

Inequality, Tax Avoidance, and Financial Instability¹

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Abstract

We model the link between inequality, lack of political commitment, and excessive risk taking. If politicians cannot commit to a long-term tax schedule, increasing returns to tax avoidance induce the middle class to take on non rewarded financial risk despite risk aversion. Electoral pressure may lead an incumbent politician to endorse this excessive risk taking if income inequalities are large. By increasing the scope for tax avoidance, globalization of capital and human capital markets might have increased financial fragility.

"We don't pay taxes. Only the little people pay taxes."

Leona Helmsley

1 Introduction

Following the 2007-2009 crisis, substantial attention has been devoted to deciphering the build-up of risk in the U.S. financial system. Numerous studies have underlined the role played by market failures, incentive problems and regulatory loopholes within the financial and banking sectors. For instance, it is frequently argued that artificially low interest rates induced excessive risk taking by fund managers "searching for yield," a view expressed by e.g. Diamond and Rajan (2009), Rajan (2005), or Stiglitz (2010). Other studies emphasize the fact that financial institutions had poor incentives to monitor borrower quality because they were transferring risks through securitization to final investors that were subsidized or unsophisticated (Parlour and Plantin, 2008, Purnanandam, 2010, Shleifer and Vishny, 2010). Yet, for others, the belief that the Fed would bail out "too big" or "too many to fail" institutions triggered excess exposure to common risk factors (see e.g. Fahri and Tirole, 2011). Such excessive risk taking was facilitated by lax prudential supervision, and by the spectacular growth of a largely unregulated "shadow banking" sector.

Overall, these analyses point at sources of financial instability that are *internal* to the financial sector. Without denying their key role in the unfolding of the crisis, this paper focusses on sources of instability that are *external* to the financial system. We aim at putting financial instability in a broader perspective than that of the financial sector. Namely we show that political economy frictions may generate a demand for inefficient risk taking in the face of rising inequality. In our framework, the high level of risk undertaken by U.S. citizens collectively can be interpreted as the equilibrium outcome of imperfect taxation and political forces. In particular, we uncover a link between the increase of inequality and the build-up of financial risk. In doing so, our paper joins the voices of several scholars who have underlined a potential causal channel between inequality and financial fragility (see e.g. Rajan, 2010 and Krugman, 2010).

The distribution of pre-tax income and wealth should in principle be irrelevant, unless redistribution is plagued by important frictions. Our model builds on such frictions. We consider an endowment economy populated by agents with identical preferences. Utilitarian welfare is thus maximal when transfers equate consumption across agents. Our first departure from this

first-best is the introduction of a tax avoidance technology with increasing returns to scale. This limits the taxation of the most affluent agents. Section 2 motivates this assumption of increasing returns to scale for legal and quasi-legal tax avoidance. We fully solve a Mirrlees program in the presence of such tax avoidance. The optimal tax scheme features a convex kink in the mapping of gross to net wealth: Taxes are regressive for the wealthiest.

Second, we assume that individuals in this economy have the ability to add risk to their endowments, and that the tax authority cannot commit to a tax scheme before such risk-taking decisions are made. The expectation of an *ex post* optimal tax scheme that is regressive for the wealthiest creates a demand for inefficient risk taking. Some members of the middle class are willing to add risk to their consumption without being compensated for it by a positive risk premium. We fully characterize this demand for excessive risk taking, and the resulting erosion of the middle-class.

In sum, the combination of increasing returns to tax avoidance and taxation with limited commitment creates a strong relationship between inequality and excessive risk taking. The anticipation of important post-tax inequality induces individuals to take excessive risk, and this in turn endogenously increases pre-tax inequality.

We also offer an extension of the model in which taxation power accrues to the winner of an election between an incumbent politician and a challenger. The incumbent politician has the ability to ban excessive risk taking by individuals before voting takes place. We show that if, however, voting has a retrospective component (as is empirically observed), then the incumbent politician may prefer to endorse inefficient risk taking. We interpret such an endorsement as the adoption of lax financial regulation and prudential supervision. The right tail of pre-tax wealth distribution drives the politician's decision. In the presence of important inequalities in the form of a fat right tail, the politician endorses excessive risk taking because the bulk of the risk takers take bets with a high probability of success. This will induce them in turn to vote for him with a high probability. If, conversely, wealth distribution is more even, then the incumbent prefers to discourage the electorally costly long-shot bets that the middle class would otherwise contemplate. Thus this political friction creates an additional link between inequality and excessive risk taking, whereby high pre-tax inequality may induce the official endorsement of inefficient gambles for electoral reasons.

Related literature. Kumhof and Ranciere (2011) also model a link between inequality and financial instability. In their model, higher inequality implies that the poor borrow more from the rich. Thus financial intermediaries have larger balance sheets, which entails larger shocks when (exoge-

nous) crises occur. Their focus is the on time series of consumption and savings in an economy without a government. By contrast, we introduce fiscal and prudential authorities, and study how inequality endogenously distorts their incentives.

Surprisingly, the optimal taxation literature based on the Mirrleesian approach has devoted very little attention to *ex post* moral hazard in the form of tax avoidance. Exceptions include Casamatta (2010) and Grochulski (2007). Grochulski (2007) shows that when the tax avoidance technology has increasing returns to scale, the optimal tax scheme deters tax avoidance. Casamatta (2010) shows that this is no longer true when marginal returns to avoidance decrease. Our paper is the first, to our knowledge, to fully solve for the optimal tax scheme in the presence of increasing returns to tax avoidance.

Finally, our paper also relates to the literature that studies Mirrleesian taxation when the tax authority cannot commit. Recent contributions include Acemoglu, Golosov, and Tsyvinski (2009), and Farhi, Sleet, Werning, and Yeltekin (2011).

2 Increasing Returns to Tax Avoidance: Some Motivation

Tax evasion may pertain either to outright tax fraud, or to tax avoidance - the minimization of one's tax liabilities by legal or quasi-legal means. This paper focusses on the latter. Arguably, such tax avoidance involves important fixed costs that generate increasing returns to scale. A major source of tax avoidance is the transformation of labor income into capital income (dividends or capital gains), which allows to avoid payroll and wage taxes. The ability of private equity and hedge fund managers to structure their pay as carried interest, which is taxed as dividends, is an example of such legal avoidance. This form of tax avoidance involves significant fixed costs associated with the setup of a business entity to collect dividend income rather than wages, or with the compensation of tax lawyers. If such fixed costs exist, people who have high incomes are more likely to pay their taxes as capital income. Consistent with this, there is substantial evidence that at the top of the distribution, individuals' income includes a disproportionate fraction of capital and business income (see e.g. Piketty and Saez (2007)).

A second important form of tax avoidance consists of international tax arbitrage, by locating assets or establishing residence in low-tax countries. Increasing returns to scale also seem natural in this case: Transportation and

legal costs have an important fixed component. Exploiting inconsistencies in international accounts, Zucman (2010) estimates that 8% of total household financial wealth is held in tax havens. Using data on the geographic mobility of soccer players, Kleven, Landais and Saez (2010) document a very high elasticity of location choice to taxes at the top of the distribution.

Notice that tax avoidance may be a major force shaping the tax code, and yet be limited in practice if the designers of fiscal policies take tax avoidance constraints into account (as they do in our model). In this case, increasing returns to tax avoidance may, as our model predicts, directly translate into regressive taxes for the most affluent. The U.K. tax code offers a striking example of such regressivity: Eligible individuals (e.g., foreign residents) can claim the non-U.K. domicile tax status against a lump sum payment of £50,000. This status entails that no income earned outside the U.K. is reportable to nor taxed by the U.K. tax authorities. Landais, Piketty, and Saez (2011) show that in France, income taxes have become regressive above the 5% top income quantile. Analyzing detailed consumer survey data in Germany, Lang, Norhass, and Stahl (1997) show that the difference between legislated and effective tax rates increases with respect to income, and that a sizeable fraction of it is due to the exploitation of legal tax write-offs.

3 Increasing Returns to Tax Avoidance and The Mirrlees Problem

Consider a one-date economy populated by a continuum of individuals with unit mass. There is a single consumption good. Individuals consume positive quantities, and have identical preferences represented by an increasing and strictly concave utility function u such that $u'(0) = +\infty$, $\frac{u(y)}{y} \xrightarrow{y \rightarrow +\infty} 0$. Individuals differ only with respect to their endowments of the consumption good ("wealth"). All endowments are positive. Let $F(\cdot)$ denote the wealth distribution, which is common knowledge. We suppose that

$$\int_0^{+\infty} w dF(w) < +\infty,$$

and that the support of the distribution is equal to $[0, +\infty)$. The assumption of an unbounded support is only meant to simplify the discussion. That the support is an interval is the substantial (and arguably realistic) part of the assumption.

A social planner seeks to maximize utilitarian welfare. The social planner faces an informational friction. Each individual privately observes its

endowment, and can secretly consume all or part of it before reporting the residual. An individual who reports only y units out of a total endowment of x secretly consumes $G(x, y)$, where G is continuous, and satisfies

$$x \geq y \geq 0 \rightarrow 0 \leq G(x, y) \leq x - y. \quad (1)$$

In words, only a fraction of the wealth that is diverted is available for consumption, and the residual $x - y - G(x, y)$ (possibly equal to zero) is wasted. This secret consumption adds up to the amount that the individual receives after the social planner redistributes the reported fraction of aggregate wealth.

In application of the Revelation Principle, one can write down the planner's problem using only direct mechanisms. A direct mechanism is a pair of functions of wealth $(r(w), v(w))$ such that an individual with wealth w has the incentive to report $r(w) \in [0, w]$, and receives $v(r(w))$ from the social planner after doing so. The social planner solves the program (φ) :

$$\begin{aligned} & \max_{r, v} \int_0^{+\infty} u(v(r(w)) + G(w, r(w))) dF(w) \\ & \text{s.t.} \begin{cases} \int_0^{+\infty} v(r(w)) dF(w) \leq \int_0^{+\infty} r(w) dF(w), \\ \forall w, w' \geq 0 \text{ s.t. } r(w') \leq w, \\ v(r(w)) + G(w, r(w)) \geq v(r(w')) + G(w, r(w')). \end{cases} \end{aligned} \quad (2)$$

The first inequality in (2) is the resource constraint of the planner. The other inequalities are incentive-compatibility constraints, ensuring that individuals truthfully report their types (which of course does not necessarily imply that they report their entire wealth). We show that the solution to this program (φ) is very simple when the losses from wealth diversion are subadditive:

Proposition 1

Suppose that for all $x \geq y \geq z \geq 0$,

$$G(x, y) + G(y, z) \leq G(x, z). \quad (3)$$

Then the solution to (φ) is attained with (r^, v^*) defined as*

$$\begin{cases} r^*(w) = w, \\ v^*(w) = G(w, 0) + \int_0^{+\infty} (t - G(t, 0)) dF(t), \end{cases} \quad (4)$$

Proof. See the Appendix. ■

First, Proposition 1 states that there is no tax avoidance in equilibrium. This result was first established in Grochulski (2007). This is a direct consequence from (3). The intuition is that any incentive-compatible tax scheme that implies some diversion can be replaced by a more efficient one that entails no diversion. To see this, suppose that a mechanism (r, v) implies $\int r(w)dF(w) < \int wdF(w)$. Then the social planner might as well devise a new scheme whereby an individual with wealth w reports w and receives $v(r(w)) + G(w, r(w)) + \varepsilon$ for $\varepsilon > 0$ sufficiently small. We have

$$\begin{aligned} v(r(w)) + G(w, r(w)) &\geq v(r(w')) + G(w, r(w')), \\ &\geq v(r(w')) + G(w', r(w')) + G(w, w'). \end{aligned}$$

The first line stems from the incentive-compatibility of (r, v) , the second one from (3). This second inequality means that this new mechanism is also incentive-compatible. It is Pareto improving since the wealth destruction induced by tax avoidance disappears.

Second, Proposition 1 exhibits the most redistributive scheme among all "avoidance-free" ones. It simply consists in making every individual indifferent between reporting its entire income or none of it.

4 Limited Commitment, Increasing Returns to Tax Avoidance, and Excessive Risk Taking

We enrich the previous model as follows. The economy now has two dates, 0 and 1. Individuals receive their endowment at date 0. They value only consumption at date 1. Let F_0 denote the date-0 wealth distribution, which is assumed to have full support over $[0, +\infty)$. A risk-free storage technology with unit return is available to all individuals for the transfer of their endowment from date 0 to date 1. A fraction $f \in (0, 1)$ of the population may also add to this risk-free return a diversifiable (and thus not rewarded) risky return with any unit-mean distribution. To simplify the discussion, we assume that this fraction f has the same initial wealth distribution F_0 as that of the overall population. The social planner does not observe individual risk-taking decisions. Critically, we suppose that the social planner cannot credibly commit to a date-1 tax scheme at date 0. Thus taxation is only *ex post* optimal at date 1, at which the social planner observes the realized endowment distribution F_1 and announces a tax scheme.

For simplicity, we also specify the tax avoidance technology as follows. We assume that two tax avoidance technologies are available to individuals.

The first one dissipates a fixed fraction $\lambda \in (0, 1)$ of each diverted unit of consumption. The second one wastes only $\lambda - \Delta\lambda \in (0, \lambda)$ out of each diverted consumption unit, but comes at a fixed cost $c\Delta\lambda > 0$ per individual. In sum, we assume that

$$G(x, y) = g(x - y),$$

with

$$g(x) = (1 - \lambda)x + \mathbf{1}_{\{x \geq c\}}\Delta\lambda(x - c).$$

Remarks.

1. The lotteries that are available to a fraction the population can be interpreted literally as financial-risk taking, such as taking on mortgages with very high loan-to-value ratios or with deferred amortization (e.g., interest only or balloon mortgages). Also, the main lever available to many individuals willing to add risk to their future consumption consists of generating riskier returns to their human capital. Opting for a career in the financial services or consulting industries, or becoming self-employed may generate such risk increases.
2. We focus on idiosyncratic bets with unit return for two reasons. First, as a result, "excessive risk taking" is simply and clearly defined in our model as the addition of a fair lottery to a safe endowment by a risk-averse agent. Second, it delivers sharp insights into the type of risk distributions that households demand. Section 6 discusses alternative modellings of the supply of risk.

We solve for the subgame perfect equilibria of this economy. An equilibrium is characterized backwards as follows:

- The social planner announces an optimal redistribution scheme after observing the date-1 wealth distribution F_1 .
- Rationally anticipating the realization of F_1 and the planner's decision, each individual i with risk-taking ability optimally chooses the risk profile of her storage technology.
- F_1 is consistent with the risk profiles chosen by the individuals.

Since F_0 has full support over $[0, +\infty)$, then so must F_1 since $f < 1$. Thus, Proposition 1 applies at date 1. This means that upon observing F_1 , the social planner simply implements the scheme

$$v(w) = g(w) + \int_0^{+\infty} (u - g(u)) dF_1(u). \quad (5)$$

We now need to solve for the optimal risk-taking of an individual who can store with risk at date 0 given her endowment and beliefs about F_1 . Such an individual $i \in [0, 1]$ with initial wealth w_i faces the following problem:

$$\begin{aligned} \sup_{\mu \in B} \int_0^\infty u(v(w)) d\mu(w) \\ \text{s. t. } \int_0^\infty w d\mu(w) = w_i, \end{aligned} \quad (6)$$

where B is the set of Borelian probability measures over $[0, +\infty)$. Notice that F_1 enters in (6) only to determine the constant term in v . The dual of problem (6) takes the following form:

$$\begin{aligned} \inf_{(z_1, z_2) \in \mathbb{R}^2} z_1 + w_i z_2 \\ \text{s. t. } \forall w \geq 0, z_1 + w z_2 \geq u(v(w)). \end{aligned}$$

In words, the dual problem minimizes the value at w_i of a straight line that is above the graph of $u \circ v$. Proposition 1 in Makarov and Plantin (2011) shows that the solutions to the primal and dual problems coincide. It is then easy to derive graphically the solution to the dual problem for a given arbitrary distribution F_1 . Recall that v is linear everywhere except for a convex kink at c . Refer to Figure 1.

Figure 1 here

The concavification of $u \circ v$ - that is, the smallest concave function above $u \circ v$, is equal to $u \circ v$ outside $[\underline{w}, \bar{w}]$, and is the chord between $(\underline{w}, u(v(\underline{w})))$ and $(\bar{w}, u(v(\bar{w})))$ over $[\underline{w}, \bar{w}]$.¹ The dual problem is solved with the tangent of $u \circ v$ outside $[\underline{w}, \bar{w}]$ and with this chord otherwise. Thus,

$$\begin{cases} S(w_i) = u(v(w_i)) \text{ if } w_i \notin (\underline{w}, \bar{w}), \\ S(w_i) = \frac{w_i - \underline{w}}{\bar{w} - \underline{w}} u(v(\bar{w})) + \frac{\bar{w} - w_i}{\bar{w} - \underline{w}} u(v(\underline{w})) \text{ if } w_i \in (\underline{w}, \bar{w}). \end{cases}$$

This means that individuals who can add risk to the risk-free return do not do so when $w_i \notin (\underline{w}, \bar{w})$, while the others enter into fair binary bets that pay either \bar{w} or \underline{w} with probabilities that depend on w_i . Refer to Figure 2.

Figure 2 here

¹More precisely, the existence and shape of the concavification of $u \circ v$ stems from the concavity of u , the piecewise linearity of v , and the fact that $u'(0) = +\infty$, $\frac{u(y)}{y} \xrightarrow{y \rightarrow +\infty} 0$.

This solution to investors' problem given F_1 ensures that a candidate equilibrium F_1 must be such that there exists $\underline{W} < c < \overline{W}$ such that

- F_1 coincides with F_0 over $[0, \underline{W})$ and $(\overline{W}, +\infty)$;
- F_1 adds a mean preserving spread to F_0 over $[\underline{W}, \overline{W}]$. Namely, denoting μ_F the measure induced by a c.d.f. F ,

$$\mu_{F_1}((\underline{W}, \overline{W})) = (1 - f)\mu_{F_0}((\underline{W}, \overline{W})),$$

and the residual mass $f\mu_{F_0}((\underline{W}, \overline{W}))$ is split into two atoms of F_1 , in \underline{W} (with mass $f \int_{(\underline{W}, \overline{W})} \frac{\overline{W}-w}{\overline{W}-\underline{W}} dF_0(w)$) and \overline{W} (with mass $f \int_{(\underline{W}, \overline{W})} \frac{w-\underline{W}}{\overline{W}-\underline{W}} dF_0(w)$).

An equilibrium is then such that $\underline{w} = \underline{W}$ and $\overline{w} = \overline{W}$, where $(\underline{w}, \overline{w})$ is defined above as the interval over which the concavification of $u \circ v$ (for this given F_1) is linear. Standard compactness and continuity arguments ensure that the mapping from a pair $(\underline{W}, \overline{W})$ into a pair $(\underline{w}, \overline{w})$ has a fixed point, so that there exists at least one equilibrium. Further, that $u'(0) = +\infty$, $\frac{u(y)}{y} \xrightarrow{y \rightarrow +\infty} 0$ ensures that all equilibrium pairs $(\underline{w}, \overline{w})$ are included in a compact subset of $(0, +\infty)$. The following proposition collects these results.

Proposition 2

There exists an equilibrium. There exists $m, M > 0$ such that each equilibrium is fully characterized by two wealth levels \underline{w} and \overline{w} satisfying $m < \underline{w} < c < \overline{w} < M$. In this equilibrium, each individual with the ability to take risk does so if and only if its initial wealth w belongs to $(\underline{w}, \overline{w})$. In this case it invests with binary payoffs $\{\underline{w}; \overline{w}\}$. The high payoff has probability $\frac{w-\underline{w}}{\overline{w}-\underline{w}}$. All other individuals invest in the risk-free technology. This implies that F_0 dominates F_1 in the sense of second-order stochastic dominance, and that a fraction f of individuals with initial wealth within $(\underline{w}, \overline{w})$ is transformed into individuals with wealth levels \underline{w} or \overline{w} .

Proof. See above. ■

While we are unable to establish equilibrium uniqueness in general, we offer in Proposition 2 a qualitative description of all equilibria that has interesting empirical content. Refer to Figure 3.

Figure 3 here

In all equilibria, there is an interval of the wealth distribution containing c in which a fraction f of the distribution is relocated at the two boundaries of the interval between dates 0 and 1. We interpret this as a "shrinking middle-class" phenomenon. People belonging to this "middle class" are risk-averse

with respect to their post-tax endowment, but risk-loving with respect to their pre-tax ones because of the convex kink in the tax code. Increasing returns to tax avoidance thus have an impact on *gross* inequality because they induce riskier behavior.

Evidence suggests that the level of idiosyncratic risk taken by individuals has actually risen over the last thirty years. Dynan et al. (2008) investigates the volatility of household income using household level data from the PSID, and find that the standard deviation of time changes in household-level income rose by a third from the early 1970s to the early 2000s (see also Krueger and Perri (2004)). They show that this rise of household income volatility is due to a greater frequency of very large income changes. Our model provides a link between less progressive taxes and such increased individual risk taking.

Notice that the assumption of a kink in c implies that $\bar{w} - \underline{w}$ is bounded away from 0 over all equilibria. If alternatively the function g was continuously differentiable, then the occurrence of risk shifting would depend on the relative curvatures of g and u . Regressive taxes at the top would not necessarily imply inefficient risk-taking by risk-averse agents. Obvious comparative statics analysis yields that the lower and upper bounds for $\bar{w} - \underline{w}$ increase when, other things equal, households are less risk-averse and/or $\Delta\lambda$ is larger.

The Value of Commitment

It is instructive to compare this situation of limited commitment with that in which the social planner can announce a tax scheme at date 0, and credibly commit to it at date 1. In order to get insights into the value of commitment, suppose that the social planner commits at date 0 to the tax scheme $z(\cdot)$ defined as follows. Denote F_1 the date-1 wealth distribution associated with the equilibrium that delivers the largest utilitarian welfare among all possible equilibria without planner's commitment described in Proposition 2. For this equilibrium, denote \tilde{w} the random date-1 pre-tax wealth of an individual with date-0 wealth w . If the individual does not gamble in this equilibrium, then \tilde{w} is deterministic, equal to w . If an individual with initial wealth w gambles, then \tilde{w} is a binary variable taking values $\{\underline{w}; \bar{w}\}$ with mean w . Let

$$z(w) = u^{-1} \left(E \left(u \left(g(\tilde{w}) + \int_0^{+\infty} (t - g(t)) dF_1(t) \right) \right) \right)$$

Notice that $u \circ z$ is equal to the concavification of $u \circ v$. Thus scheme z does not induce risk shifting at date 0 since it is concave by construction.

Further, we have

Lemma 3

The scheme z satisfies constraints (2) with $F = F_0$ and $G(x, y) = g(x - y)$. The resource constraint does not bind.

Proof. See Appendix. ■

Since the resource constraint does not bind with such a scheme z , it means that the social planner can strictly improve welfare by adding to z a constant transfer per individual so that the resource constraint binds. Thus, commitment power has strictly positive social value. Further, since scheme z satisfies constraints (2), it is strictly less efficient than the scheme that would prevail absent any possibility for individuals to gamble $g(w) + \int_0^{+\infty} (u - g(u)) dF_0(u)$. This readily implies

Proposition 4

Let S_0, S_1, S_2 denote the respective utilitarian welfares when the social planner cannot commit to a tax scheme, can commit to a tax scheme, and can ban risk taking (in which case commitment power is immaterial). We have

$$S_2 > S_1 > S_0.$$

Proof. See above. ■

The intuition behind these results is the following. When taking risk, a given individual improves her own situation given the tax scheme, but fails to internalize a negative externality that she creates for other individuals. This externality stems from the fact that a riskier date-1 wealth distribution (in the sense of second order stochastic dominance) implies that the date-1 tax scheme is less redistributive: Gambling reduces the expected fraction of one's date-1 wealth that is available for redistribution. A social planner with commitment power can alleviate this issue by offering a scheme such as z that deters risk taking. The idea behind scheme z is that the social planner implements himself through the tax scheme the concavification of $u \circ v$ that individuals realize themselves through costly gambles absent commitment. This is welfare improving, but still comes at the cost that the social planner cannot redistribute as much as he would absent gambling.

5 Inequality and Lax Prudential Regulation

The goal of this section is to exhibit plausible political-economy frictions under which a self-interested politician endorses excessive risk taking at date

0, even though he has the ability to ban it in principle. Our main result is that a retrospective component in voting generates such a behavior provided pre-tax inequalities are sufficiently large. Thus, while the previous sections emphasized the impact of excessive risk taking on inequality, we suggest here that inequality may in turn pave the way towards lax risk regulation and excessive risk taking.

We enrich the previous model as follows. We suppose that date-1 taxation power accrues to the winner of an election. Two politicians, an incumbent and his challenger, face off in a date-1 election. After F_1 is realized, they each announce a platform comprised of a redistribution scheme, and individuals vote according to criteria that we shall describe shortly. At date 0, the incumbent can decide in favor of or against the ban of risk taking.² Politicians maximize the probability of winning the election.

An important lever available to governments willing to control risk taking by society is financial regulation, in particular the prudential regulation of financial intermediaries. It consists mainly in fairly technical rules for which "the devil is in the details." These crucial details are typically not subject to parliamentary approval, nor much discussed in the public debate. For example, before the 2008 crisis erupted, how to treat the liquidity options granted by banks to their SIVs, or how to determine bank capital requirements for AAA structured products were questions discussed mainly among small groups of officials and experts, even though they directly determined the effective leverage of banks. Accordingly, we assume that the incumbent politician has a free hand at making a discretionary regulatory choice at date 0.

Voting Behavior

We adopt a probabilistic voting framework. We index by 1 the incumbent politician and by 2 his challenger, and denote by v_j each redistribution scheme, where $j \in \{1; 2\}$. Individual $i \in [0, 1]$ votes for the incumbent if

$$u(v_1(w_i)) - u(v_2(w_i)) + \tilde{\delta}_i + \tilde{\varepsilon} > 0, \quad (7)$$

He votes for the challenger if inequality (7) is reversed, and tosses a fair coin otherwise. The shock $\tilde{\varepsilon}$ is a popularity shock that is drawn at date 1 from a uniform distribution over $[-\Gamma, \Gamma]$. The shock $\tilde{\delta}_i$ is individual-specific.

We add a novel component to this otherwise standard probabilistic-voting framework by assuming that $\tilde{\delta}_i$ is determined retrospectively. Our goal here is to show in the simplest fashion how a retrospective component in voting creates a link between wealth inequality and lax risk regulation.

²We discuss a larger space of regulatory choices later.

Accordingly, we posit a simple form of retrospective voting. We determine $\tilde{\delta}_i$ as follows. First, if an individual i willing to take risk is banned from doing so, then $\tilde{\delta}_i = -\mu$, where $\mu > 0$. This popularity cost may capture lost campaign financing from the industry that manufactures gambles. Second, in case of gambling, $\tilde{\delta}_i$ is equal to $\delta > 0$ if i 's gross endowment increases between dates 0 and 1, and to $-\delta$ if it decreases.

Retrospective voting is an empirical regularity within many electoral contexts, in particular in U.S. national elections (see, e.g., Fiorina, 1978, Kramer, 1971). Here, we posit it as an exogenous behavioral trait, along the lines of Nordhaus (1975) or Lindbeck (1976). In line with our modelling, Healy et al. (2010) or Wolfers (2007) offer recent evidence suggesting that shocks that are unrelated to an incumbent politician's ability or effort affect its probability of reelection. An interesting alternative modelling would consist in justifying retrospective voting as a disciplining device a la Barro (1973), or as a vote on competence as in Rogoff and Sibert (1987)).³

Suppose that u is bounded above and that

$$\Gamma > \sup u + \sup \{\delta, \mu\}. \quad (8)$$

We study subgame-perfect equilibria. More precisely, an equilibrium can be described backwards as follows:

- At date 1, after observing history (in particular the realization of F_1) politicians announce platforms that constitute a Nash equilibrium, and voting takes place.
- Rationally anticipating these platforms, individuals make risk-taking decisions at date 0 if they are allowed to do so.
- Initially, the incumbent optimally chooses to ban risk taking or not, trading off the expected costs associated with each decision.

Working our way recursively, we have the following results. First, at date 1, after F_1 is determined, condition (8) classically implies that the unique Nash equilibrium is that politicians offer identical platforms that maximize utilitarian welfare. Thus they both propose the same scheme (5). Given this, equilibrium risk-taking decisions are characterized by Proposition 2. It remains to pin down the incumbent's initial regulatory decision. This could be problematic absent uniqueness of the equilibrium outcome of the risk-taking game. The properties of equilibria established in Proposition 2 suffice, however, to generate insights into what drives the deregulation of

³This would require the additional ingredient that individuals infer something about the incumbent politician from the outcome of their gambles. This would make the model considerably more complex, and is left for future research.

risk taking. To see this, suppose that the incumbent politician expects the equilibrium of the risk-taking game to be characterized by (\underline{w}, \bar{w}) . Banning risk taking comes at an expected popularity cost equal to

$$f\mu(F_0(\bar{w}) - F_0(\underline{w})),$$

while allowing it generates a net retrospective component of the vote equal to

$$f\delta \int_{(\underline{w}, \bar{w})} \left(\frac{w - \underline{w}}{\bar{w} - \underline{w}} - \frac{\bar{w} - w}{\bar{w} - \underline{w}} \right) dF_0(w).$$

Thus allowing risk taking is desirable if and only if

$$\delta \int_{(\underline{w}, \bar{w})} \left(\frac{w - \underline{w}}{\bar{w} - \underline{w}} - \frac{\bar{w} - w}{\bar{w} - \underline{w}} \right) dF_0(w) + \mu(F_0(\bar{w}) - F_0(\underline{w})) > 0,$$

or

$$E \left(\frac{w - \underline{w}}{\bar{w} - \underline{w}} \mid w \in (\underline{w}, \bar{w}) \right) > \frac{1 - \frac{\mu}{\delta}}{2}. \quad (9)$$

Condition (9) holds (or not) for all feasible equilibria (\underline{w}, \bar{w}) in several interesting cases. Define (m, M) as in Proposition 2. Suppose that F_0 is concave over $[m, M]$. It therefore admits a decreasing density over $[m, M]$.⁴ This corresponds to the case in which excessive risk-taking takes place only at sufficiently high income levels. In this case, for all equilibrium (\underline{w}, \bar{w})

$$E(w \mid w \in (\underline{w}, \bar{w})) < \frac{\underline{w} + \bar{w}}{2},$$

or

$$E \left(\frac{w - \underline{w}}{\bar{w} - \underline{w}} \mid w \in (\underline{w}, \bar{w}) \right) < \frac{1}{2}. \quad (10)$$

Since $\bar{w} - \underline{w}$ is bounded away from 0 for all feasible equilibria, condition (9) never holds if, *ceteris paribus*, $\frac{\mu}{\delta}$ is sufficiently small. Risk taking is detrimental to the incumbent politician in this case because it means that a majority of the risk takers would like to take "long-shot" bets. Total failures would outnumber total successes, which overall has a negative impact on the retrospective component of voting. Symetrically, if F_0 is convex over $[m, M]$, then (1) is reversed. In this case the incumbent always encourages risk taking regardless of μ , δ , and his beliefs about which risk-taking equilibrium will be played.

This illustrates that retrospective voting introduces a connection between pre-tax wealth distribution and risk regulation, because pre-tax wealth

⁴If F_0 is concave, it is absolutely continuous and thus admits a density.

distribution drives the risk profiles chosen by unconstrained individuals, which in turn has electoral consequences. It is particularly interesting to study the impact of pre-tax inequality on risk regulation. In order to simply parameterize the problem, we suppose that wealth is distributed according to a power law:

$$1 - F_0(w) = \left(\frac{(\alpha - 1)I}{\alpha w} \right)^\alpha, \quad (11)$$

where $\alpha > 1, 0 < I < c$. I is thus average wealth, and $\frac{(\alpha-1)I}{\alpha}$ is the lower bound on endowments.⁵ We also suppose that u is continuously differentiable, and that $\mu < \delta$.

Proposition 5

The incumbent politician authorizes risk taking if, ceteris paribus, α and $\Delta\lambda$ are sufficiently small. Conversely he bans risk taking for α sufficiently large other things being equal.

Proof. Specification (11) for F_0 implies that one can rewrite (9) as

$$\frac{1}{x-1} \left(\frac{\alpha}{\alpha-1} \frac{x^\alpha - x}{x^\alpha - 1} - 1 \right) > \frac{1 - \frac{\mu}{\delta}}{2} \quad (12)$$

where $x = \frac{\bar{w}}{\underline{w}}$.

Thus, if all else equal $\alpha \rightarrow +\infty$, then the left-hand side of (12) tends to 0, uniformly over any closed subset of $(1, +\infty)$. This implies that the incumbent bans risk shifting when α is sufficiently large.

If all else equal $\alpha \rightarrow 1$, then

$$E \left(\frac{w - \underline{w}}{\bar{w} - \underline{w}} \mid w \in (\underline{w}, \bar{w}) \right) \rightarrow \frac{1}{x-1} \left(\frac{x \ln x}{x-1} - 1 \right),$$

which decreases from $\frac{1}{2}$ to 0 over $[1, +\infty)$. To prove the result, it then suffices to show that all equilibrium thresholds (\underline{w}, \bar{w}) are such that x can be made arbitrarily close to 1 for $\Delta\lambda$ sufficiently small regardless of the value of α . To see this, notice that all equilibrium thresholds (\underline{w}, \bar{w}) satisfy by definition

$$\begin{aligned} & (1 - \lambda) u' \left(g(\underline{w}) + \int_0^{+\infty} (u - g(u)) dF_1(u) \right) \\ &= (1 - \lambda + \Delta\lambda) u' \left(g(\bar{w}) + \int_0^{+\infty} (u - g(u)) dF_1(u) \right), \end{aligned}$$

⁵Introducing a positive lower bound for wealth distribution does not affect any of the previous results, except for the fact that there might now be gambling equilibria where $\underline{w} = \frac{(\alpha-1)I}{\alpha}$.

or

$$\begin{aligned}
& (1 - \lambda) \begin{pmatrix} u' \left(g(\underline{w}) + \int_0^{+\infty} (u - g(u)) dF_1(u) \right) \\ -u' \left(g(\bar{w}) + \int_0^{+\infty} (u - g(u)) dF_1(u) \right) \end{pmatrix} \\
& = \Delta \lambda u' \left(g(\bar{w}) + \int_0^{+\infty} (u - g(u)) dF_1(u) \right)
\end{aligned} \tag{13}$$

The right-hand side is smaller than $\Delta \lambda u'((1 - \lambda)c)$ and thus tends to 0 as $\Delta \lambda \rightarrow 0$ uniformly over all α and all equilibria (\underline{w}, \bar{w}) . Since $\underline{w} < c < \bar{w}$ and u'^{-1} is continuous, equality (13) implies that x can be made arbitrarily close to 1 for all α and all equilibria (\underline{w}, \bar{w}) provided $\Delta \lambda$ is sufficiently small. This concludes the proof. ■

Proposition 5 shows that even if the cost of banning excessive risk taking μ is arbitrarily small, a sufficiently high pre-tax inequality induces the incumbent to encourage gambling. This result may be viewed as a political-economy version of the risk-shifting problem introduced by Jensen and Meckling (1976) in corporate finance. This seminal paper shows that overly leveraged firms may undertake value-destroying projects provided these are sufficiently risky. Here, an incumbent politician is willing to endorse excessive risk taking only if he faces sufficiently high inequalities. In this case, the aggregate fractions of successful and unsuccessful risk takers are sufficiently close that savings on costs μ offset the aggregate electoral costs. Inequality coupled with retrospective voting spurs inefficient political risk seeking.

6 Extensions

Asymmetric Retrospective Voting

Proposition 5 clearly depends on the particular specification adopted for retrospective voting. If for example δ was a linear function of the household's net profit/loss, then retrospective voting would be immaterial given that lotteries are fair. In order to assess simply how our results depend on our particular specification of the retrospective component of the vote, consider the case in which the individual-specific shock is equal to δ_+ ($-\delta_-$) in case of a positive (negative) wealth change. It is easy to check that ((9) becomes in this case:

$$E \left(\frac{w - \underline{w}}{\bar{w} - \underline{w}} \mid w \in [\underline{w}, \bar{w}] \right) > \frac{\delta_- - \mu}{\delta_+ + \delta_-}.$$

We have established that the left-hand side gets close to 1/2 when the right tail of wealth distribution is fat, to 0 when it is thin. This implies that if

$$2\mu \leq \delta_- - \delta_+, \quad (14)$$

then the incumbent politician never encourages inefficient risk taking, while he does so for a sufficiently fat wealth tail when the inequality is reversed. Overall, it means that risk taking is all the more likely to be promoted when retrospective voters reward good outcomes more than they punish bad ones, in line with our interpretation of the model as a political-economy version of the Jensen-Meckling asset substitution problem.

Partial Risk Regulation

Wealth-contingent regulation

De facto, financial regulation conditions the amount of risk that an individual can take on his wealth. For example, hedge funds can tap high net worth individuals without restriction, but have no direct access to the general public. Investments that benefit from tax subsidies such as retirement savings are typically intermediated by institutions subject to some prudential regulation. The common justification for this pertains to consumer protection: Investors who are not financially sophisticated nor can afford sophisticated advice must be shielded from taking risks that they do not fully understand nor measure. In our setup, the incumbent politician would find such wealth-contingent regulation highly valuable. Since the probability of success of a gamble increases with the gambler's wealth, the incumbent could use such a regulation to rule out politically costly long-shot gambles, and allow only those that have a high probability of success. This strategic motive for wealth-contingent investor protection is novel, to our knowledge, and contrasts sharply with the usual rationales that involve benevolent governments.

Favoring "fake alpha" strategies

The incumbent likes voters to undertake gambles that have a low probability of failure. Specifically, it benefits strictly from any gamble that has a probability of success higher than its probability of failure. If it has the technology to do so, the incumbent will thus forbid gambles with high probability of failure (those that the relatively poorer want to undertake) and will encourage gambles that have a high probability of small gains and a low probability of a large loss. These risk-profiles, labelled by Rajan (2010) as "fake alpha" strategies, are produced when collecting an insurance risk-premium against the exposure to a large disaster risk (e.g. carry trade

strategies) or when "riding a bubble". Such strategies might have been encouraged through indirect public subsidies such as the implicit guarantee of the GSAs.

Endogenous Tax Avoidance Technology and Multiple Equilibria

An interesting extension consists in endogenizing the tax-avoidance technology. Suppose that the introduction of the costlier and more efficient avoidance technology $\lambda - \Delta\lambda$ comes at an initial fixed investment outlay. There are several natural interpretations for such an outlay. It can be interpreted as the cost of political influence. It may also be the domestic taxes lost by a competing country that reduces its tax rates in order to induce high-net wealth individuals to relocate. In this case, the risk-taking decisions would become strategic complements. If a sufficiently high fraction of the middle class takes risks, then the fixed cost is spread among sufficiently many individuals that the sophisticated avoidance technology becomes viable. This vindicates taking risk in the first place. This could lead to multiple Pareto-ranked equilibria. In the worst equilibria, maximal risk-taking would generate important gross inequality, and efficient tax avoidance would in turn imply that net inequality be important as well.

Slow Adjustment of Taxation to Changes in Tax Avoidance

This paper focusses on equilibrium tax schemes that optimally address the tax-avoidance friction at date 1. In practice, reforming the tax code is a protracted process. Thus the tax code is unlikely to contemporaneously respond to innovations in tax avoidance. In our model, if accordingly the date-1 tax scheme was exogenously given, and not necessarily optimal - for example, if it was overly progressive and thus led to date-1 tax avoidance, our results on the risk-seeking behaviour of middle class individuals would still hold. The only difference is that their non concave objective at date 0 would no longer be induced by the *ex post* optimal tax scheme, but more simply by their anticipated use of the tax avoidance technology at date 1. Thus, we believe that the prediction that increasing returns to tax avoidance generate excessive risk-seeking behaviour should be empirically more pervasive than the one suggesting that such increasing returns generate regressivity of taxes at the top. The latter prediction relies on the demanding assumption that the tax scheme is always constrained-optimal, while the former holds under fairly arbitrary exogenously given tax schemes.

Idiosyncratic Versus Systematic Risk Taking

For reasons explained above, the paper simply focusses on a perfectly elastic supply of idiosyncratic risks at an exogenous expected return. This corresponds to the view that risks are manufactured by a competitive sector. Notice that in our environment, if a household could gain exposure on a systematic risk factor that affects the rest of the population, it would actually value bets that are negatively correlated with it. It is preferable to be wealthy when redistribution is limited because of a negative aggregate shock than when it is more generous.

An interesting extension of the model is the study of the polar situation in which only a fixed supply of aggregate risk is available. Intuitively, the demand of individuals that are close to the tax kink would induce low, or perhaps negative risk premia, akin to an apparent overpricing. Analytical solutions for risk premia in the presence of heterogeneous agents with nonconcave preferences seem difficult to obtain, however.

7 Appendix

Proof of Proposition 1

Step 1. We first show that a tax scheme that satisfies constraints (2) and such that

$$\int r(w)dF(w) < \int wdF(w) \quad (15)$$

cannot be optimal. From such a scheme (r, v) , fix $\varepsilon > 0$ and define the scheme (r^*, v^*) as

$$\begin{aligned} r^*(w) &= w, \\ v^*(w) &= v(r(w)) + G(w, r(w)) + \varepsilon. \end{aligned}$$

Clearly, this new scheme is strictly preferable to (r, v) because it delivers more consumption at any income level. This new scheme is incentive-compatible: For all $w \geq w'$, we have

$$\begin{aligned} v(r(w)) + G(w, r(w)) + \varepsilon &\geq v(r(w')) + G(w, r(w')) + \varepsilon, \\ &\geq v(r(w')) + G(w', r(w')) + G(w, w') + \varepsilon. \end{aligned}$$

The first inequality stems from the fact that (r, v) is incentive-compatible, and the second one follows from (3). Further, this new scheme (r^*, v^*) is feasible for ε sufficiently small because it does not waste resources through

tax avoidance while (r, v) does from (15). Thus, (r^*, v^*) satisfies (2) for ε sufficiently small and strictly dominates (r, v) , which establishes the result. Thus, one can assume $r(w) = w$ w.l.o.g.

Step 2. Consider the following auxiliary program (φ') :

$$\begin{aligned} & \max_v \int_0^{+\infty} u(v(w)) dF(w) \\ & \text{s.t.} \begin{cases} \int_0^{+\infty} v(w) dF(w) \leq \int_0^{+\infty} w dF(w), \\ \forall w \geq 0, v(w) \leq G(w, 0) + v(0). \end{cases} \end{aligned} \quad (16)$$

We will show that

$$V(w) = G(w, 0) + \int_0^{+\infty} (t - G(t, 0)) dF(t)$$

attains the solution of (φ') . Notice that V satisfies (16).

Consider a function v that attains the solution of (φ') . Clearly, v must be (weakly) increasing. Thus, v admits a right limit $v(x^-)$ and a left limit $v(x^+)$ at each point $x \in (0, +\infty)$. Suppose that for some $x_0 \in (0, +\infty)$, $v(x_0^-) < v(x_0^+)$. Then one could slightly increase v in the left neighborhood of x , slightly decrease it in the right neighborhood, and thus strictly increase social welfare while still satisfying constraints (16). Thus v must be continuous over $(0, +\infty)$ (and with a similar argument also right-continuous in 0).

Suppose now that for some $x_1 \in (0, +\infty)$,

$$v(x_1) > G(x_1, 0) + v(0). \quad (17)$$

Since v and G are continuous, inequality (17) actually holds over some neighborhood Ω of x_1 . Consider a bounded measurable function h with support within Ω s.t. $\int h dF = 0$. The function

$$w \rightarrow v(w) + th(w)$$

satisfies constraints (16) for t sufficiently small. Thus it must be that

$$\Phi(t) = \int_0^{+\infty} u(v(w) + th(w)) dF(w)$$

has a local maximum in 0, or that

$$\Phi'(0) = \int_0^{+\infty} u'(v(w)) h(w) dF(w) = 0.$$

since it holds for any function h , it must be that v is constant over Ω . Clearly this implies that v must be constant over $[0, x_1]$, which cannot be unless $G(\cdot, 0)$ is equal to 0 over this interval. In any case, this contradicts (17). Thus $v = V$.

Since constraints (16) are necessary conditions for constraints (2) and V happens to satisfy (2) from (3), this concludes the proof. ■

Proof of Lemma 3

We have

$$z(w) = u^{-1} \left(E \left(u \left(g(\tilde{w}) + \int_0^{+\infty} (t - g(t)) dF_1(t) \right) \right) \right).$$

To see that z strictly satisfies the resource constraint, notice that for all w ,

$$u^{-1} \left(E \left(u \left(g(\tilde{w}) + \int_0^{+\infty} (t - g(t)) dF_1(t) \right) \right) \right) \leq E \left(g(\tilde{w}) + \int_0^{+\infty} (t - g(t)) dF_1(t) \right)$$

by convexity of u^{-1} , with strict inequality whenever $\tilde{w} \neq w$, which occurs for a nonnegligible set of individuals. Thus,

$$\begin{aligned} \int_0^{+\infty} z(w) dF_0(w) &< \int_0^{+\infty} E \left(g(\tilde{w}) + \int_0^{+\infty} (t - g(t)) dF_1(t) \right) dF_0(w) \\ &= \int_0^{+\infty} E(g(\tilde{w})) dF_0(w) + \int_0^{+\infty} (t - g(t)) dF_1(t) \\ &= \int_0^{+\infty} g(w) dF_1(w) + \int_0^{+\infty} (t - g(t)) dF_1(t) \\ &= \int_0^{+\infty} t dF_1(t) = \int_0^{+\infty} t dF_0(t). \end{aligned}$$

It remains to show that z does not induce tax avoidance at date 1. This is because the function $z(w) - z(0)$ is increasing, convex, and larger than g . Thus

$$\begin{aligned} z(w) - z(0) &\geq z(w - w') - z(0) + z(w') - z(0), \\ &\geq g(w - w') + z(w') - z(0). \blacksquare \end{aligned}$$

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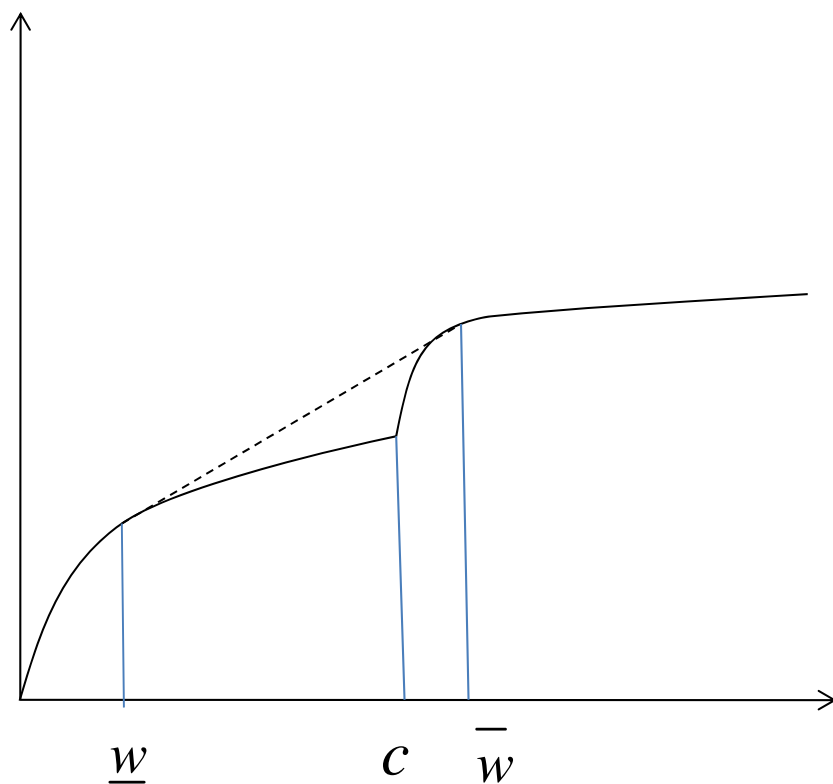


Figure 1. The function $u(w)$ and its concavification.

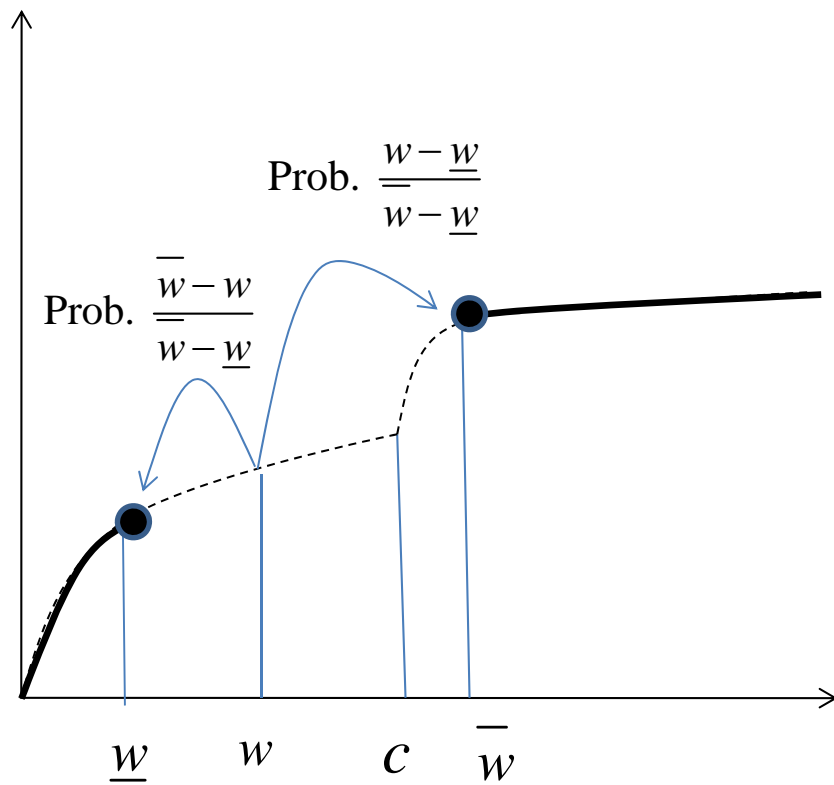


Figure 2. Risk taking.

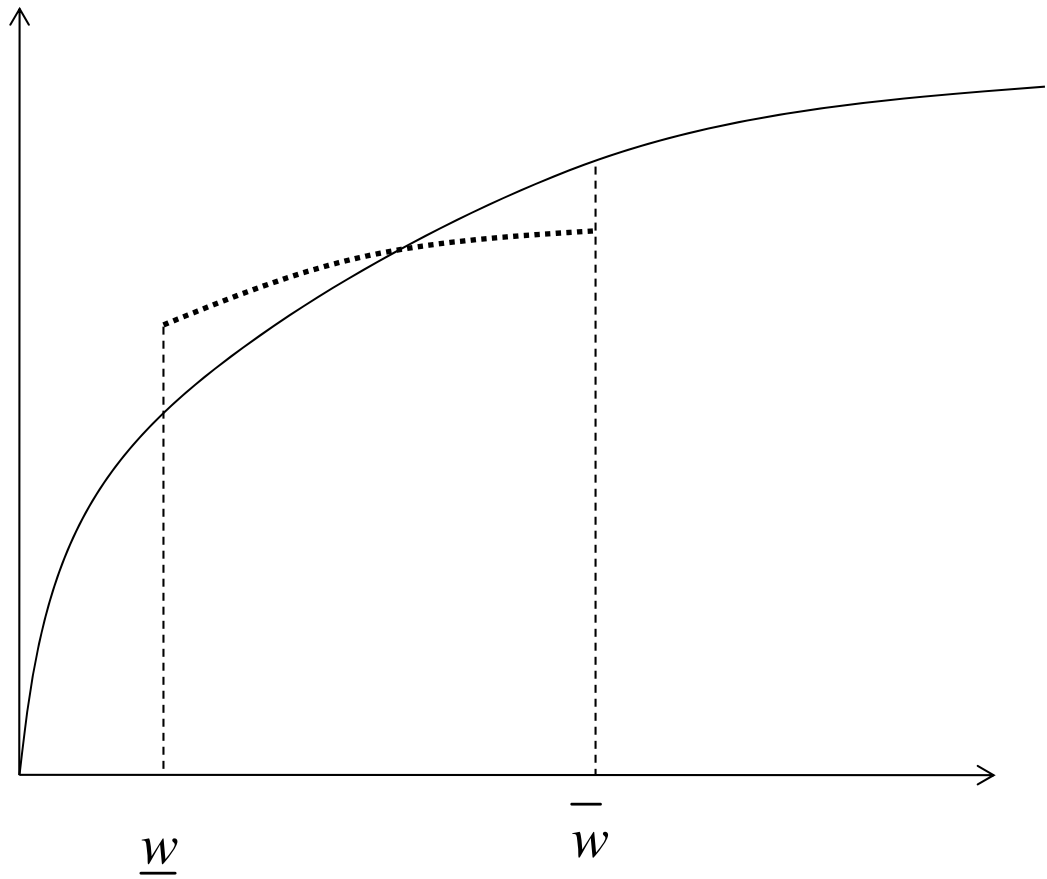


Figure 3. The shrinking middle class.
 The distribution F_0 is the solid curve, the distribution F_1 over $[\underline{w}, \bar{w}]$ is the dashed one.