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Super-Pledgeability: How Progressive Taxation Solves Entrepreneurial Commitment Problems

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Super-Pledgeability: How Progressive Taxation Solves Entrepreneurial Commitment Problems

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Abstract

This paper provides a novel efficiency rationale for progressive corporate taxation based on commitment problems in entrepreneurial finance. Poor entrepreneurs cannot credibly commit to efficient projects because non-verifiable private benefits limit pledgeable income. We show the government uniquely solves this through "super-pledgeability": combining upfront subsidies with tax enforcement powers that extract payments beyond private contracting limits. While subsidies alone merely shift financing burdens and taxes alone cannot enable unfunded projects, together they create total claims exceeding private market capabilities. The mechanism is self-financing—taxes on successful entrepreneurs fully recover subsidies in steady state. Optimal progressivity depends on moral hazard severity, not redistributive preferences. With risk-neutral entrepreneurs, any progressivity level is equally efficient; risk aversion yields unique optimality balancing insurance against deadweight losses. The system remains politically stable as entrepreneurs accept future tax obligations to access otherwise unattainable projects. This framework explains why innovation-intensive economies embrace extreme progressivity, revealing it as an efficient solution to commitment problems rather than redistribution.

Keywords: Progressive taxation, Entrepreneurial finance, Pledgeable income, Moral hazard, Super-pledgeability JEL Codes: H25, G32, D82, H21, L26

1 Introduction

Nordic economies present a striking paradox: they combine the world's most progressive tax systems with thriving entrepreneurial ecosystems. Sweden's hig-value startup production per capita exceeds that of lower-tax jurisdictions, while Danish startups flourish despite marginal tax rates exceeding 60%. This challenges the conventional wisdom that progressive taxation stifles entrepreneurship (Gentry and Hubbard 2000; Cullen and Gordon 2007). We provide a novel resolution: progressive taxation enables entrepreneurship by solving a fundamental commitment problem that private markets cannot address. The key insight is that governments possess a unique enforcement technology—the ability to extract payments through taxation that exceed what private contracts can achieve. We formalise this as 'super-pledgeability.' While private investors are constrained by entrepreneurs' pledgeable income (Tirole 2006), governments combine upfront subsidies that enable financing with ex-post tax collection that transcends these limits. Crucially, this is not about deep pockets or superior monitoring, it's about enforcement powers only governments possess.

The model builds on the pledgeable income framework pioneered by Tirole (2006), where moral hazard limits the cash flows entrepreneurs can credibly promise to investors.[1] Entrepreneurs in our model can pursue either a socially efficient but risky project G, or an inferior but safe project B that yields private benefits. These non-verifiable private benefits create a wedge between what entrepreneurs can credibly pledge to investors ($R^{\max}$) and the project's true expected value. Poor entrepreneurs, whose wealth falls below a critical threshold W^*, cannot raise sufficient private finance despite project G being socially efficient—a classic credit rationing problem.

The government solves this through a two-part mechanism that private markets cannot replicate.[2] First, it provides an upfront subsidy S that increases the entrepreneur's wealth, reducing the required private finance from $I - W$ to $I - (W + S)$. Critically, this subsidy does not eliminate the moral hazard or increase pledgeable income per dollar borrowed. Second, the government imposes state-contingent taxes on successful entrepreneurs that exceed what private contracts could extract. While private investors are limited to claiming $R^{\max}$ due to moral hazard, the government can enforce additional tax obligations τ through its coercive

[1] Holmström and Tirole (1997) show how intermediaries with monitoring capacity can increase pledgeable income itself. Our contribution differs fundamentally: while monitors improve $R^{\max}$, government achieves something different—enforcing claims that exceed $R^{\max}$ through taxation rather than improving the underlying pledgeability constraint.

[2] Several papers examine alternative government interventions in financial markets, including bailout design (Philippon and Skreta 2012), liquidity provision (Tirole 2012), and time consistency problems in credit programs (Chari and Kehoe 2016). Our mechanism differs fundamentally as it relies on tax enforcement technology rather than liquidity, monitoring, or insurance.

powers, creating total claims of $R^{\max} + \tau$ that we term "super-pledgeability."

Our framework reverses the conventional wisdom about progressive taxation and entrepreneurship. While Gentry and Hubbard (2000) and Cullen and Gordon (2007) find that tax progressivity discourages entrepreneurship, we show that progressive taxation can *enable* entrepreneurship by solving commitment problems.[3] The key insight is that entrepreneurs rationally accept future tax obligations because the subsidy provides access to projects that would otherwise remain forever unattainable.

The paper generates several novel insights. First, we show that the optimal degree of tax progressivity depends not on equity concerns but on the severity of the moral hazard problem—industries with larger private benefits require more progressive tax structures.[4] Second, we demonstrate that this system can be politically stable even under self-interested voting, as entrepreneurs agree ex-ante to the tax obligations knowing they enable access to otherwise unattainable projects.[5] Third, we uncover an interesting discipline effect: higher investment costs increase pledgeable income by making deviation to inferior projects less attractive.[6]

The model speaks directly to contemporary debates about startup ecosystems and corporate taxation. Nordic economies' combination of extensive startup support and high progressive taxation appears paradoxical through a traditional lens but emerges naturally from our framework.[7] The extreme tax progressivity in venture capital sectors, where a few massive successes fund many failures, reflects not redistributive politics but an efficient solution to severe commitment problems created by large private benefits in entrepreneurial ventures.

The analysis proceeds as follows. Section 2 establishes the basic moral hazard problem and derives the pledgeability constraint that creates credit rationing. Section 3 introduces

[3] Scheuer (2014) analyses optimal taxation when entrepreneurs have private information about project quality. Our mechanism differs in that entrepreneurs agree ex-ante to progressive taxes because these taxes are part of a mechanism that provides access to otherwise unattainable projects. Furtermore, Scheuer and Slemrod (2021) provide a comprehensive review of entrepreneurial taxation, focusing primarily on information asymmetries and behavioural responses. Our mechanism operates even under perfect information, identifying a distinct channel through which progressive taxation can enhance efficiency.

[4] The traditional public finance literature focuses on redistributive motives (Mirrlees 1971; Saez 2001) or insurance benefits (Varian 1980; Eaton and Rosen 1980). We provide an efficiency-based microfoundation independent of these considerations.

[5] This contrasts with standard political economy explanations through median voter preferences (Meltzer and Richard 1981) or imperfect capital markets generating support for redistribution (Bénabou 2000). Our mechanism provides stability through solving commitment problems that benefit all entrepreneurs ex-ante.

[6] This contributes to the broader literature on non-monotonic effects in moral hazard models (Innes 1990; Poblete and Spulber 2012).

[7] Empirical evidence supports our mechanism. Henrekson and Sanandaji (2011) document successful entrepreneurship in high-tax Nordic countries. Adelino et al. (2015) show that startup subsidies have larger effects in areas with better tax enforcement. Kleven et al. (2011) find higher tax compliance for income subject to third-party reporting, consistent with our emphasis on government's enforcement advantage.

the government's tax-subsidy mechanism and explicates the super-pledgeability principle. Section 4 characterises optimal tax progressivity. Section 5 examines political economy. Sections 6–8 extend the model to heterogeneous entrepreneurs, compare alternative policies, and derive empirical predictions. Section 9 concludes.

The core contribution is demonstrating that progressive corporate taxation can emerge endogenously from solving commitment problems rather than from redistributive preferences. By unbundling the government's dual role, providing subsidies that enable financing and extracting taxes that exceed private pledgeability limits—we show why government intervention remains essential even in developed financial markets.

2 Model Setup

2.1 Agents and Projects

Consider an overlapping generations economy with a continuum of entrepreneurs. Each entrepreneur lives for two periods. In period 1, young entrepreneur requires financing to invest in one of two projects: a bad Project (B) that is safe but yields a low return, this project is always feasible. A second good project (G) yields a high expected return but financing with outside finance is limited by incentives. In period 2, if financed, the mature firm generates returns. The bad project yields return X_B with certainty. The good project yields either a baseline success:eturn X_M with probability $(1-p-q)$, or high success return X_H with probability p.

Assumption 1. Payoff ordering and efficiency of good project:

$$X_B < X_M < X_H \quad \text{and} \quad pX_H + (1-p-q)X_M > X_B \tag{1}$$

There is a problem of committing to pay outside financiers. Young entrepreneurs have initial wealth W. Both projects require investment I.

Definition 1 (Project Payoffs with Private Benefits)**.** The two projects have the following returns: project B yields a return X_B with certainty and private benefit $Z > 0$ (non-verifiable, non-pledgeable). Hence the total private payoff is $X_B + Z$. Project G with probability p yields a return X_H (very high success), with probability $(1-p-q)$ it yields a return of X_M (baseline success), and with probability q: return 0 (failure). It does not yield any private benefits.

Assumption 2 (Efficiency and Incentive Compatibility)**.** Project G is socially efficient:

$pX_H + (1-p-q)X_M - I > X_B - I + Z$. Private benefit creates moral hazard: $Z > 0$. Failure risk limits pledgeable income: $q > 0$

Definition 2 (Incentive Compatibility Constraint)**.** For an entrepreneur to choose project G over project B after receiving financing, the following must hold:

$$p(X_H - R) + (1-p-q)(X_M - R) + q \cdot 0 \geq X_B - I + Z \tag{2}$$

where R is the repayment to private investors when the project succeeds (nothing is paid in failure due to limited liability). This simplifies to:

$$[pX_H + (1-p-q)X_M] - (1-q)R \geq X_B - I + Z \tag{3}$$

From (3), the maximum repayment an entrepreneur can credibly promise to investors is:

$$R^{\max} = \frac{pX_H + (1-p-q)X_M - (X_B - I + Z)}{1-q} \tag{4}$$

This ensures the entrepreneur prefers project G to deviating to project B.

Proposition 1 (Private Contract Upper Bound)**.** *Under limited liability and non-verifiable private benefits, any incentive-compatible private contract must satisfy $R \leq R^{\max}$.*

Proof. For any $R > R^{\max}$, the IC constraint $p(X_H - R) + (1-p-q)(X_M - R) \geq X_B - I + Z$ is violated, inducing deviation to project B. Limited liability prevents enforcement beyond realised returns, and courts cannot seize non-verifiable private benefits. Thus $R \leq R^{\max}$ binds. □

Lemma 1 (Impossibility of Private Super-Pledgeability)**.** *Under limited liability and non-verifiable private benefits, no private contract or combination of private contracts can implement total enforceable claims exceeding $R^{\max}$.*

Proof. Consider any private contracting arrangement. Incentive compatibility requires:

$$p(X_H - R) + (1-p-q)(X_M - R) \geq X_B - I + Z \tag{5}$$

For any $R > R^{\max}$, this IC constraint is violated, inducing deviation to project B. Limited liability prevents enforcement beyond realised returns in failure states. Courts cannot condition contracts on non-verifiable private benefit Z or impose penalties beyond contractual cash flows. Multiple private investors face the same constraint: even if entrepreneurs could contract with n investors each claiming R_i, the total $\sum_{i=1}^{n} R_i$ remains bounded by $R^{\max}$ as the IC constraint binds on aggregate extraction. Therefore, total private enforceable claims $\leq R^{\max}$. □

Government taxation circumvents this impossibility through three features absent in private contracts: (i) constitutional ex-ante commitment before type revelation, (ii) coercive enforcement independent of contractual pledgeability, and (iii) inability to renegotiate tax obligations after success. This enables the government to extract payments beyond $R^{\max}$, as we formalise in Section 3.

Proposition 2 (Wealth Threshold for Commitment)**.** *An entrepreneur can obtain financing for project G if and only if:*

$$W \geq W^* \equiv I - (1-q)R^{\max} = I - [pX_H + (1-p-q)X_M - (X_B - I + Z)] \tag{6}$$

If $W < W^*$, the entrepreneur cannot credibly commit to G and must choose project B.

Proof. The entrepreneur needs external financing $F = I - W$. Risk-neutral investors require:

$$\text{Expected repayment} = (1-q)R \geq F = I - W \tag{7}$$

Given the maximum pledgeable repayment $R \leq R^{\max}$, financing is feasible only if:

$$(1-q)R^{\max} \geq I - W \tag{8}$$

Substituting $R^{\max}$ from (4) and rearranging yields the wealth threshold W^*. □

Corollary 1 (Super-Pledgeability Enables Finance)**.** *For entrepreneurs with $W < W^*$, the government creates total enforceable claims $(1-q)R^{\max} + p\tau_H + (1-p-q)\tau_M = I - W$, exceeding private contract limits $(1-q)R^{\max} < I - W$.*

Definition 3 (Required Subsidy)**.** For an entrepreneur with wealth $W < W^*$, the minimum subsidy required to undertake project G is:

$$S^* = W^* - W \tag{9}$$

This subsidy relaxes the financing constraint, enabling commitment to project G.

The commitment problem arises from the interaction of three frictions:

1. **Private benefits** ($Z > 0$): Create moral hazard - entrepreneur may deviate to project B

2. **Limited liability** ($q > 0$): The entrepreneur cannot repay in failure state

3. **Pledgeability gap**: The difference between social value $pX_H + (1 - p - q)X_M$ and pledgeable income P_G equals the private benefit Z.

The larger the private benefit Z, the smaller the pledgeable income, and the higher the wealth threshold W^* needed for commitment. Poor entrepreneurs with $W < W^*$ are credit-rationed despite project G being socially efficient.

Counterintuitively, pledgeable income $R^{\max}$ is increasing in the investment cost I:

$$\frac{\partial R^{\max}}{\partial I} = \frac{1}{1 - q} > 0 \tag{10}$$

This arises because higher investment costs reduce the net payoff from deviating to project B. When the entrepreneur contemplates deviation after receiving financing, they must still invest I to obtain $X_B + Z$, yielding net payoff $(X_B - I + Z)$. As I increases, this outside option becomes less attractive, reducing the moral hazard problem and increasing pledgeable income. However, this discipline effect is exactly offset by the higher capital requirement:

$$\frac{\partial W^*}{\partial I} = 1 - (1 - q)\frac{\partial R^{\max}}{\partial I} = 1 - 1 = 0 \tag{11}$$

The wealth threshold $W^* = I - (1 - q)R^{\max}$ remains unchanged as the direct effect (higher I requires more wealth) perfectly cancels the indirect effect (higher I enables more pledging).

Economic implications:

1. **Discipline through costs**: Higher investment requirements discipline entrepreneur behavior by reducing the attractiveness of deviation, even though they don't alter the financing threshold.

2. **Policy insight**: Minimum capital requirements or regulatory compliance costs that increase I enhance pledgeable income by mitigating moral hazard, though they don't improve access to finance due to the offsetting effects.

3. **Model boundary**: This knife-edge result where $\partial W^*/\partial I = 0$ emerges from our specific functional forms. With alternative specifications, the discipline effect might dominate or be dominated by the capital requirement effect.

This highlights how commitment problems differ fundamentally from simple wealth constraints—higher costs can improve pledgeability by making opportunistic behavior less attractive, even when they don't ease overall financing constraints.

3 The Tax-Subsidy Mechanism

3.1 Government Policy Structure

The government implements an ex-ante contract that solves the commitment problem:

Definition 4 (Tax-Subsidy Contract)**.** Each young entrepreneur is offered:

- **Upfront Subsidy**: S added to wealth which enables access to private finance
- **State-Contingent Tax Payment**: Future tax obligations to government

$$\tau(X) = \begin{cases} \tau_M & \text{if } X = X_M \text{ (baseline success)} \\ \tau_H & \text{if } X = X_H \text{ (extreme success)} \\ 0 & \text{if project fails} \end{cases} \tag{12}$$

- **Private Finance Component**: With $W + S \geq W^*$, the entrepreneur can borrow $F = I - (W + S)$ from private financiers at repayment

$$R' = \frac{F}{1-q} \leq R^{\max} \tag{13}$$

The mechanism resolves the commitment problem through a carefully sequenced intervention. Initially, an entrepreneur with wealth $W < W^*$ cannot commit to project G and faces exclusion from efficient investment opportunities. Upon receiving the government subsidy S, the entrepreneur's effective wealth rises to $W + S = W^*$, enabling credible commitment to project G. In the subsequent period, successful entrepreneurs discharge their obligations through state-contingent taxes τ_M or τ_H. Entrepreneurs rationally accept these future tax obligations because the subsidy provides access to project G that would otherwise remain unattainable.

3.2 Implementation Mechanism

In steady state, the government budget must balance:

$$p \cdot \tau_H + (1 - p - q) \cdot \tau_M = S \tag{14}$$

The entrepreneurs participation and incentive compatibility are as below:

Definition 5 (Ex-Ante Individual Rationality)**.** Young entrepreneurs voluntarily participate in the tax-subsidy system if:

$$\underbrace{p(X_H - R' - \tau_H) + (1-p-q)(X_M - R' - \tau_M)}_{\text{Expected payoff with G (net of taxes)}} \geq \underbrace{X_B - I + Z}_{\text{Payoff without subsidy}} \tag{15}$$

Remark 1 (Key Insight). Entrepreneurs rationally accept future tax obligations because:

1. Without the subsidy S: the entrepreneur can only commit to and gain funding for project B, receiving return X_B.

2. With the subsidy S: the entrepreneur can commit to project G, receiving expected payoff net of taxes

3. Even knowing they must repay through taxes if successful, the expected value of accessing project G exceeds the certain payoff and private benefits from project B

This is not a loan but an ex-ante insurance contract: entrepreneurs pay fair taxes (equal in expected value to the subsidy) only conditional on success.

Definition 6 (Incentive Compatibility after Subsidy)**.** Once the entrepreneur receives subsidy S, they have sufficient capital to implement project G:

$$W + S = I \implies \text{Can commit to and implement project G} \tag{16}$$

The subsidy eliminates the need for private financiers to provide the full amount, so the entrepreneur can access the remaining finance $F = I - (W + S)$ and keeps returns minus both repayment, R', and taxes, τ.

The government's unique contribution to solving the commitment problem lies in enabling total claims on successful projects that exceed private pledgeability limits.

Definition 7 (Super-Pledgeability)**.** While private markets are constrained by the maximum pledgeable income:

$$R^{\max} = \frac{pX_H + (1-p-q)X_M - (X_B - I + Z)}{1-q} \tag{17}$$

The government can enforce additional claims through taxation, creating total enforceable payments:

$$\text{Total Claims} = R^{\max} + \tau \tag{18}$$

where $\tau \in \{\tau_H, \tau_M\}$ depending on the realised outcome.

The government subsidy S leaves the entrepreneur's pledgeable income per unit borrowed unchanged at $R^{\max} = [pX_H + (1-p-q)X_M - (X_B - I + Z)]/(1-q)$. The subsidy merely increases effective wealth from W to $W+S$, thereby reducing the required private finance from $I - W$ to $I - (W+S)$. This reduction makes the financing feasible—now $(1-q)R^{\max} \geq I - (W+S)$ can hold—without altering the fundamental moral hazard problem, as the private benefit B continues to limit pledgeability. This distinction proves crucial: if the subsidy somehow improved pledgeability itself by eliminating the private benefit Z, private markets could potentially replicate the government's solution through contract restructuring. However, since the subsidy leaves the moral hazard unchanged, entrepreneurs face the same temptation to deviate to project B, private financiers confront the same pledgeability constraint $R^{\max}$, and only the government's unique enforcement power through taxation makes the system viable.

Proposition 3 (Exceeding Private Pledgeability Limits)**.** *The government mechanism enables total extraction from successful entrepreneurs that exceeds what private markets can achieve:*

$$(1-q)R^{\max} + p\tau_H + (1-p-q)\tau_M > (1-q)R^{\max} \tag{19}$$

This additional extractive capacity $p\tau_H + (1-p-q)\tau_M = S$ is what finances the upfront subsidy.

The mechanism operates through a two-layer claim structure that transcends private contracting limits. In the first layer, private financiers receive their maximum pledgeable amount $R^{\max}$, exhausting the entrepreneur's pledgeable income given private benefit constraints. The government then extracts additional payments τ through the tax system in a second layer, employing state enforcement powers that private contracts cannot access. This combined extraction of $R^{\max} + \tau$ exceeds what any private arrangement could achieve because private contracts remain limited by moral hazard from non-pledgeable benefits Z, while government taxes are enforceable through state coercive power, with ex-ante constitutional agreements preventing renegotiation.

Corollary 2 (Enabling Finance for Poor Entrepreneurs)**.** *For entrepreneurs with $W < W^*$:*

- ***Without government**: Cannot raise $I - W$ since $(1-q)R^{\max} < I - W$*

- ***With government**:*

  1. *Receive subsidy S, increasing effective wealth to $W + S$*

  2. *Can now raise remaining finance $F = I - (W+S)$ from private markets*

3. Total repayment obligations: $R^{\max}$ to private financiers plus τ to government

4. This is feasible because: $(1-q)R^{\max} + p\tau_H + (1-p-q)\tau_M = I - W$

The subsidy S bridges the gap, while taxes τ recover this investment using the government's unique enforcement capabilities.

4 Optimal Tax Design

4.1 Social Planner's Problem

The social planner chooses (τ_M, τ_H) to maximise total surplus:

$$\begin{aligned}
\max_{\tau_M,\tau_H} \quad & [pX_H + (1-p-q)X_M - S] && (20)\\
\text{s.t.} \quad & p \cdot \tau_H + (1-p-q) \cdot \tau_M = S && \text{(BC)}\\
& p(X_H - R' - \tau_H) + (1-p-q)(X_M - R' - \tau_M) \geq X_B - I + X && \text{(IR)}\\
& \tau_M \leq X_M, \quad \tau_H \leq X_H && \text{(LL)}
\end{aligned}$$

where (BC) is budget balance, (IR) is individual rationality, and (LL) represents limited liability constraints.

4.2 Optimal Tax Characterization

Proposition 4. *The optimal tax schedule features progressive taxation with:*

$$\tau_H = \frac{S}{p} + \lambda(X_H - X_M) \tag{21}$$

$$\tau_M = -\lambda\frac{p}{1-p-q}(X_H - X_M) \tag{22}$$

where $\lambda \in \left[0, \frac{1-p-q}{p}\right]$ determines the degree of progressivity.

Proof. From the budget constraint (BC), we have $S = p\tau_H + (1-p-q)\tau_M$. Substituting into the objective function yields $\min[p\tau_H + (1-p-q)\tau_M]$. When the IR constraint holds with strict inequality, the entrepreneur receives surplus beyond what participation requires, suggesting we could reduce S while maintaining IR. Since we minimise S, the constraint must bind: $p(X_H - \tau_H) + (1-p-q)(X_M - \tau_M) = X_B - I + Z$. Expanding this binding constraint and rearranging gives $p\tau_H + (1-p-q)\tau_M = pX_H + (1-p-q)X_M - X_B + I - Z$. The budget constraint requires this left side to equal S, therefore $S^* = pX_H + (1-p-q)X_M - X_B - I - Z$.

The budget constraint with optimal subsidy becomes $p\tau_H + (1-p-q)\tau_M = S^*$. This is one equation in two unknowns. Solving for τ_M:

$$\tau_M = \frac{S^* - p\tau_H}{1-p-q}$$

Substituting $\tau_H = \frac{S^*}{p} + \lambda(X_H - X_M)$ into the budget constraint:

$$\tau_M = \frac{S^* - p\left[\frac{S^*}{p} + \lambda(X_H - X_M)\right]}{1-p-q} = \frac{S^* - S^* - p\lambda(X_H - X_M)}{1-p-q} = -\lambda\frac{p}{1-p-q}(X_H - X_M)$$

From limited liability $\tau_M \geq -X_M$:

$$-\lambda\frac{p}{1-p-q}(X_H - X_M) \geq -X_M$$

$$\lambda \leq \frac{1-p-q}{p} \cdot \frac{X_M}{X_H - X_M}$$

For reasonable parameter values and requiring $\lambda \geq 0$ for progressivity:

$$\lambda \in \left[0, \frac{1-p-q}{p}\right]$$

This completes the characterization. □

Our mechanism remains welfare-improving even with tax distortions. Let $DWL(\tau) = \epsilon \cdot f(\tau_H, \tau_M)$ represent deadweight losses from progressive taxation. The mechanism generates positive welfare when:

$$[pX_H + (1-p-q)X_M - X_B - Z] > DWL(\tau^*) \tag{23}$$

This condition holds for sufficiently severe commitment problems (large Z) or moderate tax elasticities (ϵ). Crucially, industries with the most severe moral hazard—precisely those needing the mechanism most—have the largest welfare gains that dominate reasonable deadweight losses.

In this risk neutral framework, there is no optimal degree of progression. The tax on extreme success carries the bulk of the fiscal burden, while baseline success may even receive a net transfer ($\tau_M < 0$ possible) when progressivity is high. Proposition 3 establishes that *any* tax structure (τ_M, τ_H) satisfying the budget constraint with $S = S^*$ is equally efficient. There is no optimisation over λ because all feasible values yield identical social surplus. The model suggests that progressivity must be selected based on criteria external to efficiency, such as:

- **Political stability**: Choose λ to maximise voting support (Propositions 6-7)
- **Risk-sharing**: If entrepreneurs are risk-averse with strictly concave utility of wealth (diminishing marginal utility, not assumed in the baseline model), higher λ provides implicit insurance
- **Equity concerns**: Society may have preferences over the distribution of tax burdens independent of efficiency

4.3 Risk Aversion and Unique Optimal Progressivity

While the baseline risk-neutral framework leaves the degree of progressivity indeterminate, introducing risk aversion fundamentally changes the analysis by creating a unique optimal tax structure that balances insurance provision against deadweight losses.

Proposition 5 (Unique Optimal Progressivity under Risk Aversion)**.** *Consider entrepreneurs with CRRA utility $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$ where $\sigma > 0$ represents the coefficient of relative risk aversion. There exists a unique optimal degree of progressivity $\lambda^* \in [0, \frac{1-p-q}{p}]$ that maximises entrepreneurial expected utility subject to the government budget constraint.*

Proof. The entrepreneur's expected utility from accepting the tax-subsidy contract is:

$$EU(\lambda) = p \cdot u(X_H - R' - \tau_H) + (1 - p - q) \cdot u(X_M - R' - \tau_M) + q \cdot u(0) \tag{24}$$

Substituting the tax schedules $\tau_H = \frac{S^*}{p} + \lambda(X_H - X_M)$ and $\tau_M = -\lambda\frac{p}{1-p-q}(X_H - X_M)$ from Proposition 4, and defining net consumption in each state as:

- $c_H = X_H - R' - \frac{S^*}{p} - \lambda(X_H - X_M)$
- $c_M = X_M - R' + \lambda\frac{p}{1-p-q}(X_H - X_M)$
- $c_F = 0$ (failure state)

The first-order condition for optimal progressivity yields:

$$\frac{\partial EU}{\partial \lambda} = -p \cdot u'(c_H) \cdot (X_H - X_M) + (1 - p - q) \cdot u'(c_M) \cdot \frac{p(X_H - X_M)}{1 - p - q} = 0 \tag{25}$$

Simplifying:

$$p^2 \cdot u'(c_H) = p^2 \cdot u'(c_M) \tag{26}$$

With CRRA utility where $u'(c) = c^{-\sigma}$, this implies:

$$(c_H)^{-\sigma} = (c_M)^{-\sigma} \tag{27}$$

Therefore, optimal progressivity requires $c_H = c_M$, yielding perfect insurance across success states. This condition determines:

$$\lambda^* = \frac{1-p-q}{p} \cdot \frac{S^*}{S^* + (1-p-q)(X_H - X_M)} \tag{28}$$

The second-order condition confirms this is a maximum:

$$\frac{\partial^2 EU}{\partial \lambda^2} = \sigma p (X_H - X_M)^2 \cdot \left[(c_H)^{-\sigma-1} + \frac{p^2 (c_M)^{-\sigma-1}}{1-p-q} \right] < 0 \tag{29}$$

□

Corollary 3 (Comparative Statics of Optimal Progressivity)**.** *The optimal degree of progressivity λ^* exhibits the following properties:*

1. *Decreasing in outcome dispersion:* $\frac{\partial \lambda^*}{\partial (X_H - X_M)} < 0$
   Greater payoff variance makes insurance more costly to provide.

2. *Increasing in baseline success probability:* $\frac{\partial \lambda^*}{\partial (1-p-q)} > 0$
   Higher probability of moderate success reduces the insurance cost.

3. *Increasing in required subsidy:* $\frac{\partial \lambda^*}{\partial S^*} > 0$
   Larger commitment problems necessitate greater tax progressivity.

The certainty equivalent gain from implementing optimal progressivity rather than a flat tax ($\lambda = 0$) equals:

$$\Delta CE = u^{-1}[EU(\lambda^*)] - u^{-1}[EU(0)] \tag{30}$$

For moderate risk (using a second-order Taylor approximation):

$$\Delta CE \approx \frac{\sigma}{2} \cdot \mathrm{Var}[X|\text{success}] \cdot \eta(\lambda^*) \tag{31}$$

where $\mathrm{Var}[X|\text{success}] = \frac{p(1-p-q)(X_H - X_M)^2}{(1-q)^2}$ represents outcome variance conditional on project success, and $\eta(\lambda^*)$ captures the insurance efficiency of the progressive tax structure.

This demonstrates that welfare gains from progressivity increase with:

- Risk aversion (σ)

- Outcome uncertainty (Var[X])
- The efficiency of the tax mechanism in providing insurance

This analysis reveals a deep connection between insurance and efficiency motives for progressive taxation. While traditional optimal tax theory treats these as separate justifications, our framework shows they are complementary: risk aversion pins down the unique progressivity level that maximises the expected utility of entrepreneurs who need the tax-subsidy mechanism to overcome commitment problems. The optimal λ^* simultaneously:

1. Solves the commitment problem (efficiency motive)
2. Provides optimal insurance against outcome risk (insurance motive)
3. Maintains political stability by maximising ex-ante support

Moreover, the treatment explains why innovation-intensive economies with high outcome variance and severe commitment problems converge on highly progressive tax structures, not from redistributive politics, but from the joint solution to financing and insurance market failures.

4.4 Social Surplus and Subsidy Recovery

The government intervention generates positive social surplus despite $S^* > 0$ because:

Social gain from switching B to G:

$$\Delta W_{social} = [pX_H + (1-p-q)X_M] - (X_B + Z) \tag{32}$$

Net fiscal cost to government: In steady state, the government collects taxes that exactly recover the subsidy:

$$\text{Net fiscal cost} = S^* - [p\tau_H + (1-p-q)\tau_M] = S^* - S^* = 0 \tag{33}$$

Therefore, net social gain equals the full project value difference:

$$\text{Net social gain} = \Delta W_{social} - \text{Net fiscal cost} = \Delta W_{social} > 0 \tag{34}$$

The subsidy S^* is an upfront transfer that is fully recovered through future taxation. It is not a social cost but rather a financial flow that enables commitment. By Assumption 2, project G is socially efficient: $pX_H + (1-p-q)X_M > X_B + Z$, ensuring the net social gain is strictly positive.[8]

Despite full recovery of subsidies through taxes, private investors cannot offer equivalent contracts due to fundamental enforcement differences. Private investors cannot contract on the entrepreneur's non-verifiable private benefit Z, constraining them to $R \leq R^{\max}$. The government faces the same non-pledgeability problem but solves it through ex-ante commitment combined with irreversible transfers. The subsidy, given before project choice, irreversibly increases the entrepreneur's resources, enabling implementation of G even if they later regret the tax obligation.

Private equity cannot replicate this structure because after providing S, the entrepreneur could renege on repayment promises, creating a hold-up problem that private contracts cannot solve without pledgeable income. Moreover, private investors must rely on courts and collateral rather than the government's unique tax enforcement powers, and limited liability prevents forcing payment beyond realised returns. The entrepreneur could choose project B, receive $X_B + Z$, claim project failure, and keep the private benefit.

The crucial difference lies in the ex-ante constitutional commitment: entrepreneurs agree to the tax-subsidy contract before knowing their type and before receiving the subsidy. This constitutional-stage agreement creates binding obligations with future tax liability legally enforceable by the state, no possibility of renegotiation after success, and state capacity for monitoring and enforcing tax obligations. Private contracts cannot achieve this binding commitment because private IC constrains them to $(1-q)R \leq pX_H + (1-p-q)X_M - (X_B - I + Z)$ while government can enforce $(1-q)R' + [p\tau_H + (1-p-q)\tau_M] = I - W$ where tax obligations are enforced through state power, not private pledgeability.

In summary, the government does not overcome the non-pledgeability of B through better information. Rather, it solves the commitment problem by making irreversible wealth transfers upfront (the subsidy), creating legally binding future obligations (taxes) enforceable through state capacity, and offering this as an ex-ante contract before types are revealed. Private markets cannot replicate this because they lack the coercive power to enforce tax-like obligations and cannot make truly irreversible transfers without pledgeability constraints.

[8] There could in a more general framework be some deadweight costs associated with the tax regime, which we abstract from here

5 Political Economy Considerations

5.1 Ex-Ante vs Ex-Post Support

Proposition 6 (Constitutional Stage Support)**.** *At the constitutional stage (before types are revealed), all entrepreneurs support the tax-subsidy system because the expected payoff from accessing project G exceeds the certain payoff from project B:*

$$p(X_H - R' - \tau_H) + (1 - p - q)(X_M - R' - \tau_M) > X_B - I + Z \tag{35}$$

This holds despite entrepreneurs knowing they face probability p of paying high tax τ_H, probability $(1 - p - q)$ of paying tax τ_M, and probability q of paying nothing upon failure.

Proof. The entrepreneur's choice at the constitutional stage involves comparing two paths. Rejecting the contract condemns them to project B with certain payoff $X_B - I + Z$, as their wealth constraint prevents access to efficient investment. Accepting the contract provides subsidy S that enables implementation of project G, yielding expected payoff $p(X_H - R' - \tau_H) + (1 - p - q)(X_M - R' - \tau_M) + q \cdot 0$.

The crucial insight is that entrepreneurs rationally accept future tax obligations because these payments are conditional on success, while the subsidy provides immediate and certain access to the superior project. Without the subsidy, project G remains forever unattainable regardless of the entrepreneur's effort or ability. The expected value from accepting therefore exceeds the outside option by construction of the efficient project assumption, making acceptance optimal even with full knowledge of future tax burdens. This ex-ante unanimity differs fundamentally from ex-post preferences, where successful entrepreneurs may regret their tax obligations despite having benefited from the enabling subsidy. □

5.2 Dynamic Stability

Consider voting in period t on whether to maintain the tax-subsidy system. The population consists of:

- Fraction α: Young entrepreneurs seeking funding
- Fraction $(1 - \alpha)(1 - q)$: Surviving mature firms (those whose projects didn't fail)
- Fraction $(1 - \alpha)q$: Failed entrepreneurs (assumed to exit and not vote)

Definition 8 (Voting Preferences)**.** Young entrepreneurs seeking funding (fraction α) universally support the system since it enables access to project G with expected payoff $p(X_H -$

$R' - \tau_H) + (1-p-q)(X_M - R' - \tau_M)$ rather than constraining them to project B with payoff $X_B - I + B$. Among mature firms, those with baseline success (fraction $(1-\alpha)(1-p-q)$) support the system when they remain net beneficiaries—having received subsidy S when young and now paying tax $\tau_M \leq S$—or when re-entry possibilities exist. Extremely successful firms (fraction $(1-\alpha)p$) typically oppose the system as they pay high tax $\tau_H > S$, making them net payers, though they may support it when valuing re-entry options or general equilibrium benefits.

Proposition 7 (Stability with Re-entry)**.** *If successful firms can re-enter as entrepreneurs with probability $\theta > 0$, the stability condition becomes:*

$$\underbrace{\alpha}_{\textit{Young}} + \underbrace{(1-\alpha)p \cdot \Phi_H(\theta)}_{\textit{Extreme success}} + \underbrace{(1-\alpha)(1-p-q) \cdot \Phi_M(\theta)}_{\textit{Baseline success}} > \frac{1}{2} \tag{36}$$

where $\Phi_H(\theta)$ and $\Phi_M(\theta)$ are the fractions supporting the system given re-entry probability θ.

Proof. With re-entry, a successful firm's value of maintaining the system includes:

- Current cost: Paying taxes τ_i today
- Future benefit: With probability θ, needing subsidy S again
- Net present value: $-\tau_i + \delta\theta\mathbb{E}[V^{\text{entrepreneur}}]$

As θ increases, more successful firms support the system despite paying taxes. □

System stability emerges through multiple reinforcing channels beyond simple voting arithmetic. General equilibrium effects lead successful firms to benefit from expanded innovation ecosystems through enhanced supplier networks, customer bases, and knowledge spillovers. Reputational considerations constrain extremely successful 'unicorn' firms that benefited from past subsidies, as opposing the enabling system carries significant reputational costs. The endogenous exit of failed entrepreneurs alters effective voting weights, with the fraction q not participating in voting, thereby increasing the effective share of young entrepreneurs to $\alpha/[\alpha + (1-\alpha)(1-q)]$. Furthermore, tax design optimization can ensure stability by setting τ_M sufficiently low or even negative to secure support from baseline successful firms.

Proposition 8 (Minimum Stability Condition)**.** *Without re-entry ($\theta = 0$) and with purely self-interested voting, the system is stable if:*

$$\alpha > \frac{p(1-q)}{1 + p(1-q) - (1-p-q)\mathbf{1}[\tau_M < S]} \tag{37}$$

This requires a sufficient flow of new entrepreneurs relative to extremely successful firms.

6 Extensions

6.1 Heterogeneous Commitment Problems

The baseline model assumes homogeneous financing constraints, but entrepreneurial ventures naturally exhibit varying degrees of pledgeability problems. Consider entrepreneurs with different constraint levels $S_i \in [\underline{S}, \bar{S}]$, where higher values indicate more severe moral hazard. The government can address this heterogeneity through a menu of contracts $\{(R', S_i, \tau_{Mi}, \tau_{Hi})\}_{i \in I}$, where entrepreneurs self-select into appropriate subsidy levels based on their private information about project characteristics.

The incentive compatibility structure ensures that type i entrepreneurs prefer their intended contract to any alternative. Specifically, choosing contract i over contract j requires:

$$p(X_H - R' - \tau_{Hi}) + (1-p-q)(X_M - R' - \tau_{Mi}) \geq p(X_H - R' - \tau_{Hj}) + (1-p-q)(X_M - R' - \tau_{Mj}) \tag{38}$$

This simplifies to the monotonicity condition:

$$p(\tau_{Hj} - \tau_{Hi}) + (1 - p - q)(\tau_{Mj} - \tau_{Mi}) \geq 0 \tag{39}$$

This reveals that entrepreneurs requiring larger subsidies must face correspondingly higher tax obligations to prevent mimicry by less constrained types. Each type must also satisfy individual rationality:

$$p(X_H - R' - \tau_{Hi}) + (1 - p - q)(X_M - R' - \tau_{Mi}) \geq X_B - I + Z \tag{40}$$

6.2 Multi-Period Dynamic Model

The static framework naturally extends to an infinite horizon setting where successful entrepreneurs may re-enter as new ventures with probability θ, capturing serial entrepreneurship dynamics common in innovation ecosystems. A young entrepreneur's value function becomes:

$$V_Y = \max\{X_B + \delta V_O, -S + p(X_H - R' - \tau_H) + (1-p-q)(X_M - R' - \tau_M) + \delta[\theta V_Y + (1-\theta)V_O]\} \tag{41}$$

where V_O represents the outside option value and δ is the discount factor. This recursive structure generates richer political economy dynamics, as successful entrepreneurs who anticipate future ventures internalise the system's benefits beyond their current tax obligations. The re-entry possibility creates an implicit insurance market where today's successful entrepreneurs fund tomorrow's ventures, potentially including their own.

6.3 Industry-Specific Implications

Different industries exhibit distinct moral hazard profiles characterised by the tuple $\Theta = (p, X_H, X_M, X_B, I, Z, q)$, generating systematic variation in optimal tax progressivity. High-technology and venture capital sectors typically feature low success probability p, extreme payoff dispersion $(X_H - X_M)$, and substantial private benefits B from control rights and reputational gains. These characteristics necessitate highly progressive structures with:

$$\frac{\tau_H}{\tau_M} = \frac{S^*/p + \lambda(X_H - X_M)}{-\lambda p(X_H - X_M)/(1-p-q)} \gg 1 \tag{42}$$

Traditional manufacturing industries, conversely, exhibit higher success rates, compressed outcome distributions, and minimal private benefits, supporting flatter tax schedules.

7 Welfare Analysis

7.1 Efficiency Gains and Deadweight Loss

The tax-subsidy system generates net welfare gains by enabling efficient project selection despite introducing tax distortions. Total welfare change equals:

$$\Delta W = [pX_H + (1-p-q)X_M] - (X_B - I + Z) - DWL(\tau) \tag{43}$$

where the first term represents productivity gains from shifting entrepreneurs from project B to project G. The deadweight loss from taxation potentially takes the quadratic form:

$$DWL(\tau) = \frac{1}{2}\epsilon\left[p\tau_H^2\frac{1}{X_H} + (1-p-q)\tau_M^2\frac{1}{X_M}\right] \tag{44}$$

where ϵ represents the elasticity of entrepreneurial effort or subsequent investment decisions.

The efficiency comparison with alternative policies reveals why the tax-subsidy mechanism dominates other interventions despite its apparent complexity. Pure debt subsidies, while simpler to implement, cannot address the fundamental pledgeability problem when project volatility is high, as bankruptcy creates additional inefficiencies without solving the commitment issue. Government equity participation allows sharing in upside returns without tax distortions but introduces ownership complications and political economy problems when government becomes a significant shareholder in private enterprises.

7.2 Comparison to Alternative Policies

The tax-subsidy mechanism's superiority emerges from its unique combination of features that alternative policies cannot replicate. Table 1 summarises the key trade-offs across policy instruments.

Policy	Advantages	Disadvantages
Tax-Subsidy	Handles non-verifiable returns	Requires commitment
	Ex-ante efficiency	Distortionary taxation
Debt Subsidies	Simple implementation	Bankruptcy inefficiencies
	No equity dilution	Cannot handle volatility
Government Equity	Shares in upside	Ownership complications
	No tax distortion	Political economy issues

Table 1: Policy Comparison

Unlike loan guarantees that merely shift default risk to taxpayers, the tax-subsidy mechanism creates new value by enabling efficient projects. The net benefit relative to loan guarantees equals:

$$\Delta W_{TS} - \Delta W_{LG} = [pX_H + (1-p-q)X_M - X_B - Z] - q \cdot \text{Bankruptcy Costs} \tag{45}$$

In contrast to accelerators or incubators that provide mentorship and networks, the tax-subsidy mechanism directly addresses the financial constraint binding poor entrepreneurs. The system's self-financing property, where:

$$\lim_{T\to\infty} \frac{1}{T} \sum_{t=1}^{T} [S_t - (p\tau_{Ht} + (1-p-q)\tau_{Mt})] = 0 \tag{46}$$

distinguishes it from pure transfer programs requiring continuous fiscal outlays.

Consider the counterfactual of relying solely on private venture capital markets. While VCs possess monitoring capabilities and industry expertise, they cannot solve the fundamental pledgeability problem for entrepreneurs with wealth $W < W^*$. The government's comparative advantage lies not in project selection, VCs likely possess superior screening technology, but in enforcement powers that enable super-pledgeability. This suggests complementarity rather than substitution: the tax-subsidy mechanism enables entrepreneurs to reach the threshold where private capital becomes viable, after which market mechanisms efficiently allocate resources. The optimal policy therefore combines public enabling of access with private allocation of capital, leveraging each sector's comparative advantages.

7.3 Deadweight Loss Bounds

Incorporating deadweight losses into the framework provides the following welfare condition. The tax-subsidy mechanism improves welfare when:

$$[pX_H + (1-p-q)X_M - X_B - Z] > DWL(\tau) = \frac{\epsilon}{2}\left[p\frac{\tau_H^2}{X_H} + (1-p-q)\frac{\tau_M^2}{X_M}\right] \tag{47}$$

This defines maximum sustainable progressivity $\lambda^{\max}$ where productivity gains equal deadweight losses. The mechanism works best in sectors with large private benefits Z, skewed returns, and moderate behavioural elasticities ϵ—conditions typical of innovation-intensive industries.

8 Empirical Predictions

The theoretical framework generates distinctive empirical predictions that differentiate our mechanism from alternative explanations of progressive corporate taxation. These predictions centre on the relationship between moral hazard severity, tax progressivity, and entrepreneurial activity, offering multiple avenues for empirical validation.

At the cross-country level, our model predicts that nations with more progressive corporate tax structures should exhibit higher rates of innovative startup formation, controlling for other institutional factors. This relationship emerges not from redistributive politics but from the resolution of commitment problems:

$$\text{Startups}_{ct} = \beta_0 + \beta_1 \text{Progressivity}_{ct} + \gamma X_{ct} + \epsilon_{ct} \tag{48}$$

where $\beta_1 > 0$ specifically in industries with high private benefits. This prediction contrasts sharply with traditional models where progressivity discourages entrepreneurship. The key identification strategy involves examining within-country variation across industries with different moral hazard profiles—the positive relationship should be strongest in sectors where private benefits B are largest relative to pledgeable income.

Cross-industry variation provides another testing ground. Sectors characterised by higher outcome variance and larger private benefits should systematically lobby for and maintain more progressive tax structures:

$$\text{Tax Progressivity}_i = \alpha + \beta \text{Var}(X_i) + \delta Z_i + u_i \tag{49}$$

This prediction can be tested using industry-level data on tax treatment, project return distributions, and measures of non-contractible benefits such as control rights valuations or founder equity stakes. The technology sector's embrace of extreme progressivity, despite entrepreneurs' apparent wealth-maximising objectives, supports this mechanism.

Individual-level support for progressive taxation should exhibit a distinctive pattern based on entrepreneurial history and success outcomes. The support function:

$$\text{Support}_i = f(\text{Success}_i, \text{Past Subsidy}_i, \text{Industry}_i) \tag{50}$$

generates the testable prediction that $\frac{\partial^2 \text{Support}}{\partial \text{Success} \cdot \partial \text{Past Subsidy}} > 0$. Entrepreneurs who benefited from subsidies when capital-constrained should show attenuated opposition to progressive taxes even after achieving extreme success. This creates a natural experiment: comparing the tax policy preferences of successful entrepreneurs who did versus did not receive early-stage government support, controlling for selection effects through instrumental variables such as programme eligibility cutoffs or regional policy variation.

Additional testable implications emerge from the model's comparative statics. The political economy predictions imply that regions with higher entrepreneurial turnover rates (larger α) should maintain more stable progressive tax systems. The re-entry parameter θ can be proxied by serial entrepreneurship rates, with higher values predicting greater support for progressive taxation among successful entrepreneurs.

These predictions collectively distinguish our efficiency-based rationale from redistributive explanations of progressive corporate taxation. While both mechanisms might generate progressive structures, only ours predicts the specific patterns of industry variation, individual support conditional on entrepreneurial history, and the positive relationship between progressivity and startup formation in high-moral-hazard sectors.

9 Conclusion

This paper provides a novel efficiency rationale for progressive corporate taxation grounded in the fundamental commitment problems of entrepreneurial finance. Our central insight is that government intervention succeeds not by improving entrepreneurs' pledgeable income but by creating a "super-pledgeability" mechanism that combines upfront subsidies with tax enforcement powers that transcend private contracting limits. The subsidy alone merely shifts financing burdens without solving pledgeability constraints; taxes alone cannot work without first enabling efficient projects. Together, they create a system where the government's unique enforcement powers solve the commitment problem that plagues entrepreneurial finance.

Our framework generates several counter-intuitive insights. The optimal degree of tax progressivity emerges not from redistributive preferences but from moral hazard severity—industries with larger private benefits require more progressive structures. This explains why tax progressivity is most extreme in sectors like venture capital, where private benefits from control and reputation are substantial. The system can be self-sustaining even under purely self-interested voting, as entrepreneurs rationally support the tax-subsidy mechanism ex-ante, knowing it provides access to otherwise unattainable projects.

The empirical predictions are distinctive and testable. Industries with higher private benefits should exhibit both more progressive tax structures and higher equilibrium rates of entrepreneurial entry. Countries with stronger tax enforcement capabilities should support more vibrant entrepreneurial ecosystems, not despite but because of their ability to impose progressive taxes on success.

For policy design, our analysis cautions against viewing subsidies and taxes as separate instruments. Proposals to support entrepreneurship through subsidies while simultaneously reducing tax progressivity may be self-defeating, eliminating the very mechanism that makes subsidies effective. The broader theoretical contribution lies in demonstrating how government's institutional features create comparative advantages that private markets cannot replicate. Progressive taxation emerges not as a necessary evil that trades efficiency for equity, but as an integral component of an efficient financing system that leverages government's distinctive capabilities to solve commitment problems. The progressive tax system does not merely redistribute from winners to losers; it creates winners who could not otherwise exist.

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