Rent seeking worsens economic outcomes and increases wealth inequality*

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Abstract

Rent seeking is known to lead to a misallocation of resources that worsens economic outcomes at the aggregate level. Here we find that this deterioration also increases wealth inequality. We examine rent seeking via the financial sector in an environment with idiosyncratic earnings and equal opportunity for rent seeking, under the assumption that effectiveness at extracting resources increases with wealth. On one hand, for given aggregate outcomes, rent seeking provides a means of insurance that works to correct financial market incompleteness: when rent extraction increases with wealth, this creates additional incentives for individuals to accumulate wealth, which works to decrease exposure to idiosyncratic earnings shocks and thus reduce wealth inequality. On the other hand, the negative aggregate effects of resource misallocation decrease household income and lower market returns to savings, hampering individual wealth accumulation and leading to an increase in wealth inequality. In a calibration for the US, the aggregate effects dominate and rent seeking thus increases inequality.

Keywords: rent seeking; wealth distribution; heterogeneous agents

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1 Introduction

The importance of institutional quality for economic outcomes is widely accepted (see e.g. North (1990), Hall and Jones (1999), Rodrik et al. (2004), and Acemoglu (2009)). An expression of weak institutions is rent seeking. Rent seeking is typically defined as "the socially costly pursuit of income and wealth transfers" (Drazen (2000, p. 335)) and can take many forms, ranging from access to lucrative opportunities by influencing decisions through the hiring of lawyers and lobbyists, to extra transfers and subsidies from state coffers. It is also recognised that rent-seeking competition favours elites (see e.g. the literature reviewed in Acemoglu et al. (2015)), which are typically associated with agents with higher relative wealth. This may happen because a higher relative wealth relates to a better insider position in financial or other markets and more status or power in the socio-political system.\footnote{The relationship between wealth and status has been analysed both historically (e.g. Mokyr (1985) and Perkin (1969)) and regarding its importance for economic outcomes (e.g. Cole et al. (1992)).}

Differences in wealth can thus create different abilities for resource extraction via rent seeking. Wealth is indeed not distributed equally across the population. A significant body of research has provided robust empirical evidence that the distribution of wealth is very skewed and that wealth inequality is higher than earnings inequality (see e.g. Krueger et al. (2016), Quadrini and Rios-Rull (2015), and Kuhn and Rios-Rull (2016)). A vast literature has shown that earnings inequality, and in particular idiosyncratic shocks to earnings under incomplete financial markets, generate wealth inequality, following a general equilibrium framework based on seminal contributions by Bewley (1986), Imrohoroglu (1989), Huggett (1993) and Aiyagari (1994).

In this class of models, a continuum of economic agents receives idiosyncratic earnings shocks against which they cannot fully insure because financial markets are incomplete and thus do not allow for trade with a complete set of state-contingent securities. As a result, earnings shocks pass through to income, and hence differences in histories of idiosyncratic earnings create different opportunities for accumulating assets. In other words, earnings inequality is propagated, via incomplete financial markets, to wealth inequality. In equilibrium, there is an endogenous distribution of wealth in an economy with a large number of agents, allowing the model to make predictions about statistics of the wealth distribution that can refer to any part of the actual wealth distribution.

In this paper, we examine whether rent seeking is a mechanism that works to dampen or amplify the effect of idiosyncratic earnings on wealth...
inequality and evaluate the significance of the deterioration in economy-wide aggregate outcomes, due to resource misallocation, for this. Motivated by the importance of financial markets for the transmission of earnings risk to wealth inequality, we focus on rent seeking that is related to the financial sector.

We examine whether wealth inequality is higher in an economic environment where property rights are ill-defined in the sense that a share of total assets can be redistributed among economic agents via a rent seeking competition that favours the wealthy. While the answer may appear to be obvious, it is in fact not. This is because rent seeking in this environment gives rise to two opposite effects.

On one hand, a rent-seeking competition, which favours the wealthy, incentivises individuals to accumulate wealth, which in turn reduces the exposure of households to the idiosyncratic component of their incomes and hence reduces the spread of actual incomes and decisions for savings across households. In other words, financial rent seeking provides a means of insurance, which, in an incomplete market environment, works to correct the incompleteness of the financial market. According to this channel, rent seeking tends to reduce wealth inequality.

On the other hand, rent seeking sets in motion an opposite, general equilibrium, sequence of effects to the one just described. Rent seeking typically diverts resources away from productive activities, so that in general equilibrium it worsens aggregate outcomes. In particular, it reduces the market return to savings and individuals’ income and hence individuals’ ability to increase their savings and wealth. The reduction in income from savings increases the exposure of households to the idiosyncratic component of their incomes and consequently increases the spread of actual incomes and decisions for savings across households. According to this channel, rent seeking tends to increase wealth inequality.

We demonstrate with a simple example, which allows an analytical solution, that these two effects work to (i) decrease wealth inequality in partial equilibrium (thus when not taking into account resource misallocation at the aggregate level), and (ii) increase wealth inequality in general equilibrium (when the effect of resource extraction on economy-wide outcomes is accounted for). In a more general framework, including these two opposing forces, the final net effect can be investigated quantitatively.

To explore this, we build on the benchmark incomplete markets model with production in Aiyagari (1994) and assume that, because of weak institutions, a share of aggregate savings that the financial market has collected can be diverted away from production to households’ income, via rent seeking competition. In other words, weak institutions create a contestable pie, com-
prised of a proportion of aggregate savings, over which households compete for a share in a Tullock (1967) type contest. We assume that extraction is proportional to relative wealth, capturing the intuition that wealthier households are in a better position to benefit from financial rent seeking. However, rent seeking comes at a private cost, in that the household needs to spend part of the proceeds from rent seeking as fees to an intermediation sector, capturing the services of law or lobbying firms. Lobbying firms utilise labour to provide rent seeking services. At the level of the household, the cost of such services is fixed, and the pool of contestable resources is taken as given, and independent of market returns to investment or rent seeking activities. In general equilibrium, however, rent seeking reduces capital and labour available for productive uses and leads to a deterioration of aggregate outcomes.

To examine quantitatively the impact of financial rent seeking on the distribution of wealth, we calibrate this model following standard applications to the U.S. and compute the wealth distribution for different magnitudes of financial resources that are available for rent seeking in the stationary equilibrium. We find that at the individual level or equivalently in partial equilibrium, weaker financial institutions and higher rent seeking imply lower wealth inequality. As said above, returns to savings are increased for the individual, who does not internalise the effects of her own rent seeking on aggregate outcomes, and thus rent seeking opportunity works effectively as a way to improve self-insurance. Hence, abstracting from general equilibrium aggregate outcomes, the assumption that the financial system allows the wealthy to extract more implies lower wealth inequality. However, in the stationary general equilibrium, the resource misallocation effects associated with rent seeking reduce market returns, so that savings are reduced, and thus households are more exposed to idiosyncratic earnings shocks. Putting aggregate and distributional effects together, rent seeking changes the wealth distribution by shifting its mean to the left, while increasing its implied inequality. Therefore, rent seeking is a mechanism that amplifies the effect of earnings inequality on wealth inequality.

The rest of the paper is organised as follows. After contextualising our work relative to the existing research below, in Section 2, we present a simple example which motivates the interest in analysing the relationship between rent seeking and wealth inequality in general equilibrium. In section 3, we set out the incomplete markets, heterogeneous agents model with financial rent seeking. Then, in Section 4, we discuss calibration and computation, and in Section 5 we analyse the results, focusing on the link between increased rent seeking and wealth inequality. Conclusions are in Section 6.
1.1 Literature and how we differ

There has been a rich and still expanding literature on the relationship between institutional quality, the distribution of power and inequality (see e.g. the literature reviewed in Karabarbounis (2011) and Acemoglu et al. (2015)). Regarding modelling, the most popular way to model weak institutions and rent seeking is to assume that private and/or communal properties are "common pools". Access to the latter distorts individual incentives by pushing atomistic agents to a rent seeking competition over a share of the common pool, which leads to resource misallocation and eventually to poor macroeconomic performance. The link between rent seeking and inequality has also been examined (see e.g. Chakraborty and Dabla-Norris (2006) and Chaturvedi (2017), primarily focusing on income inequality in static models. Here, we focus on rent seeking related to the financial sector and its quantitative effects on the distribution of wealth, which requires a stochastic dynamic framework. The stochastic environment can capture the role of earnings risk and the intertemporal dimension can allow for endogenous wealth accumulation.

Quantitative analysis of wealth inequality based on the benchmark model in Aiyagari (1994) captures important qualitative properties of the wealth distribution in the data, but it under-predicts inequality quantitatively, especially at the top end of the wealth distribution. The literature has considered many extensions that improve the predictions of the model, often focusing on improving wealth inequality predictions at the top percentiles (see e.g. the reviews in Quadrini and Rios-Rull (2015), Krueger et al. (2016), Benhabib et al. (2017) and Benhabib and Bisin (2018)). Here we examine whether rent seeking can work as a mechanism which amplifies the effect of earnings inequality on wealth inequality.\(^2\)

The institutional framework regarding the financial market is at the heart of this class of heterogeneous agent models. In particular, it is typically assumed that financial markets are incomplete and that their role is to transfer savings from households to firms. There has been research that aims to endogenise financial market imperfections in this framework, and, more generally, to allow for a more realistic insurance framework (see e.g. Quadrini and Rios-Rull (2015) and Krueger et al. (2016) for reviews). Instead, here we analyse a different form of financial market imperfection, related to rent seeking and arising from weak institutions, and investigate its potential insurance

\(^2\)In our analysis, returns to saving remain independent of (and are not increasing in) wealth, and are common across households, as in the benchmark model. Hence the results are not driven by heterogeneity in returns to wealth, the importance of which has been noted in the recent literature (see e.g. Fagereng et al. (2016) and Benhabib et al. (2017)).
implications which relate to wealth inequality.

2 Income inequality and rent seeking in a simple model

We present a simple model with rent seeking and income inequality that can be solved analytically to demonstrate the importance of aggregate-level effects of rent seeking on inequality. Important simplifying assumptions include a two-period horizon, and linear utility and production functions. A linear utility function implies that incomplete financial markets do not lead to precautionary wealth accumulation under earnings risk and inequality, whereas a linear production function implies that the effect of resource misallocation, in the form of diversion of resources from production to lobbying and rent seeking, does not affect market returns. Both are of course important limitations, which are addressed in the analysis of the full model focusing on wealth inequality in the next section.

We assume that there are two time-periods, $t = 1, 2$ and that the economy is populated by $N$ households. Production takes place in the second period only. Weak institutions imply that households extract a share of aggregate savings from the financial sector and this share is proportional to their individual wealth relative to aggregate wealth (this is similar to Tullock’s (1967) idea of a rent-seeking contest). To do so, they use the services of a lobbying sector subject to intermediation fees. Labour supply is exogenous, but each household’s labour productivity and income differ and depend on stochastic productivity which for simplicity takes two values. There are $N$ final good producing firms, $N$ financial firms that channel savings/capital from households to the final good producing firm and $N$ lobbying firms that provide lobbying services to households on how to extract assets from the financial sector. The timing is as follows. Households make their consumption-saving decisions in the first period without knowing their productivity and hence their future wage earnings. Then, in the second period, productivity shocks are materialised, and firms make their own decisions under certainty.

We present the structure of the economy and the problems of the various economic agents briefly below, and we reserve a full analysis when we present the more realistic setup in the following section. Where possible, we will keep assumptions and notation the same between the simple model in this section and the general model developed below, so that the former will be a simplified representation of the latter that delivers the key ideas analytically, at the cost of missing out some important channels qualitatively and quantitatively.
2.1 Households

Each household $i = 1, 2, \ldots, N$ derives utility from consumption in two periods, $c^i$ and $z^i$:

$$U^i = \log c^i + \beta E\left(z^i\right),$$

subject to the budget constraints in the two periods:

$$c^i + a^i = e^i$$

$$z^i = (1 + r)a^i + ws^i + \frac{a^i}{A}\theta K - p_e \frac{a^i}{A}\theta K + \eta^i,$$

where $a^i$ is $i$'s saving, $A \equiv \sum_{i=1}^N a^i$ denotes aggregate savings; $K$ is the contestable prize (in equilibrium, we will set $K \equiv A$); $0 \leq \theta < 1$ is a measure of institutional quality which captures the extent of aggregate resources that can be extracted because of rent seeking behaviour; $0 < p_e < 1$ is the price that households pay for lobbying services, which are required to generate rent extraction; $\eta^i$ is profits made by various firms and distributed to household $i$; and $e^i$ is an initial endowment (e.g. initial labour income). Households receive productivity shocks $s^i$ that determine their labour income in the second period. In particular, $s^i$ is assumed to be either high or low, so that $s^{i,\text{low}} < s^{i,\text{high}}$, with probabilities $q$ and $1 - q$ respectively. For simplicity, we assume $q = 1 - q = 0.5$.

The Euler equation for $a^i$ is:

$$\frac{1}{c^i} = \beta \left(1 + r + \frac{1}{A}(1 - p_e)\theta K\right).$$

Note that the simplified framework implies that savings and wealth are not affected by household income risk (this is due to the linear utility function in the second and last period) and that income heterogeneity in the second period does not affect saving and wealth accumulation in the first period. Hence, wealth inequality is driven only by potential differences in $e^i$. To simplify further the analysis, we set $e^i = e$, $\forall i$, implying that savings are the same for all households and thus we focus on the effect of rent seeking on income inequality, i.e. in differences in $z^i$.

2.2 Production sector

In the production sector, each producer $f = 1, 2, \ldots, N$ acts competitively to maximize profit

$$\eta^f = y^f - r^f k^f - w l^f,$$
using a linear production function of the form:

\[ y^f = A^k k^f + A^l l^f, \]

where \( A^k, A^l > 0 \) are parameters. The first-order conditions give the factor returns

\[ r^f = A^k \]
\[ w = A^l, \]

so that \( \eta^f = 0 \) in equilibrium.

### 2.3 Lobbying sector

In the lobbying sector, each lobbying firm \( \ell = 1, 2, ..., N \) uses its labour input, \( l^\ell \), which is paid the competitive wage \( w \), to produce and sell rent seeking services, \( \theta K \), to households. Assuming a linear technology for each firm:

\[ \frac{\theta K}{N} = A^\ell l^\ell. \]

where \( A^\ell > 0 \) is a technology parameter. Each \( \ell \) acts competitively to maximise its profit:

\[ \eta^\ell = p^\ell A^\ell l^\ell - w l^\ell. \]

The first-order condition is

\[ p^\ell = w/A^\ell, \]

so that \( \eta^\ell = 0 \) in equilibrium.\(^3\)

### 2.4 Financial sector

In the financial sector, there are \( b = 1, 2, ..., N \) firms selling financial services to households and firms. They accept deposits from households, \( A \), paying them a return \( r \) and make loans to production firms, \( K^f \), charging them with a rate \( r^f \). But the total loans given to those firms are only a fraction of total deposits, i.e. \( K^f = (1 - \theta) A \equiv (1 - \theta) K \), because \( \theta A \equiv \theta K \) can be extracted by rent seekers.

The profit of each \( b \) is

\[ \eta^b = (1 + r^f)K^f - (1 + r)A = (1 + r^f)(1 - \theta)K - (1 + r)K, \]

so that profit maximisation (implying zero profit) requires:

\[ r = (1 + r^f)(1 - \theta) - 1. \]

\(^3\)We restrict our attention below to the interesting case where \( p^\ell < 1 \), which requires, given the assumption of linear production, that \( A^\ell > A^l \).

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2.5 Rent seeking as self-insurance (partial equilibrium)

As a first step, we consider the implications of rent seeking for inequality given factor prices, \( r, r^f, w \) and \( p_e \). This can be thought of as a partial equilibrium solution or a kind of myopia on behalf of rent seekers. Since \( A = K \) in equilibrium, combining the three first-order conditions of the household (i.e. its two budget constraints and the Euler condition), we simply have for savings:

\[
a_i \equiv a^i = e - \frac{1}{\beta [1 + r + (1 - p_e)\theta]}.
\]

In the second period, some households happen to be lucky, receiving \( s^{i,\text{high}} \), and some others happen to be unlucky, receiving \( s^{i,\text{low}} \). Using the above equation for \( a \) into the household’s budget constraint in the second period, we have respectively for the lucky and the unlucky ones (profits are zero in equilibrium):

\[
z^{i,\text{high}} = y^{i,\text{high}} = [1 + r + (1 - p_e)\theta]a + s^{i,\text{high}}w = e[1 + r + (1 - p_e)\theta] - \frac{1}{\beta} + s^{i,\text{high}}w
\]

\[
z^{i,\text{low}} = y^{i,\text{low}} = [1 + r + (1 - p_e)\theta]a + s^{i,\text{low}}w = e[1 + r + (1 - p_e)\theta] - \frac{1}{\beta} + s^{i,\text{low}}w.
\]

Let us use the ratio of the two second-period incomes as a measure of inequality:

\[
\frac{y^{i,\text{high}}}{y^{i,\text{low}}} = \frac{e[1 + r + (1 - p_e)\theta] - \frac{1}{\beta} + s^{i,\text{high}}w}{e[1 + r + (1 - p_e)\theta] - \frac{1}{\beta} + s^{i,\text{low}}w}.
\]

Given prices \( r, p_e \) and \( w \), simple differentiation of this ratio with respect to \( \theta \) implies \( \frac{\partial \ln y^{i,\text{high}}}{\partial \theta} < 0 \); namely, a deterioration in institutional quality reduces inequality other things equal. This happens because weak institutions encourage savings (note that \( \theta \) increases savings in (1)) and higher savings work to reduce the importance of divergence in labour income (earnings luck and inequality) in the second period. Rent seeking in this context works as an *ad hoc* insurance mechanism that reduces inequality.
2.6 The importance of resource extraction (general equilibrium)

In general equilibrium, \( r = (1 + r^f) (1 - \theta) - 1, \) \( p_t = w/A^f, \) \( r^f = A^k \) and \( w = A^l. \) Then, saving becomes

\[
\frac{a}{\beta[(1 + r^f) (1 - \theta) + (1 - w/A^f)\theta]} = e - \frac{1}{\beta[(1 + r^f) (1 - \theta) + (1 - w/A^f)\theta]}
\]

and in turn inequality becomes

\[
\frac{y_i^{\text{high}}}{y_i^{\text{low}}} = e[(1 + A^k) (1 - \theta) + (1 - A^l/A^f)\theta] - \frac{1}{\beta} + s_i^{\text{high}} A^l,
\]

\[
\frac{y_i^{\text{low}}}{y_i^{\text{low}}} = e[(1 + A^k) (1 - \theta) + (1 - A^l/A^f)\theta] - \frac{1}{\beta} + s_i^{\text{low}} A^l,
\]

which is a closed-form analytical solution. Now \( \frac{\partial y_i^{\text{high}}}{\partial \theta} > 0 \) That is, the general equilibrium effect of \( \theta \) is opposite from the partial equilibrium one. When the effect of resource extraction is accounted for in general equilibrium, a deterioration in institutional quality increases inequality, due to the distorting effect on the interest rate \( r \) which implies that \( \theta \) decreases savings (see (2)).

3 Heterogeneous agents and financial rent seeking

We now embed the above scenario in a Aiyagari (1994) type model of inequality. In other words, we extend the model in Aiyagari (1994) to allow for rent seeking from the financial intermediation sector that requires the services provided by the lobbying sector. We analyse the long-run stationary equilibrium of an economy that is populated by a continuum of infinitely lived households distributed on the interval \( I = [0, 1] \) with measure \( \phi. \) In a stationary equilibrium, aggregate quantities are constant. Time is discrete and denoted by \( t = 0, 1, 2, \ldots. \) Households have identical preferences and derive utility from consuming one good. Labour supply is exogenous, but each household is subject to idiosyncratic labour productivity shocks. There are incomplete financial markets, and in particular, a single asset in

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4Regarding market-clearing conditions, in the capital market, when demand equals supply, \( K^f = (1 - \theta) K, \) where \( K^f \equiv \sum_{f=1} k^f \) and \( A \equiv \sum_{i=1} a^i = K. \) Hence, in per capita terms, \( k^f = (1 - \theta)a. \) In the labour market, \( Nl^f + Nl^r = NE(s) \) or in per capita terms (since \( l^f = \frac{2K}{N} = \theta a, l^f = E(s) - \theta a. \)
the economy, so that households cannot fully insure against these idiosyn-
cratic shocks. Within this framework, as we did in Section 2, we assume
that the institutional framework allows for a share of accumulated savings to
be diverted away to rent-seeking households as opposed to output producing
firms, via lobbying activity. Households compete with each other for a share
of this pie, with wealthier households being able to extract a higher share,
meaning that the share that each household can appropriate depends on its
relative wealth.

The economy also includes a producing sector, a financial sector which
channels savings from the households to the firms, and a lobbying sector that
the households use to extract assets from the financial sector. Each of these
three sectors is represented by respective competitive firms.

### 3.1 Households

We present the problem for a “typical” household. The labour productivity
of a typical household at time $t$ is denoted by $s_t$. The household observes its
labour productivity shock at the beginning of period $t$. We impose standard
assumptions on the stochastic process $(s_t)_{t=0}^{\infty}$ (see also e.g. Acikgoz (2018)
and Angelopoulos et al. (2017)). In particular, we assume that it evolves
according to the $m$-state Markov chain with $m \times m$ transition matrix $Q_{ss'} = \text{Pr}(s_{t+1} = s'|s_t = s)$, and state-space $S = [\bar{s}_1, \bar{s}_2, \ldots, \bar{s}_m]$, $\bar{s}_1 > 0$, $\bar{s}_{j+1} > \bar{s}_j$, $j = 1, ..., m - 1$, with the $\sigma$-algebra $\mathcal{S}$ that is the power set of $S$. The
transition matrix $Q_{ss'}$ provides the conditional probability that the household
will be in state $s'$ in period $t + 1$, given that it is in state $s$ in period $t$.
Denoting by $\pi_{ij}$ the elements of $Q_{ss'}$, we assume that there exists $n_0$ such
that $(\pi_{ij})^n > 0$, $\forall (i,j)$, for all $n > n_0$, where $n \in \mathbb{N}_+$, and that $\pi_{11} > 0$.
These assumptions guarantee that it has a unique invariant distribution (see
e.g. Acikgoz (2018)). We denote the unique invariant distribution by $\xi$.

Each period, households receive labour income $w s_t$, where $w$ is the wage
rate, and interest income from accumulated assets $r a_t$, where $r$ is the interest
rate on assets, and assets are given by $a_t \geq -\psi$, with $-\psi \leq 0$ denoting an
ad hoc borrowing limit. Define the set including the permissible values for
$\psi$ as $A = [-\psi, +\infty)$. Moreover, there are additional returns that can be
made in the asset/financial market by diverting resources from production
and redirecting them back to the households, and higher wealth allows an
individual to capture a higher share of these returns. In particular, there are
assets which are circulated, via the financial market, between households, and
are not used for productive purposes (e.g. returns from trading in the stock
market, using financial instruments, or via transactions in estate that do not
reflect an increase in production). These returns increase with relative wealth.
because wealthier households have more opportunity to exploit situations that create such returns.

To capture the implied rent seeking competition creating the additional returns for the wealthier, we assume that while all households receive the common and guaranteed return $r$ on their savings, implying asset income proportional to a fixed rate, there are additional returns that depend on the household’s relative wealth. In particular, we assume that the institutional framework allows for a share $\theta$ of total assets, $K$, to be redistributed, via rent seeking competition, across households. The parameter $\theta \geq 0$ therefore quantifies the strength of institutions. The amount of this pie that a typical household can appropriate depends on its wealth relative to average wealth in the economy, $d_t = \frac{a_t}{K}$, subject to a price $p_t \in [0,1]$ paid for the amount of assets extracted. The latter reflects the cost that the household incurs while rent-seeking (e.g. fees for lobbying, financial and legal advice). Finally, households receive in the form of dividends ($\eta$) an equal share of any profits that the lobbying firm makes (this sector will be discussed later).\(^5\)

Households use their income for consumption $c_t \geq 0$ and next-period wealth $a_{t+1}$. The aggregate quantities, $w$, $r$ and $p_t$, as well as $\eta$, are assumed to be fixed, which is true if the household’s actions take place in a stationary equilibrium, defined below. These prices are taken as given by the household and are determined in equilibrium. Given their sources of income analysed above, households face the budget constraint:

$$c_t + a_{t+1} = (1 + r) a_t + ws_t + d_t \theta K - p_t d_t \theta K + \eta, \text{ or }$$  \hspace{1cm} (3)

$$c_t + a_{t+1} = (1 + r + (1 - p_t) \theta) a_t + ws_t + \eta. \quad \text{(4)}$$

Some points are worth making regarding the household’s budget constraint. First, as in the simple model in section 2, the household does not choose how much to participate in rent seeking, i.e. what proportion of its assets to use to achieve higher returns. Rent seeking here reflects the existing institutional framework and captures additional returns (or costs) achieved by households with higher assets. As long as $p_t \leq 1$, as we assume, the households will participate in rent seeking with all their assets in this setup. Second, since households are allowed to borrow, (3)-(4) imply that there is a penalty imposed on households with negative wealth, in that they pay a higher cost for being in debt.\(^6\) Third, again as in section 2 above, since

\(^5\)More generally, $\eta$ can be taken to denote profits of all firms, but only lobbying firms can make profits in equilibrium in this setup.

\(^6\)The main results below do not depend on imposing a zero borrowing limit. We allow for $\psi \geq 0$ because allowing for borrowing helps the model to match the realistic aspect of the wealth distribution relating to the percentage of households in debt.
the amount of the pie that a typical household can appropriate depends on its relative wealth (i.e. \(d_t \equiv \frac{\theta K}{K}\)) and the pie itself is a fraction of total wealth \((\theta K)\), returns to saving at the household level remain independent of the household’s wealth, and common across households, as can be seen in (4). Therefore, the results of financial rent seeking on the wealth distribution are not driven by heterogeneity in returns to wealth or assuming increasing returns to savings (see e.g. Fagereng et al. (2016), Benhabib and Bisin (2017) and Benhabib et al. (2018) on the importance of these factors). Finally, since \(p_t\) is determined in equilibrium, its main role is to capture the general equilibrium costs of rent seeking, which the typical household cannot internalise.

Define the net interest rate, \(\tilde{r}\), as

\[
\tilde{r} = r + (1 - p_t) \theta,
\]

so that (4) can be written as:

\[
c_t + a_{t+1} = (1 + \tilde{r}) a_t + w s_t + \eta.
\]

The interest rate and wage rate are taken as given and satisfy \(\tilde{r} > -1\) and \(w > 0\). Moreover, as has been shown (see e.g. Aiyagari (1994), Miao (2014, ch. 8) and Acikgoz (2018)), a necessary condition for an equilibrium with finite assets at the household level in this class of models is that \(\beta (1 + \tilde{r}) < 1\). Moreover, we require that \(-\tilde{r} \psi + w \xi + \eta > 0\), i.e. if the household is at the borrowing limit and receives the worst case labour income shock, it can have non-negative consumption, by borrowing the maximum possible again.

Households have intertemporal discount factor \(\beta \in (0, 1)\) and use a per period utility function \(u(c_t) : [0, +\infty) \to \mathbb{R}\), which is bounded, twice continuously differentiable, strictly increasing and strictly concave. Furthermore, it satisfies the conditions \(\lim_{c \to 0} u_c(c) = +\infty\), \(\lim_{c \to 0} u_c(c) = 0\) and \(\lim_{c \to 0} \inf_{c \to \infty} \frac{u_{cc}(c)}{u_c(c)} = 0\). These assumptions are common in the literature relating to incomplete markets with heterogeneous agents in general equilibrium (see e.g. Aiyagari (1994) and Acikgoz (2018)).\(^7\)

Given values of \((w, \tilde{r})\), and given initial values \((a_0, s_0) \in A \times S\), the typical household chooses plans \((c_t)_{t=0}^\infty\) and \((a_{t+1})_{t=0}^\infty\) that solve the problem:

\[
V(a_0, s_0) = \sup_{(c_t, a_{t+1})_{t=0}^\infty} E_0 \sum_{t=0}^\infty \beta^t u(c_t),
\]

\(^7\)The assumption that \(\lim_{c \to 0} \inf_{c \to \infty} \frac{u_{cc}(c)}{u_c(c)} = 0\) implies that the degree of absolute risk aversion tends to zero as consumption tends to infinity.
where $\beta \in (0, 1)$, $a_t \in A$, $c_t \geq 0$ is given by (6), and $u(c_t)$ and $s_t$ satisfy the assumptions imposed earlier. To obtain the dynamic programming formulation of the household’s problem, let $v(a_t, s_t; w, \tilde{r}, \eta)$ denote the optimal value of the objective function starting from asset-productivity state $(a_t, s_t)$. Suppressing dependence on aggregate quantities, the Bellman equation is:

$$v(a_t, s_t) = \max_{a_{t+1} \geq -\psi, c_t \geq 0} \{u(c_t) + \beta \sum_{s_{t+1} \in S^n} v(a_{t+1}, s_{t+1}) Q_{s_t, s_{t+1}} \}. \quad (8)$$

Standard dynamic programming results imply that the policy functions $a_{t+1} = g(a_t, s_t)$ and $c_t = q(a_t, s_t)$, which generate the optimal sequences $(a_{t+1}^*)_{t=0}^{\infty}$ and $(c_{t+1}^*)_{t=0}^{\infty}$ that solve (7), exist, are unique and continuous. Following e.g. Stokey et al. (1989, ch. 9), we define $\Lambda [(a, s), A \times B] : (A \times S) \times (B(A) \times S) \rightarrow [0, 1]$, for all $(a, s) \in A \times S$, $A \times B \in B(A) \times S$, to be the transition function on $(A \times S)$, induced by the Markov process $(s_t)_{t=0}^{\infty}$ and the optimal policy $g(a_t, s_t)$. This transition function is given by:

$$\Lambda [(a, s), A \times B] = \begin{cases} Q(s, B), & \text{if } g(a, s) \in A \\ 0, & \text{if } g(a, s) \notin A \end{cases}. \quad (9)$$

The analysis in Acikgoz (2018) implies the following results: (i) the Markov process on the joint state-space $(A \times S)$ with transition matrix $\Lambda$ has a unique invariant distribution denoted by $\lambda(A \times B)$; (ii) assets for the typical household tend to infinity when $\beta(1 + \tilde{r}) \rightarrow 1$; (iii) the expected value of assets using the invariant distribution is continuous in the net interest rate, $\tilde{r}$.

### 3.2 Financial sector

A single firm represents the financial sector. It borrows all available assets from households at the rate $r$ and lends a proportion of these assets to the producing firms at the competitive interest rate $r^f$. In particular, it can only lend $(1 - \theta) K$ assets to the producing firms because $\theta K$ are diverted to other uses. This can capture for example intervention in the financial market (e.g. directed loans or subsidies to specific industries or households), or bonuses, payments and other expenses paid out paid to managers, shareholders or other individuals. The zero profit condition requires that:

$$(1 + r)K = (1 + r^f) (1 - \theta) K, \text{ or } r = (1 + r^f) (1 - \theta) - 1 \quad (10)$$
3.3 Producion sector

A single producing firm borrows assets from the financial sector at a constant rate $r_f$ and operates the technology to transform accumulated assets to capital to be used in production. Moreover, it operates an aggregate, constant returns to scale production function using as inputs the average (per capita) levels of capital $K_f$ and employment $L_f$. The production function is given by $F(K_f, L_f)$ and is assumed to satisfy the usual Inada conditions. In particular, $F$ is continuously differentiable in the interior of its domain, strictly increasing, strictly concave and satisfies: $F(0, L_f) = 0$, $F_{KL} > 0$, $\lim_{K \to 0} F(K_f, L_f) \to +\infty$ and $\lim_{K \to \infty} F(K_f, L_f) \to 0$. The capital stock depreciates at a constant rate $\delta \in (0, 1)$. The firm takes the interest and wage rate as given and chooses capital and employment to maximise profits. Optimisation gives the standard first order conditions, where factor input prices are equal to the relevant marginal products:

$$w = \frac{\partial F(K_f, L_f)}{\partial L_f}, \quad (11)$$

$$r_f = \frac{\partial F(K_f, L_f)}{\partial K_f} - \delta. \quad (12)$$

3.4 Lobbying sector

A single firm uses labour input $L^f$ (legal and financial advice and other lobbying services), which is paid the competitive wage $w$, to produce rent seeking, i.e. the quantity of assets extracted from the financial sector, using the production function:

$$\theta K = h(L^f), \quad (13)$$

where $h(L^f)$ is assumed to be increasing and concave and satisfies: $h(0) = 0$, $\lim_{L^f \to 0} h(L^f) \to +\infty$ and $\lim_{L^f \to \infty} F_{L^f}(L^f) \to 0$. The output of the lobbying sector (i.e. assets extracted from the financial sector) are then sold to the households at the price $p_f$. The lobbying firm is a price taker and chooses how much rent seeking to produce to maximise profit, which is determined by:

$$\eta^f = p_f h(L^f) - wL^f. \quad (14)$$

Given an inelastic demand for rent seeking services, in equilibrium, the amount of labour used in rent seeking, $L^f$, is determined by (13). This rent seeking quantity must be consistent with firm optimisation, which determines the equilibrium price of rent seeking services. The first-order condition for maximum profits requires that:

$$p_f = \frac{w}{h_{L^f}(L^f)}. \quad (15)$$
Despite perfect competition, if $h(L^f)$ is characterised by decreasing returns to scale, profits are positive, and these determine $\eta > 0$ in the household’s problem. However, if $h(L^f)$ is constant returns to scale, there are zero profits in equilibrium as it was the case in the simple model in section 2.

### 3.5 General equilibrium

Aggregation over households can be obtained by using the methods discussed e.g. in Acemoglu and Jensen (2015). These imply that idiosyncratic uncertainty is cancelled out at the aggregate level so that aggregate outcomes are fixed quantities. Moreover, the invariant distribution at the household level also gives the cross-sectional distribution. Aggregation implies the following market clearing conditions:

$$
K^f = (1 - \theta) K
$$

$$
L^f + L^e = \int_I s^i \phi (di) \equiv 1 , \tag{16}
$$

where

$$
K \equiv \int_I a^i \phi (di) .
$$

We define the distribution of households over the joint state-space. Given individual asset holdings $a^i_t$ and exogenous shocks $s^i_t$ at period $t$ by household, $i \in I$, the joint distribution over asset accumulation and shocks across households for each household type, $\bar{\pi}_t \in \mathcal{P}(A \times S)$ is given by:

$$
\bar{\pi}_t (A \times B) = \varphi \left( i \in I : (a^i_t, s^i_t) \in A \times B, A \times B \in \mathcal{B}(A \times S) \right) . \tag{17}
$$

The measure $\bar{\pi}_t (A \times B)$ gives the fraction of households whose asset holdings and shocks at period $t$ lie in the set $A \times B$. Using this, we define the stationary recursive equilibrium following e.g. Ljungqvist and Sargent (2012, ch. 18), Miao (2014, ch. 17) and Acikgoz (2016).

**Definition of Stationary Recursive Equilibrium**

A **Stationary Recursive Equilibrium**, is an aggregate stationary distribution $\bar{\pi} (A \times B)$, policy functions $a_{t+1} = g (a_t, s_t) : A \times S \to A$, $c_t = g (a_t, s_t) : A \times S \to \mathbb{R}_+$, a value function $v (a_t, s_t) : A \times S \to \mathbb{R}$, and positive real numbers $K, w (K), r (K), L^f (K), p_t (K), \eta (K)$ such that:

1. The lobbying sector maximises profits so that (13) and (15) hold and determine $L^f (K)$ and $p_t (K)$, and $\eta (K)$ is the maximum (14).
2. The firm maximises its profits given prices, so that \((w(K), r(K))\) satisfy

\[
w(K) = \frac{\partial F(K^f, L^f)}{\partial L^f}, \quad r(K) = \left\{ 1 + \left[ \frac{\partial F(K^f, L^f)}{\partial K^f} - \delta \right] \right\} (1 - \theta) - 1,
\]

where \(K^f = (1 - \theta) K\) and \(L^f = 1 - L^f(K)\), so that \(\tilde{r}(K) = r(K) + (1 - p_t(K)) \theta\).

3. The policy functions \(a_{t+1} = g(a_t, s_t)\) and \(c_t = q(a_t, s_t)\) solve the household’s optimum problem in (8) given prices and aggregate quantities, and the value function \(v(a_t, s_t)\) solves equation (8).

4. \(\lambda(A \times B)\) is a stationary distribution

\[
\lambda(A \times B) = \int_{A \times S} \Lambda[(a, s), A \times B] \lambda(da, ds),
\]

for all \(A \times B \in \mathcal{B}(A) \times \mathcal{S}\), where \(\Lambda[(a, s), A \times B] : (A \times S) \times (\mathcal{B}(A) \times \mathcal{S}) \to [0, 1]\) is the transition function on \((A \times S)\) induced by the Markov process \((s_t)_{t=0}^{\infty}\) and the optimal policy \(g(a_t, s_t)\).

5. When \(\lambda(A \times B)\) describes the cross-section of households at each date, i.e. \(\overline{\lambda}(A \times B) = \lambda(A \times B)\), the asset market clears

\[
K = \int_{A \times S} g(a, s) \overline{\lambda}(da, ds).
\]

Following standard arguments (commonly used in this class of models since Aiyagari (1994)), continuity of the asset supply and demand functions at the aggregate level with respect to the interest rate as well as the limit properties of supply and demand for assets, imply that a general equilibrium exists. A more general proof of existence of equilibrium for this class of models can be found in Acemoglu and Jensen (2015).

4 Calibration and numerical methodology

We calibrate the model using commonly used parameter estimates or information from US data, at an annual frequency. The majority of parameters in the model presented in Section 3 are the same as in standard versions of
the Aiyagari (1994) model which have been calibrated to US data in the literature. Hence, we follow the existing research regarding the choice of these parameters.

We start with the earnings process for $s_t$. We assume that labour income follows an AR(1) process and following Kitao (2008), we set the autocorrelation coefficient equal to $\rho = 0.94$ and conditional variance equal to $\sigma^2 = 0.02$. These parameter values are informed by econometric estimation based on data from the Panel Study of Income Dynamics (PSID) (e.g. Storesletten et al. (2004) and Hubbard et al. (1994)). We then approximate this AR(1) process with a 9-state Markov chain using the method in Rouwenhorst (1995). This determines an equally spaced state-space $S$, normalised to have a unit mean, and the $9 \times 9$ transition matrix $Q_{ss'}$.

The preferences of the household and production technology also follow standard calibrations for the US since Aiyagari (1994). In particular, we use a CRRA utility function:

$$u(c) = \frac{c^{1-\sigma}}{1-\sigma},$$  \hspace{1cm} (22)

and set $\sigma = 2$. Furthermore, by defining as our benchmark calibration the case when $\theta = 0.01$, we calibrate $\beta$ and $\psi$ to match targets for the US economy. Specifically, we calibrate $\beta = 0.967$ so that the economy attains a ratio of $K/Y = 2.65$ (see e.g. Kitao (2008) or Quadrini (2000)). The borrowing limit is set to $\psi = 0.15$, so that the model predicts that, in equilibrium, the percentage of indebted households (i.e. those with negative net-worth) is about 16% when $\theta = 0.01$. The implied borrowing limit means that households can borrow up to the 15% of mean annual household income in the steady state. Moreover, we set the annual depreciation rate to be $\delta = 0.10$ and we use a Cobb-Douglas production function with constant returns to scale with respect to its inputs:

$$Y = A \left( K' \right)^{\alpha} \left( L' \right)^{1-\alpha}.$$

We normalise $A = 1$ and set to $\alpha$ to one third (see, e.g Heathcote et al. (2010)). The above parameters which are kept constant across model variants and calibrations examined in the following sections are summarised in Table 1.\footnote{This number is consistent with Kuhn and Rios-Rull (2016)). Moreover, it is also consistent with Wolff (2000) in which the percentage of agents with zero or negative wealth was 15.5% in 1983, and 18% in 1998 (see Table 1 in Wolff, 2000).}

\footnote{With the exception of Table 4 for which we re-calibrate $\beta$ and $\psi$.}
Table 1: Model Parameters

<table>
<thead>
<tr>
<th>$\beta$</th>
<th>$\sigma$</th>
<th>$\psi$</th>
<th>$\delta$</th>
<th>$A$</th>
<th>$\alpha$</th>
<th>$\rho$</th>
<th>$\sigma^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.967</td>
<td>2.0</td>
<td>0.15</td>
<td>0.10</td>
<td>1.00</td>
<td>0.33</td>
<td>0.94</td>
<td>0.02</td>
</tr>
</tbody>
</table>

There are also parameters in the model in Section 3 that relate to the additional elements introduced in this framework, more specifically relating rent seeking and the lobbying sector. The key parameter measuring the extent of rent seeking, $\theta$, is the one that we vary below in our experiments to examine the effect of weaker institutions on the aggregate economy and wealth inequality. In particular, we discuss results of the model for a range of $\theta$ between 0 (implying that the model collapses to the standard Aiyagari (1994) model) and 0.02, which implies that the amount of assets that are extracted equals 5% of output.

Finally, regarding the lobbying production function, $h(L^\ell)$, we consider two possibilities. The first is that it is a constant returns to scale technology (implying $\eta = 0$ in equilibrium), and the second that it implies decreasing returns with respect to the labour input. Therefore, in the first case we assume that

$$h(L^\ell) = ZL^\ell,$$  \hspace{2cm} (23)

while, in the second, that

$$h(L^\ell) = Z(L^\ell)^\gamma.$$  \hspace{2cm} (24)

Under (23), we calibrate the parameter $Z$, which measures the productivity of labour resources in the lobbying sector so that, at the maximum $\theta = 0.02$ considered, the share of the labour force working for the lobbying sector is up to 6–7% in the various experiments considered, while it is about 3–4% for the more moderate $\theta = 0.01$. It is difficult to quantify the actual amount of activity that is associated with lobbying, and thus the share of the labour force in the financial sector, or in law firms, public sector organisations, etc. that is captured by $L^\ell$. We examine in our analysis below the importance of this diversion of resources and, in particular, we examine the robustness of the results to variations in the productivity of rent seeking (and thus to the share of the labour force that it absorbs). Under (24), we calibrate $Z$ and $\gamma$ so that the profits of the lobbying sector are up to about 0.2% of output when $\theta = 0.01$, whereas employment in the sector is roughly similar to that under the linear technology.

To solve the model computationally, to use an iterative algorithm following e.g. Ljungqvist and Sargent (2012, ch. 18) and Miao (2014, ch. 17.1) by
discretising assets in the grid $[-0.15,50]$ and allowing for 2000 points.\(^{10}\) We first guess a value for $K = K_j$ and calculate $r(K_j)$, $r^f(K_j)$, $w(K_j)$, $p_t(K)$, $L^f(K)$ and $\eta(K)$. We then solve the “typical” household’s problem to obtain $g(a_t,s_t)$ and use the policy function and $s_t$ to construct the transition function $\Lambda_{K_j}$ and calculate the stationary distribution $\lambda$. We then compute the average value of capital $K_j^*$ using $\lambda$, check whether $|K_j^* - K_j| < 10^{-4}$, update the guess if this not true and repeat until convergence.

5 Wealth inequality and rent seeking

We examine the effect of increases in financial rent seeking on wealth inequality by solving the model for different values of $\theta$, for the calibration implied by the parameters in Table 1.

5.1 Rent seeking increases wealth inequality...

We first discuss results for the base case where the lobbying technology takes a linear form, $ZL^f$, where we set $Z = 1.2$. In Table 2, we summarise the key predictions of the model regarding the wealth distribution and key aggregate quantities in this case. Then, in Table 3, we summarise these findings under the assumption that the lobbying technology takes a Cobb-Douglas form, $Z(L^f)^\gamma$, where we set $Z = 1.2$ and $\gamma = 0.9$.

The main result from Table 2 is that wealth inequality increases with higher rent seeking via the financial sector. In particular, as $\theta$ increases, so do two typical measures of wealth inequality, namely the Gini index of wealth inequality, and the coefficient of variation (denoted as CV in the tables), defined as the ratio of the standard deviation of the wealth distribution over its mean. We further investigate the wealth distribution and find that for the first three quintiles, the proportion of wealth owned decreases as $\theta$ increases, whereas for the upper two quintiles, the proportions increase. This is summarised in Table 2 by the evolution of the percentage of total wealth owned by the lower 60% (denoted as Low 60%) and the percentage owned by the upper 40% (denoted as Top 40%). Hence, the increase in wealth inequality following the increase in $\theta$ reflects changes across the distribution and is not

\(^{10}\)Although the upper bound is ad hoc, it effectively implies a near-zero probability of hitting the upper bound (less than $1 \times 10^{-5}$ for the benchmark calibration.). Indeed, we found that e.g. increasing the upper bound for the grid to 60 implies changes in the base results in Table 2 in the fourth decimal point.
limited to the tails.\footnote{Similar qualitative results regarding the effect of increases in $\theta$ are obtained in a calibration of the model that does not allow for debt. In this case, since the wealth distribution is artificially truncated, overall wealth inequality is lower, but the main results in Table 2 are not affected.}

Table 2: Wealth distributions and equilibrium for different $\theta$ (base) 
($\theta K = ZL^L$, $Z = 1.2$)

<table>
<thead>
<tr>
<th></th>
<th>$\theta = 0$</th>
<th>$\theta = 0.01$</th>
<th>$\theta = 0.02$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gini</td>
<td>0.609</td>
<td>0.621</td>
<td>0.632</td>
</tr>
<tr>
<td>CV</td>
<td>1.242</td>
<td>1.277</td>
<td>1.308</td>
</tr>
<tr>
<td>Low 60%</td>
<td>0.147</td>
<td>0.138</td>
<td>0.129</td>
</tr>
<tr>
<td>Top 40%</td>
<td>0.853</td>
<td>0.862</td>
<td>0.871</td>
</tr>
<tr>
<td>$K$</td>
<td>4.698</td>
<td>4.143</td>
<td>3.712</td>
</tr>
<tr>
<td>$K/Y$</td>
<td>2.805</td>
<td>2.650</td>
<td>2.519</td>
</tr>
<tr>
<td>$\frac{\theta K}{Y}$</td>
<td>0</td>
<td>0.026</td>
<td>0.050</td>
</tr>
<tr>
<td>$L^L$</td>
<td>1</td>
<td>0.965</td>
<td>0.938</td>
</tr>
<tr>
<td>$\mu$</td>
<td>-</td>
<td>0.900</td>
<td>0.873</td>
</tr>
<tr>
<td>$r$</td>
<td>0.019</td>
<td>0.017</td>
<td>0.014</td>
</tr>
<tr>
<td>$\tilde{r}$</td>
<td>0.019</td>
<td>0.018</td>
<td>0.017</td>
</tr>
<tr>
<td>$r^f$</td>
<td>0.019</td>
<td>0.027</td>
<td>0.035</td>
</tr>
<tr>
<td>$w$</td>
<td>1.118</td>
<td>1.080</td>
<td>1.047</td>
</tr>
<tr>
<td>$\frac{\pi}{y}$</td>
<td>-</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>% indebted</td>
<td>0.145</td>
<td>0.159</td>
<td>0.170</td>
</tr>
<tr>
<td>Welfare</td>
<td>0.057</td>
<td>0.014</td>
<td>-0.025</td>
</tr>
</tbody>
</table>

We also summarise in Table 2 some useful general equilibrium quantities. In particular, we see that increases in $\theta$ increase assets extracted as a share of output ($\frac{\theta K}{Y}$), increase the proportion of labour force working in the lobbying sector ($L^L$), and lead to reductions in aggregate capital, the market and the effective rate of return to investment ($r$ and $\tilde{r}$, respectively) and to wages and thus average labour income. Moreover, rent seeking reduces the welfare of a typical household populating the economy. The latter is calculated as the expected utility of a typical household in the stationary equilibrium using (22). Therefore, the results in Table 2 demonstrate that weaker institutions, which allow for a higher share of assets to be extracted during financial transactions, decrease overall incentives to accumulate assets, reduce labour income,
and lead to a reduction in aggregate welfare in a stationary equilibrium.

<table>
<thead>
<tr>
<th>Table 3: Wealth distributions under non-linear lobbying technology $(\theta K = Z (L^L)^\gamma, Z = 1.2, \gamma = 0.9)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\theta = 0$</td>
</tr>
<tr>
<td>Gini</td>
</tr>
<tr>
<td>CV</td>
</tr>
<tr>
<td>Low 60%</td>
</tr>
<tr>
<td>Top 40%</td>
</tr>
<tr>
<td>$K$</td>
</tr>
<tr>
<td>$K/Y$</td>
</tr>
<tr>
<td>$\theta K$</td>
</tr>
<tr>
<td>$L^f$</td>
</tr>
<tr>
<td>$p_t$</td>
</tr>
<tr>
<td>$r$</td>
</tr>
<tr>
<td>$\bar{r}$</td>
</tr>
<tr>
<td>$r^f$</td>
</tr>
<tr>
<td>$\pi/y$</td>
</tr>
<tr>
<td>% indebted</td>
</tr>
<tr>
<td>Welfare</td>
</tr>
</tbody>
</table>

Before continuing to investigate the mechanism that gives rise to these results, we evaluate their robustness to assuming a Cobb-Douglas technology for lobbying services. As discussed above, we consider the form $Z (L^L)^\gamma$ and allow for decreasing returns, implying that the lobbying sector generates profits. Similar to the linear lobbying technology case, we recalibrate $\beta = 0.9651$ and $\psi = 0.142$ to have $K/Y \simeq 2.65$ and 16% of indebted households in equilibrium respectively. The results in Table 3 demonstrate the new effects of increases in $\theta$ on the aggregate economy and on wealth inequality and imply that the profits of the lobbying sector are up to about 0.2% of output when $\theta = 0.01$, whereas employment in this sector (and thus the proportion of workforce not working in production) is similar to that under the linear technology. The effects of increases of $\theta$ on the wealth distribution, as summarised by the Gini and CV indices and distribution of wealth ownership among the top and bottom 40% and 60% of the distribution, are very similar to those in Table 2. Moreover, the effects on the aggregate capital stock and welfare are similar to those under the linear technology. Note that, under decreasing returns to scale, the increased demand for rent seeking increases profits for the sector.
5.2 ...because of negative effects at the aggregate level

The results demonstrate that rent seeking has adverse effects on both aggregate quantities and inequality. As the results in the next table will show, the deterioration of the wealth distribution follows from the deterioration of aggregate outcomes. In particular, we consider a partial equilibrium version of the model, where prices are kept fixed, and we examine the effects of changing $\theta$ on aggregate savings and wealth inequality. We set the prices to reflect the cost of lobbying activities where the price of rent seeking was determined by market interactions and the services provided by the lobbying sector. In particular, we set $p_t = 0.900$, $w = 1.080$ and $r = 0.0168$, which are the equilibrium prices when $\theta = 0.01$ in Table 2. The effects of decreasing or increasing $\theta$ in this framework on the wealth distribution and the welfare of the typical household are shown in Table 4 below. As can be seen, now increases (decreases) in the amount of assets that can be extracted decreases (increases) inequality. This generalizes the results in the simple model in Section 2.

In this model, wealth inequality is the result of the exogenous inequality in the idiosyncratic component of earnings under incomplete insurance, and of the propagation mechanism of asset accumulation, which is an endogenous decision of the agents in the economy. Asset accumulation, in turn, is determined by returns to saving and disposable income. Returns to saving, as can be seen by (5), are determined both by the market interest rate and the returns that can be achieved by rent seeking.

In partial equilibrium, where the market return ($r$) and the cost of rent seeking ($p_t$) are fixed, rent seeking ($\theta$) increases the effective or net returns to savings ($\bar{r}$), setting in motion a mechanism which leads to a rise in asset accumulation and a reduction in wealth inequality. In particular, there are no negative implications from rent seeking on the market interest rate ($r$) or cost of rent seeking ($p_t$) that the household faces. Moreover, there are no negative effects on the labour income of the households, because the wage rate ($w$) is held fixed. As a result, the typical household interprets the opportunity of rent seeking as an increase in the effective returns to saving ($\bar{r}$), which is a result of the assumption that extraction is proportional to private assets (wealthy individuals can extract more). Hence, households increase their savings, which in turn implies that they are less exposed to earnings shocks. Therefore, idiosyncratic earnings shocks do not lead to as big a spread of disposable income across households, and thus to as big a spread in investment decisions, leading to lower wealth inequality for the same earnings distribution. Rent seeking thus provides a means for self-insurance
which works to reduce the inequality effects of idiosyncratic earnings.

Table 4: Wealth distributions in partial equilibrium for different $\theta$.

<table>
<thead>
<tr>
<th></th>
<th>$\theta = 0$</th>
<th>$\theta = 0.01$</th>
<th>$\theta = 0.02$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gini</td>
<td>0.632</td>
<td>0.621</td>
<td>0.610</td>
</tr>
<tr>
<td>CV</td>
<td>1.309</td>
<td>1.277</td>
<td>1.245</td>
</tr>
<tr>
<td>Low 60%</td>
<td>0.130</td>
<td>0.138</td>
<td>0.147</td>
</tr>
<tr>
<td>Top 40%</td>
<td>0.870</td>
<td>0.862</td>
<td>0.853</td>
</tr>
<tr>
<td>$K$</td>
<td>3.802</td>
<td>4.143</td>
<td>4.532</td>
</tr>
<tr>
<td>$p_L$</td>
<td>0.900</td>
<td>0.900</td>
<td>0.900</td>
</tr>
<tr>
<td>$r$</td>
<td>0.017</td>
<td>0.017</td>
<td>0.017</td>
</tr>
<tr>
<td>$\bar{r}$</td>
<td>0.017</td>
<td>0.018</td>
<td>0.019</td>
</tr>
<tr>
<td>$r^f$</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>$w$</td>
<td>1.080</td>
<td>1.080</td>
<td>1.080</td>
</tr>
<tr>
<td>% indebted</td>
<td>0.169</td>
<td>0.159</td>
<td>0.146</td>
</tr>
<tr>
<td>Welfare</td>
<td>0.005</td>
<td>0.014</td>
<td>0.024</td>
</tr>
</tbody>
</table>

However, when the general equilibrium was analysed in Tables 2 and 3, the results were different. In this case, the resource extraction and misallocation associated with rent seeking was also considered and worked to reduce savings in the following way. First, the amount of aggregate savings extracted implied a financial loss for the financial sector and thus reduced the market return ($r$) directly, as can be seen in equation (10). This fall, in turn, reduced the effective return ($\bar{r}$), because the reduction in ($r$) outweighed the additional returns from rent seeking. The reduction in $\bar{r}$ implied a reduction in households’ incentives to save.\textsuperscript{12} Second, the reduction in the amount of capital used for production (because a proportion $\theta$ is extracted) also implied a reduction in the wage ($w$), and thus in mean earnings. Given that savings are a positive function of earnings in this class of models (see e.g. Aiyagari (1994)), this also worked to reduce savings. Both effects implied a reduction in mean asset holdings per household, in turn implying that households were more exposed to idiosyncratic earnings shocks so that the same earnings risk

\textsuperscript{12}It should also be noted that there are additional, second-order effects on the interest rate in general equilibrium. First, because there are fewer resources available to firms (because of extraction), the marginal product of capital increases, hence $r^f$ and thus $r$ also tends to increase. Second, because of allocation of labour to the lobbying sector, the labour input used in production is reduced, and thus the marginal product of capital is reduced, hence reducing $r^f$, and thus $r$. Fourth, increased demand for rent seeking services affects the price $p_L$ and thus $\bar{r}$. The net outcome of all these effects is a reduction in effective returns, $\bar{r}$, as captured in Tables 1 and 2.
implied higher wealth inequality.

The results in Table 4 show that rent seeking decreases inequality despite assuming that it is the wealthier who extract the more. Hence, the intuition that under rent seeking inequality increases because it is the wealthier individuals/agents who extract the more from the economy’s wealth is not confirmed here. Instead, as our results from the previous section (Tables 2 and 3) indicate, inequality increases under rent seeking because rent seeking has a negative impact on aggregate quantities. Overall, there are two effects from rent seeking. The first works at the individual level and tends to decrease inequality because it is the wealthier who extract more, which increases the incentives to accumulate wealth and mutes the importance of exogenous factors of idiosyncratic effects that create inequality. The second works via general equilibrium, and tends to increase wealth inequality because rent seeking leads to a reduction in the effective return to saving and disposable income and thus works in the opposite direction. In the calibrated model economy, the second effect dominates so that rent seeking leads to a worsening of aggregate outcomes and inequality. Thus, that the wealthier extract more, other things equal, tends to decrease wealth inequality in this framework. It is only because of the worsening of the aggregate economy that rent seeking increases wealth inequality.

5.3 The importance of productivity in lobbying

The lobbying sector matters for the effect of rent seeking on wealth inequality. By competing for resources with the productive sector, a lobbying sector where labour has a higher productivity will increase returns for labour. Hence, in this case, an increase in labour productivity in lobbying will raise the wage rate, increasing labour income and thus having a positive effect on savings. To demonstrate this point quantitatively, we examine the impact of higher labour productivity in the lobbying technology, $\theta K = ZL^\ell$. In particular, we re-calculate the quantities in Table 2 by setting $Z = 1.6$ and summarise the results in Table 5. As can be seen in this Table, although the results are qualitatively similar with those in Table 2, the effects of a worsening of institutions associated with an increase in $\theta$ lead to a smaller increase in inequality and a lower reduction in aggregate capital and welfare.

The higher labour productivity implies an increase in wages and a lower misallocation of labour to lobbying, accompanied by a lower cost of rent seeking at the individual level in terms of $p_l$. This analysis suggests that the negative effects of financial rent seeking on wealth inequality and aggregate outcomes are worse when the lobbying sector is less productive. In this sense, conditional on the degree of extraction from aggregates wealth (i.e.
\( \theta \) in this model), a framework for lobbying intermediation that renders it more effective (i.e. that implies a higher \( Z \) in terms of the model) is more beneficial for inequality.

| Table 5: The importance of extraction technology \((\theta K = ZL^\ell, Z = 1.6)\) |
|-----------------|-----------------|-----------------|
| \( \theta = 0 \) | \( \theta = 0.01 \) | \( \theta = 0.02 \) |
| Gini | 0.609 | 0.618 | 0.626 |
| CV | 1.242 | 1.269 | 1.292 |
| Low 60\% | 0.147 | 0.140 | 0.135 |
| Top 40\% | 0.853 | 0.860 | 0.865 |
| \( K \) | 4.698 | 4.275 | 3.926 |
| \( K/Y \) | 2.805 | 2.691 | 2.591 |
| \( gK \) | 0 | 0.027 | 0.052 |
| \( L^f \) | 1 | 0.973 | 0.951 |
| \( p_t \) | - | 0.680 | 0.664 |
| \( r \) | 0.019 | 0.015 | 0.011 |
| \( \bar{r} \) | 0.019 | 0.018 | 0.017 |
| \( r_f \) | 0.019 | 0.025 | 0.031 |
| \( w \) | 1.117 | 1.088 | 1.062 |
| \( \pi/y \) | - | 0 | 0 |
| % indebted | 0.145 | 0.156 | 0.164 |
| Welfare | 0.057 | 0.024 | -0.006 |

### 5.4 The importance of labour misallocation

The social cost associated with misallocation of resources in this model is due to two channels. First, it is caused by the direct reduction of capital available for production, since a proportion \( \theta \) of total assets is not used for productive purposes. Second, it is caused by a share of labour diverted to work in the lobbying sector, to provide rent seeking services. To quantify the contribution of the latter, relative to the former, we consider a variation of the model where we assume that rent seeking services do not require intermediation of a labour employing sector, but they are instead merely assumed to reflect a fixed transaction cost, captured by an exogenously set \( p_t \). To this end, we set \( p_t = 0.9 \) and solve the base model again, without the lobbying sector, following for the remaining parameters the calibration
giving the results in Table 2. We summarise the new results in Table 6.

<table>
<thead>
<tr>
<th></th>
<th>$\theta = 0$</th>
<th>$\theta = 0.01$</th>
<th>$\theta = 0.02$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gini</td>
<td>0.609</td>
<td>0.617</td>
<td>0.625</td>
</tr>
<tr>
<td>CV</td>
<td>1.242</td>
<td>1.266</td>
<td>1.288</td>
</tr>
<tr>
<td>Low 60%</td>
<td>0.147</td>
<td>0.140</td>
<td>0.135</td>
</tr>
<tr>
<td>Top 40%</td>
<td>0.853</td>
<td>0.860</td>
<td>0.865</td>
</tr>
<tr>
<td>$K$</td>
<td>4.698</td>
<td>4.273</td>
<td>3.904</td>
</tr>
<tr>
<td>$K/Y$</td>
<td>2.805</td>
<td>2.642</td>
<td>2.496</td>
</tr>
<tr>
<td>$\theta K$</td>
<td>0</td>
<td>0.026</td>
<td>0.05</td>
</tr>
<tr>
<td>$L^f$</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>$p^t$</td>
<td>-</td>
<td>0.900</td>
<td>0.900</td>
</tr>
<tr>
<td>$r$</td>
<td>0.019</td>
<td>0.017</td>
<td>0.016</td>
</tr>
<tr>
<td>$\bar{r}$</td>
<td>0.019</td>
<td>0.018</td>
<td>0.018</td>
</tr>
<tr>
<td>$r^f$</td>
<td>0.019</td>
<td>0.027</td>
<td>0.036</td>
</tr>
<tr>
<td>$w$</td>
<td>1.118</td>
<td>1.078</td>
<td>1.043</td>
</tr>
<tr>
<td>$\pi/y$</td>
<td>-</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>% indebted</td>
<td>0.145</td>
<td>0.154</td>
<td>0.163</td>
</tr>
<tr>
<td>Welfare</td>
<td>0.057</td>
<td>0.016</td>
<td>-0.023</td>
</tr>
</tbody>
</table>

By comparing the results in Table 6 to those in Table 2, we can see that both capital and labour misallocation matter for the deterioration of aggregate outcomes and the increase in wealth inequality. In particular, the increase in wealth inequality and the reduction in welfare associated with an increase in $\theta$ are smaller compared with those in Table 2. Labour is not diverted from production, which supports the productivity of capital (and thus $r^f$ and in turn $r$ and $\bar{r}$\textsuperscript{13}, which increases asset accumulation relative to the results in Table 2, implying a lower relative increase in wealth inequality. Therefore, the increase in wealth inequality seen in Table 2 is driven by the reduction in both capital and labour inputs in production, as a result of rent seeking. This is similar to the misallocation of talent effect in Murphy \textit{et al.} (1991).

\textsuperscript{13}Due to rounding, under $\theta = 0.01$, the results appear the same in Tables 2 and 6, but interest rates in Table 6 are higher. This is more evident under $\theta = 0.02$. 
6 Conclusions

In this paper, we analysed financial rent seeking, due to weak institutions, and wealth inequality. In particular, we examined the importance of general equilibrium in the link between weak institutions and the distribution of wealth. We considered a version of the incomplete markets heterogeneous agent model in Aiyagari (1994) that allowed for a share of accumulated assets to be diverted away from productive uses to redistributive benefits to households via rent seeking competition which favoured the wealthy. In particular, we assumed that the amount of resources that can be extracted increases with relative wealth. Rent seeking in this context works to create additional incentives for the household to increase its savings and thus to self-insure against idiosyncratic shocks for which there is no insurance market. As a result, conditional on aggregate quantities, financial rent seeking works to decrease wealth inequality, despite, or in fact because, it is the wealthier who extract more resources.

However, rent seeking also implies a misallocation of resources at the social or aggregate level, because rent seeking reduces directly the amount of savings that can be used for production, and indirectly the amount of labour that can be used for production. The latter happens because rent seeking requires intermediation in the form of lobbying services, and financial and legal advice, which absorb labour services from the producing sector (the talent misallocation effect in Murphy et al. (1991)). These effects tend to reduce market returns to savings and household income, and thus the incentive and ability of households to accumulate assets, amplifying the effect of idiosyncratic earnings shocks on wealth inequality.

In a general equilibrium model calibrated to the U.S., we found that the resource misallocation effects at the aggregate level dominate so that wealth inequality is increased when institutions get weaker in the sense that financial rent seeking can divert a higher share of aggregate savings from production to a redistributive, contestable pie. This result underlines the importance of resource misallocation at the social, aggregate level that is implied by rent seeking as the culprit for the latter’s impact on wealth inequality.

Rent seeking can increase wealth inequality for additional reasons that we did not study here. These may include, for instance, stochastic returns to rent seeking, especially in relation to earnings risk, or if rent seeking requires a different type of asset, linking thus rent seeking to portfolio choices. More directly, there may be unequal opportunities for rent seeking, for example, certain groups may be excluded from the rent seeking competition, in which case there is effectively a form of ex ante heterogeneity in rent seeking. Our analysis shows that even when these reasons are not present, and even when
rent seeking acts as a self-insurance mechanism to correct for financial market imperfections, the aggregate-level resource misallocation effects imply that it increases wealth inequality. It thus highlights the importance of studying the aggregate and distributional implications of rent seeking within a unified framework.

References


