Information Rents, Economic Growth, and Inequality: An Empirical Study of the United States

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Abstract

In this paper I estimate the impact of unproductive activities on economic growth, labor productivity, and income inequality in the United States from 1947 to 2011. Productive activities directly create value, while unproductive activities do not. I develop a new methodology to compute the growth of productive and unproductive activities in terms of flows of income and stocks of fixed assets using input-output matrices and national income accounts. A core feature of my methodology is the notion that the commodification of knowledge and information gives rise to "information rents". Information rents are, as I demonstrate, a determinant factor of growth and distribution. I find that unproductive activities have a net positive effect on economic growth and labor productivity, but at the price of increasing income inequality. Unproductive activities that rely on information rents, in particular, have increased income inequality and slowed down valued-added growth despite their positive contribution to labor productivity. Information rents have drawn too much value from productive activities and benefitted the top income earners.

Key Words: Unproductive Activity, Information Rents, Growth and Distribution, Inequality, Time Series Econometrics

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1. Introduction

In this paper I estimate the impact of unproductive activities on economic growth, labor productivity, and income inequality in the United States from 1947 to 2011. Productive activities directly create value, while unproductive activities do not. I develop a new methodology to compute the growth of productive and unproductive activities in terms of flows of income and stocks of fixed assets using input-output matrices and national income accounts. A core feature of my methodology is the notion that the commodification of knowledge and information gives rise to "information rents". Information rents, as I demonstrate, are a determinant factor of growth and distribution. I find that unproductive activities have a net positive effect on economic growth and labor productivity, but at the price of increasing income inequality. Unproductive activities that rely on information rents, in particular, have increased income inequality and slowed down valued-added growth despite their positive contribution to labor productivity. Information rents have drawn too much value from productive activities and benefitted the top income earners.

Unproductive activity is any economic activity that does not *directly* produce new value. From a classical Political Economy perspective, to be *productive* an activity must have workers creating useful commodities with value for sale. Activities that create new use-values or recirculate existing use-values, but not new commodities with value, are considered to be *unproductive*. Unproductive activities do not directly add any new value to the economy and therefore draw their incomes from the value generated in productive activities. Productive activities create and also consume value, but unproductive activities only consume it (Shaikh 2016; Shaikh and Tonak 1994).

The productive-unproductive differentiation relies on the concept of *value* and, as such, derives from the classical Political Economy notion that value needs to come from somewhere (Foley 2013). Unproductive means neither unnecessary nor less important, and it is not a derogatory term. Neither is there a direct connection between productive activity and tangible goods, given that services and intangible commodities can be the output of productive activities. Moreover, unproductive endeavors must be conceptualized as *activities* instead of *sectors* since most enterprises and industries operate with a mix of productive and unproductive activities, with few firms actually being classified as purely productive or purely unproductive (Rotta 2018).

Despite directly drawing from the value pool of productive endeavors, unproductive activities can well enhance labor productivity or boost demand in productive activities, thus *indirectly* enabling and improving the creation of value. There is hence a double effect under consideration in my estimations: unproductive activity might *indirectly* increase labor productivity, or increase aggregate demand, and thus boost value-added growth while it still draws from the value that it does not *directly* produce. The relation between productive and unproductive activity, therefore, can be a relation of *substitutability* (crowding out) or one of *complementarity* (crowding in). Commercial banks, for example, can create liquidity and enable a higher rate of investment in productive activities. The same banks, under different circumstances, might create liquidity to finance stock buybacks which would not necessarily enable the creation of value added, and might even be detrimental to value creation.

My empirical approach shows that the indirect boost has been greater than the direct draw from the value pool, implying that unproductive activity has had a *net positive* impact on economic growth and labor productivity in the United States. In the aggregate, there has been a *net crowding in* effect between unproductive and productive activity. But despite its net positive contribution to productivity and growth, the rise of unproductive activity has significantly contributed to the rapid increase in income inequality in the post-1980 period.

In this study I develop a new methodology to compute aggregate estimates of productive and unproductive activities using data from input-output matrices, national income accounts, and fixed assets accounts for the Unites States economy between 1947 and 2011. A key difference of the approach developed in this paper in relation to previous studies is the treatment of knowledge and information production as forms of unproductive activity. Information requires labor time to be produced but tends to require no labor time to be reproduced. Because the value of a commodity is determined by the labor time necessary to reproduce it, the production and ownership of knowledge and information do not directly create new value. Intellectual property rights then allow the owners of commodified information to extract *information rents* from other activities in the economy (Rotta 2018; Rotta and Teixeira 2019, 2016; Teixeira and Rotta 2012). Corporate producers and owners of commodified information (like Google, Amazon, Microsoft, Apple, Facebook, Uber, Netflix, Alibaba, Airbnb etc.) now rank among the biggest companies in terms of global revenues and market capitalization.

The evidence presented in this paper suggests that information rents have drawn "too much" from the value pool, whose creation they enabled in the first place. My econometric estimations indicate that unproductive activities that rely on information rents as sources of income have significantly contributed to enhance labor productivity in the American economy, but at the price of slowing value-added growth in productive activities and also contributing significantly to the rise in the income shares of the top 1% and top 0.1% earners. The values channeled through information rents have benefitted the top income earners and, hence, have widened income inequality.

The paper is organized as follows. In the second section I compare my theoretical framework and empirical findings with previous studies. In the third section I present different measures of the evolution of productive and unproductive activity in the United States economy between 1947 and 2011. In the fourth section I present my econometric estimates and show that unproductive activity has had a net positive effect on economic growth and labor productivity. I also show how information rents, in particular, have contributed to increase labor productivity despite reducing value-added growth and increasing the income share of the top 1% and top 0.1% earners. In the last section I present my final remarks on unproductive activity, economic growth, and inequality. In the (online) appendix I present further technical details on the econometric approach, impulse-response simulations, and the complete classification of productive and unproductive activities.

2. Comparison with Previous Studies

In this section I review the most recent literature on the rise of unproductive activities and their impact on economic growth, labor productivity, and the distribution of income in the United States and across countries. Particular attention is given to the direction of causality between productive and unproductive growth, and also to the specific roles of finance and knowledge commodification. In the first subsection I begin by explaining how my estimates complement the existing scholarship, which has hitherto focused mostly on the effects of finance and financial assets using panel data for the post-1980 period.

2.1 Contributions to the Literature

The paper provides a complementary and innovative treatment of the dynamic effects between productive and unproductive activity in the United States economy. The main contributions of the paper to the existing literature are as follows. First, most empirical studies have employed panel data models either across countries or across firms within particular countries, most often within the US and UK economies (as in Arcand et al. 2015; Autor et al. 2020; Bivens and Mishel 2013; Cecchetti and Kharroubi 2015, 2012; Davis 2018, 2017, 2016; Kneer 2013; Kohler, Gushanski, and Stockhammer 2019; Law and Singh 2014; Orhangazi 2008; Tori and Onaran 2018). The main limitation of panel regressions is data availability, which mostly start in the 1980s for panel datasets and, hence, miss the transition from the Regulated to the Neoliberal phase of Western capitalism. My approach, on the contrary, uses annual time series from 1947 to 2011 and thus covers both the pre- and post-1980 institutional regimes.

Second, empirical studies of the United States use firm-level data that focus mostly on the manufacturing sector, which is the sector with greater data coverage at the firm level (as in Autor et al. 2020); or focus solely on listed companies given the difficulty to find reliable data on unlisted firms (as in Davis 2018 and Orhangazi 2008). My approach, on the contrary, uses industry-level data from input-output matrices and then aggregates them into several measures of productive and unproductive forms of economic activity at the national level. My estimates thus cover all sectors of the US economy from 1947 to 2011 while also controlling for the gross and net measures of output.

Third, the econometric estimates in this paper control for the short- and long-run effects of unproductive activity on value-added growth, labor productivity, and income inequality (and therefore complement the descriptive approaches of Orhangazi 2019; Rikap 2021; and Shaikh and Tonak 1994). Fourth, the econometric estimates control for the income flows and the investment expenditures in fixed assets across productive and unproductive activities. Fifth, the estimates control for the rise not only of finance but also of the knowledge economy through the measurement and econometric modelling of knowledge rents. While also controlling for financial activities, the paper emphasizes the role of knowledge rents as a driver of economic growth, labor productivity, and income inequality (unlike the usual differentiation between financial and nonfinancial corporations, as in Arcand et al. 2015; Bivens and Mishel 2013; Cecchetti and Kharroubi 2015, 2012; Davis 2018; Kneer 2013; Orhangazi 2008; Tori and Onaran 2018; Kohler, Guschanski, and Stockhammer 2019).

Sixth, my approach develops a consistent treatment of the labor theory of value and of commodified knowledge, providing empirical estimates of knowledge rents (unlike previous approaches in the Marxist tradition that do not theorize or measure information rents, as in Shaikh and Tonak 1994; Mohun 2014, 2006, 2005; Wolff 1987; Moseley 1997, 1992, 1985; Tsoulfidis and Paitaridis 2019; Paitaridis and Tsoulfidis 2012). The proposed theoretical framework brings together Marx's value theory, the determination of commodities' values by the labor time necessary to reproduce them, and the productive-unproductive distinction.

2.2 THE DIRECTION OF CAUSALITY

Economists have been divided for a long time regarding the implications of unproductive activity. Thomas Malthus (1820) and some of his modern followers understand that unproductive expenditures are a saving grace, for they generate demand and employment without necessarily generating supply. Malthus argued that unproductive expenditures, even if from the rentier classes, can pump up a system suffering from a chronic lack of demand. David Ricardo (1821) 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. For the United States economy in particular, the first empirical studies on unproductive activity and its impact on productive growth date back to the 1960s. There has been, however, no final agreement on the net effects between productive and unproductive activity.

The scholarship has also long debated the direction of causality between unproductive and productive activity. On one side of the literature, we find the advocates of the hypothesis that faster unproductive growth is preceded by an earlier phase of productive stagnation. Examples of this branch of the literature are Baran and Sweezy (1968), Sweezy and Magdoff (1987), and Harvey (2003; 2005). These authors have suggested that companies first experienced a decline in productive profitability before shifting their investments towards unproductive activities such as marketing, advertisement, finance, insurance, and real estate. What explains the shift from productive to unproductive forms of investment, these authors claim, is a prior profit squeeze in productive activities. More recently, Kliman and Williams (2015) claimed that the explanation for the slowdown in the American economy in the post-1980 era was a profit rate decline rather than a lack of enough funding to finance investment in fixed assets. They argued that the interplay between investment in fixed assets and financial payments and purchases is not necessarily a zero-sum game, as many would suggest, because liquidity is created endogenously and hence these expenditures do not compete over shares of a fixed sum of funding.

On the other side of the literature, we locate the advocates of the opposite hypothesis, namely that productive activity stagnates because of a previous episode of faster unproductive growth. The rationale for this hypothesis is that unproductive activity draws from the value added created in productive activities and, hence, leaves less of it to be reinvested in productive outlets. The key studies in this group are those of Shaikh and Tonak (1994), Edward Wolff (1987), Fred Moseley (1997; 1992; 1985), Simon Mohun (2014; 2006; 2005), Tsoulfidis and Paitaridis (2019), Paitaridis and Tsoulfidis (2012), Cockshott, Cottrell, and Michaelson (1995).

Shaikh and Tonak (1994), in particular, posit that the interaction between unproductive and productive activities is more nuanced and the effects must be separated into the short and long runs. In a dynamic setting, a rise in unproductive expenditures may indeed stimulate demand and productive output in the short run (as Malthus had originally claimed). But in so far as it diminishes the share of value that stays within productive activities, unproductive activity reduces the rate of productive growth over the longer run (as Ricardo had originally claimed). My findings confirm Shaikh and Tonak's hypothesis that the impacts of unproductive activity should be distinguished between the short- and long-run effects.

2.3 The Role of Finance

Finance is certainly the type of unproductive activity that has undergone the greatest level of scrutiny in the recent literature. A growing body of empirical work has found that an oversized financial sector does have negative implications for value-added growth, and hence that "too much" finance can cause a misallocation of resources away from productive activity (Lapavitsas 2013).

In a comprehensive examination of the effects of excessive financial activity on economic growth, Arcand, Berkes, and Panizza (2015) find robust evidence of an inverted-U relationship between the ratio of total private credit over GDP and real GDP growth per capita. Using panel data for 67 countries from 1960 to 2010, they find that the total volume of credit directed to the private sector (comprising bank credit and credit from the shadow banking system allocated to firms and households) has a positive effect on real GDP per capita growth up to a certain treshold, which they estimate at between 80% and 120% of GDP. But beyond this treshold the level of credit over GDP begins to have a significant negative effect on real GDP per capita growth. Law and Singh (2014) find similar results using a sample of 87 developed and developing countries from 1980 to 2010. They employ different measures of financial growth and argue that a dynamic panel method with an endogenous threshold effect is more appropriate than the usual quadratic specification in modelling the inverted-U effect of finance on growth. Arcand, Berkes, and Panizza (2015) and Law and Singh (2014) conclude that there is indeed an optimal level beyond which a country has "too much" finance. They argue that the main reasons behind this result are a misallocation of labor and resources away from productive activities, and that an oversized financial sector tends to create credit not to finance production but to fund the purchase of existing assets, leading to asset price bubbles, financial crises, and increased macroeconomic volatility.

In a previous study of how the excess growth of finance leads to a misallocation of resources, Tobin (1984) suggested that a large financial sector might cause a brain drain from the productive sectors of the economy. Drawing on Tobin's (1984) argument, Kneer (2013) and Cecchetti and Kharroubi (2015; 2012) show that a large financial sector has a negative impact on industries that, for technological reasons, need skilled workers. Using a panel of 13 countries from 1980 to 2005, Kneer (2013) finds that financial liberalization decreases labor productivity and value-added growth disproportionally in industries which rely strongly on skilled labor. Similarly to Arcand, Berkes, and Panizza (2015) and Law and Singh (2014), Cecchetti and Kharroubi (2015; 2012) find that at 90% of GDP, private sector credit extended by banks begins to harm GDP growth, and that the faster the financial sector grows, the slower the economy as a whole grows. Hence, a large and rapidly growing financial sector places a burden on the rest of the economy. In particular, they claim that financial growth disproportionately harms financially dependent and

R&D-intensive industries. Cecchetti and Kharroubi (2012) also estimate that finance tended to damage economic growth when it accounted for more than 3.9% of total employment.

In the post-Keynesian literature, empirical studies on finance have also estimated the effects of financial activities on investment, GDP growth, and wages. The most recent scholarship argues that the change in corporate governance toward shareholder value maximization has become a key determinant of the behavior of nonfinancial corporations.

Davis (2018; 2017; 2016) and Orhangazi (2008) use firm-level data for nonfinancial corporations listed in the United States and find that the level of financial assets and financial payments (interest payments, dividends, and stock buybacks) have risen rapidly in the post-1980 period. The data also reveal that corporations have received significantly more financial income by holding financial assets on their balance sheets. Orhangazi (2008) estimates a dynamic panel model and finds that both financial payments and financial profits reduce nonfinancial firms' investment rates in fixed assets, particularly among large firms. Utilizing firm data from 1971 to 2013, Davis (2018; 2017; 2016) improves Orhangazi's (2008) methodology and finds that payments to shareholders via dividends and stock buybacks need to be explored independently from interest payments to creditors. Davis (2018) proxies shareholder value orientation using average yearly industry-level stock buybacks, a variable that is exogenous to any individual firm in the industry. Among large firms, payments to shareholders depress investment rates significantly. Among smaller companies, firm-level sales volatility has a stronger negative effect on investment rates. Financial profits made by nonfinancial corporations have a significant positive effect on investment for large firms, and holdings of financial assets are positively correlated with fixed investment for all firm sizes. Davis (2018) concludes that while shareholder value maximization (via increasing dividend payments and stock repurchases) has depressed investment in large firms, the stocks of financial and nonfinancial assets are actually *complementary* to each other, therefore rejecting the hypothesis that the acquisition of financial assets by nonfinancial firms have crowded out physical investment. Tori and Onaran (2018) apply a similar methodology to firm-level data from nonfinancial listed companies in the UK economy between 1985 and 2013. Even though not controlling for financial asset holdings, they find that financial payments and financial incomes have harmed investment in physical fixed assets.

Kliman and Williams (2015) use the notion of endogenous credit creation to call into question the hypothesis that financialization implies a reduction of available funds for investment in fixed assets. They claim that financial payments and purchases are not necessarily detrimental to firm investment, as these factors may actually improve investment and growth through leveraging. Companies' financial constraints, they argue, are not restricted to internal funds if they have easier access to credit or other financial sources of income. While Davis (2018; 2017; 2016), Orhangazi (2008), and Tori and Onaran (2018) conclude that shareholder value orientation is one of the main causes of financialization and lower investment rates, Kliman and Williams (2015) conclude that the main explanation for the lack of investment and growth is declining profitability.

2.4 Financialization versus Production Offshoring

Firm-level datasets that are restricted to the domestic economy, however, might not be enough to disentangle the effects of financialization from those of outsourcing and offshoring in the post-1980 period. Firm-level data on tangible fixed assets that are constrained to national borders are unlikely to capture the effects of cross-border reallocation of production and the effects of globalized networks of production. If the financialization of the United States happened *pari passu* with outsourcing and offshoring to Asian countries, then only global data on multiple countries could help to partial out the effects of finance and globalization. Even firm-level data provided on a consolidated basis, including both the parent companies and their subsidiaries, would not circumvent Milberg and Winkler's (2010) critique that offshoring blurs the links between financialization and accumulation. If companies in the US, UK, and Europe were accumulating fixed assets in-house prior to 1980 and, in the period after 1980, shifted to increasingly outsourced production to Asian companies in China, Taiwan, Vietnam etc., then the consolidated data would not reflect the outsourcing and offshoring of supply chains, given that the companies in Asia are not necessarily subsidiaries. Milberg and Winkler (2010) argue that the globalization, offshoring, and outsourcing of production networks have increased the profit shares in high-income countries. But the extra profits were channeled to interest payments, dividends, and stock buybacks instead of financing domestic investment in tangible assets.

2.5 THE IMPORTANCE OF INCOME AND WEALTH DISTRIBUTION

Using aggregate data for the United States, UK, France, and Germany, van Treek (2008) finds that the declining correlation between aggregate profits and investment is an outcome of shareholder value maximization and growing consumption out of profit income. Despite the rise in the profit share in the post-1980 period, companies have not reinvested the extra profits into production. Amid a declining wage share and declining rates of investment, van Treek (2008) claims that GDP growth was still possible because consumption out of profit income and wealth effects kept aggregate consumption growing.

Utilizing aggregate data for the United States, Onaran, Stockhammer, and Grafl (2011) find that the rentier profit share of GDP has risen at the expense of both wages and non-rentier forms of profit. The redistribution of income away from wages and non-rentier profit income has contributed to the stagnation of investment rates and would have caused stagnation in GDP growth if it were not for the positive wealth effects from shareholders. In this regard, Onaran, Stockhammer, and Grafl' (2011) and van Treek (2008)'s argument that consumption by shareholders can keep growth apace is similar to Malthus' (1820) erstwhile insight that the consumption of the rentier classes can compensate for the lack of demand out of wage income and investment.

In an empirical study that does control for trade and capital account openness, Kohler, Guschanski, and Stockhammer (2019) estimate the impact of financialization and globalization on the wage shares of

14 developed countries from 1992 to 2014. They find that financial openness (openness of current account transactions), financial globalization (foreign assets plus foreign liabilities divided by GDP), net financial payments (interest plus dividends) of nonfinancial corporations, and trade openness (exports plus imports over GDP) all have significant negative effects on the wage share. Kohler, Guschanski, and Stockhammer (2019) estimate that capital account openness and financial payments from nonfinancial corporations have had a negative effect on the wage in the same order of magnitude as the effects of trade openness. In terms of its contribution to the fall in the wage share, the financialization of nonfinancial corporations has a similar effect to that of financial and trade globalization. Kohler, Guschanski, and Stockhammer (2019) also find that international capital mobility has a much stronger and significant negative impact on wages than labor mobility through migration. These results provide evidence that globalization is a major determinant of the fall in the wage shares of high-income countries.

2.6 The Labor Value of Commodified Knowledge

The Political Economy concept of unproductive activity, however, is broader than that of financialization and it includes other types of activities that do not directly create new value added. Examples of unproductive activities are finance and insurance, retail and wholesale trade, public administration, national defense, non-profit organizations, and real estate. But as Rotta (2018), Rotta and Teixeira (2016; 2019), and Teixeira and Rotta (2012) have claimed, the concept of unproductive activity also includes all economic activities that commodify knowledge and information. Intellectual property rights assure rent-like revenues to information proprietors such as pharmaceutical companies, software and app developers, data and tech companies, biotech companies, publishers, movie producers, record music companies, advertising and marketing companies, social media, and streaming platforms.

In a Marxist framework, an economic activity must *directly* produce new value added in order to be classified as productive. To be directly productive of new value added, an economic activity must fulfill two necessary conditions: (i) it must produce useful goods or services for profit, meaning that it must produce commodities; (ii) these commodities must require labor time (direct living labor) to be *reproduced*, otherwise they are commodities with zero value and thus zero value added and zero surplus value. Marx and the ensuing Marxist tradition have emphasized the first condition but largely took for granted the second condition, probably because most studies have either focused on tangible goods or not paid particular attention to the huge gap between the production and reproduction time of intangible goods. Technology has a major impact on reducing the reproduction time of new commodities, given that computers can now automate many tasks with very little (or no) direct human labor. The commodification of knowledge and information therefore satisfies the first condition but not the second and, hence, must be classified as unproductive.

Commodified information is a special type of commodity, for it requires time and effort to be produced but not to be further reproduced. Hence, from a Marxist perspective, commodified information tends to have zero value. Marx's concept of *value* is substantially different from that of Adam Smith and David Ricardo. In Smith and Ricardo, value is equated with embodied labor. But in Marx, value is the social form of wealth in a commodity-producing system, and the quantity of value of a commodity is *not* determined by the labor embodied (objectified) in its original production. Marx had a much more dynamic understanding of value:

> "The value of any commodity - and thus also of the commodities which capital consists of - is determined not by the necessary labour-time that it itself contains, but by the socially necessary labour-time required for its reproduction. This reproduction may differ from the conditions of its original production" (Marx [1894]1994, pp.237-238). "[T]he 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" (p.522). Hence, "however young and full of life the machine may be, its value is no longer determined by the necessary labour-time actually objectified in it, but by the labour-time necessary to reproduce either it or the better machine. It has therefore been devalued to a greater or lesser extent" (Marx [1887]1990, p.528)

Commodified knowledge and information such as software, computer codes and applications, data series, drug formulae, biotech, digital content of publications, advertising, news, music, movies, photos, videos, and even the commodified information from human behavior on social media all require virtually no labor time to be *re*-produced once produced, and thus tend to contain zero value. Because commodified information tends to have zero value it cannot originate either new value added or surplus value, which implies that the profits derived from commodified information are in fact value added reallocated from other activities in the economy.

For this reason, and despite potential *indirect* contributions to labor productivity, job creation, and productive investment, the commodification of information should be classified as a form of unproductive activity. Commodified knowledge and information can still increase labor productivity *indirectly*, and hence boost value added creation elsewhere if used as an *input* into another productive activity. But the revenues that information proprietors receive are *rents*, or specifically *information rents*, which are value added drawn from the aggregate pool of value added that productive activities create.

It is important to bear in mind the distinction between the knowledge commodity itself and the eventual material artifact that stores it. In the case of drugs, the knowledge commodity is the drug formula, as this is the commodified knowledge that requires no labor time to be reproduced and which gives rise to knowledge rents. The chemical powder and the pills do have some value, but they tend to be a minor fraction of production costs relative to the research and development costs necessary to discover the correct drug formula. Input-output tables and national income accounts do not allow for the separation of the revenues from R&D and non-R&D, and as an empirical approximation I classify the entire activity as unproductive.

A similar case applies to the music industry. If a singer or a musical band performs a live concert, the musicians are the productive workers. The commodified information in that case is the music score that the songwriter composed, and for which knowledge rents are due. The intellectual labor performed by the songwriter is then classified as unproductive labor, given that virtually no reproduction time is required to make copies of the compositions. It is crucial to separate the knowledge-commodity itself (the musical composition, which is the product of the intellectual labor of the songwriter) from the productive labor of the musicians who perform live on the stage. Once composed, the music score can be reproduced (digitally copied) indefinitely with no further living labor applied to it.

Even though Marx often incorrectly assumed that the production of commodities for profit, subsumed under capital, was a necessary and sufficient condition to classify an activity as productive, in other passages he did acknowledge that this was not a sufficient condition:

> "Once discovered, the law of the deflection of a magnetic needle in the field of an electric current, or the law of the magnetization of iron by electricity, cost absolutely nothing. […] Science, generally speaking, costs the capitalist nothing, a fact that by no means prevents him from exploiting it" (Marx [1887]1990, p.508).

> "[The] use-value is the general bearer of the exchange-value, but not its cause. If the same use-value could be created without labor, it would have no exchange-value, yet it would have the same useful effect as ever" (Marx [1894]1994, p.786).

Producing a commodity for profit is therefore a *necessary but not a sufficient condition* to classify an activity as productive. A worker producing commodities with zero value, even though subsumed under capital, will not create new value added and thus will be an unproductive worker in that particular task (even though the same worker could be a productive laborer in a different, complementary task). Furthermore, the productive-unproductive classification is endogenous to the existing technology. Modern computers allow many digital commodities to be reproduced indefinitely at zero reproduction cost and without the application of direct living labor. But this was not possible before the invention of modern computers and, in this way, the digital revolution transformed many previously productive activities into unproductive ones.

Marx's value theory did include limiting cases in which goods are produced for profit but require no direct labor to be further reproduced. As such, these would be commodities with no value and whose production would be unproductive of new value added and surplus value. The rise of intangible goods (as the "laws of electromagnetism" in Marx's quote above) in fact expands the domain in which goods are produced for profit but do not directly create new value added and, hence, must be classified as unproductive.

The paper therefore offers a consistent approach by combining Marx's insights on value theory, his insights on productive versus unproductive activities, and the central role of reproduction time in determining commodities' values. The relevance of the proposed approach lies in the massive growth of the digital industries, biotech industries, data commodification, and in the expansion of the knowledge economy in general. There is a growing share of commodities that, once produced, require no further living labor to be reproduced and, hence, give rise to profits at the micro level that are in fact redistributions of value added at the macro level.

2.7 Intangible Assets and the Information Economy

The concepts of information rents and commodified knowledge share some similarities with the mainstream approach to marginal cost. In mainstream Economics, knowledge and information have *zero marginal costs* and thus would be classified as *public goods* (non-rivalrous and non-excludable) if it were not for the existence of intellectual property rights that turn commodified information into artificially scarce goods (non-rivalrous but excludable), therefore granting their proprietors legal rights to royalties and rent-like revenues (Arrow 1962; Stiglitz 1999; Duffy 2004). Shavell and van Ypersele (2001) claim that the zero marginal cost property also applies to all industries that produce pharmaceuticals, software, data bases, movies, recorded music, news, books, advertisement, and visual products.

Information rents are an additional explanation for the investment-profit puzzle, or the rise in profits amid declining investment rates in fixed assets. Orhangazi (2019) argues that intangible assets such as patents and intellectual property rights may lead to greater profit margins but without a corresponding increase in firms' investment levels. He presents aggregate and firm-level data from the United States and shows that firms with more intangible assets have higher pricing power and lower investment to cash flow ratios. The industries with the highest markups and profit rates, namely healthcare and high-tech, are exactly the industries with the highest levels of intangible assets and the lowest ratios of investment over cash flow. The highest investment to cash flow ratios, on the contrary, are in energy and utilities industries, which are location specific and have very low intangible asset ratios. Orhangazi (2019) also presents evidence that the payments to shareholders as a ratio of cash flow is increasing much faster in the healthcare and high-tech industries, which are the industries with the highest markups, highest levels of intangible assets, and lowest investment ratios.

Pagano (2014), likewise, claims that financialization and the growth of intangible assets (knowledge assets in particular) are complementary phenomena which tend to reinforce each other. Appelbaum (2017) argues that the combination of domestic outsourcing, offshoring, rent seeking, and networked forms of production have jointly contributed to increase earnings inequality, as earnings have been higher in companies that are able to extract more rents from global production networks. Baker (2016) claims that rents derived from patents and copyrights is a crucial component in the rise of wage inequality and top earnings in the United States. Baker (2016) also claims that the rise in inequality is mostly a result of wage inequality, not of a shift of national income from wages to profits. Hence, "if inequality stems from rents, the appropriate response is not to focus on redistributive measures such as strongly progressive income taxes or wealth taxes, but rather to alter the institutional arrangements that allow for such enormous rents". Bivens and Mishel (2013) provide evidence that rents are a key element behind the rise of CEO pay and the incomes of the top 1%. They argue that the fast increase in the top 1% income share results from opportunities and incentives to pursue rent seeking rather than well-functioning competitive markets rewarding skills or productivity based on marginal differences.

Activities that benefit from information rents are usually characterized by strong positive network externalities (when users prefer to share the same services or platforms) and a "winner take most" structure in which a few companies have very large market shares (Autor *et al.* 2020). Information rents are, hence, a plausible explanation for the concomitant rise in labor productivity, reduced economic growth, and increased inequality. The extra profits derived from information rents that are not reinvested can accumulate in the hands of the top income earners via dividends, share buybacks, and capital gains, therefore reducing investment rates and economic growth while increasing income inequality. Autor *et al.* (2020), in particular, use firm-level census data from the United States to demonstrate that the rise of the "superstar" companies has contributed to increase labor productivity but at the price of reducing the wage share. The reduction in the wage share results from the larger market share and the greater markup pricing over marginal costs in the superstar companies.

Instead of democratizing its benefits to all citizens, the zero reproduction costs of information and knowledge have disproportionately fueled the profits of a few firms (Pagano 2014). In this regard, information rents do resemble the emergence of land rents upon the enclosure of the commons and the monopolization of natural resources. A progressive agenda that aims to reduce inequality must necessarily advocate for a drastic reduction in the level of intellectual enclosure of the economy (Pagano and Rossi 2009; Rikap 2021).

In the next section I analyze the evolution of knowledge rents and unproductive activity in the American economy in more detail.

3. Unproductive Activity in the United States

In this section I present my measurements of productive and unproductive activity in the United States economy from 1947 to 2011. In Table 1 I summarize the variables utilized in this paper. Table A.2 in appendix 3 presents the complete classification of productive and unproductive activities used in this paper.

[Table 1 about here]

I utilize data from the *modified* benchmark input-output matrices, national income and product accounts, and fixed assets accounts from the Bureau of Economic Analysis (BEA), as well as compensation and productivity data from the Bureau of Labor Statistics (BLS). The *modified* benchmark input-output matrices from the BEA offer more accurate and detailed estimates of productive and unproductive activity. The modified input-output matrices classify each row (and respective column) into its primary and secondary sources of revenue. The secondary sources of revenue are then regrouped with their matching primary activity. A hotel that offers lodging and restaurant services, for example, would have its primary activity recorded in the lodging services row, and its restaurant would be regrouped in the restaurant services row. The same happens to an automaker that produces vehicles but also has a captive bank that offers car loans and insurance to its customers: the captive banking division is regrouped in the financial services and insurance row. Because of this transfer of secondary sources of revenue to their respective primary activity rows (and columns), the measurement of unproductive and productive *activity* (rather than *sectors)* becomes significantly more accurate.

My methodology builds on and complements previous studies from Shaikh and Tonak (1994), Mohun (2014; 2006; 2005), Wolff (1987), Moseley (1997; 1992; 1985), Tsoulfidis and Paitaridis (2019), Paitaridis and Tsoulfidis (2012). But unlike the existing literature, my approach employs the *modified* benchmark input-output matrices and offers a wide range of annual estimates of productive and unproductive activity in terms of both *flows* of income and *stocks* of fixed assets, including aggregate estimates of information rents. Information rents are present whenever the main source of revenue comes from intellectual property rights on commodified knowledge and information that tend to require no labor time to be reproduced. Information rents consist of all income from activities involving software development, data management, research and development, advertising, development of pharmaceuticals, biotech, publishing industries, sound recording, and movie production. The full list is in Table A.2 of appendix 3.

In Table 2 I present the cumulative real growth rates of key measures of productive and unproductive activity. The estimates are broken down into cumulative rates for the whole 1947-2011 postwar period, the Regulated period from 1947 to 1980, and the Neoliberal period from 1980 to 2011. The cumulative growth rates of unproductive activity were mostly higher than their productive counterparts for the whole postwar period and more markedly so after 1980.

[Table 2 about here]

In Figure 1 I plot three measures of the total size of unproductive activity relative to their productive counterparts, in terms of annual aggregate flows of income. The gross income of unproductive activities relative to the total value generated in productive activities jumps from 13.4% in 1948 to 53.6% in 2009, hence quadrupling over the same period. The net income of unproductive activities relative to the value added in productive activities rises from 14.1% in 1948 to 50.8% in 2009, an accumulated increase of 260%. The net income of unproductive activities relative to the surplus value generated in productive activities rises from 24.4% in 1948 to 78% in 2009, an accumulated increase of 220% in the period.

[Figure 1 about here]

In Figure 2 I decompose the net income of unproductive activities into the shares of five unproductive sub-categories: (i) government administration with the exception of productive government enterprises, consisting mostly of the government wage bill at all levels; (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 (imputed owner-occupied rents are excluded); and (v) information rents. Finance and information rents combined have increased from 21.9% to 40.5% of the net income of all unproductive activity, nearly doubling their combined share in the postwar period.

[Figure 2 about here]

In Figure 3 I plot the non-residential fixed assets in unproductive activities (the "unproductive capital stock") relative to fixed assets in productive activities (the "productive capital stock"). The stock of fixed assets in unproductive activities is plotted twice, first including and then excluding government fixed assets. The stock of residential assets is excluded from all measurements. From 1981 to 2009 the ratio of unproductive to productive capital stock rises 37.5%. Once I exclude fixed assets at all government levels (local, state, and federal; while keeping productive government enterprises in the productive capital stock) the ratio more than triples its value from 11% in 1954 to 35% in 2006.

[Figure 3 about here]

In Figure 4 I decompose the unproductive capital stock into the shares of five sub-categories of unproductive activity: trade, rental, and leasing; knowledge and information; finance and insurance; unproductive services; and government (excluding productive state companies, which are counted as productive of value). The major share is from the general government even though it has shrunk from 86.2% in 1947 to 64% in 2011. The unproductive activities featuring the fastest growth rates in terms of 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%). Finance- and information-related activities have grown their combined capital stock six-fold (or 502%) from 1947 to 2011 as a share of the total unproductive capital stock.

[Figure 4 about here]

In Figure 5 I compare the ratios of the aggregate net income to the capital stocks in productive and unproductive activities. These ratios measure how much net income a unit of fixed capital stock returns per year and indicate whether or not competition equilibrates the rates of return between productive and unproductive activities. Figure 5 reveals that a very slow convergence of return rates takes place over the postwar period. The value added relative to the stock of fixed assets in productive activities is 84% in 1947, then falling to a low point of 58% in 1982, recovering in the post-1980 period to 81% in 2000 and 68% in 2011. The net income over the stock of fixed assets in unproductive activities is 14% in 1947, then rising to a peak at 45% in 2001, and settling at 38% in 2011.

[Figure 5 about here]

[Figure 6 about here]

In Figure 6 I plot five series converted to index numbers (1980=100): the top 0.1% and top 1% income shares inclusive of capital gains; the rate of exploitation of productive workers, which is an aggregate index of class struggle; the share of financial revenues and information rents in the aggregate net income of unproductive activities; and the share of the unproductive capital stock in activities whose main revenues come from finance and information rents. The trends display sharp increases after 1980, revealing a potential long-run relationship between unproductive activity, information rents, finance, exploitation, and inequality. In the next section I test the hypothesis of such long-run relationship utilizing time series econometrics.

4. The Effects of Unproductive Activity on Growth, Productivity, and Inequality

4.1 Estimations and Simulations

To evaluate the effects of unproductive activity on value creation, labor productivity, and income inequality in the United States economy from 1947 to 2011, I estimate single-equation auto-regressive distributed-lag (ARDL) models following the approach of Pesaran, Shin, and Smith (2001) –"PSS" henceforth– utilizing the variables in Table 1. The PSS approach controls for long- and short-run effects by including lagged levels and lagged differences of the dependent and independent variables. The lagged levels control for the permanent long-run effects, while the lagged differences control for the temporary short-run effects. To avoid endogeneity problems the ARDL specifications in this paper utilize only lagged rather than contemporaneous values of the explanatory variables. Technical details of the estimation procedure and unit root tests are available in the (online) appendix.

In Table 3 I summarize the estimations results and diagnostic tests from eight different ARDL specifications. In models 1a and 1b the dependent variable is the real aggregate value added (VA) of productive activities. In models 2a and 2b the dependent variable is the economy-wide real labor productivity. Real values are in 2005 dollars. In models 3a and 3b the dependent variable is the income share of the top 0.1% inclusive of capital gains. In models 4a and 4b the dependent variable is the income share of the top 1% inclusive of capital gains. In each model I control for the growth in unproductive activity in terms of aggregate income flows, investment expenditures in the stocks of fixed assets, and I also control for the shares of unproductive activities that rely on financial revenues and information rents. To capture potential nonlinear relationships, and to reduce heteroskedasticity in the data, all variables are in natural logs.

The set of independent variables, as described in Table 1, consists of: the rate of exploitation; labor productivity; the aggregate net income of unproductive activity over the aggregate value added of productive activity; financial incomes and information rents as shares of the net income of all unproductive activity; the aggregate stock of fixed assets in unproductive activity over the aggregate stock of fixed assets in productive activity; the share of the capital stock of unproductive activities whose main source of revenue are financial incomes and information rents; and finally, a Neoliberal dummy variable equal to 0 from 1947 to 1979 and equal to 1 from 1980 to 2011. The dummy aims to capture the institutional regime change from the Keynesian to the Neoliberal era in the 1980s. Each model is estimated twice, first without the Neoliberal dummy (version "a") and then with the dummy included (version "b").

[Table 3 about here]

The rate of exploitation is an aggregate index of class struggle that summarizes the role of factors such as labor laws and bargaining power as well as globalization, outsourcing, and subcontracting. As a robustness test, I have also re-estimated the models by adding a control for globalization (share of imports in GDP) but this variable did not affect the results and was statistically insignificant, probably because its effect is already incorporated through the rate of exploitation (with a linear correlation of 0.86).

The stocks of fixed assets measure the cumulative investments of productive and unproductive activities. The BEA computes the net capital stock as the cumulative sum of past investment expenditures in plants, equipment, and software, and then applies a nonlinear annual depreciation rate. A potential positive effect of the capital stock implies that investment expenditures in fixed assets have a positive effect on the dependent variable, while a concomitant flow effect can still be negative because the flow variables measure the resulting levels of income rather than the cumulative expenditures. Macroeconomic theory suggests that expenditures precede incomes, such that investment expenditures are logically prior to current incomes (as in Keynes and Kalecki). This implies that that the excess draw of income from productive to unproductive activity happens after the determination of investment expenditures. In this way, the positive effect reflects the boost from the cumulative investment expenditures in fixed assets, while the concomitant negative effect reflects the excess income that unproductive activities draw from productive activities.

I specified the models as follows. The optimal lag length for the lagged differences is chosen via the Bayesian information criterion (BIC). The lag length is increased until the residuals are well behaved. No more than a maximum of three lags of the variables in differences are included. I test for the statistical significance of the long-run effects using the PSS (2001) bounds F-test for the variables in lagged levels, with small sample critical values from Narayan (2005). In the PSS approach to ARDL modelling it is possible to maintain an asymmetry between the long- and short-run effects given that only the variables in lagged levels determine the limiting distribution of the bounds F-test. Hence, if a set of variables contributes only to the short-run effects, these are added to the model solely in lagged differenced form. Further discussion on this asymmetry between long- and short-run regressors is available in the (online) appendix. Because the Neoliberal dummy is not a one-off variable, I include it within the long-run equilibrium equation. If I were to include contemporaneous differences of the regressors, the fit of all models would improve substantially but at the risk of generating endogeneity problems.

To evaluate the specific impact of information rents, holding constant the shares of finance in the net income and in the capital stock of unproductive activity, I estimate ARDL models 1c, 2c, 3c, and 4c. Estimates are summarized in Table 4, which is similar to Table 3 but now featuring the shares of information rents in lieu of the previous combined shares of information rents and financial incomes.

[Table 4 about here]

Ziliak and McCloskey (2008) argued that we should differentiate between statistical significance and economic significance. In Tables 5 and 6 I present the long-run elasticities, the cumulative change in each variable, and the economic effect of the regressors for each model. The long-run elasticity is computed as the coefficient of the regressor in lagged level divided by the negative of the coefficient of the dependent variable in lagged level. Only the variables that appear in lagged level form in an ARDL model have long-run elasticities. The *economic effect* is the cumulative change in the variable from 1947 to 2011 times its respective long-run elasticity. A comparison of the economic effects reveals which regressors have contributed the most to the cumulative change in the dependent variable, and hence avoids overreliance on statistical significance and p-values.

The difference between Tables 5 and 6 is the same as that between Tables 3 and 4. Table 5 presents the economic effects considering the joint effects of finance and information rents, while Table 6 holds constant the shares of finance in the net income and in the capital stock of unproductive activity, thus focusing on the impact of commodified knowledge.

[Table 5 about here]

[Table 6 about here]

To compare the dynamics of the permanent long-run and temporary short-run effects, I simulate the ARDL models following the approach developed by Jordan and Philips (2018) and Philips (2018). I simulate the specifications in Tables 3 and 4 by setting the impulses to each regressor equal to the actual 1947-2011 cumulative change in the underlying variable. The responses show the *cumulative economic effects* on the dependent variable traced over time. For the variables in lagged levels, the impulse-responses converge to the permanent long-run economic effects reported in Tables 5 and 6. The temporary short-run responses of the variables in lagged differences will decay to zero over time. Simulation plots of the ARDL models are available in appendix 2. The black dashed lines represent the economic effects. The shaded bands around the economic effects represent the bootstrapped 75, 90, and 95 percentiles of the predictions from the simulations, akin to confidence intervals. The horizontal axis shows the 65 years after the initial impulse at time t=10.

4.2 Summary of Results

The main conclusion from the estimations and simulations is as follows. At the aggregate level, unproductive activity has had a positive effect on the creation of value in productive activities and also on the economy-wide labor productivity. Despite drawing their incomes from the pool of value added, unproductive activities still had an *indirect* positive effect that more than compensated for the *direct* draw from the pool of value. There has been, hence, a *net positive effect* of unproductive activity on the creation of value added and on labor productivity.

Among unproductive activities, however, finance and the commodification of information have had a joint positive effect on labor productivity but a two-pronged effect on value creation: a *negative flow effect* coupled with a larger *positive stock effect*. In terms of flows of income, the rise in the joint share of financial revenues and information rents has been associated with an increase in the productivity of labor and a *negative effect* on value-added growth, possibly because these unproductive activities have made labor more productive but concomitantly drawing "too much" from the value pool. Even though unproductive activity in the aggregate has had a net positive effect on value-added growth, the unproductive activities that rely on financial revenues and information rents have had a joint *negative effect* on the creation of value. The investment expenditures in the accumulation of fixed assets in unproductive activities whose main source of revenue are finance and information rents have, on the other hand, had a *large positive effect* on value-added growth. Finance and the commodification of knowledge have had, therefore, a joint positive impact on value creation via their investment expenditures in fixed assets, while still drawing "too much" from the value pool of productive activities. Moreover, unproductive activity that rely on finance and information rents, coupled with the rapid rise in the rate of exploitation in the post-1980 era, have worsened income inequality by substantially increasing the income shares of the top 1% and 0.1% earners.

When the shares of finance in the incomes and fixed asset stocks of unproductive activities are held constant, as reported in Tables 4 and 6, the estimates indicate that knowledge rents per se have had a negative effect on value added growth, a positive effect on the economy-wide labor productivity, and also contributed to substantially increase the income shares of the top 1% and top 0.1% earners. Even though unproductive activities have had an overall positive effect on the creation of value in productive activities, the particular impact of knowledge commodification within these unproductive activities has been negative. The negative effect of information rents on value-added growth might be partially explained by the fact that the "monopolization of certain product markets through the use of intangible assets allows firms to collect monopoly rents which are reflected in higher profits, while not necessarily generating a matching increase in investment" (Orhangazi 2019, p.1260).

4.3 Interpretation of the Estimates

(i) Impact on the Creation of Value

From 1947 to 2011, the joint share of financial income and information rents in the aggregate net income of all unproductive activities rose 85%, while the share of information rents alone increased 120%. Each 10% rise in the share of financial income and information rents has been associated with a *reduction* in real value added by 3.2% (Model 1a) and 8.3% (Model 1b). If only information rents are considered, real value added falls by 8.8% for every 10% rise in the share of information rents (Model 1c).

In the aggregate, a rise in the net income of all unproductive activity has been associated with an *increase* in the value added of productive activity. In Models 1a and 1b, the effect is positive but temporary. Model 1c provides an estimate of the long-run elasticity: each 10% rise in the net income of all unproductive activity, relative to the value added in productive activities, has produced a 11.2% rise in real value added. Hence, unproductive activity in the aggregate has tended to have a positive contribution to value creation in the short and long runs. The cumulative economic effect from 1947 to 2011 indicates that the overall impact of unproductive activity on value creation has been *positive and larger* than then the negative cumulative economic effect caused by the rising share of finance and information rents. Therefore, even though finance and information rents have had a negative effect on value creation, possibly by extracting too much from the value pool, unproductive activities other than finance and information commodification have had a positive and larger effect on value creation.

Once the stocks of fixed assets in unproductive activity are considered, finance and information commodification have had a two-pronged effect on value added. Each 10% rise in the cumulative investment expenditures in the net capital stock of unproductive activities whose main sources of income are finance and information rents, as a share of the total capital stock of unproductive activities, has implied a *rise* in real value added by 5.3% (in Model 1a) and 4.8% (in Model 1b). When the actual cumulative change from 1947 to 2011 is considered, the positive economic effect from the investment expenditures in fixed assets *more than compensates* for the negative economic effect from the share of financial revenues and information rents. Hence, the *positive stock effect* has been stronger than the *negative flow effect* of finance and information rents on the creation of value in productive activities. But despite this net positive effect through the accumulation of fixed assets, finance and information rents have still represented a drag on the creation of value via the negative flow effect.

Moreover, each 10% rise in labor productivity has been associated with a rise in real value added by 7.1% (in Model 1a) and 7.9% (in Model 1b). Higher rates of exploitation have also had positive temporary effects on the creation of value in productive activities.

(II) IMPACT ON LABOR PRODUCTIVITY

Unproductive activity has had a *positive* effect on the economy-wide real labor productivity. Each 10% rise in the net income of unproductive activity over the value added in productive activity has *increased* labor productivity by 7.7% (in Model 2a), 6.5% (in Model 2b), and 7.1% (in Model 2c). Finance and the commodification of knowledge and information, considered separately or combined, have also had a *positive* but short-run impact on labor productivity.

The cumulative investment expenditures in the net stocks of fixed assets in unproductive activities (relative to the stocks of fixed assets in productive activities) have had much higher long-run elasticities compared to the elasticities of their flow counterparts. However, the larger long-run elasticities of labor productivity with respect to the capital stock of unproductive activities have been canceled out by their much lower cumulative economic effect.

(III) IMPACT ON INEQUALITY

Financial revenues, information rents, and the rate of exploitation have been strong predictors of the rise in inequality, as measured by the income shares of the top 1% and top 0.1%. In the 1947-2011 period, the top 0.1% income share featured a cumulative rise of 136%, while the top 1% income share accumulated an increase of 64%. The 54% increase in the rate of exploitation from 1947 to 2011 has implied an increase in the top 0.1% income share by 49% (in Model 3a), 71% (in Model 3b), and 91% (in Model 3c). The cumulative increase in the rate of exploitation has also implied a rise in the top 1% income share by 39% (in Model 4a), 53% (in Model 4b), and 67% (in Model 4c).

When all unproductive activities are considered together, their joint effect has been an overall small *reduction* in inequality in the 1947-2011 period, as the small negative economic effect reported in Table 5 demonstrates. But within unproductive activities it has been finance and knowledge commodification that have in fact contributed to the rapid *increase* in the shares of the top 1% and top 0.1% income earners, as the positive and much larger economic effect reported in Table 5 indicates.

Each 10% increase in the joint share of financial income and information rents has boosted the top 0.1% income share by 12.2% (in Model 3a) and 7.8% (in Model 3b). If financial income is held constant, each 10% rise in the share of information rents has increased the top 0.1% income share by 5.5% (in Model 3c). Additionally, each 10% increase in the joint share of financial income and information rents has implied a rise in the top 1% income share by 7% (in Model 4a) and 4.7% (in Model 4b). If financial income is held constant, each 10% rise in the share of information rents has increased the top 1% income share by 3% (in Model 4c).

The regressors that control for the investment expenditures in the capital stock in unproductive activities had only temporary and insignificant economic effects on the income shares of the top 1% and top 0.1%. Most of the variation in inequality is accounted for by the rate of exploitation and the net income flows of unproductive activity, particularly finance and information rents.

5. Final Remarks

The paper contributes to the literature by estimating the impact of unproductive activity on value added, labor productivity, and inequality in the United States from 1947 to 2011. Utilizing data from modified benchmark input-output matrices, I present several measurements of productive and unproductive activity in terms of income flows and stocks of fixed assets. Particular attention is given to the rapid rise of financial revenues and information rents in the post-1980 period. Using time series econometrics, I find that unproductive activity has had an overall net positive effect on value creation and on labor productivity, but at the price of increasing income inequality.

The recent scholarship has focused on the role of finance (and financialization) as a key factor in the slowdown of economic growth and lower investment rates in tangible assets after the 1980s. My approach adds to the existing literature by claiming that information rents should be given a similar role to that of finance as a determinant factor of growth and distribution. As I argue in the paper, the production and ownership of commodified knowledge and information do not directly originate new value added, and therefore give rise to information rents that draw from the aggregate pool of value of productive activities. Information rents are therefore transfers of value that companies like Google, Amazon, Microsoft, Apple, Facebook, Uber, Netflix, Alibaba, Airbnb, Pfizer, Merk, Bayer, Eli Elly etc., to name just a few, are able to extract from consumers, governments, and companies both at home and abroad. The literature features a wide range of studies that show how an oversized financial sector can impact growth and distribution. My estimates confirm this result and also reveal that a similar claim can be made about intellectual property rights and information rents.

My econometric estimations indicate that the net effect of the rising joint share of information rents and financial incomes on labor productivity has been positive. Finance and the commodification of knowledge have also had a joint positive impact on value creation via their investment expenditures in fixed assets, despite the negative effect from an excessive draw from the incomes of productive activities. Coupled with a rapid increase in the rate of exploitation in the post-1980 period, the rising joint share of information rents and financial incomes has also widened the income shares of the top 1% and top 0.1% earners in the United States.

When the share of finance is held constant within unproductivity activity, the commodification of knowledge has had a negative effect on the growth of value added in productive activities, despite the positive contribution to the economy-wide labor productivity, and it has also contributed to increase economic inequality. The commodification of knowledge and information does increase the productivity of labor but, nonetheless, harms value-added growth and benefits the top 1% and top 0.1%. If we are to tackle the factors that reduce growth and worsen income distribution, we need to seriously address the rapid rise of information rents.

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Tables and Figures

Table 1: Description of Variables for the United States (1947-2011)

Productive Activity (PA)	
Total value (TV)	Real total value created in productive activities (gross of intermediate inputs and depreciation)
Value added (VA)	Real value added created in productive activities (net of intermediate inputs and depreciation)
Surplus value (S)	Real value added minus the total compensation of productive workers in productive activities
Rate of exploitation (s)	Surplus value over the total compensation of productive workers in productive activities
K_{PA}	Real stock of non-residential fixed assets in productive activities (at replacement cost)
Unproductive Activity (UA)	
GI_{UA}	Real gross income of unproductive activities (gross of intermediate inputs and depreciation)
NI_{UA}	Real net income of unproductive activities (net of intermediate inputs and depreciation)
IR in NI_{UA}	Share of information rents (IR) in NI_{UA}
FI+IR in NI_{UA}	Share of financial income (FI) and information rents (IR) in NI_{UA}
NI_{UA} / VA	Net income of unproductive activities over the value added created in productive activities
K_{UA}	Real stock of non-residential fixed assets in unproductive activities (at replacement cost)
IR in K_{UA}	Share of K_{UA} in activities whose main sources of revenues are information rents
FI+IR in K_{UA}	Share of K_{UA} in activities whose main sources of revenue are finance and information rents
K_{UA} / K_{PA}	Stock of fixed assets in unproductive relative to productive activities
Whole Economy	
Top 1%	Income share of the top 1% earners, with capital gains included
Top 0.1%	Income share of the top 0.1% earners, with capital gains included
Labor productivity	Real GDP per total working hours (index 2005 = 100)

Sources: Measures of productive and unproductive activity computed from the modified benchmark BEA input-output matrices, national income and product accounts, fixed assets accounts, and from the BLS series on compensation and employment. Estimation techniques from Rotta (2018). Real values in 2005 dollars. Top income shares from Piketty (2014). Labor productivity index is the nonfarm business sector real output per hour of all persons from the BLS, rebased to 2005. See Table A.2 in appendix 3 for the complete classification of productive and unproductive activities.

Table 2: Cumulative Growth Rates in the United States (1947-2011)

	1947-1980	1980-2011	1947-2011
Productive Activity (PA)			
Total value (TV)	184%	82%	416%
Value added (VA)	179%	115%	499%
Surplus value (S)	177%	155%	607%
Rate of exploitation (s)	-2%	56%	54%
Capital stock (K_{PA})	298%	95%	677%
VA / K_{PA}	-30%	16%	-19%
Unproductive Activity (UA)			
Gross income (GI_{UA})	322%	335%	1734%
Net income (NI_{UA})	461%	256%	1896%
Share of information rents in NI_{UA}	25%	76%	120%
Share of financial income and information rents in NI_{UA}	20%	54%	85%
NI_{UA} / VA	102%	40%	182%
Capital stock, with government assets (K_{UA})	194%	161%	667%
Capital stock, no government assets (K_{UA}*)	449%	266%	1909%
Share of information rents in K_{UA}	171%	126%	514%
Share of financial income and information rents in K_{UA}	208%	96%	502%
K_{UA} / K_{PA}	-26%	34%	-1%
NI_{UA} / K_{UA}	89%	44%	173%
Whole Economy			
Top 1% income share (with capital gains)	-16%	96%	64%
Top 0.1% income share (with capital gains)	-13%	172%	136%
Labor productivity	121%	91%	322%

Sources: Author's calculations. Real growth rates in 2005 dollars. Variables described in Table 1. See Table A.2 in appendix 3 for the complete classification of productive and unproductive activities.

Table 3: ARDL Models for the United States (1947-2011)

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b	Model 4a	Model 4b
Dependent variable (all in first differences)	**Value Added**	**Value Added**	**Labor Productivity**	**Labor Productivity**	**Top 0.1%**	**Top 0.1%**	**Top 1%**	**Top 1%**
Dependent variable								
Lagged level	-0.429**	-0.310*	-0.059***	-0.126***	-0.515***	-0.560***	-0.455***	-0.498***
First lagged difference	-0.257	-0.355*	0.112	0.105	0.014	0.035	0.023	0.041
Rate of exploitation								
Lagged level					0.467	0.741	0.329	0.491*
First lagged difference	0.277*	0.830**	-0.010	-0.056	1.202**	0.976*	0.722**	0.590
Labor productivity								
Lagged level	0.303	0.244						
First lagged difference	0.718**	0.335***						
Share of finance and information rents in NI_{UA}								
Lagged level	-0.139**	-0.260***			0.628***	0.439*	0.316***	0.233
First lagged difference	0.259***	0.335***	0.082**	0.117***	-0.504	-0.387	-0.263	-0.205
NI_{UA} / Value Added								
Lagged level			0.046**	0.082***		-0.057		-0.046
First lagged difference	0.079	0.087	0.014	-0.042	0.280	0.270	0.154	0.152
Share of finance and information rents in K_{UA}								
Lagged level	0.228***	0.148**						
First lagged difference	0.072	-0.200	-0.071	-0.145	-0.318	-0.396	-0.407	-0.449
K_{UA} / K_{PA}								
Lagged level			0.133***	0.188***				
First lagged difference	0.530	0.224	0.033	-0.030	-0.301	-0.444	-0.415	-0.466
Neoliberal dummy		0.083**		0.023***		0.110		0.053
Intercept	5.299**	4.232**	-0.493***	-0.619***	-3.605**	-4.104**	-1.521	-1.796*
Lagged differences (p)	3	3	2	3	1	1	1	1
Observations (n)	65	65	65	65	65	65	65	65
Ind. regressors in levels (k)	3	3	2	3	2	4	2	4
R^2	0.663	0.719	0.422	0.568	0.388	0.403	0.368	0.381
Adjusted R^2	0.422	0.505	0.233	0.319	0.284	0.275	0.261	0.248
Log-likelihood	157.545	163.15	190.392	200.032	51.557	52.372	82.6	83.279
Bayes IC	-204.096	-211.195	-310.622	-301.403	-57.539	-50.883	-119.625	-112.698
Breusch-Godfrey (p-value)	0.70	0.916	0.75	0.65	0.98	0.89	0.513	0.61
Breusch-Pagan (p-value)	0.68	0.54	0.86	0.94	0.12	0.14	0.23	0.23
Shapiro-Wilk (p-value)	0.25	0.015	0.28	0.74	0.38	0.43	0.106	0.18
Jarque-Bera (p-value)	0.40	0.15	0.18	0.51	0.34	0.34	0.06	0.07
PSS bounds F-statistic	6.095**	7.064***	6.58***	5.53***	7.225***	4.548**	6.706**	4.179*
PSS bounds F-test case	case 3	case 3	case 2	case 2	case 3	case 3	case 3	case 3

Note: Significance levels: 10% (*), 5% (**), and 1% (***). Variables in logs, as described in Table 1. ARDL models in error correction form: dependent variable in first difference. The PSS bounds F-test (for the k independent regressors in lagged levels) is from Pesaran, Shin, and Smith (2001), using small sample critical values for n=65 from Narayan (2005). Only the coefficients for the first lagged differences are shown. Model 1b uses robust HAC standard errors.

Table 4: Modified ARDL Models for the United States (1947-2011)

	Model 1c	Model 2c	Model 3c	Model 4c
Dependent variable (all in first differences)	**Value Added**	**Labor Productivity**	**Top 0.1%**	**Top 1%**
Dependent variable				
Lagged level	-0.085	-0.100***	-0.574***	-0.501***
First lagged difference	-0.368*	-0.053	0.015	0.005
Rate of exploitation				
Lagged level			0.981**	0.629***
First lagged difference	0.445***	-0.001	0.700*	0.434
Labor productivity				
Lagged level				
First lagged difference	0.648			
Share of information rents in NI_{UA}				
Lagged level	-0.075		0.318***	0.151***
First lagged difference	0.087	0.117***	-0.243	-0.126
NI_{UA} / Value Added				
Lagged level	0.095	0.071***		
First lagged difference	0.073	-0.007	0.255	0.173
Share of information rents in K_{UA}				
Lagged level				
First lagged difference	0.025	-0.070	0.164	0.091
K_{UA} / K_{PA}				
Lagged level		0.166***		
First lagged difference	0.369	-0.061	-0.150	-0.250
Neoliberal dummy	0.090***	0.015*		
Intercept	1.032*	-0.575***	-4.759**	-2.230**
Total lagged differences (p)	3	2	1	1
Total observations (n)	65	65	65	65
Ind. regressors in levels (k)	3	3	2	2
R^2	0.641	0.49	0.399	0.374
Adjusted R^2	0.384	0.31	0.297	0.267
Log-likelihood	155.61	194.281	52.16	82.884
Bayes IC	-200.226	-314.273	-58.745	-120.194
Breusch-Godfrey (p-value)	0.07	0.26	0.54	0.84
Breusch-Pagan (p-value)	0.41	0.90	0.073	0.12
Shapiro-Wilk (p-value)	0.86	0.81	0.86	0.64
Jarque-Bera (p-value)	0.93	0.80	0.92	0.65
PSS bounds F-statistic	5.203**	8.19***	7.613***	6.908***
PSS bounds F-test case	case 3	case 2	case 3	case 3

Note: Significance levels: 10% (*), 5% (**), and 1% (***). Variables in logs, as described in Table 1. ARDL models in error correction form: dependent variable in first difference. The PSS bounds F-test (for the k independent regressors in lagged levels) is from Pesaran, Shin, and Smith (2001), using small sample critical values for n=65 from Narayan (2005). Only the coefficients for the first lagged differences are shown. Model 3c uses robust HAC standard errors.

Table 5: Economic Effects and Long-Run Elasticities (1947-2011)

	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b	Model 4a	Model 4b
Dependent variable	**Value Added**	**Value Added**	**Labor Productivity**	**Labor Productivity**	**Top 0.1%**	**Top 0.1%**	**Top 1%**	**Top 1%**
Dependent Variable								
Cumulative change	1.79	1.79	1.44	1.44	0.86	0.86	0.50	0.50
Rate of exploitation								
Cumulative change	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Long-run elasticity	--	--	--	--	0.91	1.32	0.72	0.99
Economic effect	--	--	--	--	0.39	0.57	0.31	0.42
Labor productivity								
Cumulative change	1.44	1.44						
Long-run elasticity	0.71	0.79						
Economic effect	1.02	1.13						
Share of finance and information rents in NI_{UA}								
Cumulative change	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Long-run elasticity	-0.32	-0.83	--	--	1.22	0.78	0.69	0.47
Economic effect	-0.20	-0.51	--	--	0.75	0.48	0.43	0.29
NI_{UA} / Value Added								
Cumulative change	1.04	1.04	1.04	1.04	1.04	1.04	1.04	1.04
Long-run elasticity	--	--	0.77	0.65	--	-0.10	--	-0.09
Economic effect	--	--	0.80	0.68	--	-0.11	--	-0.10
Share of finance and information rents in K_{UA}								
Cumulative change	1.79	1.79	1.79	1.79	1.79	1.79	1.79	1.79
Long-run elasticity	0.53	0.48	--	--	--	--	--	--
Economic effect	0.95	0.86	--	--	--	--	--	--
K_{UA} / K_{PA}								
Cumulative change	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Long-run elasticity	--	--	2.23	1.49	--	--	--	--
Economic effect	--	--	-0.03	-0.02	--	--	--	--
Neoliberal dummy								
Cumulative change		1.00		1.00		1.00		1.00
Long-run elasticity		0.27		0.18		0.20		0.11
Economic effect		0.27		0.18		0.20		0.11

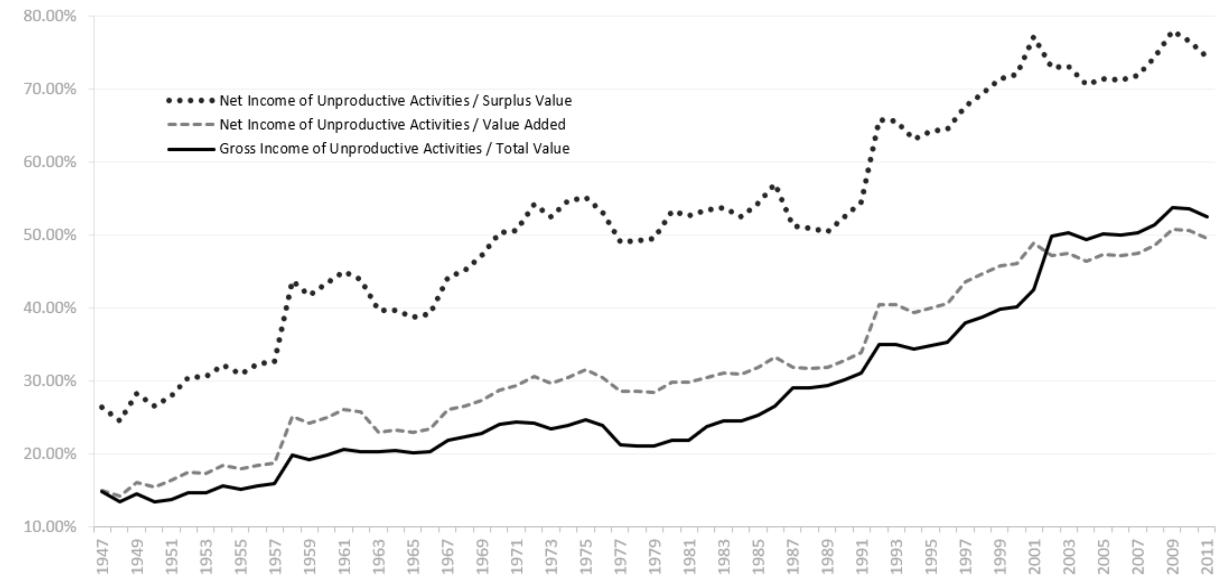
Note: Variables in logs, as described in Table 1. Cumulative change is the last value minus the initial value, in logs. The long-run ARDL multiplier (elasticity) is the coefficient of the lagged level of the regressor divided by the negative value of the coefficient of the dependent variable in lagged level. The economic effect is the cumulative change times the long-run multiplier. Only variables in lagged levels have long-run multipliers. Variables in lagged differences (indicated with '--') have a short-run temporary effect only.

Table 6: Economic Effects and Long-Run Elasticities (1947-2011)

	Model 1c	Model 2c	Model 3c	Model 4c
Dependent variable	**Value Added**	**Labor Productivity**	**Top 0.1%**	**Top 1%**
Dependent Variable				
Cumulative change	1.79	1.44	0.86	0.50
Rate of exploitation				
Cumulative change	0.43	0.43	0.43	0.43
Long-run elasticity	--	--	1.71	1.26
Economic effect	--	--	0.73	0.54
Labor productivity				
Cumulative change	1.44			
Long-run elasticity	--			
Economic effect	--			
Share of information rents in NI_{UA}				
Cumulative change	0.79	0.79	0.79	0.79
Long-run elasticity	-0.88	--	0.55	0.30
Economic effect	-0.69	--	0.44	0.24
NI_{UA} / Value Added				
Cumulative change	1.04	1.04	1.04	1.04
Long-run elasticity	1.12	0.71	--	--
Economic effect	1.16	0.73	--	--
Share of information rents in K_{UA}				
Cumulative change	1.81	1.81	1.81	1.81
Long-run elasticity	--	--	--	--
Economic effect	--	--	--	--
K_{UA} / K_{PA}				
Cumulative change	-0.01	-0.01	-0.01	-0.01
Long-run elasticity	--	1.65	--	--
Economic effect	--	-0.02	--	--
Neoliberal dummy				
Cumulative change	1.00	1.00		
Long-run elasticity	1.06	0.15		
Economic effect	1.06	0.15		

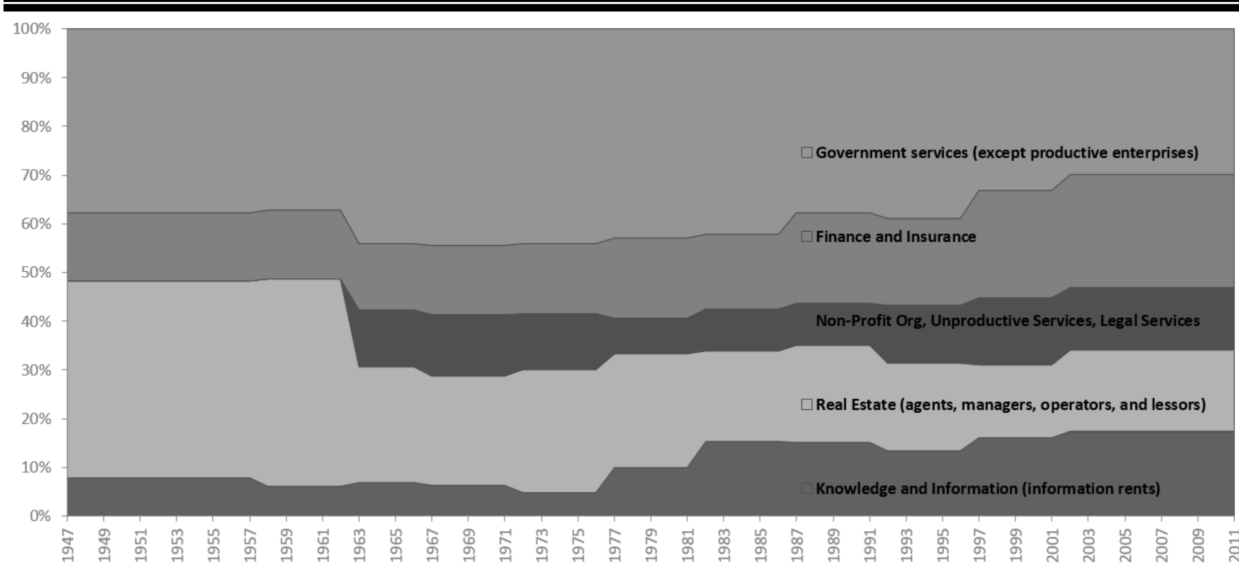
Note: Variables in logs, as described in Table 1. Cumulative change is the last value minus the initial value, in logs. The long-run ARDL multiplier (elasticity) is the coefficient of the lagged level of the regressor divided by the negative value of the coefficient of the dependent variable in lagged level. The economic effect is the cumulative change times the long-run multiplier. Only variables in lagged levels have long-run multipliers. Variables in lagged differences (indicated with '--') have a short-run temporary effect only.

Figure 1: Unproductive Activity Relative to Productive Activity – Aggregate Flows (1947-2011)



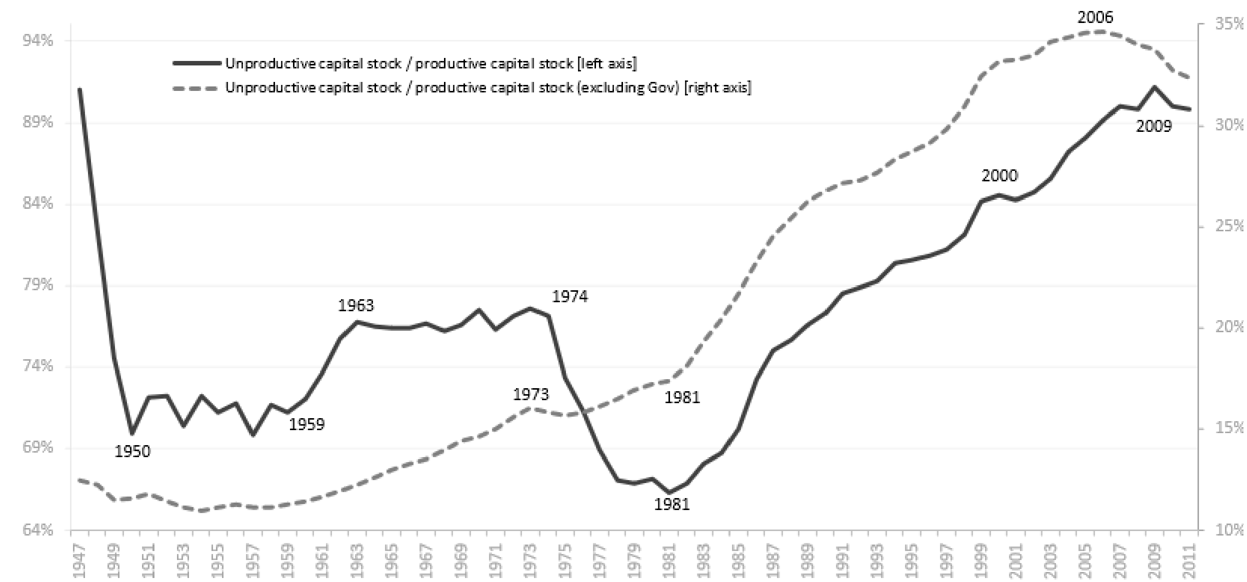
Source: Author's own calculations. Raw data from BEA and BLS.

Figure 2: Decomposition of the Net Income of Unproductive Activity (1947-2011)



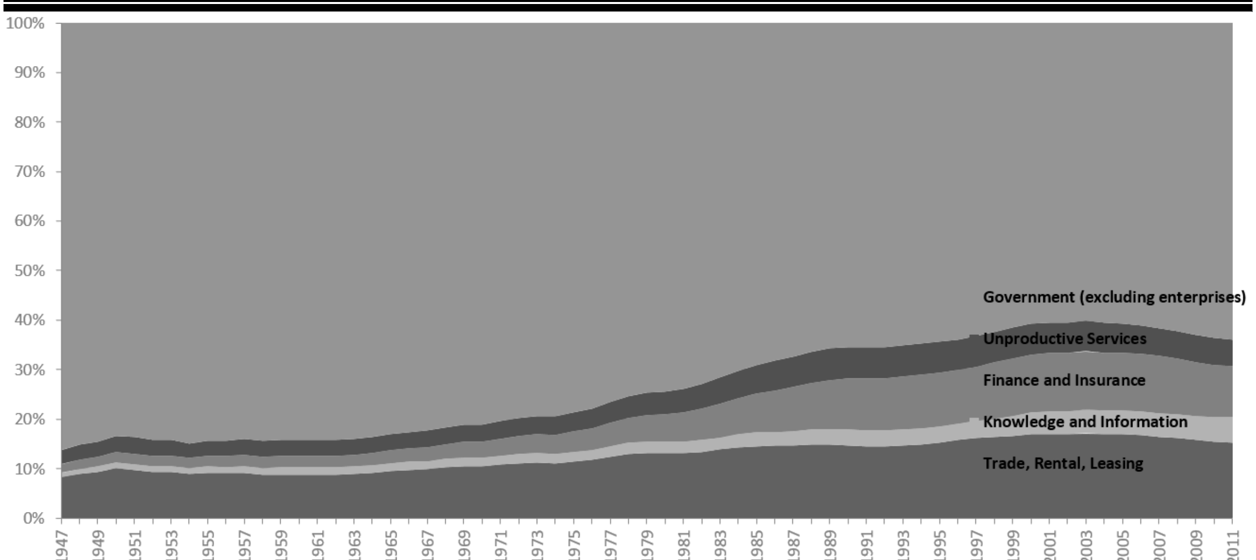
Source: Author's own calculations. Raw data from BEA and BLS.

Figure 3: Ratio of Unproductive to Productive Capital Stock, with and without Government Fixed Assets (1947-2011)



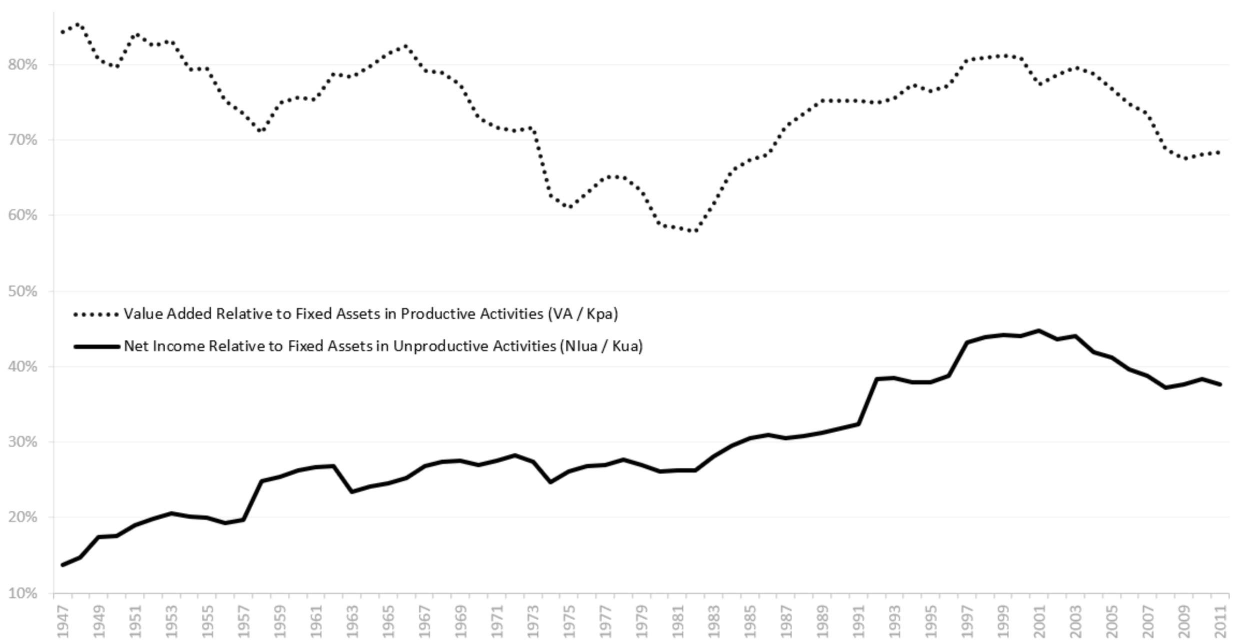
Sources: Author's own calculations. Raw data from BEA and BLS.

Figure 4: Decomposition of the Capital Stock of Unproductive Activity (1947-2011)



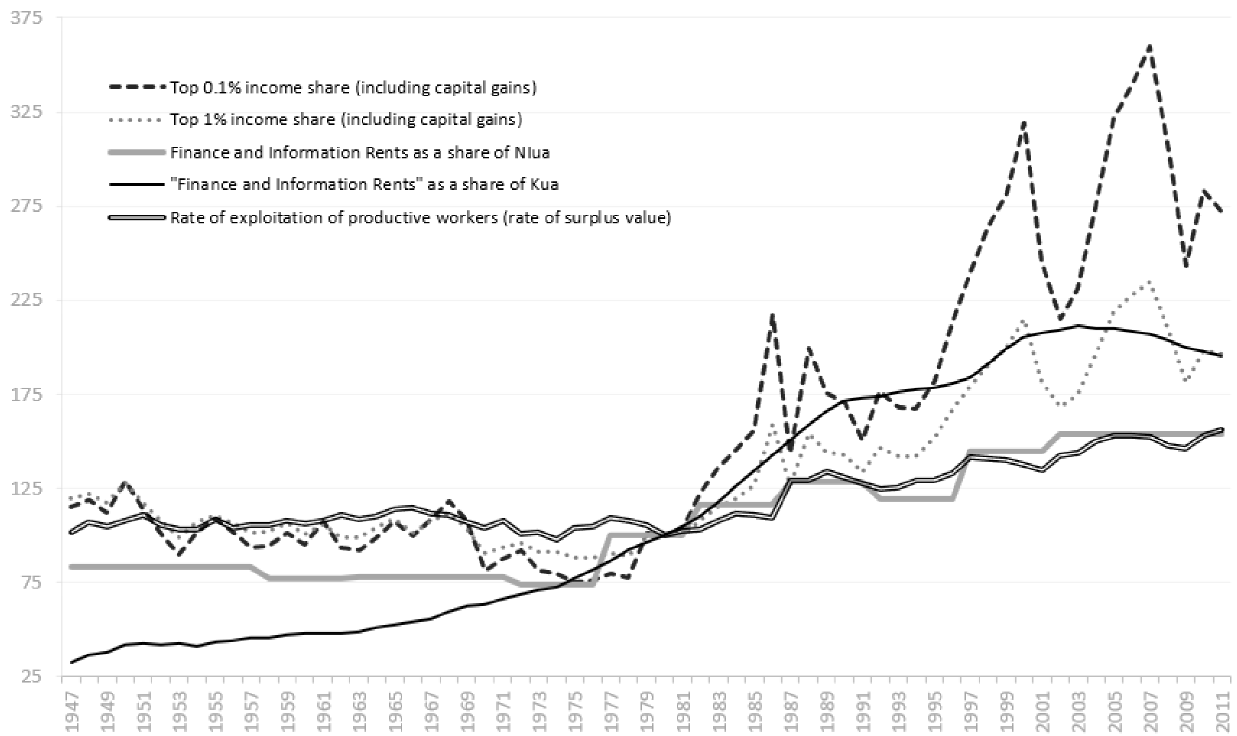
Sources: Author's own calculations. Raw data from BEA and BLS.

Figure 5: Aggregate Income Relative to Fixed Assets
in Productive and Unproductive Activities (1947-2011)



Sources: Author's own calculations. Raw data from BEA and BLS.

Figure 6: Top 0.1%, Top 1%, Financial Income and Information Rents, and the Rate of Exploitation – Index Numbers (1980 = 100)



Sources: Author's own calculations. Raw data from BEA and BLS. Top income shares from Piketty (2014).

Appendix

[The entire appendix can be placed online]

Appendix 1

In this appendix I provide further technical details on estimation and simulation procedures.

A.1 The ARDL Model

I use the functional form in equation A.1 to estimate the auto-regressive distributed lag (ARDL) models in error correction form:

$$\Delta Y_t = \alpha + \left[\beta Y_{t-1} + \sum_{j=1}^{k} \beta_j X_{j,t-1}\right] + \left[\sum_{i=1}^{p} \gamma_i \Delta Y_{t-i} + \sum_{h=1}^{m} \sum_{i=1}^{p} \gamma_{h,i} \Delta X_{h,t-i}\right] + \varepsilon_t \qquad \text{(A.1)}$$

Where ΔY_t is the dependent variable in first difference, Y_{t-1} is the dependent variable in lagged level, $X_{j,t-1}$ are the k independent variables in lagged levels, ΔY_{t-i} are the p lagged differences of the dependent variable, $\Delta X_{h,t-i}$ are the p lagged differences of the m independent variables, α is a constant, and ε_t is a white noise error process.

The variables in lagged levels (the first bracket on the right-hand side) represent the permanent long-run effects. The variables in lagged differences (the second bracket on the right-hand side) represent the temporary short-run effects. The lagged independent variables $\Delta X_{h,t-i}$ should be at least weakly exogenous, and the error term ε_t must be a normally distributed white noise process free of serial correlation. To avoid endogeneity problems, the specifications include lagged terms only. The PSS bounds F-test procedure tests the null hypothesis that the long-run coefficients β and β_j are jointly equal to zero.

In an ARDL model with both long- and short-run effects, and in which the dependent variable ΔY_t is in first differences on the left-hand side of the equation, the coefficient on the lagged dependent variable Y_{t-1} in levels is expected to be negative. If the coefficient is negative, a rise in the level of the dependent variable will produce a change in the opposite direction, which implies a stable (self-correcting) long-run equilibrium. If the coefficient were positive, the long-run equilibrium would be unstable and the trajectory of the dependent variable would not converge to its long-run equilibrium.

A.2 Asymmetry Between Short- and Long-Run Regressors

On July 6th, 2020, I sent the following email to the original authors of the ARDL bounds F-test (Pesaran, Shin, and Smith 2001):

> Dear Prof., I have a question about your PSS (2001) bounds F-test and would really appreciate it if you could help me. I have read a few publications that employ the PSS (2001) bounds F-test in an ARDL model in error correction (EC) form with a set of variables that are I(1) in levels and I(0) in first differences. However, the authors of these papers selectively drop regressors from the list of variables appearing in lagged level form if they do not cointegrate, while still keeping the same excluded variables in lagged difference form in order to control for short-run effects. Hence, some variables that are I(1) in levels are included in the ARDL EC model in lagged difference form only (to capture short-run effects) but not in lagged level form (within the long-run cointegrating relationship). So my question to you would be the following: Does your bounds F-test allow for this asymmetry between short-run and long-run variables? Or is it the case that the critical values for the PSS bounds F-test suppose that all I(1) variables included in lagged difference form must also be included in lagged level form?

Reply from prof. Yongcheol Shin on July 6th, 2020:

> Strictly speaking, only the number of I(1) regressors included as the level matters, because the stationary regressors (say first differences) do not affect the limiting distribution of the PSS test. Still, you need to justify why you use I(1) regressors differently.

Reply from prof. Ron Smith, also on July 6th, 2020:

> Hashem Pesaran passed your question to me, we work together. The bounds test only applies to the lagged level terms, there is no requirement that the same variables appear both in the first difference and levels terms. Notice that the bounds test is for a long run levels relationship, which is more general than a test for cointegration. It applies whether the variables are I(0) or I(1) in levels. But if they are I(1) in levels, it is perfectly possible for a variable to have a short run effect but no long run effect. If you think of logs of consumption and income being I(1), the consumption income relationship may be the only long run relationship, but growth rates of other variables or I(0) variables may influence the short run growth rate of consumption.

Hence, we can keep an asymmetric list of variables across short-run and long-run effects, giving us more freedom in building the ARDL model.

A.3 Unit Root Tests

The PSS bounds F-test allows for I(0) and I(1) variables, but it does not allow for I(2) variables. In Table A.1 I present the results from six unit-root tests on the variables in levels and in differences. The first five unit-root tests are: Augmented Dickey-Fuller (ADF), Philips-Perron (PP), Kwiatkowski–Phillips–Schmidt–Shin (KPSS), Elliott, Rothenberg, Stock (ERS) feasible point optimal test, and the Dickey-Fuller Generalized Least Squares (DF-GLS) test. Note that the KPSS has a null hypothesis of no unit root, which is the opposite of the other unit root tests. Test statistics, null hypotheses, and significance levels are summarized in Table A.1.

The unit root tests indicate that three variables might be I(2) in levels, namely the "share of finance and information rents in Kua", the "share of information rents in Kua", and the "Kua / Kpa" ratio. For these three variables we cannot unanimously reject the null of unit root in first differences. Visual inspection of the variables in first differences reveals a structural break in the 1980s which some of the unit root tests identify as a potential unit root process. I run the Zivot-Andrews (ZA) unit-root test with one endogenous structural break to account for the possibility that a seemingly I(1) process is an I(0) process with structural break. The Zivot-Andrews (ZA) model employs an intercept shift and a trend shift to identify a structural change in a time series, selecting the break point endogenously by minimizing the ADF t-statistic. There is strong evidence of an endogenous break point during the 1980s in the first differences given that the ZA test rejects the null of a unit root at the 1% significance level in these three series. Hence, the variables "share of finance and information rents in Kua", "share of information rents in Kua", and the "Kua / Kpa" ratio are non-stationary I(1) processes in levels and I(0) break-stationary processes in first differences, with a structural break in the 1980s. For this reason, I add the Neoliberal dummy variable (equal to 1 after 1980) within the long-run relationship in the ARDL models estimated in Tables 3 and 4.

Table A.1: Unit Root Tests

	ADF	PP	KPSS	ERS	DF-GLS	ZA	Conclusion
Null hypothesis	Unit root	Unit root	No unit root	Unit root	Unit root	Unit root	
Deterministic components	Drift	Drift	Drift	Drift	Drift	Drift and trend breaks	
Top 0.1% with capital gains							
Level	-0.44	-0.58	1.32***	17.14	-0.24		I(1): non-stationary
First difference	-5.89***	-9.64***	0.17	0.79***	-3.71***		I(0): stationary
Top 1% with capital gains							
Level	-0.38	-0.47	1.25***	16.04	-0.25		I(1): non-stationary
First difference	-5.79***	-9.26***	0.23	0.76***	-3.82***		I(0): stationary
Value Added							
Level	-1.25	-1.53	1.72***	760.01	1.16		I(1): non-stationary
First difference	-5.88***	-8.08***	0.19	0.97***	-2.72***		I(0): stationary
Rate of exploitation							
Level	0.002	-0.16	1.38***	32.06	0.67		I(1): non-stationary
First difference	-5.31***	-8.55***	0.15	1.39***	-2.41**		I(0): stationary
Labor productivity							
Level	-1.33	-1.35	1.70***	1831.1	1.35		I(1): non-stationary
First difference	-4.92***	-7.02***	0.25	1.05***	-3.63***		I(0): stationary
Share of finance and information rents in NIua							
Level	-0.22	-0.19	1.52***	35.83	0.18		I(1): non-stationary
First difference	-5.73***	-8.09***	0.17	0.67***	-3.98***		I(0): stationary
Share of information rents in NIua							
Level	-0.78	-0.80	1.31***	14.37	-0.61		I(1): non-stationary
First difference	-5.53***	-7.90***	0.12	0.69***	-3.87***		I(0): stationary
NIua / Value Added							
Level	-2.19	-1.70	1.57***	107.44	0.15		I(1): non-stationary
First difference	-5.27***	-9.22***	0.12	1.98**	-2.09**		I(0): stationary
Share of finance and information rents in Kua							
Level	-1.09	-1.74	1.70***	185.66	0.33		I(1): non-stationary
First difference	-2.52	-5.31***	0.42*	19.42	-0.55	-6.44*** (a)	I(0): break-stationary
Second difference	-7.11***	-15.91***	0.10	1.10***	-0.37		I(0): stationary
Share of information rents in Kua							
Level	-0.38	-1.62	1.72***	992.31	2.70		I(1): non-stationary
First difference	-4.56***	-7.60***	0.15	7.87	-0.78	-5.79*** (b)	I(0): break-stationary
Kua / Kpa							
Level	-1.19	-1.80	0.80***	21.73	-1.63*		I(1): non-stationary
First difference	-6.09***	-5.48***	0.42*	20.28	-0.50	-6.45*** (c)	I(0): break-stationary
Second difference	-7.13***	-11.36***	0.22	0.73***	-5.74***		I(0): stationary

Note: Significance levels: 10% (*), 5% (**), and 1% (***). Variables in levels are in logs. Regression results are for the entire postwar period (1947-2011). ZA unit root test with one endogenous break point, using both intercept and trend shifts: (a) with 3 lags, structural break in 1989; with 1 lag, structural break in 1983; (b) with 3 lags, structural break in 1997; with 1 lag, structural break in 1950; (c) with 3 lags, structural break in 1981; with 1 lag, structural break in 1981.

A.4 Simulation of Economic Effects

To compute the ARDL specifications, PSS bounds F-tests, and model simulations with bootstrapped intervals, I use the approach from Jordan and Philips (2018) and Philips (2018) and their open-source package “dynamac” for R. Jordan and Philips (2018) and Philips (2018) compute the ARDL simulations as follows. The ARDL coefficients are simulated through 20,000 draws from a multivariate normal distribution with mean and variance from the estimated variance-covariance matrix from equation A.1. A stochastic component is added to the predicted value of each simulation by computing the standard deviations scaled by random draws from the chi-squared distribution. The independent variables in levels are held at their means and other variables in differences are held at 0. A “burn in” period of 10 years allows equation A.1 to equilibrate before the independent variables are shocked. The 20,000 simulated draws do not lower uncertainty as they do not decrease the underlying variance from equation A.1. More simulations just improve and smooth the estimates within each time period. Simulation plots of all models are available in appendix 2.

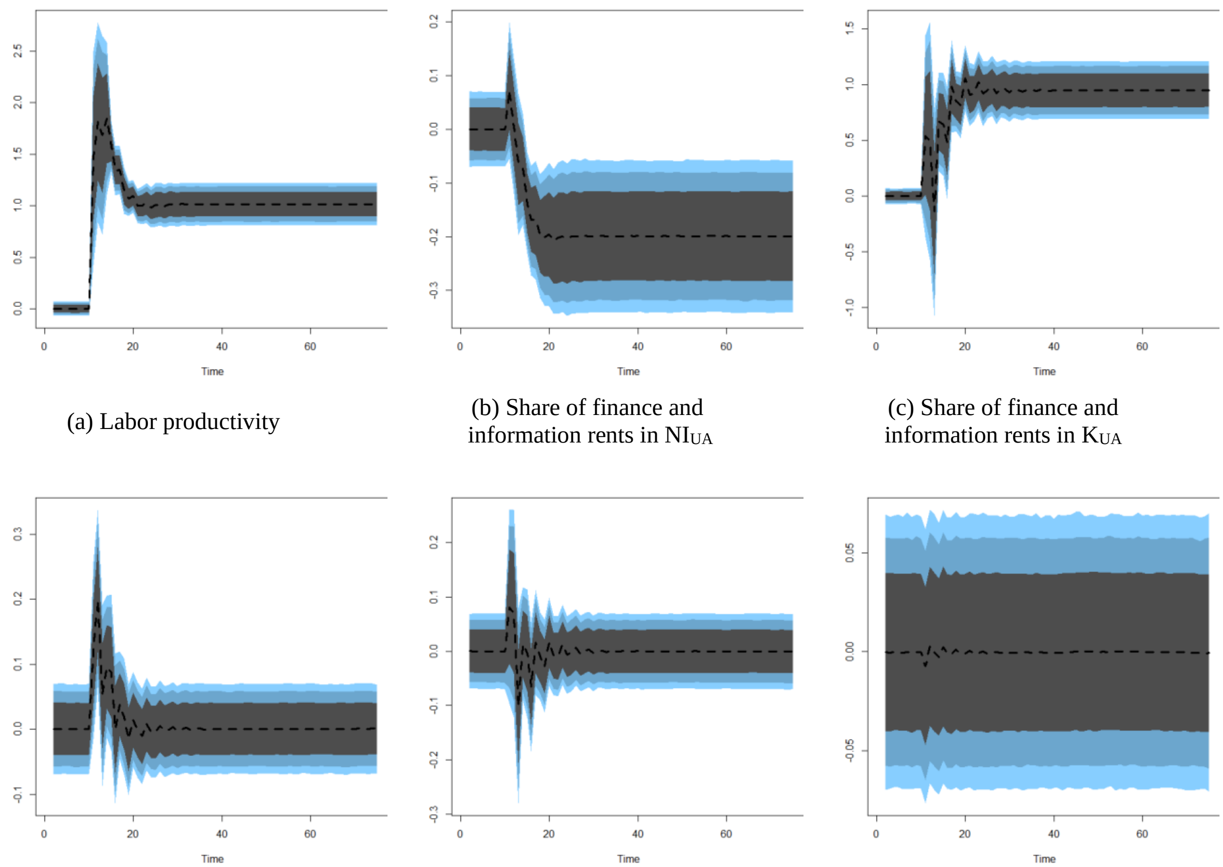
In this paper I simulate the ARDL models using impulses that replicate the actual cumulative changes in the underlying variables from 1947 to 2011. For the variables in lagged differences, the respective temporary responses of the dependent variables will decay to zero over time. For the variables in lagged levels, the responses of the dependent variables will converge to their long-run economic effect. The economic effect of a regressor is equal to its long-run elasticity times the actual cumulative change in the underlying variable. Tables 5 and 6 in the main text present the long-run elasticities, cumulative changes, and economic effects of the regressors in each model. The '--' symbol indicates that the regressor is included only in lagged differences.

Appendix 2

In this appendix I present the simulations of the ARDL models in Tables 3 and 4. The simulations show the temporary short-run effects as well as the permanent long-run economic effects. Regressors receive an impulse equal to the actual cumulative change in the respective variables as reported in Tables 5 and 6.

Figure A1: Economic Effect on Value Added (Model 1a)

Cumulative change in the **value added** of productive activities from the actual cumulative change in:



(a) Labor productivity

(b) Share of finance and information rents in NI_{UA}

(c) Share of finance and information rents in K_{UA}

(d) Rate of exploitation

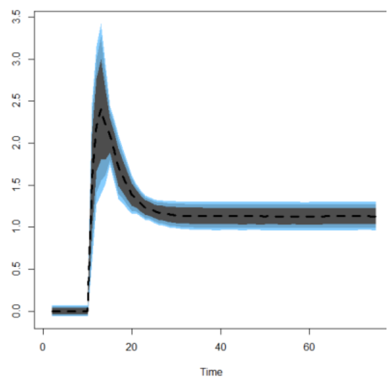
(e) NI_{UA} / Value Added

(f) K_{UA} / K_{PA}

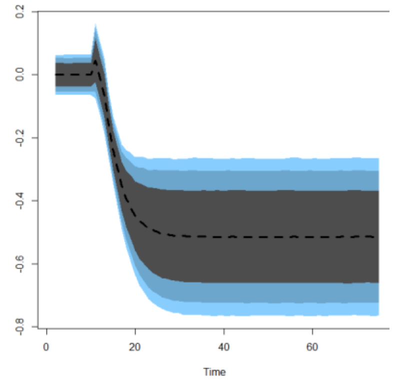
Note: ARDL model from Table 3. Shaded areas around the dotted line represent the 75%, 90%, and 95% bootstrapped intervals with 20,000 simulations. The economic effect is the dependent variable's response to an impulse equal to the actual cumulative change in each regressor from 1947 to 2011, plotted over the entire time frame of 65 years. All variables in logs.

Figure A2: Economic Effect on Value Added (Model 1b)

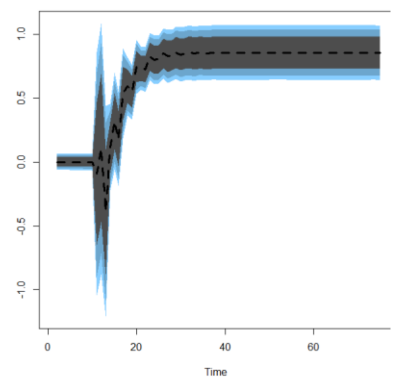
Cumulative change in the **value added** of productive activities from the actual cumulative change in:



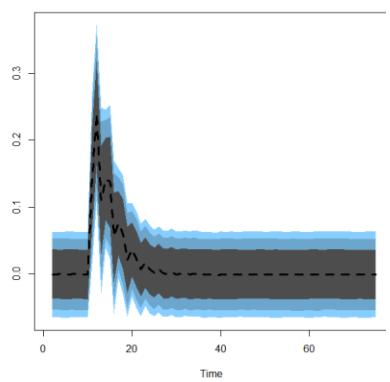
(a) Labor productivity



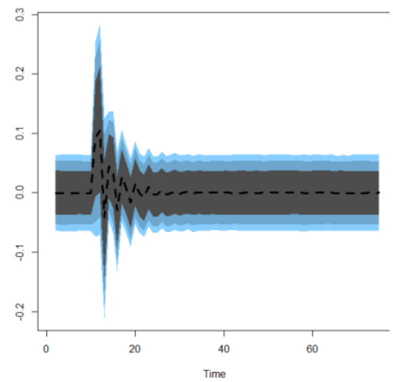
(b) Share of finance and information rents in NI_{UA}



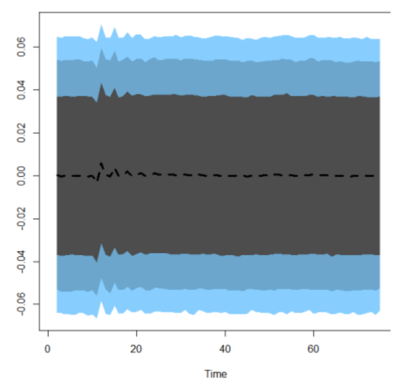
(c) Share of finance and information rents in K_{UA}



(d) Rate of exploitation



(e) NI_{UA} / Value Added

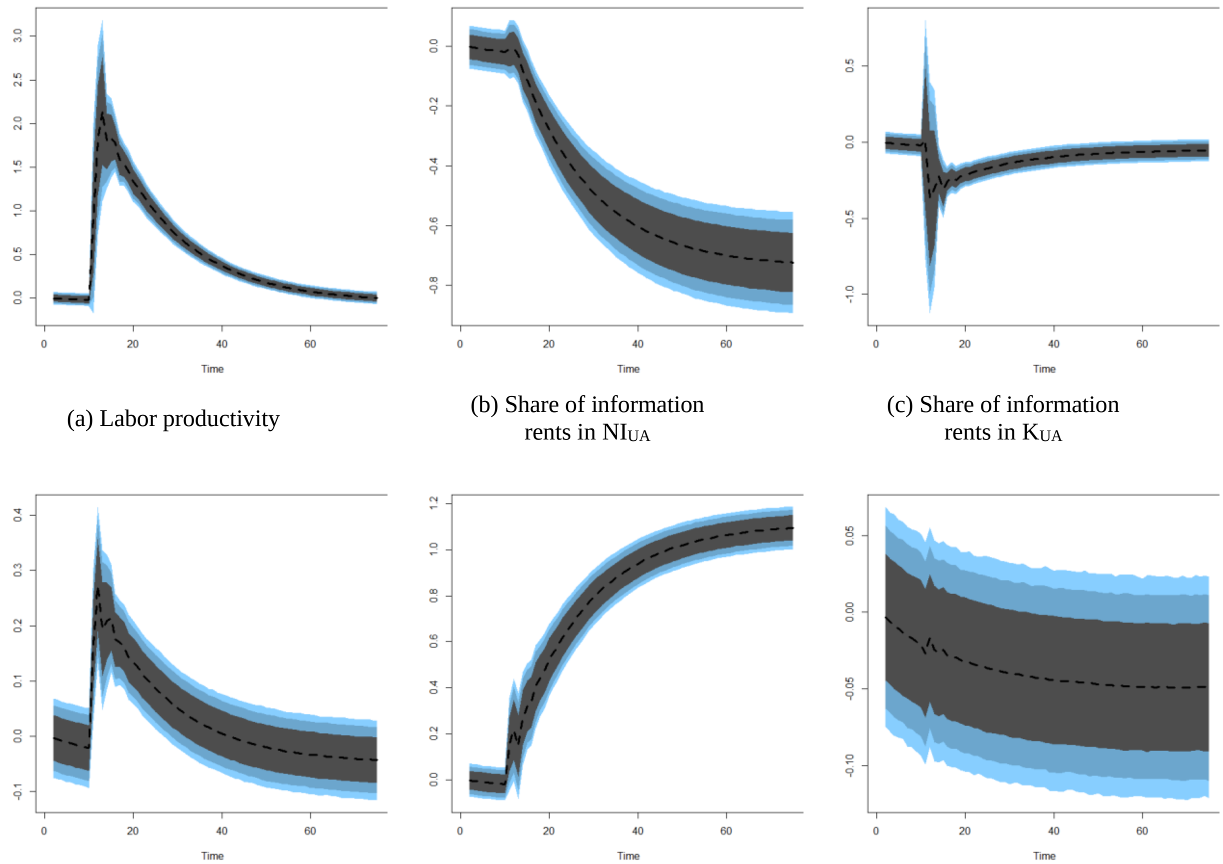


(f) K_{UA} / K_{PA}

Note: ARDL model from Table 3. Shaded areas around the dotted line represent the 75%, 90%, and 95% bootstrapped intervals with 20,000 simulations. The economic effect is the dependent variable's response to an impulse equal to the actual cumulative change in each regressor from 1947 to 2011, plotted over the entire time frame of 65 years. All variables in logs.

Figure A3: Economic Effect on Value Added (Model 1c)

Cumulative change in the **value added** of productive activities from the actual cumulative change in:



(a) Labor productivity

(b) Share of information rents in NI_{UA}

(c) Share of information rents in K_{UA}

(d) Rate of exploitation

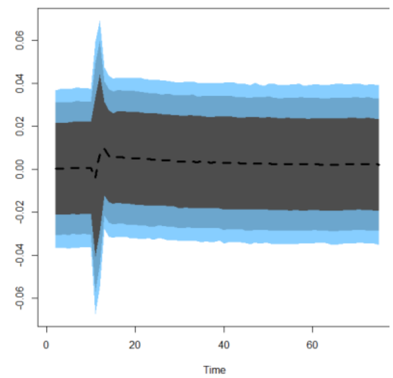
(e) NI_{UA} / Value Added

(f) K_{UA} / K_{PA}

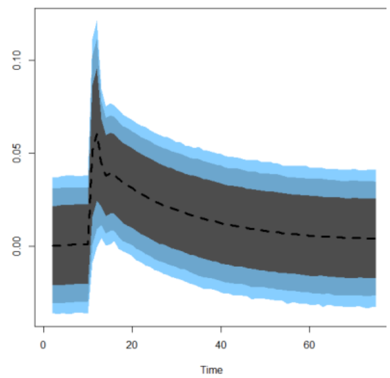
Note: ARDL model from Table 4. Shaded areas around the dotted line represent the 75%, 90%, and 95% bootstrapped intervals with 20,000 simulations. The economic effect is the dependent variable's response to an impulse equal to the actual cumulative change in each regressor from 1947 to 2011, plotted over the entire time frame of 65 years. All variables in logs.

Figure A4: Economic Effect on Labor Productivity (Model 2a)

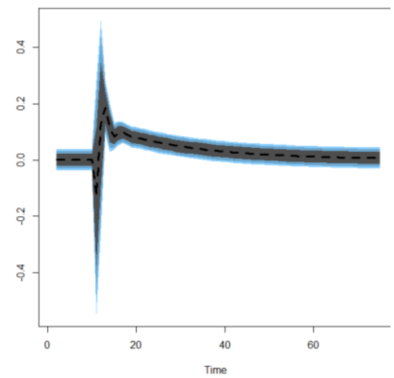
Cumulative change in the economy-wide **labor productivity** from the actual cumulative change in:



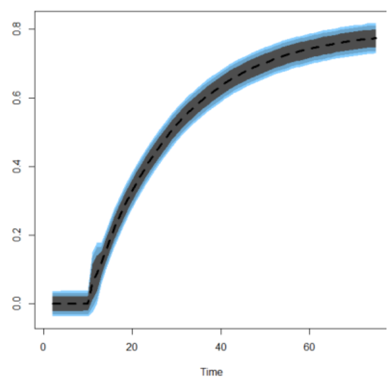
(a) Rate of exploitation



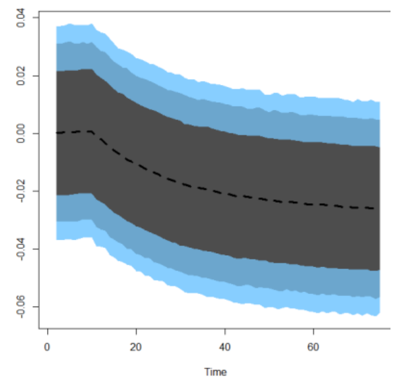
(b) Share of finance and information rents in NI_{UA}



(c) Share of finance and information rents in K_{UA}



(d) NI_{UA} / Value Added

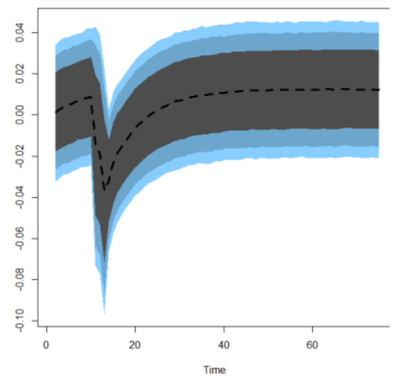


(e) K_{UA} / K_{PA}

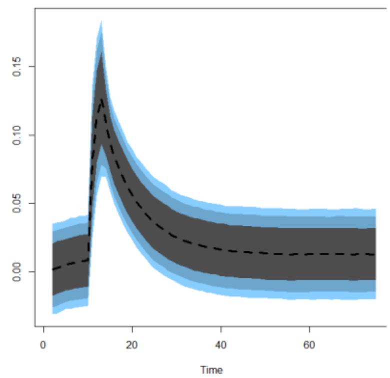
Note: ARDL model from Table 3. Shaded areas around the dotted line represent the 75%, 90%, and 95% bootstrapped intervals with 20,000 simulations. The economic effect is the dependent variable's response to an impulse equal to the actual cumulative change in each regressor from 1947 to 2011, plotted over the entire time frame of 65 years. All variables in logs.

Figure A5: Economic Effect on Labor Productivity (Model 2b)

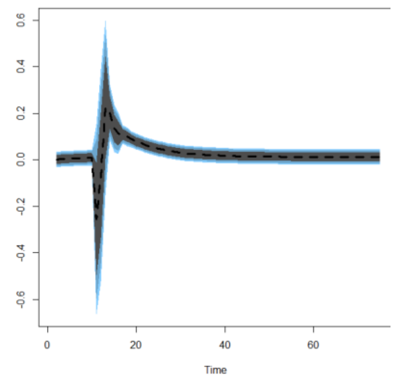
Cumulative change in the economy-wide **labor productivity** from the actual cumulative change in:



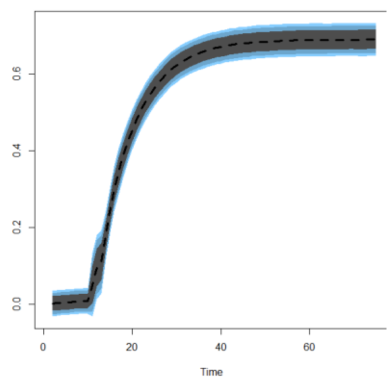
(a) Rate of exploitation



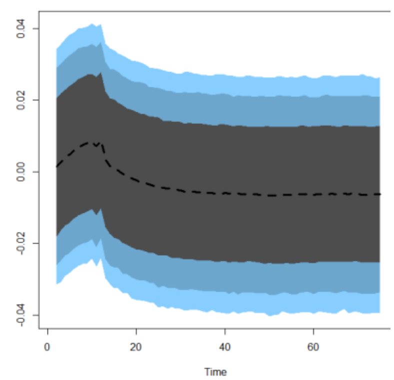
(b) Share of finance and information rents in NI_{UA}



(c) Share of finance and information rents in K_{UA}



(d) NI_{UA} / Value Added

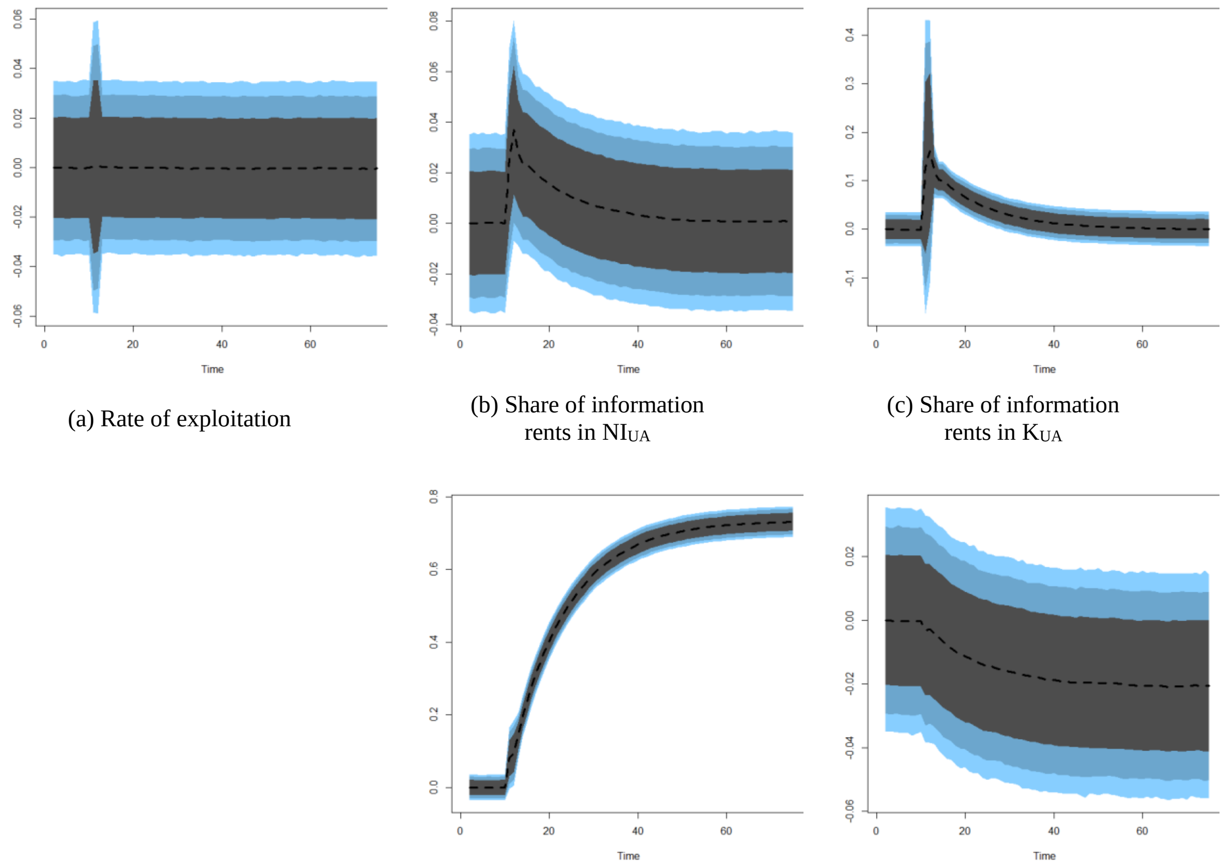


(e) K_{UA} / K_{PA}

Note: ARDL model from Table 3. Shaded areas around the dotted line represent the 75%, 90%, and 95% bootstrapped intervals with 20,000 simulations. The economic effect is the dependent variable's response to an impulse equal to the actual cumulative change in each regressor from 1947 to 2011, plotted over the entire time frame of 65 years. All variables in logs.

Figure A6: Economic Effect on Labor Productivity (Model 2c)

Cumulative change in the economy-wide **labor productivity** from the actual cumulative change in:



(a) Rate of exploitation

(b) Share of information rents in NI_{UA}

(c) Share of information rents in K_{UA}

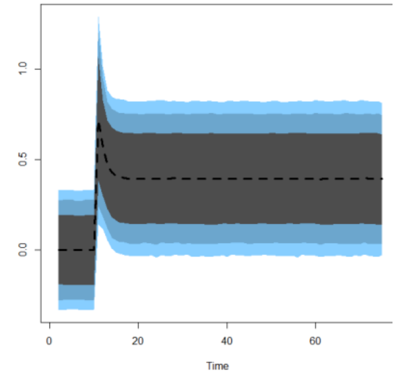
(d) NI_{UA} / Value Added

(e) K_{UA} / K_{PA}

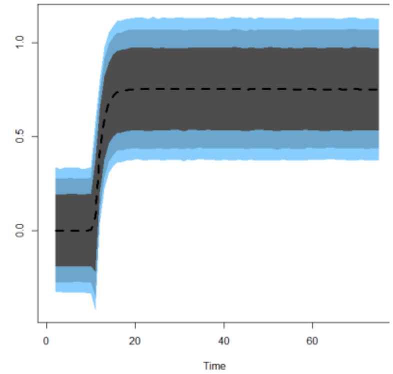
Note: ARDL model from Table 4. Shaded areas around the dotted line represent the 75%, 90%, and 95% bootstrapped intervals with 20,000 simulations. The economic effect is the dependent variable's response to an impulse equal to the actual cumulative change in each regressor from 1947 to 2011, plotted over the entire time frame of 65 years. All variables in logs.

Figure A7: Economic Effect on Inequality (Model 3a)

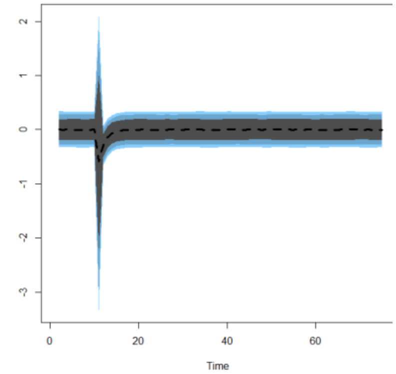
Cumulative change in the **income share of the top 0.1%** from the actual cumulative change in:



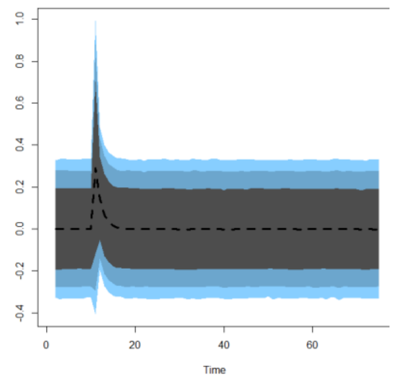
(a) Rate of exploitation



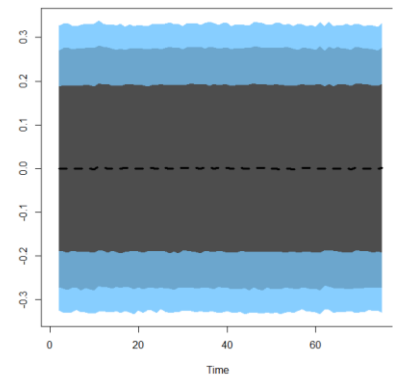
(b) Share of finance and information rents in NI_{UA}



(c) Share of finance and information rents in K_{UA}



(d) NI_{UA} / Value Added

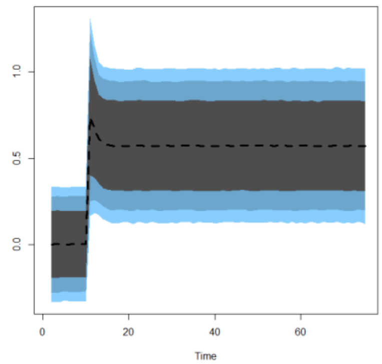


(e) K_{UA} / K_{PA}

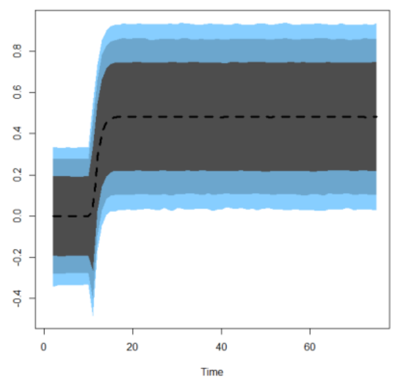
Note: ARDL model from Table 3. Shaded areas around the dotted line represent the 75%, 90%, and 95% bootstrapped intervals with 20,000 simulations. The economic effect is the dependent variable's response to an impulse equal to the actual cumulative change in each regressor from 1947 to 2011, plotted over the entire time frame of 65 years. All variables in logs.

Figure A8: Economic Effect on Inequality (Model 3b)

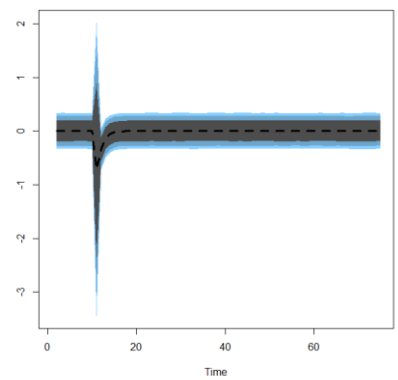
Cumulative change in the **income share of the top 0.1%** from the actual cumulative change in:



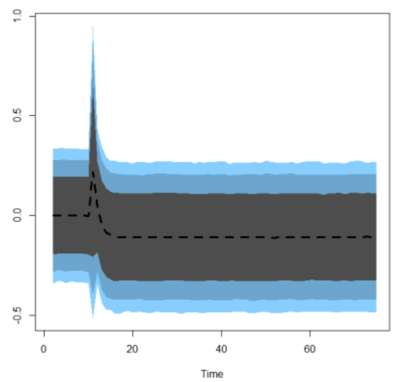
(a) Rate of exploitation



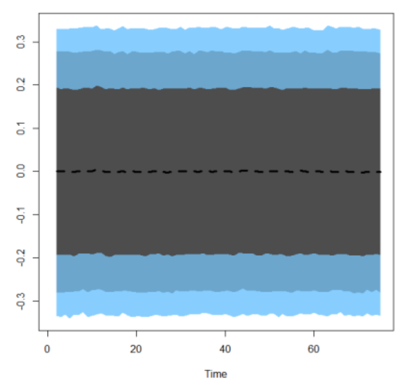
(b) Share of finance and information rents in NI_{UA}



(c) Share of finance and information rents in K_{UA}



(d) NI_{UA} / Value Added

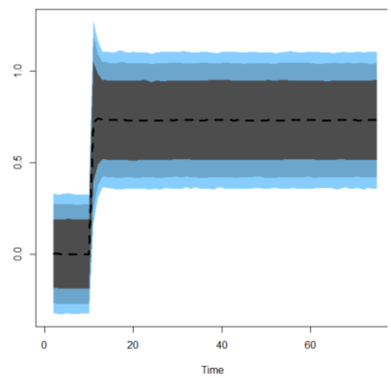


(e) K_{UA} / K_{PA}

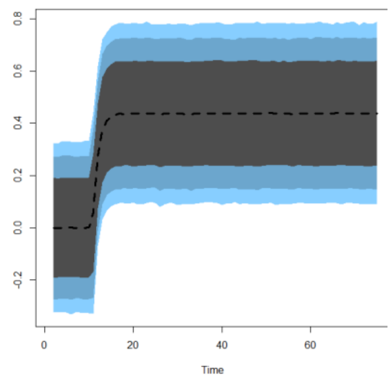
Note: ARDL model from Table 3. Shaded areas around the dotted line represent the 75%, 90%, and 95% bootstrapped intervals with 20,000 simulations. The economic effect is the dependent variable's response to an impulse equal to the actual cumulative change in each regressor from 1947 to 2011, plotted over the entire time frame of 65 years. All variables in logs.

Figure A9: Economic Effect on Inequality (Model 3c)

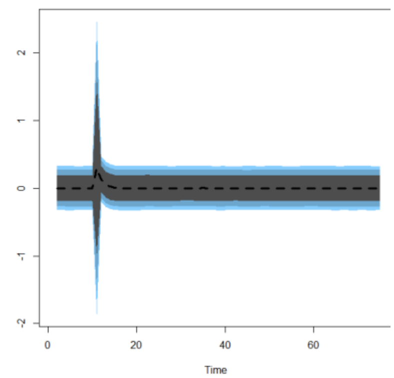
Cumulative change in the **income share of the top 0.1%** from the actual cumulative change in:



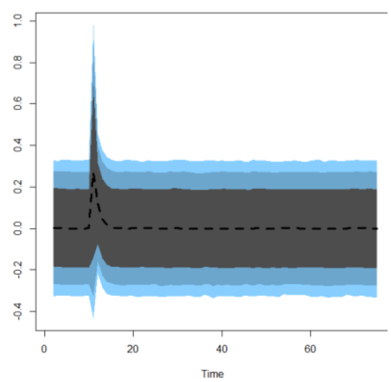
(a) Rate of exploitation



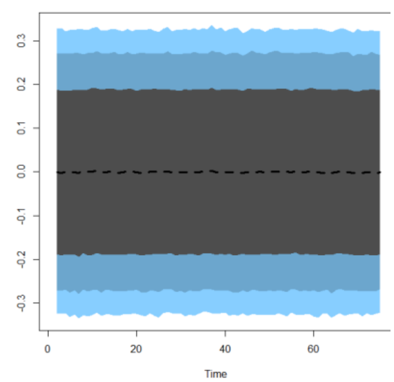
(b) Share of information rents in NI_{UA}



(c) Share of information rents in K_{UA}



(d) NI_{UA} / Value Added

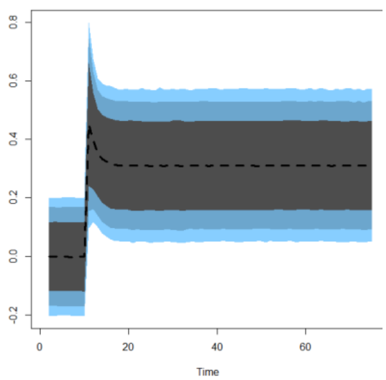


(e) K_{UA} / K_{PA}

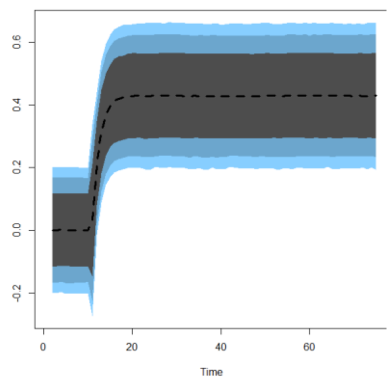
Note: ARDL model from Table 4. Shaded areas around the dotted line represent the 75%, 90%, and 95% bootstrapped intervals with 20,000 simulations. The economic effect is the dependent variable's response to an impulse equal to the actual cumulative change in each regressor from 1947 to 2011, plotted over the entire time frame of 65 years. All variables in logs.

Figure A10: Economic Effect on Inequality (Model 4a)

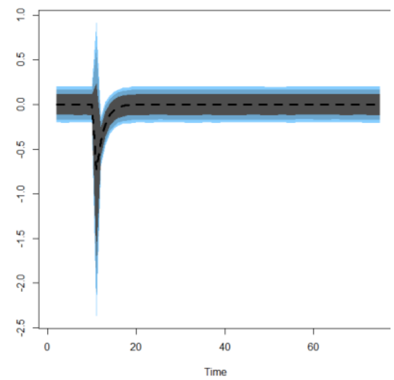
Cumulative change in the **income share of the top 1%** from the actual cumulative change in:



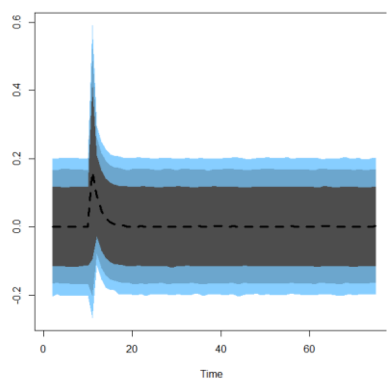
(a) Rate of exploitation



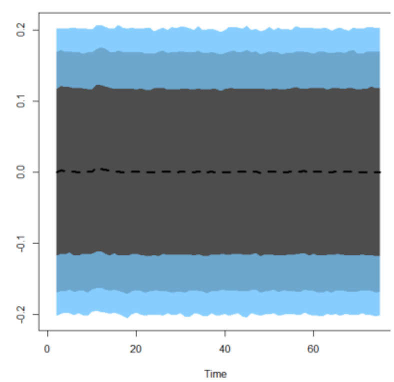
(b) Share of finance and information rents in NI_{UA}



(c) Share of finance and information rents in K_{UA}



(d) NI_{UA} / Value Added

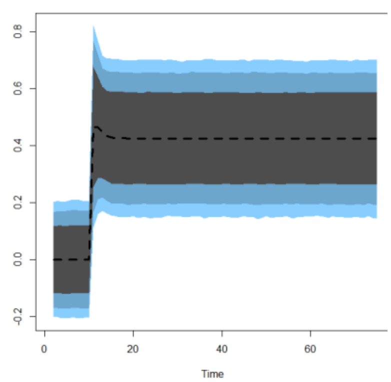


(e) K_{UA} / K_{PA}

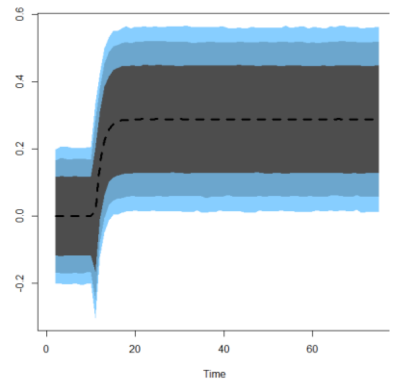
Note: ARDL model from Table 3. Shaded areas around the dotted line represent the 75%, 90%, and 95% bootstrapped intervals with 20,000 simulations. The economic effect is the dependent variable's response to an impulse equal to the actual cumulative change in each regressor from 1947 to 2011, plotted over the entire time frame of 65 years. All variables in logs.

Figure A11: Economic Effect on Inequality (Model 4b)

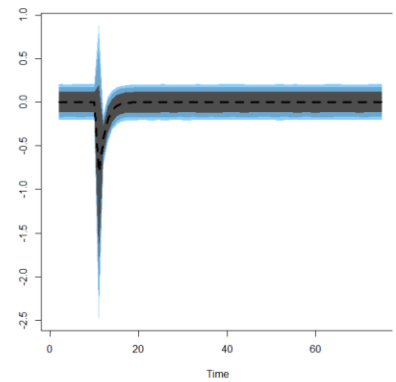
Cumulative change in the **income share of the top 1%** from the actual cumulative change in:



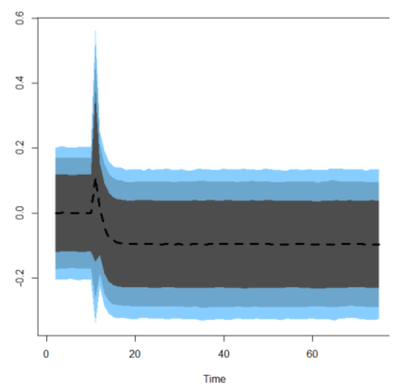
(a) Rate of exploitation



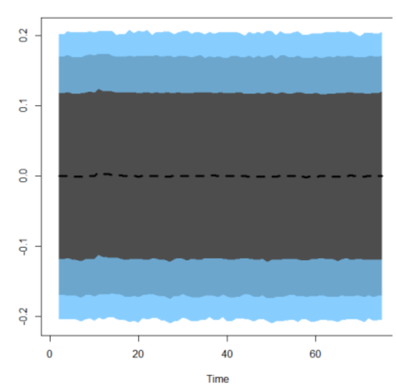
(b) Share of finance and information rents in NI_{UA}



(c) Share of finance and information rents in K_{UA}



(d) NI_{UA} / Value Added

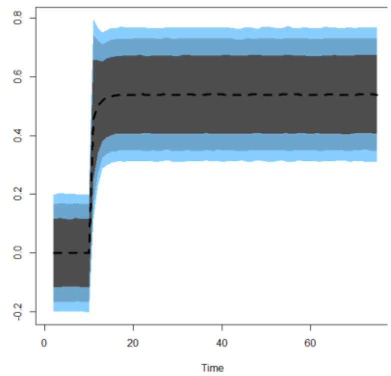


(e) K_{UA} / K_{PA}

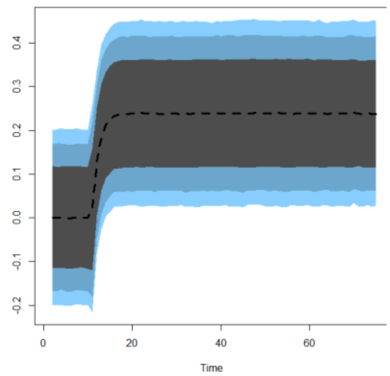
Note: ARDL model from Table 3. Shaded areas around the dotted line represent the 75%, 90%, and 95% bootstrapped intervals with 20,000 simulations. The economic effect is the dependent variable's response to an impulse equal to the actual cumulative change in each regressor from 1947 to 2011, plotted over the entire time frame of 65 years. All variables in logs.

Figure A12: Economic Effect on Inequality (Model 4c)

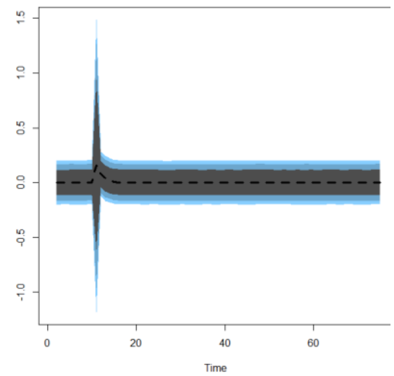
Cumulative change in the **income share of the top 1%** from the actual cumulative change in:



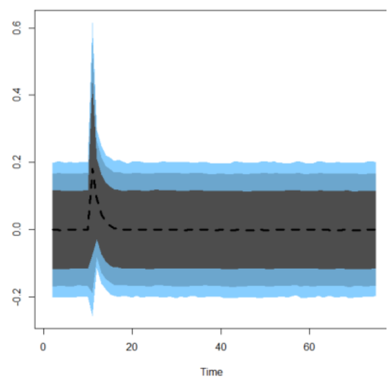
(a) Rate of exploitation



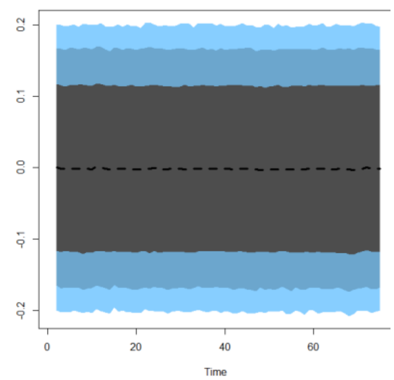
(b) Share of information rents in NI_{UA}



(c) Share of information rents in K_{UA}



(d) NI_{UA} / Value Added



(e) K_{UA} / K_{PA}

Note: ARDL model from Table 4. Shaded areas around the dotted line represent the 75%, 90%, and 95% bootstrapped intervals with 20,000 simulations. The economic effect is the dependent variable's response to an impulse equal to the actual cumulative change in each regressor from 1947 to 2011, plotted over the entire time frame of 65 years. All variables in logs.

Appendix 3

In this appendix I present the classification of productive and unproductive activities using the 2002 BEA modified benchmark input-output table. Table A.2 shows the classification that I maintain throughout the paper. The methodology employed follows the approach developed in Rotta (2018). For a detailed explanation of the construction of all series from 1947 to 2011 for the United States, see the long appendix of Rotta (2018).

There are, evidently, some specific activities that are difficult to classify in practice. But from an empirical perspective, borderline sectors are not big enough to modify the aggregate measures in any significant way. Even if we modify the classification of certain particular sectors, the aggregate measures at the national level will change only slightly.

The paper focuses on the 1947-2011 period because the available data and the most recent methodology (from Rotta 2018) to transform the BEA input-output matrices and the NIPA accounts into Marxist categories relate to that time frame. At the time of writing, the BEA has released two newer benchmark input-out matrices, one for 2007 and another for 2012. But the more recent period requires a different estimation methodology, given that in the years from 1997 to 2019 the BEA has released both the benchmark input-output matrices (with 405 industries) and also the aggregate annual input-output matrices (with 71 industries). The estimation of Marxist categories from the combination of benchmark input-output matrices and aggregate annual input-output matrices requires a proper estimation technique that is not yet available in the literature. The main difference in terms of estimation techniques is that the current methodology from Rotta (2018) interpolates the benchmark input-output matrices with the NIPA accounts, while a newer technique must be developed to interpolate the benchmark input-output matrices with the annual aggregate input-output matrices between 1997 and 2019.

Table A.2: 2002 BEA Modified 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	Magnetic and optical recording media manufacturing	334613
Other residential structures	230202	Electric lamp bulb and part manufacturing	335110
Nonresidential maintenance and repair	230301	Lighting fixture manufacturing	335120
Residential maintenance and repair	230302	Small electrical appliance manufacturing	335210
Dog and cat food manufacturing	311111	Household cooking appliance manufacturing	335221
Other animal food manufacturing	311119	Household refrigerator and home freezer manufacturing	335222
Flour milling and malt manufacturing	311210	Household laundry equipment manufacturing	335224
Wet corn milling	311221	Other major household appliance manufacturing	335228
Fats and oils refining and blending	311225	Power, distribution, and specialty transformer manufacturing	335311
Soybean and other oilseed processing	31122A	Motor and generator manufacturing	335312
Breakfast cereal manufacturing	311230	Switchgear and switchboard apparatus manufacturing	335313
Beet sugar manufacturing	311313	Relay and industrial control manufacturing	335314

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**
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**
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**
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**

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**
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**

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 technical services	**5419A0**
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**

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**
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**
Farm machinery and equipment manufacturing	**333111**
Lawn and garden equipment manufacturing	**333112**
Construction machinery manufacturing	**333120**
Mining and oil and gas field machinery manufacturing	**333130**
Plastics and rubber industry machinery manufacturing	**333220**
Semiconductor machinery manufacturing	**333295**
Other industrial machinery manufacturing	**33329A**
Optical instrument and lens manufacturing	**333314**
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**
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**
Funds, trusts, and other financial vehicles	**525000**
Monetary authorities and depository credit intermediation	**52A000**
Real estate	**531000**
Video tape and disc rental	**532230**
Lessors of nonfinancial intangible assets	**533000**
Custom computer programming services	**541511**
Computer systems design services	**541512**
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**

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