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Dynamic rent, corporate political expenditure, and normative corporate income tax rates

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Abstract

Since the 1990s, there has been a worldwide "race to the bottom" in lowering corporate tax rates. This paper attempts to determine normative corporate tax rates. It defines the normative corporate tax rate as the sum of a normal corporate tax rate and monopoly and transfer rents, which firms obtain from other economic agents. Using a Cobb-Douglas function and dynamic pseudo-competitive profit optimal conditions, we calculated the rents of 234 American corporations listed on the S&P 500. The normative tax rates from 1982 to 2014 for these companies are stable at forty to fifty percent depending on the assumption, while corporate income tax has gradually decreased from forty percent to less than thirty percent. By examining the relationship between rent and lobbying using a Granger test, we found that rents cause, and are caused by, lobbying.

Keywords: dynamic rent, corporate income tax, normative corporate tax, lobbying, U.S. company

JEL codes: H25 D72 P16 H26 D63

1. Introduction

1.1. Corporate lobbying and rent

Production and industrial organization theories have developed various indicators to evaluate corporations' market activities. For example, indicators such as production efficiency and total factor productivity measure the efficiency and the productivity of a corporation's production activities. Furthermore, indicators such as the degree of monopoly and monopsony measure price formation in the market.

However, it is not clear whether studies of corporation activities should focus only on their market activities. Many recent studies have analyzed corporations' political and nonmarket activities, such as lobbying. For example, Drutman (2015) pointed out that the average lobbying expenditure of 1,066 U.S companies listed on the S&P 500 between 1981 and 2004 more than doubled in that period. Data on corporate lobbying has been more readily available since the passage of the *Lobbying Disclosure Act* (LDA) in 1995. The data indicates that corporate spending on lobbying activities increased from USD $1.13 billion in 1998 to USD $2.09 billion in 2010. According to de Figueiredo and Richter (2014), majority of the total lobbying expenditure is comprised of the expenditures by corporations and trade associations (i.e., business lobbying groups). Wrona and Sinzig (2018) suggest that more heavily regulated industries – such as the steel, oil, telecommunications, and pharmaceutical industries – engage in political activity more frequently. This extensive lobbying is not confined to the United

States; corporations attempt to shape government policy in their favor in most countries (Gorostidi-Martinez and Zhao, 2017). Firms in Sweden, Japan, and Germany formally participate in the public policy process, and companies in the United States, Canada, and Mexico informally compete with a variety of other interest groups to affect public policy.

Some scholars argue that corporate lobbying generates high returns. Alexander, Mazza, and Scholz (2009) examined the costs and returns of lobbying in support of the *American Jobs Creation Act*, which allowed U.S. corporations with multinational operations a one-time opportunity to deduct 85 percent of the dividends they received during a single year from a foreign subsidiary (i.e., they only paid taxes on 15 percent of their repatriated income). The authors calculated that lobbying activity had an astounding 22,000 percent rate of return. Etzioni (2018) noted that Whirlpool spent $1.8 million on lobbying over the course of two years and secured an energy tax credit which increased its profits by $120 million, a return of approximately 6,700 percent.

These returns above normal profits can be regarded as rents in political economy. Rent generally means receipt above normal profit, although there are many types of rent. The rents related to this study comprise transfer rent in which a company uses political efforts to allocate resources that would otherwise be allocated to other departments to its own sector, monopoly rents obtained by raising product prices above competitive prices by setting various barriers to entry, sometimes accompanied by political efforts, and rents by monopsony in production factor markets such as labor and resources. This study focuses on the aspects of these rents that may be obtained through political activities. Rent is an important index in analyzing the relationship between a company's political process and its distribution in economic society, and therefore, the study attempts to develop a general calculation method.

1.2. Taxation for rents

Most corporate rent is classified as transfer rent or monopolistic rent in public choice theory. These are resources which should have been distributed to other economic agents but were diverted to a corporation because of barriers to entry or political actions that reduce economic efficiency. Because lobbying expenditure is regarded as unproductive, Bhagwati (1982) has labeled these expenditures as directly unproductive profit-seeking (DUP) activity. Governments should prohibit DUP activities because they do not benefit anyone but the rent-seekers.

However, it is difficult to prohibit these activities because corporate lobbying tends to provide benefits to politicians with legislative authority. Although governments could charge corporations for the unproductive rent, this might encourage companies to move overseas to avoid being taxed. Reducing tax rates has not encouraged companies to keep their profits in their home countries, either. Clausing (2016) and Cobham and Janský (2017) provide evidence that profit-shifting has grown significantly even as effective tax rates have fallen. This situation has led to the average corporate tax rate in OECD (Organization for Economic Cooperation and Development) member countries dropping considerably since the 1990s in a virtual “race to the bottom”.

In recent years, increasing rates of corporate tax evasion have eroded governments’ finances across the world. For instance, Alstadsæter, Johannesen, and Zucman (2018) showed that about 10 percent of global gross domestic product (GDP) is held in tax havens. These figures differ by country; while only a few percent of Scandinavian countries’ GDP is held in offshore tax havens, this figure rises to about 15 percent in continental Europe and 60 percent in Russia, some Latin American countries, and the oil-rich Persian Gulf. Crivelli, de Mooij, and Keen (2016) and Cobham and Janský (2018) have estimated the resulting global tax loss at between $650 billion and $5 trillion per year.

International organizations have only recently begun acting on this front. For instance, Zhu (2016) states that the “G20 + OECD” regime has taken the initiative since 2012 to fight tax evasion; the basic role of the G20 is to set the agenda and provide the political consensus guiding and steering the entire governance process, while the OECD provides technical support and facilitates the implementation of the consensus. Weinzierl (2018) argues that it would be easier to implement substantial international tax reforms if policymakers could point to an additional, complementary, normative logic. They suggest that this is possible if the international community collaborates and calculates a normative corporate tax rate – especially for large corporations – for each country and works together to enforce this rate.

1.3. Normative corporate tax rates

Economists who support orthodox taxation theory have developed various arguments against imposing corporate taxes. For instance, Stiglitz and Rosengard (2015, 713) suggest that "in a perfectly competitive economy, there would presumably be no pure profits, so the tax is just a tax on the return to capital." They also point out that "corporate earnings that are transferred to individuals in the form of dividends are taxed twice – once in the form of the corporate tax and again by way of the individual income tax" (729). Although neoclassical taxation theory assumes the existence of an efficient state under perfect competition to identify the distortions caused by taxes, this does not reflect the oligopolistic reality of the global market. Thus, if rents are created because of imperfect competition, they should be attributed to other economic entities and taxed and redistributed appropriately.

It is often argued that even in an oligopolistic market, competitive prices are formed in a contestable market; however, this proposition should be verified empirically to determine whether rent is being generated. In addition to the oligopoly in the product market and the factor market, companies should be considered to have a monopsony for corporate taxes. In principle, corporations conduct business activities utilizing local human resources, public safety resources, and various infrastructural resources of the country in which they are located. In this light, corporate tax could be considered a form of compensation for using public services. However, the low corporate tax rates that we see around the world under the threat of capital flight causes governments to lose immense amounts of potential corporate tax revenue. Based on the foregoing, this paper defines the normative corporate tax rate as a corporate tax rate which includes monopolistic and transfer rents in the product, factor, and public service markets.

This paper will examine the following three issues. First, we construct a method to divide the profits of companies into proper rewards obtained through market competition and rents obtained through political activities and monopolistic means. Second, we calculate rents for 234 companies from the S&P 500 for which lobbying data exists through LDA reports over the past thirty-three years[1] and estimate a normative corporate tax rate for large American corporations. Third, we analyze the causal relationships between rent and the amount of lobbying reported in the LDA report and R&D investment.

2. Development of Indicators for Measuring Company Performance and Data Limitations

We assess corporate activities using the process discussed above. To develop indicators that can be used widely in economic analysis and administrative procedures, it must be easy to obtain data. We discuss this issue in this section. We will examine what kind of data are used

[1] Available online at https://www.senate.gov/legislative/Public_Disclosure/LDA_reports.htm.

and what kind of difficulties exist in the main indicators that measure the market behavior and political behavior of corporations.

2.1. Production efficiency

First, we selected a purely technical indicator of production efficiency. Many previous studies have attempted to develop such an indicator. Farrell (1957) suggested that production efficiency could be measured as the distance between an observation and an estimated ideal, referred to as the production frontier.[2] Subsequent empirical studies of productive efficiency have taken a parametric or nonparametric approach. The former estimates the production frontier using a functional form, such as a Cobb-Douglas function (see Aigner and Chu 1968). The use of stochastic methods (e.g., Bauer 1990) and panel data analysis (Schmidt and Sickles 1984) has improved the accuracy of these estimations. Nonparametric approaches, such as that of Varian (1984), consolidated the theoretical background by using revealed preference theory to show the relationship between actual data and the production frontier behind it. In this vein, scholars such as Charnes, Cooper, and Rhodes (1978) reduced the maximization of a ratio of weighted outputs to weighted inputs (an index of production efficiency) to a linear programming form. This watershed discovery, which has come to be called Data Envelop

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[2] Førsund, Lovell, and Schmidt (1980) provide an instructive review and outline of the initial research in this area.

Analysis (DEA), has become the workhorse of efficiency studies today and is widely used for practical analysis in the field of operational research as well as economics.

Data on input and output quantity are required to calculate this indicator. However, in existing empirical analyses, only one industry is targeted; the region examined limits the quantity of data that can be obtained, as can be confirmed from the above empirical analyses and literature review. Although output and labor input data are relatively readily available, data for other production factors are extremely difficult to obtain, and some DEA analyses use accounting information on revenue and expenses as proxy variables for the output and input of production factors. However, if the markets are not competitive, such an approach would not be theoretically supported.

2.2. Degrees of Monopoly or Monopsony

It is common sense that a corporation's profits would be a good measure of their market performance under perfect competition. However, because markets are not always competitive, it is necessary to employ indicators that measure if corporations are operating under market competition. The Lerner index (Lerner 1934) captures the general degree of monopoly in a supplier's market by dividing the difference between the price of the product and its marginal cost by the price. To obtain this value, we must calculate the price elasticity of demand. A similar index can be used to measure monopsony. Calculating this second index requires that we calculate the price elasticity of supply. Empirical studies such as those of Appelbaum (1982), Schroeter (1988), and Azzam and Pagoulatos (1990) have utilized standard models to obtain these parameters by solving an equation system. Shimamoto (2018) reviewed these studies in detail.

There are, however, limitations on the availability of data to calculate these parameters. The estimation requires quantity and price data for both products and production inputs; although most empirical studies employ cost or profit functions at the firm level or even the industry level, it is difficult to obtain data for the labor and energy inputs used in many different industries and production processes.

2.3. Rent

The indicators of corporate activity in orthodox economics have been related to corporate production activities and market economic activities as described above. But public choice has focused on the profits of corporate nonmarket behavior, that is, political action. Rent is defined as an additional income higher than that earned from economic efficiency. The actions of people who lobby governments and bureaucrats to achieve an advantageous business environment and secure rents are called rent-seeking.

Tullock (1967) argued that both the dead weight loss caused by monopolies and tariffs and the rents accruing to firms from these measures are social costs. Rents obtained through monopoly price formation due to entry barriers are called monopoly rents, while rents generated by tariffs, taxation, or subsidies set by government policies are called transfer rents.

Krueger (1974) argued that rent-seeking activities are often competitive and rewards from such activities can be expended on non-productive activities for further rent acquisition.

Despite the importance of rents in the literature and in society, public choice theorists seem to have shifted their focus to game-theoretic clarification of political phenomena rather than quantifying rent since the 1990s. To analyze this relationship empirically, we must measure rent with a standardized method so that it can be compared with other analyses. Because rents have only been measured at the macro and industrial levels using unsystematic methods, a comprehensive and versatile method for measuring rents has not been established (Shimamoto 2018). Here again, the difficulty of obtaining quantity and price data is a problem.

Obtaining indicators of market economic activity and corporate political activity for many companies by a general method usually pose difficulties in collecting data of quantities and prices. Value data, however, can be widely collected from corporate accounting data. Thus, this paper aims to establish a standardized method of rent measurement which uses only the value data found in financial statements.

3. Dynamic Rent

As noted above, the profits of a company can be divided into normal profits generated by production efficiency and rents. Because monopoly rents and transfer rents are surplus taken away from other economic entities and are social costs, according to Tullock's (1967) logic, they should be taxed and the original distribution should be restored.

We define dynamic rents as a time series of rents for each company. Shimamoto (2018) explains how to calculate dynamic monopoly rents for each corporation using their accounting data and analyzed them for Japanese companies. By this method, we can calculate the time series of excess profits (under the assumption that companies are under monopolistic price formation). If, under the market price given by the shadow price (i.e., the marginal profit at the optimal production volume of the monopoly model = marginal cost at the same volume) in the monopoly price formation model rather than the actual selling price (monopoly price), the producer maximizes the dynamic profit, as in a competitive market, the actual time series of input-output would be the result of long-term profit maximization in this model in theory. We calculate dynamic monopoly rents as the difference between the actual price and the shadow price multiplied by the production amount.

In this paper, we consider this method to calculate both the monopoly and transfer rents of a company, with special attention to companies' bargaining power over public services. In light of this, we propose the following behavioral hypothesis: the government provides various public services to corporations in exchange for income tax. Multinational companies can move their bases to foreign countries at any time, thus putting pressure on the government to reduce corporate taxes. This means, essentially, that the markets for public services are under monopsony. Governments are forced to discount the price of public services for companies, so they must reduce the amount of the other public services (such as social security and education) provided to other actors in the country. Therefore, the portion of corporate income tax that the corporation has deducted can be considered as monopsony rents in the markets for public services or as rents transferred from other members of society. Any subsidies received by the company are included in the calculation of product market rents because they are accounted for in revenue but are transfer rents in nature.

4. Model

Our model applied the mechanism discussed above to the model constructed in Shimamoto (2018) to calculate the company's rent.

4.1. Short-term equilibrium conditions

We assume monopolistic and monopsonistic product markets. Producers maximize short-term profits and have long-term equilibrium. Assume that a producer uses a general Cobb–Douglas production technology to produce one product using four production factors. This function is denoted by:

$$y = \alpha_5 v_1^{\alpha 1} v_2^{\alpha 2} v_3^{\alpha 3} K^{\alpha 4} \quad , \tag{1}$$

where y is the output quantity, $v_1, v_2,$ and v_3 are the quantities of variable inputs, and K is the quantity of the fixed input, namely capital. In the short-term equilibrium, K is a given value, and $\alpha_1 + \alpha_2 + \alpha_3 < 1$, which ensures that the marginal cost function is convex.

As the producer simultaneously faces both a monopolistic product market and monopsonistic factor markets, the short-run profit maximization problem is given as

$$\max\ \pi_m = p(y) \cdot y - w_1(v_1) \cdot v_1 - w_2(v_2) \cdot v_2 - w_3(v_3) \cdot v_3 - rK$$

s.t. (1). (2)

The optimal conditions come from differentiating the Lagrange equation by the variable factors $v_1, v_2,$ and v_3. These are given as:

$$\{p'(y) \cdot y + p(y)\} \cdot f'_{v_i} = \{w_i'(v_i) \cdot v_i + w_i(v_i)\}, \quad i=1, 2, 3. \tag{3}$$

$\{p'(y) \cdot y + p(y)\}$ can be expressed as $(1+\gamma)\cdot p(y)$, where γ is now assumed to have a constant inverse demand elasticity and $-1 < \gamma \leq 0$. $p_m(y)$ can be defined by

$$p_m(y) = \{p'(y) \cdot y + p(y)\} = (1+\gamma) \cdot p(y). \tag{4}$$

$\{w_i'(v_i) \cdot v_i + w_i(v_i)\}$ can be expressed as $(1+\sigma_i) \cdot w_i$, where σ_i is now assumed to have a constant inverse factor supply elasticity and $\sigma_i \geq 0$. In the same way, $w_{im}(v_i)$ can be defined by

$$w_{im}(v_i) = \{w_i'(v_i) \cdot v_i + w_i(v_i)\} = (1 + \sigma_i) \cdot w_i(v_i), \quad i=1, 2, 3. \tag{5}$$

The short-run optimization conditions in the monopoly and monopsony markets can be expressed by arranging eqs. (1), (3), and (4) as follows:

$$y = \alpha_5 \cdot \left(\frac{w_{1m}^{1-\alpha 2-\alpha 3} \cdot w_{2m}^{\alpha 2} \cdot w_{3m}^{\alpha 3}}{\alpha 5 \cdot \alpha 1^{1-\alpha 2-\alpha 3} \cdot \alpha 2^{\alpha 2} \cdot \alpha 3^{\alpha 3} \cdot p_m K^{\alpha 4}} \right)^{\frac{\alpha 1}{\alpha 1+\alpha 2+\alpha 3-1}} \cdot$$

$$\left(\frac{w_{1m}^{\alpha 1} \cdot w_{2m}^{1-\alpha 1-\alpha 3} \cdot w_{3m}^{\alpha 3}}{\alpha 5 \cdot \alpha 1^{1} \cdot \alpha 2^{1-\alpha 1-\alpha 3} \cdot \alpha 3^{\alpha 3} \cdot p_m K^{\alpha 4}} \right)^{\frac{\alpha 2}{\alpha 1+\alpha 2+\alpha 3-1}} \cdot$$

$$\left(\frac{w_{1m}^{\alpha 1} \cdot w_{2m}^{\alpha 2} \cdot w_{3m}^{1-\alpha 1-\alpha 2}}{\alpha 5 \cdot \alpha 1^{1} \cdot \alpha 2^{\alpha 2} \cdot \alpha 3^{1-\alpha 1-\alpha 2} \cdot p_m K^{\alpha 4}} \right)^{\frac{\alpha 3}{\alpha 1+\alpha 2+\alpha 3-1}} \cdot K^{\alpha 4}$$

(6)

$$v_i = \alpha_5 \cdot \left(\frac{w_{im}^{1-\alpha j-\alpha k} \cdot w_{jm}^{\alpha j} \cdot w_{km}^{\alpha k}}{\alpha 5 \cdot \alpha i^{1-\alpha j-\alpha k} \cdot \alpha j^{\alpha j} \cdot \alpha k^{\alpha k} \cdot p_m K^{\alpha 4}} \right)^{\frac{1}{\alpha 1+\alpha 2+\alpha 3-1}}, \quad i, j, k=1,2,3 \ (i \neq j \neq k) \qquad (7)$$

It is important to note that these equations are not normal supply and factor demand functions: p_m(y) and $w_{im}(v_i)$ are endogenous variables and differ from the exogenous prices of a product and factors in competitive markets. This interdependence makes it difficult to find an optimal point and to formulate an empirical model.

We utilized the relationship between imperfect competition models and perfect competition models to facilitate our calculations. Now y^{t*} indicates the short-term optimum production level and p^{t*} is the equilibrium price in this imperfect competition model, as described in figure 1. A superscript *t* indicates a value in the *t* period.

Given the same production technology and the same given value of K^t, $p^{t*}(1+\gamma^t)$ is defined as a given market price with constant $p^{t*}$and γ^t in a perfect competition. Then, it brings the same production level y^{t*} as the short-term competitive equilibrium value. γ^t is the degree of monopoly in this imperfect competition model at the optimal point.

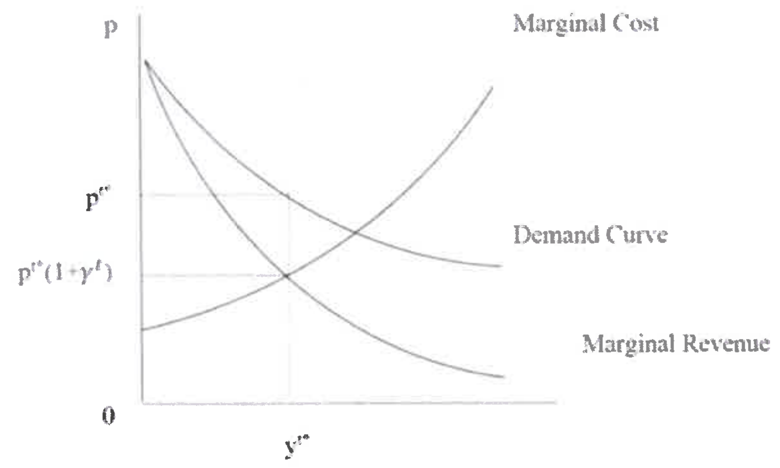

Figure 1. Imperfect Competition and Perfect Competition in the Products Market

We can consider the production factor markets in the same manner. In this model, the producer is a monopsonist in the factor markets. v_1^{t*}, v_2^{t*}, and v_3^{t*} are the short-term optimal factor quantities, and w_1^{t*}, w_2^{t*}, and w_3^{t*} are the equilibrium prices in this monopsonic equilibrium, as described in figure 2. Under the same production technology and the same given value of K^t, $w_1^{t*}(1+\sigma_1^t)$, $w_2^{t*}(1+\sigma_2^t)$, and $w_3^{t*}(1+\sigma_3^t)$ are defined as the market prices with constant $w_1^{t*}, w_2^{t*}, w_3^{t*}, \sigma_1^t, \sigma_2^t$, and σ_3^t, which bring the short-term equilibrium factor quantities v_1^{t*}, v_2^{t*}, and v_3^{t*} in a perfect competition. Then, we can get markup rates of σ_1^t, σ_2^t, and σ_3^t, which satisfy the condition where $w_1^{t*}v_1^{t*}, w_2^{t*}v_2^{t*}$, and $w_3^{t*}v_3^{t*}$ are the costs for each realized by profit maximization in the imperfect competition in the *t* period.

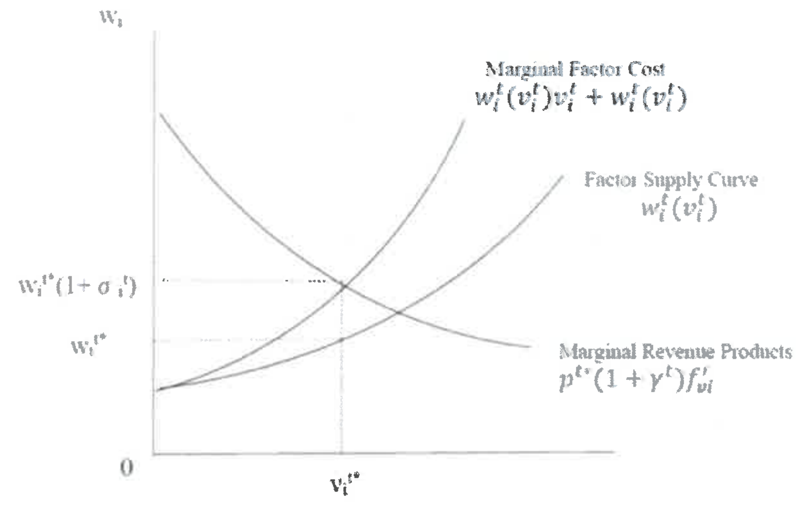

Figure 2. Imperfect Competition and Perfect Competition in the Factor Market

Therefore, considering the long-term equilibrium conditions, the supply equation (6) and factor demand equation (7) can be regarded as the supply function and factor demand function, respectively, under the given K^t, $p^{t*}(1+\gamma^t)$, and $w_i^{t*}(1+\sigma_i^t)$, which satisfy the short-term equilibrium conditions in the perfect competitive model.

4.2. Long-term equilibrium conditions

Long-term equilibrium conditions are derived by maximizing the time-series total of the discounted present value of profits defined by the short-term pseudo-competitive equilibrium model minus capital costs. By deriving these long-term pseudo-competitive profit maximization conditions, we can find the optimal $\gamma^t, \sigma_1^t, \sigma_2^t$, and σ_3^t that make the time series data of K^t, $p^{t*}y^{t*}, w_1^{t*}v_1^{t*}, w_2^{t*}v_2^{t*}$, and $w_3^{t*}v_3^{t*}$ for each of the four periods the optimal dynamic solution. These past data can be regarded as results that have satisfied both the short-term and long-term equilibrium conditions. We can then determine the rent ratios, γ^t and σ_i^t, which are the proportions of rent in the product price and factor prices, respectively.

Now, let us formulate the long-term pseudo-competitive profit maximization conditions. It is maximized for discrete time periods from 1 to *T*. The pseudo-competitive profit function in period *t* is defined as follows:

$$\begin{aligned}\pi^t = \;& p^{t*}(1+\gamma^t)\cdot y^t(p^{t*}(1+\gamma^t), w_1^{t*}(1+\sigma_1^t), w_2^{t*}(1+\sigma_2^t), w_3^{t*}(1+\sigma_3^t), K^t) \\ & - w_1^{t*}(1+\sigma_1^t)\cdot v_1{}^t(p^{t*}(1+\gamma^t), w_1^{t*}(1+\sigma_1^t), w_2^{t*}(1+\sigma_2^t), w_3^{t*}(1+\sigma_3^t), K^t\ ) \\ & - w_2^{t*}(1+\sigma_2^t)\cdot v_2{}^t(p^{t*}(1+\gamma^t), w_1^{t*}(1+\sigma_1^t), w_2^{t*}(1+\sigma_2^t), w_3^{t*}(1+\sigma_3^t), K^t\ ) \\ & - w_3^{t*}(1+\sigma_3^t)\cdot v_3{}^t(p^{t*}(1+\gamma^t), w_1^{t*}(1+\sigma_1^t), w_2^{t*}(1+\sigma_2^t), w_3^{t*}(1+\sigma_3^t), K^t\ ) \\ & - Q^t\cdot I^t(K^{t-1}, K^t, \delta^t)\end{aligned} \quad ,$$

(8)

where $y^t(\cdot)$ *and* $v_i{}^t(\cdot\ )$ are defined by equations 6 and 7, and γ^t, σ_1^t, σ_2^t, and σ_3^t are assumed to change over time. Investment in period *t*, $I^t(K^{t-1}, K^t, \delta^t\ )$ is defined as follows:

$$I^t(K^{t-1}, K^t, \delta^t) = K^t - (1-\delta^t)\cdot K^{t-1} \quad , \tag{9}$$

where δ^t is the depreciation rate in period *t*, and Q^t is the exogenous unit price of investment in period *t*.

The long-term equilibrium condition arises from maximizing the sum of the discounted present value of π^t from period 1 to *T* based on K^t, as follows:

$$\max_{K^t} \;\; \Pi = \pi^1 + \sum_{t=2}^{T} \prod_{s=2}^{t} \frac{1}{(1+r^s)} \pi^t \quad .$$

(10)

Thus, the necessary condition for optimization, is given as follows:

$$\partial \Pi / \partial K^t = \prod_{s=2}^{t} \frac{1}{(1+r^s)} \cdot [\ p^{t*}(1+\gamma^t) \cdot \frac{\partial y^t}{\partial K^t} - w_1^{t*}(1+\sigma_1^t) \cdot \frac{\partial v_1^t}{\partial K^t} - w_2^{t*}(1+\sigma_2^t) \cdot \frac{\partial v_2^t}{\partial K^t}$$

$$- w_3^{t*}(1+\sigma_3^t) \cdot \frac{\partial v_3^t}{\partial K^t} - Q^t \cdot \frac{\partial I^t}{\partial K^t}] + \prod_{s=2}^{t+1} \frac{1}{(1+r^s)} [-Q^{t+1} \cdot \frac{\partial I^{t+1}}{\partial K^t}] = 0 \ . \quad (11)$$

By modifying the partial differentiation using logarithmic differentiation,[3] this condition can be finally arranged into the following simple equation:

$$(1+\gamma^t) \cdot \frac{p^t y^t}{K^t} - (1+\sigma_1^t) \cdot \frac{w_1^t v_1^t}{K^t} - (1+\sigma_2^t) \cdot \frac{w_2^t v_2^t}{K^t} - (1+\sigma_3^t) \cdot \frac{w_3^t v_3^t}{K^t}$$

$$- \frac{\alpha_1+\alpha_2+\alpha_3-1}{-\alpha_4} \cdot \left[Q^t - \frac{1}{(1+r^{t+1})} \cdot Q^{t+1} \cdot (1 - \delta^{t+1})\right] = 0 \quad (12)^4$$

[3] See Shimamoto (2018) for the detailed derivation process. Generally, the following equation holds for partial differentiation:

$$\frac{\partial B}{\partial A} = \frac{\partial B}{\partial \ln B} \cdot \frac{\partial \ln B}{\partial \ln A} \cdot \frac{\partial \ln A}{\partial A}$$

Referring to the short-term optimizing conditions, eqs. (6) and (7):

$$\frac{\partial \ln y}{\partial \ln K} = \frac{-\alpha_1\alpha_4}{\alpha_1+\alpha_2+\alpha_3-1} + \frac{-\alpha_2\alpha_4}{\alpha_1+\alpha_2+\alpha_3-1} + \frac{-\alpha_3\alpha_4}{\alpha_1+\alpha_2+\alpha_3-1} + \alpha_4 = \frac{-\alpha_4}{\alpha_1+\alpha_2+\alpha_3-1}$$

$$\frac{\partial \ln v_i}{\partial \ln K} = \frac{-\alpha_4}{\alpha_1+\alpha_2+\alpha_3-1}, \qquad i = 1, 2, 3$$

Using $\partial \ln x / \partial x = 1/x$,

$$\frac{\partial y}{\partial K} = \frac{-\alpha_4}{\alpha_1+\alpha_2+\alpha_3-1} \cdot \frac{y}{K}$$

$$\frac{\partial v_i}{\partial K} = \frac{-\alpha_4}{\alpha_1+\alpha_2+\alpha_3-1} \cdot \frac{v_i}{K}, \qquad i = 1, 2, 3$$

[4] In this empirical study, the data are collected from the financial statements of each company. The depreciation amount for a year is included as an item among the costs. Therefore, we set δ^{t+1} as zero to avoid double counting.

5. Calculating Rents from Corporate Accounting Data

Here, we will calculate the rent (monopolistic rent + transfer rent) by applying the model described in the previous section to corporations' financial data. Before applying the model, we must consider that because the breakdown of costs for production factors is not always shown in detail in accounting data, it is not possible to properly distinguish labor, raw materials, etc., the typical production factors used in economics. Shimamoto (2018) showed a way to solve this problem using Japanese accounting data. Until 2013, listed companies in Japan had to disclose manufacturing cost reports accounting for their labor, raw materials, etc. However, since 2014, this obligation was decided to be exempted in case the segment information was noted, when preparing consolidated financial statements. Therefore, using the data before 2013, we compared the rent calculated from the production factors typical in economics using the manufacturing cost report with the one calculated from the pseudo production factors that can be easily obtained from accounting data. We calculated the correlation coefficient between rent when w1, w2, and w3 are set as labor, raw materials, and other expenses, respectively, and rent when w1, w2, and w3 are set as operating expenses, non-operating expenses plus extraordinary losses, and corporate taxes, respectively. The correlation coefficient calculated for a total of 1,664 samples in the time series of seventy-five companies with no missing values was 0.987. From this, it was concluded that general accounting data items, operating expenses, non-operating expenses plus extraordinary losses, and corporate taxes can be used as proxy variables in calculating rents as factors.

Based on the above considerations, the following accounting items in financial statements are assigned to each variable in the model outlined above under "model". The output value (*py*) is the total sales, and the four production factors $w_1^t v_1^t, w_2^t v_2^t, w_3^t v_3^t$, and K are operating expenses, non-operating expenses plus extraordinary losses, corporate taxes, and total assets. Among the model's four parameters – $\gamma^t, \sigma_1^t, \sigma_2^t$, and σ_3^t – one should be removed when *R*(= $\frac{\alpha_1+\alpha_2+\alpha_3-1}{-\alpha_4}$) is regarded as a fourth variable. At this time, σ_2 will be set to 0 because of the nature of the production factor; γ represents the degree of monopoly in the product market; and σ_1 represents the degree of monopsony for production factors (labor, raw materials, etc.). As described under "dynamic rent", σ_3 represents the degree of monopsony for public services, assuming that taxes are discounted due to monopsony in markets for public services.

When we regard the variable *R* relating to scale as the fourth parameter, $\gamma, \sigma_1, \sigma_3$, and *R* can be obtained by quadratic programming using data for at least four years, as calculated in Shimamoto (2018). However, when the parameters are determined in this way, the time series values of *R* fluctuate drastically from year to year, which makes the sequential values of rent unstable. Therefore, we define a scale variable, S, as follows:

$$S = \alpha_1 + \alpha_2 + \alpha_3 + \alpha_4 \quad . \tag{13}$$

The calculation is performed by setting S to 1 (i.e., R=1) for the time being. Sensitivity analysis will be performed with S = 1.2, which is the upper bound of induced returns to scale in the United States in recent years according to Boussemart et al. (2019).

6. Capital Reward and Rent Distribution

In the case of constant returns to scale (i.e., *S*=1), total rent is regarded as $-\gamma^t p^t y^t + \sigma_1^t w_1^t v_1^t + \sigma_2^t w_2^t v_2^t + \sigma_3^t w_3^t v_3^t$. However, if the yield shows increasing returns to scale, it is necessary to devise profit and rent distribution. To explain this point, we must define the distribution of capital reward and rent specifically.

Transforming Equation 12,

$$\frac{p^t y^t}{K^t} - \frac{w_1^t v_1^t}{K^t} - \frac{w_2^t v_2^t}{K^t} - \frac{w_3^t v_3^t}{K^t}$$

$$= R \cdot \left[Q^t - \frac{1}{(1+r^{t+1})} \cdot Q^{t+1} \cdot (1 - \delta^{t+1})\right] + \frac{-\gamma^t p^t y^t}{K^t} + \frac{\sigma_1^t w_1^t v_1^t}{K^t} + \frac{\sigma_3^t w_3^t v_3^t}{K^t}. \quad (14)$$

In the accounting data, capital depletion δ is recorded as an item in $w_1^t v_1^t$ as a depreciation expense, so δ = 0. Further, regarding I^t as the investment amount, both Q^t and Q^{t+1} are equal to 1. Taking these things into account, we multiply both sides of equation 14 by K:

$$p^t y^t - w_1^t v_1^t - w_2^t v_2^t - w_3^t v_3^t$$

$$= R \cdot \frac{r^{t+1}}{1+r^{t+1}} \cdot K + (-\gamma^t p^t y^t + \sigma_1^t w_1^t v_1^t + \sigma_2^t w_2^t v_2^t + \sigma_3^t w_3^t v_3^t) \quad .$$

(15)

Since r^{t+1} is the interest rate, it can be generally regarded as (discounted present value of) the marginal efficiency of capital. When $R = 1$, $R \cdot \frac{r^{t+1}}{1+r^{t+1}} \cdot K$ means a competitive and normative capital reward. Thus, this equation can be interpreted as:

Net Income = Capital Reward + Rent. (16)

In other words, in the case of constant returns to scale, rewards above the marginal efficiency of capital are rents.

What about the case of increasing returns on scale? When $S > 1$, $R < 1$ and R converges to 0 as S increases. Regarding $R \cdot \frac{r^{t+1}}{1+r^{t+1}} \cdot K$ as capital reward according to equation 15 in this case, as the scale harvest increases, the proportion of capital rewards among net income decreases and the proportion of rents, increases.

However as shown in figure 3, as the yield increases, marginal costs (MC) decrease (from MC1 to MC2), and the ratio of rent to revenue or profit increases, covering the grid area rather than just the grey area. Therefore, when there are increasing returns to scale, we must revise the distribution of net income. It may be appropriate to consider the capital reward under the constant return to scale multiplied by the scale factor S as the capital share. In this case, the capital reward and the rent distribution can be expressed as the first and second terms on the right side of the following equation:

Net Income = $= S \cdot \frac{r^{t+1}}{1+r^{t+1}} \cdot K$

$$+\left\{\left(-\gamma^t p^t y^t + \sigma_1^t w_1^t v_1^t + \sigma_2^t w_2^t v_2^t + \sigma_3^t w_3^t v_3^t\right) \quad + \quad R \cdot \frac{r^{t+1}}{1+r^{t+1}} \cdot K - S \cdot \frac{r^{t+1}}{1+r^{t+1}} \cdot K\right\} \quad .$$

(17)

In this case, all the scale effects are attributed to capital, so this distribution method can be regarded as the upper limit of the capital reward.

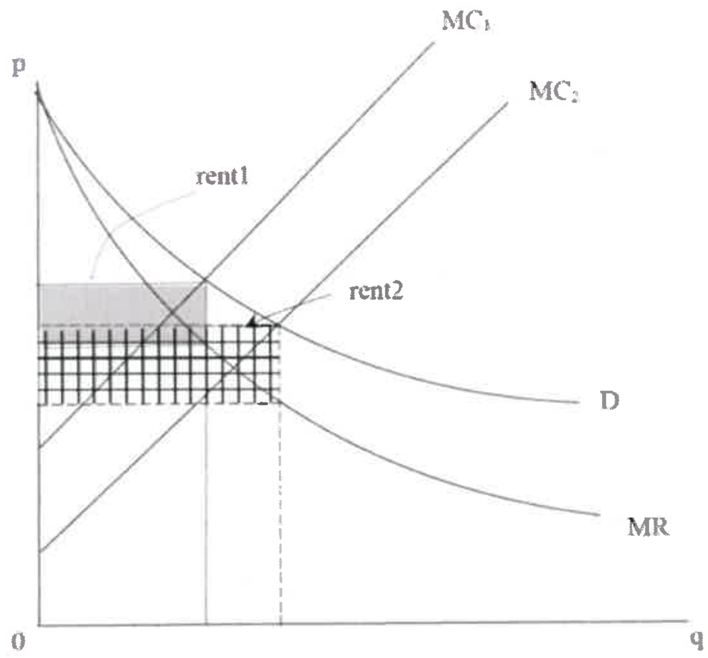

Figure 3. Increasing Returns to Scale and Capital Reward

Some people may be dissatisfied with the absence of the Schumpeter rent. It is defined that corporations will gain rents by selling goods and services with more novelty and originality that those of other companies, including the result of research and development investments. They might suggest that we should count Schumpeter rent separately. Indeed, Schumpeter rent should deduct from the sum of monopoly rents and transfer rents as a legitimate reward for investment in the calculation of normative corporate tax as it was generated by research and development investment. As described in the next section, the rent will be divided into γ and σ_i segments. The Schumpeter rent would be considered part of γ segment. However, we do not know what percentage of monopoly rents are constituted by Schumpeter rents. Therefore, when calculating the normative corporate tax rate in this paper, we will use the total rent minus the monopoly rent of the product market.

7. Data and Calculation

The system of equations was solved using MATLAB software.[5] Using matrix expressions, simultaneous equations that solve for γ, σ_1, and σ_3 in equation 12 can be specified and then estimated with three years of financial data as follows:

$$\begin{bmatrix} R\widehat{Q^t} + \widehat{V_2^t} \\ R\widehat{Q^{t+1}} + \widehat{V_2^{t+1}} \\ RQ^{t+2} + \widehat{V_1^{t+2}} \end{bmatrix} = \begin{bmatrix} \widehat{Y^t} & -\widehat{V_1^t} & -\widehat{V_3^t} \\ \widehat{Y^{t+1}} & -\widehat{V_1^{t+1}} & -\widehat{V_3^{t+1}} \\ \widehat{Y^{t+2}} & -\widehat{V_1^{t+2}} & -\widehat{V_3^{t+2}} \end{bmatrix} \begin{bmatrix} (1+\gamma^t) \\ (1+\sigma_1^t) \\ (1+\sigma_3^t) \end{bmatrix},$$

(18)

where $\widehat{Q^t} \equiv Q^t - \frac{1}{1+r^{t+1}} \cdot Q^{t+1}$, $\widehat{Y^t} \equiv \frac{p^t y^t}{K^t}$, $\widehat{V_i^t} \equiv \frac{w_i^t v_i^t}{K^t}$. γ^t, and σ_i^t (i=1,3) are the markup rates for outputs and inputs in periods t to t+2. If the coefficient matrix has an inverse matrix, equation 19 holds.

5 MATLAB ver. R2016a. These equations systems were solved using the "lsqlin" command in MATLAB, which is a solution for quadratic programming (i.e., constrained linear least-squares problems).

$$\begin{bmatrix} (1+\gamma^t) \\ (1+\sigma_1^t) \\ (1+\sigma_3^t) \end{bmatrix} = \begin{bmatrix} \widehat{RQ^t} + \widehat{V_2^t} \\ \widehat{RQ^{t+1}} + \widehat{V_2^{t+1}} \\ \widehat{RQ^{t+2}} + \widehat{V_1^{t+2}} \end{bmatrix} \begin{bmatrix} \widehat{Y^t} & -\widehat{V_1^t} & -\widehat{V_3^t} \\ \widehat{Y^{t+1}} & -\widehat{V_1^{t+1}} & -\widehat{V_3^{t+1}} \\ \widehat{Y^{t+2}} & -\widehat{V_1^{t+2}} & -\widehat{V_3^{t+2}} \end{bmatrix}^{-1}$$

(19)

By these equations we obtain γ, σ_1, and σ_3. When the actual calculations were made, we found a considerable difference between the value on the left side and the value on the right side of equation 18. Therefore, the estimated values of γ, $\sigma 1$, and $\sigma 3$ have been modified so that the difference between the left and right sides of equation 18 can be distributed to the ratio of the terms $-\gamma^t p^t y^t$, $\sigma_1^t w_1^t v_1^t$, and $\sigma_3^t w_3^t v_3^t$ to the total rent.[6]

We used thirty-six years' worth of financial data and set t from the first year to the thirty-fourth year. For each t, the solutions of γ, σ_1, and σ_3 are given; however, the equation for period t contains the discount rate of the t+1 period, r^{t+1}, so the maximum length of the time series of solutions is thirty-three.

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[6] Let the estimated values of the parameters γ, σ_1, and σ_3 by calculation be $\hat{\gamma}$, $\widehat{\sigma_1}$, and $\widehat{\sigma_3}$. The error value E and the error rate ρ are defined as follows:

$$-E = \left[(1+\widehat{\gamma^t})\cdot\frac{p^t y^t}{K^t} - \quad (1+\widehat{\sigma_1^t})\cdot\frac{w_1^t v_1^t}{K^t} - (1+\widehat{\sigma_3^t})\cdot\frac{w_3^t v_3^t}{K^t} \quad - S\cdot\left\{1-\frac{1}{(1+r^{t+1})}\right\}\right] - \frac{w_2^t v_2^t}{K^t}$$

$$\rho^t = \frac{-K^t E}{-\gamma^t p^t y^t + \sigma_1^t w_1^t v_1^t + \sigma_2^t w_2^t v_2^t + \sigma_3^t w_3^t v_3^t}$$

The parameters $\breve{\gamma}^t$, $\breve{\sigma_1}^t$, and $\breve{\sigma_3}^t$, which equate RHS and LHS of equation (18), are as follows:

$$\breve{\gamma}^t = \ (1+\rho^t)\hat{\gamma}^t, \qquad \breve{\sigma_1}^t = (1+\rho^t)\widehat{\sigma_1}^t, \qquad \breve{\sigma_3}^t = (1+\rho^t)\widehat{\sigma_3}^t$$

We collected the accounting data of 234 corporations on the U.S. S&P 500 in 2018 (downloaded from Mergent online). These were the corporations for which lobbying data were available in the LDA reports (available online, as discussed earlier). These companies were classified into 28 industries according to their Standard Industrial Classification (SIC) codes.[7] Data on discount rates are U.S. interest rates for each year, as found in the of IMF's International Financial Statistics. The unit price of investment (Q) was set as one for every year.

8. Results

8.1. Characteristics of rent in industrial sectors and in time series

First, we compared industries based on the ratio of corporations' rents to their net income. Table 1 shows the time series average rent rate for each industry in cases of scale variable S was set at 1 and 1.2. The rent rate is slightly lower when assuming economies of scale (i.e.,

[7] While the numbering followed SIC codes wherever possible, several sectors that had few firms were consolidated. For this reason, there are numbers up to thirty-three, but there are only twenty-eight industries.

S=1.2). The relative rankings among industries show that the top industries are almost the same, although their ranks changed slightly.[8]

The industries with the highest rent rates are business services, measuring analyzing and controlling instruments, chemicals, health services products, and petroleum refining. This is almost consistent with the results of previous studies discussed early on in this paper. Since the size of the rent for one company is not known from the rent rate, the average rent for an industry in the case of S = 1 is also shown in table 1. The largest rent amounts are for the petroleum refining, communications, mining, and chemicals sectors.

[8] For the results in tables 1 and 2, equation 18 was solved for the case of S = 1, and the rent calculated from the value of the parameter after error correction was used. However, in the case of S = 1.2, it is necessary to adjust the capital reward by the scale factor, so the rent is the value obtained by subtracting the capital reward from net profit. As a result, it seems that there is a slight difference in the ranking between industries when S = 1 and when S = 1.2.

Table 1. Average Rate of Rent Occupying NetIncome in Each Industry from 1982-2014

	Industry	Samples	S=1			S=1.2	
			Rent Rate	Ranking	rent (US$)	Rent Rate	Ranking
2	Mining	15	0.261		1,144,003,230	0.210	
3	Construction	4	0.232		112,732,040	0.172	
4	Food, Tabacco	6	0.296		480,769,673	0.246	
5	Textile and Apparel	4	0.303		112,477,315	0.235	
6	Wood,Furniture and Paper	5	0.242		195,833,288	0.186	
7	Printing and Publishing	1	0.216		140,561,234	0.159	
8	Chemicals and Allied Products	17	0.411	4	1,087,798,371	0.363	3
9	Petroleum Refining and Related Industries	2	0.394	6	1,623,837,565	0.362	4
10	Rubber and Miscellaneous Plastics Products	2	0.369	10	324,167,006	0.298	
12	Stone, Clay Glass and Concrete Products	1	0.247		571,116,385	0.208	
13	Primary Metal Industries	1	0.284		246,663,068	0.231	
14	Fabricated Metal Products, Except Machinery andTransportation Equipment	2	0.247		133,539,785	0.184	
15	Industrial and Commercial Machinery and Computer Equipment	8	0.396	5	305,172,979	0.343	6
16	Electronic and Other Electrical Equipment and Components,Except Computer Equipment	10	0.313		359,995,846	0.264	
17	Transportation Equipment	6	0.252		536,212,084	0.204	
18	Measuring Analyzing and Controlling Instruments; Photographic, Medical and Optical Goods;	15	0.423	2	318,938,582	0.363	2
19	Miscellaneous Manufacturing Industries	1	0.394	7	192,234,039	0.325	9
20	Ttransportation and Postal Service	8	0.178		478,307,429	0.140	
21	Electric, Gas and Sanitary Services	22	0.089		104,824,650	0.051	
22	Communications	4	0.286		1,146,942,982	0.239	
23	Wholesales Trade	6	0.385	9	237,060,851	0.327	8
24	Retail Trade	18	0.392	8	536,566,790	0.329	7
25	Finance, Security and Commodity Brokers, and Holding and Other Investment Offices	22	0.077		51,612,337	0.038	
26	Insurance	17	0.048		110,421,389	0.032	
28	Real Estate	6	0.299		145,190,501	0.231	
29	Health Services	5	0.421	3	394,481,552	0.358	5
30	Business Service	25	0.470	1	636,786,584	0.415	1
33	Public Administration	1	0.365		66,261,437	0.309	10

Note1) The average for each industry is the average of the average from 1982 to 2014 for each sample.
2) Rent Rate = Rent / Net Income

How would the corporate tax rate change if the rent calculated in this study were added to the corporate tax? Table 2 shows a comparison between the ratio of corporate income tax to profit before tax and the ratio of corporate income tax plus rent to profit before tax. In table 2, there are two types of rents, including and excluding monopoly rent in products markets (i.e., the maximum amount of Schumpeter rent). From this result, even considering scale economy (i.e., S=1.2), the normative corporate tax rate (i.e., the rate which considers rent) is around 15 percent higher than the current corporate tax rate.

Table 2 Corporate Income Tax Including Rent

		S=1	S=1.2	
Industry	W3/TI(a)	(W3+rent)/TI	(W3+rent)/TI(b)	(b)-(a)
2	0.382	0.571	0.534	0.152
3	0.294	0.502	0.459	0.166
4	0.321	0.545	0.505	0.184
5	0.282	0.508	0.460	0.178
6	0.356	0.599	0.555	0.199
7	0.067	0.402	0.274	0.207
8	0.189	0.520	0.484	0.295
9	0.391	0.669	0.647	0.256
10	0.419	0.670	0.624	0.204
12	0.261	0.580	0.542	0.281
13	0.331	0.521	0.485	0.153
14	0.313	0.502	0.457	0.144
15	0.182	0.520	0.476	0.294
16	0.230	0.446	0.417	0.188
17	0.301	0.491	0.456	0.155
18	0.297	0.638	0.592	0.295
19	0.267	0.564	0.516	0.249
20	0.308	0.424	0.399	0.092
21	0.352	0.419	0.390	0.038
22	0.415	0.625	0.593	0.178
23	0.304	0.480	0.462	0.158
24	0.359	0.610	0.570	0.211
25	0.272	0.292	0.300	0.028
26	0.265	0.310	0.297	0.033
28	0.186	0.439	0.384	0.197
29	0.386	0.655	0.616	0.230
30	0.289	0.650	0.610	0.321
33	0.278	0.509	0.473	0.196
Average	0.296	0.524	0.485	0.189

Note: W3=Income Tax TI=Profit before Tax

Figure 4 shows the time series of rent excluding monopoly rent of product markets and corporate income taxes derived from the accounting data. It shows that the corporate tax rate has fallen gradually over the past 30 years while the rent rate has risen monotonically.

Furthermore, the rent rate rose at roughly the same pace or a little faster than of the decline in the corporate tax rate.

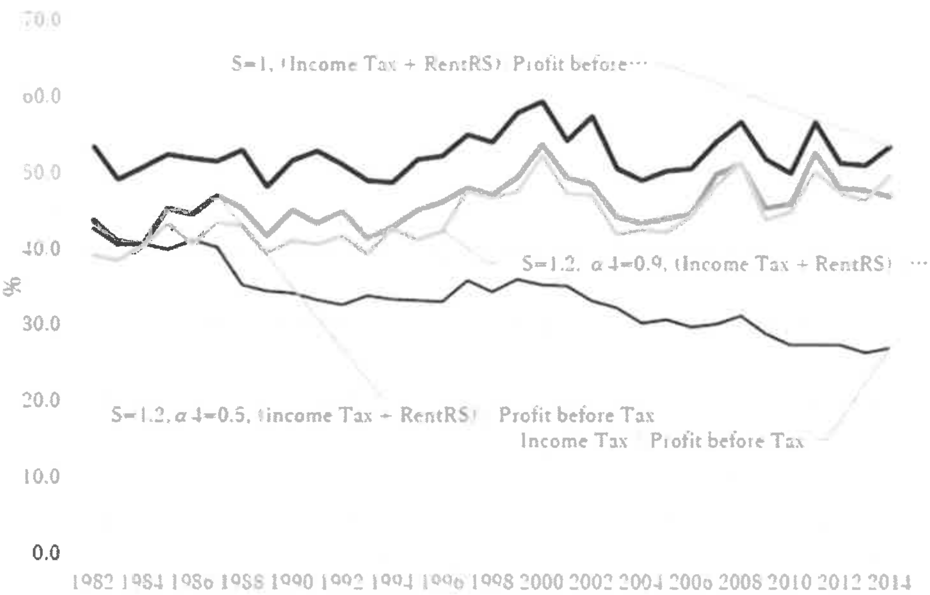

Figure 4. Time Series of Rent and Income Tax

Note : rentRS is total rent minus exclusive rent in the product market (maximum Schumpeter rent)

Normative tax should contain monopolistic and transfer rents in the product, factor, and public service markets. However, we excluded Schumpeter rent as the result of novelty and/or research and development investment from our calculation of the normative tax rate. The total normative tax rate is thus calculated as the sum of corporate income tax and total rent minus monopoly rent in product markets, which is the maximum amount of Schumpeter rent. Figure 4 shows the time series of the normative tax rate under the various assumptions of scale variables S and α_4.

From the foregoing, we can see that the normative corporate tax rate for the past thirty years has been stable at around fifty percent, although it has been on a slight upward trend since the 1990s when S = 1.2.

8.2. Relationship between rent and corporations' political action: panel data analysis

To assess whether the political actions of corporations generate high returns, we performed panel data analysis using rent as the explained variable and lobbying amount as the explanatory variable. Kerr, Lincoln, and Mishra (2014) found that whether U.S. firms lobbied or not was related to firm size, and revenues of lobbied firms were roughly four times more than those of firms that did not. Drutman (2015) also showed that lobbying expenditures were influenced by the volume of sales. Following them, we added annual sales as an explanatory variable.

First, we estimated a regression without lagging lobbying. We also used a Hausman test to determine whether fixed or random effects models were appropriate. The coefficients of determination were then compared for models of the lobbying data with various time lags. When moving the lag of the lobbying data forward and backward, peak values of the coefficient of determination appeared in each direction. The models in table 3 use the lag structures that generated the two peak values.

Table 3 rent and lobbying of corporates

sample=234			Independent variables			
Scale parameter	type	lag or lead operator	lobby	py	R2	method
S=1		l1 b)	52.21511	0.043241	0.4644	re
			(0.002) a)	(0.000)		
		f1	34.60893	0.043641	0.4692	re
			(0.029)	(0.000)		
	log-log	l2	0.08999	0.965632	0.4595	re
			(0.002)	(0.000)		
		f3	0.060189	1.048933	0.4865	re
			(0.029)	(0.000)		
		f3	0.122773	0.928		
			(0.005)	(0.000)		pa ar(4) (d
S=1.2		l1	42.79533	0.041408	0.4445	re
			(0.009)	(0.000)		
		f3	29.26516	0.042817	0.4451	re
			(0.049)	(0.000)		
	log-log	l2	0.089021	0.940016	0.4766	re
			(0.003)	(0.000)		
		f6	0.128032	1.014605	0.5195	re
			(0.000)	(0.000)		

Note a) () is p value

Note b) fn is lead operator of n periods, ln is lag operator of n periods.

Note c) fe: fixed-effects estimator, re: random-effects estimator,
pa: population-averaged estimator

Note d) ar(4) is autoregressive of order 4.

Based on the results, when S = 1, a \$1 increase in lobbying expenditure would increase the rent by about \$52; at S = 1.2, it would increase the rent by about \$43. However, we note that this result is based on a correlative, not a causal relationship between lobbying and rent, an issue we address below.

Another concern is that each of these variables is likely to have an autoregressive process. Therefore, we also tried population-averaged estimation (PA) to set the autoregressive process for the error term of each panel. However, it is difficult to find significant results, and only the successful case is included in table 3.

A more difficult econometric problem occurs when both the independent and dependent variables are unit root processes. If this is the case, observed relationships between the variables may be spurious. Therefore, a unit root test was performed on rent and lobbying data. Scholars have developed specific unit root tests for panel datasets. We used a method developed by Harris and Tzavalis (1999) (we will express the method as HT).[9] Since missing values are not allowed, the tests were conducted using a balanced dataset of sixty-five companies during the years from 1999 to 2014. The null hypothesis was rejected for both variables through this test. However, since the null hypothesis states that all panels contain unit root in HT, this result still allows the possibility that some of the panels have unit root processes.

Next, we tested the causal relationship between the rent and the lobbying expenditure described above using this balanced data. Although Granger causality testing (Granger 1969) has long been used for single time series, methods for panel data have developed more recently. We performed a panel Granger test developed by Dumitrescu and Hurlin (2012).[10] The lag period was set to one, and we used a bootstrap procedure. As a result, both the null hypotheses, that rent was not the cause of lobbying expenditure and that lobbying expenditure was not the

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[9] The xtunitroot package in Stata version 15 was used for the test.

[10] This was calculated using a library called xtgcause in Stata version 15. See Lopez and Weber (2017) for a specific explanation.

cause of rent, were rejected. It was concluded that rent was the cause of lobbying expenditure for at least one panel and that lobbying expenditure was the cause of rent for at least one panel.

From the above results, it can be said that while some corporations have obtained high rents by lobbying, other companies have invested in lobbying because they have obtained high rents in the past.

8.3. Which generates rents: lobbying, or research and development?

It may be argued that rent is the outcome of investment in corporate research and development rather than the outcome of looting from other economic agents. We tried to analyze this issue with panel data for seventy-three companies for which accounting data include research and development expenditures.

We considered adding research and development expenditures to the explanatory variables, but unfortunately, the correlation coefficient between research and development and lobbying was 0.7214, creating a multicollinearity problem.[11] We performed separate panel data analyses using lobbying expenditure and sales and then research and development expenditure and sales as explanatory variables. Table 4 shows the results. The coefficients of determination for the two models are very similar, and both models have almost the same explanatory power.

[11] Kerr, Lincoln, and Mishra (2014) also found that firms that did lobby were only slightly more likely to engage in research and development than those that did not.

However, it is not possible to separate the relationships between these two variables and rent in this context.

Table 4 comparison of lobbying and R&D Investment as explanatory variables

Sample= 73	dependent variable	lag or lead operator	Independent variables			
S=1			rd	py	R2	method
	rent	l2 b)	0.5070377 (0.000) a)	0.0878681 (0.000)	0.7394	fe c)
	rent	f2	0.4518075 (0.000)	0.0874368 (0.000)	0.7416	fe
			lobby	py	R2	method
	rent		75.869930 (0.013)	0.075207 (0.000)	0.7448	re
	rent	f1	101.6844 (0.001)	0.0751806 (0.000)	0.7513	re
S=1.2			rd	py	R2	method
	rent	l2	0.475582 (0.000)	0.0837668 (0.000)	0.7206	fe
	rent	f2	0.4195512 (0.001)	0.0832397 (0.000)	0.7227	fe
			lobby	py	R2	method
	rent		64.14124 (0.034)	0.0716944 (0.000)	0.7319	re
	rent	f	89.57607 (0.002)	0.0716855 (0.000)	0.7379	re

Note a) () is p value

Note b) fn is lead operator of n periods, ln is lag operator of n periods.

Note c) fe: fixed-effects estimator, re: random-effects estimator,

9. Conclusions and Remarks

This paper makes three major contributions to the field. First, it provides a method to separate corporate profits (from market competition) from the corporate rents derived from political expenditure, monopoly, and monopsony. We solved the pseudo-competitive dynamic profit maximization model and by applying Shimamoto's (2018) model, found the optimal conditions when the markets of products, production factors, and public services were all monopolistic.

The results showed that profits (net income after tax in accounting) can be divided into capital compensation and rents (equation 15). In the case of increasing rate of return, adjustments were made with the scale factor.

Second, we estimated a normative corporate tax rate for large American companies using S&P 500 accounting data. Orthodox taxation theory has basically assumed the existence of competitive markets and considered corporate tax as a tax on capital rewards, leading to the argument that corporate tax is double taxation. However, this paper considered corporate tax to be a payment for public services and calculated the corporate tax rate including the monopsony rent associated with public service. Figure 4 shows the time series of the average normative corporate tax rate. The normative corporate tax consists of the corporate income tax and the total rent minus monopoly rent of products markets, which can be regarded as the maximum of Schumpeter rent.

The time series of the average normative tax rate for these 234 corporations from 1982 to 2014 are rather stable at around forty to fifty percent depending on the assumption of values of parameters S and α_4. This contrasts with the monotonical decrease of the corporate income tax rate during these periods and may be due to the international race to the bottom in corporate tax rates. If data are available, it will be possible to calculate the normative corporate tax rate for each country from corporations' accounting data. By building international cooperation based on these results, each country will be able to achieve an appropriate corporate tax rate.

Additionally, if the OECD+G20 regime takes more action against tax havens, it will be possible for each government to achieve greater financial soundness.

Third, we identified a causal relationship between rent and lobbying, which was assessed with a panel Granger test on rent and lobbying data obtained from LDA reports. We concluded that rent was the cause of lobbying expenditure for at least one panel and that lobbying was the cause of rent for at least one panel. By including panel data for research and development expenditure, we tried to test the proposition whether rent was due to research and development rather than corporate lobbying. However, the correlation between lobbying expenditure and research and development expenditure was high and no clear results were obtained. This result supports the finding of Kerr, Lincoln, and Mishra (2014) that companies that actively engage in research and development expenditure also perform lobbying. We therefore recommend the government build systems to encourage the productive investments for research and development while curbing unproductive investments such as political expenditure from a social point of view.

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