Entrepreneurs, Managers and Inequality*

Sang Yoon (Tim) Lee

Toulouse School of Economics and CEPR

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Abstract

Income concentration in the U.S. rose sharply since the 1970s. But the share of wealth held by the top 1 percent increased less. This can be partially accounted for by a quantitative model of occupational choice, in which rich individuals choose to become entrepreneurs or managers. Collateral constraints induce entrepreneurs to hold more wealth, while managers earn higher wages as a result of competitive assignments to firms. Declining tax progressivity from 1970 to 2000 replaces top entrepreneurs with top managers, which can account for all of the increase in the share of wages earned by the top 1 percent and 20-25% of the increase in the share of income earned by the top 1 percent. At the same time, the share of wealth held by the top 1 percent remains stable, as entrepreneurs decumulate but managers accumulate wealth.

Keywords: occupational choice; wealth inequality; progressive taxation

JEL Classifications: *E21, E62, H31*

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1. Introduction

Wealth is much more concentrated than income in the United States. For most of the latter half of the 20th century, the top 1% of the wealthiest households held approximately 30% of aggregate wealth. In contrast, the top 1% of the highest income households earned approximately 10% of aggregate income.[1] At the same time, income has become much more concentrated toward rich households since the 1970s compared to the previous post-war era, with the highest income percentile earning 7.8% of aggregate income in 1970 and 16.5% in 2000. Most of this can be accounted for by wages: Both the share of wages earned by the top wage earners, and the wage component of the highest income households, have risen throughout the same time frame (Piketty and Saez, 2003). In contrast, wealth concentration has either been rather flat according to the Survey of Consumer Finances.

Two questions beg explanation: What drove the dramatic increase in wage and income concentration? And why was this pattern not mirrored in wealth concentration? To answer these questions, I develop a model where firms can remain in the hands of an entrepreneur, or be sold and run by managers. I show that less progressive taxation improves the market for managers, replacing top entrepreneurs with top managers. Because their sources of income and savings behavior differ, this ultimately shifts the distributions of wage, income and wealth. Feeding observed tax policies in 1970 and 2000 into the model can account for all of the increase in the share of wages earned by the top 1%, and about a quarter of the increase in the share of income earned by the top 1 %. Moreover, the concentration of wealth at the top 1 % first drops before starting to rise again.

The novel component of the model is the distinction between entrepreneurs and managers. Most models treat them identically, and by doing so miss a market for managers, or "talent." To incorporate the missing market, I take a simple approach where entrepreneurs are constrained to use their own assets to run a firm, while managers are hired by firms in which they need not invest.[2] At the individual level, there is a trade-off between becoming an entrepreneur or a manager. Entrepreneurs must save to put capital into the firms they run in the face of collateral constraints, while managers are hired in a frictional market with agency costs. Occupational choices are affected by tax policy because managers earn most of their income in the form of wages, while entrepreneurs earn relatively more from their business.

The manager market is assumed to be competitive. This implies that managerial com-

[1] In a standard model of precautionary savings, it is natural that wealth should be more concentrated than income. However, numerous studies have found that it cannot quantitatively explain the degree of wealth concentration that is observed in the data. See Cagetti and De Nardi (2008) for a review.

[2] E.g., a company of which the executive has only does not hold the majority of shares. The main distinction I make in the model is that entrepreneurs are fully liable for the company's debt, while managers are not.

pensation is proportional to the size of the firms they run (up to a constant). Therefore, the wages of the managers who run the largest firms rise with the total size of firms in the economy (Tervio, 2008; Gabaix and Landier, 2008). When managers replace entrepreneurs at the high end of the income distribution, income becomes more concentrated because managers have higher earnings.[3] This is in line with the explosive increase in managerial compensation since the 1980s and the rise in earnings concentration being the main culprit for the rise in income concentration, which led to "the working rich replacing the traditionally rich" (Piketty and Saez, 2003).[4]

The collateral constraints create a strong concentration of wealth by inducing individuals to save up, both in anticipation of becoming an entrepreneur, and to expand their business when they are an entrepreneur. When it becomes better to be a manager, however, individuals have less incentive to save since they can just wait for an opportunity to become a manager. As this happens, wealth concentration initially drops. But because becoming a top manager is a scarce opportunity, individuals save disproportionately more when they finally make it. Moreover, top managers save out of a higher income than top entrepreneurs (on average). So as the top managers continue to crowd out the top entrepreneurs, wealth concentration eventually rises again. These two forces keep the concentration of wealth stable.

My quantitative results show that such occupational shifts at the top can be induced by a decline in tax progressivity. Taxes are fed into the model exogenously, and I numerically compute the response of the economy to historical changes. Federal income taxation has become much less progressive, with the highest income groups paying as much as 70% of their income in taxes in the 1970s as opposed to 35% today.While other forms of taxation such as the capital gains tax have also fell, in Appendix B I present evidence that much of capital and business income at the top has been historically deducted, but less so over time. This indicates that the major shift at the top will have come from how income taxation affects top earnings which is mostly non-deductible, and of which as much as half may be managerial compensation.[5]

In the model, lower taxes on high levels of managerial compensation increases both the supply and demand of managers in equilibrium, which reduces the relative measure of entrepreneurs versus managers both in aggregate and more importantly, at the high end of the income distribution. Note that this occupational shift occurs *in equilibrium*: A rich, high ability individual does not choose to become a manager because *after-tax* managerial

[3]In this paper, both "wages" and "earnings" refer to labor income, and "income" to total income.

[4]In my model, entrepreneurs are rich because of large assets accumulated over time, which can also be considered the outcome of large, successive bequests as in Cagetti and De Nardi (2006).

[5]Figure A3(b) in Appendix A.1 shows the wage share of managers in the top wage percentile.

compensation is high, but because the *pretax* compensation becomes higher when there is a larger mass of managers.

There is a subtlety here: Top income shares depend both on the supply *and* demand of managers. Even if top manager wages should rise with more managers, if it is mainly due to a rise in supply without a commensurate rise in demand, relative price changes may uniformly drive down the compensation for all managers. In Section 5, I show that allowing technological parameters that govern the size of the manager market to change simultaneously with tax parameters can improve the model fit to 2000 data, but results in only small additional changes in top income shares and occupations. The same analysis shows that without a change in tax policy, enlarging the manager market in fact drives down top manager wages due to general equilibrium price effects.

The main message of my model is that wealth concentration need not follow income concentration, since it depends on rich individuals' savings incentives.[6] This highlights a mechanism that is important to consider when designing tax policies. My model lets progressive taxation affect the production side of the economy by changing the equilibrium composition of entrepreneurs and managers, who produce all output. Since the producers also save, the wealth distribution depends on the interaction of their capital demand and supply. This result contrasts with previous studies that weigh the benefits of public insurance against the individual labor supply incentives of workers.

Contribution to Existing Literature Much of the literature attempts to explain the high degree of wealth concentration observed in the data. Aiyagari (1994) shows that incomplete markets alone come far from accomplishing this. Krusell and Smith (1998) find that adding aggregate uncertainty is also insufficient.[7] Castañeda, Díaz-Giménez, and Ríos-Rull (2003) find that a model with endogenous labor supply and taxes can almost exactly match the earnings and wealth inequality moments in the data by assuming an extremely high labor productivity shock that occurs with very small probability.

In these models, all individuals are wage workers and the main source of risk is an exogenously assumed labor productivity shock. This may not be ideal for analyzing the very rich. For example, while the typical progressive taxation debate is between the welfare of workers and the productivity of firms, firms in these models play little role besides pinning down equilibrium prices. In my model, all workers are hired by either entrepreneurs or managers. Hence a change in tax policy alters the production side as well, by altering the

[6] In Appendix E, I show that flattening the tax structure even more leads to an increase in earnings and income concentration but a drop in wealth concentration.

[7] They do find that the wealth distribution in their model comes close to that of the U.S. when incorporating a stochastic subjective discount factor that varies with the aggregate state.

the equilibrium allocation of producers and workers. This also implies that individuals' income processes themselves respond endogenously to policy changes.

This insight is borrowed from the span-of-control model of Lucas (1978), which endogenously generates high income for top managers. In a parsimonious overlapping generations framework, Cagetti and De Nardi (2006) shows that adding collateral constraints into a variant of the Lucas model can generate a realistic wealth distribution with high concentration. Quadrini (2000) shows that collateral constraints and entrepreneurial risk can explain income class mobility as well as the wealth distribution in the U.S..

In practice, these models add a small fraction of entrepreneurs into a model of what they call the "corporate sector," which is more or less identical to Aiyagari (1994). Such models are suitable for analyzing the behavior of entrepreneurs and how they interact with the macroeconomy, but do not capture the large role played by the corporate sector, which accounts for more than 70% of output in the U.S.. The manager market in my paper can be viewed as a model of the corporate sector in such papers.

More important, all the models above cannot endogenously explain rising income concentration without large shifts in wealth concentration.[8] These models are able to create a strong concentration of wealth because high income earners have an unusually large savings motive, whether it be because they face a different income process or because they have a different occupation. Consequently, an increase in income concentration is necessarily linked to an even higher concentration of wealth.

To break this link, I combine elements from both strands of the literature. Starting from a model of entrepreneurs similar to Cagetti and De Nardi (2006); Buera and Shin (2013), I add another high income earning occupation, a manager, that competes with the entrepreneurs. The market in which managers are hired is similar to technology transfers: potential entrepreneurs choose between running their own business or selling it. This component of the model can be viewed as a simplified version of Holmes and Schmitz (1990, 1995), which Silveira and Wright (2010) generalize by adding various frictions to the transfer process. In contrast, I interpret such transfers as a mechanism that brings a business to the disposal of a competitive investment market, and simplify the process so that it can be embedded in a general equilibrium framework. This simplification is done by borrowing from managerial assignment models, e.g. Tervio (2008), Gabaix and Landier (2008).

In equilibrium, high income groups display different characteristics depending on the ratio of entrepreneurs versus managers that comprise them. When there are more entrepreneurs, the model behaves similarly to an entrepreneurial model with collateral constraints. When there are more managers, it behaves more similarly to a competitive assign-

[8] To be clear, this was not the focus of any of the cited literature.

ment model with superstar earnings; the equilibrium income process then resembles that of Castañeda et al. (2003). Thus, a shift in occupational choices alters the savings behavior of different income groups and the dynamics of their sources of income.

It is important that I allow policy to affect such occupation shifts. Feeding in a rich set of fiscal policies into a model similar to Castañeda et al. (2003), Kaymak and Poschke (2016) find that policy changes can explain about half of the rise in the concentration of wealth by making savings more attractive, but that rising wage dispersion is the main driver of inequality trends. At first glance, this may seem to contradict my results. But it is still true in my model that wage dispersion drives inequality, and that top earners save more than before. The main difference is that wage dispersion is not exogenous, but endogenously determined by equilibrium occupation choices. Because less progressive taxation leads to more managers in equilibrium, top wages rise, and top earners save more to take advantage of their luck. However, this is countered by a drop in the mass and savings of entrepreneurs, who now find it more attractive to become a manager. Thus, the implications for wealth inequality remain ambiguous, unlike their predictions that it will become even more concentrated in the long-run.

Since what triggers the occupation shifts in the model is tax progressivity, the paper is also related to the empirical public finance literature. These papers I discuss in the next section while summarizing the empirical facts that form the basis of my study. Section 3 presents the theoretical model and its properties. Section 4 describes the calibration strategy and the numerical experiment. Section 5 discusses the results and the quantitative mechanisms of the model, and Section 6 concludes. Supplementary data and simulations are included in the Appendix.

2. Facts

This section details the empirical facts outlined in the introduction. In Appendix B, I document that much of gross income is deducted at the top, especially capital and business incomes—but less and less so since the 1970s. That is, much of the change in progressivity can be attributed to changes in the progressivity of wage income taxes.

2.1 U.S. Income and Wealth Distribution

Figure 1 plots the time series for the top 1% share of wealth from the Survey of Consumer Finances (SCF), Kopczuk and Saez (2004) and Saez and Zucman (2016).[9] The SCF series

[9] I account for wealth as "NET WORTH" as defined in the SCF; my results are similar to Scholz (2003) and Kennickell (2009), except that the former excludes 1986 due to spurious reporting concerns and the latter only

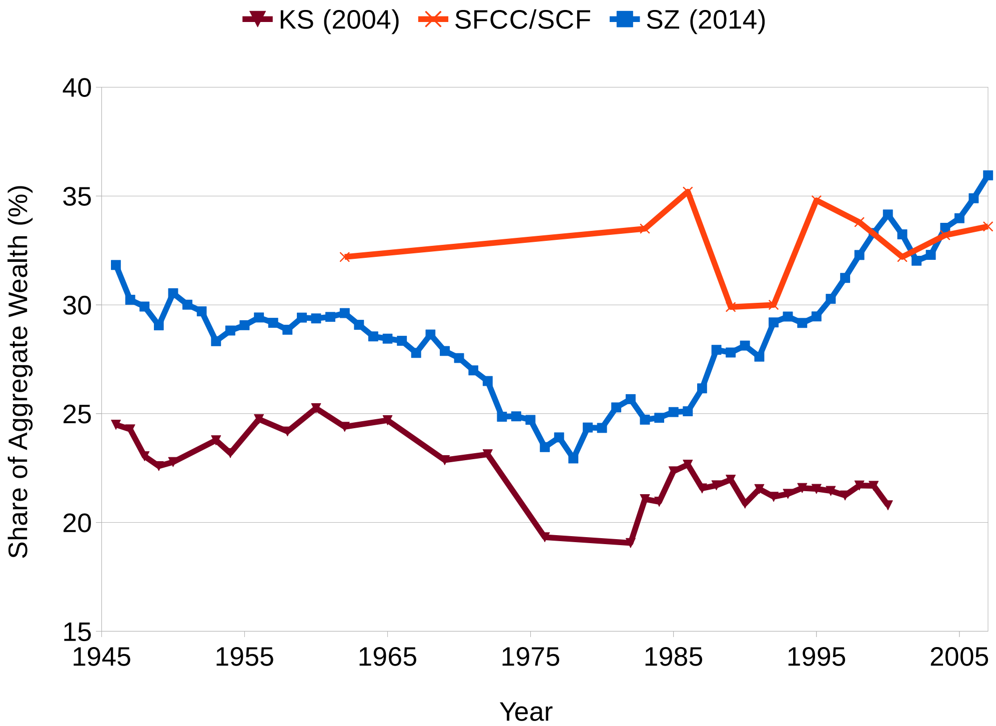


Figure 1: Top percentile wealth shares, different authors.

The 1962/63 Survey of Financial Characteristics of Consumers and Survey of Changes in Family Finances (SFCC/SCFF) was the precursor of the Survey of Consumer Finances (SCF). The wealth measure for the SCF is the variable NET WORTH. Kopczuk and Saez (2004) use estate tax returns reported to the IRS and Saez and Zucman (2016) impute wealth using a capitalization technique using interest rates implied from matching capital income reported in tax returns to the Federal Funds accounts.

includes every three years all available years from 1983 to 2007, as well as the 1963 Survey of Changes in Family Finances (SCFF). The SCF is suitable for analyzing the top income groups since it over-samples the very rich and does not top-code large-dollar observations. As well known, it shows that the top percentile wealth share has no specific trend over this period. While it does seem to display a slight increase in the early 1990s, this trend was reversed afterward. This contrasts with top income shares, which has continually increased. Kopczuk and Saez (2004) also find a stable trend in wealth shares.

Saez and Zucman (2016) work around tax avoidance concerns by imputing wealth using a capitalization technique that matches capital income reported in tax returns to Federal Funds accounts. Unlike previous studies, they find sizable increases in recent years, but also find that most of this rise can be attributed to the top 0.1%. Moreover, the trend is not monotonic, but U-shaped. So potential issues with their capitalization technique aside, the question still remains why there is a disconnect with the clear pattern of rising wage and income concentration.

Figure 2(a), replicated from Piketty and Saez (2003), shows that the top income percentile's share of income has grown dramatically since the 1980s, and that it seems to reflect the large rise in the top earnings percentile's share of earnings.Figure 2(b), also replicated, shows that when total income is divided into capital, wage and business income, the wage share of income became higher for the top income percentile.[10] This indicates the "crowding out" story of this paper, that the "savings rich" (entrepreneurs) have been replaced by the "earnings rich" (managers).[11]

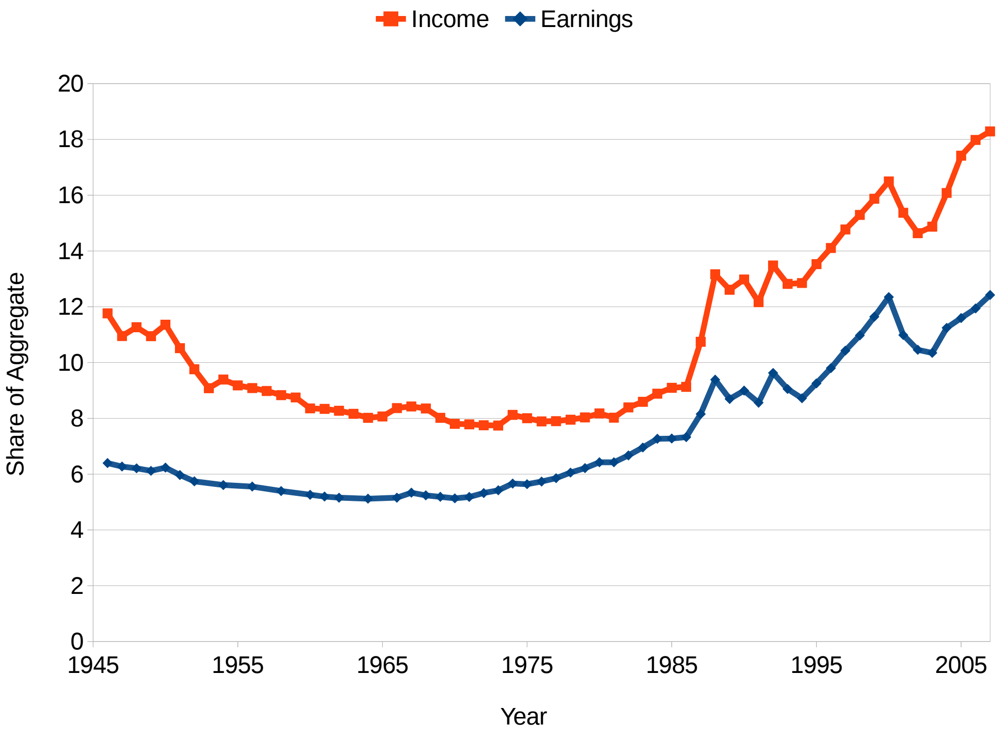
2.2 Entrepreneurs vs Managers

A large fraction of the rich people are entrepreneurs, defined by Cagetti and De Nardi (2006) as self-employed owners or share-holders of privately-held businesses, in which s/he also has an active management role. Using this definition, they find that 7.6% of the population are entrepreneurs, own 33% of total wealth, and comprise 54% of the top wealth percentile in the 1989 SCF (their Tables 1–3, respectively). But as shown in Figure 3(a), this share has been rather flat in aggregate, and fell by about 27 percentage points in the top income percentile. Furthermore, as they also ask, who are the other rich?

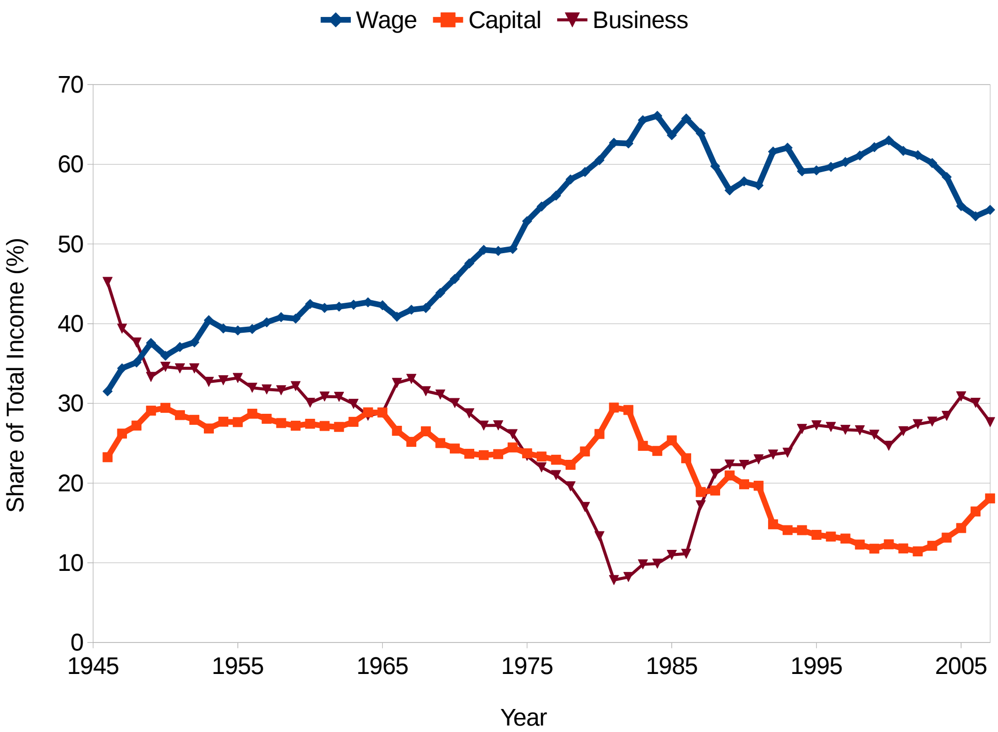
analyzes 1989 onward. Kopczuk and Saez (2004) is based on estate tax returns and Saez and Zucman (2016) a capitalization technique that matches tax returns to Federal Funds accounts.

[10] They use tax returns data published annually by the Internal Revenue Service (IRS), based on income as reported by a tax unit (single or married couple). They also show that such trends hold for higher income groups in general (10th percentile and above), but is more pronounced for richer groups.

[11] However, the increase in the wage income share for top income groups happens earlier than the surge of top earnings and income shares. Piketty and Saez (2003) conjecture that time-varying shifts in social norms may also have played a role, but this is not explored in this paper.



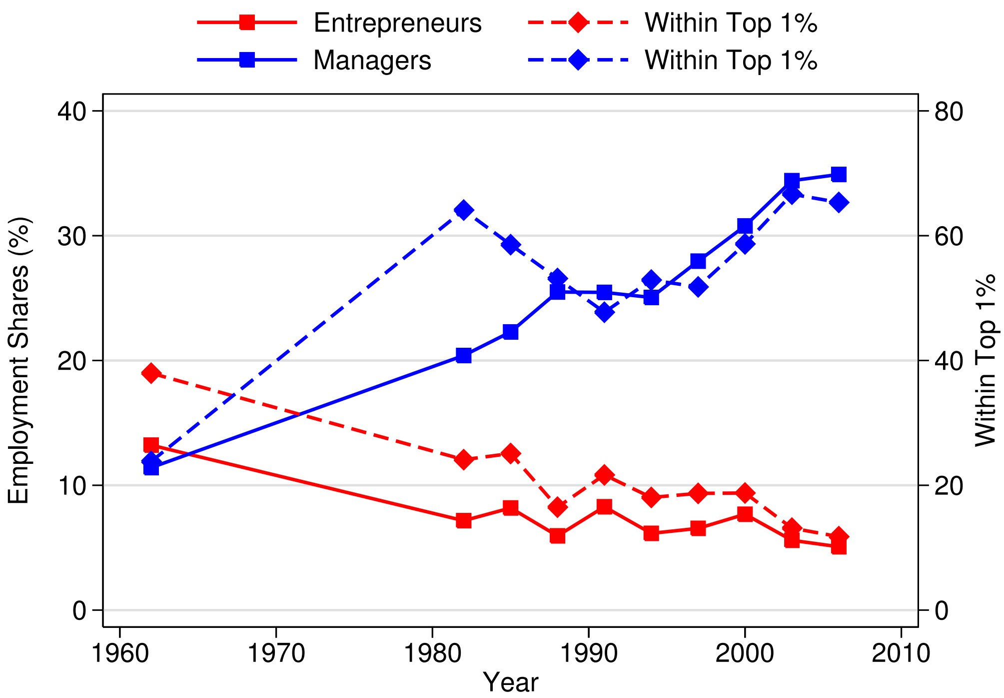
(a) Top 1% share of total and wage incomes



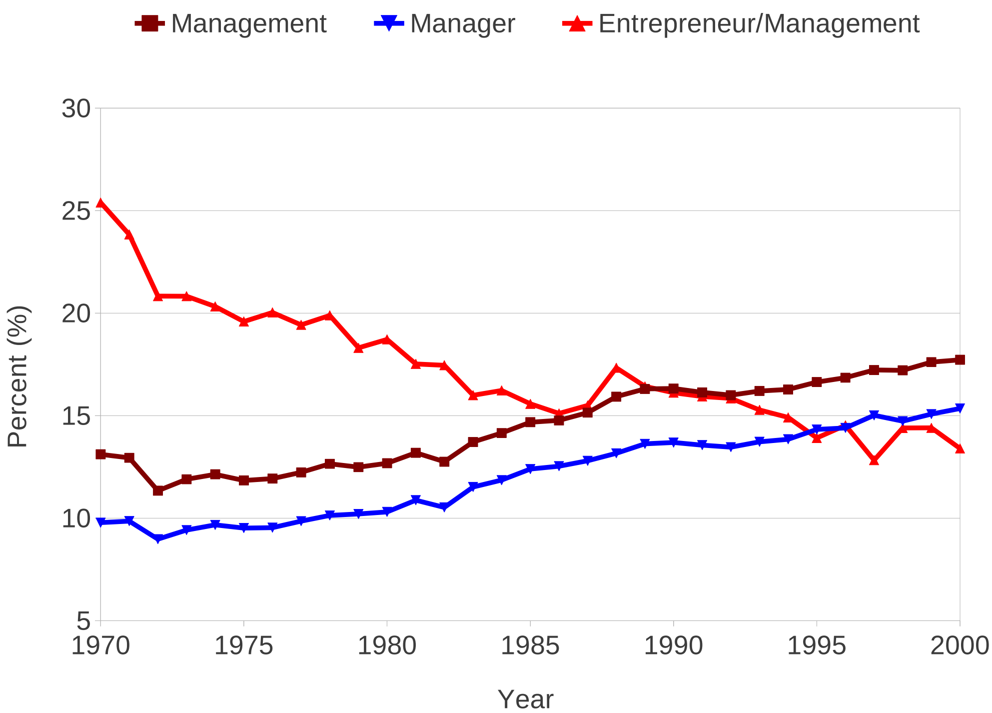
(b) Income sources of top (total) income percentile

Figure 2: Top percentile statistics, 1946-2007.

Replicated from Piketty and Saez (2003). Tax units are ordered by the size of their total or wage incomes, from which they compute how much the highest percentile earns as a fraction of the aggregate. So the top 1% tax units in Figure 2(a) for total and wage incomes are not the same. Figure 2(b) looks only at the top 1% tax units in terms of total income, and compute the shares of three sources of income. For all computations, capital gains are excluded.



(a) SCF 1983-2007



(b) CPS 1970-2000

Figure 3: Entrepreneur-Manager occupation shares

SCFF/SCF (triennial) and IPUMS CPS March (annual). For the SCF, within top income percentile shares are plotted together. For the CPS, the fraction of entrepreneurs among households involved in management is plotted together. Whenever possible, entrepreneurs are defined as self-employed business owners, and managers are defined by 1950 or 1990 Census occupation codes. The SCF does not contain detailed information on occupations, while CPS incomes are top-coded and lack business ownership information. See text for more details.

Recent trends suggest that many of them are managers. Figure 3(a) also plots the employment shares of managers and professionals in the SCF. It is clear that their shares have risen, and even more so at the top. Taken together, this leads to a sharp decline in the relative share of entrepreneurs compared to managers, and more so at the top, as shown in Appendix Figure A1(b). However, because the publicly released version of the SCF lumps managers with professionals, we cannot know for sure if it was managers who crowded out the entrepreneurs.

For additional evidence, I also investigate entrepreneur and manager shares in the Current Population Survey March supplement.[12] In addition to lacking information on business ownership and capital income, the CPS top-codes the various sources of income data they collect, so we can only check aggregate shares. In the CPS, I define entrepreneurs as any self-employed who reports business income, and managers as "Managers, Officials, and Proprietors" under the 1950 Census occupational coding convention (`occ1950` codes 200-290) or "Executive, Administrative, and Managerial Occupations" under the 1990 convention (`occ1990` codes 003-037).

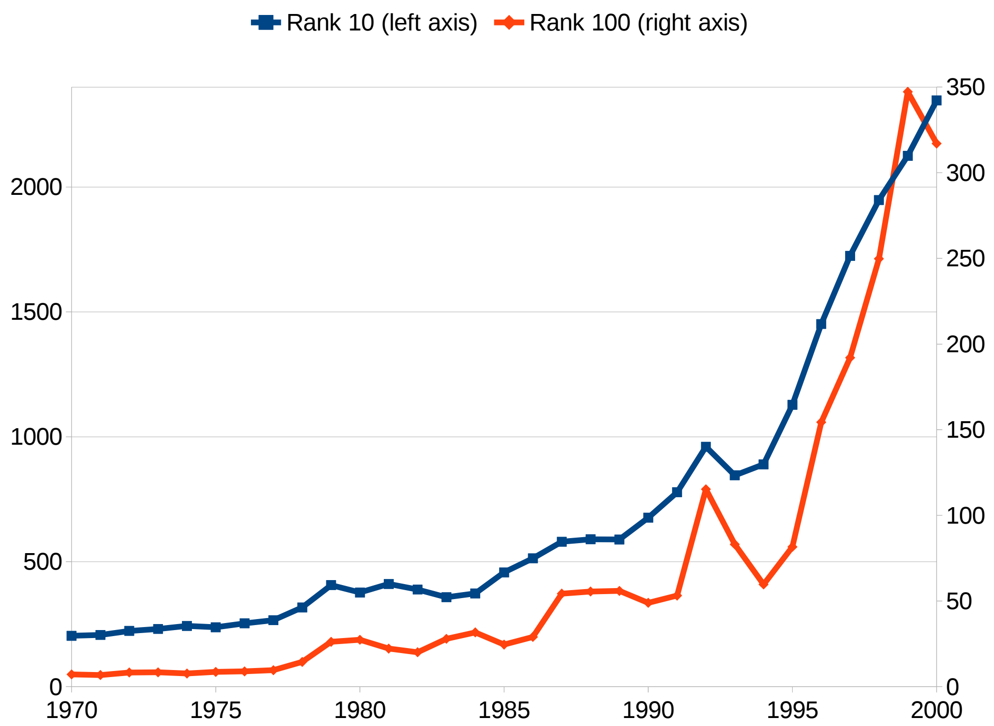
In Figure 3(b), I first compute the fraction of households involved in management, defined as a household member being categorized as either an entrepreneur or manager. This share increases from 13% in 1970 to 18% in 2000. Then I plot the share of households who are *not* entrepreneurs according to Cagetti and De Nardi (2006)'s definition (self-employed and report business income). As expected, manager shares are lower in the CPS than in the SCF, since we have more information on occupation codes. The fraction of entrepreneurs is relatively stable throughout this time span at approximately 2.5%.[13] The rising trend of managers and relative decline of entrepreneurs in management is clear: The fraction of entrepreneurs in management declines from 25% to 15%.[14]

Who are these managers? In my model, a manager is an individual who runs a company on owners' behalf, with no direct liability. Accordingly, the top managers in my model correspond to CEOs of large corporations. Gabaix and Landier (2008) report that CEO compensation has increased nearly 6-fold since the 1980s, which coincided with a 6-fold increase in market capitalization. The magnitude of its increase is large enough to posit that executives of large corporations are now sitting at the top of the earnings distribution, consequently crowding out self-run business owners from the top of income distribution as well. Figure 4(b) plots the corresponding production side of the economy: the size of the corporate sector,

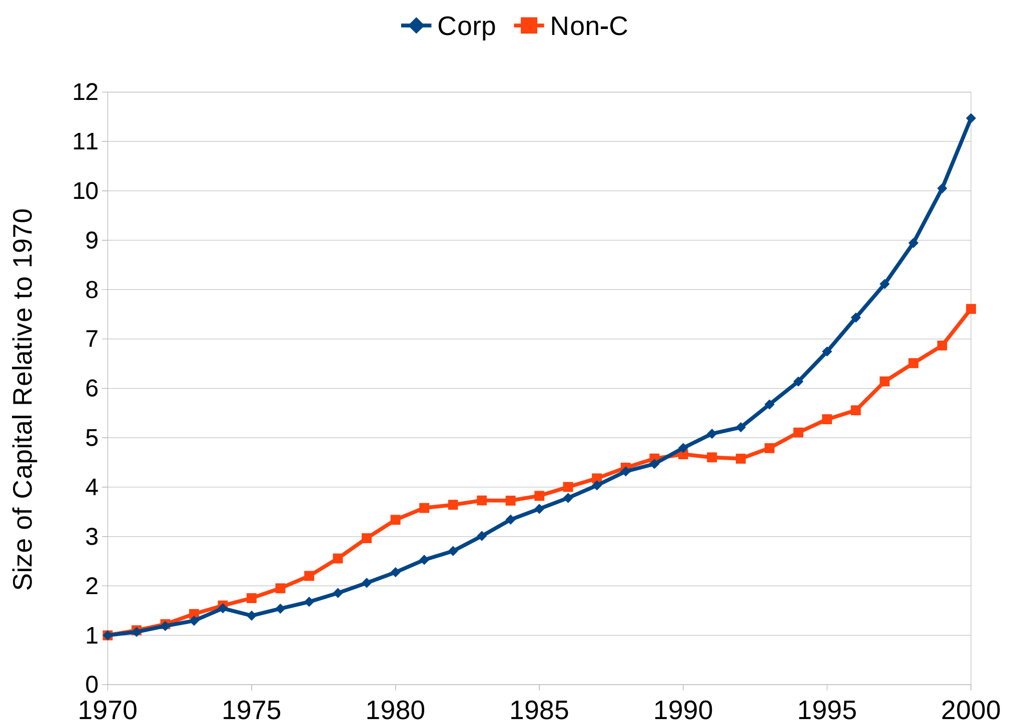
[12] King, Ruggles, Alexander, Flood, Genadek, Schroeder, Trampe, and Vick (2010).

[13] This number is small compared to the SCF likely because the CPS business income data is noisy.

[14] The census, which is also top-coded, shows similar trends: Appendix A.1. There, I also check that the qualitative trends are robust to various different definitions of a manager, and exploit its size to work around top-code issues.



(a) Executive compensation / Average wage



(b) Corporate vs. noncorporate capital

Figure 4: Managers and Corporate Sector

Average annual wages are computed from NIPA. In panel (a), executive compensation is either the top 10 (left axis) or 100 (right axis) rank CEO pay from the Forbes survey. In panel (b), capital in each sector is normalized to 1 in 1970, at which time corporate businesses held approximately 47% of the the total, which grew to 67% in 2000.

both in absolute terms and relative to the size of the noncorporate sector, also rose during the same time period.[15]

2.3 Tax Progressivity

Federal top marginal statutory tax rates (both personal and corporate) dropped dramatically in the 1980s, as shown in Figure 5(a).[16] Effective tax rates (the fraction of income paid as taxes) have also become less progressive. Piketty and Saez (2007) show that the effective tax rate of the top 0.01 percentile richest households closely tracks top statutory rates, replicated in Figure 5(a). The effective tax rate for the top income percentile fell from 47.2% to 38.6%; in contrast, the effective rate for all households rose from 23.3% to 27.4%. Overall, they find that policy changes mainly affected the amount and type of taxes paid by the top income percentile or above, with relatively small changes among the rest. Interestingly, while the effective tax rate fell for the top income percentile, their share of tax revenues paid increased from 18.4% to 27.7% (Figure 5(b)), consistent with the huge increase in their share of aggregate income.

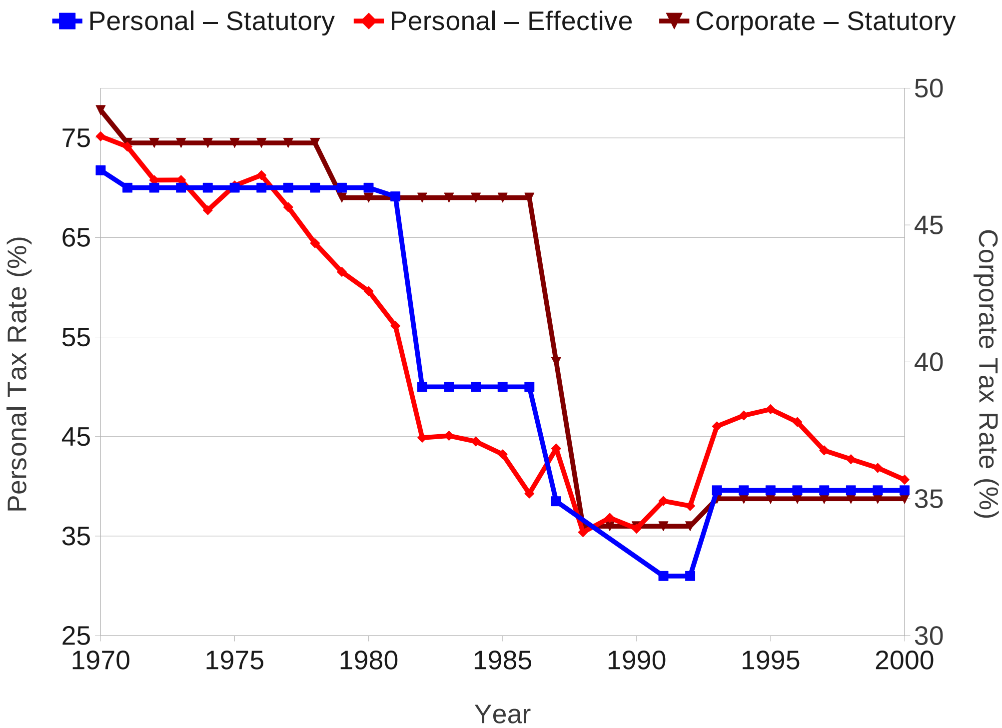
In addition to the behavioral responses coming from tax reporting, there are other indirect ways through which high incomes, in particular top executive compensation, can be affected by the tax code. When income taxes are progressive, not only does the manager occupation become less desirable for individuals (manager supply), but also for the firm (demand). This is because high marginal income tax rates require huge pretax compensations that firms may simply not be able to meet with salary and stock grants (Frydman and Saks, 2005). In contrast, lower personal income taxes for high income brackets enable firms to pay out higher after-tax salaries.[17] This kind of equilibrium response of managerial compensation is exactly what my model intends to capture.

In summary, this section has established that

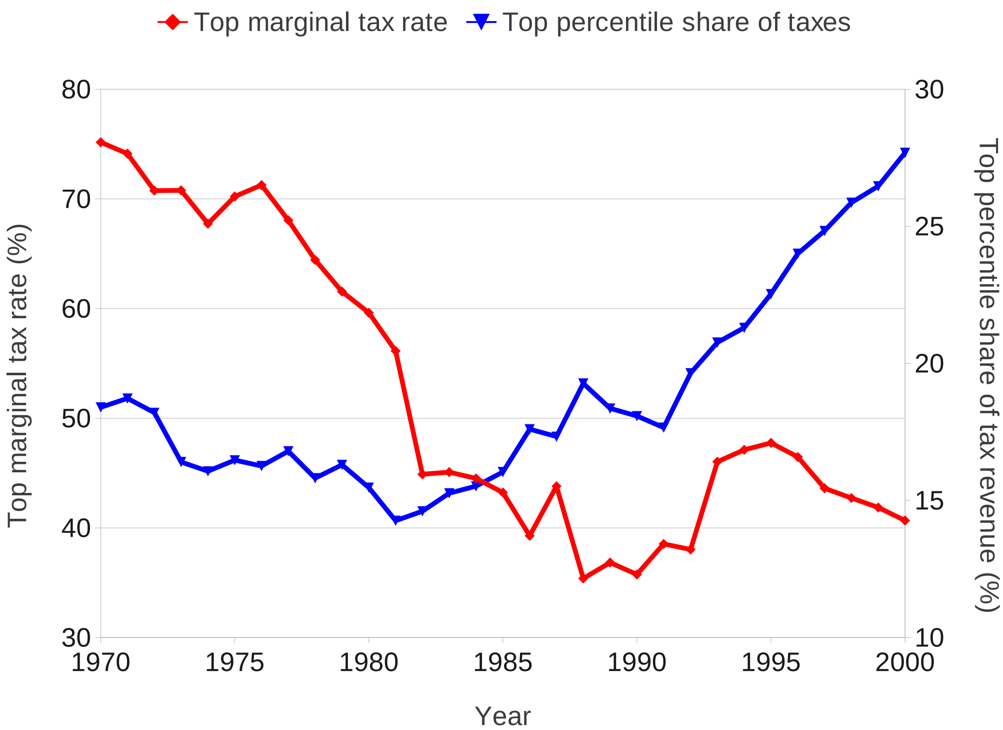
[15]The size of sectors is based on the Federal Flow of Funds accounts, from which I compute the size of capital held by non-financial corporate and noncorporate business. Financial businesses are excluded since they play a special role in recent years, and also to show that the growth of the corporate sector was not solely due to the emergence of large financial companies. To construct these series, I follow Quadrini (2000)'s approximation of productive capital and include plant and equipment, inventories, land at market value and residential structures. Refer to Appendix A.2 for more details.

[16]While ignored in my quantitative analysis, the decline top corporate tax rates will mainly affect individuals with a large number of shares and top level management compensated in stock. So while it may potentially play a large role in explaining the evolution of top income and wealth shares, it would reinforce my mechanism of generating more managers in equilibrium.

[17]Lower corporate income taxes and favored tax treatment for capital gains can also indirectly affect executive compensation. These allow the firm to compensate the manager in the form of stock options or other forms of compensation that are less heavily taxed. Accordingly, Frydman and Saks (2010) find that option grants have been on a steady rise since the 1950s.



(a) Top marginal tax rates



(b) Top tax rate and top percentile share of taxes paid

Figure 5: Top Taxation

In panel (a), personal effective top marginal tax rates are measured as the effective tax rates of the top .01 percentile richest households, computed in Piketty and Saez (2007). Other series are publicly available from the IRS. In panel (b), personal effective top marginal tax rates are plotted against the share of total tax revenues paid by the top income percentile, also in Piketty and Saez (2007).

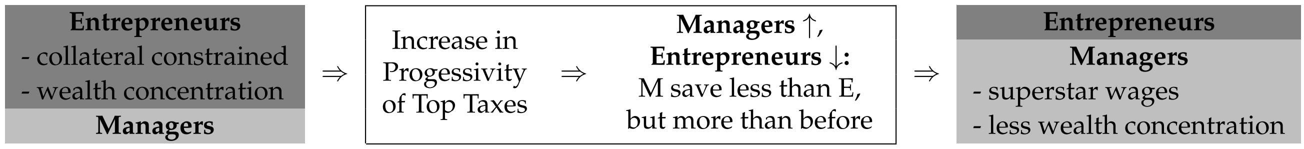


Figure 6: Mechanism of the model

An exogenous change that induces the top income group to be composed by more managers as opposed to entrepreneurs will deliver the observed empirical shifts in the distribution. In the box, M stands for managers and E for entrepreneurs.

1. wage and income concentration have rose dramatically but was not accompanied by a corresponding increase in wealth concentration;
2. there has been a relative rise of managers compared to entrepreneurs both in aggregate and at the top, concurrently with an explosion of top manager compensation;
3. taxation in the U.S. has become much less progressive taxation, even as high income groups pay a larger share of total tax revenue.

In my quantitative exploration, I show that less progressive taxation raise both the supply and demand of managers, consequently driving up both the equilibrium mass of managers and their compensation. In contrast, changing other parameters that govern the manager market increases the mass of managers, but reduces their compensation in equilibrium. Figure 6 depicts how the model connects the above facts.

3. Model

To model both entrepreneurs and managers, I embed a market that assigns projects to managers into a model similar to Buera and Shin (2013) in which entrepreneurs face collateral constraints. I assume this market is competitive, so that managerial compensation is increasing in talent.

3.1 Environment

Time is discrete and there is a unit mass of individuals who live forever. Individuals enter each period t with the state vector $x = (q, m, \epsilon, a)$,[18] which denotes projects, managerial ability, labor productivity, and assets. Projects are drawn from a binary set $q \in \{0, 1\}$ according to a Markov transition matrix Ω with associated stationary distribution G. If an individual's $q = 1$, she owns a project: Specifically, she has access to an economy-wide technology specified below. The project can be implemented, sold or simply discarded. If $q = 0$ she has no

[18]For most of the analysis I assume that the economy is in a steady state, so ignore aggregate states.

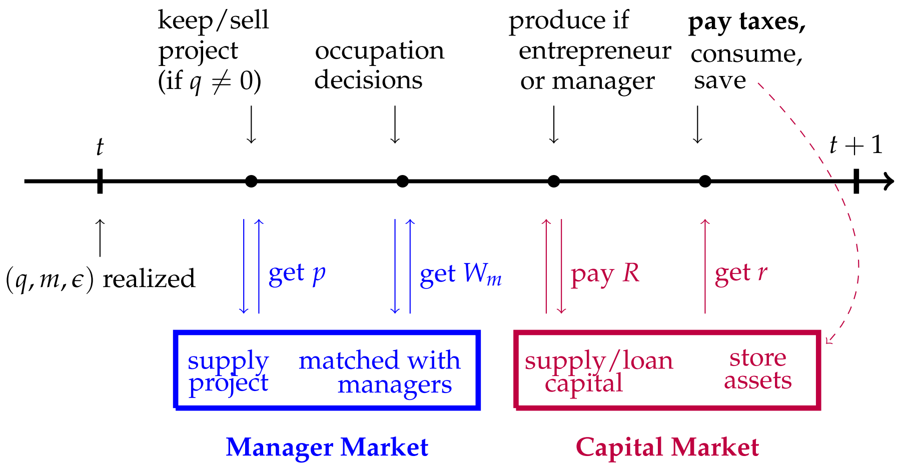


Figure 7: Manager and Capital Markets

In any given period t, all prices and decisions are determined simultaneously in equilibrium. The other side of both markets are competitive intermediaries.

project so cannot access the technology on her own. In a steady state, there is a mass $g(1)$ of projects at any point in time.

Managerial ability shocks are also Markov. If today's managerial ability shock is m, the probability that tomorrow's ability $m' = m$ is χ. Otherwise, m' is newly drawn from a distribution F_m with non-negative, finite support. Idiosyncratic labor productivity ϵ determines wage workers' wages, and is independent of the project and manager shock. As is standard in Bewley models, I assume ϵ follows a discrete Markov chain with transition matrix Γ. Assume that the multivariate Markov process over (q, m, ϵ) is such that a stationary distribution is well-defined. The only endogenous state is a, individuals' asset holdings.

Projects are rival and fully depreciate within a period: That is, once an individual sells her project she cannot implement it on her own, and regardless of ownership, it is gone at the end of the period. Whenever the project is implemented, I call this a "firm." Projects can only be sold to intermediaries at a competitive price, which the project owners take as given.[19] If an individuals with $q = 1$ does not sell her project, and instead keeps and implements it, I call her an *entrepreneur*. If she sells or discards it, she chooses between becoming a *manager* or *worker*.[20] Those with $q = 0$ choose between becoming a manager or worker as well. Managers are hired in a market where the employers are the new owners of the projects (i.e., the intermediaries). I call a firm run by a manager a *corporate* firm, and those run by an entrepreneur a noncorporate.[21]

[19] To be precise, this means I do not model individual project transfers, during which information or bargaining problems may arise between buyers and sellers. I also assume all states are publicly observable.

[20] Depending on parameter values, we may have an equilibrium in which projects are in over-supply.

[21] In reality some corporate firms are run privately. To account for this, the calibration takes a conservative estimate for the size of the corporate sector. If an individual in the model sells her project but chooses to become a manager, she can be viewed as an entrepreneur who has gone public.

After all occupation choices are made, entrepreneurs and managers make their production decisions, and all individuals generate occupation- and state-dependent incomes. These incomes are subject to taxes, which is the only role of the government in my model.[22] Individuals then make consumption and savings decisions with their after-tax incomes. The sequence of events is depicted in Figure 7.

Preferences and technology Preferences are standard: given a state contingent consumption plan $c^t = \{c_t, c_{t+1}, \dots\}$, expected utility at time t is

$$U(c^t) = \mathbb{E}_t \left[\sum_{s=t}^{\infty} \beta^{t-s} u(c_s(x^s)) \right]$$

where $u(\cdot)$ is period utility, β the discount factor, and the expectation is taken over future realizations of $\{x^s\}_{s=t}^{\infty}$.

There is a single economy-wide technology only accessible by owners of projects, i.e., individuals with $q = 1$ who have not sold their project or those who purchased a project. Production requires a project, a manager, capital, and labor. The manager makes all production decisions subject to the production function $f(\tilde{m}, k, l) = \tilde{m}^{\theta} k^{\alpha} l^{\nu}$, where $\tilde{m}$ is the effective ability of the individual implementing the project, and the technology displays decreasing returns, i.e. $\alpha + \nu < 1$. Without loss of generality, assume $\theta = 1 - \alpha - \nu$.[23]

If the manager is also the owner of the project she is an entrepreneur; otherwise she is a manager. For entrepreneurs, $\tilde{m} = m$, while for managers, $\tilde{m} = (1 - \kappa)m$. The parameter $\kappa \in [0, 1)$ captures an advantage entrepreneurs have over managers: All else equal, the original owner of a project is better at implementing her project. This is a reduced-form representation of agency costs and/or the cost of bargaining that arises when assigning projects to managers (Silveira and Wright, 2010).

Since I later incorporate collateral constraints, it is useful to define the indirect profit function and factor decisions without collateral constraints. These are

$$\pi^*(\tilde{m}) = \max_{k,l} \left\{ \tilde{m}^{\theta} k^{\alpha} l^{\nu} - Rk - wl \right\} = \tilde{m} \cdot z(R, w),$$
$$Rk^*(\tilde{m}) = (\alpha/\theta) \cdot \tilde{m} \cdot z(R, w), \quad wl^*(\tilde{m}) = (\nu/\theta) \cdot \tilde{m} \cdot z(R, w),$$

where R is the equilibrium rate of return on capital, w the wage rate, and

$$z(R, w) \equiv \theta \left[(\alpha/R)^{\alpha} (\nu/w)^{\nu} \right]^{1/\theta}.$$

[22]I.e., all tax revenues are thrown in the ocean.
[23]If this does not hold, we could simply redefine managerial ability units.

Manager and Capital Markets Since markets are competitive, we can assume that any arbitrary number of intermediaries behave as a single representative entity. This representative intermediary buys projects from individuals at a competitive price p. Managers are hired at a competitive compensation schedule $W(m)$ to implement the purchased projects.

Individuals can save (but not borrow) at the risk-free rate r. Aggregate savings are used as funds to supply capital for production (both entrepreneurial and managerial), so assuming a depreciation rate of δ, the rental rate of capital is $R = r + \delta$. Most importantly, I assume that managers are not subject to any constraints (beyond the agency cost κ), which can be justified by viewing the capital market being intermediated by the same representative intermediary in the manager/project market: Managers produce on behalf of the intermediary, who holds all the capital.

Entrepreneurs can use only their own assets or make within-period loans from the intermediary for production. Specifically, capital loans are subject to a collateral constraint $k \leq \lambda a$, meaning that she can loan up to λ times of her own assets. If $\lambda = 0$ entrepreneurial production is impossible, if $\lambda = 1$ the entrepreneur can only use her own funds to implement her project, and if $\lambda = \infty$ she is unconstrained.[24] This type of constraint has been used widely in the literature (Kiyotaki and Moore, 1997; Buera and Shin, 2013). Thus, the main differences between an entrepreneur and manager are that the former assumes full liability over the firm subject to a constraint, while managers face no liability but lose a fraction of revenue (due to agency costs) and split profits with the intermediary.

Since a constrained entrepreneur will always rent up to her limit, her indirect profits and factor decisions are

$$\begin{aligned}
\pi_c(m,a) &= (1-\nu) m^{\frac{\theta}{1-\nu}} (\lambda a)^{\frac{\alpha}{1-\nu}} (\nu/w)^{\frac{\nu}{1-\nu}} - R\lambda a \\
l_c(m,a) &= m^{\frac{\theta}{1-\nu}} (\lambda a)^{\frac{\alpha}{1-\nu}} (\nu/w)^{\frac{1}{1-\nu}} .
\end{aligned}$$

Hence the profits and factor decisions of an arbitrary entrepreneur can be written as

$$\{\pi(m,a), k(m,a), l(m,a)\} = \begin{cases} \{\pi^*(m), k^*(m), l^*(m)\} & \text{if} \quad \lambda a \geq k^*(m) \\ \{\pi_c(m,a), \lambda a, l_c(m,a)\} & \text{if} \quad \lambda a < k^*(m). \end{cases}$$

Since the manager market is competitive and there is only one type of project, the price of a project p must equal the returns from buying any project, d. The role of the intermediary will be discussed in more detail along with the manager market in Section 3.2.

[24] This is typically motivated by limited enforceability of lending contracts, which I assume to be exogenous. I refrain from assuming an endogenous debt limit as in Cagetti and De Nardi (2006); Buera, Kaboski, and Shin (2011) as my main focus is the contrast between entrepreneurs and managers, not the collateral constraint. Endogenous debt limits would increase computational costs without adding much insight.

Income Sources and Taxation Individuals make occupation-consumption-savings decisions. Those with $q = 1$ must also decide whether to sell, keep or discard their projects. If an individual sells her project, she earns p. Denote the individual's occupation decision as $o \in \mathcal{O} = \{o_e, o_m, o_w\}$, which denotes the choice of becoming a entrepreneur, manager or worker, respectively. Obviously, only individuals with $q = 1$ can choose $o = o_e$.

The individuals' occupational choices determine their current period pretax income $\tilde{\tilde{\phi}}(o; x)$, which is occupation and state dependent. This is determined endogenously not only by the individual's occupation decision but also by μ, the distribution over individual states. More precisely,

$$\tilde{\tilde{\phi}}(o; q = 0, m, \epsilon, a) = \begin{cases} w\epsilon + ra & \text{if} \quad o = o_w, \\ W(m) + ra & \text{if} \quad o = o_m, \end{cases}$$

$$\tilde{\tilde{\phi}}(o; q = 1, m, \epsilon, a) = \begin{cases} w\epsilon + p + ra & \text{if} \quad o = o_w, \\ W(m) + p + ra & \text{if} \quad o = o_m, \\ \pi(m, a) + ra & \text{if} \quad o = o_e. \end{cases}$$

These incomes are subject to taxes and transformed into after-tax incomes that are occupation- and project-dependent. To model taxes, we first need to define the model counterparts to different sources of incomes in the data. To be consistent with the categorization of incomes in Section 2, I divide income in the model into four categories: capital, wage, business income, and capital gains. The only capital income in the model is the interest income earned through savings, ra, and clearly $[w\epsilon, W(m)]$ are wage incomes. Now we need to define how entrepreneurs report their income $\pi(m, a)$, what source of income the project proceeds p corresponds to, and how different income sources are deducted.

To facilitate characterization of the manager market, I make a few assumptions on income-reporting and deduction behavior for the quantitative exercise. First, I assume that all progressivity falls on earnings according to an after-tax earnings schedule $T(\cdot)$ that is strictly increasing; and that capital income (ra) and capital gains (including project sales) are taxed at the flat rates of (τ_k, τ_g), respectively.

Second, in reality, entrepreneurs face the same tax schedule as workers on much of their business income. To capture this, even if an individual chooses to become an entrepreneur, I assume she reports the wage she would have earned as a worker or manager as wage income.[25] This forces entrepreneurs to face the same progressive schedule $T(\cdot)$ on her earnings, regardless of whether she becomes an entrepreneur or not.

[25]Most high-income individuals who file self-proprietors' Schedule C returns also have wage income, reported on an employee's W-2 and recorded in their Schedule A returns.

Third, because it is hard to find an empirical counterpart for the project proceeds p, I assume it is reported as capital gains. This is the return from having been lucky enough to have a project, which could be interpreted as the returns to an "idea." Moreover, it is excluded when computing income shares which are based on pretax incomes excluding capital gains following the empirical work of Piketty and Saez (2003).

Lastly, I assume some leverage in tax-reporting for entrepreneurs. A portion ψ of the remainder of her income (sans earnings), if any, is reported as capital gains and taxed at a rate of τ_g, and $1-\psi$ is reported as business income and taxed at a rate of τ_b. To this end, I define a business income function $B(x)$:[26]

$$B(x) = q \cdot \max\left\{0, \pi(m,a) - \max\{w\epsilon, W(m)\}\right\},$$

so $B(x) = 0$ if $q = 0$. Then, after-tax incomes can be written as

$$\tilde{\phi}(o;x) = T\left(\max\{w\epsilon, W(m)\}\right) + (1-\tau_k)ra + \begin{cases} (1-\tau_g)pq & \text{if } o \neq o_e \\ (1-\tau_\psi)B(x) & \text{if } o = o_e. \end{cases} \tag{1}$$

where $\tau_\psi = \psi\tau_g + (1-\psi)\tau_b$ is the effective tax rate on business income.[27] The after-tax income function (1) implies that at the individual level, progressivity does not affect the occupational choice, only $B(x)$. While this particular form is chosen mainly for analytical and quantitative convenience, in Appendix B I document that since the 1970s,

1. effective capital income taxation has become more progressive, and effective capital gains taxation has increased
2. taxable income as a fraction of gross income has increased, especially at the top
3. itemized deductions have declined at the top
4. business and capital income related deductions have declined

Facts 1. and 2. suggest that the rich take advantage of the many deductions available in the tax code for capital and business incomes, but have done less so as federal income taxes became less progressive. Facts 3. and 4. confirm that such behavior is indeed reflected in itemized deductions. I also argue In the appendix that the flat tax rate assumptions on capital income, capital gains and business income, (τ_k, τ_g, τ_b), are not so extreme since the very rich can deduct these incomes when tax conditions are less favorable, side-stepping the progressive schedule.[28]

[26] Recall that $x = (q, m, \epsilon, a)$ is the individual state. In the calibration, the parameter ψ is exogenously set to the empirical ratio of capital gains and business income of the top income percentile.

[27] The conceptual mapping to the real world is that Schedule C income includes business-related deductions.

[28] I also abstract from modeling the decline in the progressivity of corporate income taxation (Figure 5(a)).

3.2 Manager Market

Since projects completely depreciate after one period, we can analyze the manager market separately from the agents' dynamic decisions. In other words, given (r, w), the manager market is static and all dynamics are determined by the agents' savings decisions, as in standard Bewley models.Then since occupation decisions depend only on the current state, after-tax income within-period is

$$\phi(x) = \max_{o \in \{o_w, o_m, o_e\}} \tilde{\phi}(o; x).$$

I now explain the occupation decisions which determine $\phi(x)$, which are determined in the manager market.

In the manager market, individuals and the intermediary take $[p, W(m)]$ as given. Project owners decide whether or not to sell, and all individuals make their occupation choice. The intermediary purchases projects from the owners, and hire managers to run them. So the manager market is in fact an agglomeration of two markets: a project exchange market and a manager hiring market. But since the intermediary will only purchase projects for which a manager will be hired, the demand for projects must equal the demand for managers, and the two markets will be linked by a single market clearing condition.

Let Q denote the mass of projects purchased by the intermediary; for market clearing then, the mass of managers hired $M = Q \geq> 0$ in equilibrium. Individuals sell their project only if $p \geq 0$; if $p = 0$ they are indifferent between selling and discarding. So there are two possible types of equilibria:[29]

$$p > 0 \quad : \text{no projects are discarded} \tag{2a}$$

$$p = 0 \quad : \text{a non-negative mass of projects are discarded.} \tag{2b}$$

Since all projects are identical, $p > 0$ in equilibrium implies that the demand for projects meets supply. If $p = 0$, individuals are indifferent between selling and discarding. Either case is possible depending on equilibrium managerial compensation.

Individuals who keep their project become entrepreneurs and do not participate in the manager market. So the pool of available managers is comprised of individuals who didn't

Since most large corporations face the top marginal tax rate, any effect that comes from a declining rate would be indistinguishable from a drop in κ in the model, which I allow to vary with time.

[29]When $p = 0$, it could also be interpreted as the transfer occurring, but the intermediary discarding the project. It does not matter who discards it as long as it is not being used in production.

have a project to begin with, or had one but sold it:

$$\int_{\{q=0\}\cup\{q=1,o\neq o_e\}} \mu(dx) \geq M.$$

Potential managers make the choice between becoming a manager or worker depending on their state (m, ϵ). Since the after-tax schedule $T(\cdot)$ is levied only on earnings and is strictly increasing, their occupation choice depends only on pretax earnings and nothing else. Perfect competition implies that the agents with the highest ability are hired as managers: For each level of labor efficiency ϵ, there is an ability threshold $\hat{m}_\epsilon$ such that $o = o_w$ if $m \leq \hat{m}_\epsilon$ and $o = o_m$ otherwise. At the threshold, it must be that $W(\hat{m}_\epsilon) = w\epsilon$.

Now let ϵ_1 denote the lowest possible realization of ϵ. If an individual with $\epsilon > \epsilon_1$ demands a higher compensation as a manager, the intermediary can always just hire an ϵ_1-individual with the same managerial ability level m instead. The ergodicity assumption ensures that such an individual always exists. Hence, the manager market is not segregated by ϵ and the threshold manager earns $w\epsilon_1$. All other managers earn returns proportional to their contributions (their marginal product), i.e.

$$W(m) = w\epsilon_1 + \int_{\hat{m}_{\epsilon_1}}^{m} \left[\frac{\partial \pi^*((1-\kappa)\tilde{m})}{\partial \tilde{m}}\right] d\tilde{m} = w\epsilon_1 + (1-\kappa)(m - \hat{m}_{\epsilon_1}) \cdot z(R, w). \tag{3}$$

The return the project generates for the intermediary, d, is determined at the threshold:

$$d = p = (1-\kappa)\hat{m}_{\epsilon_1} \cdot z(R, w) - w\epsilon_1. \tag{4}$$

All other thresholds—$\hat{m}_\epsilon$ s.t. $\epsilon \neq \epsilon_1$—are determined by

$$T\left(W(\hat{m}_\epsilon)\right) = T\left(w\epsilon\right) \quad \Rightarrow \quad \hat{m}_\epsilon = \hat{m}_{\epsilon_1} + \frac{w(\epsilon - \epsilon_1)}{(1-\kappa) \cdot z(R, w)}, \tag{5}$$

since the tax schedule $T(\cdot)$ is strictly increasing, and using (3). The remaining task is to determine the threshold $\hat{m}_{\epsilon_1}$. First, individuals implement their project, or equivalently $o = o_e$, if their after-tax income is higher:

$$(1-\tau_\psi) \cdot B(x) = (1-\tau_\psi) \cdot \max\left\{0, \pi(m, a) - \max\{w\epsilon, W(m)\}\right\} \geq (1-\tau_g)p. \tag{6}$$

This makes clear that the decision to become an entrepreneur does not hinge on the form of the after-tax function $T(\cdot)$, as long as it is increasing. In particular, whether a rich, high-ability individual becomes an entrepreneur or manager does not depend on the after-tax income generated by her occupational choice. I explain how a more progressive $T(\cdot)$ can still alter the occupation choice in the manager market *equilibrium* in Section 3.4.

Second, from equations (2) and (4) above, $(p, \hat{m}_\epsilon)$ must satisfy

$$\begin{aligned}
\text{if} \quad p > 0: \quad & (1-\kappa)\hat{m}_{\epsilon_1} \cdot z(R,w) = w\epsilon_1 + p \\
& \text{and} \quad g(1) - \int_{o=o_e} \mu(q=1, dm, d\epsilon, da) = \int_{o=o_m} \mu(dx) \\
\text{if} \quad p = 0: \quad & (1-\kappa)\hat{m}_{\epsilon_1} \cdot z(R,w) = w\epsilon_1 \\
& \text{and} \quad g(1) - \int_{o=o_e} \mu(q=1, dm, d\epsilon, da) \geq \int_{o=o_m} \mu(dx)
\end{aligned}$$

where $g(1)$ is the total mass of projects that is exogenously assumed. When $p = 0$, we are at a corner where individuals are indifferent between selling or discarding the project, and just enough projects are sold to clear the supply of managers.

The prices $[p, W(m)]$ and threshold $\hat{m}_{\epsilon_1}$ jointly determine the individuals' occupation decisions and hence current period after-tax income ϕ. When $p > 0$ the manager market clearing condition becomes

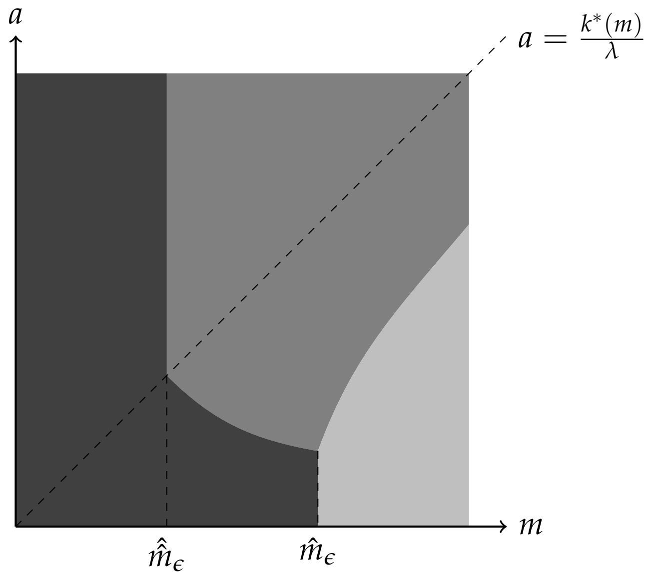
$$\int_{o=o_w} \mu(q=1, dm, d\epsilon, da) = \int_{\hat{m}_\epsilon} \mu(q=0, dm, d\epsilon, da), \tag{7}$$

i.e., the mass of $q = 1$ individuals who become workers must equal the mass of $q = 0$ individuals who become managers (since we can ignore those who sell their projects and subsequently become managers). Otherwise there is excess supply of projects and $p = 0$. The market clearing condition 7 is one of the most important components of the model.

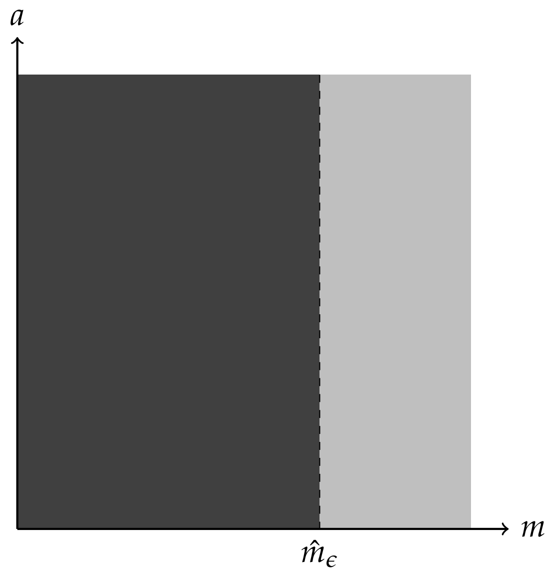
Individuals' occupation choices are depicted in Figure 8, for a given level of ϵ. Individuals whose states fall in the dark gray, light gray and gray regions choose $o = o_w$, o_m and o_e, respectively. Figure 8(b) is straightforward: individuals with $q = 0$ discard their project and become a worker if $m < \hat{m}_\epsilon$, and become a manager otherwise. Next refer to Figure 8(a). The lower threshold, $\underline{m}_\epsilon$, is the managerial ability threshold such that conditional on being unconstrained, an individual with $q = 1$ sells (discards) her project and becomes a worker:

$$(1-\tau_\psi) \cdot \left[\pi^*(\hat{\hat{m}}_\epsilon) - w\epsilon\right] = (1-\tau_g)p.$$

For $m \in [0, \underline{m}_\epsilon)$, all individuals sell (or discard) their projects and become workers regardless of their asset levels. For $m \in [\underline{m}_\epsilon, \hat{m}_\epsilon)$, the asset threshold is decreasing in m because holding the level of assets fixed, selling (or discarding) the project and becoming a worker gives a constant return while the returns from becoming an entrepreneur increase in m. But for $m \geq \hat{m}_\epsilon$, managerial compensation increases more than would profits for a constrained



(a) $q = 1$



(b) $q = 0$

Figure 8: Occupation decision thresholds

The figures depict thresholds for any given level of labor efficiency ϵ. Individuals in the light gray, gray, and dark gray regions choose to become managers, entrepreneurs, and workers, respectively. The manager market clears (in an interior) when the mass of individuals who fall in dark gray region in Figure 8(a) across all levels of ϵ equals the mass of individuals who fall in the light gray region in Figure 8(b).

entrepreneur. Hence the threshold is increasing in m.[30]

The manager market clearing condition (7) means that the mass of individuals in the dark gray region of Figure 8(a) (across all values of ϵ) must equal the mass of individuals in the light gray region of Figure 8(b) (across all values of ϵ).[31] Individuals in the light gray region of Figure 8(a) sell their project (supply) and become managers (demand), so this mass becomes irrelevant for market clearing. We can now show:

Proposition 1 *Given any (r, w) and a distribution μ over individual states x,*

1. *As long as $\kappa \in [0, 1)$, managers exist in any equilibrium.*
2. *Occupation decisions are such that*

$$o(q = 0, m, \epsilon, a) = \begin{cases} o_w & \text{if } m \leq \hat{m}_\epsilon, \\ o_m & \text{if } m > \hat{m}_\epsilon, \end{cases}$$

$$o(q = 1, m, \epsilon, a) = \begin{cases} o_w & \text{if } m \leq \hat{m}_\epsilon, \ (1 - \tau_\psi) \cdot [\pi(m, a) - w\epsilon] \leq (1 - \tau_g)p, & \text{(8a)} \\ o_m & \text{if } m > \hat{m}_\epsilon, \ (1 - \tau_\psi) \cdot [\pi(m, a) - W(m)] \leq (1 - \tau_g)p, & \text{(8b)} \\ o_e & \text{otherwise}, & \text{(8c)} \end{cases}$$

where $\tau_\psi = \psi\tau_g + (1 - \psi)\tau_b$.

[30] The curvature of the asset thresholds depend on parameter values.
[31] This does not mean that the areas depicted in the figures must be equal.

Proof: See Appendix C. $\square$

If $\kappa \geq 1$, there are no managers in equilibrium and we revert to the case of standard entrepreneurial models: individuals become entrepreneurs if business profits are high enough, or discard their project and become wage workers otherwise.

The critical components of the model are the collateral constraint and the manager market. Since output increases in managerial ability, when $\kappa = 0$ the unconstrained planner's solution has the best managers running all the projects regardless of ownership, thus the manager market is efficient. In a similar vein, even when $\kappa > 0$ the economy is more efficient than one with collateral-constrained entrepreneurs but no manager market. Hence in terms of efficiency, my model falls in between the unconstrained planner's solution and previous entrepreneurial models.

3.3 Stationary Recursive Equilibrium

Individuals learn their individual state x at the beginning of each period. In the stationary distribution, the only source of uncertainty comes from next period's idiosyncratic states (q', m', ϵ'). Given the price vector $P = \{R, r, w, p, W(m)\}$, the problem of an individual with state $x = (q, m, \epsilon, a)$ can be written recursively as

$$
\begin{aligned}
&V(x) = \max_{a'} \left\{ u(c) + \beta \mathbb{E}\left[V(x') | q, m, \epsilon \right] \right\} \quad \text{s.t.} \quad c + a' = \phi(x) + a, \quad \text{where} \\
&\mathbb{E}\left[V(x') | q, m, \epsilon \right] \\
=& \sum_{q'} \Omega(q, q') \cdot \Gamma(\epsilon, \epsilon') \cdot \left[\chi V(q', m, \epsilon', a') + (1 - \chi) \int_{m'} V(q', m', \epsilon', a') F_m(dm') \right].
\end{aligned}
$$

That is, once we know $\phi(x)$, which determines a stochastic income process, the model collapses to a standard incomplete markets model. So we can define a *stationary recursive competitive equilibrium (RCE)* as follows:

Definition 1 *A stationary RCE is a price vector $P = \{R, r, w, p, d, W(m)\}$, production decisions $\{k(x), l(x)\}$, occupational choices and associated incomes $\{o(x), \phi(x)\}$, individual policies $\{c(x), a'(x)\}$, and a distribution $\mu(\cdot)$ s.t.*

1. *given P, the production decisions, choices and policies solve the individual's problem,*
2. *intermediaries earn zero profit,*
3. *the manager market clears, i.e. (7) holds and $p \geq 0$.*

4. *capital and labor markets clear:*

$$\int a(x)\mu(dx) = \int_{o\in\{o_m,o_e\}} k(x)\mu(dx), \qquad \int_{o=o_w} \epsilon\mu(dx) = \int_{o\in\{o_m,o_e\}} l(x)\mu(dx),$$

   and the goods market clears by Walras' Law, and

5. *μ is a fixed point of $\mathcal{H}$, the aggregate law of motion induced by $[\Omega, F_m, \Gamma]$ and the individuals' decisions; i.e. $\mu = \mathcal{H}(\mu)$.*

By virtue of Proposition 1, a stationary RCE exists under the standard assumptions with slight modifications, regardless of whether managers exist in equilibrium:

PROPOSITION 2 *If $u(\cdot)$ is CRRA, a stationary RCE exists.*

Proof: See Appendix C. □

Given that an equilibrium exists, I use numerical techniques to compute it and conduct quantitative policy experiments.Section 4 summarizes the numerical strategy and Section 5 discusses the results. Importantly, Section 5.3 visualizes how occupational choices in the manager market affect dynamic saving decisions in equilibrium. Before turning to the numerical analysis though, I discuss the equilibrium response in the manager market to a change in tax progressivity.

3.4 Manager Market Response to Tax Policies

If there is only a small mass of corporate firms, managerial compensation is small (relative to the competitive wage) regardless of firm size. Only when there is a large mass of corporate firms can we see large levels of compensation. This is particularly important when individuals with $q = 1$ and $m > \hat{m}_\epsilon$ make their decision between becoming an entrepreneur or manager. Notice from Proposition 1.2 that it is not the case that this decision directly depends on the progressivity of the earnings tax schedule—between the choice of becoming an entrepreneur or something else, earnings are the same and taxed equally progressively. It is only when managerial compensation $W(m)$ becomes higher *in equilibrium* that a top entrepreneur may switch occupations. Hence, either there needs to be more managers (so top managers earn more by competitive assignment), and/or the demand for managers must be high (pushing up manager wages overall). So the most important role of progressive taxation in terms of top occupations is whether it increases *pretax* managerial compensation, not that it affects *after-tax* earnings.

To see this, first consider how the individual decision between becoming a worker or manager may shift in response to less progressive taxation (a change in the tax function from

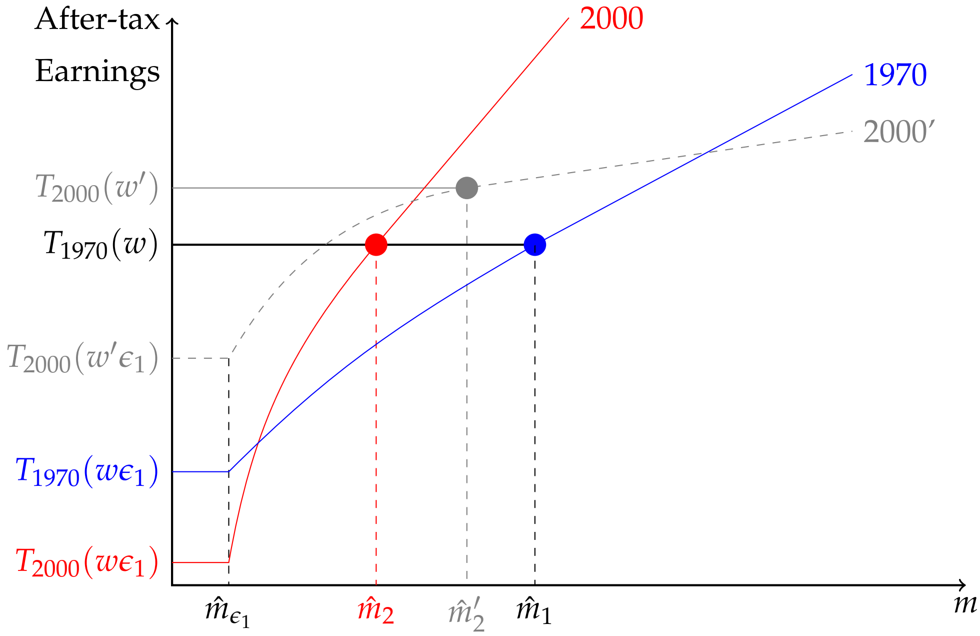


Figure 9: After-tax earnings and managerial choice.

The 1970 line depicts after-tax earnings with progressive taxation. With less progressive taxation, depicted by the 2000 line, the compensation schedule tilts so that median tax payers without a project switch to becoming managers rather than workers ($\hat{m}_1 \to \hat{m}_2$). The increased supply of managers increases the pretax compensation earned by the top manager relative to the competitive wage, also inducing top entrepreneurs to switch, pushing up the supply of projects (or demand of managers) in equilibrium. These effects push even more individuals to become managers. The final outcome depends on relative changes.

T_{1970} to T_{2000}). This is depicted in Figure 9. The line labeled 1970 depicts an individual's *after-tax* earnings as a function of managerial ability in 1970. Assume that changes in progressive taxation do not affect the tax rate paid by the median taxpayer, which in the quantitative model are those wage workers with $\epsilon = 1$.[32] The ability thresholds for individuals with ϵ_1 and $\epsilon = 1$ are initially at $\hat{m}_{\epsilon_1}$ and $\hat{m}_1$, respectively. A decline in tax progressivity that does not affect the median tilts after-tax earnings so that those below the median earn less, and those above earn more, than before the change. This is depicted by the solid line labeled 2000. So now, the median taxpayer (with $\epsilon = 1$ and wage w) who was previously a worker would want to switch to becoming a manager; that is, their ability threshold shifts from $\hat{m}_1$ to $\hat{m}_2$. This is a consequence of equation (5), and since w is assumed to remain constant.

This increases the supply of managers, so according to (3), the *pretax* compensation for top managers also rises. But it also implies that the intermediary must buy more projects to hire such managers (project demand rises), which in turn must come from more projects sold. In particular, in (7), something must change to induce entrepreneurs to sell their projects and instead become workers on the left-hand side, which are to be implemented by the larger mass of managers on the right-hand side. But as we can see from (8a), such

[32]These workers earn the competitive wage w, and in the quantitative model I fix their effective tax rate even as I alter $T(\cdot)$, which is also consistent with the data.

entrepreneurs are not affected by the new tax code, and again w is assumed constant. Thus it must be that the price of projects rises in response to the rise in its demand.

If the slope of the compensation schedule remains unchanged, top entrepreneurs will also start selling their projects and become managers instead, as can be seen from (8b): the left-hand side of the manager-entrepreneur decision threshold drops while the right-hand side increases. However, since these entrepreneurs can be viewed as simply selling and buying their own project, it does not affect project prices (but they do contribute to pushing up managerial compensation).

But this depends on how much the drop in progressivity tilts the after-tax schedule, i.e., how much it shifts down the wages earned by the lowest wage income earner (who earns $w\epsilon_1$). This determines the change in the intercept of after-tax earnings as a function of m (the difference between $w\epsilon_1$ and $w'\epsilon_1$), which counters the rise in project prices through (2) and how much more steeper this function becomes (the difference between the slopes of the 1970 to 2000 lines). In particular, even if we assume no change in w, the intercept may not change but the slope will still be affected by the rental rate R in general equilibrium.[33]

In the standard span-of-control model, more managers means higher demand for workers, which pushes up the competitive wage in equilibrium. So we generally end up in a situation represented by the gray dashed 2000′ line instead of the solid 2000 line. In such a scenario top managerial compensation declines even as the population mass of managers rises ($\hat{m}_1 \to \hat{m}_2'$). Thus among top income groups, there will be less managers.[34]

However, in my model, the initial tilt in the compensation schedule induces entrepreneurs, not only workers, to become managers. Thus whether we remain close to the 2000 line in equilibrium, or shift toward the 2000′ gray line as in the standard model, depends on whether or not the new managers demand more workers than the old entrepreneurs, which becomes a quantitative question. Nonetheless, it should be emphasized that such a mechanism is only possible because there are two competing top occupations in my model.

4. Calibration

I first obtain benchmark model parameters by calibrating a stationary equilibrium to empirical moments from 1970. Some parameters are fixed according to information outside of the model, the rest are calibrated to corresponding empirical moments.

The main goal of the exercise is to see how close the model comes to the data in 2000

[33]Since more managers demand more capital inputs, R will generally rise.

[34]Theoretically, the threshold $\hat{m}_{\epsilon_1}$ will also shift; this is ignored for graphical simplicity.

when recalibrating the progressivity of the tax function T to 2000 tax moments. Keep in mind that all computations are based on pretax income, both in the data and in the model.

4.1 Parameterization

Preferences and Technology The utility function is standard CRRA:

$$u(c) = \frac{c^{1-\gamma}}{1-\gamma}.$$

Relative risk aversion is fixed at $\gamma = 2$. The discount factor β is calibrated to an equilibrium interest rate of 4% in 1970. The capital income share and depreciation rate are taken from conventional values in the literature and fixed at $\alpha = 0.30$ and $\delta = 0.06$, respectively.[35] This leaves ν as a parameter to calibrate from the model. The collateral constraint λ along with the friction parameter κ are critical parameters that affect the relative mass of entrepreneurs and, hence, the relative mass of managers in the high income groups; these are also calibrated from the model.

Exogenous Processes The q and m processes are assumed to be independent.[36] The Markov transition matrix for projects, Ω, gives us two parameters to calibrate:

$$\Omega = \begin{pmatrix} \omega_0 & 1-\omega_0 \\ 1-\omega_1 & \omega_1 \end{pmatrix}.$$

Managerial ability m dictates the size of firms in the model, which corresponds to an establishment in the data. As the empirical distribution of establishments is well approximated by a Pareto distribution, I assume that m is drawn from a "shifted" Pareto distribution with shape parameter $s = 1$ following Axtell (2001):[37]

$$F(m) = \frac{1-(1+m)^{-s}}{1-(1+\overline{m})^{-s}}$$

so that the lowest ability manager has zero productivity.[38]

My model focuses on the differentiation between entrepreneurs and managers, and par-

[35] These values are identical to those in Buera et al. (2011). In their model, factor shares are approximately equal to factor elasticities when capital markets are perfect and the equilibrium mass of entrepreneurs is small (their proposition 2). My model is slightly different, but nonetheless, the capital share is close to $\alpha = 0.30$ in the calibration.

[36] Assuming correlations of up to 0.5 did not have any visible effects.

[37] A value of $s = 1$ is not very different from Buera et al. (2011); Buera and Shin (2013) once we do the appropriate transformations of variables.

[38] I use a Gauss-Legendre quadrature with 10 grid points when computing the expectations.

Parameter	Value	Description
γ	2.00	Coefficient of Relative Risk Aversion
δ	0.06	capital depreciation rate, Buera et al. (2011)
α	0.30	capital income share of total output, Buera et al. (2011)
ρ	0.95	persistence of worker wages, Storesletten, Telmer, and Yaron (2004)
χ	0.89	CEO turnover rate 1990-2000, Murphy and Zabojnik (2007)
s	1.00	size distribution of firms, Axtell (2001)
$g(1)$	0.13	population share of management, IPUMS CPS 1970

Table 1: Parameters to 1970

The fraction of management, $g(1)$, is the only parameter allowed to change when recalibrating the model to 2000, of which value is shown in Table 4.

ticularly relevant are the equilibrium masses of each occupation. Along with the friction parameters (λ, κ), the persistence parameters $(\omega_0, \omega_1, \chi)$ and ability parameters $(s, \overline{m})$ govern the distribution and the relative mass of different occupations. They also determine the sources of income within, and relative income between, different income groups. Since all firms come from projects, I fix $g(1) = \frac{1-\omega_0}{2-\omega_0-\omega_1}$, the population share of management (entrepreneurs plus managers) in the model, at 13.1%, the population share of management in the 1970 CPS.

The probability that m does not change, χ, is fixed at 0.887 according to Murphy and Zabojnik (2007), who report that the average CEO turnover rate from 1990-2000 is 11.3%. The maximum ability $\overline{m}$ is fixed at 1000. Given $s = 1$, this means that I miss the top 0.1% of the highest abilities if F were instead an unbounded Pareto distribution.[39]

The idiosyncratic labor efficiency shocks ϵ do not play a major role in my model, but create realistic variation in the lower income groups and also facilitate numerical clearing of the labor market in the calibration. As such, I assume that idiosyncratic labor efficiency shocks are independent of the managerial ability shocks.[40] I assume a 5-state Markov transition matrix that approximates a discretized version of the $AR(1)$ process

$$\log \epsilon' = (1-\rho)\mu_\epsilon + \rho \log \epsilon + \varepsilon, \quad \varepsilon \sim \mathbb{N}(0, \sigma_\varepsilon^2)$$

where ρ, the persistence in labor efficiency, is set to 0.95 following Storesletten et al. (2004), and $\mu_\epsilon = -\frac{\sigma_\varepsilon^2}{1-\rho^2}$ so that mean labor efficiency is normalized to 1.[41] This leaves us with one free parameter, ω_1, to be calibrated within the model. All the fixed parameters up to now

[39] Thus, the model focuses only on the top 1%; I do not claim that the model can explain the behavior of individuals in the top 0.1%. As explained in Appendix B and Saez and Zucman (2016), wealth and taxation patterns again diverge at the very top; further assumptions would be needed to explain this behavior quantitatively.

[40] Allub and Erosa (2014) find that manager and worker abilities are barely correlated in Brazil.

[41] I discretize using the Rouwenhorst method, showed by Kopecky and Suen (2010) to deliver accurate approximations for highly persistence processes.

are summarized in Table 1.

Tax Variables While many studies have calibrated parametrized tax functions to specific points in time, to the best of my knowledge, the only study which provides a time series of such functions is Gouveia and Strauss (1994, 2000). However, they only provide functions up to 1989. So I calibrate the progressive earnings tax schedule within the model, separately to 1970 and 2000, using the parametrized average tax rate (ATR) function of Guvenen, Kuruscu, and Ozkan (2014). This captures progressivity at the top very well, having the largest number of parameters among commonly used specifications (Guner, Kaygusuz, and Ventura, 2014). The ATR function in year t is:

$$ATR^t(y) = \tau_0^t + \tau_1^t(y/w_t) + \tau_2^t(y/w_t)^{\tau_3^t},$$

where y is an individual's wage income, and w_t is the equilibrium competitive wage in the years $t = 1970$ or 2000. So after-tax earnings are $T(y) = (1 - ATR(y)) \cdot y$. In each year, these parameters are chosen so that

1. the effective taxes paid by the median taxpayer in the model equals the average effective rate paid by the bottom 90% in Piketty and Saez (2007), which was 20.5% for both years 1970 and 2000 (this includes federal and payroll taxes);
2. the marginal tax rate paid by the median taxpayer in the model equals the average marginal tax rate in Mertens (2014), which was 20.4% in both 1970 and 2000;
3. total taxes paid as a share of total income—not just wage income—equals 23.3% in 1970 and 27.4% in 2000 (Piketty and Saez, 2007);
4. the share of total taxes paid by the top income percentile equals 18.4% in 1970 and 27.7% in 2000 (Piketty and Saez, 2007).

Items 1. and 2. are chosen to discipline the tax rate faced by workers in my model, who are in lower income groups. These assumptions admit closed form expressions of (τ_1^t, τ_2^t) as functions of (τ_0^t, τ_3^t):

$$\tau_0^t + \tau_1^t + \tau_2^t = 0.205, \quad \tau_0^t + 2\tau_1^t + \tau_2^t(1 + \tau_3^t) = 0.204. \tag{9}$$

So in practice, only the latter two parameters are calibrated to match items 3. and 4. for the years 1970 and 2000. Then (τ_1^t, τ_2^t) are adjusted to satisfy (9). Note that total taxes paid as a share of total income changes by only 4.1 percentage points between the years 1970 and 2000, so that government revenues are nearly neutral. Figure 10 plots the calibrated functions for the years $t = 1970$ and 2000. The 2000 function is close to that estimated

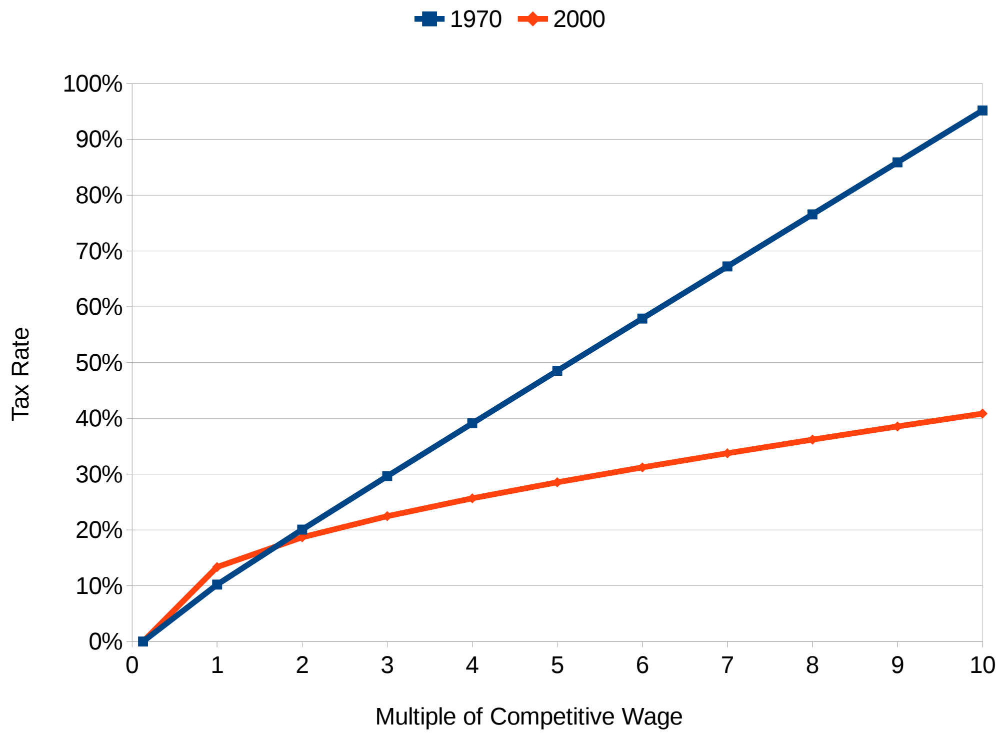


Figure 10: Calibrated earnings average tax rate functions, 1970 vs 2000.

in Guner et al. (2014), while the 1970 function is as high as 95% for earnings 10 times the competitive wage.[42]

Since equilibrium occupational choices will be affected by the relative taxes imposed on the different sources of income, I keep the rest of the policy variables exogenously fixed to their empirical effective rates to isolate the effect of progressivity. Aggregate average tax rates have only changed modestly compared to the top marginal tax rate, and as argued in Appendix B, it is unclear if other tax rates have become effectively less progressive.[43]

Capital and business income tax rates (τ_k, τ_b) are taken from the effective marginal tax rates (EMTR) estimated by Gravelle (2007). I use the noncorporate EMTRs to tax business income and total EMTR to tax capital income, both at their average values from 1970 to 2000. These are approximately 33% and 23%, respectively. Her estimates show that there has been some variation in the 1970s but not much since the 1980s.

[42]Statutory marginal tax rates on total income were as high as 70% for the top income bracket in the 1970s, which is close to the total effective income tax rate for the richest individuals in the model once we include taxes levied on capital and business incomes. Imposing a ceiling on top tax rates—both in 1970 and 2000—equal to their empirical counterparts had only small effects, for different reasons. In 1970, even at 70% almost no one in the model actually pays such high taxes, and in 2000, we are already in a corner equilibrium in which no additional managers can enter. The latter is also reinforced by the fact that when I run a counterfactual exercise of completely flatten out the tax schedule in Appendix E, there are only small changes in moments.

[43]Of course a richer tax-transfer system may also help in terms of fitting the data, but then the main driving force of the model becomes less clear.

Parameter	Value		Description
A. Fixed outside the model			
τ_k	0.36		effective tax rate on capital income, Gravelle (2007)
τ_b	0.23		effective tax rate on business income, Gravelle (2007)
τ_g	0.26		tax rate on project sales income, average capital gains tax rate
ψ	0.44		share of business income reported as capital gains, see text
τ_ψ	0.24		$\approx \psi\tau_g + (1-\psi)\tau_b$, see text
B. Calibrated from the model			
	1970	2000	(first two rows calibrated for each year, latter two implied)
τ_0	0.11	0.66	total taxes paid as a share of total income = (23.3%, 27.4%)
τ_3	-0.10	-0.09	top income percentile share of taxes = (18.4%, 27.7%)
τ_1	0.09	0.02	average tax rate of median taxpayer = 20.5%
τ_2	-0.10	-0.55	marginal tax rate of median taxpayer = 20.4%

Table 2: Tax Parameters.

While there is no particular time trend in the fraction of capital gains paid as taxes, there is a surge during the 1980s Reagan tax reforms, typically attributed to rich individuals leveraging the tax rate faced on their capital gains by timing its realization. Since I do not explicitly model this behavior, I fix the capital gains tax rate τ_g that is imposed on part of entrepreneurial profits and project sales for both 1970 and 2000. The average ex post realized tax rate from 1970 to 2000 is approximately 26%.

The ratio of capital gains and business income of the top 1%, ψ, is 44% on average and changes by only 3-4 percentage points from 1970 to 2000 (Piketty and Saez, 2003). Consequently, the effective tax rate on $B(x)$, the entrepreneurs profits after accounting for her wage income, is $\tau_\psi \approx 24\%$. All tax parameters are summarized in Table 2.

4.2 Calibration Targets

The remaining six parameters are chosen so that model-simulated moments match six data moments from 1970, as summarized in Table 3. The first four data moments—the population share of managers, corporate share of capital, and top percentile shares of aggregate wealth and earnings—were discussed in Section 2.[44] The first additional moment is the Gini coefficient of earnings, which I compute from the 1962 SFCC.[45] The annual interest rate is set to 4%, the commonly used value in the literature representing the average rate of return on all assets, and as is standard, is pinned by the discount factor.

1. **Size parameters.** Given managerial ability persistence $\chi = 0.887$ and the population

[44] If corporate and non-corporate capital is K_c and K_n, the corporate share is $K_c/(K_c + K_n)$.

[45] The value is slightly higher than what is found in other surveys (approximately 0.35-0.38), such as the Panel Study of Income Dynamics, which does not sample high income households.

Parameter	Value	Target	Data	Model
ω_1	0.92	population share of managers (%)	9.8	8.8
κ	0.83	corporate share of capital (%)	47.7	47.7
λ	5.66	top percentile share of aggregate wealth (%)	27.6	27.6
ν	0.47	top percentile share of aggregate earnings (%)	5.1	6.1
σ_ε	0.27	Gini coefficient of earnings (wage incomes)	0.44	0.44
β	0.97	annual interest rate (%)	4.0	4.0

Table 3: Parameters calibrated to 1970 moments

share of management $g(1) = 13.1\%$, a higher persistence in q—i.e. a large ω_1—leads to more entrepreneurs.[46] On the other hand, managers naturally have a larger span-of-control of capital if κ is smaller. Hence these two parameters are calibrated to the equilibrium population share of managers and corporate share of capital.

2. **Collateral constraint and worker wage income share.** Since I want to explain the dynamic relationship between earnings and wealth concentration, it is important that the model captures their static levels. The constraint parameter λ is chosen to to match the top percentile concentration of wealth.[47] All individuals generate earnings in my model, but only wage workers' earnings shares are determined by ν. Since entrepreneurs and managers earn the highest earnings, which are governed by m, smaller values of ν increase the concentration of earnings. The calibrated value of ν is similar to Buera and Shin (2013). The calibrated value of λ also implies an aggregate capital-output ratio slightly below 3, close to its empirical counterpart.[48]

3. **Variance of labor efficiency shock (σ_ε^2).** As discussed earlier, this parameter is not so important for the model per se, but creates some realistic variation among wage workers and is calibrated to the earnings Gini coefficient.

The benchmark 1970 calibration is near-perfect.[49] But when recalibrating tax parameters to 2000, it is impossible we get the population share of managers in the 2000 CPS of 15.3% by construction, since $g(1)$ is held fixed at its 1970 value of 13.1%. Note that we cannot just change only $g(1)$ to its 2000 value of 17.7%; in that case ω_1 also needs to be recalibrated because $g(1)$ is a function of (ω_0, ω_1); without recalibrating, we would be implicitly changing

[46] Moll (2014) shows that higher persistence in entrepreneurial ability leads to less capital misallocation, which implies higher degrees of wealth concentration.

[47] Buera (2008) shows that collateral constraints induces low ability entrepreneurs to have almost no savings motive at all.

[48] Since we also target the corporate share of capital and the rest is capital raised by entrepreneurs through debt, this means that the external finance-GDP ratio is about 1.6, which is also close to its empirical counterpart.

[49] Only the population share of managers is slightly off. This is because by discretizing the managerial ability of entrepreneurs and managers, varying $\hat{m}_\epsilon$ smoothly can create discrete jumps in labor demand and it becomes difficult to control the population split between entrepreneurs and managers in very small increments. Using a larger grid would improve the fit, but at large computational cost with little gains.

Parameter	Value	Target	Data	Model
$g(1)$	0.18	(population share of management in 2000)		
ω_1	0.95	mass of managers (%)	15.3	13.8
κ	0.80	size of corporate sector (%)	67.7	66.4

Table 4: Parameters recalibrated to 2000 moments

All other parameters are held fixed to their values in Tables 1-3. The population share of management, $g(1)$, is changed exogenously to the population share of management in the 2000 IPUMS CPS.

the value of ω_0 for no reason.

So given the calibrated tax parameters, I also recalibrate three technological parameters $[g(1), \omega_1, \kappa]$ in 2000: $g(1)$ is set to 17.7%, and (ω_1, κ) are chosen to improve the model fit of the population share of managers and the corporate capital share, as shown in Table 4. As we will see, the improvement is only marginal, especially for top income statistics. This is because the shift in tax policy raises both the population share and wages of managers; technology parameters also raise the population share but at the expense of an equilibrium decline in the wage of managers. As such, the exercise quantitatively illustrates that tax and technology changes are similar to the red and gray lines in Figure 9, respectively. That is, tax changes alone increase the share of managers at the top.

5. Results

The main results are tabulated in a series of steady state comparisons in Tables 5-9. Figure 11 shows the trajectory of the top percentile wealth share along the benchmark transition path from 1970 to 2000 and 13 the model's implications for saving rates by occupation.[50]

5.1 Top percentile concentrations

The first two columns of Table 5 compares the top percentile concentrations of wealth, earnings and income in the model when only tax parameters are changed. Earnings concentration rises at a similar magnitude as in the data, while the rise in income and wealth concentration is about a quarter of the data. With the exception of the top income percentile share in 1970—the only 1970 moment in the table that was not targeted and is too high compared to the data—the levels of all moments are similar to the data.When technology parameters are also recalibrated (third column), the fit marginally improves. This is not a trivial result: The 2000 calibration targets only the change in tax moments, or additionally population shares. In either case, no distributional moments were targeted.

[50]Table D1 in Appendix D shows the change in utilitarian welfare and other aggregates.

		1970	Only Taxes	2000	Only Tech
Wealth	Data	27.6		34.1	
	Model	27.6	29.2	33.7	48.9
Earnings	Data	5.1		12.3	
	Model	6.1	11.8	11.9	6.0
Income	Data	7.8		16.5	
	Model	14.0	16.0	16.4	17.9

Table 5: Top percentile concentrations of wealth, earnings and income.

The data moments for wealth are from Saez and Zucman (2016), and earnings and income from Piketty and Saez (2003). The calibration targets wealth and earnings moments, but not income. The benchmark 2000 is when both taxes and $[g(1), \omega_1, \kappa]$ are recalibrated. "Only Taxes" is when only tax parameters are recalibrated, and "Only Tech" is when only technological parameters are changed to their recalibrated values while keeping tax parameters at their 1970 values.

In the last column of Table 5, I keep the parameters of the progressive ATR function on earnings $(\tau_0, \tau_1, \tau_2, \tau_3)$ constant at their 1970 values, while only changing $[g(1), \omega_1, \kappa]$ to their 2000 values. The results are clear. If only the environment were to have changed, there would be virtually no change in earnings concentration, a slightly larger rise in income concentration, and a massive increase in wealth and income concentration.[51]

Figure 11 plots the evolution of the top wealth percentile's share of wealth along the transition path. The benchmark transition scenario considered is one in which the population distribution is initially at the 1970 steady state, but then both tax and technology parameters, namely $[g(1), \omega_1, \tau_0, \tau_1, \tau_2, \tau_3]$, suddenly change to their 2000 values in 1971. The new steady state is assumed to be reached in 300 years. Under this scenario, most simulated moments jump close to their 2000 values immediately, except for the top wealth percentile concentration, which is a stock.[52]

As shown in the figure, the concentration of wealth follows a long, protracted U-shape pattern. The fact that the concentration of wealth can move in the opposite direction of those of earnings and income demonstrates the novelty of my occupational choice model in explaining distributional changes at the top. Wealth concentration initially drops as entrepreneurs become crowded out by managers at the top. But as top manager incomes continue to rise and accumulate wealth along the transition path, eventually the concentration of wealth goes back up. How all these changes are related to occupation shares is investigated next.

[51] In contrast, recent studies such as Kaymak and Poschke (2016) would attribute almost all the changes to an exogenously assumed labor productivity process.

[52] To prevent moments from jumping on impact, one could change the parameters incrementally, allow agents to anticipate the shock, and/or include adjustment costs for switching occupations. I have tried simple variants and verified that the path of wealth concentration always follows a U-shaped pattern, but over a more protracted period of time. By choosing some combination of these scenarios one could bring the entire transition path closer to the data, but at extreme computational costs.

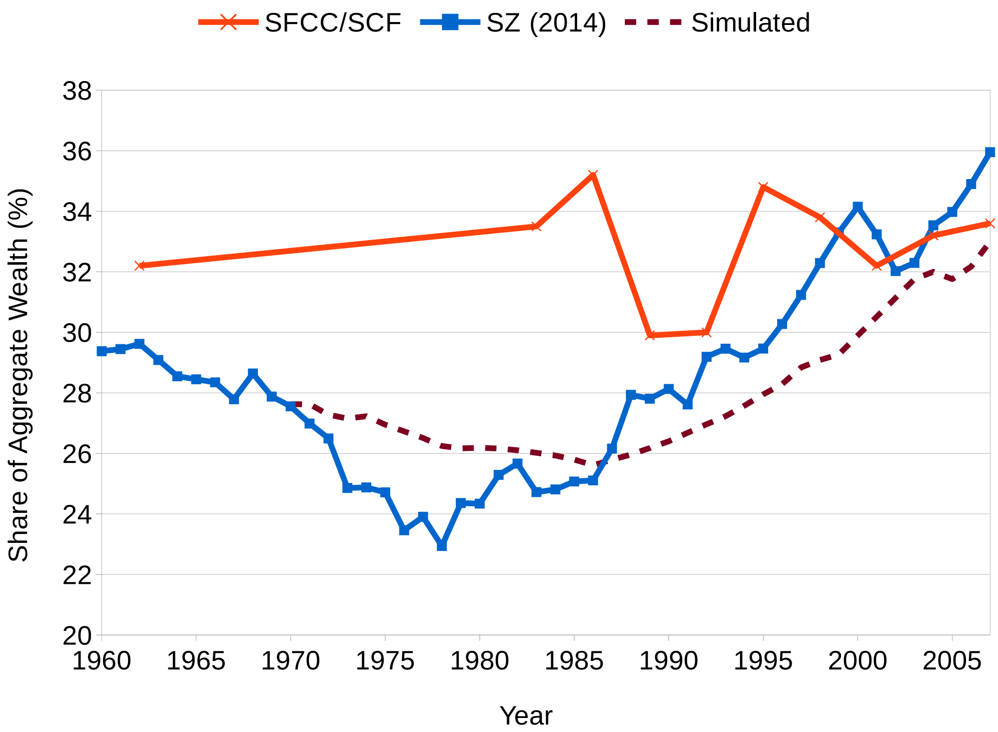


Figure 11: Top percentile share of aggregate wealth, data and simulated 1970-2007

The SFCC/SCF and Saez and Zucman (2016) series are identical to Figure 1. The simulated series is under the transition scenario that all parameters change suddenly in 1971. The new steady state is assumed to be reached in 300 years.

		1970	Only Taxes	2000	Only Tech
Mass of Managers	Data	9.8		15.3	
	Model	8.8	9.1	13.8	13.1
Corporate K-Share	Data	47.0		67.0	
	Model	47.0	58.6	66.4	53.1
Top Manager vs Wage Worker	Data	29.7		342.2	
	Model	9.8	36.8	35.3	9.6

Table 6: Managers, corporate capital, and executive compensation.

Population share of managers and corporate share of capital data from the CPS and Federal Flow of Funds accounts, respectively. In the model, the latter is the share of capital operated by hired managers. The top manager-wage worker ratio in the data refers to the ratio between the compensation for the rank 100 CEO in the Forbes survey, and annual wage in the NIPA accounts. In the model, it is the ratio between the compensation for the highest ability manager and the competitive wage, $W(\overline{m})/w$. The benchmark 2000 is when both taxes and $[g(1), \omega_1, \kappa]$ are recalibrated. "Only Taxes" is when only tax parameters are recalibrated, and "Only Tech" is when only technological parameters are changed to their recalibrated values while keeping tax parameters at their 1970 values.

5.2 Rise of managers

Table 6 shows that the time trends in top percentile concentrations reflect the shift in occupations at the top. Because the total share of entrepreneurs plus managers is constrained by $g(1)$, the population share of managers rises only slightly when only taxes are changed. Nonetheless, the corporate capital share rises by more than 10 percentage points, meaning that top managers are running larger firms. This also leads to an almost 4-fold increase in top manager compensation relative to the competitive wage, $W(\overline{m})/w$.[53] So even without a large increase in the overall supply of managers, the rise in their demand crowds out the entrepreneurs in the top income percentile, as can be seen in the fourth panel.

When the population share of managers and corporate share of capital are also targeted in the third column, obviously the fit of these two moments improve but there is little change in $W(\overline{m})/w$ and the share of managers in the top income percentile. But when it is only the technology that is changing, top manager compensation drops as well as the share of managers in the top income percentile. This is because the increase in the share of managers is mainly due to a rise in their supply, lowering their equilibrium compensation as we saw in the gray line of Figure 9.

The equilibrium effect is even greater when one recalls that all computations are based on pretax income and not after-tax income. It is not so surprising that a decrease in taxes can lead to higher after-tax compensation. But in a standard model, lower taxes would result in *lower* levels of pretax compensation for any given level of managerial ability, both on-and-

[53]However, both the levels and change are smaller than in the data. This is likely due to the lack of multiple project qualities, which would amplify the level and sensitivity of top manager compensation due to stronger positive sorting (Gabaix and Landier, 2008). I return to this issue in Section 5.4.

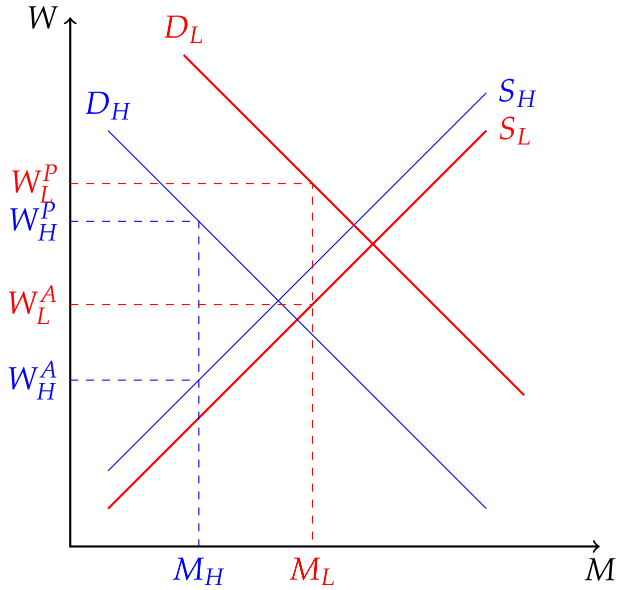


Figure 12: Equilibrium managerial compensation with lower taxes.

M denotes the quantity of managers and W their compensation for a given level of managerial ability. When taxes are high, the equilibrium mass of managers is M_H, who earn pretax and after-tax compensations of W_H^P and W_H^A, respectively. With lower taxes, the equilibrium shifts to M_L, where managers earn pretax and after-tax compensations of W_L^P and W_L^A, respectively.

off equilibrium. This is depicted in Figure 12, which visualizes the supply and demand for managers of a given (high) ability.[54] Partial equilibrium effects occur as movements *along* the supply and demand curves without the curves themselves shifting; with lower taxes, the wedge between pre- and after-tax compensation, $W_H^P - W_H^A$, would shrink, increasing after-tax but decreasing pretax compensation. This is also the case if the supply curve shifted more outward than the demand curve, as is happening when only technology parameters are changed.

But with changes in tax progressivity, the general equilibrium effects are such that both the supply and demand curves shift outward, so that even pretax compensation rises to higher levels with lower taxes. Therefore, even a small rise in $W(m)/w$ can shadow a much larger increase in the mass of individuals who become managers for any given ability level. In Figure 12, this is depicted as a small rise in pretax compensation, $W_L^P - W_H^P$, associated with a large increase in the equilibrium mass of managers, $M_L - M_H$, for a given managerial (high) ability level.

Most interesting for our purposes is how this affects the relative share of entrepreneurs and managers *at the top*. These moments were not targeted in the calibration, since the related data is less reliable. Nonetheless, Table 7 compares the model-implied change in occupation shares within the top income percentile to the SCF moments we saw in Section

[54]For such a thought experiment to work, the chosen ability level must lie well above $\hat{m}$, the ability threshold for becoming a manager, in 1970.

		1970	Only Taxes	2000	Only Tech
Data (SCF 1962)	Ent.	38.0		18.8	
	Mgr.	23.8		58.7	
Model	Ent.	55.5	33.9	28.9	42.6
	Mgr.	27.7	51.6	52.1	12.1

Table 7: Occupation shares in top income percentile.

Population share of entrepreneurs and managers in the top income percentile. The benchmark 2000 is when both taxes and $[g(1), \omega_1, \kappa]$ are recalibrated. "Only Taxes" is when only tax parameters are recalibrated, and "Only Tech" is when only technological parameters are changed to their recalibrated values while keeping tax parameters at their 1970 values.

2.[55] In the model, there is almost a complete flip: managers rise from 28 to 52 percent, while entrepreneurs drop from 56 to 29 percent of the top percentile. Despite not being targeted, both the level and rise of managers is quantitatively close to the SCF. And while the model has more entrepreneurs in both 1970 and 2000 compared to the data, their decline is comparable to the SCF in magnitude.

This gives us two insights into the results we saw in the previous subsection. First, wealth concentration moving differently from earnings and income concentration will be tied to differences in the savings behavior of top entrepreneurs and managers. This is investigated further in the next subsection. Second, the reason that income concentration was too high in the 1970 benchmark is due to top entrepreneurs generating too much income. This is a limitation of the quantitative model that I return to in Section 5.4

5.3 Saving propensities

Figure 13 plots the saving rates of entrepreneurs, workers and managers in both the 1970 and 2000 benchmark equilibria. Saving rates are defined in the same way as in Cagetti and De Nardi (2006): the change in an individual's asset position divided by current period pretax income. In the figure, I plot the saving rates of an entrepreneur and manager who both have the highest managerial ability ($m = \overline{m}$), the only difference between the two being whether they received a project $q \in \{0, 1\}$. Workers' saving rates are averaged over all the 5 possibly realizable labor productivity states for individuals with such that both $(q, m) = 0$.

Saving rates in 1970 are quite similar to Figure 5 in Cagetti and De Nardi (2006): starting from a low level, entrepreneurs' saving rates increase quickly, and maintain a high saving rate for all levels of wealth.[56] For both managers and workers, saving rates decline quickly

[55] Recall that we cannot separately identify managers in the SCF, and that the CPS and Census are top-coded.

[56] A small difference is that in their model, entrepreneurs' saving rates initially drop at very low asset levels. This does not happen in my model because even if individuals with projects do not implement it, they still get an income from selling the project. Since the project (business opportunity) occurs only with a very small

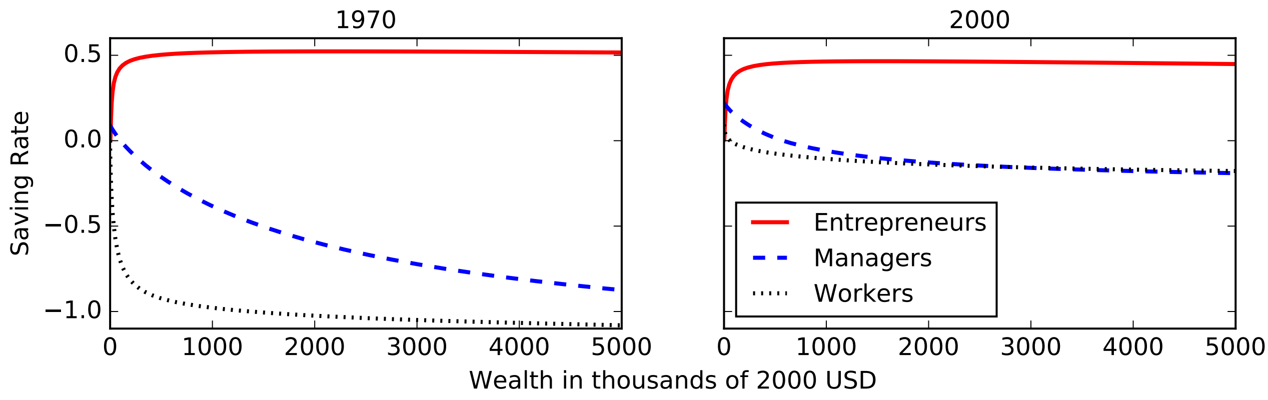


Figure 13: Saving rates

In panel (a), personal effective top marginal tax rates are measured as the effective tax rates of the top .01 percentile richest households, computed in Piketty and Saez (2007). Other series are publicly available from the IRS. In panel (b), personal effective top marginal tax rates are plotted against the share of total tax revenues paid by the top income percentile, also in Piketty and Saez (2007).

with wealth, and more so for the latter. Since top managers are at the top of the earnings distribution, managers' saving rates decline slowly due to the same mechanism as in Castañeda et al. (2003): they are motivated to save while their luck lasts. However, in the 1970 benchmark, they are still publicly insured by the progressive tax system, so the fear of losing their high managerial ability shock is not so strong.

When taxes become less progressive in 2000, there is a overall drop in entrepreneurial saving rates, although it still remains flat throughout all relevant levels of wealth. The reason is two-fold. First, the precautionary value of saving when receiving a project shock (which occurs with small probability) is less, since receiving a high managerial ability shock—regardless of whether it concurs with a project shock—becomes more valuable. Second, entrepreneurs are less motivated to overcome the collateral constraint, since again, receiving a high managerial ability shock will overcome such needs (and has a much higher return than in 1970). Hence not only does their population share decline, but they also disproportionately fall out from top percentile groups as they save less.

In contrast, both managers and workers save much more in the 2000 benchmark. The precautionary motive of taking advantage of the ability shock is now fully operational since a top manager earns more than before in pretax earnings, even more in after-tax earnings, and is no longer protected by the redistributiveness of taxes once she loses her ability.[57] Hence not only are there more managers, but the rich ones are now saving disproportionately more than in 1970 (although still much less than entrepreneurs).

To summarize, savings behavior at the top is comparable to a model with only en-

probability, individuals with $q = 1$ maintain a precautionary motive to save in anticipation of losing it.

[57] While it is quite surprising that workers' saving rates rise up to the level of managers', there are only a very small mass of workers at such high levels of wealth in equilibrium.

		1970	Only Taxes	2000	Only Tech
Wages	Data	45.6		61.7	
	Model	18.8	44.8	43.8	8.2
Business	Data	30.0		20.7	
	Model	57.7	27.8	20.0	33.1
Capital	Data	24.4		13.6	
	Model	23.5	27.4	36.2	58.7
Interest Rate		4.0	8.1	11.4	10.8

Table 8: Income composition of the top income percentile.

Data is from Piketty and Saez (2003). How I account for separate sources of income in the model is explained in Section 3.3. The benchmark 2000 is when both taxes and $[g(1), \omega_1, \kappa]$ are recalibrated. “Only Taxes" is when only tax parameters are recalibrated, and “Only Tech" is when only technological parameters are changed to their recalibrated values while keeping tax parameters at their 1970 values.

trepreneurs in 1970, but starts to resemble a model with “superstar shocks” in 2000. Most important, since the relative saving rates of top entrepreneurs and managers move exactly in opposite directions, whether wealth concentration increases or declines depends both on the relative composition of the two occupations at the top, and the quantitative differences in how much their saving rates change between 1970 and 2000. Since wealth concentration rises in the benchmark 2000 calibration, this means the rise in managers’ saving rates and their relative mass more than counters the drop in entrepreneurs’ saving rates at the top, albeit only by a small margin.

5.4 Other implications

Income sources of top income groups The calibration did not directly target any of the moments related to the composition of top percentile incomes (shown in Section 2, Figure 2). Table 8 shows the shares of wage, business and capital income for the top income percentile, which helps us understand to what the degree a change in the top percentile mass of managers translates into differences in the composition of top percentile income.

Let us first focus on the first two columns. The fall in the business income share of the top income percentile reflects the decline of rich entrepreneurs, although both the level in 1970 and the drop are much larger than in the data (57.7 vs 30 percent, and 37.7 vs 9.3 percentage points, respectively). On the flip-side, the rising wage income share in the top income percentile reflects the rise of rich managers, which is also larger than in the data (25 vs 16.1 percentage points). The 1970 wage income share is smaller since the business income share is larger, while the capital share of income is similar to the data. When technology parameters are also recalibrated, there is not much change in the wage share of income but

		1970	2000
Wages	Data	52.8	72.3
	Model	59.2	63.7
Business	Data	20.2	18.8
	Model	24.2	11.0
Capital	Data	14.7	8.9
	Model	16.7	25.3

Table 9: Income composition of the top income decile.

Data is from Piketty and Saez (2003). How I account for separate sources of income in the model is explained in Section 3.3. The benchmark 2000 is when both taxes and $[g(1), \omega_1, \kappa]$ are recalibrated.

business income shares drop even more.

Taken together, the qualitative directions of the wage and business income shares for the top income percentile are qualitatively in line with the data, although the magnitudes are exaggerated because the initial level of the business income share is counterfactually high. This is related to the total income share of the top income percentile being too high compared to the data, as was shown in Table 5. Since they are mostly entrepreneurs, who earn business income, it means their income is too high. It is also related to there being a larger share of entrepreneurs in the top income percentile than in the data, as shown in Table 7.

Since the model does well on delivering average statistics, this means top entrepreneurs earn too much compared to those with lower ability. This is also confirmed in Table 9, where I decompose the income sources of the top income decile. Once we go below the very top groups, both the level and changes become much more quantitatively in line with the data.

In my model, top entrepreneurial incomes are high because entrepreneurial abilities are the same as managerial abilities. That is, forcing the model to push down top entrepreneurial incomes would necessarily lower all possible managerial incomes as well, which is also counterfactual. So to correct for this problem quantitatively, we would need to assume different distributions for the respective abilities (but possibly correlated), or assume multiple project qualities. But while any such assumptions are theoretically straightforward, it is empirically unclear how one would disentangle two dimensions of heterogeneity.[58] In addition, it is unclear how one would model the various frictions in the idea transfer—or firm-manager matching—process, depending on which my results could be very different. Such investigations are left for future research.

[58]It is also computationally inhibitive, although I have checked that such a mechanism works qualitatively with two project types. This would push up the wages of top managers through stronger assortative matching in the manager market (best managers get matched with the best projects), while pushing down the incomes of entrepreneurs who have low managerial ability but a low quality project (or vice versa).

Welfare implications Without any change in tax progressivity—the last column of Table 8—*both* wage and business income shares are smaller, and the rich earn the largest share of their income from capital alone (almost 60%). Recall from Table 6 that under this scenario, managerial compensation is virtually unchanged, and from Table 7 that there are not many managers at the top. There are only very rich entrepreneurs who demand large amounts of capital, which is also why wealth concentration was high in Table 5. The capital income share is so high both because the rich have a large stock (the concentration of wealth is extreme at 48.9%), and because the interest rate is very high at 10.8%. In fact, the equilibrium interest rate is even higher in the 2000 benchmark.[59]

When more production is carried out by managers instead of entrepreneurs, capital demand is relatively higher and supply lower; the former because managers choose their unconstrained optimal level of capital inputs and the latter because of the drop in the entrepreneurial savings motive.[60] These implications differ from a standard model of savings with taxation. In such models, lower tax rates increase both consumption and savings, increasing capital supply and lowering interest rates in equilibrium. In my model, this is countered because the suppliers of capital (the consumers) also demand capital (especially those at the top), so the capital demand curve shifts depending on the equilibrium composition of occupations. Reflecting on Figure 13, entrepreneurs save more than they demand, and managers demand more than they save.

Ultimately, the different implications for capital demand and supply also leads to welfare effects absent in existing models. In Appendix D, I compute that consumption equivalent welfare increases by 1%-9%, depending on different transition scenarios. The positive welfare gain contrasts with previous studies that focus only on individual labor supply incentives, where progressive taxation provides insurance against the precautionary motive. While my model lacks some real world dimensions that would make it more suitable for a policy analysis, the results are intended to highlight the effect that progressive taxation can have on the production side of the economy (the equilibrium composition of entrepreneurs and managers) in addition to the consumer side. A detailed social welfare analysis that weighs such benefits against social insurance is left for further research.

[59] I also tried a reverse calibration, i.e. calibrated the model to 2000 and recalibrated a subset of parameters to 1970. In this case, β is calibrated so that the 2000 interest rate is 4%, and the equilibrium interest rate in 1970 is approximately 2.4%, which is perhaps more realistic. Except for the capital income share of the top income percentile changing less, there are not any major differences in the quantitative results. For the purposes of this paper, it was more natural to calibrate the model 1970 and go forward rather than start from 2000 and go backward, which creates less confusion.

[60] As we saw in Section 5.3 however, the precautionary saving motive of managers is still enough to counter the drop among rich income groups. But average capital drops in the new steady state, as shown in Appendix D.

6. Conclusion

I presented a model of occupational choice in which individuals choose to become entrepreneurs, managers or workers, to simultaneously explain the time trends of the concentrations of earnings, income and wealth in the U.S.. The model can qualitatively replicate the rise in income concentration, which was driven by an increase in earnings concentration but not in wealth concentration.

A change in the tax code can quantitatively account for the rise in earnings concentration and wealth concentration, and a quarter of the rise in income concentration. This is due to high-income households choosing managerial rather than entrepreneurial occupations when tax conditions are more preferable for higher levels of managerial compensation. While the simulated transition path of wealth concentration is a flat, U-shaped pattern, I show that making taxation even flatter does not necessarily lead to higher wealth concentration in the long-run in Appendix E.

One issue I have abstracted from is changes in other types of taxes: e.g., on capital/business/corporate income taxation, and capital gains. A comprehensive policy analysis of the overall tax system is left for future research, with the caveat that any such exercise should take into account the many variations in taxable income, deductions and tax credits, etc.—especially at the high end—which effectively renders inference based on tax rates alone meaningless (Piketty and Saez, 2007).[61] In any case, my model highlights that mechanisms relying only on labor supply may miss important margins at the top.

On the modeling side, it can also be used to revisit previous studies using entrepreneurial models with collateral constraints. In addition to the collateral constraint faced by entrepreneurs, my model introduces a new type of friction that arises during project transfers. When taking into account that not all production relies on entrepreneurs, especially in more developed countries, financial development can have different impacts on productivity growth and the persistence of capital misallocation depending on the relative importance of financial versus other frictions. Of course, one unrealistic feature of the model is that firm productivity is mostly attributed only to the managers' ability. Incorporating project heterogeneity and more realistic features of how firms match with managers, within a context that entrepreneurial motives coexist, are exciting possible extensions left for future research.

[61] For example, Appendix B presents evidence that capital and business income may have become *more* rather than less progressive.

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Appendices

A. Data Not Shown in Text

A.1 Occupations in the Census

All data in this section are based on the census 1970 1%, 1980 and 1990 5%, and 2010 ACS (American Community Survey) samples. Managers are split into 3 types using the 1990 occupation coding convention: top managers (code 4), narrow managers (7-8,13-15,18-19), and broad managers, which includes all codes 22 and below that are not top or narrow managers. The rationale for this selection is because narrow managers are the only ones that exist separately in all censuses, once occupational code crosswalks are applied. Entrepreneurs are all self-employed workers who report any business income. In the paper, I take the broad managers as the benchmark definition.

All samples are cleaned closely following Autor and Dorn (2013), including how they handle top- and bottom-coding. Since the census top-codes various different sources of income separately, and top-code values differ by state in recent years, generally the richest income group consists of individuals who are top-coded in all categories. Fortunately, the share of such individuals is far above 1% of the population, allowing us to approximate a somewhat meaningful top income percentile.

In Figure A1(a), both in aggregate and within the top income percentile, the decline of entrepreneurs and rise of managers are apparent, although the rise of managers is less pronounced in the top income percentile. So although entrepreneur and manager shares in the three datasets I consider (SCF, CPS, Census) differ in levels, the trends are qualitatively similar in aggregate. More important for my purposes, the crowding out of entrepreneurs by managers in the top income percentile is also similar in the SCF and Censuses, as summarized in Figure A1(b).

Figure A2 shows that the relative rise of managers are robust to the various definitions defined above. Figure A3 is a bit different: here I look at the wage shares by each type of occupation, in aggregate and within the top wage percentile. Since the wage levels are top-coded, this is a broad approximation at best. Nonetheless, especially in the top wage percentile, we can observe a rising share of manager compensations and especially for top managers.

A.2 Corporate and Noncorporate Sectors

The main difficulty in defining the corporate and noncorporate sectors are the special forms of organizations such as S-corporations, for which it is difficult to define whether the manager is in fact an entrepreneur or not; similarly for limited partnerhips and limited liability companies. Owners and/or managers of such businesses get tax benefits by passing through their business incomes to their individual income taxes while also bearing limited liability.

Since some of such corporations may be run by self-proprietors (such as S-corporations), mak- ing the link between the size of the corporate sector and executive compensation is only indi- rect. When computing corporate capital in the main text, I included plant and equipment, inventories, land at market value and residential structures following Quadrini (2000). Other entities (mainly households) are excluded as it is unclear whether their assets should belong to the corporate or non-corporate sectors. This partially addresses the reality that some firms in the corporate sector are private, which would correspond to firms run by entrepreneurs (and not managers). As stated in the text, the financial corporate sector is also excluded.

Pass-through entities have increased in recent decades/years, and on a year-to-year basis it is hard to know whether the business owner decided to take advantage of particular changes in tax policy or because of the limited liability. In practice, we would need to know whether the owner of a S-corporation would have instead chosen to be a sole proprietorship or a C-corporation in the absence of such exemptions.

For my purposes, I consider (general) partnerships and proprietorships as run entrepreneurs, and the rest as run by managers, since I do not explicitly consider corporate income tax changes in the model, and the main difference between entrepreneurs and managers is whether or not they are liable for the firm. In this case, we can see from Figures A4-A5 that the size of such businesses have increased, although C-corporations have generally declined. All tax returns data here is available from the Statistics of Income Integrated Business Dataset (IBD), but only from 1980 and onward.

In the paper, I target the corporate-noncorporate capital ratio rather than any of these statistics since the technology I assume is a direct constraint on operational capital, and from the IBD data alone it is difficult to deduce value-added without direct access to micro-level firm data (such as the confidential Longitudinal Business Database).

	B90 total	T1 total	B90 K-inc	T1 K-inc	Realized Kgains (% GDP)	ATR Kgains	Max Rate (Long-Term)
1970	10%	33%	28%	49%	2.01	15.2	32.21
2000	8%	30%	16%	44%	6.47	19.8	21.19

Table B1: Average tax rates on total income, capital income and capital gains.

B90: bottom 90; T1: top 1 percentile (when tax units are ordered by total income). The first two columns uses data from Saez and Zucman (2016) and shows the average tax rates on total income—the fraction of total income paid as taxes—for each group. The next two columns show the average tax rates on capital income. The last three columns are from the Office of the Treasury, and shows the size of net capital gains as a fraction of GDP, the average tax rate on capital gains—the fraction of realized capital gains paid as taxes—and the effective top marginal tax rate on long-term capital gains.

B. Evidence of Income Deduction at the Top

In the U.S., taxes are levied on adjusted gross income (AGI) after deductions, but in the model I assumed that entrepreneurs report most of their income as earnings, on to which all tax progressivity was imposed.[62] I also assumed flat rates on capital and business incomes and capital gains, where for entrepreneurs, business income is defined as entrepreneurial profits minus earnings. Lastly, I assumed that entrepreneurs exogenously report some of their business income as capital gains, thereby receiving preferential tax treatment. Such assumptions were made primarily to elucidate how shifts in the relative effective tax rates on different sources of income can alter the equilibrium.[63]

But such assumptions are also consistent with high income earners being able to deduct large amounts of their capital and business incomes and thus side-stepping the progressive schedule, which is not unrealistic. Piketty and Saez (2007) argue that due to various deductions and exemptions, and how capital gains are reported, the tax rate faced by very rich individuals did not change as much as would be expected from just looking at statutory tax rates. I present evidence that most high-income earners indeed do deduct large amounts of their capital and business incomes, and shift income between business incomes and capital gains to change the effective tax rates they face.

First, the relative drop in the average tax rate of capital income (the fraction of capital income paid as taxes) for the top income percentile compared to the bottom 90% is modest, compared to the drop in the average tax rate of total income (the fraction of total income paid as taxes). In Table B1, I show these rates for the years 1970 and 2000.[64]

Even as tax progressivity has declined during this period, not much is visible up to the top income percentile: the drop in the average tax rate of total income is similar for both the

[62]The model does not address tax avoidance or evasion, nor double taxation issues.

[63]Earnings still is the dominant source of income for households in all income groups up to the top 1 percent, so any changes in a generic income tax schedule would affect earnings the most.

[64] The entire series available from the appendix data of Saez and Zucman (2016) confirm that all these numbers show a monotonic trend, so there is nothing special about the two years.

bottom 90% and top 1%. The bulk of the decline comes from even higher income fractiles, as evidenced in Figure 5(a). More relevant for this paper, the average tax rate on capital income has also dropped for both groups, but the drop is much larger for the bottom 90%. This suggests that taxation of capital has in fact become *more* progressive. Since statutory rates were much higher in earlier years, it must be that much of capital income was not subject to taxation then.

Second, as seen in the lower panel of Table B1, even as the maximum tax rate on capital gains declined, the amount of taxes collected from realized gains has steadily increased as a fraction of total capital gains.[65] This means that very few capital gains were subject to the maximum rate in the 1970s, despite the much higher rate. Combined with the fact that the absolute amount of realized gains was smaller while the capital income of the top 1% was less progressively taxed than lower income groups, this again implies that a large fraction of top percentile incomes were not subject to taxation, possibly through deductions or credits.

Since most deductions or tax credits available for earnings are for median-to-low income households (e.g., the earned income tax credit), the above evidence implies that the rich may take advantage of the many loopholes in the tax code for capital and business incomes. In order to confirm this conjecture, I look at how much of capital and business incomes are deducted, especially for the higher income groups.

Gruber and Saez (2002) shows that taxable incomes are the most sensitive to changes in tax policy in a three year horizon, for high income households that itemize their tax returns. I now present evidence that taxable incomes have grown for rich households even over longer horizons, as taxation became less progressive, and that this is related to less itemized deductions at the top.

Using data in the annual Statistics of Income (SOI) tables, publicly available from the IRS, in Figure B1 I plot the fraction of taxable income over AGI by income percentile (ordered by AGI) for every 10 years from 1970 to 2000. For ease of comparison I only plot the top income decile. While not shown, aggregate taxable income has increased as a fraction of total AGI for the U.S. population, but as shown in the figure especially among groups above the top percentile.

Moreover, Goolsbee (2000) finds using Execucomp data that the effect of tax policy on the taxable income of executives is transitory at best. This is because while there are changes in the timing of compensation to exploit differential tax rates, executive compensation of all forms—including stock grants and options—are ultimately reported as salary and wages. This supports my modeling assumption that while capital and business *owners* can avoid

[65] The top 1% earns more than 70% of total capital gains, which comprises approximately 20% of their total income (Piketty and Saez, 2003). So as far as capital gains are concerned, we can focus on aggregate rather than relative numbers by income percentile.

high tax rates on their incomes, managers cannot.

Figure B2 shows the number of tax units who itemize, and how much they itemize, for top AGI percentiles. Panel (a) shows no clear trend for lower income groups, but the fraction of itemizers in the top AGI percentile shows a declining trend. More importantly, Panel (b) shows that while there is again no clear trend even up to the top percentile, the size of itemized deductions as a fraction of AGI has dropped dramatically for groups above the top 0.5 percentile.[66]

Finally in Figure B3, I compute the amount of each itemized category as a fraction of total itemized deductions, both for the entire population and the top AGI percentile, in the years 1980 and 2000.[67] Two trends are important for my purposes. First, deducting taxes paid (these are state and municipal taxes) is important for both the population and top percentile. But not only is it relatively more important for the top percentile, it has become even more important for them in recent years. A sizable fraction of state taxes are property taxes (about one third across all states in 2000), which is especially relevant for the rich. Properties are illiquid but interest-generating assets, and while the rates are low, capital owners have some leverage over which statutory income bracket they fall in by investing in property. Second, investment and contributions are important deductions for the top percentile relative to the population, and the relative importance of contributions has increased in recent years. This can be interpreted as less business income being deducted in comparison to capital income, which is consistent with self-run business owners being crowded out by rich managers.

C. Proofs

I make use of the fact that m is bounded above by $\overline{m}$, and that ϵ takes on a finite number of values. I also use the following assumption, which I show is satisfied in equilibrium.

ASSUMPTION 1 *a' is bounded above by $\bar{a}$, and $\forall x \in \{0,1\} \times [0,\overline{m}] \times E \times [0,\bar{a}]$, where E is the support of ϵ, $\mu(q,m,\epsilon,da) > 0$.*

Proof of Proposition 1 *Part (1).* Suppose not, that there are no managers in equilibrium. Then all production is carried out by entrepreneurs, and no project can sell at a positive price. But $\mu(\cdot,da) > 0$ for any (q,m,ϵ) by Assumption 1, so there is a positive mass of individuals with $q = 1$ but sufficiently small a that they do not implement the project. Then for any $e_1 \geq 0$, intermediaries can purchase one of these projects at $e_2 > 0$, offer a

[66] In aggregate, the total number of itemized returns as a fraction of total tax returns have decreased, while the total amount of itemized deductions as a fraction of AGI has remained relatively stable.

[67] I plot 1980 because investment deductions are not available for earlier years.

compensation of $(1-\kappa)\pi^*(\overline{m}) - e_2 - e_1$ to a wage worker with managerial ability $\overline{m}$ and labor efficiency ϵ_1 s.t. $(1-\kappa)\pi^*(\overline{m}) - e_2 \geq w\epsilon_1$ and still generate non-negative profit e_1. Such a manager exists since the exogenous Markov process is ergodic. Hence there must be at least one manager, a contradiction. *Part (2)* then follows.

Proof of Proposition 2 Assume $\beta(1+r) < 1$. The value function exists and attains the supremum of the sequence problem by Theorem 9.12 in Stokey and Lucas (1989). Note that once we assume incomes are stationary (or equivalently, that prices (r, w) are constant), the individual's problem is identical to one where she receives a stochastic endowment $\phi(x)$ depending on her individual state x. The only difference from a standard savings model is that the endowment is dependent on her current asset level when she is a collateral-constrained entrepreneur. The endowment of a constrained entrepreneur is uniformly bounded above by that of an unconstrained one, which is in turn assumed to be bounded above by $\pi^*(\overline{m})$. Since endowments are bounded above, once we assume CRRA preferences Proposition 4 in Aiyagari (1993) applies so that assets are also bounded above. Furthermore since the exogenous Markov process is ergodic, Assumption 1 is satisfied. Existence of a stationary RCE is a straightforward application of Proposition 5 in Aiyagari (1993), from which we can also verify that $\beta(1+r) < 1$, a standard implication of incomplete markets models.[68]

D. Welfare analysis

In this appendix I compute the utilitarian welfare gain (loss) of transitioning from the 1970 steady state to the 2000 steady state. The welfare trade-offs are explained in terms of contrasting the two frictions λ and κ.

Table D1 shows the percentage change in aggregate variables. AK, AY, AC denote the percentage change in aggregate capital, output, and consumption, respectively. TX is the percentage point change in the share of aggregate income paid as taxes between the 1970 and 2000 benchmark. AW_{SS} is the percentage increase (decrease) of consumption at all individual states in the 1970 steady state required to obtain the utility levels in the 2000 steady state, i.e. the consumption equivalent welfare gain (loss).

Transition welfare gains (losses), AW_{Tr}, are computed under several different scenarios. In the benchmark case with a sudden shock, agents are initially at the 1970 steady state. In 1971, they wake up to new tax and environmental parameters, which are identical to those from the 2000 steady state, and that they know will stay constant forever. Then AW_{Tr}

[68] Unfortunately, uniqueness is not guaranteed; nor is existence in the non-stationary case. The literature has thus far been unable to show monotonicity of the aggregate savings function, which is needed to show uniqueness; additional assumptions need to be made for existence without stationarity.

AK	AY	AC	TX	AW_{SS}	AW_{Tr}
-44.9%	-4.6%	3.3%	0.7 pp	-8.8%	1.0%∼9.3%

Table D1: Aggregate impact of change in tax code

Reference point is 1970. AK, AY, AC refer to, respectively, the percentage change in aggregate capital, output and consumption. TX refers to the percentage point change in total taxes paid as a fraction of output. AW_{SS} is consumption equivalent welfare gains across steady states and AW_{Tr} along the transition path. The lower bound 1.3% is when $[g(1), \omega_1, \kappa, \tau_0, \tau_3]$ all change linearly for 30 years, and the upper bound is when all parameters change suddenly. The new steady state is assumed to be reached in 300 years.

denotes the consumption equivalent welfare gain (loss) between the 1970 steady state and expected utility level in 1971, formally

$$\int_{ss} \sum_{t=1970}^{\infty} \beta^{t-1970} u(c_t^{ss} \cdot (1 + AW_{tr}))\mu(dx) = \int_{ss} \sum_{t=1971}^{\infty} \beta^{t-1971} u(c_t^{tr})\mu(dx).$$

The left-hand side is mean utility from increasing 1970 steady state consumption by AW_{tr} percent, and the right-hand side is mean utility induced from equilibrium consumption along the transition path, both integrated over the 1970 stationary distribution.

In Table D1, an unborn agent is -8.8% worse off under 2000 taxes across steady states, in consumption equivalent terms. There are many mechanisms underlying this number. As top entrepreneurs drop out of production, steady state capital drops by 45%. But steady state output drops by only 4%, implying that managerial production is more efficient. Although both entrepreneurial and managerial production are subject to frictions, the calibration is such that the friction κ is socially less costlier than λ since more is produced with less capital.[69] Moreover, aggregate consumption increases by 3.1%, because although less is produced, less is invested as well. By construction, tax revenues are almost equivalent in the benchmark 1970 and 2000 steady states.

In the 1970 steady state with more entrepreneurs, individuals save more both in anticipation of becoming an entrepreneur, and to overcome collateral constraints as an entrepreneur. As top entrepreneurs are crowded out, savings decline and rich managers benefit the most from the increased consumption—they earn much more but save less—and consumption inequality becomes higher. This also leads to more consumption variation in the 2000 steady state. Since risk-averse agents prefer flatter consumption plans, the increase in the mean level of consumption is countervailed by the utility loss in consumption variation, leading to a welfare loss of 8.8%.

However, as production becomes more efficient and capital is decumulated and instead

[69]Since the model has no exogenous growth, this need not necessarily mean that capital stock actually shrunk but that production became more efficient, i.e. that TFP increased.

	Benchmark 1970	Benchmark 2000	Flat Tax	$\kappa = 1$	$\lambda = 0$	$\lambda = 0$, $\kappa/2$
Wealth	27.6	33.7	32.8	42.9	19.6	21.1
Earnings	6.1	11.9	15.3	3.9	6.4	6.4
Income	14.0	16.4	18.5	26.6	5.7	5.7

Table E1: Counterfactuals.

All counterfactuals are steady state comparisons. In "Flat Tax," the flat tax rate on earnings is set so that the share of earnings paid as taxes is equal to the benchmark, 22.4% in both 1970 and 2000. For the last three columns, all other parameters are held at their 1970 benchmark values but β is always recalibrated so that the equilibrium interest rate is 4%. $\kappa = 1$ becomes a model with no managers and $\lambda = 0$ one with no entrepreneurs. The last column also has no entrepreneurs, but κ is set to half its value in 1970.

consumed, welfare increases along the transition path. When the transition occurs fast as in the benchmark case, the welfare gains are quite large at 9.3%. In a more realistic scenario in which parameters change gradually (but still with agents having perfect foresight), the speed of transition becomes slower and welfare gains smaller. When all parameters change linearly for 30 years, for example, the welfare gains are smaller, but still positive at 1%.

E. Counterfactuals

My results show that changes in tax policy can have significant effects on inequality once the earnings process is endogenized through occupational choice. It is also different from the standard span-of-control model where there is only a worker-manager choice.

To highlight the effect of tax progressivity, I conduct an experiment where I fix the earnings tax at a flat rate at 22.4%, approximately equal to the average rate in both the 1970 and 2000 benchmarks. I compare this to the benchmark 2000 case in the third column of E1.[70] Lowering progressivity beyond the 2000 benchmark leads to even higher levels of earnings and income concentration, due to an even stronger rise of top managers. Despite this, the concentration of wealth is lower than in the 2000 benchmark: There is a disconnect between the incomes and savings behavior of the rich.

From Section 5.3, we can deduce that the managers' precautionary saving motive is no longer enough to cancel out the entrepreneurial saving motive for high wealth levels. The next two columns in Table E1 labeled $\kappa = 1$ and $\lambda = 0$ confirm this. For these two experiments and also the last column, I held the parameters at their 1970 benchmark values, except β, which I always recalibrate so that the equilibrium interest rate is 4%.[71] When $\kappa = 1$, no managers can exist in equilibrium; when $\lambda = 0$, no entrepreneurs can exist. Note that when

[70] We get similar results if fix the technology parameters.

[71] One could alternatively solve for a new interest rate holding β fixed, but the results are very similar. The results are also similar if we use 2000 instead of 1970 benchmark values.

there are only entrepreneurs ($\kappa = 1$), income concentration shoots up as does the concentration of wealth.[72] Conversely, when there are only managers ($\lambda = 0$), earnings, income and wealth concentration all become significantly lower.

Thus, there is no one-to-one relationship between the concentrations of earnings and wealth: even when managers are earning very high incomes in a flat tax regime, the concentration of wealth becomes lower than when taxation is somewhat more progressive (as in the 2000 benchmark). Although in general, entrepreneurs have a higher savings incentive, what matters for these counterfactual scenarios is the magnitude at which entrepreneurs' and managers' savings incentives change *relatively*.

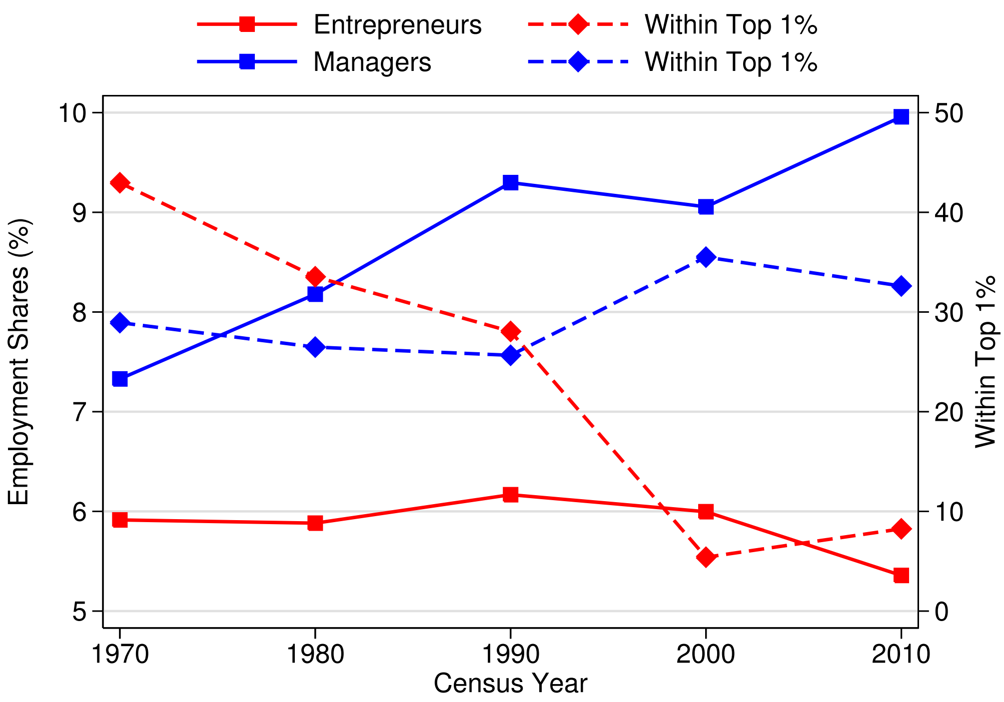
The $\kappa = 1$ and $\lambda = 0$ counterfactuals also demonstrate that previous models cannot create such a disconnect between earnings, income and wealth concentrations. When $\kappa = 1$, the model reverts to one with only entrepreneurs à la Buera and Shin (2013). In terms of my model, what this does is make income concentration even higher than the 1970 benchmark (the parameters are held at their 1970 values). Since the 1970 equilibrium is already favorable for entrepreneurs, this exercise shows that making income even more concentrated on these top entrepreneurs makes wealth concentration even higher.

When $\lambda = 0$, the model reverts to one with only managers, or individuals with extremely high earnings shocks that occur with very small probabilities à la Castañeda et al. (2003). Compared to the 1970 benchmark, this experiment eliminates all income of the entrepreneurs, in particular those who sit at the top of the income distribution, so does exactly the opposite of the $\kappa = 1$ experiment: it makes income concentration lower. As expected, the exercise shows that this leads to a sizable drop in the concentration of wealth as well.

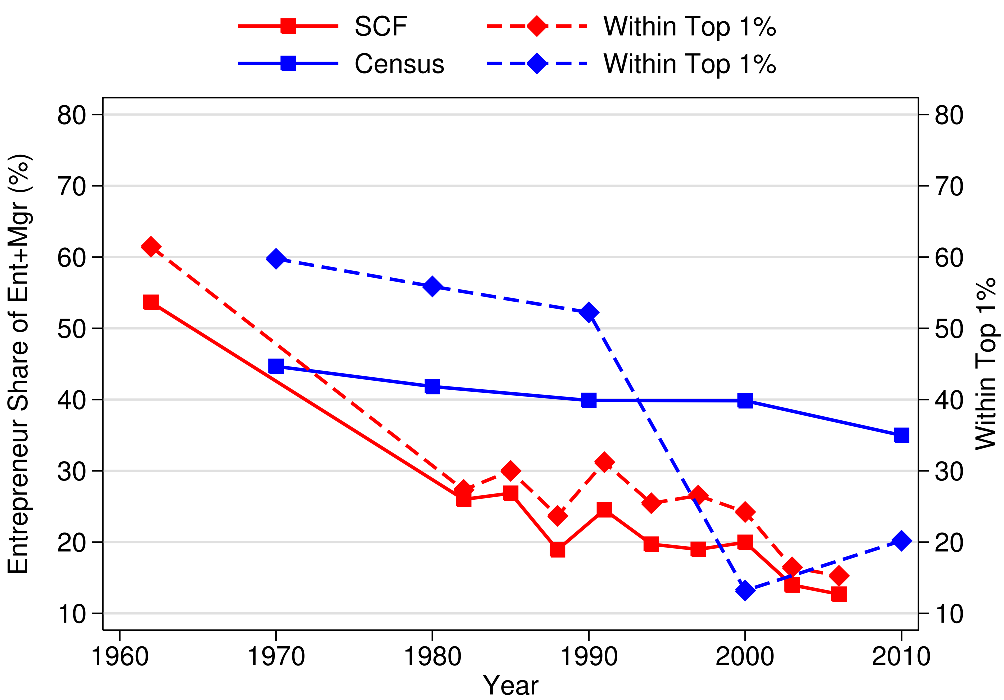
In the last column, I keep $\lambda = 0$ but change the value of κ to half its calibrated value in 1970. Compared to the preceding case, this makes the environment more favorable for managers in a world without entrepreneurs, since less of their compensation is lost: This is equivalent to increasing the "superstar shock" in extant models. Compared to the previous column, earnings and income concentration barely change, despite the newly gained advantage. The advantage manifests itself instead as a rise in the concentration of wealth, meaning larger precautionary savings.[73]

[72] In this case, earnings concentration is almost irrelevant since there are no managers.

[73] Alternatively, I could keep $\lambda = 0$ or $\kappa = 1$ and conduct a tax experiment. While not shown in the text, this has the same anticipated effects qualitatively.



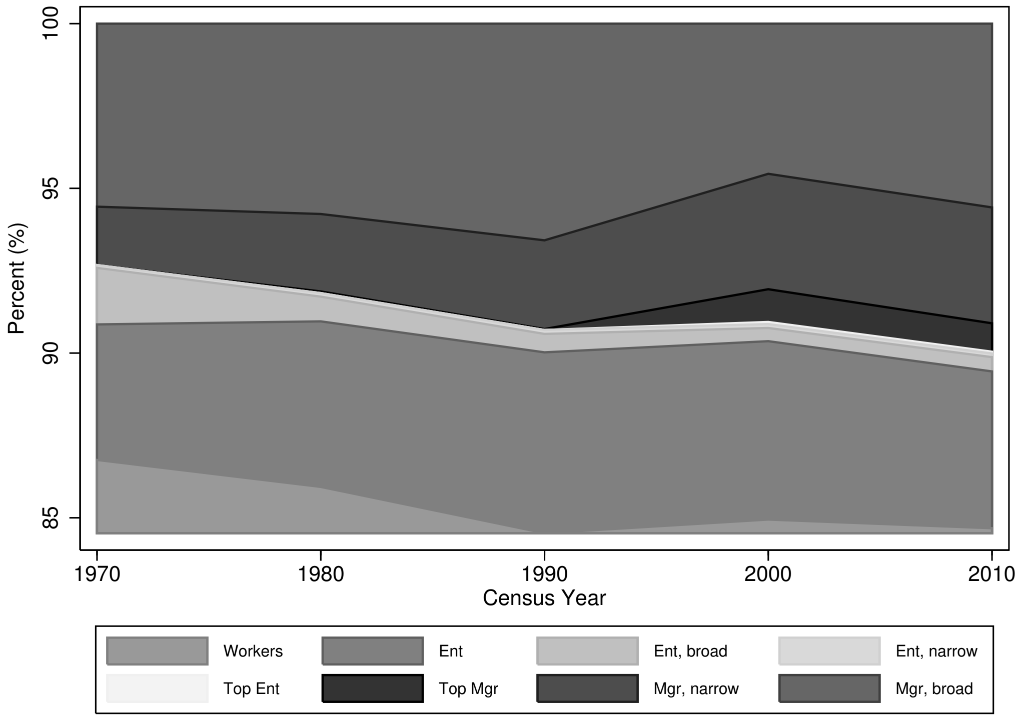
(a) Entrepreneur-Manager shares



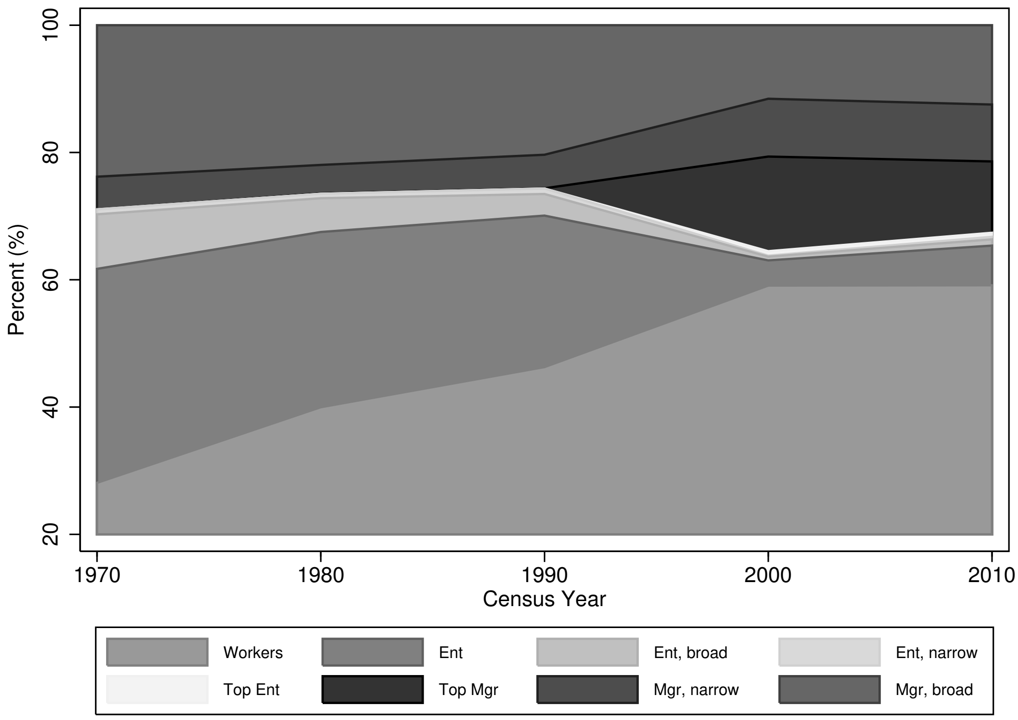
(b) Relative share of entrepreneurs

Figure A1: Occupation shares in the Census.

Left: Entrepreneur and manager shares in the census. Right: Relative share of entrepreneurs among management (entrepreneurs+managers) in aggregate and in the top income percentile, in the SCF and census.

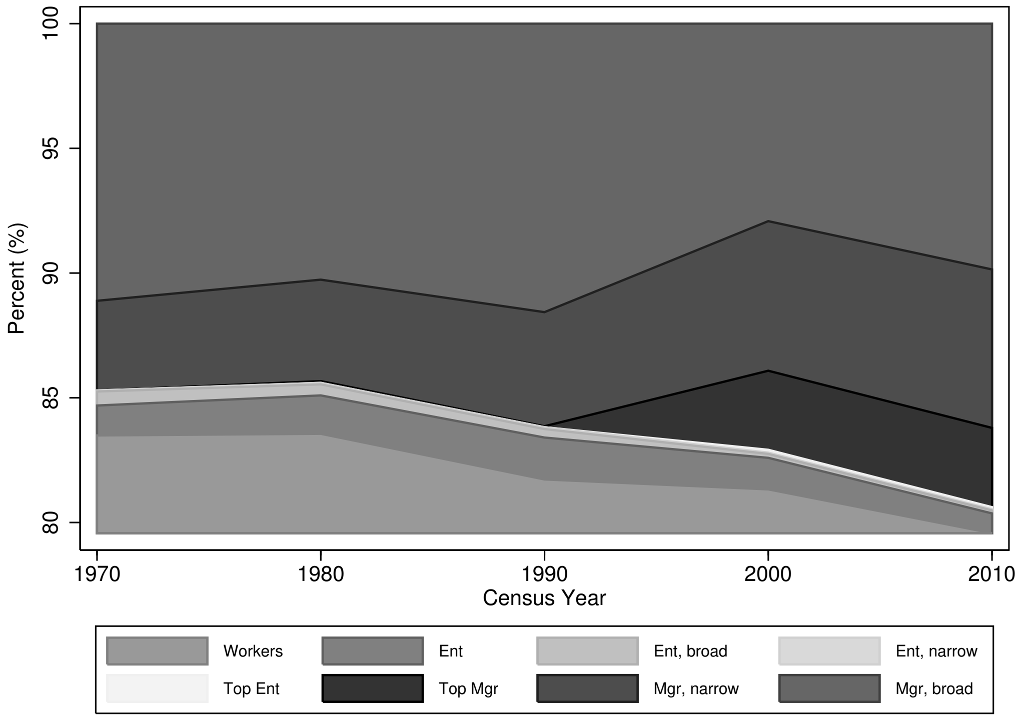


(a) Aggregate

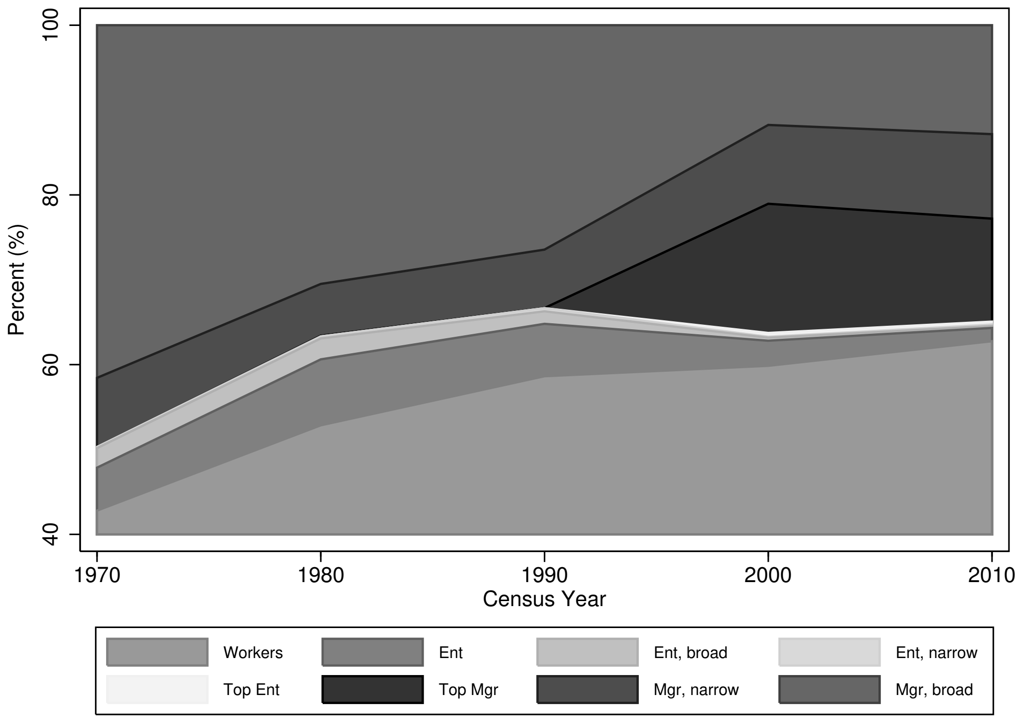


(b) Top percentile

Figure A2: Entrepreneur-Manager occupation shares.

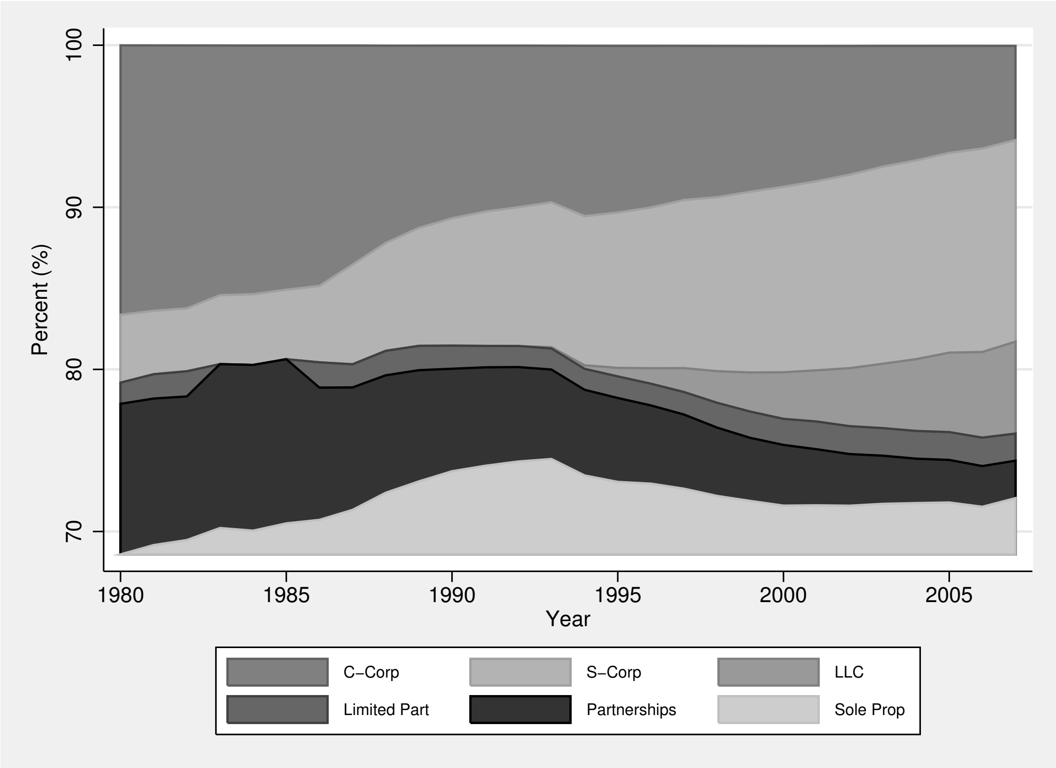


(a) Aggregate

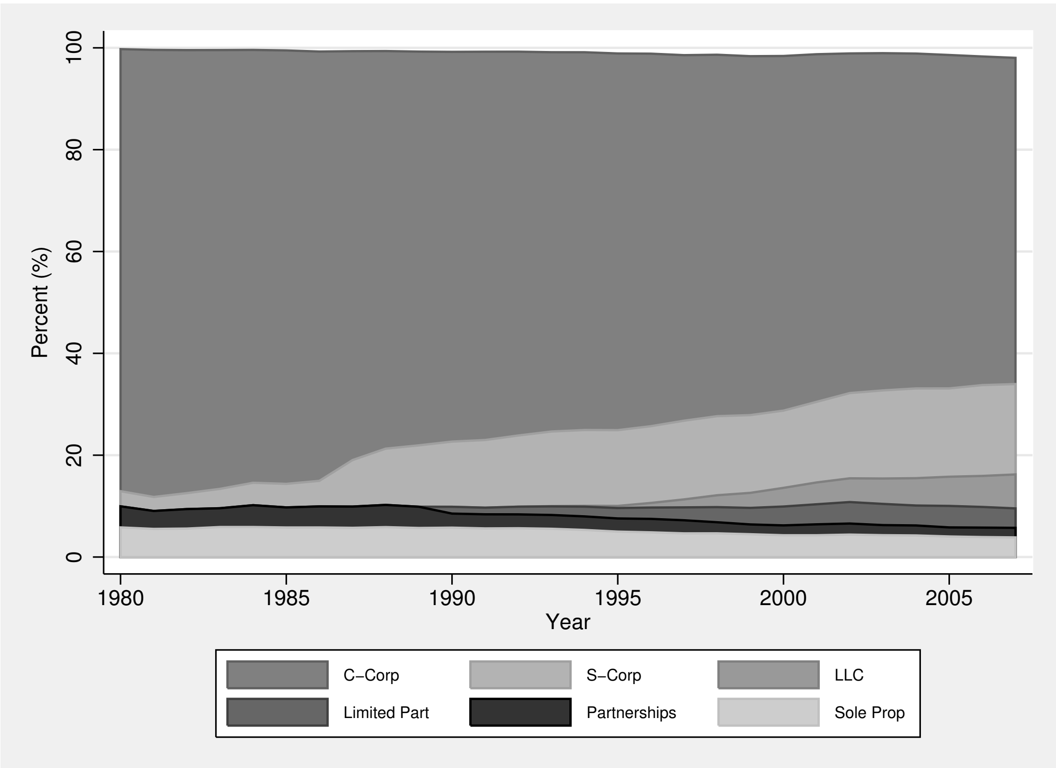


(b) Top percentile

Figure A3: Entrepreneur-Manager wage shares.



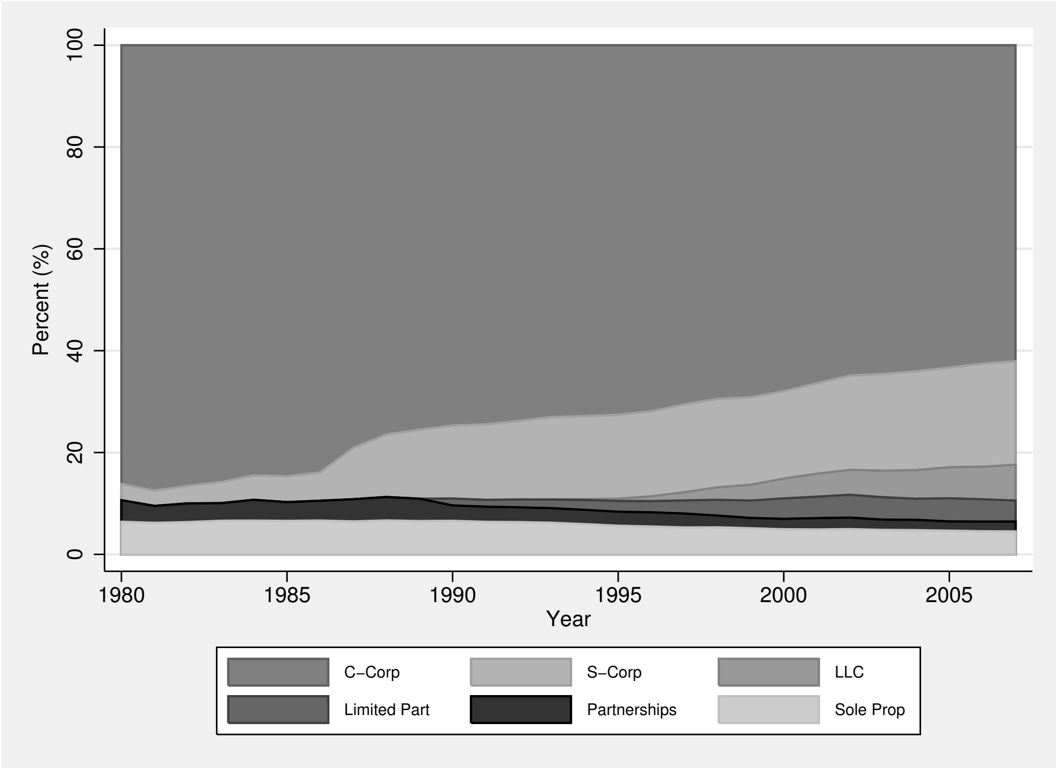
(a) Number of Returns



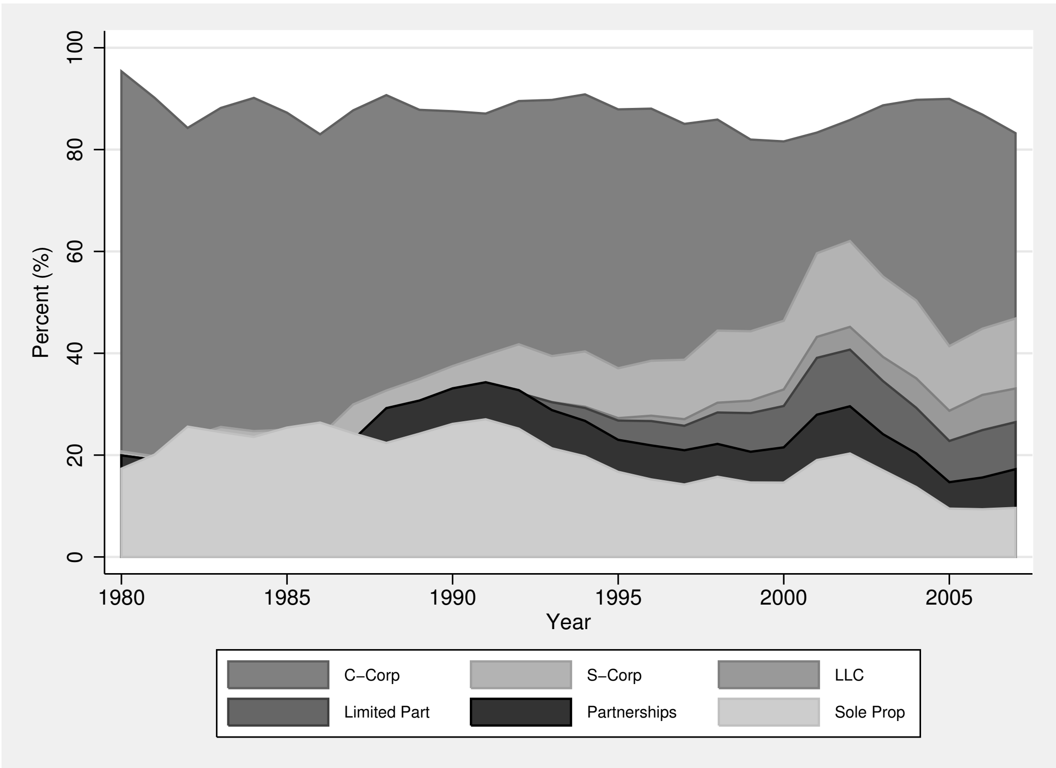
(b) Total Receipts

Figure A4: Number of returns and total recipts by type of corporation.

C-Corp, S-Corp: C- and S-Corporations. LLC: Limited Liability Company, 1993-. Limited Part: Limited Partnership, Sole Prop: Sole Proprietorships. Source: https://www.irs.gov/uac/soi-tax-stats-integrated-business-data



(a) Business Receipts



(b) Net Income (less Deficit)

Figure A5: Business receipts and net income by type of corporation.

C-Corp, S-Corp: C- and S-Corporations. LLC: Limited Liability Company, 1993-. Limited Part: Limited Partnership, Sole Prop: Sole Proprietorships. Source: https://www.irs.gov/uac/soi-tax-stats-integrated-business-data

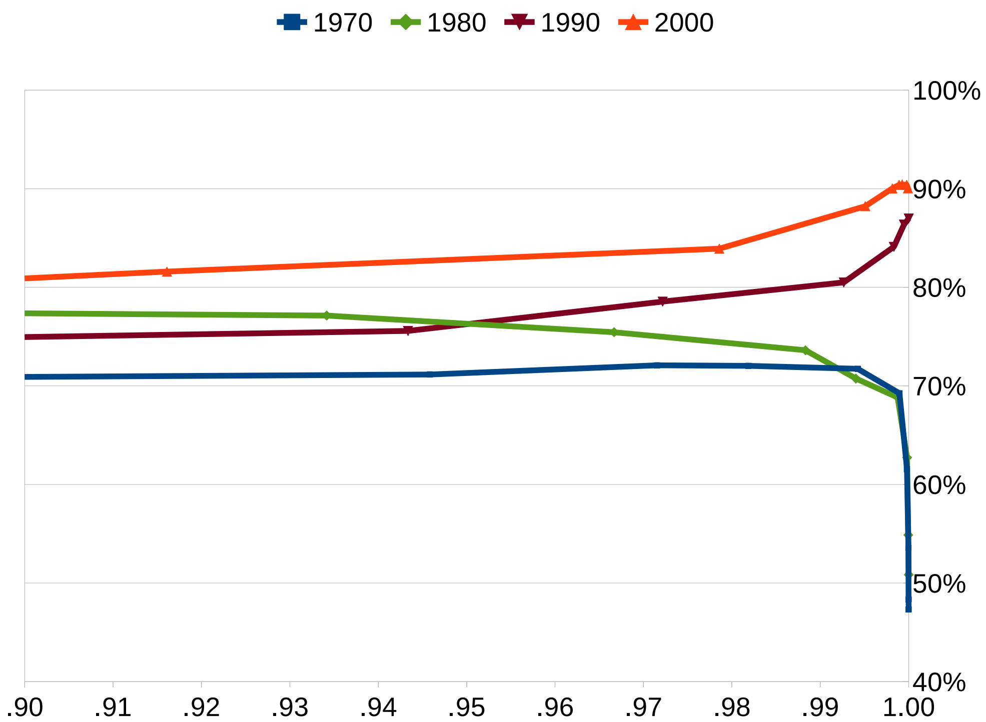
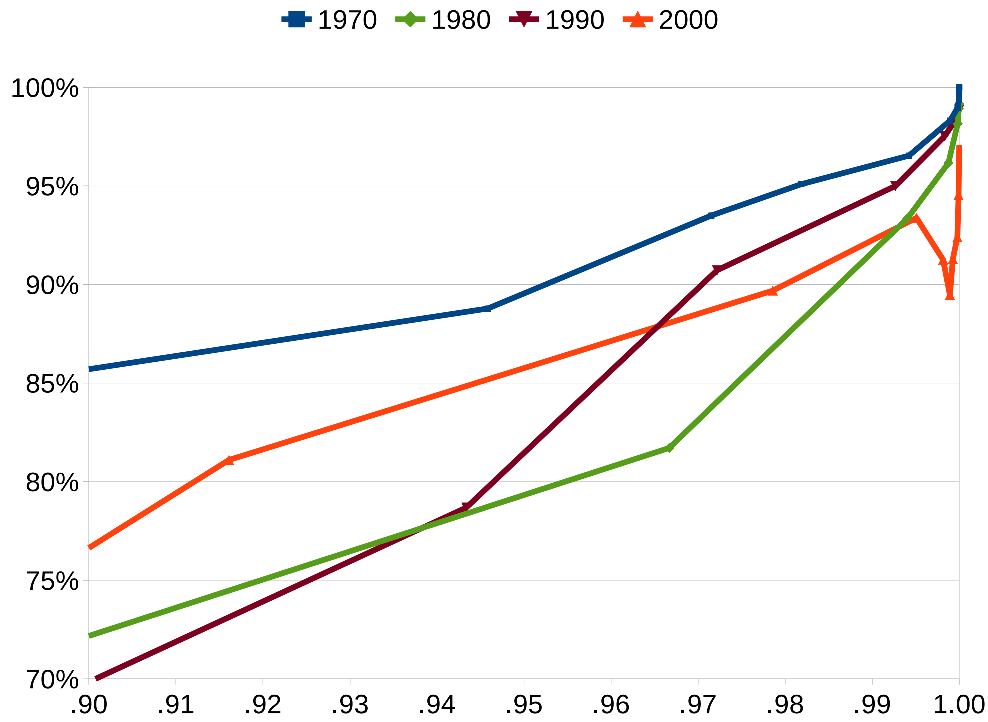
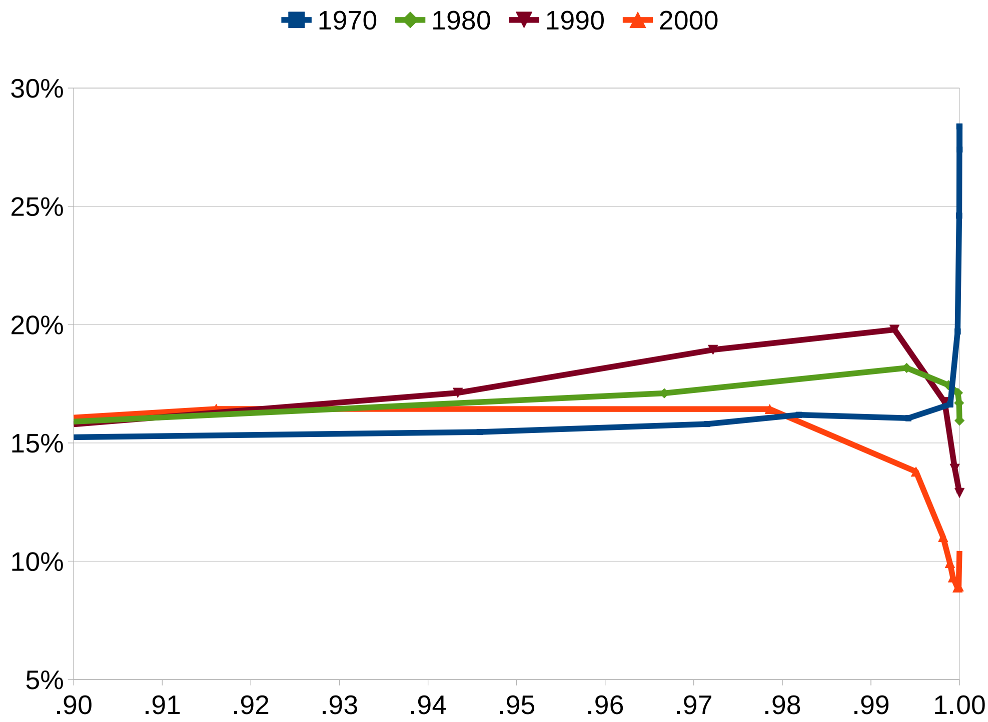


Figure B1: Fraction of taxable income by AGI percentile.

Using SOI tables publicy available from the IRS, I order groups by AGI and plot the share of AGI that is taxable. Overall, taxable income as a fraction of AGI has increased in the overall population throughout 1970-2000, and as shown in the figure especially for the top AGI percentile and higher.



(a) Fraction of itemizers by AGI percentile



(b) Fraction of AGI itemized by AGI percentile

Figure B2: Number of itemizers and itemized amounts by AGI percentile.

Groups in the publicly available SOI tables (IRS) are ordered by AGI. Panel (a) and (b) plot the fraction of tax returns that are itemized, and the size of itemized deductions as a fraction of AGI, respectively.

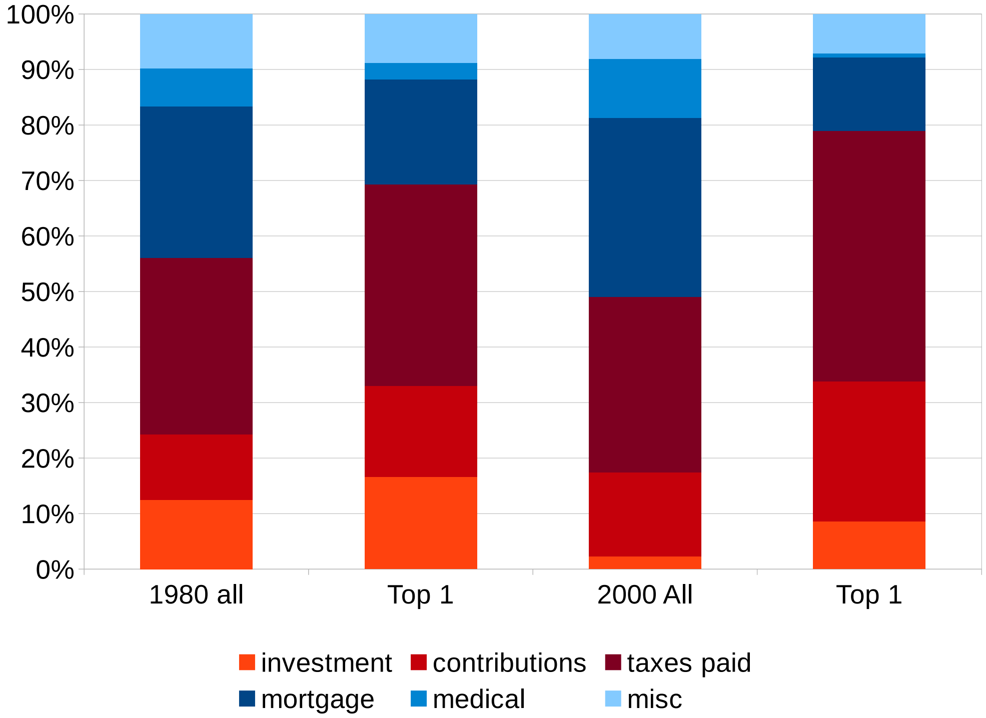


Figure B3: Itemized categories.

Using SOI tables publicy available from the IRS, I compute the amount of each itemized category as a fraction of total itemized deductions, for the entire population and the top AGI percentile. I compare 1980 with 2000 because investment deductions are not available for earlier years.