability, which implies that even interest- and rent-bearing capitals can potentially become fictitious capital.

Marx understood that the price of assets was not determined in the same way as the price of commodities. Market prices for goods and services fluctuate around production prices, but no such gravitational mechanism exists for the prices of assets. The price of tradable securities and derivative contracts, for example, is determined in secondary markets quite independently of the

productive activities from which they get their share of surplus value. Decades before Keynes and then Minsky wrote about the two-price system, Marx anticipated their contributions:

> The independent movement of the value of these titles of ownership, not only of government bonds but also of stocks, adds weight to the illusion that they constitute real capital alongside of the capital or claim to which they may have title. For they become commodities, *whose price has its own characteristic movements and is established in its own way*. Their market-value is determined differently from their nominal value, without any change in the value (even though the expansion may change) of the actual capital. (Marx, 1994, p.598 – emphasis added)

The high degree of autonomization enables fictitious capital to avoid the limitations that interest- and rent-bearing capitals have. The extra layers of mediation that it introduces in relation to labor exploitation allow movements in asset prices to generate *fictitious profits* — incomes derived from capital gains and financial trading margins — merely based on market re-pricing effects and speculations about future conditions for surplus value creation.

The fictitious form of capital thus closes the logical system that began with the commodity form. In the beginning of the chain of abstractions, value was closely tied to its source. But the development of the distinct forms of abstract wealth in capitalism increasingly contributed to autonomize them from the creation of new value. In interest-bearing capital, rent-bearing capital, and fictitious capital the independent existence of the forms of value is raised to an even higher power than in productive capital. With fictitious values, capital and its unproductive activities achieve the highest level of separation — even though not a complete one — from surplus value generation and labor exploitation in productive activities:

> [T]he form of mutual alienation and ossification of the various portions of surplus-value is complete, the *inner connection* definitively torn asunder and *its source completely buried*, precisely through the assertion of their *autonomy vis-à-vis each other* by the various relations of production which are bound up with the different material elements of the production process. (Marx, 1994, p.968 – emphasis added)

During any period of time all incomes from any type of individual activity, productive or not, relate to an aggregate flow of surplus value. This is the inner connection among all forms of

abstract wealth. But these same forms of abstract wealth progressively autonomize from the production of surplus value and also autonomize from the production and circulation of concrete wealth in commodities. Capital, now as the paradoxical totality of productive and unproductive activities, therefore depends on and also contradictorily tries to acquire independence from labor exploitation. Periodic crises forcefully realign incomes in unproductive activities with the surplus value generated in productive activities and impose a limit on the autonomization of value forms.

1.5 Conclusion and Implications

The standard and long-standing 'successive approximations' interpretation of Marx's labor value theory is inaccurate. It incorrectly understands the dialectical movement from more abstract toward more concrete analysis as if it were a simple progression from unrealistic toward more realistic assumptions. It additionally neglects the substantial effort that Marx made to theorize capitalism as an economic system that produces ever more autonomized forms of value. The categories in *Capital* progress from a high level of abstraction toward a higher level of concreteness and complexity at the same time that the forms of value that those same categories represent perform the opposite progression. The most concrete and complex concepts are also the most abstract value forms, which increasingly separate from and obscure the source of value in labor exploitation.

Our approach locates the origin of autonomization in the double determination of wealth (as value and use-value) and in the progressive subjugation of use-values to the forms of value. Our approach thus offers a new way to incorporate financial and rentier forms of accumulation into the labor theory of value. This broadened labor value theory can then provide a unique account of the co-existence and interaction of different forms of wealth at different levels of abstraction. The autonomization perspective presents an alternate understanding of the co-evolution

of these value forms while also offering a framework in which the dynamics of concrete and abstract wealth are explicitly incorporated.

Our reconceptualization of the Marxist value theory potentially opens up a new research agenda on contemporaneous forms of capital valorization, for the present stage of capitalism might have demonstrated that "individuals are now ruled by abstractions, whereas earlier they depended on one another" (Marx, 1973, p.164). It opens the possibility of investigating new interactions between concrete and abstract forms of wealth, possibly on the most recent innovations in financial instruments and business practices.

The exegetical approach here undertaken elucidates that Marx's original project was larger than what Marxists have hitherto understood. Our framework and proposed re-reading of his writings thus bring a novel perspective to the existing scholarship by demonstrating how autonomization is a crucial concept in the labor theory of value. The shift from the usual theory of successive approximations toward the theory of autonomization allows us to theorize new forms of wealth creation and distribution that cannot be understood through the standard approach.

CHAPTER 2

UNPRODUCTIVE ACCUMULATION IN THE UNITED STATES: A NEW ANALYTICAL FRAMEWORK

2.1 Introduction

In this chapter I conceptualize and measure the accumulation of capital in the postwar United States economy. I focus in the shifting balance between productive and unproductive activity and the distribution of capital between these two categories. I develop a new methodology to compute Marxist categories and provide several empirical estimates of productive and unproductive forms of accumulation from 1947 to 2011. My methodology and results provide new evidence of how exploitation, inequality, and unproductive accumulation interact in an advanced capitalist economy.

Official income and product accounts have to be translated to be used in a Marxist analysis since Marx developed his own system of concepts grounded on his unique understanding of the labor theory of value. Official data series, on the contrary, are constructed using concepts drawn from Neoclassical and Keynesian economics that conceptualize value in a different man-

ner. In particular, official accounts do not distinguish between productive and unproductive activities.

To separate industries between productive and unproductive activities I introduce the *Marxist Industry Classification System*, whose main feature is the treatment of knowledge production as unproductive activity. Besides trade, finance, insurance, real estate, non-profit organizations, and government administration, I also classify as unproductive the production of software, data, pharmaceuticals, movies, recorded video and music, and published materials such as books and journals. The *re*-production of knowledge and information requires no labor time and therefore produces neither value nor surplus value, implying that these activities must be classified as unproductive. My estimates reveal that knowledge creation and finance have been the fastest growing unproductive activities both in terms of net incomes and capital stocks.

Aggregate and industry-level information on incomes, inputs used up, expenditures, compensations, employment, depreciation, and stocks of fixed assets are available through the Bureau of Economic Analysis and the Bureau of Labor Statistics. From these sources it is possible to arrive at estimates of standard Marxist measures such as total value produced, constant and variable capitals, surplus value, the organic composition of capital, the rate of exploitation, and the rate of capital accumulation. To compute Marxist measures of total value and value added produced it is required to net out from official accounts the unproductive inputs used in productive activities as well as the revenues of every unproductive activity.

To further extend the analysis, I estimate new Marxist categories that better represent the magnitude of the accumulation of unproductive capital. The first category that I introduce is the unproductive composition of capital, which measures the stock of unproductive assets relative to the value of labor power employed in productive activities. The second new category that I present is the net unproductive burden, measured as the net income of unproductive activities rela-

tive to the surplus value created in productive activities. The third category is the gross unproductive burden, which measures the gross income of unproductive activities relative to the total value created in productive activities. These new measures provide a better understanding of the coevolution of productive and unproductive activities, thus overcoming a basic shortcoming in the standard categories that do not explicitly incorporate the effects of unproductive accumulation.

My approach indicates that accumulation patterns in the United States economy have changed substantially throughout the postwar period. Prior to 1980 the US experienced rapid productive accumulation, slow growth in unproductive fixed assets, non-increasing rates of exploitation of productive workers, and low levels of inequality. Throughout the postwar period workers gradually took on unproductive jobs and by the early 1970s the majority of employees were already unproductive workers. After 1980 the situation changed dramatically and the economy shifted to faster unproductive accumulation, faster growth in the stock of unproductive assets, exhibited an ever-increasing rate of exploitation of productive workers, and widening inequality. The total income of unproductive activities quadrupled relative to the total value generated in productive activities during the 1947-2011 period.

The post-1980 Neoliberal phase of United States capitalism has been characterized by the rising exploitation of productive workers while capitalists have at the same time shifted their investments to unproductive activities. Paradoxically, capitalists have been extracting more surplus value from a diminishing portion of the working class. The result is that for the Neoliberal period the general profit rate has fallen substantially behind the rate of exploitation. I attribute the rapid pace of unproductive accumulation as the possible reason for the post-1980 disconnection between exploitation and profitability.

2.2 Comparison with other Approaches

The major contributions in the tradition of analyzing unproductive accumulation in the United States economy and of estimating Marxist categories are those of Shaikh and Tonak (1994), Edward Wolff (1987), Moseley (1982), and Mage (1963).

In 1987 Edward Wolff published his book-length contribution *Growth, Accumulation, and Unproductive Activity*, in which he developed his own methodology to estimate Marxist categories from official input-output matrices. He asserted that traditional national income and product accounts reduce to only two components of final demand, namely consumption and investment. The other conventional components of standard accounts (government expenditures, imports, and exports) can all be reduced to consumption or investment measures. Marxist analysis, on the contrary, introduces a third outlet for the national product: unproductive expenditure, whose crucial feature is that it is not reducible to either standard consumption or investment expenditures. As a result, traditional concepts must be altered in order to maintain the identity between income and output measures.

One of Edward Wolff's (1987, p.177-179) key conclusions is that the existence of unproductive activities poses a challenge to non-Marxist types of economic analysis. The failure to acknowledge the existence of unproductive activities and the unproductive dimension associated with income and output measures has engendered a crisis for Macroeconomics both in Keynesian and non-Keynesian forms. The more unproductive activities grow, he states, the worse is the predictive performance of macro models that disregard unproductive accumulation.

Shaikh and Tonak (1994, p.229) share the same conclusion as Edward Wolff. They claim that the rise of Neoclassical economics obliterated the distinction between productive and unproductive activities by positing all labor as productive and by enthroning the market as the ultimate arbiter of social necessity. In spite of its other differences with Neoclassical theory, Keynesian

economics is part of the same tradition. Soviet-style accounts also did little to combat this hegemony since its physicalist approach embedded in the measure of the 'national material product' ended up strengthening non-Marxist concepts.

In *Measuring the Wealth of Nations* Shaikh and Tonak (1994) developed the most comprehensive methodology for estimating Marxist categories for the US economy, while also incorporating earlier insights from Ed Wolff (1987), Fred Moseley (1982), and Shane Mage (1963). Their contribution is certainly a major addition to the Marxist literature. The approach that I here develop builds on and extends Shaikh and Tonak's work.

The crucial difference between the approach introduced in this chapter compared to that of Shaikh and Tonak, Edward Wolff, Fred Moseley, and Shane Mage is the treatment of knowledge and information production as unproductive activity. Predicated on Teixeira and Rotta (2012), my methodology is the only one that provides estimates of Marxist categories considering knowledge as a valueless commodity. I do so by first differentiating production from reproduction and then following Marx when positing that value is determined by the labor time necessary to *re*-produce a commodity. Knowledge is valueless because it requires labor to be originally produced but no labor to be further *re*-produced. In standard economic theory this unique characteristic of knowledge is known as zero marginal cost, which in Political Economy translates as zero reproduction cost. With this key insight on the labor theory of value I can then provide new measures and a new analysis of productive and unproductive forms of accumulation in the United States economy. The direct result of this procedure is to reduce the measure of total value produced each year and to boost the measures of unproductive accumulation. Treating knowledge and information production as unproductive also dampens the estimates of value added, surplus value, and consequently the rate of surplus value.

An interesting result is that my estimate of the rate of exploitation correlates very closely with measures of income inequality and is more in accordance with historical and institutional analyses on the transition from a Regulated to a Neoliberal phase of capitalism in the United States − as in Kotz (2009; 2008; 2003), Harvey (2005; 2003), Lapavitsas (2014), and Duménil and Lévy (2011a). For Marx, a crucial cause of inequality is exploitation, or simply how much workers *pay* to work. Compared to Shaikh and Tonak (1994), my measure of the rate of exploitation correlates far better with the top 1% and top 0.1% income shares and also with the inverted Pareto-Lorenz inequality coefficient from Piketty (2014) and the World Top Income Database for the United States (Alvaredo, Atkinson, Piketty, and Saez 2014). While my methodology is based on the functional distribution of income, Piketty's estimates are based on the personal distribution of income. The World Top Income Database is estimated using tax data from the Internal Revenue Service (IRS), a procedure that is much different from my methodology of employing input-output matrices and national income accounts, but the similarity in terms of trends in inequality and exploitation is striking.

I additionally provide a solution to make compatible the North-American Industry Classification System (NAICS) and the Standard Industry Classification (SIC) methodologies by employing the *Marxist Industry Classification System* (MICS). Earlier works did not have to consider the compatibility issue since the SIC system was the only one available. However, starting in 1997 the official industry classification changed to the more recent NAICS. A key difference between the two systems is the treatment of the real estate sector, given that in the NAICS the fictitious 'owner-occupied housing' industry is implicitly included in the measure of value added. The transition between industry classification methodologies poses two problems. First, the NAICS and SIC produce different estimates for the years when the two series overlap. Second, the change in methodology creates discrete jumps over time in some of the series. The MICS provides the common ground necessary to deal with datasets that differ in methodology across series

and over time, and therefore allows for the construction of more consistent estimates covering the entire 1947-2011 period. In the Appendix I provide a detailed description of data sources as well as a step-by-step explanation of how to apply the MICS to publicly available data.

My method also differs from that of Shaikh and Tonak in regard to the procedure of estimating the compensation of unproductive and productive workers. As much as possible I try not to blend series from different sources, and hence I refrain from using wage and compensation data from the Bureau of Labor Statistics (BLS). I also avoid mixing data on employment by sector from the BLS with data on employment compensation from the BEA. The only instance in which I employ data from the BLS is to calculate the percentage of nonsupervisory workers in productive activities. Even more, within productive activities I exclude supervisory workers solely from the full-time equivalent (FEE) employees, contrary to Shaikh and Tonak's procedure of also excluding the supervisory jobs of self-employed persons (SEP). From my perspective there is no meaning in separating unincorporated businesses into supervisory and nonsupervisory workers.

Similarly to Aglietta (1979), Shaikh and Tonak modify the measure of variable capital (or the value of productive labor power) by also estimating the 'social wage', which consists of the net benefits that workers receive as part of government welfare programs. In their procedure the value of labor power is modified so as to include all net benefits that the welfare state provides to productive workers. To calculate this social wage Shaikh and Tonak summed the social benefits that productive workers got (such as public education, public infrastructure, unemployment benefits, and social security) and then deducted the taxes that productive workers paid to the state. Interestingly, they found that the estimated social wage was negative for most of the postwar period, indicating that it had been in fact a welfare system for the capitalist class. In my analysis I did not include estimates of this social wage, even though I work not with workers' wages but with labor compensations that already include social security benefits.

The methodology and estimates that I present constitute a direct critique of the "immaterial labor" theories of Michael Hardt and Antonio Negri (2001), Maurizio Lazzarato (1996), Lazzarato and Negri (2001), and André Gorz (2010). The main claim of those who advocate the immaterial labor thesis is that Marx's original value theory has become inadequate in a knowledge society. By knowledge society they mean an advanced capitalist economy in which knowledge and information are crucial inputs to and outputs of production. Marx, they claim, theorized a capitalist world in which commodities consisted primarily of tangible goods, and hence developed a value theory that carried a 'physicalist' bias. In the world of tangible and material commodities the type of labor that plays a central role is that of material labor, but Marx's supposed focus on material labor and tangible commodities becomes out of date in contemporary societies in which immaterial labor and intangible commodities comprise the axis of capitalist production.

The key problem is that Antonio Negri, Michael Hardt, Maurizio Lazzarato, and André Gorz have not properly understood Marx's value theory. These authors have neither understood the difference between productive and unproductive activity nor the difference between production and reproduction. Furthermore, they do not recognize that knowledge is a valueless commodity. As long as one considers the distinction between activities that produce value and activities that consume value, and considers that value is determined by the labor time necessary to *re*-produce a commodity, there is no inadequacy in Marx's approach in this respect. The defenders of the immaterial labor thesis seem to be unaware of the crucial difference between production and re-production in Marx's theory.

The new Marxist categories that I introduce also measure unproductive accumulation in a broader way compared to its counterparts in Keynesian approaches to financialization. While the Keynesian notion of *financialization* remains circumscribed to financial circuits of capital, the Marxist notion of *unproductive accumulation* includes the idea of financialization and additional-

ly considers that other unproductive activities also draw on the surplus value that productive workers generate.

2.3 Standard and New Marxist Categories

Standard Marxist categories stem from Marx's original writings and the tradition that followed him thereafter. Since Marxist Political Economy has a unique class theory of the production, appropriation, and distribution of surplus value, estimates of these categories provide a diagnosis of capitalism that radically differs from usual economic analyses. From the Marxist point of view the official measures of gross and net outputs (such as GDP) contain systematic double counting of values and therefore constitute artificially inflated indicators of outputs and incomes. In the official national income and product accounts, for example, growing financial incomes imply ceteris paribus an also growing GDP. This artificial inflation of the net product, on the contrary, does not take place with Marxist estimates. Growing financial incomes simply means that the accumulation of unproductive capital is drawing more from the surplus value generated in productive activities.

Virtually every enterprise operates with a mix of productive and unproductive activities, with few firms actually being classified as purely productive or purely unproductive. For this reason I do not employ the term unproductive *sector* but rather unproductive *activity*. The purpose is to make clear that productive and unproductive endeavors are not separated into sectors but in fact into activities.

The value of any commodity (λ_i) can be decomposed into the indirect and direct labor necessary to reproduce it. Indirect or past labor appears through the use of means of production while direct or current labor appears through the employment of labor power. Indirect labor contributes to the value of a new commodity because the means of production used up are themselves commodities and therefore products of past human labor. The direct labor applied adds more val-

ue and, eventually, a surplus value (S_i) over and above that required to reproduce labor power as a commodity. The value of every commodity (λ_i) can thus be decomposed into the value transferred from the means of production used up, called constant capital (C_i), and the new value added by direct labor (VA_i). The constant capital C_i comprises the value transferred from circulating constant capital, or the inputs consumed all at once, and the value transferred from fixed constant capital, or the inputs that gradually transfer their value over multiple production turnovers. Constant capital is therefore the sum of the raw materials and inputs immediately consumed plus the depreciation of fixed capital.

The direct labor applied (VA_i) can then be further decomposed into the value necessary to reproduce the laborers, called variable capital (V_i), and the extra value that workers produce but do not receive, named surplus value (S_i). The ratio of the realized surplus value to the variable capital spent to produce the surplus is the realized rate of surplus value ($s_i = S_i/V_i$), or the rate of exploitation of productive workers, an index of how much productive workers *pay* to work. Hence:

$$\lambda_i = C_i + VA_i = C_i + V_i + S_i = C_i + V_i(1 + s_i) \tag{2.1}$$

To arrive at the total value (TV) realized in an economy we simply sum the realized values of all n commodities. The total value is thus the sum of all constant capital used up ($C = \sum_{i=1}^{n} C_i$), all the variable capital used up ($V = \sum_{i=1}^{n} V_i$), and all the surplus value ($S = \sum_{i=1}^{n} S_i$) realized. The constant capital C reflects all the productive inputs used up when producing the value of all commodities, or simply all the past indirect labor transferred to current productive output. The sum of variable capital and surplus is the total Marxist value added ($VA = \sum_{i=1}^{n} VA_i$) in the economy and it reflects all the direct productive labor employed. Letting $s = S/V$ denote the economy-wide average rate of surplus value, we now have:

$$TV = \sum_{i=1}^{n} \lambda_i = C + VA = C + V + S = C + V(1 + s) \quad (2.2)$$

The total value TV measures the realized values of all n commodities in an economy. It is a gross measure of productive output since it includes the value transferred from the inputs. When we net out the value of constant capital C we arrive at the Marxist value added VA measure. The direct inputs consumed and the depreciation of fixed capital are both included in the measure of C, implying that the Marxist value added is both net of inputs used up and net of depreciation. The surplus value S is the residual that we obtain after subtracting from VA the value of the labor power of productive workers V.

The constant capital C includes only inputs used up in productive activities that were themselves produced by productive labor. Inputs produced in unproductive activities that are then used up in productive activities are not included in the measurement of C, even if they were purchased at a positive price. For example, payments for land (land-rents) are not included in C. The same reasoning applies to the value of labor power, since the measure of variable capital V includes only the compensation of productive workers in productive activities. Unproductive workers in productive activities (such as supervisory workers) and all the workers in unproductive activities do not enter into the computation of V. Surplus value S is the new value that is then consumed to maintain all those activities that were excluded from the estimate of value added.

It is now straightforward to compute other key Marxist measures. The economy-wide average profit rate (r) is simply the total surplus value realized relative to the total capital stock (K) employed in the economy: $r = \frac{S}{K}$. The organic composition of capital (OCC) can be computed as the stock of productive capital relative to variable capital. The stock of productive capital is the stock of fixed assets in productive activities (K_{PA}), hence: $OCC = \frac{K_{PA}}{V}$.

Standard Marxist categories, however, do not directly reflect the accumulation of unproductive capital. To fill in this gap I present new measures that explicitly capture unproductive accumulation. The purpose is to better understand how unproductive accumulation interacts and coevolves with productive accumulation over time.

First, I provide a specific decomposition of the general profit rate in order to make explicit the role of unproductive activities. The total stock of fixed assets in the economy comprises the fixed capital stock in productive (PA) and unproductive activities (UA), hence: $K = K_{PA} + K_{UA}$. Using $s = S/V$ as the economy-wide average rate of surplus value and $OCC = \frac{K_{PA}}{V}$ as the organic composition of capital it then becomes possible to rewrite the equation for the general profit rate as:

$$r = \frac{S}{K} = \frac{S}{K_{PA} + K_{UA}} = \frac{\frac{S}{V}}{\frac{K_{PA}}{V} + \frac{K_{UA}}{V}} = \frac{s}{OCC + UCC} \tag{2.3}$$

The new category that I introduce is the *unproductive composition of capital*: $UCC = \frac{K_{UA}}{V}$. The UCC captures the relationship between the accumulation of unproductive capital stock and the variable capital representing the workers generating surplus value in productive activities. It thus becomes evident that the general profit rate can rise if the rate of surplus value is rising, and it can fall if either the OCC or the UCC is rising, all else held constant. The profit rate falls if the rise in the rate of exploitation is not rapid enough to compensate for the effect of a rising unproductive composition of capital.

Analogous to the total value TV and value added VA of productive activities it is possible to compute corresponding measures for unproductive activities. The corresponding measure to TV is the *gross income of unproductive activities* (GI_{UA}), and the corresponding measure to VA is

the *net income of unproductive activities* (NI_{UA}). The difference between GI_{UA} and NI_{UA} is that the net measure excludes the intermediate inputs that are included in the gross measure of unproductive income.

Two other categories that I introduce capture the relative magnitude of unproductive to productive flows of income. The first is the *net unproductive burden* (NUB), estimated as the ratio of the net income of unproductive activities to the surplus value generated in productive activities: $NUB = \frac{NI_{UA}}{S}$. The second is the *gross unproductive burden* (GUB), estimated as the ratio of the gross income of unproductive activities to the total value generated in productive ties: $GUB = \frac{GI_{UA}}{TV}$.

The UCC, NUB, and GUB are three different ways of measuring the *relative* size of unproductive accumulation, given that the corresponding denominators reflect magnitudes of productive accumulation. A rise in the UCC, NUB, and GUB measures indicates that unproductive accumulation is outweighing productive accumulation. In summary, these new categories that I propose complement the standard measures to offer a richer analysis of the dynamics of capital accumulation in its productive and unproductive dimensions.

2.4 The Marxist Industry Classification System

In order to estimate the total value annually produced in the United States it is necessary to have detailed industry-level information on the national gross output, which includes both the value added as well as the inputs used up. The only way to obtain historical information on value added and intermediate inputs with the required level of detail is through the benchmark input-output matrices that the Bureau of Economic Analysis (BEA) computes. For any single year, an input-output table consolidates the three approaches to value added: the sum of final uses or ex-

penditures, the sum of all incomes, and the sum of all contributions from all industries net of their respective inputs.

Annual data on industry incomes, products, inputs used up, employment, and labor compensations is also publicly available through the BEA. To separate supervisory from nonsupervisory employees I use industry-level data from the Bureau of Labor Statistics (BLS) on the total number of employees and the number of production and nonsupervisory workers. In the Appendix I describe in detail all data sources, together with a step-by-step explanation of how to compute Marxist categories for the United States economy from 1947 to 2011.

Information on stocks of fixed assets and depreciation by industry is available through BEA's Fixed Assets Accounts (FAA). For my estimates I use the series on current-cost net stocks of fixed assets by industry, which comprises stocks of buildings, equipment, and software at replacement costs. For stocks of assets and their respective depreciations I combine the datasets from nonresidential private entities with the federal, state, and local government entities. The official measure of fixed asset depreciation includes the physical deterioration of buildings and equipment as well as the obsolescence due to new technological advances, implying that depreciation also measures early retirements and discards as assets are withdrawn from service while still being useful.

The very first step to transform official national accounts data into Marxist categories is to classify and separate the different industries into new groups that actually reflect Marxist theory. The industry classification scheme associated with Marxist theory is what I would like to call the *Marxist Industry Classification System* (MICS). In contrast to the official North-American Industry Classification System (NAICS) and the Standard Industry Classification (SIC), the MICS posits that the value created in productive activities cannot be recounted in unproductive

activities. The MICS has only three industry groupings, meant to replace the official SIC and NAICS industries so as to allow for the proper estimation of Marxist categories:

(i) *Productive activities* (PA): Includes all commodity-producing activities in which capitalists hire wage-labor to generate surplus value. Agriculture, mining, manufacturing, transportation, construction, maintenance, and government enterprises are counted here. Only productive services are counted.

(ii) *Trade, rental, and leasing* (TRL): Includes retail trade, wholesale trade, rental of equipment, and leasing of commodities. Retail and wholesale industries contain trade margins only, and the rental of equipment and leasing of commodities imply that values are being realized via piecemeal sales. However, the rentals of use-values that contain no value (such as land and knowledge) are not counted here.

(iii) *Unproductive activities* (UA): Accounts for all activities that either create new or recirculate existing use-values without generating any surplus value. Included here are the rentals of land (land-rents) and knowledge along with finance, insurance, advertising, legal services, non-profit entities, government administration, pharmaceuticals, software production, data management, research and development, publishing industries, sound recording, and movie production.

It is necessary to separate trade from unproductive activities because the input-output system that the BEA has developed is cast in producer's prices, with trade margins recorded in the retail and wholesale industries. If the official accounts were cast in final selling prices (purchaser's price) then trade would be directly incorporated into the unproductive activities groups, but since trade margins are recoded in their own rows and columns it becomes necessary to first distinguish them from both productive and unproductive activities. To estimate the measure of total value TV we then have to combine the incomes recorded under the productive activities (PA)

grouping with the trade and rental margins recorded under the trade, rental, and leasing (TRL) grouping.

The main methodological novelty that I introduce regarding the productive-unproductive distinction is the classification of knowledge and information production as unproductive activity. The unproductive nature of knowledge and information derives from the unique feature that the *re*-production of knowledge and information requires no labor time. Once initially produced, the labor time necessary to reproduce knowledge and information is zero. The value of a commodity is determined by the labor time required to reproduce it, not the labor time required in its original production. If no labor time is needed to reproduce the product of human labor then this product becomes valueless (Teixeira and Rotta 2012). The valueless property of knowledge and information as commodities is a direct implication of what Marx himself stated in *Capital III*:

> Apart from all the accidental circumstances, a large part of the existing capital is always being more or less devalued in the course of the reproduction process, since *the value of commodities is determined not by the labor-time originally taken by their production, but rather by the labor-time that their reproduction takes*, and this steadily decreases as the social productivity of labor develops. At a higher level of development of social productivity, therefore, all existing capital, instead of appearing as the result of a long process of capital accumulation, appears as the result of a relatively short reproduction period. (Marx 1994, p.522 − emphasis added)

Knowledge production is therefore an unproductive activity. Even more, the owners of knowledge and information become *knowledge-lords* analogously to how we commonly refer to the owners of land as landlords. Workers laboring for knowledge-lords produce no value and hence no surplus value. If no surplus value creation takes place in the production of knowledge and if certain capitalists become knowledge-lords due to the monopoly rights they possess over produced information, then all the profits knowledge-lords make are pure *knowledge-rents*.

Even though the production of new knowledge does not generate surplus value it does give rise to rents that allow knowledge-lords to appropriate a share of the surplus value produced in productive activities. The role of intellectual property rights and of copyrights in general is to

guarantee that the owners of knowledge and information get a fraction of the surplus value produced elsewhere in the economy. Intellectual property rights have a similar economic role compared to land ownership rights, namely that they assure a flow of surplus value to unproductive capitalists in the form of rents. In the case of commodified knowledge, market prices are gross overestimations of its null value.

I therefore classify several activities as unproductive on the grounds that they produce knowledge that requires no labor to reproduce: software, data, pharmaceuticals, movies, recorded video and music, and published materials. As an approximation, I classify the entire value of output of those industries as unproductive, despite the fact that a part of the value that these industries produce is attributed to new labor that is required each year. For example, the pharmaceutical industry must produce pills that require new labor as well as existing knowledge. Ideally it would be desirable to count part of the above industries' output as productive, but data limitations prevent me from doing so in this study.

2.5 Historical Trends in the US Economy

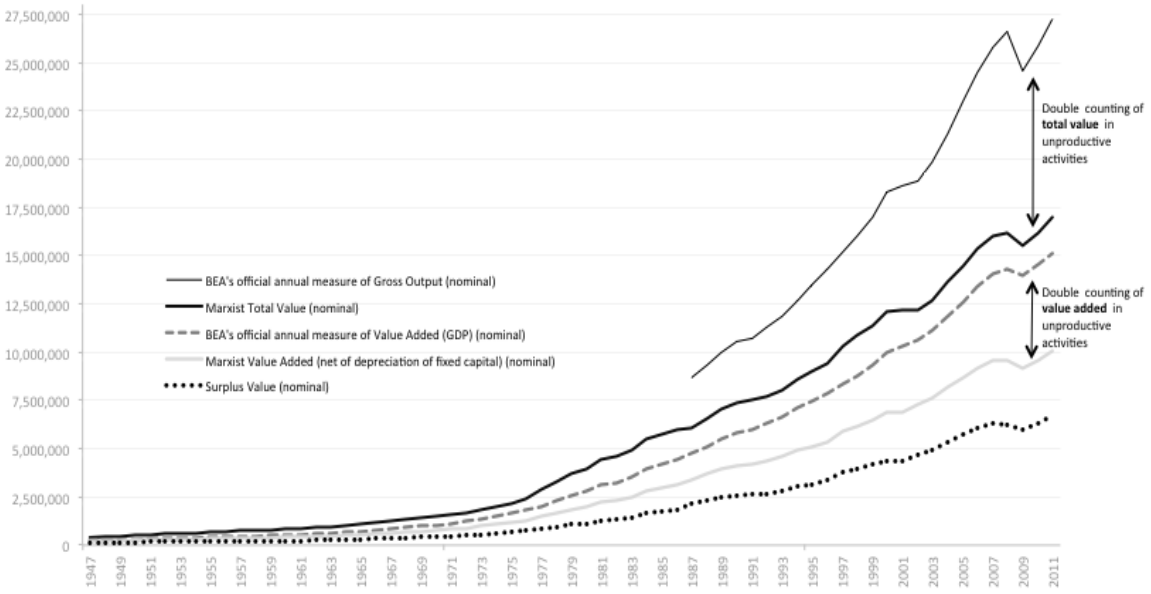
2.5.1 Exploitation, Inequality, and Unproductive Activity

I begin my evaluation of the United State economy by plotting in Figure 2.1 key Marxist measures together with their official counterparts from the Bureau of Economic Analysis (BEA). All series are nominal in millions of dollars. I compare the BEA measure of gross output with Marxist total value, indicating that the gap between the two series is due to the double counting of values in unproductive activities. I additionally compare the BEA measure of gross domestic product (GDP) with my estimate of the Marxist value added, also indicating that the gap between the two series is due to the double counting of value added in unproductive activities. I additionally plot my estimate of surplus value. The comparisons make clear how from a Marxist perspective the BEA artificially inflates its official annual measures of income and output by counting

produced values more than once. Netting out unproductive activities from the measures of value creation makes a significant difference.

In Figure 2.2 I plot my estimate for the rate of surplus value in the United States from 1947 to 2011. The rate of surplus value is the rate of exploitation of productive workers in productive activities measured as the flow of surplus value relative to the value of labor power. The value of labor power is, in turn, the variable capital measured as a flow of productive labor compensation.

Figure 2.1: Marxist Categories and Official Measures of Output (1947-2011) – Millions of Dollars



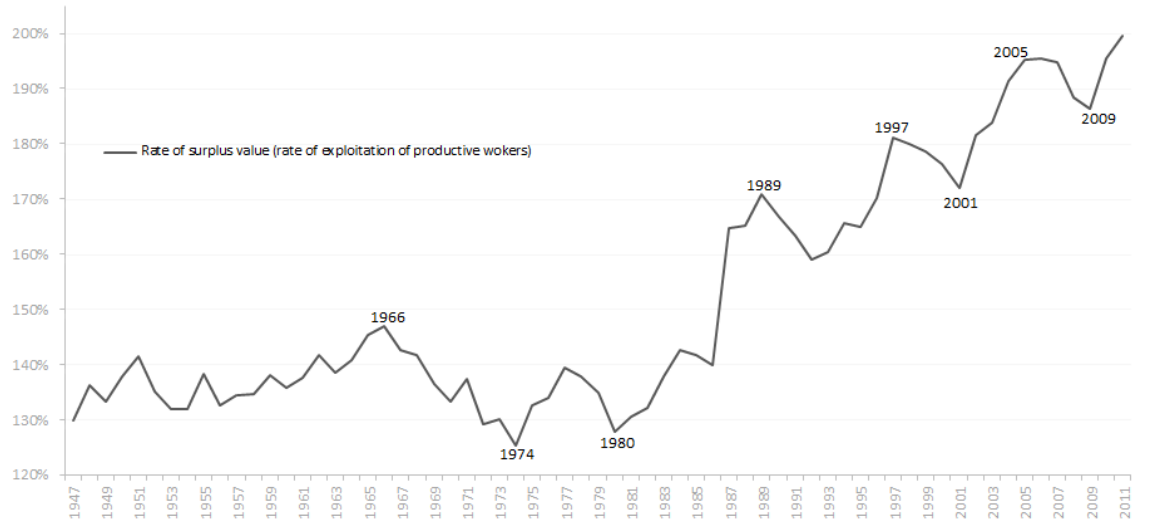
Sources: Author's calculations and BEA. All figures are nominal in millions of US dollars.

The rate of surplus value was roughly stable during the 'Golden Age' from 1947 to 1966, implying that productive workers were exploited roughly at the same rate every year. Possibly due to labor militancy and low levels of unemployment, capitalists could not extract surplus value from workers at an increasing rate. From 1966 to 1980, the 'crisis of Keynesianism' period, the rate of surplus value dropped sharply. Possibly due to international competition with European

and Japanese capitalists in global markets and to escalating labor militancy at home, the surplus of the capitalist class was indeed squeezed.

The Neoliberal period beginning in the early 1980s then produced a sharp recovery of the rate of exploitation. By the end of the 1980s it had significantly surpassed its previous peak in 1966. Possibly due to the erosion of workers' bargaining power and increased competition in labor markets, the rate of surplus value continued to rise to unprecedented levels in the entire postwar period. Raising from a low point of 125% in 1974 it reached 200% in 2011. This implies that in 2011 productive workers labored 1/3 of the time for themselves and 2/3 of the time for the capitalists.

Figure 2.2: Rate of Surplus Value (1947-2011)



Sources: Author's calculations.

The rate of surplus value functions as an index of class struggle and indicates who has the margin of victory across different historical phases. The trends in the rate of exploitation of productive workers correspond to three different phases of postwar US capitalism. First, the Golden Age aligns with the years featuring a constant rate of exploitation (1947-1966). Second, the crisis of Keynesianism occurs when a falling rate of exploitation puts a squeeze on capitalists (1967-

1979), suggesting that it was initially a crisis for capitalists which was transformed afterwards into a crisis for workers. The Neoliberal era then matches with a sustained increase in exploitation to record levels (1980-2011), suggesting that Neoliberalism is a class project of squeezing the compensation of productive workers to the benefit of the capitalist class.

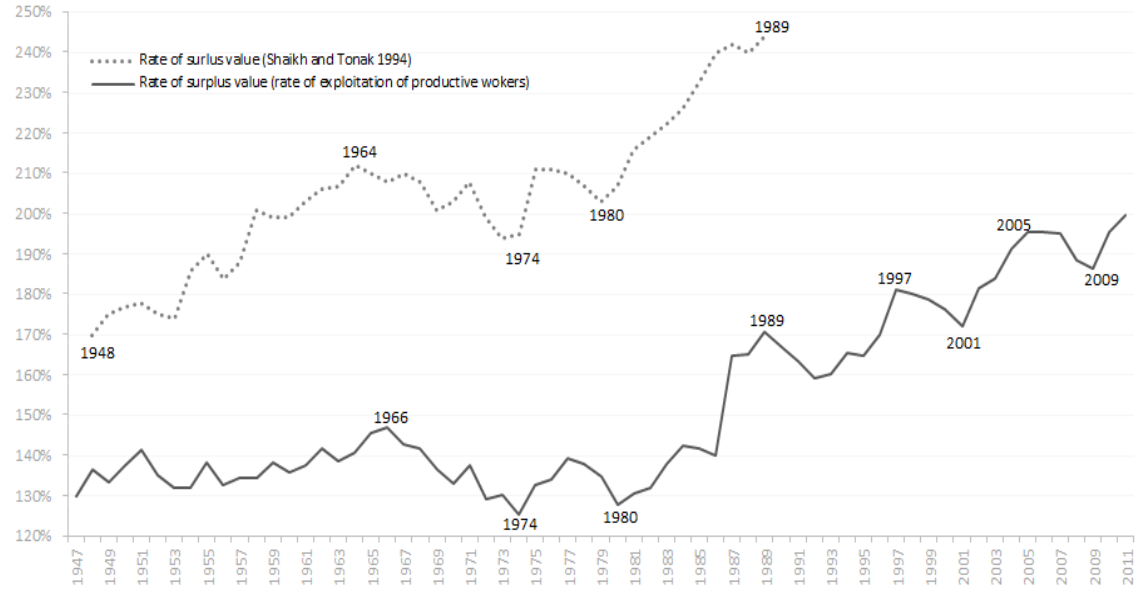
In Figure 2.3 I plot my estimate of the rate of surplus value together with the profit-wage ratio calculated directly from the BEA data. To compute the profit-wage ratio I divide the gross operating surplus by total employee compensation series from the annual GDP by industry accounts under the Standard Industry Classification (SIC) system from 1947 to 1986 and under the North-American Industry Classification System (NAICS) from 1987 to 2011. The immediate conclusion is that the profit-wage ratio available from the official income accounts is not a good proxy for the rate of exploitation. Because it ignores the productive-unproductive distinction present in Marxist theory, the profit-wage ratio substantially underestimates the rate of surplus value. The profit-wage ratio homogenizes all economic activities while the rate of surplus value explicitly considers that unproductive activities do not produce any surplus value. The gap between the two series reveals the weight of unproductive activity.

In Figure 2.4 I plot my estimate of the rate of exploitation together with that from Shaikh and Tonak (1994). Not only is the level of the rate of surplus value different but also its long-run trend. In contrast to my approach, Shaikh and Tonak: (i) classify all activities related to knowledge and information production as productive of surplus value, (ii) deduct supervisory workers from self-employed persons in productive activities, and (iii) add a negative 'social wage' to the value of labor power. For these three reasons they arrive at a rate of surplus value that has a steeper trend and is systematically higher than what I estimate for the 1948-1989 period.

Figure 2.3: Rate of Surplus Value and Profit-Wage Ratio (1947-2011)

Sources: Author's calculations and BEA.

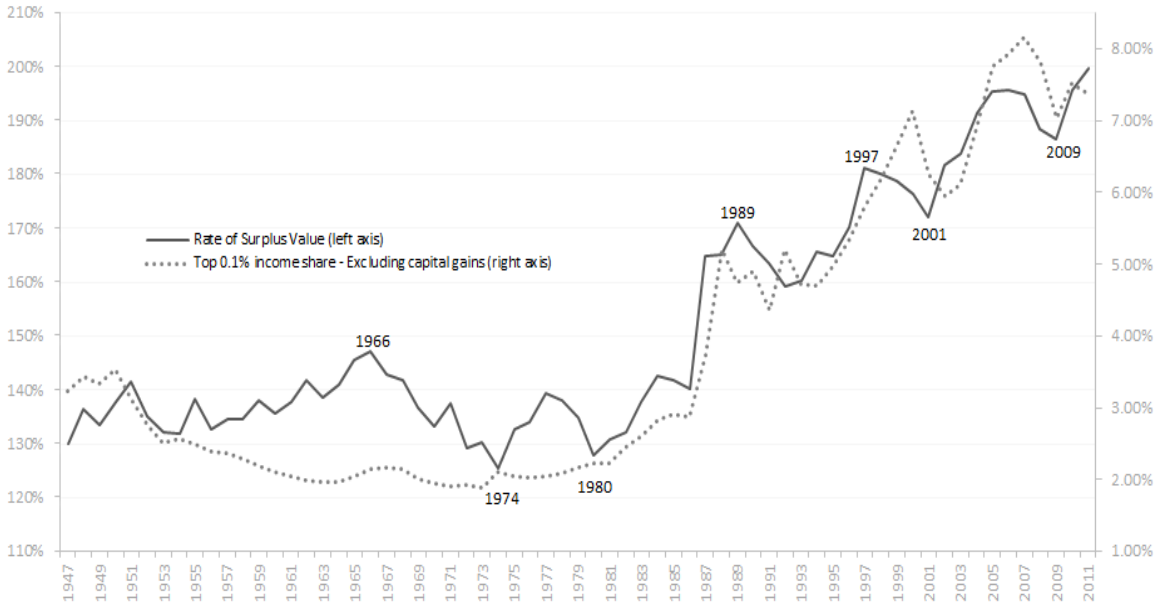
Figure 2.4: Comparison between Rates of Surplus Value (1947-2011)



Sources: Author's calculations and Shaikh and Tonak (1994).

For Marx, exploitation is a crucial cause of inequality. To show how this relationship manifests in the postwar Unites States I plot in Figure 2.5 my estimate of the rate of exploitation together with the top 0.1% income share (excluding capital gains) from Piketty (2014) and Alvaredo, Atkinson, Piketty, and Saez (2014). The similarity of trends is remarkable. The correspondence is all the more striking given that I estimate Marxist categories from input-output matrices while Piketty (2014) computes inequality from Internal Revenue Service (IRS) tax data. The very high correlation between exploitation and inequality also holds if I use instead either the top 1% income share or the inverted Pareto-Lorenz inequality measure.

Figure 2.5: Rate of Exploitation and Top 0.1% Income Share (1947-2011)



Sources: Author's calculations; Piketty (2014); Alvaredo, Atkinson, Piketty, and Saez (2014).

In Table 2.1 I further show how my new methodology improves our understanding of the relationship among exploitation, inequality, and unproductive activity. I compute the correlation coefficients between my estimates of the rate of exploitation, Shaikh and Tonak's (1994) exploitation estimates, the official profit-wage ratio from the BEA, and Piketty's (2014) measures of income inequality for the US economy. The correlation coefficients between my estimate of ex-

ploitation and Piketty's top 1% income share is 0.95, 0.96 for the top 0.1% income share, and 0.94 for the inverted Pareto-Lorenz inequality coefficient. Correlation surely does not imply causality, but all measures are remarkably close to unity. If we use instead Shaikh and Tonak's (1994) estimates we arrive at only 0.05, 0.26, and 0.45, respectively. If I truncate my estimates to stop in 1989, when Shaikh and Tonak's dataset ends, I still arrive at correlation coefficients between exploitation and inequality that are substantially higher than theirs. Even if we use the profit-wage ratio computed from the official BEA data, the correlations with Piketty's measures of inequality are substantially lower than my estimates.

Table 2.1: Exploitation and Inequality in the United States – Correlations (1947-2011)

	Correlation
Rate of Surplus Value (from Rotta) and Top 1% income share - 1947 to 2011	0.95
Rate of Surplus Value (from Rotta) and Top 0.1% income share - 1947 to 2011	0.96
Rate of Surplus Value (from Rotta) and Inverted Pareto-Lorenz coefficient - 1947 to 2011	0.94
Rate of Surplus Value (Shaik and Tonak 1994) and Top 1% income share - 1948 to 1989	0.05
Rate of Surplus Value (Shaik and Tonak 1994) and Top 0.1% income share - 1948 to 1989	0.26
Rate of Surplus Value (Shaik and Tonak 1994) and Inverted Pareto-Lorenz coef. - 1948 to 1989	0.45
Rate of Surplus Value (from Rotta) and Top 1% income share - 1948 to 1989	0.63
Rate of Surplus Value (from Rotta) and Top 0.1% income share - 1948 to 1989	0.71
Rate of Surplus Value (from Rotta) and Inverted Pareto-Lorenz coefficient - 1948 to 1989	0.70
Profit-Wage Ratio (from BEA) and Top 1% income share - 1947 to 2011	0.41
Profit-Wage Ratio (from BEA) and Top 0.1% income share - 1947 to 2011	0.34
Profit-Wage Ratio (from BEA) and Inverted Pareto-Lorenz coefficient - 1947 to 2011	0.29

Sources: Author's calculations; Shaikh and Tonak (1994); Piketty (2014); Alvaredo, Atkinson, Piketty, and Saez (2014); and BEA.

Since inequality is a different measure from exploitation in various ways, one would not expect the movements of the rate of exploitation to entirely explain movements of inequality. The rate of exploitation is computed from the functional distribution of income between productive workers and productive capitalists. Inequality is instead computed from the personal distribution

of income across households, whether or not they are attached to productive activities. Despite the differences between the two measures, it is striking that the rate of exploitation is so closely correlated with the income share of the super rich. This high correlation suggests that the rate of exploitation may be a major determinant of the degree of inequality.

In sum, official estimates artificially inflate output and income measures by not netting out unproductive activity. Once we take into account that not all forms of economic activity create new value it becomes possible to arrive at estimates of the rate of exploitation that clearly indicate different phases of class conflict in the postwar Unites States. Compared to the existing literature, the new methodology that I put forth yields estimates of economic exploitation that correlate far better with current measures of economic inequality.

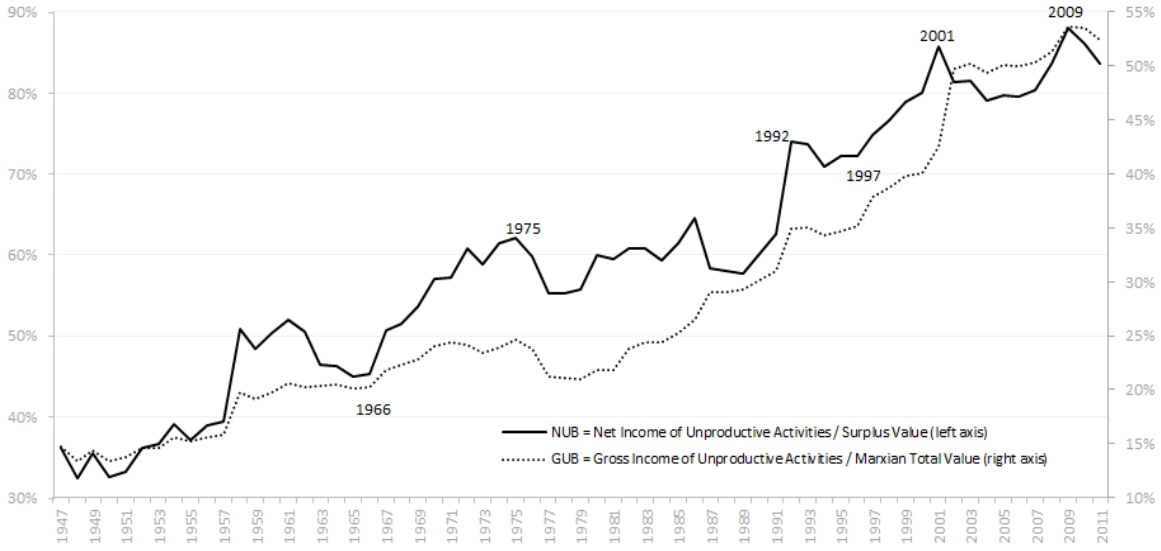
2.5.2 The Magnitude of Unproductive Accumulation

Marxist theory posits that all forms of unproductive activity survive by consuming the surplus that productive activities generate. To better understand the magnitude of unproductive accumulation I plot in Figure 2.6 the gross and net unproductive burdens. The net unproductive burden (NUB) is the net income of unproductive activities relative to the surplus value generated in productive activities. It rises from a low point at 32.4% in 1948 to a peak at 88% in 2009, implying that the net income of unproductive activities relative to the surplus value generated in productive activities rose over 171% in this period. The gross unproductive burden (GUB) is the gross income of unproductive activities relative to the total value generated in productive activities. It rises from a low point at 13.4% in 1948 to a peak at 53.3% in 2009, implying that the gross income of unproductive activities relative to the total value generated in productive activities rose over 300%, hence quadrupling during the same period.

Unproductive accumulation has been a core feature of the postwar United States. In Figure 2.7 I plot the NUB and GUB together with the ratio of the net income of unproductive activi-

ties to Marxist value added, and also together with the ratio of the surplus income of unproductive activities to the surplus value from productive activities. I compute the surplus income of unproductive activities as the net income of unproductive activities minus employee compensation in these activities, with no distinction between supervisory and nonsupervisory workers. These four estimates jointly demonstrate the astonishing pace of unproductive accumulation in the US economy. All measures rise consistently from 1947 to 2011 and therefore provide strong evidence of how unproductive activity has been growing significantly faster than productive activity. Similarly to the NUB and GUB, the ratio of net income of unproductive activities to Marxist value added increases over 206% between 1948 and 2009, while between 1951 and 2009 the surplus income of unproductive activities increases 168% over the surplus value from productive activities.

Figure 2.6: Gross and Net Unproductive Burdens (1947-2011)

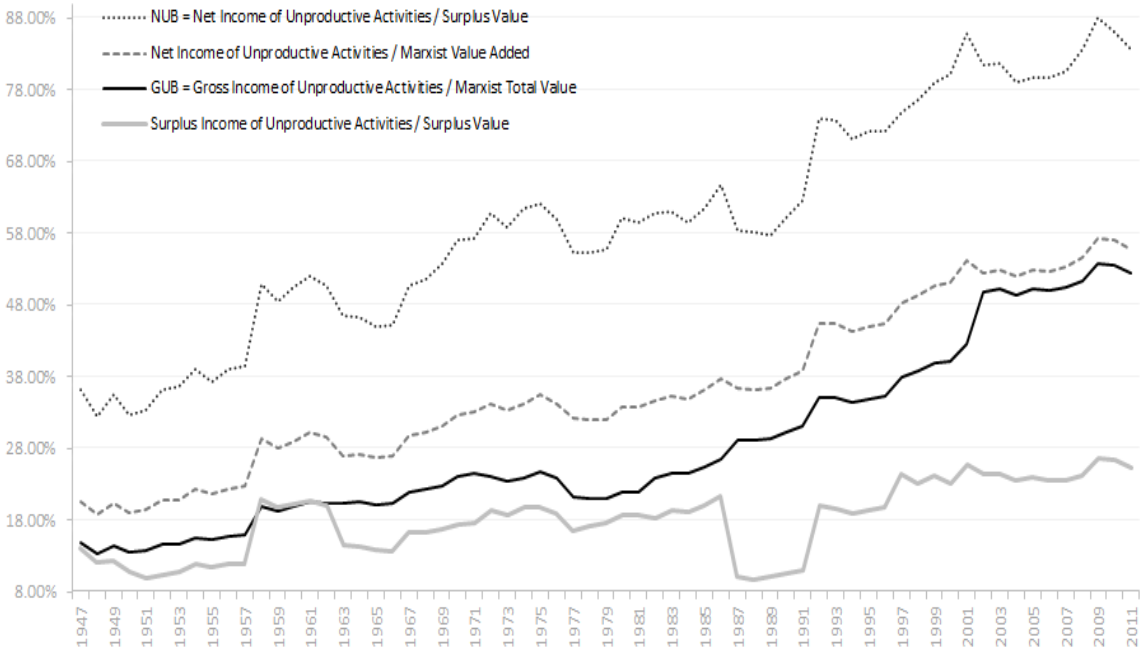


Sources: Author's calculations.

I further decompose the Net Income of unproductive activities from 1947 to 2011 into the shares of five sub-categories: (i) government administration, consisting mostly of the government wage bill at all levels with the exception of productive government enterprises; (ii) finance and insurance; (iii) non-profit organizations and unproductive services, such as legal services and

corporate management; (iv) real estate, comprising land-rents accruing to agents, managers, operators, and lessors; (v) knowledge and information rents, comprising all net incomes from activities involving advertising, pharmaceuticals, software production, data management, research and development, publishing industries, sound recording, and movie production. This decomposition appears in Figure 2.8.

Figure 2.7: Relative Measures of Unproductive Accumulation (1947-2011)

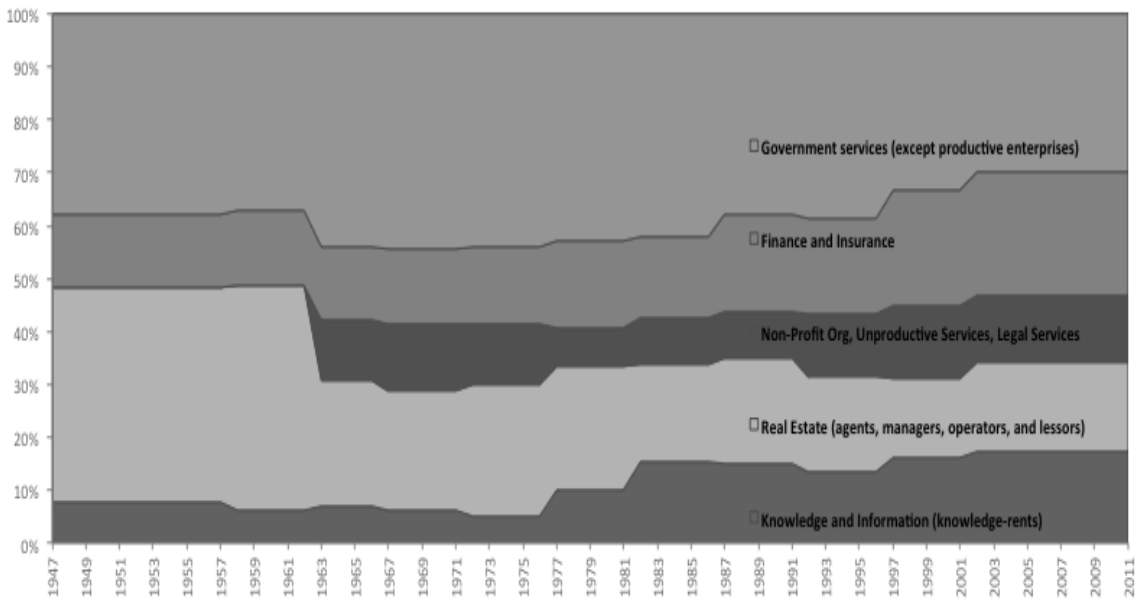


Sources: Author's calculations.

The chart shows substantial growth in the shares of finance and insurance from 14% to 23.2%, and also in knowledge and information rents from 7.9% to 17.4%. *Combined, finance and knowledge rents have risen from 21.9% to 40.5% of the Net Income of all unproductive activity*. The share of Government administration has shrunk from 37.7% to 29.9%, while the real estate sector has also shrunk from 23.8% in 1963 (when we began to have better real estate input-output data) to 16.8% in 2011. The share of non-profit, legal and corporate management services re-

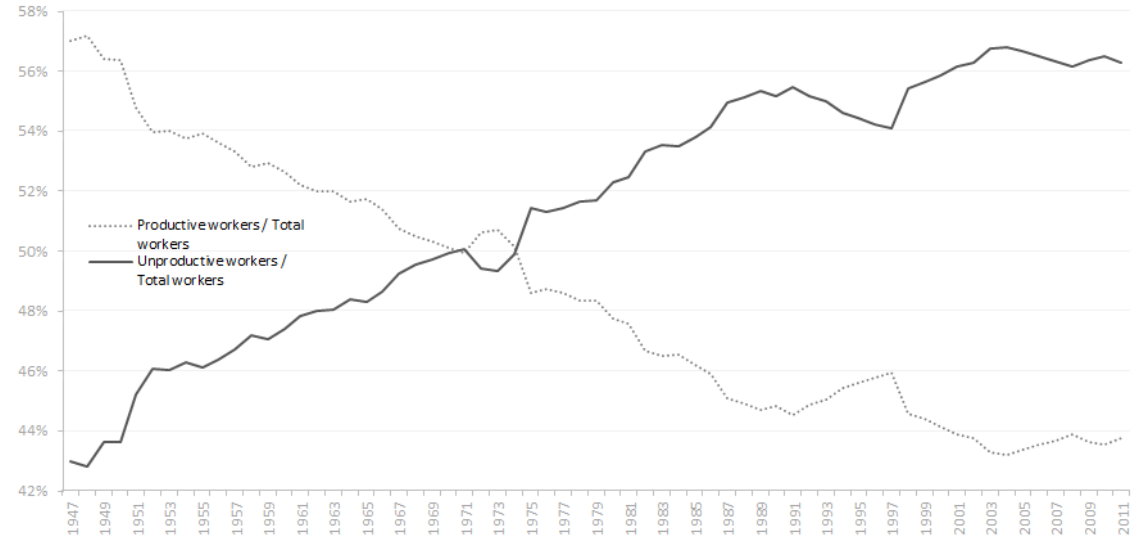
mained somewhat stable around 11% since 1963 (when we began to have better input-output data for these activities).

Figure 2.8: Decomposition of the Net Income of Unproductive Activities (1947-2011)



Sources: Author's calculations.

Figure 2.9: Productive and Unproductive Shares of Total Employment (1947-2011)



Sources: Author's calculations.

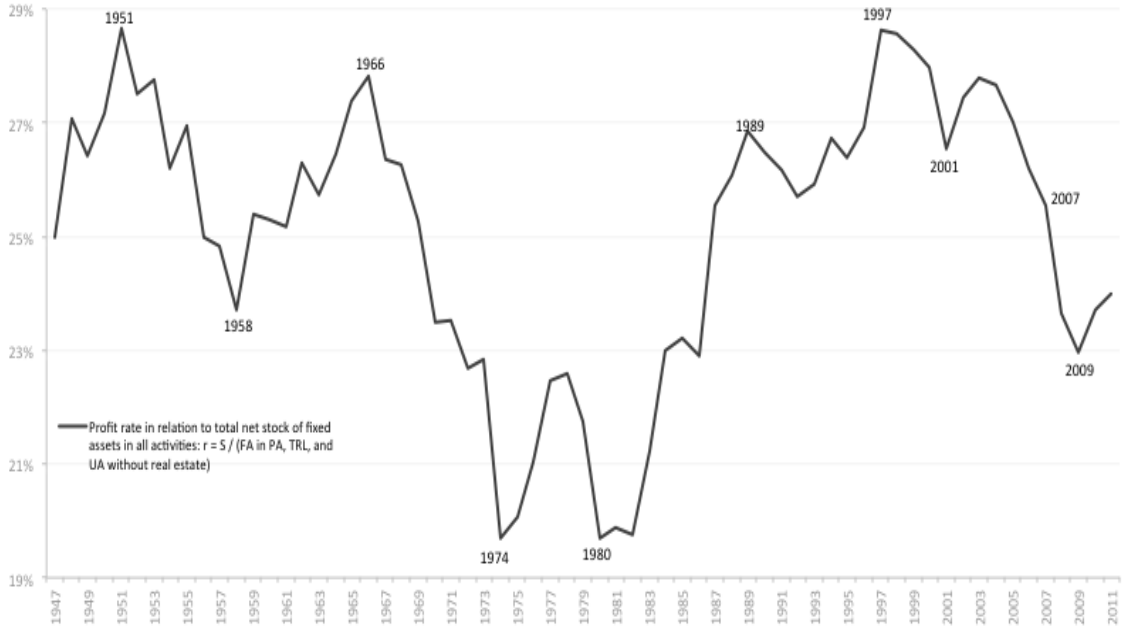
Unproductive accumulation has its effect not only on value distribution but also on employment. The relative importance of unproductive employment has risen consistently in the postwar period, and since the early 1970s the employment of unproductive workers has surpassed their productive counterparts. In Figure 2.9 I plot the number of productive and unproductive workers as shares of total employment. The share of unproductive relative to total employment rises from 43% in 1947 to 56% in 2011, while the complementary share of productive workers drops from 57% in 1947 to 44% in 2011. Productive workers are nonsupervisory workers in productive activities, and unproductive workers are supervisory workers in productive activities plus all workers in unproductive activities. These figures show the employment effects associated with unproductive accumulation.

The empirical evidence so far examined points to a paradox. While productive workers produce more surplus value per year, increasingly unproductive activities consume more of the surplus they produce. Neoliberal policies in the United States have therefore facilitated higher labor exploitation in productive activities while changing the composition of the capitalist class away from productive activities. These opposite forces constitute what I would like to call the *Marxist Neoliberal paradox*. Crotty (2003) originally coined the term 'Neoliberal paradox' to refer to the negative effects that destructive product market competition and impatient finance have imprinted on nonfinancial corporations. Here I use his term and reinterpret it in a Marxist way as the contradictory effects of *rising exploitation of productive labor* combined with *faster unproductive accumulation* in the post-1980 era. The consequences of the Marxist Neoliberal paradox on profitability are analyzed in the next section.

2.5.3 Profitability and Unproductive Accumulation

In Figure 2.10 I plot my estimate of the general profit rate à la Marx, calculated through equation 2.3 as the flow of surplus value relative to the stock of fixed assets in all nonresidential activities.

Figure 2.10: General Profit Rate à la Marx (1947-2011)



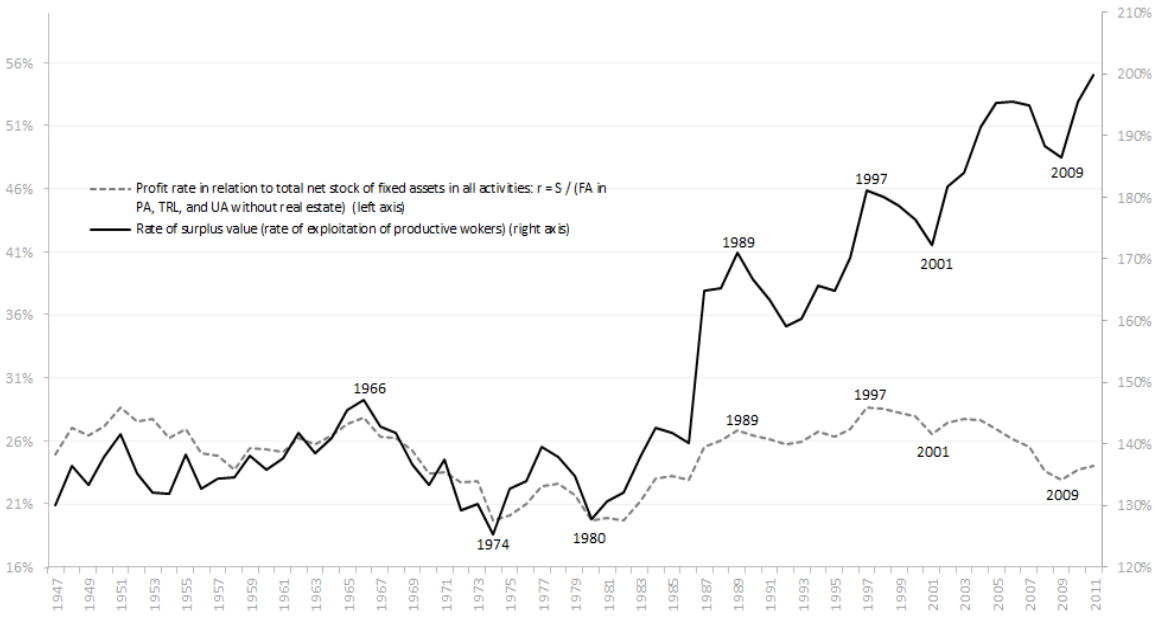
Sources: Author's calculations.
Note: S = surplus value; PA = productive activities; TRL = trade, rental, and leasing; UA = unproductive activities; FA = fixed assets; r = general profit rate.

The general profit rate is an index of how the surplus value generated in productive activities compensates the investment in fixed assets in all productive and unproductive activities combined. It displays four distinct phases during the postwar period. First, during the Golden Age between 1947 and 1966 it is roughly stable at around 26.3%. Second, during the crisis of Keynesianism from 1966 to 1980 it plummets from 27.8% to 19.7%. Third, during the Neoliberal period it recovers from its depressed level at 19.7% in 1980 to a historical high at 28.6% in 1997, indicating that Neoliberal policies did restore profitability to the capitalist class. Fourth, from its peak at 28.6% in 1997 the profit rate falls significantly to 23% in 2009. It is therefore interesting to notice that the general profit rate was *falling consistently* during the ten years before the major crisis that began in late 2007.

To give an idea of the changing correlation between exploitation and profitability, in Figure 2.11 I plot the rate of surplus value (on the right axis) together with the general profit rate à la

Marx (on the left axis). To facilitate the comparison I adjust the left and right axes so as to make the two series overlap. The joint plot reveals a remarkable pattern. The rate of surplus value and the general profit rate tracked each other very closely until 1980. From 1947 to 1980 the trend, though not the level, of the general profit rate displayed the same behavior as the rate of exploitation of productive workers in productive activities. Beginning in the early 1980s, however, the rate of surplus value starts to rise significantly while the profit rate falls behinds. The gap between the two series widens considerably every year between 1980 and 2011, indicating that *the general profit rate stalls despite a rising rate of exploitation of productive workers*.

Figure 2.11: General Profit Rate and Rate of Surplus Value (1947-2011)

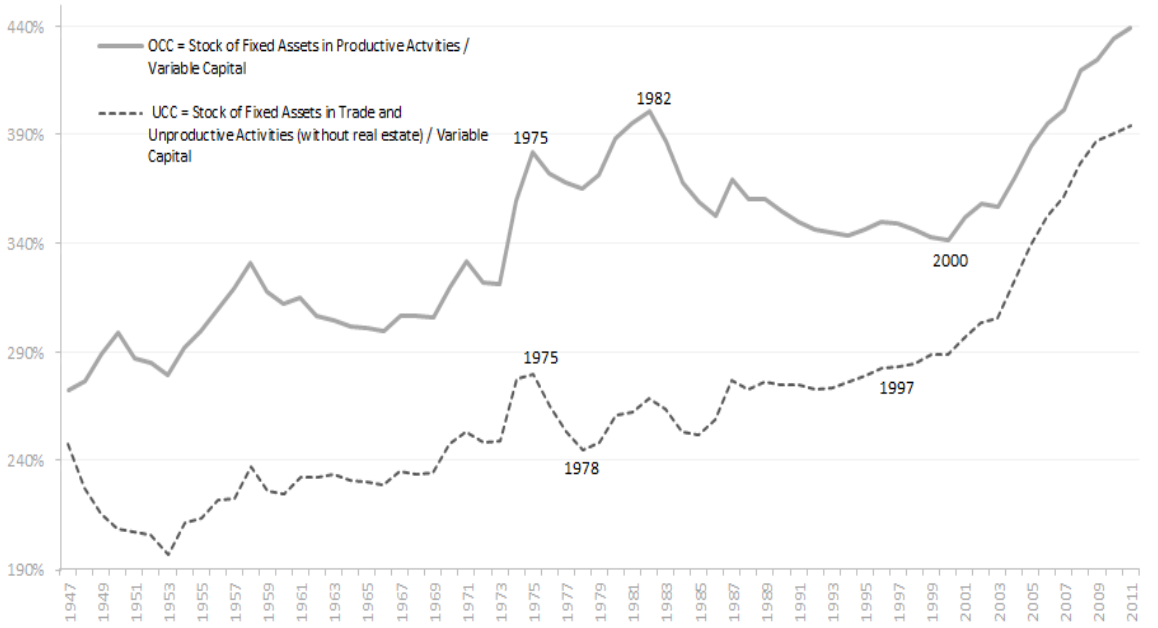


Sources: Author's calculations.
Note: S = surplus value; PA = productive activities; TRL = trade, rental, and leasing; UA = unproductive activities; FA = fixed assets; r = general profit rate.

In order to better understand the role that unproductive activity plays on profitability I further decompose the general profit rate via equation 2.3 as the surplus value relative to the sum of the OCC and UCC: $r = \frac{S}{K} = \frac{S}{K_{PA}+K_{UA}} = \frac{S/V}{K_{PA}/V + K_{UA}/V} = \frac{s}{OCC + UCC}$. The organic composition

of capital (OCC) is the usual Marxist measure of mechanization that considers the technical relationship between productive fixed assets and the productive labor power employed, plus the revaluation effects stemming from changes in the relative prices of fixed assets and labor power. The unproductive composition of capital (UCC) represents the size of unproductive fixed assets (computed as the stocks of fixed assets in trade, rental, leasing, and in all other unproductive activities excluding real estate) relative to the productive labor power employed in productive activities.

Figure 2.12: Organic and Unproductive Compositions of Capital (1947-2011)



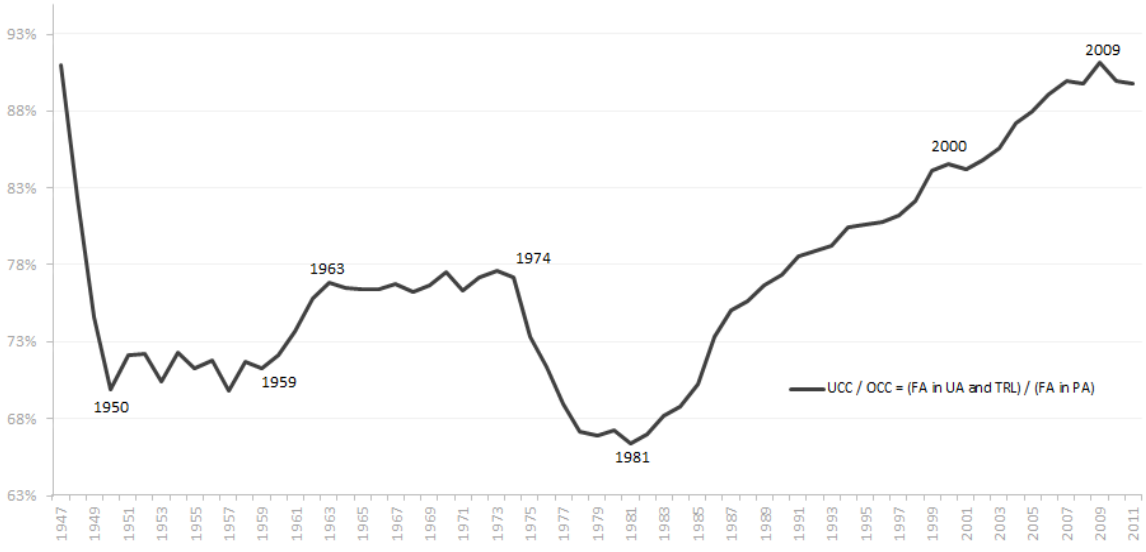
Sources: Author's calculations.
Note: OCC = organic composition of capital; UCC = unproductive composition of capital.

In Figure 2.12 I plot the OCC together with the UCC for the entire 1947-2011 period. Both series rise over time even though with distinct behaviors. The OCC rises substantially from 1947 to a peak in 1982, but falls continuously until 2000. It then sharply recovers to record-high levels after 2000. The UCC rises continuously from 1953 to 1975, but stagnates from 1975 until the mid-1990s. Only by 1997 does the UCC reach its previous 1975 peak level. From 2000 on-

wards the UCC rises systematically to an extent that its annual growth outpaces the growth rate of the OCC. The joint plot in Figure 2.12 reveals that despite the historical rise in the OCC, the UCC has indeed been rising faster and closing the gap between the two series.

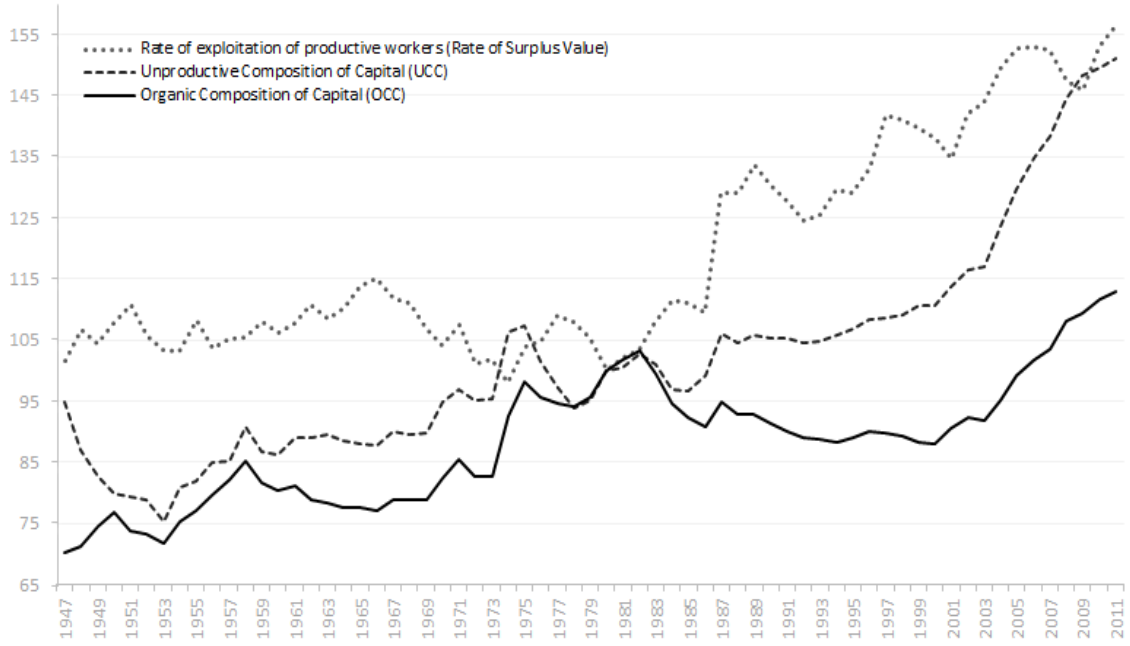
To show how the unproductive composition of capital has been rising faster than the organic composition I plot in Figure 2.13 the ratio of the UCC to the OCC, which is in turn equal to the ratio of the stock of fixed capital in all nonresidential unproductive activities relative to productive activities: $\frac{UCC}{OCC} = \frac{K_{UA}}{K_{PA}}$. The historical pattern is remarkable. During the 1950s the $\frac{UCC}{OCC}$ ratio fluctuates around 70%, and then around 77% from 1963 to 1974. It then drops consistently until its lowest historical level in 1981. Beginning in 1981 the $\frac{UCC}{OCC}$ ratio climbs faster and higher than in any other period. From 1981 to 2009 the ratio of unproductive to organic composition of capital rises 37.5%, a record increase for the postwar era. The trend therefore indicates that the unproductive composition of capital does rise much faster than the organic composition exactly during the post-1980 phase.

Figure 2.13: Ratio of Unproductive to Organic Composition of Capital (1947-2011)



Sources: Author's calculations.
Notes: OCC = organic composition of capital; UCC = unproductive composition of capital; FA = fixed assets; PA = productive activities; TRL = trade, rental, leasing; UA = unproductive activities.

Figure 2.14: Components of Profitability (1947-2011)



Sources: Author's calculations. All measures are cast in index numbers, 1980=100.

A common understanding among several Marxist scholars is that a rising rate of exploitation pulls the profit rate upwards unless counteracted by an also rising organic composition of capital. Kliman (2012; 2007), for example, has focused on the possibility that a rising OCC has driven down the general profit rate in the postwar Unites States economy, especially in the years prior to the 2007 crash. This usual reasoning thus neglects that a rising unproductive composition of capital has a similar effect. The profit rate can fall if the UCC rises fast enough to outweigh the rise in the rate of exploitation.

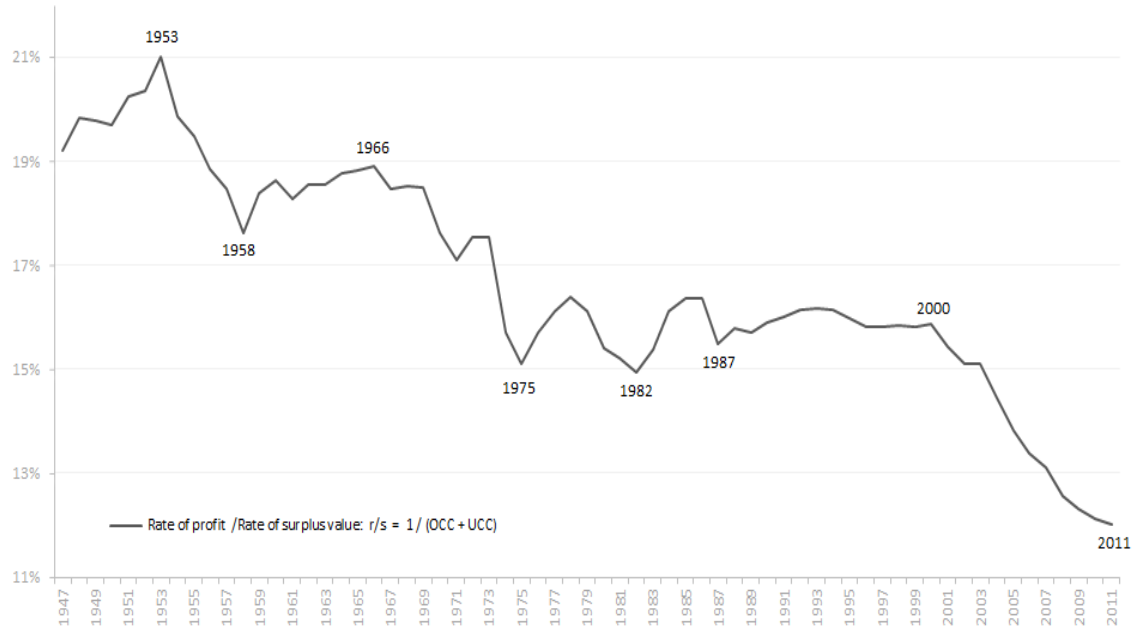
In Figure 2.14 I plot jointly the rate of exploitation of productive workers, the OCC, and the UCC as index numbers (1980=100). Three remarks are in order. First, during the crisis of Keynesianism from 1966 to 1980 the OCC rose substantially while the rate of exploitation fell, a combined effect that can explain the severe drop in profitability during this period. Second, *in the Neoliberal phase beginning in 1980 the UCC increases substantially above the OCC, together*

with a steep rise in the rate of exploitation. Third, while the Regulated 1947-1980 period was characterized by a rising organic composition of capital and a stable rate of exploitation, the Neoliberal 1980-2011 era has been characterized by *increasing levels of both exploitation and unproductive accumulation*.

The ratio of the general profit rate to the rate of surplus value is equal to the inverse of the sum of the organic and unproductive compositions of capital:

$$\frac{r}{s} = \frac{\frac{S}{K_{PA} + K_{UA}}}{\frac{S}{V}} = \frac{V}{K_{PA} + K_{UA}} = \frac{1}{OCC + UCC} \tag{2.4}$$

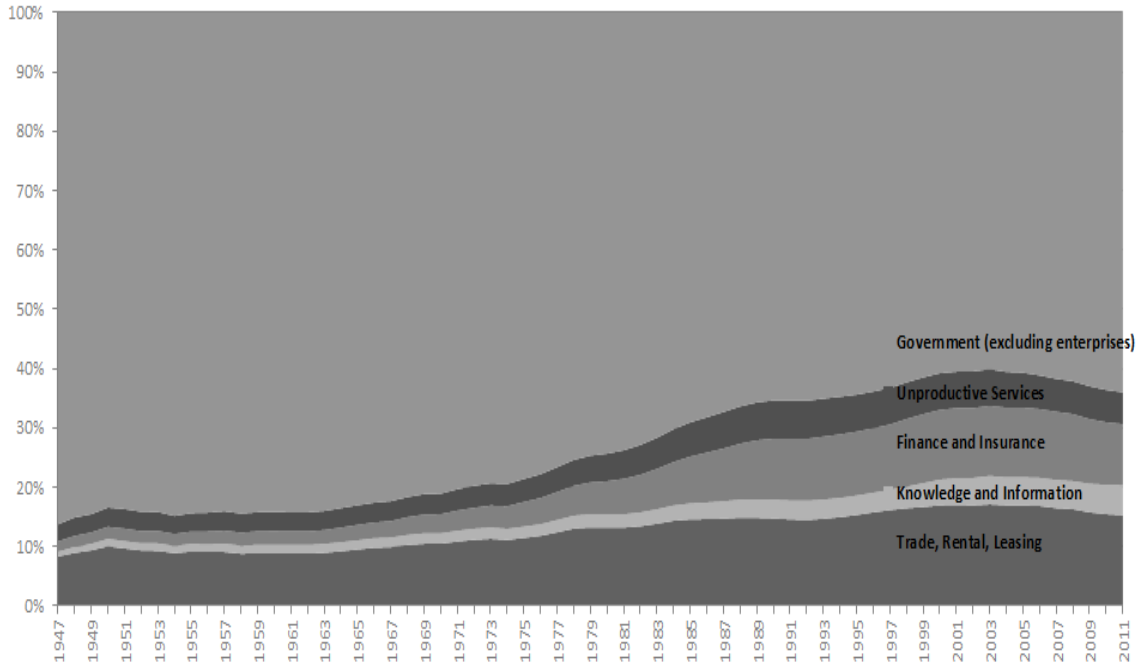
Figure 2.15: Profit Rate – Surplus Value Rate Ratio (1947-2011)



Sources: Author's calculations.
Notes: OCC = organic composition of capital; UCC = unproductive composition of capital; s = rate of surplus value; r = general profit rate.

In Figure 2.15 I then plot the profit rate – surplus value rate ratio from equation 2.4 for the entire postwar period. From its peak at 21% in 1953 the $\frac{r}{s}$ ratio falls to nearly half of that by 2011. The systematic fall in $\frac{r}{s}$ throughout the postwar period is further evidence of how more exploitation of workers in productive activities has failed to engender higher economy-wide profitability for capitalists.

Figure 2.16: Decomposition of the Unproductive Capital Stock (1947-2011)



Sources: Author's calculations.

It is also possible to decompose the current-cost nonresidential net stock of fixed assets of unproductive activities (excluding real estate), trade, rental, and leasing into five sub-categories: (i) trade, rental, and leasing; (ii) knowledge and information; (iii) finance and insurance; (iv) unproductive services; and (v) general government, excluding public enterprises. In Figure 2.16 I present the evolution of the shares of these five sub-categories from 1947 to 2011 in percentage terms. The major share still belongs to the general government (excluding public productive enterprises) even though it has shrunk from 86.2% in 1947 to 64% in 2011. In terms of capital stock

the unproductive activities with the fastest growth rates in shares have been, in descending order: knowledge and information (from 0.8% to 5.0%); finance and insurance (from 1.7% to 10.3%); trade, rental, and leasing (from 8.3% to 15.3%), and finally unproductive services (from 2.9% to 5.4%). Combined, *finance- and knowledge-related activities have grown their capital stocks six fold (or 502%) from 1947 to 2011 as a share of the total unproductive capital stock*.

In Table 2.2 I summarize the real growth rates of key measures of productive and unproductive forms of accumulation. Estimates are broken down into averages for the whole 1948-2011 postwar period, the Regulated period from 1948 to 1979, and the Neoliberal period from 1980 to 2011. I deflate each nominal series of current-cost fixed assets by the producer price index (PPI) and each nominal series of flow measures of income by the implicit GDP deflator to obtain real growth rates in 2005 dollars.

Table 2.2: Average Real Growth Rates (1948-2011)

	Whole period (1948-2011)	**Regulated period** (1948-1979)	**Neoliberal period** (1980-2011)
Productive Activity (PA)			
Total Value of PA	2.66%	3.46%	1.86%
Marxist Value Added of PA	2.89%	3.42%	2.37%
Surplus Value of PA	3.19%	3.50%	2.89%
Capital Stock of PA	3.30%	4.44%	2.16%
Unproductive Activity (UA)			
Gross Income of UA	4.73%	4.61%	4.84%
Net Income of UA	4.55%	4.91%	4.18%
Surplus Income of UA	5.08%	4.85%	5.31%
Capital Stock of UA (nonresidential only)	3.29%	3.47%	3.12%

Sources: Author's calculations. Real growth rates are all in 2005 dollars.
Notes: Real growth rates were obtained by deflating nominal flow measures by the implicit GDP deflator, and nominal stock measures by the producer price index (PPI).

All measures of productive accumulation (total value, Marxist value added, surplus value, and the productive capital stock) exhibit substantial declines in the Neoliberal era compared to the earlier Regulated phase. The real growth rates of total value and of the productive capital stock are cut in half after 1980. The real growth rates of unproductive forms of accumulation, on the contrary, tended to be consistently higher than their productive counterparts for each period under consideration. The gross income and surplus income of unproductive activities, besides growing significantly faster than their productive analogues, also grew faster in the Neoliberal phase than in the Regulated period. The net income of unproductive activities and the unproductive capital stock (including trade, rental, and leasing, and excluding real state) grew mildly slower in the Neoliberal phase but were still way above their productive counterparts during the same period. The growth rates of fixed assets in unproductive activities remained below the growth rates of fixed assets in productive activities prior to 1980, and stayed above after 1980. Finally, it is worth noting that the transition period from an accumulation strategy prioritizing productive activities to a new pattern of accumulation prioritizing unproductive activities occurred between 1975 and 1986.

2.6 Conclusion

In this chapter I developed a new theoretical and empirical framework to analyze unproductive and productive forms of capital accumulation in the postwar United States. A core aspect of my proposed methodology is the classification of knowledge and information production as unproductive activity. To substantiate this procedure I offered theoretical reasons grounded on Marx's labor theory of value, namely that commodified knowledge is a valueless commodity and that knowledge production gives rise to knowledge-rents. Besides the activities usually classified as unproductive, such as trade, finance, insurance, government administration, real estate, and not-for-profit services, I also include as unproductive the production of software, pharmaceuti-

cals, books, journals, recorded music, movies, and data management. Combined, financial gains and knowledge-rents have risen to over 40% of the net income of all unproductive activity in the United States.

My analysis reveals that unproductive accumulation and productive stagnation have been main features of the US economy from 1947 to 2011. In the post-1980 phase these two features were joined by rising levels of exploitation and inequality. The evidence indicates a close association between faster unproductive accumulation, greater exploitation of productive workers, rising overall inequality, and slower productive accumulation. Because of the burden placed on the surplus by greater unproductive activity, average profitability stalled despite rising levels of exploitation.

CHAPTER 3

PRODUCTIVE STAGNATION AND UNPRODUCTIVE ACCUMULATION: AN ECONOMETRIC ANALYSIS

3.1 Introduction

In this chapter I employ econometric techniques to evaluate how productive and unproductive forms of capital accumulation interact in the United States. The objective is to answer two questions: Does unproductive accumulation hinder or foster productive accumulation, in terms of both short- and long-run effects? Conversely, does productive stagnation lead to faster unproductive accumulation? Based on my new methodology to estimate Marxist categories from Chapter 2, I apply time series econometrics to these estimates in order to evaluate the coevolution of capital accumulation in its productive and unproductive dimensions from 1947 to 2011. I provide a formal econometric assessment of a question that other scholars have considered mostly through verbal or descriptive approaches.

Despite directly consuming the surplus from productive endeavors, unproductive accumulation can well enhance labor productivity in productive activities, and therefore indirectly improve the creation of surplus value. There is, hence, a double effect under consideration: un-

productive activity might *indirectly* increase labor productivity and boost productive accumulation while it draws on the surplus value that it does not *directly* produce. My econometric approach shows that the indirect boost to productive accumulation is greater than the direct draw on the surplus, implying that unproductive accumulation tends to have a *net positive impact* on productive accumulation.

To formally check for significant co-movements between the estimates of productive and unproductive accumulation I use cointegration analysis, vector auto-regressions (VAR), Granger and instantaneous causality tests, impulse-response functions, and forecast error variance decompositions. Cointegration analysis answers questions about the *long-run behavior* of the variables while the VAR methodology answers questions about the *short run*. In a VAR framework it is possible to treat every variable as endogenous while estimating dynamic interactions within the system. The VAR is therefore the most appropriate econometric methodology to assess co-movements between multiple endogenous variables over time. The Granger and instantaneous causality tests can address the question of how significantly previous and current realizations of the variables affect one another. Impulse response functions and forecast error decompositions then display the estimated coevolution patterns.

Specifically, I find evidence of an *absolute crowding-in effect* (or positive level effect) coupled with a *relative crowding-out effect* (or a negative share effect). When the unproductive capital stock grows, it has a *positive* impact on the growth of the total flow of productive value. However, when the unproductive capital stock grows faster than the productive capital stock, it then has a *negative* impact on the growth of the total flow of productive value. In addition, productive and unproductive forms of accumulation share no common trend over the long run. There is, hence, no self-correcting mechanism that brings these two forms of capital accumulation back into a stable long-run equilibrium.

My econometric approach confronts at least two strands of the heterodox tradition concerned with capital accumulation. First, it confronts the tradition that has focused on the one-way causality running from unproductive accumulation to productive stagnation. Second, it confronts the opposite tradition that has focused on the reverse one-way causality that runs from productive stagnation to unproductive accumulation. My findings reveal instead a *two-way reinforcing relationship* between productive and unproductive forms of accumulation in the postwar United States economy.

A key difference between the approach developed in this chapter compared to previous publications is the treatment of knowledge and information production as unproductive activity. With this insight on the labor theory of value I can provide new econometric evidence on the interactions between productive and unproductive forms of accumulation in the United States economy.

3.2 Comparison with other Studies

The study of unproductive activity in the United States and its impact on productive capital accumulation dates back at the least to the 1960s. One of the first theoretical and empirical works on this theme was that of Baran and Sweezy (1966). In *Monopoly Capital* they laid out an interesting theory on the dynamic relationship between productive and unproductive activities in the monopolist phase of advanced capitalism. Their assessment begins with Marx's claim that competition undermines itself by creating the seeds for the increasing centralization and concentration of capital. Increasing returns to scale pave the way to larger firm sizes, while bankruptcies leave fewer of them in the market.

Baran and Sweezy argue that the drive to innovate and cut costs remains strong in monopoly capitalism, while the dynamics of price leadership prohibit price cuts and result instead in prices that rise over time. Falling costs and rising prices lead to the surplus rising relative to out-

put at full employment but the uses of surplus do not rise relative to output at full employment. Hence, there would be a shortage of demand at full employment, and the total output sinks to a level at which the reduced surplus can be realized. Monopoly capitalism would thus be plagued by systemic stagnation. In the monopolist stage the form of competition begins to mutate to demand management. The source of trouble to the individual firm shifts from production to circulation, and firms devote more of their resources to selling and marketing activities.

Baran and Sweezy's theory implies that monopoly capitalism is characterized by major incentives to shift resources from productive to unproductive activities. More interestingly, they located the cause of the rise in unproductive activity in the realization problem. Monopoly capitalism leads to greater unproductive accumulation as firms invest more in selling and marketing. Their contribution to Marxist theory thus has a Keynesian effective demand argument attached to it.

Baran and Sweezy, however, never presented any econometric treatment of their assertions. My procedure therefore offers a more formal corroboration of their verbal and descriptive approach. A first 'Baran-Sweezy hypothesis' can be posited as follows: In the monopolist phase of advanced capitalism there is a positive correlation between productive and unproductive forms of accumulation, since the expansion of unproductive activities aid in realizing the surplus. My empirical findings support this first Baran-Sweezy hypothesis. I find evidence that productive accumulation is positively associated with unproductive accumulation both in terms of contemporaneous and lagged effects.

Additionally, a second 'Baran-Sweezy hypothesis' can be posited as follows: In the monopolist phase of advanced capitalism there is a causal relationship running from productive stagnation to faster unproductive accumulation. More recently, David Harvey (2003; 2006) and James Crotty (2003) have also suggested that North-American capitalists first had to experience a slow-

down in productive accumulation and profitability to then begin shifting their investments towards unproductive activities. The empirical evidence of this chapter supports this hypothesis but does so when the *share* (not just the level) of the unproductive capital stock rises. Stagnation in the total value produced by productive activities occurs only when both the share and the level of the unproductive stock increase.

Even though Baran and Sweezy's hypotheses are consistent with my empirical findings, their theory rests on a specific institutional form of capitalism predicated on oligopolies with corespective pricing that applies to the 1947-1979 Regulated phase of US capitalism but not to the Neoliberal era. Thus, rising unproductive accumulation after 1980 occurred in tandem with the disappearance of the form of capitalism from which Baran and Sweezy derived their theory.

In 1977 Edward Wolff published his book-length contribution on the linkages between growth and unproductive activities in the postwar US economy. In *Growth, Accumulation, and Unproductive Activity* he developed his own methodology to estimate Marxist categories from official input-output matrices and concluded that new insights could be derived from the recognition that several profitable activities do not produce any surplus but rather draw on it. His empirical study showed that the gross output of unproductive sectors grew at an annual rate of 4.1% over the 1947-1976 period, compared to 3.5% for productive gross output. For the same period he found that unproductive net output grew at 3.8% per year while productive net output grew at 2.9%. He also pointed to the existence of a negative correlation between growth in unproductive output and growth in productive output (Ed Wolff 1977, p.165-174).

Despite its great contribution, Edward Wolff's (1977) approach mistakenly assumes that unproductive accumulation is pure waste with no positive effects on productive accumulation. The key problem, according to his approach, is that unproductive activity is detrimental to capitalism itself since it reduces the amount of surplus available for productive accumulation. Unpro-

ductive accumulation therefore diminishes the rate of productive expansion and consequently threatens the reproduction of the entire system.

The econometric results that I present partially contradict Edward Wolff's claims. I show that there are in fact positive contemporaneous and lagged effects between productive and unproductive accumulation. Even more, according to Ed Wolff's assessment, unproductive accumulation has a simple one-way causal relationship with productive accumulation. According to his analysis productive accumulation plays no role in explaining unproductive accumulation. My estimates, on the contrary, suggest that unproductive accumulation is itself caused by productive activity.

In 1994 Anwar Shaikh and Ahmet Tonak published their book-length analysis *Measuring the Wealth of Nations*, a major contribution to the theoretical and empirical investigation of unproductive accumulation in the United States economy. In this impressive book they developed a broader and better methodology to estimate Marxist measures from standard income and output data, while also incorporating insights from previous studies. Their contribution is certainly a major addition to the heterodox literature. The approach that I develop builds on and extends their work.

Shaikh and Tonak (1994, p.211) note that political economists are divided in regard to the effects of unproductive expenditures. Malthus and some of his modern followers understand that unproductive expenditures are a saving grace, for they generate demand and employment without generating supply. Unproductive expenditures can pump up a system suffering from a chronic lack of effective demand. Ricardo and his modern followers, on the contrary, argue that increases in unproductive expenditures diminish the share of the surplus available for productive investment, and hence decrease the growth rate of productive capital.

Shaikh and Tonak (1994, p.18-19 and p.212) then claim that in Marxist theory the interaction between unproductive activities and productive expansion is more nuanced. In a dynamic setting a rise in unproductive expenditures may indeed stimulate effective demand and productive output in the short run (as Malthus claimed), but in so far as it diminishes the share of surplus value that stays within productive activities it reduces the rate of productive accumulation (as Ricardo claimed). The long-term negative effects of unproductive accumulation on the growth rate of productive output, they claim, outweigh any short-run positive level effects.

My approach puts Shaikh and Tonak's arguments under scrutiny. Even though their work is certainly the best undertaking in measuring Marxist categories, their assessment of the dynamic relationship between productive and unproductive forms of accumulation remains verbal and descriptive. My econometric results illuminate some patterns in the postwar US economy that they did not identify, in some cases contradicting their conclusions.

First, I find no stable long-run relationship between productive and unproductive forms of accumulation. In total, I test 100 cointegration models employing several different proxies and find no evidence of any significant cointegrating vector. The absence of cointegration implies the absence of a stable long-run equilibrium relationship between productive and unproductive forms of accumulation. In this case it is not possible to maintain Shaikh and Tonak's claim that the long-term negative effects of unproductive accumulation on the growth rate of productive output tend to outweigh short-run positive level effects. To the best of my knowledge, I have conducted the most comprehensive cointegration tests on the interactions between productive and unproductive forms of capital accumulation. The econometric evidence cannot support any claim on long-run effects.

Second, even though there is evidence of positive short-run feedback between levels of productive and unproductive forms of accumulation, there is also evidence of negative short-run feedback between the flow of productive value added and the share of unproductive capital stock.

Third, my findings point to a case of reverse causality that Shaikh and Tonak, similarly to Edward Wolff, did not contemplate. In their work they only mention the causal link that runs from unproductive accumulation to productive stagnation. In accordance with Sweezy, Baran, Harvey, and Crotty, my econometric results point to a complementary reverse causation running from slower growth in productive value added to faster growth in the share of the unproductive capital stock.

3.3 Addressing Causality with Time Series Econometrics

To estimate the empirical interactions between the accumulation of productive and unproductive forms of capital I employ bivariate vector auto-regression (VAR) models. The VAR is a time series methodology suitable for investigating the interactions among a group of time series variables. Unlike a single equation regression model, in which the dependent variable is by assumption endogenous and some of the independent variables are exogenous, a VAR model treats multiple variables as jointly endogenous and allows for complex lagged effects. Every endogenous variable is explained by contemporaneous and past values of other endogenous variables in the system. The structural-form VAR(p) model with *p* lags for *k* endogenous variables is:

$$Bx_t = \sum_{i=1}^{p} B_i x_{t-i} + B_0 d_t + \varepsilon_t \qquad (3.1)$$

where x_t is the (*k* x 1) vector of *k* endogenous variables, *B* is the (*k* x *k*) matrix containing the coefficients for the contemporaneous interactions between the endogenous variables, B_i are the (*p* x

k) matrices containing the coefficients for the lagged interactions, B_0 is the coefficient matrix of potentially deterministic regressors, d_t the (k x 1) vector holding the appropriate deterministic regressors, and ε_t the (k x 1) vector of structural errors. Though the elements of ε_t must be uncorrelated white noise, there may be systematic variations caused by contemporaneous feedback across endogenous variables, which would appear as non-zero non-diagonal elements of matrix B. In this case, structural shocks to one endogenous variable have immediate effects on the other endogenous variables.

Table 3.1: Description of Available Variables

Proxies for Productive Accumulation		
Real TV	Real Total Value produced in productive activities, in 2005 dollars	flows
Real MVA	Real Marxist Value Added produced in productive activities, in 2005 dollars	flows
Real K_{PA}	Real stock of fixed capital in productive activities, in 2005 dollars	stocks
K_{PA} / K_{UA}	Stock of fixed capital in productive activities relative to the stock of fixed capital in unproductive activities	stocks
Proxies for Unproductive Accumulation		
Real GI_{UA}	Real Gross Income of unproductive activities, in 2005 dollars	flows
Real NI_{UA}	Real Net Income of unproductive activities, in 2005 dollars	flows
Real K_{UA}	Real stock of fixed capital in unproductive activities, in 2005 dollars	stocks
K_{UA} / K_{PA}	Stock of fixed capital in unproductive activities relative to the stock of fixed capital in productive activities	stocks
NUB	Net Unproductive Burden, which is the ratio of Net Income of unproductive activities to the Surplus Value created in productive activities	flows
GUB	Gross Unproductive Burden, which is the ratio of Gross Income of unproductive activities to the Total Value produced in productive activities	flows
UCC	Unproductive Composition of Capital, which is the ratio of the stock of fixed capital in unproductive activities to the value of labor power employed in productive activities (or variable capital)	stock over flow

Available variables that could serve as proxies for productive and unproductive forms of accumulation are summarized in Table 3.1, all of which I have estimated using the procedures outlined in Chapter 2 and in the Appendix.

Since accumulation can be analyzed from a flow or from a stock perspective I estimate different two-variable VAR models with different proxies for the accumulation of capital. In each model the first endogenous variable is a proxy for unproductive accumulation while the second endogenous variable is a proxy for productive accumulation.

3.3.1 Nonstationarity and De-Trending

Prior to estimating the VAR models it is necessary to check for the presence of nonstationary variables. Nonstationarity can invalidate coefficient estimates and Granger causality tests. The Granger causality test statistic does not have the usual asymptotic distribution if some of the variables are nonstationary.

To formally check for nonstationarity I perform unit root tests on the levels of all available variables described in Table 3.1. I perform Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests and compile the calculated test statistics in Tables 3.2 and 3.3. I employ the Bayesian information criterion (BIC) to determine the optimal lag length in the ADF tests, noting that the Akaike information criterion (AIC) gives the exact same results. While the ADF procedure uses parametric autoregressive lags to correct for serial correlation in the residuals, the Phillips and Perron (1988) procedure checks for unit roots by implementing a nonparametric correction for serial correlation and heteroskedasticity in the regression residuals. The PP procedure employs the Newey-West heteroskedasticity- and autocorrelation-consistent covariance matrix estimator. The ADF and PP tests are asymptotically equivalent but the PP performs better with smaller samples. Since both the ADF and PP tests are estimated under the null hypothesis of nonstationarity, I also crosscheck the results by employing KPSS tests under the opposite null hypothesis of stationarity.

Table 3.2: Unit Root Tests

	Real TV	Real MVA	Real GI_{UA}	Real NI_{UA}	K_{UA} / K_{PA}
Augmented Dickey-Fuller: Ho = series has a unit root (nonstationarity)					
Optimal lag length	1 lag	1 lag	1 lag	1 lag	1 lag
No drift, no trend: τ	3.30(**)	3.61(**)	3.88(**)	3.90(**)	0.64
Drift, no trend: τ_μ	0.39	0.93	2.38	2.21	-1.07
Drift, no trend: ϕ_1	6.48(*)	7.47(**)	8.57(**)	9.31(**)	0.84
Drift and trend: τ_τ	-2.76	-2.07	-0.65	-1.10	-2.29
Drift and trend: ϕ_2	7.56(**)	7.14(**)	7.27(**)	8.01(**)	2.18
Drift and trend: ϕ_3	4.16	3.16	4.89	4.76	2.99
Phillips-Perron: Ho = series has a unit root (nonstationarity)					
Optimal lag length	1 lag	1 lag	1 lag	1 lag	1 lag
Drift, no trend: Z_α	0.33	0.66	1.77	1.43	-8.89(.)
Drift, no trend: Z_τ	0.55	1.17	3.03(*)	2.83(.)	-2.14
Drift and trend: Z_α	-9.25	-5.04	-0.87	-1.56	-18.69(.)
Drift and trend: Z_τ	-2.35	-1.87	-0.61	-1.09	-4.13(**)
KPSS: Ho = series does not have a unit root (stationarity)					
Lag length	3 lags	3 lags	3 lags	3 lags	3 lags
Drift, no trend	1.69(**)	1.66(**)	1.51(**)	1.57(**)	0.82(**)
Drift and trend	0.32(**)	0.38(**)	0.40(**)	0.41(**)	0.30(**)
Total observations	65	65	65	65	65
Conclusion	I(1)	I(1)	I(1)	I(1)	I(1)

Notes: ADF implemented with the number of lags chosen with the Bayesian Information Criterion (BIC). Null hypothesis for the ADF and PP t-tests is of nonstationarity. Critical values from Hamilton (1994, Appendix B). Null can be rejected at the following significance levels: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Results are consistent across different methods and suggest that all variables in Table 3.1 are not stationary. It is not possible to reject the null hypothesis of nonstationarity for any of the series using the ADF and PP models. Consistently, it is also possible to reject the null hypothesis of stationarity for all series using the KPSS procedure. Since it is not recommended to estimate VAR models with nonstationary variables, I address the unit root problem by instead using real growth rates of the variables listed in Table 3.1. As expected, a consequence of working with stationary growth rates upon de-trending nonstationary series is the loss of substantial information.

Table 3.3: Unit Root Tests (continued)

	NUB	GUB	UCC	Real K_{UA}	Real K_{PA}
Augmented Dickey-Fuller: Ho = series has a unit root (nonstationarity)					
Optimal lag length	1 lag	1 lag	1 lag	1 lag	1 lag
No drift, no trend: τ	1.84(.)	2.90(**)	2.12(*)	3.99(**)	3.85(**)
Drift, no trend: τ_μ	-0.98	0.65	1.07	1.32	0.44
Drift, no trend: ϕ_1	2.85	4.35 (.)	2.52	9.60(**)	11.31(**)
Drift and trend: τ_τ	-3.09	-1.29	-1.10	-1.66	-2.20
Drift and trend: ϕ_2	5.00(*)	3.90	2.84	8.26(**)	9.83(**)
Drift and trend: ϕ_3	4.82	1.60	2.23	3.16	2.73
Phillips-Perron: Ho = series has a unit root (nonstationarity)					
Optimal lag length	1 lag	1 lag	1 lag	1 lag	1 lag
Drift, no trend: Z_α	-1.08	1.04	2.97	0.84	0.25
Drift, no trend: Z_τ	-0.71	1.14	1.78	1.42	0.53
Drift and trend: Z_α	-21.28(*)	-3.53	-5.87	-4.2	-7.46
Drift and trend: Z_τ	-3.43(.)	-1.35	-1.56	-1.87	-2.30
KPSS: Ho = series does not have a unit root (stationarity)					
Lag length	3 lags	3 lags	3 lags	3 lags	3 lags
Drift, no trend	1.61(**)	1.52(**)	1.41(**)	1.61(**)	1.68(**)
Drift and trend	0.10	0.36(**)	0.23(**)	0.38(**)	0.32(**)
Total observations	65	65	65	65	65
Conclusion	I(1)	I(1)	I(1)	I(1)	I(1)

Notes: ADF implemented with the number of lags chosen with the Bayesian Information Criterion (BIC). Null hypothesis for the ADF and PP t-tests is of nonstationarity. Critical values from Hamilton (1994, Appendix B). Null can be rejected at the following significance levels: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

3.3.2 The Long Run: Cointegration Analysis

When variables are not stationary it becomes necessary to check if they are cointegrated before estimating a VAR model. Cointegration means that variables share a common trend. If variables are cointegrated it is then required to include their long-run relationships in the VAR model, meaning that we should in fact estimate a Vector Error Correction Model (VECM). The VECM includes both the cointegrating long-run relationship and also lags of the endogenous variables as regressors. If variables are cointegrated we must include the error correction vector as a regressor since failing to do so implies a misspecification error. When variables are not cointegrated we can simply estimate the system using a VAR model without the error correction term as

in equation 3.4. To test for cointegration between pairs of nonstationary variables I employ both the Engle-Granger and Johansen methodologies.

The first step in the Engle-Granger procedure is to estimate the equilibrium relationship between endogenous variables using ordinary least squares. If the estimated residuals from this long-run relationship are stationary it is possible to conclude that there is a cointegration vector between variables. The second step, in case of cointegration, is to include the stationary residuals from the long-run equilibrium equation as the error correction term in the VAR.

Table 3.4: Cointegration Tests — Engle-Granger Methodology

	Right-hand-side Variables						
Left-hand-side Variables	GUB	NUB	UCC	Real GI_{UA}	Real NI_{UA}	Real K_{UA}	K_{UA} / K_{PA}
Real TV	t = -2.58	t = -3.18	t = -2.27	t = -1.66	t = -1.72	t = -2.68	t = -2.08
Real MVA	t = -2.82	t = -2.97	t = -2.24	t = -1.55	t = -1.79	t = -3.39(.)	t = -2.13
Real K_{PA}	t = -1.55	t = -2.84	t = -1.81	t = -0.87	t = -1.15	t = -1.27	
K_{PA} / K_{UA}	t = -3.44(.)	t = -2.72	t = -2.60	t = -3.11	t = -2.99		
Total obs.	65	65	65	65	65	65	65

Notes: Main entries indicate the estimated t-stats for the ADF test on the residuals from the long-run relationship using pairs of endogenous variables. Regression results are over the entire postwar period (1947-2011). ADF implemented with the optimal number of lags chosen with the Bayesian Information Criterion (BIC). Null hypothesis for the ADF t-tests (with no intercept or trend) on the estimated residuals is of nonstationarity. Null hypothesis can be rejected at the following significance levels: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1. Critical values are taken from Hamilton (1994, Table B7) and Enders (2010, Table C).

In Table 3.4 I summarize the results from 25 bivariate regressions, in which one endogenous variable is a proxy for productive accumulation while the second endogenous variable is a proxy for unproductive accumulation. In no case is there strong evidence of cointegration. The main entries on the table indicate the t-statistics from Augmented Dickey Fuller (ADF) tests without intercept or trend on the residuals from the long-run equilibrium relationship. Since the residuals being tested for nonstationarity derive from a regression, we cannot use the usual ADF

critical values. In this case the appropriate critical values are taken from Hamilton (1994, Table B7) and Enders (2010, Table C). The results indicate that for any of the 25 cases examined it is not possible to reject the null hypothesis of unit-root in the residuals either at the 5% or 1% significance levels. None of the pairs of nonstationary variables suggest the existence of a strong cointegrating relationship.

To further investigate if the pairs of nonstationary variables share a common trend I also perform cointegration tests using the Johansen methodology. The Johansen procedure avoids the two-step estimation present in the Engle-Granger methodology by implementing a multivariate generalization of the ADF test. The Johansen procedure is also more general and allows us to include deterministic elements inside and outside of the cointegration space. The one-step methodology consists of computing a Vector Error Correction model (VECM) of the form:

$$\Delta x_t = \Gamma_1 \Delta x_{t-1} + \cdots + \Gamma_{p-1} \Delta x_{t-p+1} + \Pi x_{t-p} + B_0 d_t + \varepsilon_t \qquad (3.2)$$

in which $\Gamma_i = -(I - B_1 - \cdots - B_i)$ with $i = 1, \ldots, p-1$; and $\Pi = -\left(\mathrm{I} - B_1 - \cdots - B_p\right)$, and the B_i matrices are from the VAR(p) model in equation 3.1. The Γ_i matrices therefore contain the cumulative long-run impacts. It is also possible to decompose Π as the product of the speed of adjustment coefficients (α) times the cointegration space (β): $\Pi = \alpha\beta'$, in which vector β can be augmented so as to include an intercept and a linear trend. Vector B_0 can also be modified so as include deterministic elements outside of the cointegration space.

In Table 3.5 I summarize the results for the 25 cases as in Table 3.4 but now employing Johansen's methodology. Since it is possible to include different deterministic elements the total number of estimated regression models becomes 75. The first column indicates the two endogenous variables used (x_t); the second column indicates the deterministic elements inside of the cointegration space; the third column indicates the deterministic element in the regression but

outside of the cointegration space ($B_0 d_t$); the fourth column indicates the number of lags used (p). Lag lengths were chosen so as to remove serial correlation from the estimated residuals. The fifth and sixth columns show the estimated λ_{max} and λ_{trace} test-statistics, together with their levels of significance under the null hypothesis that there are zero cointegration vectors ($r = 0$). Column seven finally concludes with the estimated rank of the Π matrix, which indicates the number of cointegrating vectors. Regression results are for the entire postwar period (1947-2011).

In none of the 75 regressions using the Johansen procedure was it possible to find evidence of cointegration, a result that confirms the conclusions drawn previously from the 25 regressions using the Engle-Granger methodology. In total, in none of the 100 cases analyzed is there evidence of a shared common trend between productive and unproductive forms of accumulation.

Table 3.5: Cointegration Tests — Johansen Methodology

Endogenous Variables	Deterministic element in the cointegration space	Deterministic element in the regression	Lags	λ_{max} (r = 0)	λ_{trace} (r = 0)	rank(Π)
Real TV and Real GI_{UA}	none	trend	9	6.21	6.74	0
	constant	none	9	13.91(.)	17.99	1(d)
	trend	none	9	15.49	18.22	0
Real TV and Real NI_{UA}	none	trend	9	6.62	7.25	0
	constant	none	9	11.32	15.37	0
	trend	none	9	14.01	18.71	0
Real TV and GUB	none	trend	any	-	-	0
	constant	none	any	-	-	0
	trend	none	any	-	-	0
Real TV and NUB	none	trend	any	-	-	0
	constant	none	any	-	-	0
	trend	none	any	-	-	0
Real TV and UCC	none	trend	4	7.77	7.80	0
	constant	none	9	12.06	15.17	0
	trend	none	9	13.85	20.85	0
Real TV and Real K_{UA}	none	trend	4	5.17	5.48	0
	constant	none	4	10.22	14.40	0

	trend	none	4	9.98	14.70	0
Real TV and K_{UA} / K_{PA}	none	trend	any	-	-	0
	constant	none	any	-	-	0
	trend	none	any	-	-	0
Real MVA and Real GI_{UA}	none	trend	9	12.72	13.38	0
	constant	none	9	22.04(**)	26.30(**)	1(a)
	trend	none	9	21.44(*)	29.55 (**)	1(a)
Real MVA and Real NI_{UA}	none	trend	12	10.74	11.85	0
	constant	none	12	12.86	19.06(.)	1(b)
	trend	none	12	11.16	21.12	0
Real MVA and GUB	none	trend	10	4.52	7.60	0
	constant	none	10	9.24	12.48	0
	trend	none	any	-	-	0
Real MVA and NUB	none	trend	3	12.21	12.80	0
	constant	none	6	8.77	15.01	0
	trend	none	8	12.54	19.62	0
Real MVA and UCC	none	trend	3	10.32	10.33	0
	constant	none	3	21.79(**)	24.47(*)	1(a)
	trend	none	3	10.33	16.01	0
Real MVA and Real K_{UA}	none	trend	3	10.42	10.51	0
	constant	none	3	13.94 (.)	18.65 (.)	1(c)
	trend	none	3	12.80	17.51	0
Real MVA and K_{UA} / K_{PA}	none	trend	3	4.00	4.87	0
	constant	none	7	11.52	15.52	0
	trend	none	7	-	-	0
Real K_{PA} and GUB	none	trend	any	-	-	0
	constant	none	any	-	-	0
	trend	none	any	-	-	0
Real K_{PA} and NUB	none	trend	any	-	-	0
	constant	none	any	-	-	0
	trend	none	any	-	-	0
Real K_{PA} and UCC	none	trend	3	20.44(**)	21.37(*)	1(a)
	constant	none	4	17.71(*)	20.43(*)	1(c)
	trend	none	4	11.99	21.6	0
Real K_{PA} and Real GI_{UA}	none	trend	8	7.20	7.28	0
	constant	none	any	-	-	0
	trend	none	8	14.13	20.97	0
Real K_{PA} and Real NI_{UA}	none	trend	10	14.47(.)	16.71(.)	1(b)
	constant	none	10	26.59(**)	30.12 (**)	1(d)
	trend	none	10	16.29	27.05 (*)	1(d)
Real K_{PA} and Real K_{UA}	none	trend	10	7.03	7.18	0
	constant	none	10	8.86	13.85	0
	trend	none	10	15.88	22.90(.)	0
K_{PA} / K_{UA} and GUB	none	trend	3	5.35	5.83	0
	constant	none	4	10.25	13.55	0
	trend	none	4	7.49	9.13	0

K_{PA} / K_{UA} and NUB	none	trend	3	3.83	4.71	0
	constant	none	6	13.42	18.39(.)	0
	trend	none	6	11.63	19.41	0
K_{PA} / K_{UA} and UCC	none	trend	4	5.67	7.68	0
	constant	none	6	9.99	14.00	0
	trend	none	6	10.73	15.48	0
K_{PA} / K_{UA} and Real GI_{UA}	none	trend	11	11.58	16.19(.)	0
	constant	none	11	14.67(.)	19.29(.)	1(c)
	trend	none	11	20.13 (*)	27.83 (*)	1(d)
K_{PA} / K_{UA} and Real NI_{UA}	none	trend	10	10.81	12.33	0
	constant	none	10	11.23	14.28	0
	trend	none	10	23.24 (*)	32.56 (**)	1(b)

Notes: Regression results are for the entire postwar period (1947-2011). Lag lengths chosen so as to remove serial correlation from the estimated residuals. A dash (-) indicates that the system is computationally singular and that Π is either rank-deficient or indefinite. Critical values are taken from Osterwald-Lenum (1992). Null hypotheses can be rejected at the following significance levels: 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1. (a) Residuals are not normal; (b) Residuals are not normal and are still serially correlated; (c) Residuals are not normal and are heteroskedastic; (d) Residuals are not normal, still serially correlated, and heteroskedastic.

The cointegration analysis therefore indicates that *productive and unproductive forms of accumulation in the postwar United States do not have a stable long-run relationship*. This result is consistent with the idea that unproductive accumulation occurs systematically at a faster pace than productive accumulation. This finding is also consistent with the idea that *there is no self-correcting mechanism that would bring these two forms of accumulation back into a stable long-run equilibrium*. If unproductive accumulation has been systematically faster than productive accumulation, as made evident through the nonstationarity of the NUB, GUB, UCC, and K_{UA} / K_{PA} measures, it is then expected that *no self-correcting mechanism exists over the long run*. The lack of cointegration and of a common trend formally supports this expectation.

3.3.3 The Short Run: Two-Variable VAR Models

It is unfortunately not possible to directly estimate the structural VAR model in 3.4 since the strucural shocks ε_t are not readily identified. The solution to this identification problem is to first estimate the VAR model in its reduced form and then use a Cholesky decomposition on the

estimated residuals in order to recover the structural error terms. The Cholesky decomposition offers a way to make the estimated residuals orthogonal (independent) to each other, thus allowing for the identification of the independent shocks that directly affect the endogenous variables. Multiplying both sides of the structural-form VAR(p) model in 3.4 by B^{-1} leads to the reduced-form VAR(p) model with *p* lags for *k* endogenous variables in 3.3:

$$x_t = \sum_{i=1}^{p} A_i x_{t-i} + A_0 d_t + e_t \tag{3.3}$$

where A_i is the (p x k) coefficient matrix on the lagged endogenous variables x_{t-i}, A_0 is the coefficient matrix of potentially deterministic regressors, and e_t the (k x 1) estimated residual vector with time invariant positive definite covariance matrix $\sum_e = E[e_t e_t']$.

I estimate three models in reduced forms using different endogenous variables as proxies for unproductive and productive forms of capital accumulation. In Table 3.6 I summarize the regression results for the two-variable VARs. For each model, endogenous variable 1 is a proxy for unproductive accumulation while endogenous variable 2 is a proxy for productive accumulation. VAR Model 1 employs as endogenous variables the growth rate of the K_{UA} / K_{PA} ratio and the real growth rate of Total Value (TV). VAR Model 2 employs as endogenous variables the real growth rate of K_{UA} and the real growth rate of Marxist Value Added (MVA). VAR Model 3 employs as endogenous variables the real growth rate of K_{UA} and the real growth rate of Total Value (TV). The reason for using these specific variables and not others is that these are the only cases in which the residuals are well behaved. I estimated several VARs using every possible combination of variables, but unfortunately in most cases the residuals are not normally distributed or present problems of heteroskedasticity and serial correlation.

Table 3.6: Estimated Reduced-Form VAR Models

	Whole period (1948-2011)	Regulated period (1948-1979)	Neoliberal period (1980-2011)
Reduced-form VAR Model 1			
Endogenous variable 1: *Growth rate of* $\frac{K_{UA}}{K_{PA}}$	0.00	0.34	0.00
Endogenous variable 2: *Real* $\widehat{TV}$	0.01	0.02	0.00
Deterministic regressors	constant	none	none
Optimal lag length (using AIC)	2	3	1
Residual correlation coefficient	-0.31	-0.50	-0.08
Reduced-form VAR Model 2			
Endogenous variable 1: *Real* $\widehat{K_{UA}}$	0.00	0.00	0.00
Endogenous variable 2: *Real* $\widehat{MVA}$	0.00	0.02	0.00
Deterministic regressors	none	none	none
Optimal lag length (using AIC)	2	2	2
Residual correlation coefficient	+0.13	+0.33	+0.09
Reduced-form VAR Model 3			
Endogenous variable 1: *Real* $\widehat{K_{UA}}$	0.00	0.00	0.00
Endogenous variable 2: *Real* $\widehat{TV}$	0.00	0.02	0.00
Deterministic regressors	none	none	none
Optimal lag length (using AIC)	3	3	2
Residual correlation coefficient	-0.01	+0.14	+0.01

Notes: Each estimated VAR model in reduced form has two endogenous variables and no exogenous variables. For each regression equation I report the p-values from the joint F-tests that the estimated coefficients equal zero. Optimal lag length chosen through the Akaike Information Criterion (AIC). Carets (^) indicate growth rates.

In Table 3.6 I also report the VAR results for three different time periods: the whole postwar period (1948-2011); the regulated period only (1948-1979); and the Neoliberal period only (1980-2011). I use the Akaike information criterion (AIC) to determine the optimal lag length *p* and incorporate a determinist regressor when appropriate. For each equation I report the p-values from the joint F-tests on the estimated regression coefficients; p-values lower than 0.10 indicate that the regression coefficients are jointly meaningful at standard significance levels. Lastly, for each model I report the residual correlation coefficient.

The first result is the presence of negative residual correlation coefficients for the first model and of positive residual coefficients for the second and third models. In a reduced-form

VAR the estimated residual correlation indicates the correlation of contemporaneous movements in the endogenous variables. The results imply that the total value and the value added of productive activities move contemporaneously in *opposite* directions only with respect to the *share* of unproductive capital stock. With respect to the *total* unproductive capital stock, the total value and the value added of productive activities actually move contemporaneously in the *same* direction. For the non-contemporaneous (lagged) co-movements between productive and unproductive accumulations it is better to perform Granger causality tests and then check the shapes of the impulse response functions.

3.3.4 Granger and Instantaneous Causality Tests

I perform two causality tests for each VAR model in its reduced form. The first is an instantaneous causality test that verifies if current realizations of one endogenous variable explain current realizations of another endogenous variable. It is a Wald-type test for nonzero correlation between the estimated residual processes of the cause and effect variables, given that in a reduced-form VAR the contemporaneous feedback appears through the estimated residuals. The second is the Granger causality test, which verifies whether or not lags of one variable explain current realizations of another variable. The Granger test can thus be thought of as a prediction test: a variable z Granger-causes variable w if past realizations of z explain current realizations of w.

In Table 3.7 I report the p-values from instantaneous and Granger causality tests for the three estimated VAR models under different time periods. All tests are implemented as non-causality tests, meaning that if the calculated p-value is lower than 0.10 we can reject the null of no causality.

Table 3.7: Instantaneous and Granger Non-Causality Tests (p-values)

	Whole period (1948-2011)	Regulated period (1948-1979)	Neoliberal period (1980-2011)
Reduced-form VAR Model 1			
Instantaneous non-causality:			
Growth rate of $\frac{K_{UA}}{K_{PA}} \leftrightarrow$ *Real* $\widehat{TV}$	0.02	0.01	0.85
Granger non-causality:			
Growth rate of $\frac{K_{UA}}{K_{PA}} \rightarrow$ *Real* $\widehat{TV}$	0.00	0.06	0.04
Growth rate of $\frac{K_{UA}}{K_{PA}} \leftarrow$ *Real* $\widehat{TV}$	0.01	0.08	0.01
Reduced-form VAR Model 2			
Instantaneous non-causality:			
Real $\widehat{K_{UA}} \leftrightarrow$ *Real* $\widehat{MVA}$	0.23	0.06	0.58
Granger non-causality:			
Real $\widehat{K_{UA}} \rightarrow$ *Real* $\widehat{MVA}$	0.01	0.06	0.00
Real $\widehat{K_{UA}} \leftarrow$ *Real* $\widehat{MVA}$	0.00	0.07	0.00
Reduced-form VAR Model 3			
Instantaneous non-causality:			
Real $\widehat{K_{UA}} \leftrightarrow$ *Real* $\widehat{TV}$	0.98	0.47	0.94
Granger non-causality:			
Real $\widehat{K_{UA}} \rightarrow$ *Real* $\widehat{TV}$	0.09	0.08	0.01
Real $\widehat{K_{UA}} \leftarrow$ *Real* $\widehat{TV}$	0.00	0.08	0.00

Notes: p-values reported for the instantaneous and Granger non-causality tests. Granger non-causality Ho: x does not Granger-cause y. Instantaneous non-causality Ho: x does not instantaneously cause y.

The results indicate the presence of dynamic interactions between the productive and unproductive dimensions of capital accumulation for the postwar United States. For the first model the estimates suggest significant contemporaneous and lagged interactions in both directions. For the Regulated period the Granger causality running from unproductive accumulation to productive accumulation is stronger that the reverse case. In contrast, the Granger causality running from productive accumulation to unproductive accumulation becomes stronger during the Neoliberal period. When the whole 1948-2011 period is considered both the instantaneous and Granger cau-

sality tests show very significant two-way effects between productive and unproductive forms of accumulation.

For the second model the results once more indicate that there are significant interactions in both directions. Similarly to the first model, Granger causality is relatively weaker during the Regulated period but highly significant when the Whole and Neoliberal periods are considered. Compared to the first, the second model exhibits stronger two-way Granger causality between productive and unproductive accumulation but weaker instantaneous causality for all periods under consideration.

For the third model the results indicate that there are no significant instantaneous effects for any of the three periods. Similarly to the first and second models, Granger causality is relatively weaker during the Regulated period but very significant when the Neoliberal period is considered. Granger tests additionally suggest that for the Whole period there is stronger causality running from productive accumulation to unproductive accumulation than the reverse case.

3.3.5 Impulse Response Functions

I have so far shown the empirical evidence of contemporaneous and lagged interactions between productive and unproductive forms of capital accumulation in the postwar United States economy. In the current and next sections I address the question of the signs and magnitudes of the dynamic effects.

Instead of reporting coefficient estimates, in a VAR framework it is more meaningful to graph the impulse response functions (IRFs) in order to evaluate the shapes of the feedback patterns between endogenous variables. Impulse response functions allow us to check how endogenous variables in a VAR system coevolve over time when impacted by an unexpected change in any of the variables, holding everything else constant. The unexpected changes are simulated as one-standard deviation impulses imparted to the structural error terms.

The key procedure in calculating the IRFs is to transform the vector auto-regressions into vector moving averages. Every stationary auto-regressive (AR) process has a convergent infinite moving average (MA) representation. When dealing with multiple variables it is then possible to represent a vector auto-regressive (VAR) system of order *p* as an infinite vector moving average (VMA) process:

$$x_t = \mu + \sum_{i=0}^{\infty} \phi_i \varepsilon_{t-i} \tag{3.4}$$

where μ is the vector with the unconditional means of the endogenous variables in x_t, and $\phi_i = \frac{A_1^i}{\det(B)}\ B^{-1}$ are the impact multiplier matrices, which in turn rely on the A_i and B matrices as previously defined in 3.1 and 3.3.

Using 3.4 it is possible to visualize the IRFs directly from the ϕ_i matrices by graphing its coefficients against i. In this way the coefficients of ϕ_i are used to generate the effects of the structural shocks ε_t on the entire time path of the x_t sequence. Given that the impact multipliers are associated with the structural errors it becomes necessary to recover ε_t from the estimated residual vector e_t. To compute the IRFs it is first required to identify the structural system by imposing restrictions on the estimated residuals of the reduced-form VAR. The restrictions amount to forcing the elements of ε_t to be orthogonal to each other, assuring that shocks to one error term are not correlated with shocks to another error. With the restrictions it becomes possible to distinguish the effects of changes in one endogenous variable from the other endogenous variables.

Since the estimated VAR models in this study have only two endogenous variables it is enough to impose only one restriction. The restrictions can be applied using the Cholesky decomposition to orthogonalize the estimated residual vector by cancelling some of the contemporaneous cross effects. The orthogonal decomposition is applied to the *B* matrix in 3.1 and 3.4 and the

structural errors are then recovered using $\varepsilon_t = Be_t$. By limiting the contemporaneous feedback, each possible orthogonalization of the residuals implies a specific ordering of the endogenous variables in the structural VAR.

With two endogenous variables there are only two possible orderings. In one ordering the variable associated with unproductive accumulation is posited as prior to the variable associated with productive accumulation. In the other ordering the exact opposite occurs. Positing an endogenous variable as causally prior to another in a structural VAR means that the first variable is not contemporaneously affected by the second, while second is contemporaneously affected by the first. Changing the ordering in a two-variable structural VAR implies simply inverting this causal priority. The Cholesky decomposition therefore introduces a potentially important asymmetry in the system, but as long as the shapes of the IRFs are similar under the two orderings it is safe to state that the structural VAR is well identified.

In what follows I apply both possible orderings to plot the IRFs corresponding to the three models for the three time periods under consideration. The results indicate that the shapes of the impulse responses are similar under both decompositions, and hence that the estimated VARs are not sensitive to a specific ordering of the variables. Additionally, since each series is in stationary real growth rates, the lack of unit root forces the IRF to decay to zero. A non-convergent IRF is evidence of unit root in the original series.

In Figure 3.1 I graph the orthogonalized IRFs from the first model. Panel (a) uses the *Growth rate of* $\frac{K_{UA}}{K_{PA}} \rightarrow$ *Real* $\widehat{TV}$ ordering while panel (b) uses the opposite *Growth rate of* $\frac{K_{UA}}{K_{PA}} \leftarrow$ *real* $\widehat{TV}$ ordering. Plots in the left column are IRFs for the Whole 1948-2011 period; plots in the center column are for the Regulated 1948-1979 period only; and plots in the right column are for the Neoliberal 1980-2011 period only. In each panel the first row contains IRFs with shocks from unproductive accumulation (endogenous variable 1) to productive accumulation (endogenous var-

iable 2), while the second row contains IRFs with shocks from productive accumulation to unproductive accumulation. Each IRF is shown for 20 lags and the dashed lines indicate bootstrapped 90% confidence intervals with 100 runs.

The IRFs for VAR model 1 are similar under both orderings. Except for the Neoliberal period, an unproductive shock has a predominantly negative impact on productive accumulation. When the $\frac{K_{UA}}{K_{PA}}$ ratio growths faster it causes Total Value (TV) to slow down. Conversely, a productive shock also has a negative impact on unproductive accumulation, except during the Neoliberal period. When Total Value (TV) grows faster it causes the $\frac{K_{UA}}{K_{PA}}$ ratio to slow down. These results imply that faster productive accumulation (measured through the annual real growth rate of the flow of Total Value) makes the stock of unproductive capital grow more slowly than the stock of productive capital. The converse is also true: when the stock of unproductive capital grows faster than its productive counterpart it imparts a negative effect on the growth rate of Total Value.

Model 1 therefore shows that slower productive accumulation (lower real Total Value growth rates) produced a *relatively* faster unproductive accumulation (higher growth rates of $\frac{K_{UA}}{K_{PA}}$), and in turn that a *relatively* faster unproductive accumulation produced slower productive accumulation. I emphasize the term 'relatively' since the ratio of unproductive to productive capital stock is a *relative* measure of unproductive accumulation. The opposite result holds for the Neoliberal period. The IRFs between $\frac{K_{UA}}{K_{PA}}$ and TV are predominantly positive from 1980 to 2011.

In Figure 3.2 I plot the IRFs for the second model, displaying the impulses and responses in the same way as was done for the first model. Panel (a) displays the results for the *Real* $\widehat{K_{UA}} \rightarrow$ *Real* $\widehat{MVA}$ ordering, while panel (b) displays the results for the opposite *Real* $\widehat{K_{UA}} \leftarrow$ *Real* $\widehat{MVA}$ ordering.

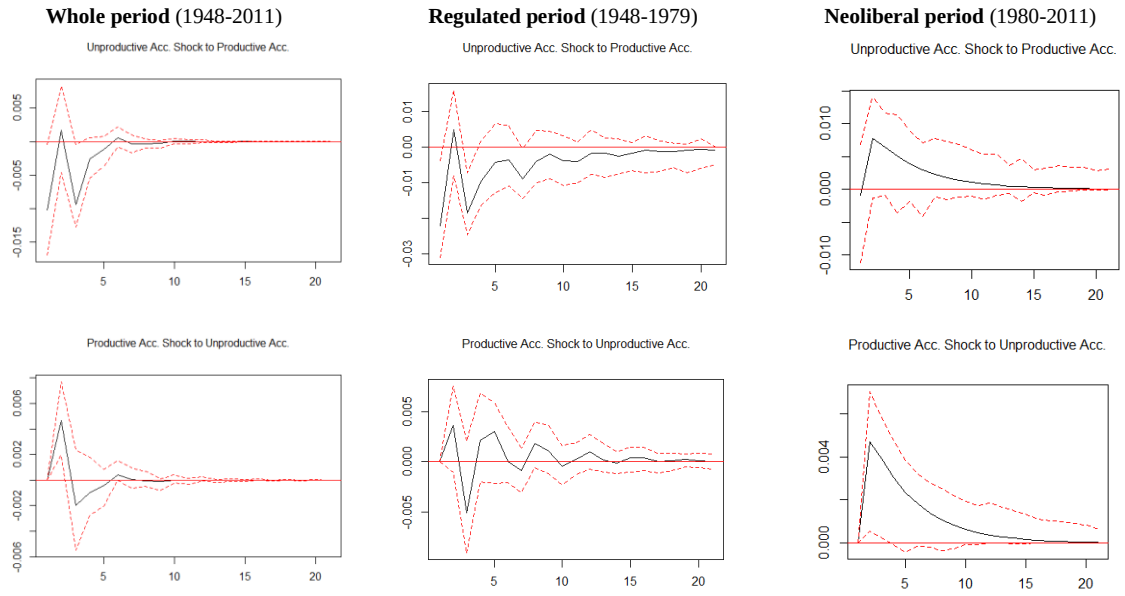
Model 2 presents a clear message, namely that productive and unproductive forms of accumulation tend to *reinforce* each other. Higher real growth rates of Marxist Value Added (MVA) impart positive effects on the real growth rates of the unproductive capital stock (K_{UA}). Conversely, faster growth of the unproductive capital stock produces greater growth in Marxist VA. These results imply that when measured in *absolute terms*, productive accumulation and unproductive accumulation are *mutually reinforcing*. The finding is consistent for both orderings, in both directions of causality, and for all periods under consideration.

In Figure 3.3 I plot the IRFs calculated from the third VAR model. Panel (a) displays the IRF for the *Real* $\widehat{K_{UA}}$ → *Real* $\widehat{TV}$ ordering, while panel (b) displays the IRFs for the opposite *Real* $\widehat{K_{UA}}$ ← *Real* $\widehat{TV}$ ordering. The findings are similar under the two alternative decompositions. Similarly to Model 2, the results further indicate that when measured in *absolute terms*, productive accumulation and unproductive accumulation are *mutually reinforcing*. The finding is consistent for both orderings, in both directions of causality, and for all periods under consideration.

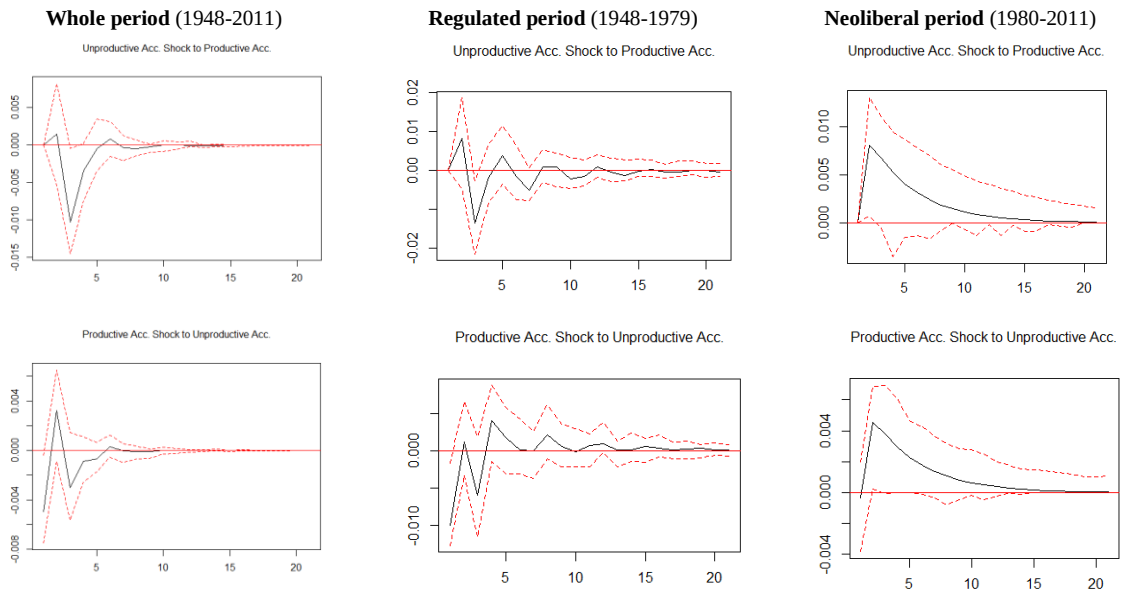
Without further investigation it is not possible to know with certainty how productive accumulation and unproductive accumulation mutually reinforce one another. Potential explanations would be that unproductive activity offers a source of aggregate demand and also provides ways to enhance labor productivity in productive activities. The production of useful knowledge, innovations, cheaper credit, and government expenditures, for example, can well induce faster productive growth and labor productivity. Likewise, productive growth provides further aggregate demand for unproductive accumulation.

Figure 3.1: Impulse Response Functions from VAR Model 1

(a) Ordering: *Growth rate of* $\frac{K_{UA}}{K_{PA}} \rightarrow$ *Real* $\widehat{TV}$



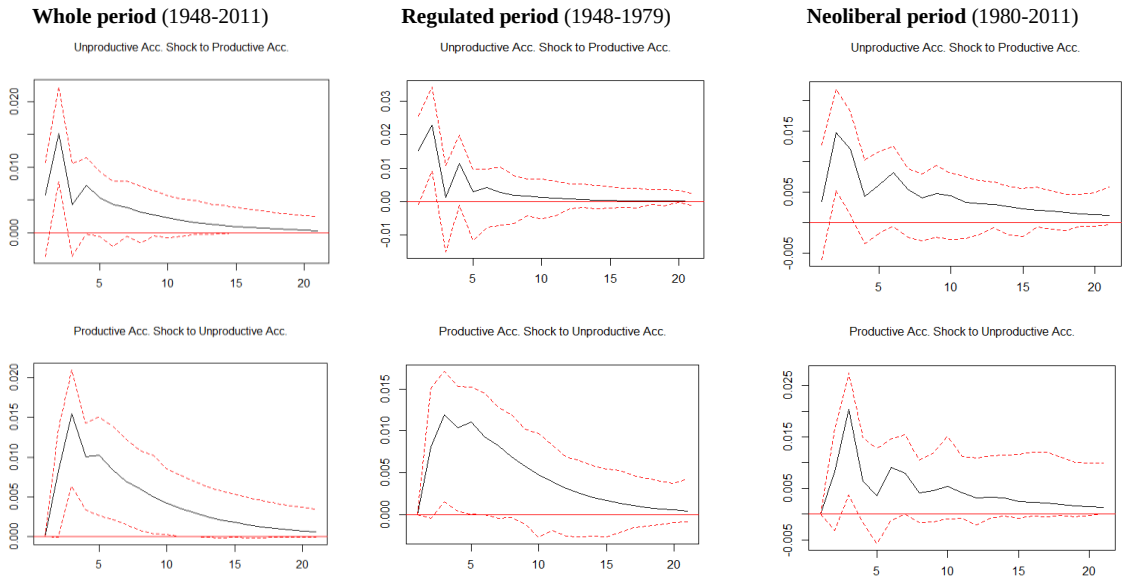
(b) Ordering: *Growth rate of* $\frac{K_{UA}}{K_{PA}} \leftarrow$ *Real* $\widehat{TV}$



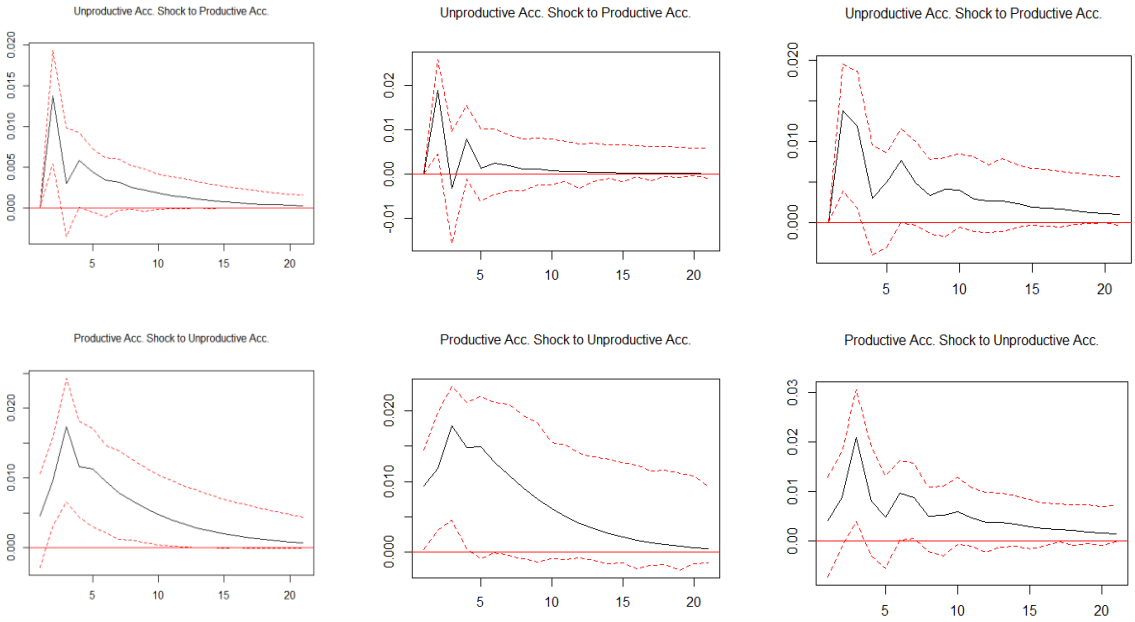
Notes: Dashed lines indicate bootstrapped 90% confidence intervals with 100 runs. IRFs shown for 20 lags.

Figure 3.2: Impulse Response Functions from VAR Model 2

(a) Ordering: *Real* $\widehat{K_{UA}}$ → *Real* $\widehat{MVA}$



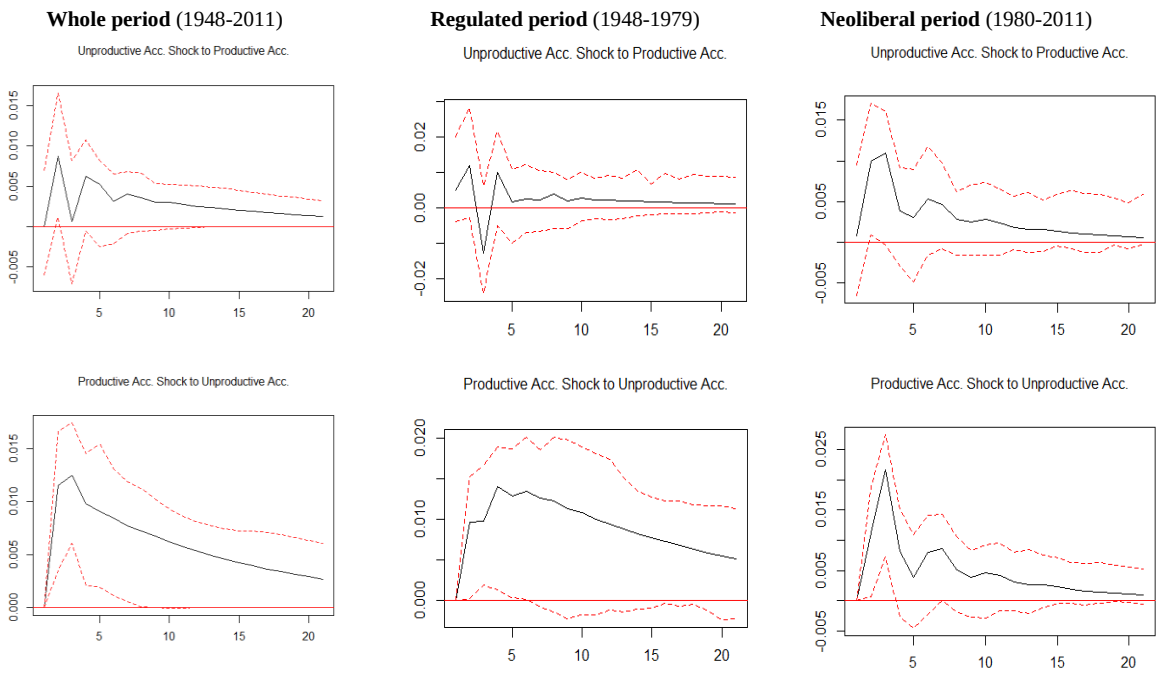
(b) Ordering: *Real* $\widehat{K_{UA}}$ ← *Real* $\widehat{MVA}$



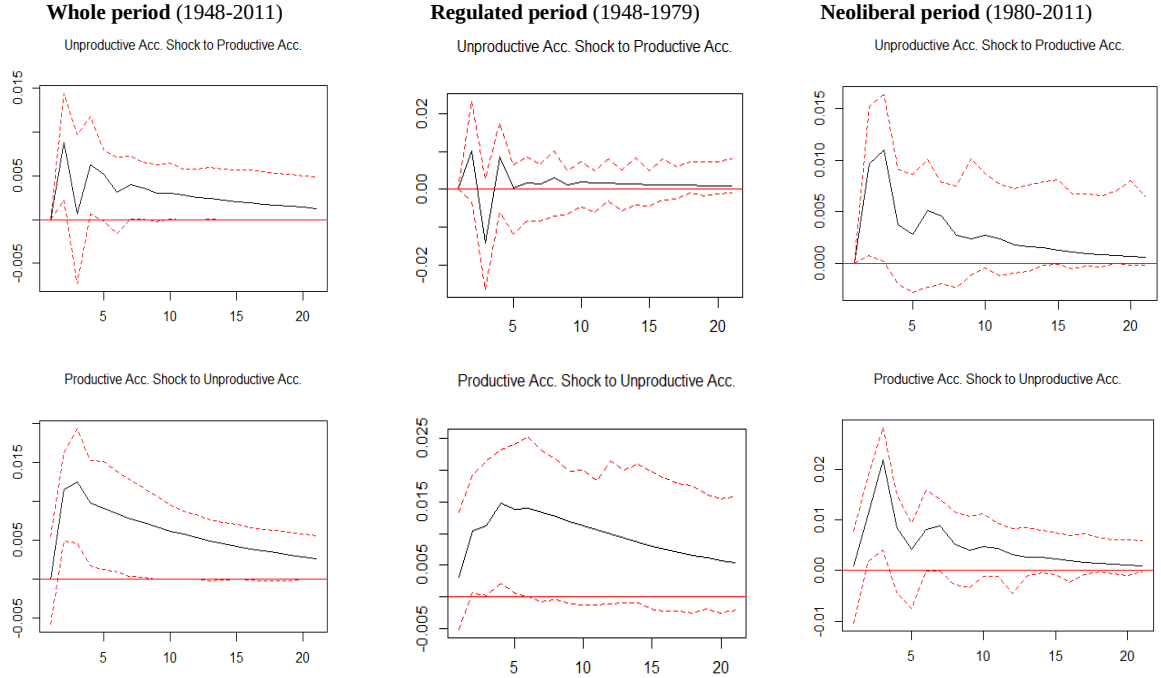
Notes: Dashed lines indicate bootstrapped 90% confidence intervals with 100 runs. IRFs shown for 20 lags.

Figure 3.3: Impulse Response Functions from VAR Model 3

(a) Ordering: *Real* $\widehat{K_{UA}}$ → *Real* $\widehat{TV}$



(b) Ordering: *Real* $\widehat{K_{UA}}$ ← *Real* $\widehat{TV}$



Notes: Dashed lines indicate bootstrapped 90% confidence intervals with 100 runs. IRFs shown for 20 lags.

The econometric results imply that when the unproductive capital stock grows, it has a *positive* impact on the growth of the total flow of productive value. However, when the unproductive capital stock grows faster than the productive capital stock, it then has a *negative* impact on the growth of the total flow of productive value. The slowdown in the total flow of productive value, similarly to the slowdown in the flow of productive value added, occurs not because the unproductive capital stock grows but because the unproductive capital stock grows *faster than* the productive capital stock. The annual flows of total productive value and productive value added grow slower only when the *share* of the unproductive capital stock increases. Conversely, once there is a slowdown in the annual flows of total productive value and productive value added then the unproductive capital stock grows faster than the productive capital stock.

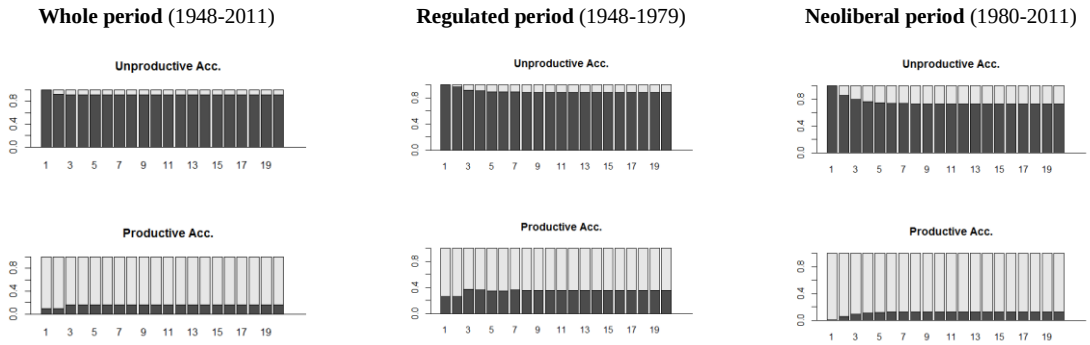
3.3.6 Variance Decompositions

The three estimated models indicate the existence of a dynamic evolution between productive and unproductive forms of accumulation. To further confirm the presence of feedback between the endogenous variables it is convenient to decompose the variance of forecast errors into a portion attributable to productive accumulation and another portion attributable to unproductive accumulation.

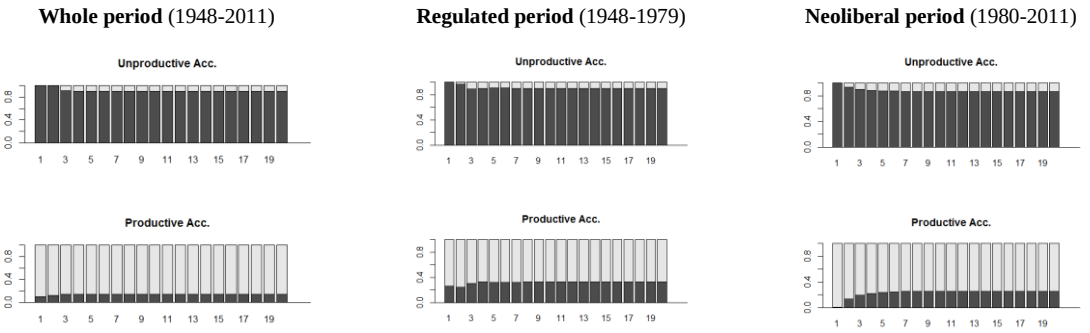
From the vector moving average (VMA) representation and the associated coefficients in ϕ_i it is possible to iterate forward equation 3.4 so as to obtain the forcast errors of each model. From the forecast errors it is then easy to compute the associated variances and to further decompose them into the proportion of movements in one varaible due to its own shocks versus shocks to the other variables. As is the case with IRFs, the decomposition of the forecast error variances also necessitates the identification of the structural shocks and hence the prior retriction on the *B* matrix in 3.1. In what follows I apply the same Cholesky decompositions as before and present the results under both possible orderings of the endogenous variables.

Figure 3.4: Forecast Error Variance Decompositions from VAR Model 1

(a) Ordering: *Growth rate of* $\frac{K_{UA}}{K_{PA}}$ → *Real* $\widehat{TV}$



(b) Ordering: *Growth rate of* $\frac{K_{UA}}{K_{PA}}$ ← *Real* $\widehat{TV}$



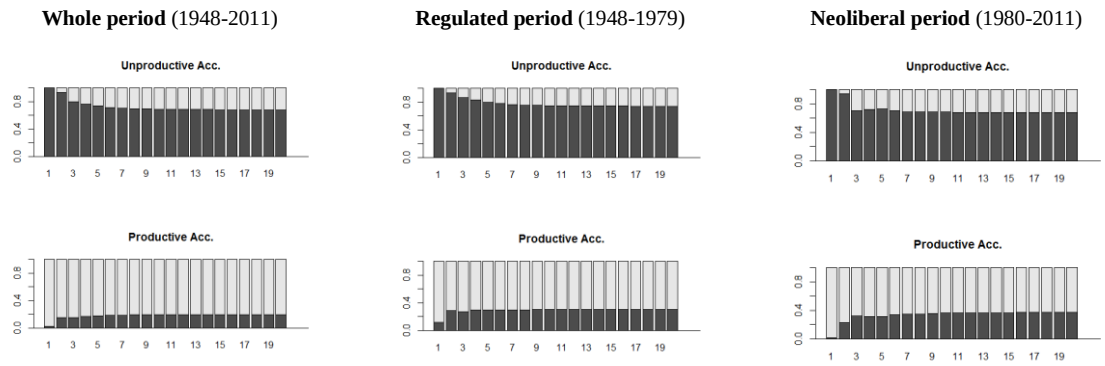
Notes: Forecast error variance decomposition in percentage for a horizon of 20 years. Grey area = share of the respective forecast error variance attributable to productive accumulation; Black area = share of the respective forecast error variance attributable to unproductive accumulation.

In Figure 3.4 I present the forecast error variance decomposition from the first VAR model in percentage terms for a horizon of 20 years. Panel (a) displays the variance decompositions under the *Growth rate of* $\frac{K_{UA}}{K_{PA}}$ → *Real* $\widehat{TV}$ ordering, while panel (b) displays the variance decomposition under the opposite *Growth rate of* $\frac{K_{UA}}{K_{PA}}$ ← *Real* $\widehat{TV}$ ordering. In Figure 3.5 I present the forecast error variance decomposition from the second VAR model. Panel (a) displays the variance decompositions under the *Real* $\widehat{K_{UA}}$ → *Real* $\widehat{MVA}$ ordering, while panel (b) displays the variance decomposition under the opposite *Real* $\widehat{K_{UA}}$ ← *Real* $\widehat{MVA}$ ordering. In Figure 3.6 I present the forecast error variance decomposition from the third VAR model. Panel (a) displays

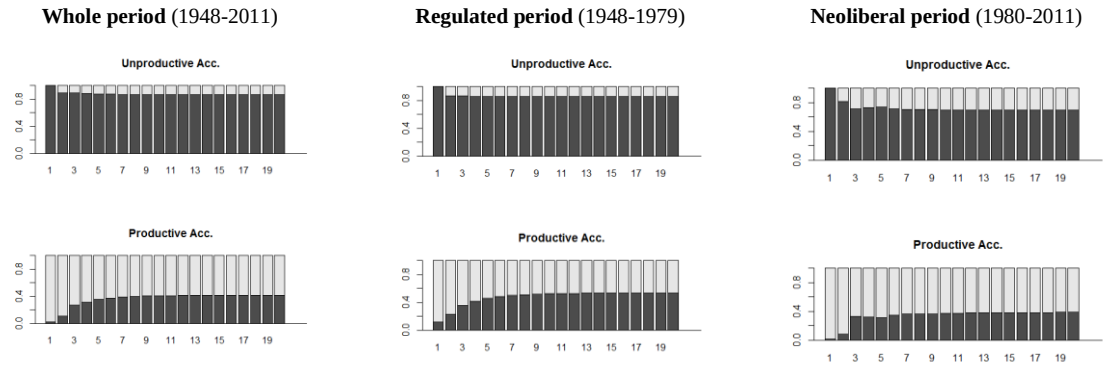
the variance decompositions under the *Real* $\widehat{K_{UA}} \rightarrow$ *Real* $\widehat{TV}$ ordering, while panel (b) displays the variance decomposition under the opposite *Real* $\widehat{K_{UA}} \leftarrow$ *Real* $\widehat{TV}$ ordering.

Figure 3.5: Forecast Error Variance Decompositions from VAR Model 2

(a) Ordering: *Real* $\widehat{K_{UA}} \rightarrow$ *Real* $\widehat{MVA}$



(b) Ordering: *Real* $\widehat{K_{UA}} \leftarrow$ *Real* $\widehat{MVA}$



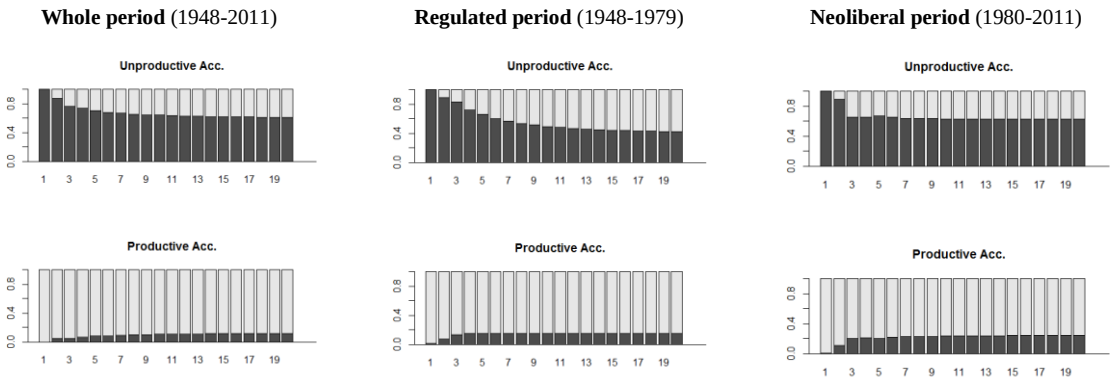
Notes: Forecast error variance decomposition in percentage for a horizon of 20 years. Grey area = share of the respective forecast error variance attributable to productive accumulation; Black area = share of the respective forecast error variance attributable to unproductive accumulation.

Plots in the left columns are for the whole 1948-2011 period; in the center columns for the Regulated 1948-1979 period only; and in the right columns for the Neoliberal 1980-2011 period only. In each panel the first row contains the plots for the decomposition of the variable representing the unproductive accumulation of capital, while the second row contains the plots for the decomposition of the variable representing the productive accumulation of capital. Grey areas

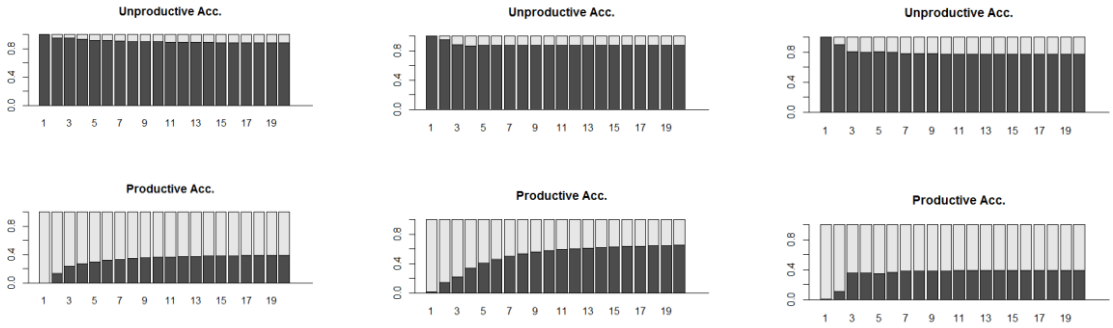
indicate the share of the forecast error variance attributable to productive accumulation, and black areas indicate the complementary share of the forecast error variance attributable to unproductive accumulation.

Figure 3.6: Forecast Error Variance Decompositions from VAR Model 3

(a) Ordering: *Real* $\widehat{K_{UA}}$ → *Real* $\widehat{TV}$



(b) Ordering: *Real* $\widehat{K_{UA}}$ ← *Real* $\widehat{TV}$



Notes: Forecast error variance decomposition in percentage for a horizon of 20 years. Grey area = share of the respective forecast error variance attributable to productive accumulation; Black area = share of the respective forecast error variance attributable to unproductive accumulation.

The results from the forecast error variance decompositions for all three models provide further evidence of a coevolution between productive and unproductive forms of capital accumu-

lation in the United States economy from 1947 to 2011. There are significant interactions within the system and no variable can therefore be deemed exogenous. Shares do not change substantially across time periods and the results are sensitive to the ordering of the variables only for the third model. In any of the cases under consideration each variable's forecast error variance is jointly explained by its own realizations as well as realizations of the other variable.

3.3.7 Diagnostic Tests

In this section I perform seven diagnostic tests for the three estimated VAR models across all time periods analyzed. I summarize the results in Table 3.8, indicating under each diagnostic test the respective null hypothesis and calculated p-values. P-values lower than 0.10 suggest that the null can be rejected at standard significance levels. The general conclusion is that the three regression models are well specified.

The first is the multivariate Portmanteau test for serial correlation in the estimated residuals, in which the null is of no serial correlation. I apply the adjusted version of the test for smaller samples. In a static system the autocorrelation in the residuals reduce the efficiency of the OLS coefficient estimators even though they remain unbiased. In a dynamic VAR the auto-correlation in the residuals makes OLS estimates inconsistent, hence invalidating t- and F-tests. The results show no problems for any version of the three models.

The second is the Edgerton-Shukur test for serial correlation in the estimated residuals. This test is based on the asymptotic Breusch-Godfrey procedure but corrected for smaller samples. The null is also of no serially correlated errors. The results show no problems for any version of the three models, except for a slight evidence of serial correlation at the 9% confidence level for the first model under the whole 1948-2011 period.

The third is the multivariate Jarque-Bera test for normality in the residuals. The multivariate version of this test is computed using a Cholesky decomposition of the variance-covariance

matrix for the standardized residuals. The null is of jointly normal residuals. Non-normal distributions distort estimates and confidence intervals. I perform the Jarque-Bera test together with the multivariate tests for skewness and kurtosis, checking if the multivariate skewness and kurtosis match a normal distribution. These fourth and fifth diagnostic checks test the null hypothesis of joint zero skewness and zero excess kurtosis. Since test results are dependent upon the ordering of the variables, I report p-values for the Jarque-Bera normality test, skewness, and kurtosis tests under the two possible orderings for each model. The computed statistics suggest no problems for any version of the three models.

Table 3.8: Diagnostic Tests of VAR Residuals (p-values)

	Serial Correlation	**Serial Correlation**	**Normality**	**Skewness**	**Kurtosis**	**Stability**	**ARCH**
Test Type	Adjusted Portmanteau	Edgerton-Shukur	Jarque-Bera			Recursive CUSUM	Autoregressive conditional heteroskedasticity
Null hypothesis (Ho)	No serial correlation	No serial correlation	Normal residuals	Zero skewness	Zero excess kurtosis		No heteroskedasticity
VAR Model 1							
1948-2011	0.30	0.09(.)	0.54/0.49	0.77/0.94	0.27/0.19	no break	0.40
1948-1979	0.22	0.49	0.77/0.82	0.88/0.90	0.45/0.52	no break	0.51
1980-2011	0.81	0.69	0.79/0.92	0.54/0.63	0.79/0.98	no break	0.73
VAR Model 2							
1948-2011	0.91	0.15	0.58/0.38	0.26/0.13	0.91/0.95	no break	0.23
1948-1979	0.92	0.61	0.68/0.67	0.47/0.35	0.68/0.87	no break	0.33
1980-2011	0.68	0.83	0.91/0.76	0.72/0.46	0.84/0.84	no break	0.54
VAR Model 3							
1948-2011	0.71	0.56	0.67/0.68	0.50/0.50	0.63/0.63	no break	0.12
1948-1979	0.72	0.37	0.71/0.72	0.73/0.75	0.47/0.48	no break	0.16
1980-2011	0.78	0.85	0.97/0.97	0.88/0.88	0.89/0.89	no break	0.26

Notes: For each test I report p-values, except for the stability test using the recursive CUSUM for which I report the conclusion from visual inspection. For the Jarque-Bera normality test and the skewness and kutosis tests I report p-values under the two possible orderings for each model. Null hypotheses can be rejected at the following significance levels: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1.

The sixth is the parameter stability test. It computes an empirical fluctuation process according to a specified method from the generalized fluctuation test framework. This is a visual test for structural change and there is no associated p-value. I apply the recursive cumulative

summation criterion. The results point to no stability problems in any of the models. The seventh and last diagnostic check is the test for autoregressive conditional heteroskedasticity in the estimated residuals. It computes a multivariate ARCH-LM test for a VAR system. The results indicate no problems in any of the models.

3.4 Conclusion

In this chapter I provided an assessment of the dynamic interactions between productive and unproductive forms of capital accumulation in the Unites States from 1947 to 2011. I conducted a quantitative, econometric evaluation of a question that other scholars have dealt with only through verbal and descriptive analysis. I employed time series techniques such as cointegration analysis, vector auto-regressions, Granger causality tests, impulse-response functions, and forecast error variance decompositions for multivariate systems using both standard and new Marxist categories estimated with a new methodology for the postwar United States economy.

A core feature of the methodology that I introduce is the classification of knowledge and information production as an unproductive activity whose expansion is predicated on knowledge-rents. In this way, my measures of unproductive accumulation are broader than the Keynesian measures of financialization. The Marxist notion of unproductive accumulation incorporates the idea of financialization and further acknowledges that other unproductive activities draw on the surplus value that productive workers generate.

The main empirical results are as follows. First, productive and unproductive forms of accumulation share no common trend or no stable long-run equilibrium relationship. There is, hence, no self-correcting mechanism that brings these two forms of capital accumulation back into a stable long-run equilibrium. Second, productive and unproductive forms of accumulation tend to be mutually reinforcing in the short run. Despite consuming the surplus from productive endeavors, unproductive accumulation still has a net positive effect on productive accumulation.

Third, I find evidence of an absolute crowding-in effect (or positive level effect) coupled with a relative crowding-out effect (or negative share effect) between productive and unproductive forms of capital accumulation. The total value produced in productive activities grows faster when the unproductive capital grows, but slows down when the unproductive capital stock grows faster than the productive capital stock. Fourth, I find evidence of reverse causality indicating that the share of unproductive capital stock grows faster when there is a slowdown in the total value produced in productive activities.

APPENDIX

ESTIMATING MARXIST CATEGORIES FOR THE UNITED STATES ECONOMY

A.1 Introduction

In this appendix I explain step-by-step how to estimate Marxist categories for the postwar United States economy using publicly available information. I explain in detail: (i) how to obtain the necessary data from input-output matrices, national income accounts, and employment statistics; (ii) how to apply the Marxist Industrial Classification System (MICS); and (iii) how to convert official income and asset measures into estimates of Marxist categories.

A.2 Data Sources

In order to estimate the Marxist total value produced in the United States it is necessary to have detailed industry-level information on the national gross output, which includes both the value added as well as the inputs used up. The only way to obtain historical information on value added and intermediate inputs with the required level of detail is through the benchmark input-output matrices. For any single year, an input-output table consolidates the three approaches to value added: the sum of final uses or expenditures, the sum of all incomes, and the sum of all contributions from all industries net of their respective inputs. However, since benchmark input-

output matrices are calculated roughly every five years it is also necessary to interpolate with estimates from annual GDP by industry data.

Aggregate and industry-level information are available through the Bureau of Economic Analysis (BEA) and the Bureau of Labor Statistics (BLS). From the BEA I use: (a) the benchmark input-output tables, compiled roughly every five years; (b) annual GDP by industry data using both the most recent North American Industry Classification System (NAICS) and the former Standard Industrial Classification (SIC); (c) data on stocks of fixed assets from the BEA Fixed Assets Accounts (FAA); (d) annual data on total employees and nonsupervisory workers per industry from the BLS; (e) price indices such as the producer price index (PPI) from BLS.

The first obstacle in estimating historical series is that BEA's methodologies and industry classification systems are neither stable nor consistent across input-output tables and GDP by industry accounts for the same year. The second obstacle is that BEA's methodologies and the industry classification systems are not entirely consistent through time. Even more, employment data from the BLS is based on a different industry classification system and hence must be adjusted when combined with the BEA series.

Benchmark input-output (I-O) matrices are available for 1947, 1958, 1963, 1967, 1972, 1977, 1982, 1987, 1992, 1997, and 2002. The closer to the present date the more details they contain. The I-O tables for 1947 and 1958 are available at the two-digit SIC level for 85 industries. For 1963 it is available at the four-digit SIC level for 387 industries. For 1967, 1972, 1977, 1982, 1987, and 1992 they are available at the six-digit SIC level for 484, 496, 537, 498, 570, 498 industries, respectively. The 1997 and 2002 benchmark I-O tables shift to the NAICS system and display, respectively, 494 and 428 industries. Prior to 1982 it is necessary to manually mount each I-O matrix and manually assign industry labels to every single row and column.

Input-output matrices display at the same time the income (revenues) side as well as the expenditure (uses) side of gross output and gross product. Incomes for each industry are organized vertically in columns while expenditures for the same industries are organized horizontally in rows. Inter-industry exchanges are shown as intermediate inputs on the income side and as intermediate demands on the expenditure side. Beginning in 1977 the value added component of each industry in the detailed I-O tables is decomposed into employee compensation, indirect business taxes, and gross operating surplus. For the summary I-O tables, which display 85 industries only, the decomposition of value added by industry begins in 1967. This implies that information on employee compensation and profit-type incomes is not available at all before 1967 and available between 1967 and 1977 solely at the summary level with industries grouped at the two-digit SIC system.

In 1987 the BEA also began to publish redefined benchmark I-O matrices by reassigning some secondary products and their associated inputs to the industry in which they are the primary products. The standard I-O tables assign both primary and secondary products to each industry as originally reported by businesses. From the original standard tables the BEA then computes the redefined tables to include the redefinitions made when the input structure of the industry's secondary product differs significantly from the input structure of its primary product. For example, the restaurant services in hotels are redefined from the accommodations industry to the food services industry. These redefined tables are referred to as 'after redefinition'. Redefinitions affect numerous industries in the I-O accounts, mainly wholesale trade, retail trade, construction, publishing industries, and accommodations and food services. As a result of redefinitions, the total value of secondary products is decreased, and the total value of primary products is increased by the same amount. However, commodity outputs are not affected, only industry outputs (BEA 2009; 2011).

For the years not covered in the benchmark I-O tables it is necessary to interpolate with the BEA GDP by industry data available annually from 1947 to 2011. Through the GDP by industry sheets it is possible to obtain information on value added, employee compensation (EC), profit-type income (gross operating surplus), full-time and part-time workers (FTPT), full-time equivalent workers (FEE), and persons engaged in production (PEP). Annual data on gross output and input costs are available only from 1987 onwards. The GDP by industry series are available at the industry level but unfortunately with a different industry classification system than the I-O tables since the aggregation methods that the BEA employs are different between I-O tables and GDP by industry series.

Besides the differences concerning the aggregation method employed in I-O matrices for any single year, the GDP by industry aggregation method also changes through time. From 1947 to 1997 the BEA uses the SIC system while from 1977 to 2011 it employs the NAICS. Unfortunately, in the 20 years from 1977 to 1997 when the two methods overlap the SIC and NAICS systems do produce different results. The methodology that I propose to transform the official series into Marxist categories corrects for the *cross-sectional* and *temporal* differences and therefore generates more consistent annual estimates.

Information on stocks of fixed assets and depreciation by industry is available through the BEA's Fixed Assets Accounts (FAA). For the Marxist estimates I use series on current-cost net stocks of fixed assets by industry, which comprises stocks of buildings, equipment, and software at replacement costs. For stocks of assets and their respective depreciations I combine the datasets from nonresidential private entities with the federal, state, and local government entities.

The official measure of fixed asset depreciation includes the physical deterioration of buildings and equipment as well as the obsolescence due to new technological advances, implying that depreciation also measures early retirements and discards as assets are withdrawn from

service while still being productive. For the annual depreciation estimates the BEA no longer applies the straight-line depreciation model with assumed patterns of retirements. It now uses a new model with a geometric pattern approximating the empirical evidence on the prices of used equipment and structures in resale markets (Fraumeni 1997). A geometric pattern is a specific type of accelerated pattern which assumes higher dollar depreciation in the early years of an asset's service life than in the later years. The geometric pattern of depreciation is also the default option when information on specific assets is unavailable. For some assets such as autos, computers, missiles, and nuclear fuel, the BEA uses a nongeometric pattern of depreciation.

Finally, to separate supervisory from nonsupervisory employees I use industry-level data from the BLS on the total number of employees and the number of production and nonsupervisory workers. Also from BLS I use the producer price index (PPI).

A.3 Applying the Marxist Industry Classification System

The Marxist Industry Classification System (MICS) provides a new way to regroup industries into three categories that reflect Marxist theory. The main task consists of applying the MICS to the available data from the BEA and BLS. In the tables and figures that follow I explain the steps of this procedure.

In Table A.1 I apply the MICS to the 2002 benchmark I-O matrix, the last one that the BEA has made available. Earlier I-O matrices were regrouped in a similar way. In Table A.1 I also display the input-output industry codes to facilitate identification.

Table A.1: MICS Applied to the 2002 BEA Benchmark Input-Output Matrix

Productive Activities	code	Productive Activities (continued)	code
Oilseed farming	**1111A0**	Rolling mill and other metalworking machinery manufacturing	**33351B**
Grain farming	**1111B0**	Turbine and turbine generator set units manufacturing	**333611**
Vegetable and melon farming	**111200**	Speed changer, industrial high-speed drive, and gear manufacturing	**333612**
Tree nut farming	**111335**	Mechanical power transmission equipment manufacturing	**333613**
Fruit farming	**1113A0**	Other engine equipment manufacturing	**333618**
Greenhouse, nursery, and floriculture production	**111400**	Pump and pumping equipment manufacturing	**333911**
Tobacco farming	**111910**	Air and gas compressor manufacturing	**333912**
Cotton farming	**111920**	Material handling equipment manufacturing	**333920**
Sugarcane and sugar beet farming	**1119A0**	Power-driven handtool manufacturing	**333991**
All other crop farming	**1119B0**	Packaging machinery manufacturing	**333993**
Dairy cattle and milk production	**112120**	Industrial process furnace and oven manufacturing	**333994**
Cattle ranching and farming	**1121A0**	Other general purpose machinery manufacturing	**33399A**
Poultry and egg production	**112300**	Fluid power process machinery	**33399B**
Animal production, except cattle and poultry and eggs	**112A00**	Electronic computer manufacturing	**334111**
Logging	**113300**	Computer storage device manufacturing	**334112**
Forest nurseries, forest products, and timber tracts	**113A00**	Computer terminals and other computer peripheral equipment manufacturing	**33411A**
Fishing	**114100**	Telephone apparatus manufacturing	**334210**
Hunting and trapping	**114200**	Broadcast and wireless communications equipment	**334220**
Support activities for agriculture and forestry	**115000**	Other communications equipment manufacturing	**334290**
Oil and gas extraction	**211000**	Audio and video equipment manufacturing	**334300**
Coal mining	**212100**	Electron tube manufacturing	**334411**
Iron ore mining	**212210**	Bare printed circuit board manufacturing	**334412**
Copper, nickel, lead, and zinc mining	**212230**	Semiconductor and related device manufacturing	**334413**
Gold, silver, and other metal ore mining	**2122A0**	Electronic connector manufacturing	**334417**
Stone mining and quarrying	**212310**	Printed circuit assembly (electronic assembly) manufacturing	**334418**
Sand, gravel, clay, and ceramic and refractory minerals mining and quarrying	**212320**	Other electronic component manufacturing	**334419**
Other nonmetallic mineral mining and quarrying	**212390**	Electronic capacitor, resistor, coil, transformer, and other inductor manufacturing	**33441A**
Drilling oil and gas wells	**213111**	Electromedical and electrotherapeutic apparatus manufacturing	**334510**
Support activities for oil and gas operations	**213112**	Search, detection, and navigation instruments manufacturing	**334511**
Support activities for other mining	**21311A**	Automatic environmental control manufacturing	**334512**
Electric power generation, transmission, and distribution	**221100**	Industrial process variable instruments manufacturing	**334513**
Natural gas distribution	**221200**	Totalizing fluid meters and counting devices manufacturing	**334514**
Water, sewage and other systems	**221300**	Electricity and signal testing instruments manufacturing	**334515**
Nonresidential commercial and health care structures	**230101**	Analytical laboratory instrument manufacturing	**334516**
Nonresidential manufacturing structures	**230102**	Irradiation apparatus manufacturing	**334517**
Other nonresidential structures	**230103**	Watch, clock, and other measuring and controlling device manufacturing	**33451A**

Residential permanent site single- and multi-family structures	**230201**
Other residential structures	**230202**
Nonresidential maintenance and repair	**230301**
Residential maintenance and repair	**230302**
Dog and cat food manufacturing	**311111**
Other animal food manufacturing	**311119**
Flour milling and malt manufacturing	**311210**
Wet corn milling	**311221**
Fats and oils refining and blending	**311225**
Soybean and other oilseed processing	**31122A**
Breakfast cereal manufacturing	**311230**
Beet sugar manufacturing	**311313**
Sugar cane mills and refining	**31131A**
Chocolate and confectionery manufacturing from cacao beans	**311320**
Confectionery manufacturing from purchased chocolate	**311330**
Nonchocolate confectionery manufacturing	**311340**
Frozen food manufacturing	**311410**
Fruit and vegetable canning, pickling, and drying	**311420**
Cheese manufacturing	**311513**
Dry, condensed, and evaporated dairy product manufacturing	**311514**
Fluid milk and butter manufacturing	**31151A**
Ice cream and frozen dessert manufacturing	**311520**
Poultry processing	**311615**
Animal (except poultry) slaughtering, rendering, and processing	**31161A**
Seafood product preparation and packaging	**311700**
Bread and bakery product manufacturing	**311810**
Cookie, cracker, and pasta manufacturing	**311820**
Tortilla manufacturing	**311830**
Snack food manufacturing	**311910**
Coffee and tea manufacturing	**311920**
Flavoring syrup and concentrate manufacturing	**311930**
Seasoning and dressing manufacturing	**311940**
All other food manufacturing	**311990**
Soft drink and ice manufacturing	**312110**
Breweries	**312120**
Wineries	**312130**
Distilleries	**312140**
Tobacco product manufacturing	**3122A0**
Fiber, yarn, and thread mills	**313100**
Broadwoven fabric mills	**313210**
Narrow fabric mills and schiffli machine embroidery	**313220**
Magnetic and optical recording media manufacturing	**334613**
Electric lamp bulb and part manufacturing	**335110**
Lighting fixture manufacturing	**335120**
Small electrical appliance manufacturing	**335210**
Household cooking appliance manufacturing	**335221**
Household refrigerator and home freezer manufacturing	**335222**
Household laundry equipment manufacturing	**335224**
Other major household appliance manufacturing	**335228**
Power, distribution, and specialty transformer manufacturing	**335311**
Motor and generator manufacturing	**335312**
Switchgear and switchboard apparatus manufacturing	**335313**
Relay and industrial control manufacturing	**335314**
Storage battery manufacturing	**335911**
Primary battery manufacturing	**335912**
Communication and energy wire and cable manufacturing	**335920**
Wiring device manufacturing	**335930**
Carbon and graphite product manufacturing	**335991**
All other miscellaneous electrical equipment and component manufacturing	**335999**
Automobile manufacturing	**336111**
Light truck and utility vehicle manufacturing	**336112**
Heavy duty truck manufacturing	**336120**
Motor vehicle body manufacturing	**336211**
Truck trailer manufacturing	**336212**
Motor home manufacturing	**336213**
Travel trailer and camper manufacturing	**336214**
Motor vehicle parts manufacturing	**336300**
Aircraft manufacturing	**336411**
Aircraft engine and engine parts manufacturing	**336412**
Other aircraft parts and auxiliary equipment manufacturing	**336413**
Guided missile and space vehicle manufacturing	**336414**
Railroad rolling stock manufacturing	**336500**
Ship building and repairing	**336611**
Boat building	**336612**
Motorcycle, bicycle, and parts manufacturing	**336991**
Military armored vehicle, tank, and tank component manufacturing	**336992**
All other transportation equipment manufacturing	**336999**
Wood kitchen cabinet and countertop manufacturing	**337110**
Upholstered household furniture manufacturing	**337121**
Nonupholstered wood household furniture manufacturing	**337122**
Institutional furniture manufacturing	**337127**
Propulsion units and parts for space vehicle and guided missiles	**33641A**

Nonwoven fabric mills	**313230**
Knit fabric mills	**313240**
Textile and fabric finishing mills	**313310**
Fabric coating mills	**313320**
Carpet and rug mills	**314110**
Curtain and linen mills	**314120**
Textile bag and canvas mills	**314910**
All other textile product mills	**314990**
Apparel knitting mills	**315100**
Cut and sew apparel contractors	**315210**
Men's and boys' cut and sew apparel manufacturing	**315220**
Women's and girls' cut and sew apparel manufacturing	**315230**
Other cut and sew apparel manufacturing	**315290**
Apparel accessories and other apparel manufacturing	**315900**
Leather and hide tanning and finishing	**316100**
Footwear manufacturing	**316200**
Other leather and allied product manufacturing	**316900**
Sawmills and wood preservation	**321100**
Reconstituted wood product manufacturing	**321219**
Veneer and plywood manufacturing	**32121A**
Engineered wood member and truss manufacturing	**32121B**
Wood windows and doors and millwork	**321910**
Wood container and pallet manufacturing	**321920**
Manufactured home (mobile home) manufacturing	**321991**
Prefabricated wood building manufacturing	**321992**
All other miscellaneous wood product manufacturing	**321999**
Pulp mills	**322110**
Paper mills	**322120**
Paperboard mills	**322130**
Paperboard container manufacturing	**322210**
Coated and laminated paper, packaging paper and plastics film manufacturing	**32222A**
All other paper bag and coated and treated paper manufacturing	**32222B**
Stationery product manufacturing	**322230**
Sanitary paper product manufacturing	**322291**
All other converted paper product manufacturing	**322299**
Printing	**323110**
Support activities for printing	**323120**
Petroleum refineries	**324110**
Asphalt paving mixture and block manufacturing	**324121**
Asphalt shingle and coating materials manufacturing	**324122**
Petroleum lubricating oil and grease manufacturing	**324191**
Metal and other household furniture (except wood) manufacturing	**33712A**
Office furniture and custom architectural woodwork and millwork manufacturing	**337212**
Showcase, partition, shelving, and locker manufacturing	**337215**
Wood television, radio, and sewing machine cabinet manufacturing	**33721A**
Mattress manufacturing	**337910**
Blind and shade manufacturing	**337920**
Laboratory apparatus and furniture manufacturing	**339111**
Surgical and medical instrument manufacturing	**339112**
Surgical appliance and supplies manufacturing	**339113**
Dental equipment and supplies manufacturing	**339114**
Ophthalmic goods manufacturing	**339115**
Dental laboratories	**339116**
Jewelry and silverware manufacturing	**339910**
Sporting and athletic goods manufacturing	**339920**
Doll, toy, and game manufacturing	**339930**
Office supplies (except paper) manufacturing	**339940**
Sign manufacturing	**339950**
Gasket, packing, and sealing device manufacturing	**339991**
Musical instrument manufacturing	**339992**
Broom, brush, and mop manufacturing	**339994**
All other miscellaneous manufacturing	**33999A**
Air transportation	**481000**
Rail transportation	**482000**
Water transportation	**483000**
Truck transportation	**484000**
Transit and ground passenger transportation	**485000**
Pipeline transportation	**486000**
Scenic and sightseeing transportation and support activities for transportation	**48A000**
Postal service	**491000**
Couriers and messengers	**492000**
Warehousing and storage	**493000**
Radio and television broadcasting	**515100**
Cable and other subscription programming	**515200**
Telecommunications	**517000**
Accounting, tax preparation, bookkeeping, and payroll services	**541200**
Architectural, engineering, and related services	**541300**
Specialized design services	**541400**
Other computer related services, including facilities management	**54151A**
Management, scientific, and technical consulting services	**541610**
Environmental and other technical consulting services	**5416A0**
All other miscellaneous professional, scientific, and	**5419A0**

All other petroleum and coal products manufacturing	**324199**
Petrochemical manufacturing	**325110**
Industrial gas manufacturing	**325120**
Synthetic dye and pigment manufacturing	**325130**
Alkalies and chlorine manufacturing	**325181**
Carbon black manufacturing	**325182**
All other basic inorganic chemical manufacturing	**325188**
Other basic organic chemical manufacturing	**325190**
Plastics material and resin manufacturing	**325211**
Synthetic rubber manufacturing	**325212**
Artificial and synthetic fibers and filaments manufacturing	**325220**
Fertilizer manufacturing	**325310**
Pesticide and other agricultural chemical manufacturing	**325320**
Paint and coating manufacturing	**325510**
Adhesive manufacturing	**325520**
Soap and cleaning compound manufacturing	**325610**
Toilet preparation manufacturing	**325620**
Printing ink manufacturing	**325910**
All other chemical product and preparation manufacturing	**3259A0**
Plastics packaging materials and unlaminated film and sheet manufacturing	**326110**
Unlaminated plastics profile shape manufacturing	**326121**
Plastics pipe and pipe fitting manufacturing	**326122**
Laminated plastics plate, sheet (except packaging), and shape manufacturing	**326130**
Polystyrene foam product manufacturing	**326140**
Urethane and other foam product (except polystyrene) manufacturing	**326150**
Plastics bottle manufacturing	**326160**
Other plastics product manufacturing	**32619A**
Tire manufacturing	**326210**
Rubber and plastics hoses and belting manufacturing	**326220**
Other rubber product manufacturing	**326290**
Pottery, ceramics, and plumbing fixture manufacturing	**32711A**
Brick, tile, and other structural clay product manufacturing	**32712A**
Clay and nonclay refractory manufacturing	**32712B**
Flat glass manufacturing	**327211**
Other pressed and blown glass and glassware manufacturing	**327212**
Glass container manufacturing	**327213**
Glass product manufacturing made of purchased glass	**327215**
Cement manufacturing	**327310**
Ready-mix concrete manufacturing	**327320**

technical services	
Photographic services	**541920**
Veterinary services	**541940**
Office administrative services	**561100**
Facilities support services	**561200**
Employment services	**561300**
Business support services	**561400**
Travel arrangement and reservation services	**561500**
Investigation and security services	**561600**
Services to buildings and dwellings	**561700**
Other support services	**561900**
Waste management and remediation services	**562000**
Elementary and secondary schools	**611100**
Junior colleges, colleges, universities, and professional schools	**611A00**
Other educational services	**611B00**
Home health care services	**621600**
Offices of physicians, dentists, and other health practitioners	**621A00**
Medical and diagnostic labs and outpatient and other ambulatory care services	**621B00**
Hospitals	**622000**
Nursing and residential care facilities	**623000**
Community food, housing, and other relief services, including rehabilitation services	**624200**
Child day care services	**624400**
Individual and family services	**624A00**
Performing arts companies	**711100**
Spectator sports	**711200**
Independent artists, writers, and performers	**711500**
Promoters of performing arts and sports and agents for public figures	**711A00**
Museums, historical sites, zoos, and parks	**712000**
Fitness and recreational sports centers	**713940**
Bowling centers	**713950**
Amusement parks, arcades, and gambling industries	**713A00**
Other amusement and recreation industries	**713B00**
Hotels and motels, including casino hotels	**7211A0**
Other accommodations	**721A00**
Food services and drinking places	**722000**
Car washes	**811192**
Automotive repair and maintenance, except car washes	**8111A0**
Electronic and precision equipment repair and maintenance	**811200**
Commercial and industrial machinery and equipment repair and maintenance	**811300**
Personal and household goods repair and maintenance	**811400**

Concrete pipe, brick, and block manufacturing	**327330**
Other concrete product manufacturing	**327390**
Lime and gypsum product manufacturing	**3274A0**
Abrasive product manufacturing	**327910**
Cut stone and stone product manufacturing	**327991**
Ground or treated mineral and earth manufacturing	**327992**
Mineral wool manufacturing	**327993**
Miscellaneous nonmetallic mineral products	**327999**
Iron and steel mills and ferroalloy manufacturing	**331110**
Steel product manufacturing from purchased steel	**331200**
Secondary smelting and alloying of aluminum	**331314**
Alumina refining and primary aluminum production	**33131A**
Aluminum product manufacturing from purchased aluminum	**33131B**
Primary smelting and refining of copper	**331411**
Primary smelting and refining of nonferrous metal (except copper and aluminum)	**331419**
Copper rolling, drawing, extruding and alloying	**331420**
Nonferrous metal (except copper and aluminum) rolling, drawing, extruding and alloying	**331490**
Ferrous metal foundries	**331510**
Nonferrous metal foundries	**331520**
Custom roll forming	**332114**
All other forging, stamping, and sintering	**33211A**
Crown and closure manufacturing and metal stamping	**33211B**
Cutlery, utensil, pot, and pan manufacturing	**33221A**
Handtool manufacturing	**33221B**
Plate work and fabricated structural product manufacturing	**332310**
Ornamental and architectural metal products manufacturing	**332320**
Power boiler and heat exchanger manufacturing	**332410**
Metal tank (heavy gauge) manufacturing	**332420**
Metal can, box, and other metal container (light gauge) manufacturing	**332430**
Hardware manufacturing	**332500**
Spring and wire product manufacturing	**332600**
Machine shops	**332710**
Turned product and screw, nut, and bolt manufacturing	**332720**
Coating, engraving, heat treating and allied activities	**332800**
Plumbing fixture fitting and trim manufacturing	**332913**
Valve and fittings other than plumbing	**33291A**
Ball and roller bearing manufacturing	**332991**
Fabricated pipe and pipe fitting manufacturing	**332996**
Ammunition manufacturing	**33299A**
Arms, ordnance, and accessories manufacturing	**33299B**
Other fabricated metal manufacturing	**33299C**
Personal care services	**812100**
Death care services	**812200**
Dry-cleaning and laundry services	**812300**
Other personal services	**812900**
Federal electric utilities	**S00101**
Other state and local government enterprises	**S00203**
Noncomparable imports	**S00300**
Scrap	**S00401**
Used and secondhand goods	**S00402**

Trade, Rental, Leasing	**code**
Wholesale trade	**420000**
Retail trade	**4A0000**
Automotive equipment rental and leasing	**532100**
Commercial and industrial machinery and equipment rental and leasing	**532400**
General and consumer goods rental except video tapes and discs	**532A00**

Unproductive Activities	**code**
Medicinal and botanical manufacturing	**325411**
Pharmaceutical preparation manufacturing	**325412**
In-vitro diagnostic substance manufacturing	**325413**
Biological product (except diagnostic) manufacturing	**325414**
Software, audio, and video media reproducing	**33461A**
Newspaper publishers	**511110**
Periodical publishers	**511120**
Book publishers	**511130**
Directory, mailing list, and other publishers	**5111A0**
Software publishers	**511200**
Motion picture and video industries	**512100**
Sound recording industries	**512200**
Internet publishing and broadcasting	**516110**
Internet service providers and web search portals	**518100**
Data processing, hosting, and related services	**518200**
Other information services	**519100**
Nondepository credit intermediation and related activities	**522A00**
Securities, commodity contracts, investments, and related activities	**523000**
Insurance carriers	**524100**
Insurance agencies, brokerages, and related activities	**524200**

Farm machinery and equipment manufacturing	**333111**	Funds, trusts, and other financial vehicles	**525000**
Lawn and garden equipment manufacturing	**333112**	Monetary authorities and depository credit intermediation	**52A000**
Construction machinery manufacturing	**333120**	Real estate	**531000**
Mining and oil and gas field machinery manufacturing	**333130**	Video tape and disc rental	**532230**
Plastics and rubber industry machinery manufacturing	**333220**	Lessors of nonfinancial intangible assets	**533000**
Semiconductor machinery manufacturing	**333295**	Custom computer programming services	**541511**
Other industrial machinery manufacturing	**33329A**	Computer systems design services	**541512**
Optical instrument and lens manufacturing	**333314**	Legal services	**541100**
Photographic and photocopying equipment manufacturing	**333315**	Scientific research and development services	**541700**
Other commercial and service industry machinery manufacturing	**333319**	Advertising and related services	**541800**
Vending, commercial, industrial, and office machinery manufacturing	**33331A**	Management of companies and enterprises	**550000**
Heating equipment (except warm air furnaces) manufacturing	**333414**	Religious organizations	**813100**
Air conditioning, refrigeration, and warm air heating equipment manufacturing	**333415**	Grantmaking, giving, and social advocacy organizations	**813A00**
Air purification and ventilation equipment manufacturing	**33341A**	Civic, social, professional, and similar organizations	**813B00**
Industrial mold manufacturing	**333511**	Other Federal Government enterprises	**S00102**
Special tool, die, jig, and fixture manufacturing	**333514**	General Federal defense government services	**S00500**
Cutting tool and machine tool accessory manufacturing	**333515**	General Federal nondefense government services	**S00600**
Metal cutting and forming machine tool manufacturing	**33351A**	General state and local government services	**S00700**

In Table A.2 I apply the MICS to the BEA GDP by industry accounts that originally employed the SIC system for the 1947-1997 period.

In Table A.3 I apply the MICS to the BEA GDP by industry accounts that originally employed the NAICS for the 1977-2011 period. In Table A.2 and Table A.3 the indentation indicates the level of industry aggregation: the more to the left the greater is the level of aggregation, and the more to the right the lower the level of industry aggregation. In Table A.1, on the contrary, there is no indentation and all industries are at the lowest level of aggregation.

Table A.2: MICS Applied to the 1947-1997 BEA GDP by Industry Accounts under SIC

Productive Activities	Trade, Rental, Leasing
Agriculture, forestry, and fishing	Wholesale trade
Mining	
Construction	Retail trade
Manufacturing	
Transportation	
Electric, gas, and sanitary services	
Telephone and telegraph	**Unproductive Activities**
Radio and television	
	Banking
Hotels and other lodging places	Credit agencies other than banks
Personal services	Security and commodity brokers
	Insurance carriers
Auto repair, services, and parking	Insurance agents, brokers, and service
Miscellaneous repair services	Holding and other investment offices
Amusement and recreation services	Other real estate
Health services	
	Motion pictures
Educational services	
Social services	Legal services
Business services	Membership organizations
Statistical discrepancy	Miscellaneous professional services
Federal Government enterprises	Federal General government
State and local Government enterprises	State and local General government

Table A.3: MICS Applied to the 1977-2011 BEA GDP by Industry Accounts under NAICS

Productive Activities	Trade, Rental, Leasing
Agriculture, forestry, fishing, and hunting	Wholesale trade
Mining	
Utilities	Retail trade
Construction	
Manufacturing	Rental and leasing services and lessors of intangible assets
Transportation and warehousing	
Broadcasting and telecommunications	
	Unproductive Activities
Educational services, health care, and social assistance	
Arts, entertainment, recreation, accommodation, and food services	Administrative and waste management services
	Administrative and support services
Other services, except government	Waste management and remediation services
Federal Government enterprises	Publishing industries (includes software)
	Motion picture and sound recording industries
State and local Government enterprises	Information and data processing services
	Finance and insurance
	Real estate

	Legal services
	Computer systems design and related services
	Miscellaneous professional, scientific, and technical services
	Management of companies and enterprises
	Federal General government
	State and local General government

In Table A.4 I apply the MICS to the BEA net stock of fixed assets and depreciation accounts (FAA) under the NAICS for the 1947-2011 time period, combining private and public nonresidential fixed assets. Unlike the GDP by industry accounts that use both the NAICS and the SIC system, the BEA has a complete series for the whole postwar period for fixed assets and depreciation using only the NAICS.

Table A.4: MICS Applied to the BEA 1947-2011 Fixed Assets and Depreciation Accounts under NAICS

Productive Activities	**Trade, Rental, Leasing**
Agriculture, forestry, fishing, and hunting	Wholesale trade
Mining	
Utilities	Retail trade
Construction	
Manufacturing	Rental and leasing services and lessors of intangible assets
Transportation and warehousing	
Broadcasting and telecommunications	
	Unproductive Activities
Educational services	
	Publishing industries (includes software)
Health care and social assistance	Motion picture and sound recording industries
Arts, entertainment, and recreation	Information and data processing services
Accommodation and food services	Finance and insurance
Other services, except government	Real estate
Government enterprise fixed assets	Legal services
	Computer systems design and related services
	Miscellaneous professional, scientific, and technical services
	Management of companies and enterprises
	Administrative and support services
	Waste management and remediation services
	General government fixed assets

In Table A.5 I apply the MICS to the 1947-2011 BLS series on total employees per industry under the NAICS. The series are from the national annual Current Employment Statistics (CES) survey, not seasonally adjusted. In Table A.5 I also display the BLS industry codes to facilitate identification.

Table A.5: MICS Applied to the BLS 1947-2011 Series on Total Workers under NAICS

Productive Activities	industry code	Trade, Rental, Leasing	industry code
Mining and logging	**10000000**	Wholesale + Retail	**calculated**
Construction	**20000000**		
Manufacturing	**30000000**		
Transportation + warehousing + utilities	**calculated**	**Unproductive Activities**	**industry code**
Professional and business services	**60000000**	Information (includes publishing, software, motion picture and sound recording, video production, movie production, movie exhibition, broadcasting, TV, radio, cable TV, telecommunications, wired carriers, wireless carriers, data processing, hosting, internet)	**50000000**
Education and health services	**65000000**		
Leisure and hospitality	**70000000**		
Other services	**80000000**	Financial activities (includes finance, insurance, real estate, rental, leasing, lessors, lessors of intangible assets)	**55000000**
		Government	**90000000**

In Table A.6 I apply the MICS to the 1947-2011 BLS series on production and nonsupervisory workers per industry that originally used the NAICS and the SIC system. The series are from the national annual CES survey, not seasonally adjusted. The series using the SIC were discontinued in 2002 so it is necessary to combine it with the series under the NAICS. In Table A.6 I also display the BLS industry and series codes to facilitate identification.

Table A.6: MICS Applied to the BLS 1947-2011 Series on Nonsupervisory Workers under SIC and NAICS

system	Productive Activities	industry code	series code
NAICS	Mining and logging	**10000000**	**CEU1000000006**
SIC	Mining	**100000**	**EEU10000003**
NAICS	Construction	**20000000**	**CEU2000000006**
SIC	Construction	**200000**	**EEU20000003**
NAICS	Manufacturing	**30000000**	**CEU3000000006**
SIC	Manufacturing	**300000**	**EEU30000003**
NAICS	Transportation + warehousing + utilities	**calculated**	
NAICS	Professional and business services	**60000000**	**CEU6000000006**
NAICS	Education and health services	**65000000**	**CEU6500000006**
NAICS	Leisure and hospitality	**70000000**	**CEU7000000006**
NAICS	Other services	**80000000**	**CEU8000000006**
SIC	Transportation and public utilities	**400000**	**EEU40000003**
SIC	Services	**800000**	**EEU80000003**
SIC	Transportation + Utilities + Services	**calculated**	

system	Trade, Rental, Leasing	industry code	series code
NAICS	Wholesale + Retail	**calculated**	
SIC	Wholesale and retail trade	**500000**	**EEU50000003**

system	Unproductive Activities	industry code	series code
NAICS	Information	**50000000**	**CEU5000000006**
NAICS	Financial activities	**55000000**	**CEU5500000006**
SIC	Finance, insurance, and real estate	**700000**	**EEU70000003**

The Marxist Industry Classification System therefore provides a way to make compatible official data from the BEA and BLS both across series and through time. The conversion to the MICS is required because the official series were calculated using different methodologies and different methods of industry aggregation during the 1947-2011 period. In order to estimate Marxist categories we need to convert input-output, GDP by industry, and employment data from different sources. The MICS provides the common ground for the conversion. Additionally, the MICS directly embodies the productive-unproductive distinction present in Marxist theory.

A.4 Transforming Official Data into Marxist Categories

The task of this section is to provide a step-by-step explanation of how to transform the official BEA and BLS series into the desired Marxist categories.

Step 1: Apply the MICS to the Benchmark Input-Output Matrices

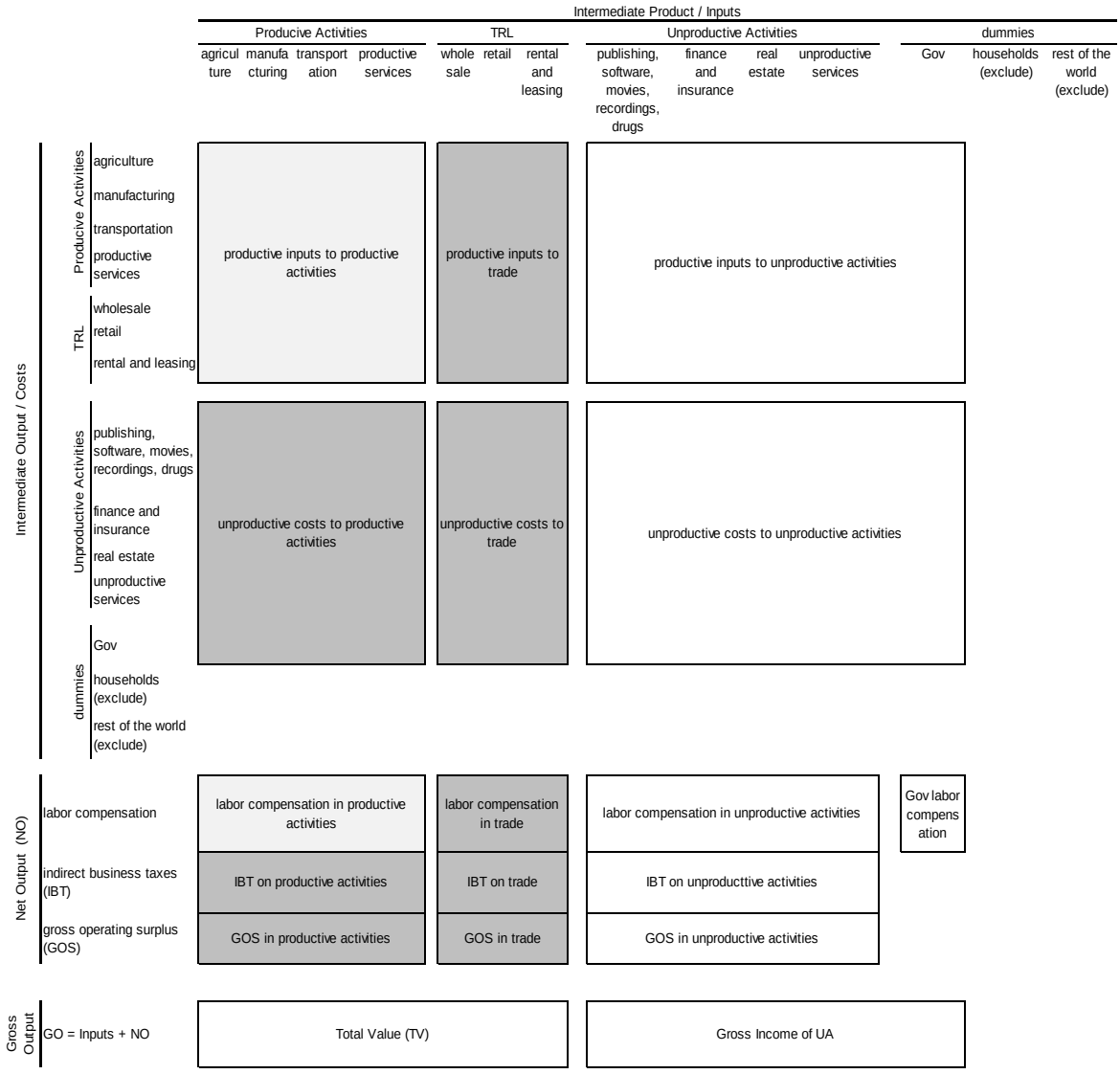
All benchmark I-O tables from 1947 to 2002 are available through the BEA. The first task is to properly mount the *use* matrices and assign industry labels corresponding to each SIC and NAICS codes for every row and column. Matrix sizes vary across years but each detailed I-O table is usually a matrix with roughly 500 rows by 520 columns. Rows indicate the industries producing outputs that are then used as inputs by the industries indicated in columns.

When read vertically, columns in I-O tables show industry gross outputs (GO) in current dollars. Inputs are displayed first and the decomposition of value added appears at the bottom. Value added usually appears divided into four rows: inventory valuation adjustment (IVA), employee compensation (EC), indirect business taxes (IBT), and gross operating surplus (GOS). When read horizontally, rows in I-O tables show industry gross products (GP) in current dollars. Intermediate demands are displayed first and the decomposition of final demand appears at the right-end of the table. Final expenditures usually appear divided into standard Keynesian categories: personal consumption, investment in fixed assets and inventory adjustments, government purchases (local and federal, military and nonmilitary), imports and exports.

Input-output tables published prior to 1997 have industries assorted according to the SIC system. The NAICS has been applied solely to the 1997 and 2002 matrices. As long as each industry for every benchmark year is properly labeled with the corresponding codes and names, it is then possible to re-assort rows and columns according to the MICS. After the MICS has been applied, the interior input matrix of the Marxist I-O table should be symmetrical in term of indus-

tries in rows and columns. At the bottom we still have the decomposition of value added, and the far right we still have the decomposition of final demand.

Figure A.1: Stylized Marxist Input-Output Matrix Using MICS



Notes: The total shaded grey area represents total value (TV) produced. The dark grey shaded are represents a first approximation to surplus value (S). The top-left light grey area represents the circulating (non-fixed) part of constant capital (C), while the lower light grey area represents a first approximation to variable capital (V).

In Figure A.1 I show a stylized Marxist I-O table that represents how actual benchmark I-O tables are to be organized after applying the MICS, independently of their sizes. The procedure is similar to that of Shaikh and Tonak (1994) but with the key difference that activities associated with the production of knowledge and information are classified as unproductive. The procedure deals solely with incomes and revenues by industry and not with expenditures or uses, hence I do not show the expenditures side of the I-O matrix. In a Marxist I-O table we should have productive activities (PA) grouped together row- and column-wise at the top-left, then trade margins and rentals (TRL) in the middle-center, and finally unproductive activities (UA) grouped together row- and column-wise at the bottom-right. The dummy industries (government, household, rest of the world, scrap, and noncomparable imports) should be placed right after unproductive activities.

The total shaded grey area in Figure A.1 represents the total value (TV) produced. The dark grey area represents a first approximation to surplus value (S). The top-left light grey area represents the circulating (non-fixed) part of constant capital (C), while the lower light grey area represents a first approximation to variable capital (V). Since official I-O tables are cast in producers' prices, the rows corresponding to trade margins must also be included in the light grey area representing the productive inputs to productive activities. For the same reason the first approximation to surplus value (S) must include all columns associated with trade and rentals. The gross income of unproductive activities (GI_{UA}) is the row-sum of all columns grouped under unproductive activities. I additionally indicate the areas representing the productive inputs to productive activities (which corresponds to a first approximation to the measure constant capital), unproductive costs to productive activities (which is part of surplus value), productive inputs to unproductive activities, and finally unproductive costs to unproductive activities.

Step 2: Deal With Specific Industries

From the Marxist I-O tables reflecting the MICS we can then proceed to fine-tune some specific industries. The necessary changes are as follows.

The official real estate sector comprises three different activities: (i) real estate brokerage, officially named ‘real estate’, which must be shifted to the unproductive group since it represents land rents; (ii) fictitious rents imputed to owner-occupied dwellings, which must be excluded altogether since the BEA treats homeowners as businesses renting their homes to themselves; (iii) rental and leasing of equipment, which must be shifted to the trade, rental, and leasing (TRL) group since it consists of piecemeal sales of commodities.

The entries in the household dummy industry row and column contain payments and incomes of household servants when they are not hired by an enterprise. Since household servants do not create any surplus value but merely use-values directly consumed by the household, they are part of a non-capitalist mode of production. Household do produce a surplus product but they are paid out of incomes, not capital. When servants are hired by an enterprise, such as home cleaning business, it then appears as a productive service. As it stands, the household dummy row and column should be excluded altogether.

The dummy row and column associated with ‘rest of the world adjustment’ can also be excluded. This entry reflects the incomes of US businesses abroad and therefore consists of an adjustment industry that offers the bridge between the domestic and national products. I exclude these entries since my focus is the domestic and not the national production of surplus value.

Federal, state, and local government enterprises should be put together with productive activities. Federal, state, and local government administration, on the other hand, should be grouped with unproductive activities. The revenues that support government offices and civil servants are deductions from surplus value and in order to avoid double counting of values they must be grouped together with unproductive activities. Additionally, the BEA records the wages and salaries of government employees in a dummy column and row (often labeled ‘general government’) whose entries represent the wage bill of civil servants. Since these wages are incomes

drawn from surplus value, the respective row and column must be shifted to the unproductive activity grouping.

The retail and wholesale trade rows and columns can be directly grouped as trade activities. The rental of equipment and the lease of commodities should also be added to the trade activities group. The rental of information and knowledge-commodities such as the rental of movies, DVDs, CDs, and software, however, should be considered unproductive activity since those commodities carry no value or surplus value.

Every industry should be properly classified and separated both column- and row-wise into one of the three grouping specified in the MICS. We can then proceed to simplify each Marxist I-O table so as to make them resemble the one depicted in Figure A.2, in which I show the simplified Marxist I-O matrix derived from the official 2002 benchmark I-O table. It is a simplified matrix because it shows only the row and column sums within each MICS grouping.

Figure A.2: Simplified Marxist Input-Output Matrix Using MICS for 2002

	Productive Activities	Trade+Rental+Leasing	Unproductive Activities
Productive Activities	**3,866,754**	**284,844**	**1,082,179**
Trade + Rental + Leasing	**432,703**	**57,137**	**67,975**
Unproductive Activities	**1,122,032**	**259,425**	**1,079,658**
Value Added	**4,852,474**	**1,285,745**	**3,818,040**
Compensation of employees	3,164,865	699,708	2,203,645
Taxes on production and imports, less subsidies	205,795	278,253	140,699
Gross operating surplus	1,481,813	307,784	1,409,941

Sources: Author's calculations; BEA.
Note: Nominal figures in millions of 2002 dollars.

As long as all benchmark I-O matrices are transformed into Marxist I-O tables using the MICS, and as long as we deal with specific industries as outlined above, we can then construct a

simplified Marxist I-O table similar to the one in Figure A.2 for each of the BEA benchmark I-O matrices.

Step 3: Interpolate with Annual Data Converted to MICS

Benchmark I-O matrices are much more complete and detailed than any other industry series. Only benchmark I-O tables have detailed information on the inter-industry flows of inputs and outputs, but unfortunately these matrices cover only some specific years. To bridge this gap it is possible to interpolate the years not covered by the benchmark tables using the BEA annual data on GDP by industry. The GDP by industry series, contrary to I-O matrices, do not have information on the production and uses of intermediate goods. The solution is to calculate the ratios of the benchmark I-O entries to corresponding entries in the annual GDP by industry series and then extrapolate them to the non-benchmark years.

First, as explained in Step 1, I apply the MICS to all official benchmark I-O matrices using Table A.1 in order to get Marxist I-O matrices just like the one depicted in Figure A.1. Second, as explained in Step 2, I fine-tune specific industries and then calculate the row and column sums within each of the three MICS groupings. It is then possible to calculate simplified Marxist I-O matrices similar to the one depicted in Figure A.2 for each benchmark year. Third, I apply the MICS to the BEA GDP by industry series on value added. From 1947 to 1997 I use the SIC series on value added and apply the MICS as specified in Table A.2. From 1977 to 2011 I use the NAICS series on value added and apply the MICS as specified in Table A.3. I do not use the NAICS series on value added prior to 1977 because data is missing for many industries. Unfortunately the methodologies used under the NAICS and SIC are different and a quick check on the overlapping years from 1977 to 1997 reveal that they do produce different estimates.

The purpose of Step 3 is to estimate a series of value added for productive activities, trade, and unproductive activities from 1947 to 2011 from the GDP by industry annual data that

can then be used for interpolation. In this procedure, special care must be taken with the real estate row. In the SIC series the real estate industry can be broken down into 'housing' (consisting of the fictitious imputation for owner-occupied housing) and 'other real estate' (consisting of land rents). As can be seen in Table A.2 I simply delete the 'housing' row and then move the 'other real estate' row to the unproductive activities group. The problem emerges, surprisingly, with the newer NAICS series in which it is not possible to exclude the fictitious imputation for owner-occupied housing given that only one row is displayed for the entire real estate sector. In this case I exclude the owner-occupied imputation from the NAICS series by comparing the SIC and NAICS series during the 20 years from 1977 to 1997 when the two datasets overlap. I calculate that between 1947 and 1997 the SIC real estate sector was on average composed of 25% of land rent and 75% of fictitious owner-occupied housing. I then exclude 75% of the real estate row entries in the NAICS series, which brings it very close to the real estate sector estimate without owner-occupied housing in the SIC series for the overlapping years between 1977 and 1997. Since this method produces a very close estimate for land rents between the two series I then apply it to the whole 1977-2011 period in the NAICS data.

With this procedure I can obtain value added for every year for the three industry groupings in the MICS. The removal of the owner-occupied housing brings the 1977-2011 NAICS series in line with the 1947-1976 SIC series on value added per Marxist industrial grouping. The end result is three 1947-2011time series of value added for productive activities, trade, and unproductive activities that properly combine the original SIC and NAICS series.

The next task consists of calculating the ratios of the entries in the simplified Marxist I-O matrices to the respective value added estimates from the annual GDP by industry dataset for all of the benchmark years. Starting from the scheme depicted in Figure A.2 I divide all the main entries in the 'productive activities' column in the simplified Marxist I-O by the value added of productive activities obtained from the GDP by industry annual series. I then divide all the main

entries in the 'trade, rental, leasing' column in the simplified Marxist I-O by the value added of trade obtained from the GDP by industry annual series. Finally I divide all the main entries in the 'unproductive activities' column in the simplified Marxist I-O by the value added of unproductive activities obtained from the GDP by industry annual series. I repeat this procedure for all entries in the simplified Marxist I-O tables except for the decomposition of value added (labor compensation, indirect business taxes, and gross operating surplus), and I do it for all the years covered by the benchmark I-O tables. The coefficients that I obtain are then extrapolated for the years immediately following the benchmark publications until a new benchmark I-O table appears. The coefficients are hence updated every year in which a new benchmark I-O table is published, and then remain fixed for the subsequent years. These same coefficients are then all multiplied by the corresponding 1947-2011 series of value added of productive activities, trade, and unproductive activities.

Let $i = (PA, Trade, UA)$ be the industry grouping in the MICS, t any year from 1947 to 2011, and b any year for which there is a benchmark I-O table. Now let $\mathrm{X}_{\mathrm{i,t=b}}^{\mathrm{IO}}$ indicate the I-O entry for the Marxist industry grouping i for any year $t = b$ when a benchmark matrix is published, then let $\mathrm{VA}_{\mathrm{i,t=b}}^{\mathrm{GDP}}$ indicate the value added calculated from the GDP by industry annual series for the same Marxist industry grouping i for the same year ($t = b$) when a benchmark I-O matrix is published. Therefore the benchmark interpolation coefficients are $x_{i,t=b} = \frac{\mathrm{X}_{\mathrm{i,t=b}}^{\mathrm{IO}}}{\mathrm{VA}_{\mathrm{i,t=b}}^{\mathrm{GDP}}}$, which I then extrapolate for the non-benchmark years ($t \neq b$) when multiplying them by the value added for the same industry grouping i, namely $\mathrm{VA}_{\mathrm{i,t\neq b}}^{\mathrm{GDP}}$. Letting $\mathrm{X}_{\mathrm{i,t\neq b}}$ indicate the extrapolated Marxist I-O entry for a non-benchmark year ($t \neq b$), we have:

$$X_{i,t\neq b} = x_{i,t=b} \,.\, VA^{GDP}_{i,t\neq b} = \left(\frac{X^{IO}_{i,t=b}}{VA^{GDP}_{i,t=b}}\right).VA^{GDP}_{i,t\neq b} \quad \text{(A.1)}$$

The end result are annual series for the entire 1947-2011 period containing estimates for the main entries in the simplified Marxist I-O tables as if we had simplified Marxist I-O tables for every year. The basic idea is to extrapolate the proportions of the I-O matrices to the annual GDP by industry series after applying the MICS. The application of the MICS against the BEA GDP by industry series also has the nice consequence of making the SIC and NAICS series compatible with each other through time.

Step 4: Calculate the Number of Workers

Input-output matrices have information on labor compensation but no information on the number of workers employed in each industry. From the BEA GDP by industry dataset it is possible to obtain the number of full-time equivalent employees (FEE) and the number of persons engaged in production (PEP). The FEE and PEP annual series are available under the SIC system from 1948 to 1997 and under the NAICS from 1998 to 2011. The evident obstacles are that the industry classification and aggregation systems are very different across I-O tables and GDP by industry series, including the change in methodology from 1998 onwards with the introduction of the NAICS.

The first task is to make compatible the I-O, SIC, and NAICS methodologies. I hence regroup industries according to the MICS in the exact same way I did for value added in Step 3. For the SIC series on FEE and PEP I apply the MICS using Table A.2 while for the NAICS series on FEE and PEP I apply the MICS using Table A.3. The MICS therefore offers the common ground across the I-O, SIC, and NAICS datasets. I then construct the full 1948-2011 series combining the 1948-1997 SIC series and the 1998-2011 NAICS series for the three Marxist industry groupings: productive activities, trade, and unproductive activities. Since no data are available for 1947 I

simply suppose that 1947 had the same employment level as 1948. This procedure produces annual information on FEE and PEP for the whole 1947-2011 period.

The second task is to calculate the number of self-employed workers (SEP) recalling that PEP is the sum of FEE and SEP. Let $i = (PA, Trade, UA)$ be the industry grouping in the MICS, and t any year from 1947 to 2011, we have:

$$SEP_{i,t} = PEP_{i,t} - FEE_{i,t} \quad \text{(A.2)}$$

By subtracting the FEE from PEP for each year I estimate the corresponding number of self-employed workers within each Marxist industry grouping.

Step 5: Calculate Employee Compensation

A similar procedure as the one used in Step 4 for the number of workers can be applied to employee compensation (EC). The data are available through the BEA GDP by industry accounts. The EC annual series are available under the SIC format from 1947 to 1997 and under the NAICS format from 1987 to 2011. I then regroup industries according to the MICS in the exact same way I did for value added in Step 3. For the SIC series on EC I apply the MICS using Table A.2 while for the NAICS series on EC I apply the MICS using Table A.3. I can thus obtain annual estimates of EC from 1947 to 2011 for the three industry groupings in the MICS by combining the SIC series from 1947 to 1986 with the NAICS series from 1987 to 2011.

The employee compensation series from the GDP by industry accounts cover only the compensation of full-time equivalent employees ($EC_{i,t}^{FEE}$). Since I use persons engaged in production ($PEP_{i,t}$) as the measure of employment I then need to impute a compensation for self-employed workers ($EC_{i,t}^{SEP}$). Self-employed workers constitute the 'unincorporated business sector' and the BEA does not break down the value added that they produce each year into labor

compensation and gross operating surplus. In this procedure I therefore suppose that self-employed workers receive on average the same compensation as their full-time counterparts in incorporated businesses. I follow Shaikh and Tonak (1994) by imputing a wage equivalent to self-employed workers in the unincorporated business sector. Let $i = (PA, Trade, UA)$ be the industry grouping in MICS, and t any year from 1947 to 2011, we have:

$$EC_{i,t}^{PEP} = \ EC_{i,t}^{FEE} + EC_{i,t}^{SEP} = EC_{i,t}^{FEE} + \left(\frac{EC_{i,t}^{FEE}}{FEE_{i,t}}\right).SEP_{i,t} \qquad \text{(A.3)}$$

I estimate $EC_{i,t}^{SEP}$ by imputing the average compensation of full-time equivalent employees $\left(\frac{EC_{i,t}^{FEE}}{FEE_{i,t}}\right)$ to self-employed workers ($SEP_{i,t}$); and $SEP_{i,t}$ is in turn obtained from Step 4 through equation A.2. I then finally estimate the compensation of PEP as the sum of the compensation of full-time equivalent employees ($EC_{i,t}^{FEE}$) and the imputed compensation of self-employed workers ($EC_{i,t}^{SEP} = \frac{EC_{i,t}^{FEE}}{FEE_{i,t}}.SEP_{i,t}$).

Step 6: Net Out Supervisory Workers from Productive Activities

Productive workers are workers performing productive activities within industries classified as productive in the MICS. Unproductive workers in productive activities and workers in trade and unproductive activities are considered to be unproductive laborers. To net out unproductive labor from productive activities I use the BLS series on total and nonsupervisory employees by industry.

The procedure consists of applying the MICS against the BLS series on total employees and nonsupervisory workers. Both series are organized by industry so the MICS can be applied directly as shown in Tables A.5 and A.6. The BLS series on total employees per industry is com-

plete for all years and is organized solely under NAICS from 1947 to 2011, hence I apply the MICS using Table A.5.

For nonsupervisory workers the BLS has two series: one using the SIC from 1947 to 2002 and another using the NAICS from 1947 to 2011. The first task is to apply the MICS to the SIC and NAICS series on nonsupervisory workers using Table A.6. It is necessary to work with both series at the same time since data for many years are missing: NAICS data for nonsupervisory workers is complete from 1972 onwards but missing for all services from 1947 to 1963, and missing also for transportation, warehousing, and utilities from 1947 to 1971; SIC data is also missing prior to 1964 for services, transportation, and utilities.

To overcome the problem of missing data I proceed as follows. First, I calculate the ratio of nonsupervisory workers in productive activities to 'total private' nonsupervisory workers under NAICS from 1972 to 2011. This ratio is stable at around 70%. From 1964 to 1971 I use 'total private' nonsupervisory workers from the NAICS data and then multiply it by the stable ratio of 70% to get nonsupervisory workers in productive activities only. From 1947 to 1963 I use 'total private' nonsupervisory workers from the SIC data and then multiply it by the stable ratio of 70% to get nonsupervisory workers in productive activities only. Combining the three pieces (1947-1963, 1964-1971, and 1972-2011) I get a complete 1947-2011 estimate of the number of nonsupervisory workers in productive activities. Since I treat all workers in trade and in unproductive activities as unproductive labor I do not need to estimate the share of supervisory workers in them.

I thus have complete series from 1947 to 2011 for both total employees and nonsupervisory workers in productive activities. I then divide one by the other to get annual estimates for the share of nonsupervisory workers in productive activities. I find that on average 18% of all employees in productive activities should be classified as unproductive labor. Letting $\Omega_{i,t}$ indicate

the share of nonsupervisory workers in total employment in the industry grouping $i = (PA, Trade, UA)$ we now have:

$$\Omega_{i,t} = \frac{(nonsupervisory\ workers)_{i,t}^{BLS}}{(total\ workers)_{i,t}^{BLS}} \tag{A.4}$$

I can then multiply the percentage of nonsupervisory workers in productive activities $\left(\Omega_{PA,t}\right)$ by the full-time equivalent employees in productive activities $\left(FEE_{PA,t}\right)$ estimated in Step 4. Notice that I multiply the percentage of nonsupervisory workers by $FEE_{PA,t}$, not $PEP_{PA,t}$, since the persons engaged in production series also includes self-employed workers ($SEP_{PA,t}$). In contrast to Shaikh and Tonak (1994), I proceed in this way because it does not seem reasonable to net out supervisory workers from self-employed workers in productive activities.

Step 7: Estimate the Value of Labor Power

I estimate variable capital (V), or the value of labor power, as the compensation of productive workers in productive activities. The estimate of variable capital has two components: the compensation of nonsupervisory full-time equivalent workers in productive activities $\left(\Omega_{PA,t}\,.\,EC_{PA,t}^{FEE}\right)$, and the imputed compensation of self-employed workers in productive activities $\left(EC_{PA,t}^{SEP}\right)$. To estimate the compensation of nonsupervisory full-time equivalent workers in productive activities I simply multiply the ratio of nonsupervisory workers to total employees $\left(\Omega_{PA,t}\right)$ calculated from the BLS data by the compensation of full-time equivalent employees in productive activities $\left(EC_{PA,t}^{FEE}\right)$ calculated from the BEA data. The imputed compensation of self-employed workers in productive activities is obtained in Step 5 as $EC_{PA,t}^{SEP} = \frac{EC_{PA,t}^{FEE}}{FEE_{PA,t}}.SEP_{PA,t}$. Using equations A.2 through A.4 I can then estimate variable capital (V) in year t as:

$$V_t = \Omega_{PA,t} \, . EC^{FEE}_{PA,t} \; + \; EC^{SEP}_{PA,t} \tag{A.5}$$

Step 8: Calculate Stocks of Fixed Assets and Depreciation

To estimate fixed assets and their depreciation per MICS grouping I use the BEA annual data on the current-cost net stock of fixed assets and depreciation by industry for both nonresidential private and government entities as available in the Fixed Assets Accounts (FAA).

To estimate the net stock of fixed assets I proceed as follows. I firstly obtain data on current-cost net stock of fixed assets, yearend estimates, from the FAA under NAICS for the entire 1947-2011 period. I use data for both private and government-owned fixed assets through the BEA Tables 3.1ES, 7.1A, and 7.1B. Total fixed assets include stocks of equipment, software, and structures at replacement costs. I then apply the MICS using Table A.4 to classify and separate industries and subsequently combine the data for private and government-owned fixed assets. To make numbers compatible with other Marxist estimates I finally convert units to millions of dollars. In order to exclude residential assets I estimate net stocks in unproductive activities net of the real estate sector.

The purpose of classifying the stock of fixed assets into the three industry groupings according to the MICS is to break down the annual estimate of the total capital stock (K) in the economy as the sum of the capital stocks in productive activities (K_{PA}), in trade, rental, and leasing (K_{TRL}), and finally in unproductive activities net of real estate (K_{UA}):

$$K_t = K_{PA,t} + \; K_{TRL,t} + K_{UA,t} \tag{A.6}$$

The next task consists of applying a similar procedure to the current-cost depreciation of the stocks of fixed assets using data for both private and government-owned fixed assets from

BEA Tables 3.4ES, 7.3A, and 7.3B. I apply the MICS according to Table A.4 so as to classify and separate industries and subsequently combine the data for private and government-owned fixed assets. To make numbers compatible with other Marxist estimates I finally convert all units to millions of dollars. Also, in order to exclude the depreciation of residential assets I estimate the depreciation of net stocks in unproductive activities net of the real estate sector.

The purpose of classifying depreciation according to the three industry groupings in the MICS is to break down the annual estimate of total capital stock depreciation (δ) in the economy as the sum of capital stock depreciations in productive activities (δ_{PA}), in trade, rental, and leasing (δ_{TRL}), and finally in unproductive activities net of real estate (δ_{UA}):

$$\delta_t = \delta_{PA,t} + \delta_{TRL,t} + \delta_{UA,t} \tag{A.7}$$

Step 9: Estimate Constant Capital

I estimate constant capital (C) as the use up of productive inputs in productive activities. Productive inputs $\left(A_{i,t}^{PA}\right)$ are the outputs of productive activities that are then used as inputs by any other activity i. For the measure of constant capital I only consider the outputs of productive activities that are then used as inputs by productive activities. Constant capital (C) then consists of two parts: the productive inputs directly consumed in productive activities $\left(A_{PA,t}^{PA}\right)$, which correspond to circulating capital, and the depreciation of the stock of fixed assets in productive activities $\left(\delta_{PA,t}\right)$, which corresponds to the fixed capital used up. Let $A_{i,t}^{j}$ indicate the outputs of activity j that are used as inputs by activity i in time t, then:

$$C_t = A_{PA,t}^{PA} + \delta_{PA,t} \tag{A.8}$$

The productive inputs used up in productive activities can be obtained from the simplified Marxist I-O tables in Step 2 and also from the annual interpolations for the non-benchmark years in Step 3. The depreciation of the capital stock is obtained in Step 8. As displayed in Figure A.1, since I-O matrices are cast in producers' prices the estimate of $A_{PA,t}^{PA}$ has to include the corresponding rows of trade margins.

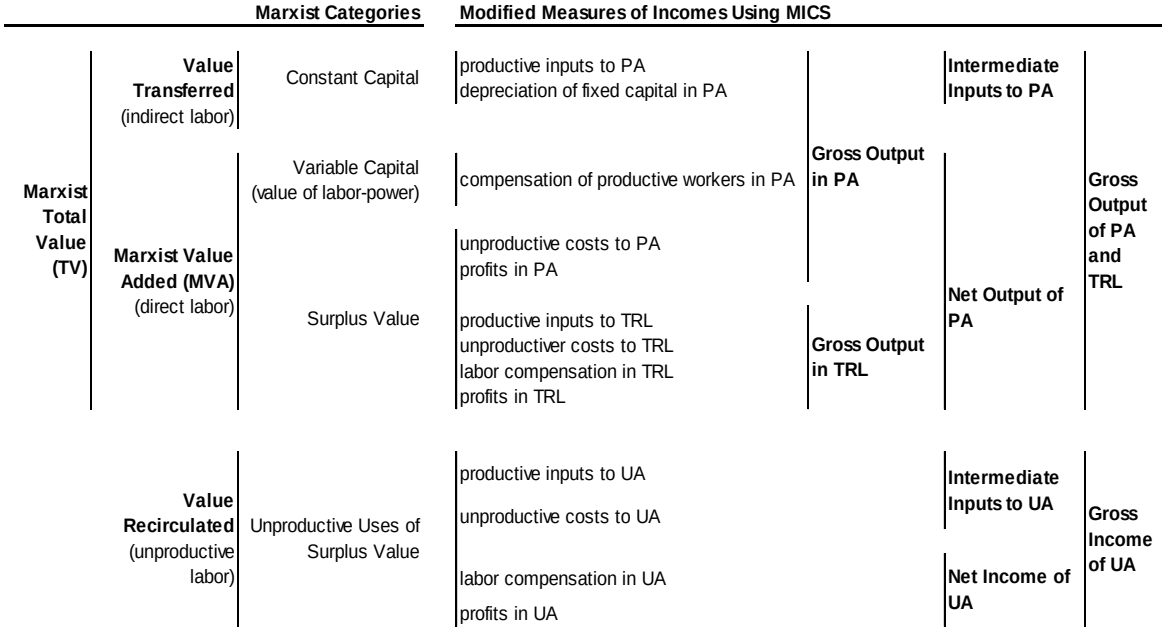
Step 10: Estimate Total Value, Marxist Value Added, and Surplus Value

The total value (TV) produced in the United States economy can now be estimated from the series obtained in previous steps. From the simplified Marxist I-O tables and the annual interpolations it is possible to estimate TV for each year from 1947 to 2011 as the sum of the gross output of productive activities (GO_{PA}) and the gross output of trade, rental, and leasing (GO_{TRL}). Since I-O matrices are cast in producers' prices the gross output of TRL needs to be added to the measure of total value. Trade, rental, and leasing clearly belong to the sphere of circulation and therefore are unproductive activities from the Marxist perspective, but because I-O matrices put trade margins in trade industries we then have to add these activities to the measure of total value produced in order to consider both the full production and piecemeal realization of value.

In Figure A.3 I display the correspondences between key Marxist categories and the modified measures of income derived from the official national accounts after the application of the MICS. The mathematical correspondences are as follows. Let $A_{i,t}^{j}$ indicate the outputs of activity j that are used as inputs by activity i in time t, and let $NO_{i,t}$ indicate the net output of activity i. The gross output of any activity i is the sum of all the inputs used up $\left(\sum_j A_{i,t}^{j}\right)$ and the net output:

$$GO_{i,t} = \sum_{j} A_{i,t}^{j} + NO_{i,t} \tag{A.9}$$

Figure A.3: Mapping between Marxist Categories and Modified Measures of Incomes using MICS



Notes: PA = productive activities; TRL = trade, rental, and leasing; UA = unproductive activities; MICS = Marxist Industry Classification System.

I estimate the Marxist total value in year t as the sum of the gross outputs of productive activities together with trade, rental, and leasing:

$$\begin{aligned} TV_t &= GO_{PA,t} + GO_{TRL,t} \\ &= A_{PA,t}^{PA} + A_{PA,t}^{UA} + NO_{PA,t} + A_{TRL,t}^{PA} + A_{TRL,t}^{UA} + NO_{TRL,t} \end{aligned} \tag{A.10}$$

The Marxist value added (VA) is then estimated as the total value less the value of constant capital. The measure of constant capital from equation A.8 includes depreciation, hence the measure of Marxist value added becomes net of depreciation:

$$VA_t = TV_t - C_t \tag{A.11}$$

I finally estimate the surplus value (S) produced in the United State economy for each year as the Marxist value added minus variable capital, which is the value of labor power calculated through equation A.5:

$$S_t = TV_t - C_t - V_t = VA_t - V_t \tag{A.12}$$

It then becomes simple to estimate other Marxist categories.

Step 11: Estimate Measures of Unproductive Accumulation

As long as Steps 1 through 10 are followed correctly it also becomes straightforward to compute measures associated with unproductive accumulation. Using the general scheme depicted in Figures A.1 through A.3, as well as equations A.9 through A.12, we can estimate the gross unproductive burden (GUB), net unproductive burden (NUB), and the unproductive composition of capital (UCC).

I compute the annual surplus income of unproductive activities (SI_{UA}) as the net income of unproductive activities (NI_{UA}) minus employee compensation in these same activities:

$$SI_{UA,t} = NI_{UA,t} - EC_{UA,t}^{PEP} \tag{A.13}$$

In the case of unproductive activities I make no distinction between supervisory and non-supervisory workers, which implies that the total employee compensation $EC_{UA,t}^{PEP}$ can be obtained directly via equation A.3 for unproductive workers in unproductive activities.

Step 12: Break Down Unproductive Accumulation into Its Subcomponents

The gross and net incomes of unproductive activities ($GI_{UA,t}$ and $NI_{UA,t}$ respectively) can be further decomposed into five sub-categories: (i) government administration, consisting mostly of the government wage bill at all levels with the exception of productive government enterprises; (ii) finance and insurance, including the former federal commodity credit corporation (CCC); (iii) non-profit organizations and unproductive services, such as legal services and corporate management; (iv) real estate, comprising land-rents accruing to agents, managers, operators, and lessors; (v) knowledge and information rents, comprising all incomes from activities involving advertising, pharmaceuticals, software production, data management, research and development, publishing industries, sound recording, and movie production. For each Marxist benchmark I-O matrix, as depicted in Figure A.1, I separate unproductive industry columns according to these five sub-categories, and then compute a summary sheet as shown in Figure A.4.

Figure A.4: Decomposition of Unproductive Activities for the 2002 Input-Output Matrix

Decomposition of Unproductive Activities	Net Income (VA or NIua)	Gross Income (GIua)
Knowledge and Information (knowldge-rents)	**663,075**	**1,083,920**
Real Estate (agents, managers, operators, and lessors)	**642,766**	**815,660**
Finance and Insurance	**884,082**	**1,514,384**
Non-Profit Org, Unproductive Services, Legal Services	**486,637**	**801,786**
Government services (except productive enterprises)	**1,141,479**	**1,832,104**
Total	**3,818,040**	**6,047,852**

Sources: Author's calculations; BEA.
Note: Nominal figures in millions of 2002 dollars.

Since benchmark matrices are only available for certain specific years it becomes necessary to interpolate the years not covered by the benchmark matrices with annual data from the estimated 'value added' of unproductive activities, analogously to what is described in Step 3. Let t be any year from 1947 to 2011, and b any year for which there is a benchmark I-O table. Now let $\mathrm{H}^{\mathrm{IO}}_{\mathrm{UA,t=b}}$ indicate any I-O unproductive sub-category (as in figure A.4) for any year $t = b$ when a benchmark matrix is published; then let $\mathrm{VA}^{\mathrm{GDP}}_{\mathrm{UA,t=b}}$ indicate the 'value added' of unproductive activities calculated from the GDP by industry annual series for the same year ($t = b$) when a benchmark I-O matrix is published. Therefore the benchmark interpolation coefficients are $h_{i,t=b} = \frac{\mathrm{H}^{\mathrm{IO}}_{\mathrm{UA,t=b}}}{\mathrm{VA}^{\mathrm{GDP}}_{\mathrm{VA,t=b}}}$, which I then extrapolate for the non-benchmark years ($t \neq b$) when multiplying them by the value added of unproductive activities, namely $\mathrm{VA}^{\mathrm{GDP}}_{\mathrm{UA,t\neq b}}$. Letting $\mathrm{H}_{\mathrm{i,t\neq b}}$ indicate the extrapolated unproductive sub-category for a non-benchmark year ($t \neq b$), we have:

$$H_{i,t\neq b} = \; h_{i,t=b} \,.VA^{GDP}_{UA,t\neq b} \; = \left(\frac{H^{IO}_{UA,t=b}}{VA^{GDP}_{UA,t=b}}\right).VA^{GDP}_{UA,t\neq b} \qquad \text{(A.14)}$$

The interpolation coefficients $h_{i,t=b}$ that I obtain are extrapolated for the years immediately following the benchmark publications until a new benchmark I-O matrix appears. The coefficients are then updated every year in which a new benchmark I-O table is published, and remain fixed for the subsequent years. Using equation A.13 and Figure A.4 it is possible to arrive at annual estimates for the five unproductive sub-categories for both the gross and net incomes of unproductive activities.

From Step 8 it is also possible to decompose the current-cost nonresidential net stock of fixed assets of unproductive activities (excluding real estate), trade, rental, and leasing into five sub-categories: (i) trade, rental, and leasing; (ii) knowledge and information; (iii) finance and in-

surance; (iv) unproductive services; and (v) general government, excluding public enterprises. Annual data is available through the BEA FAA under the NAICS for the entire 1947-2011 period.

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