Entrepreneurial Taxation, Occupational Choice and Credit Market Frictions

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Key ingredients to model these tradeoffs:

- Heterogeneity in skill and occupational preference
- Endogenous occupational choice
- Entrepreneurs hire workers, endogenous wages

Preview of Main Results

Baseline model without credit market frictions

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Add investment, borrowing and credit markets

- Adverse selection from private heterogeneity among entrepreneurs
- Credit market equilibrium affects entry into entrepreneurship

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- Adverse selection from private heterogeneity among entrepreneurs
- Credit market equilibrium affects entry into entrepreneurship
  $\longrightarrow$ Cross-subsidization from high to low-quality borrowers
  $\longrightarrow$ Excessive (insufficient) entry of low-skill (high-skill) entrepreneurs
  $\longrightarrow$ Regressive entrepreneurial taxation restores efficient occupational choice

Related Literature

- Simulating tax reforms in quantitative models with entrepreneurs
  Meh (2005) (flat tax reform), Cagetti/DeNardi (2009) (estate tax), Kitao (2008), Panousi (2008) (capital tax)
- Optimal savings distortions with entrepreneurial investment
  Albanesi (2006), (2008), Chari et al. (2002)
- Credit market interventions with adverse selection
  Stiglitz/Weiss (1976), DeMeza/Webb (1987), Innes (1992), Parker (2003)
- Optimal taxation with endogenous wages
  Feldstein (1973), Zeckhauser (1977), Allen (1982), Boadway et al. (1991), Parker (1999), Stiglitz (1982), Moresi (1998), Naito (1999)
- Nonlinear taxation with multidimensional private information
  Kleven et al. (2009)

Baseline Model

Measure one of heterogeneous individuals with two-dimensional private type

$$(\theta, \phi) \in [\underline{\theta}, \overline{\theta}] \times [0, \overline{\phi}_\theta], \quad \text{cdf } F(\theta) \text{ and } G_\theta(\phi)$$

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Individuals can choose between two occupations:

- Workers supply effective labor l at (endogenous) wage w
  Quasi-linear preferences

$$U(c, l, \theta) = c - \psi(l/\theta), \quad \psi(.) \text{ increasing, convex}$$

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  Profits

$$\pi = Y(L, E) - wL, \quad Y(L, E) \text{ is CRS, concave}$$

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  Utility

$$U(\pi, E, \theta) = \pi - \psi(E/\theta) - \phi,$$

  where ϕ is a (heterogeneous) cost of becoming an entrepreneur

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Critical cost value for occupational choice:

$$\tilde{\phi}(\theta, w) \equiv v_E(\theta, w) - v_W(\theta, w)$$

All (θ, ϕ) with $\phi \leq \tilde{\phi}(\theta, w)$ become entrepreneurs, the others workers

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Definition

An equilibrium without taxes is a wage w^* and an allocation $\{l^*(\theta, w^*)$, $L^*(\theta, w^*)$, $E^*(\theta, w^*)\}$ such that the labor market clears:

$$\int_\Theta G_\theta(\tilde{\phi}(\theta, w^*))L^*(\theta, w^*)dF(\theta) = \int_\Theta (1 - G_\theta(\tilde{\phi}(\theta, w^*)))l^*(\theta, w^*)dF(\theta)$$

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Given E, w, entrepreneurs of all types θ solve

$$\max_L Y(L, E) - wL \quad \Rightarrow \quad Y_L(L^c(E, w), E) = w$$

With CRS,

$$Y(L^c(E, w), E) = Y_L(L^c(E, w), E)L^c(E, w) + Y_E(L^c(E, w), E)E,$$

and thus $\pi = Y_E(L^c(E, w), E)E$

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Lemma

(i) Any no tax equilibrium involves $\tilde{w}(w^*) > w^*$ and $E^*(\theta, \tilde{w}^*) > l^*(\theta, w^*)\ \forall\theta$.
(ii) The critical cost value $\tilde{\phi}(\theta, w^*)$ is increasing in θ
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$G_\theta(\phi)$ can produce more general relationships between skill and entrepreneurship

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Non-linear income tax $T(.)$, treating labor income and firm profits equally

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$\rightarrow$ Cannot discriminate entrepreneurs of skill θ and workers of skill $(\tilde{w}/w)\theta$

Constrained Pareto Problem

With Pareto-weights $\tilde{F}(\theta)$, $\tilde{G}_\theta(\phi)$, the constrained Pareto problem is

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(i) In any constrained Pareto optimum, $\tilde{w} > w$ and $\tilde{w}E(\theta) > wl(\theta)\ \forall\theta \in \Theta$
(ii) $T'(wl(\underline{\theta})) = T'(\tilde{w}E(\overline{\theta})) = 0$ if $Y(L, E)$ is linear
(iii) Otherwise, $T'(wl(\underline{\theta}))$ and $T'(\tilde{w}E(\overline{\theta}))$ have opposite signs.
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Affect wages to relax (ND) and achieve more redistribution (trickle down)

Optimal Taxation Results

Pecuniary externality from prices w and $\tilde{w}$ entering program through (ND)

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(i) In any constrained Pareto optimum, $\tilde{w} > w$ and $\tilde{w}E(\theta) > wl(\theta)\ \forall\theta \in \Theta$
(ii) $T'(wl(\underline{\theta})) = T'(\tilde{w}E(\overline{\theta})) = 0$ if $Y(L, E)$ is linear
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Production distortions to relax (ND)
Production efficiency (Diamond/Mirrlees, 1971) not generally optimal

Differential Income and Profit Taxation

Allow different tax schedules $T_y(.)$ for labor income $y \equiv wl$ and $T_\pi(.)$ for profits π

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Relaxed constrained Pareto problem:

Differential Taxation

$$\max_{\substack{E(\theta),\, L(\theta),\, l(\theta),\\ v_E(\theta),\, v_W(\theta)}} \int_\Theta \Big[\tilde{G}_\theta(\tilde{\phi}(\theta))v_E(\theta) + (1-\tilde{G}_\theta(\tilde{\phi}(\theta)))v_w(\theta)\Big]d\tilde{F}(\theta) - \int_\Theta \int_{\underline{\phi}}^{\tilde{\phi}(\theta)} \phi d\tilde{G}_\theta(\phi) d\tilde{F}(\theta)$$

$$\text{s.t.} \quad \tilde{\phi}(\theta) = v_E(\theta) - v_W(\theta) \;\; \forall \theta \in \Theta$$

$$v_E'(\theta) = E(\theta)\psi'\left(E(\theta)/\theta\right)/\theta^2, \; v_W'(\theta) = l(\theta)\psi'\left(l(\theta)/\theta\right)/\theta^2, \; E(\theta), l(\theta) \text{ increasing } \forall \theta \in \Theta \tag{IC}$$

$$\int_\Theta G_\theta(\tilde{\phi}(\theta))L(\theta)dF(\theta) \leq \int_\Theta (1 - G_\theta(\tilde{\phi}(\theta)))l(\theta)dF(\theta) \tag{LM}$$

$$\int_\Theta G_\theta(\tilde{\phi}(\theta))\left[Y(L(\theta), E(\theta)) - v_E(\theta) - \psi(E(\theta)/\theta)\right]dF(\theta)$$
$$- \int_\Theta (1 - G(\tilde{\phi}(\theta)))\left[v_w(\theta) + \psi(l(\theta)/\theta)\right]dF(\theta) \geq \quad 0 \tag{RC}$$

Same as with uniform taxation, but without constraints (ND) and (MP)

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Differential taxation eliminates pecuniary externalities

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Observations:

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Observations:

- Production efficiency always optimal
- Optimal tax formulas no longer depend on whether $Y(L, E)$ is linear or not
- In particular, $T'_\pi(\pi(\underline{\theta})) = T'_\pi(\pi(\overline{\theta})) = T'_y(y(\underline{\theta})) = T'_y(y(\overline{\theta})) = 0$ in any case

Optimal Taxation Results II

Corollary

With a constant elasticity ε, the average marginal tax across occupations satisfies

$$G_\theta(\tilde{\phi}(\theta))\frac{T'_\pi(\pi(\theta))}{1-T'_\pi(\pi(\theta))}+\left(1-G_\theta(\tilde{\phi})\right)\frac{T'_y(y(\theta))}{1-T'_y(y(\theta))}=\frac{1+1/\varepsilon}{\theta f(\theta)}\left(\tilde{F}(\theta)-F(\theta)\right)$$

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Reintepretation: testing for Pareto optimality of T_π, T_y

Corollary

The schedules T_π, T_y inducing an allocation $(\pi(\theta), y(\theta), \tilde{\phi}(\theta))$ are Pareto optimal iff

$$\frac{\theta f_E(\theta)}{1+1/\varepsilon}\,\frac{T'_\pi(\pi(\theta))}{1-T'_\pi(\pi(\theta))}+F_E(\theta)-\int_{\underline{\theta}}^{\theta}\frac{g_{\hat{\theta}}(\tilde{\phi}(\hat{\theta}))f(\hat{\theta})}{\overline{G}}\Delta T(\hat{\theta})d\hat{\theta}\quad\text{and}$$

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are increasing in θ, where $\overline{G}\equiv\int_\Theta G_\theta(\tilde{\phi}(\theta))dF(\theta)$ and
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Only identification of $F(\theta)$ required

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Comparing Profit and Income Taxes

Assumption 1

θ and ϕ are independent and $g(\phi)$ is non-increasing

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Redistribution across cost types

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Suppose $\tilde{F}(\theta) = F(\theta)$ and $\tilde{g}(\phi) < g(\phi)$ for all $\phi \leq \tilde{\phi}(\overline{\theta})$. Then
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Redistribution across skill types

Proposition

Suppose that $\tilde{G}(\phi) = G(\phi)$ but $\tilde{F}(\theta) \neq F(\theta)$. If occupations are fixed, then

$$\frac{T'_\pi(\pi(\theta))}{1 - T'_\pi(\pi(\theta))} = \frac{T'_y(y(\theta))}{1 - T'_y(y(\theta))} = \frac{1 + 1/\varepsilon}{\theta f(\theta)} \left(\tilde{F}(\theta) - F(\theta)\right) \quad \text{for any } w, \tilde{w}$$

Numerical Illustration: Calibration I

Data on profits, income and entrepreneurship from 2007 SCF

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Entrepreneur: (i) self-employed, (ii) own business, (iii) actively manage it, (iv) ≥ 2 employees

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Descriptive Statistics

	Entrepreneurs		Workers	
	Mean	St. Dev.	Mean	St. Dev.
Age	48.4	10.2	42.1	11.6
Yearly Income (in 1000$)	88.5	234.7	69.5	128.3
Hours per Week	48.3	14.1	43.4	10.5
Weeks per Year	50.2	6.0	50.4	5.7
Wage per Hour (in $)	55.5	243.8	34.6	124.9

Numerical Illustration: Calibration II

Constant elasticity disutility of effort $\psi(e) = e^{1+1/\varepsilon}/(1+1/\varepsilon)$ with $\varepsilon = .25$

Cobb-Douglas technology $Y(L, E) = L^{\alpha} E^{1-\alpha}$ with $\alpha = .63$ (workers' share of income in SCF data)

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Identify $f(\theta)$ from empirical income distributions
$\rightarrow$ Impute marginal tax using functional form (Gouveia/Strauss, 1994)

$$\frac{T(y)}{y} = b - b\left[sy^{p} + 1\right]^{-1/p} \tag{1}$$

$\rightarrow$ Cagetti/DeNardi (2009) estimate b, s, p using PSID data
$\rightarrow$ Back out marginal tax rates T'_y and T'_π from (1),

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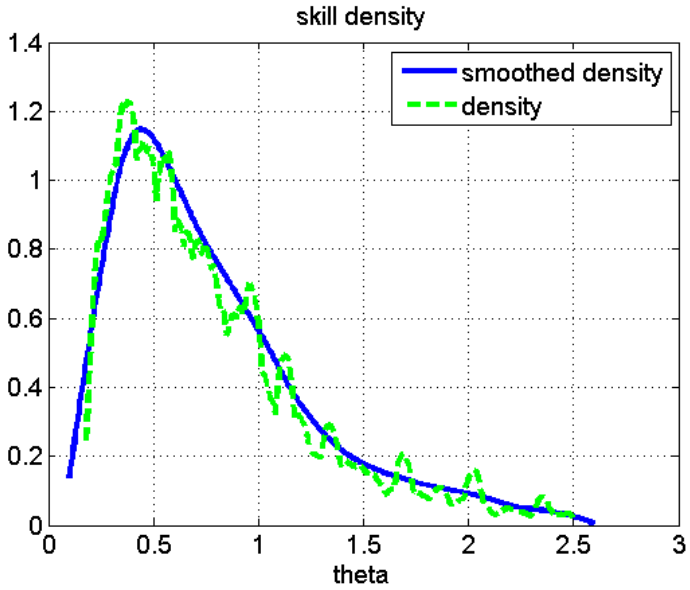
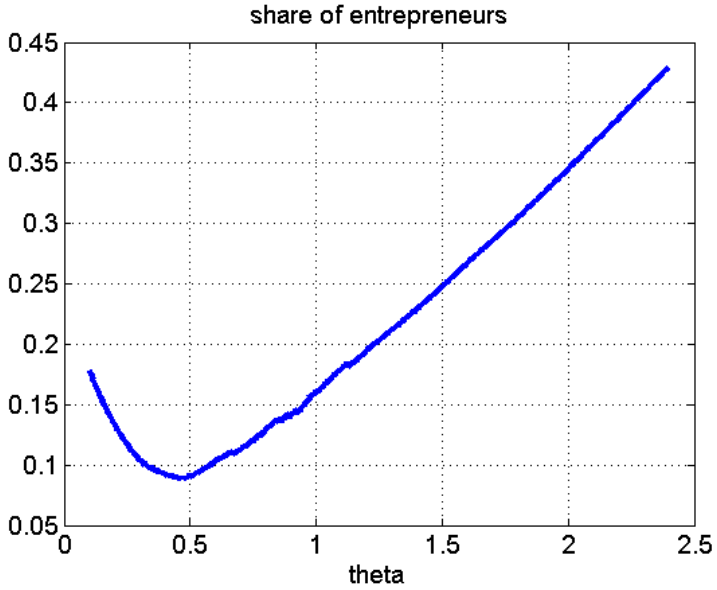
$\rightarrow$ $w\theta$ and $\tilde{w}\theta$ from

$$1 - T'_y(y) = \left(\frac{y}{w\theta}\right)^{1/\varepsilon} \text{ and } 1 - T'_\pi(\pi) = \left(\frac{\pi}{\tilde{w}\theta}\right)^{1/\varepsilon},$$

$\rightarrow$ w and $\tilde{w}$ such that $\tilde{w}/w$ equals ratio of mean wages of entrepreneurs and workers, and $\tilde{w} = (1-\alpha)(\alpha/w)^{\frac{\alpha}{1-\alpha}}$

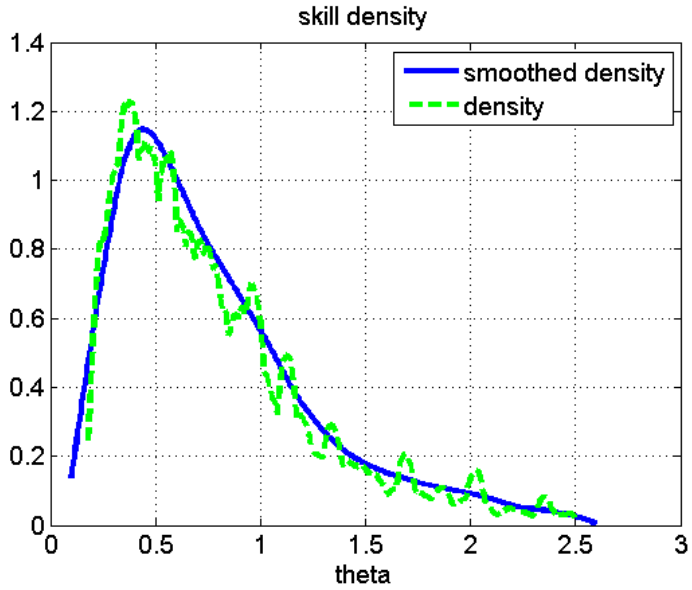
Numerical Illustration: Calibration III

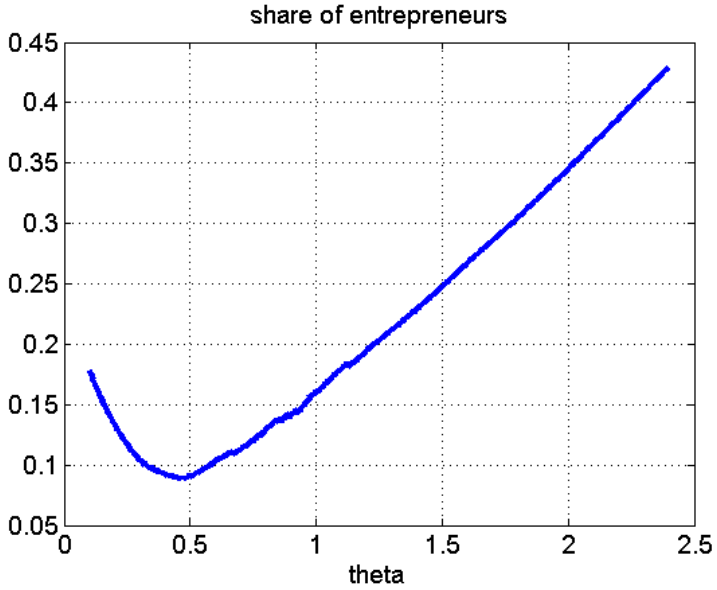




Kernel estimate of inferred skill density $f(\theta)$, truncated at 99 percentile

Numerical Illustration: Calibration III



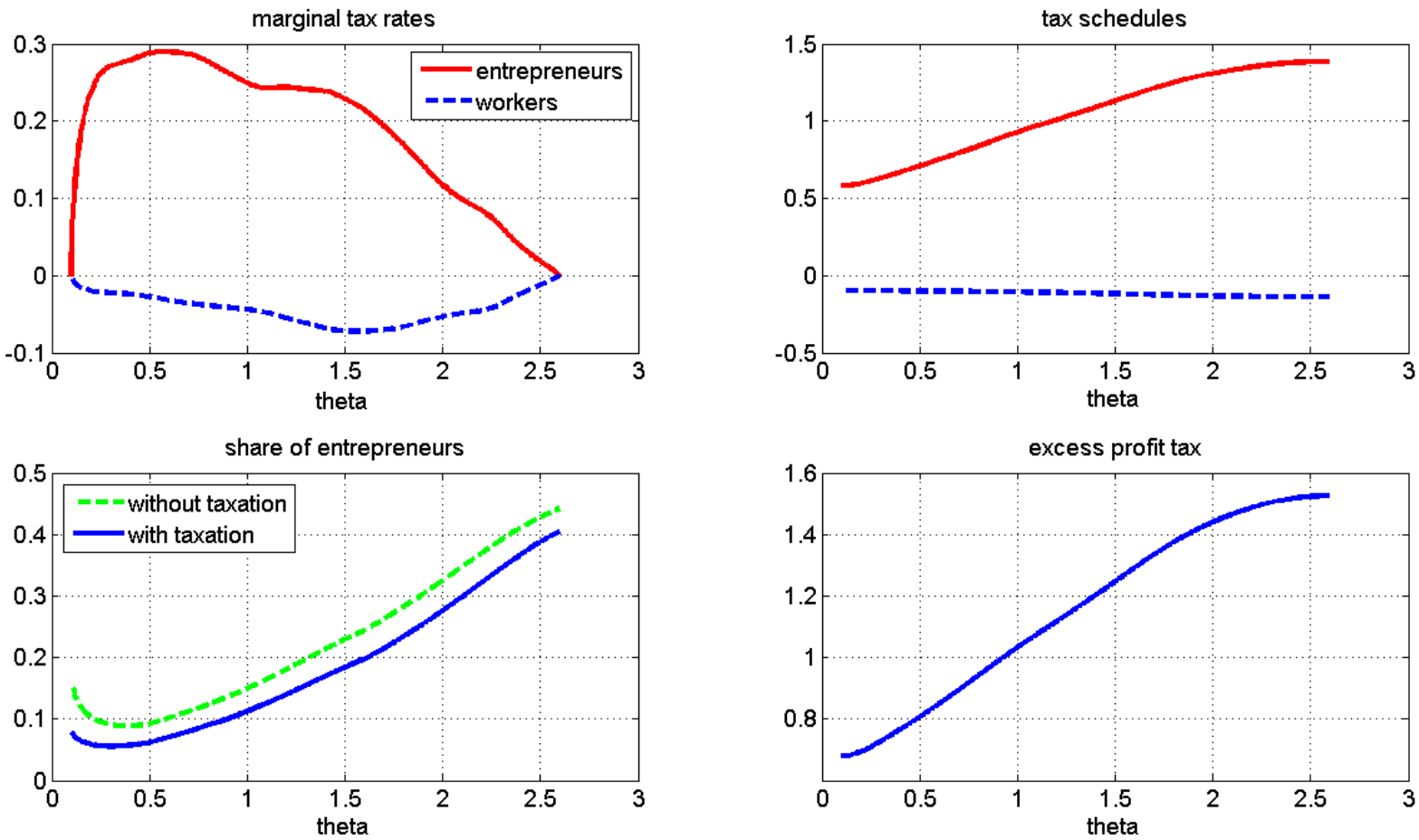


Kernel estimate of inferred skill density $f(\theta)$, truncated at 99 percentile

Iso-elastic cost distribution $G_\theta(\phi) = (\phi/\overline{\phi}_\theta)^\eta$ with $\eta = .5$

Adjust $\overline{\phi}_\theta$ to generate the pattern of the share of entrepreneurs in the right panel

Numerical Illustration: Redistribution Across Cost Types

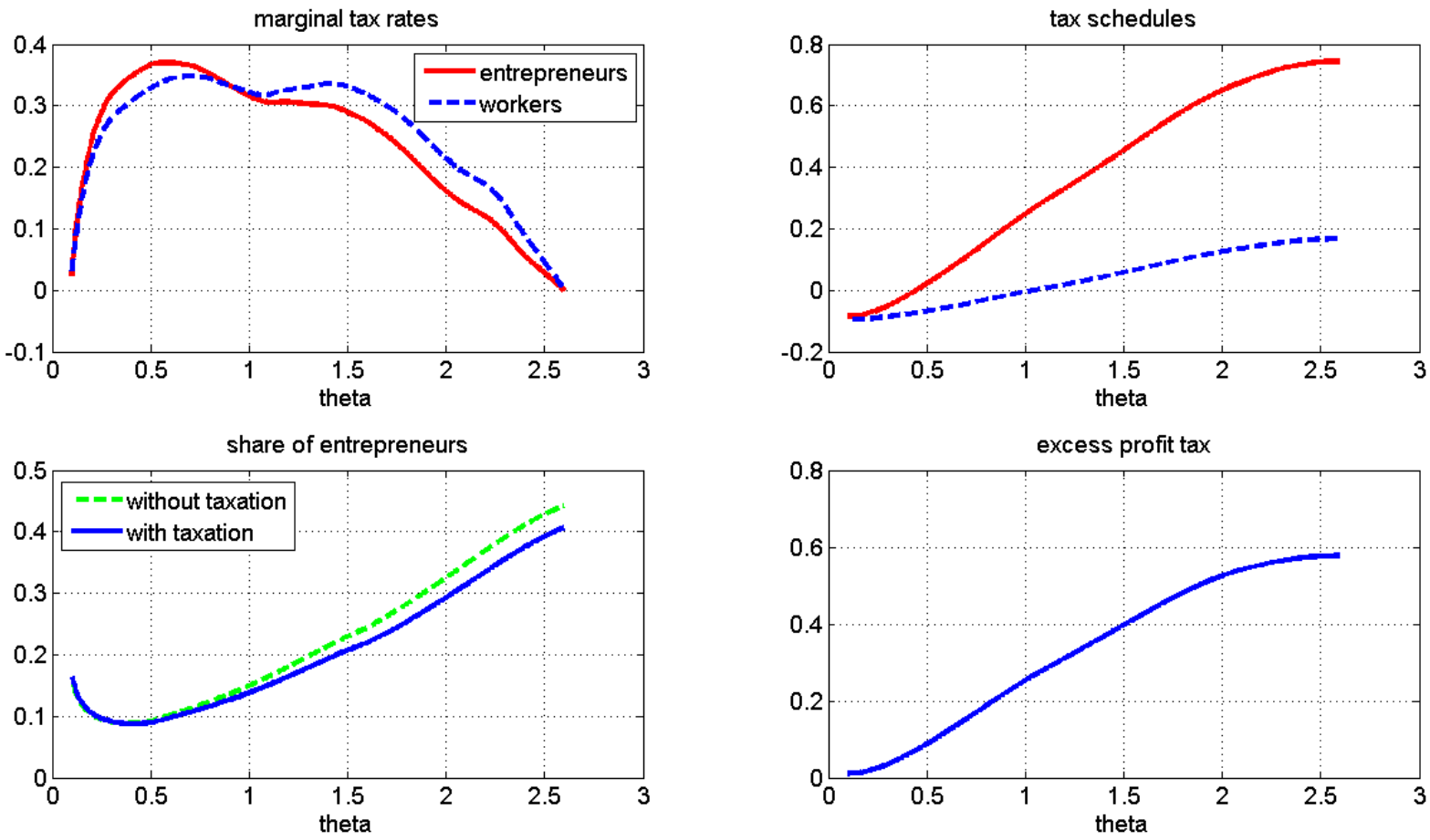


Pareto weights $\tilde{G}_\theta(\phi) = G_\theta(\phi)^{\rho_\Phi}$, $\rho_\Phi = 2$

$\longrightarrow$ Redistribution from low to high cost agents (entrepreneurs to workers)

$\longrightarrow$ w falls by 10% as a result of tax policy

Numerical Illustration: Redistribution Across Skill Types

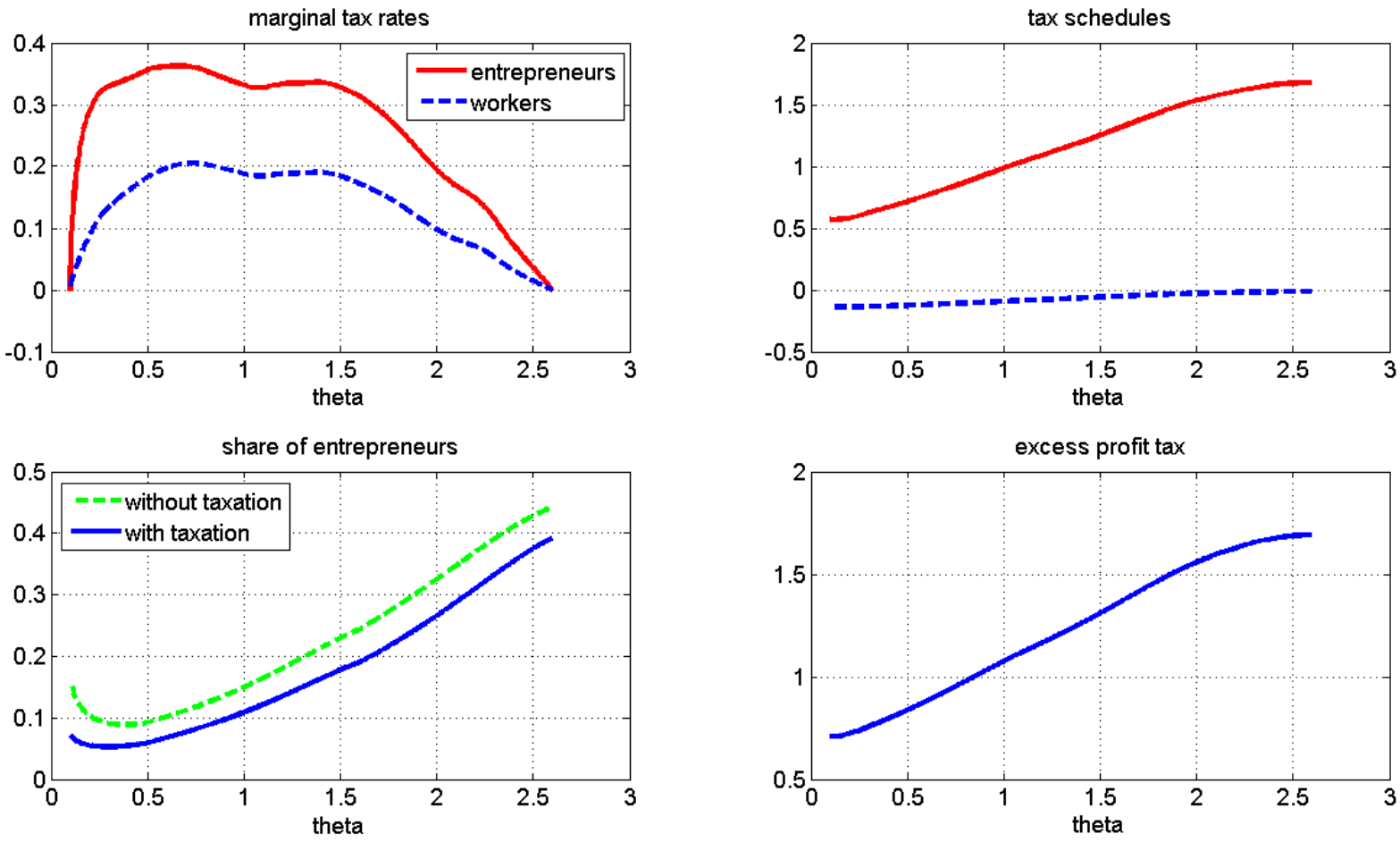


Pareto weights $\tilde{F}(\theta) = F(\theta)^{1/\rho_\Theta}$, $\rho_\Theta = 2$

$\longrightarrow$ Redistribution from high to low skill agents

$\longrightarrow$ w falls by 3% as a result of tax policy

Numerical Illustration: Redistribution Across θ and ϕ

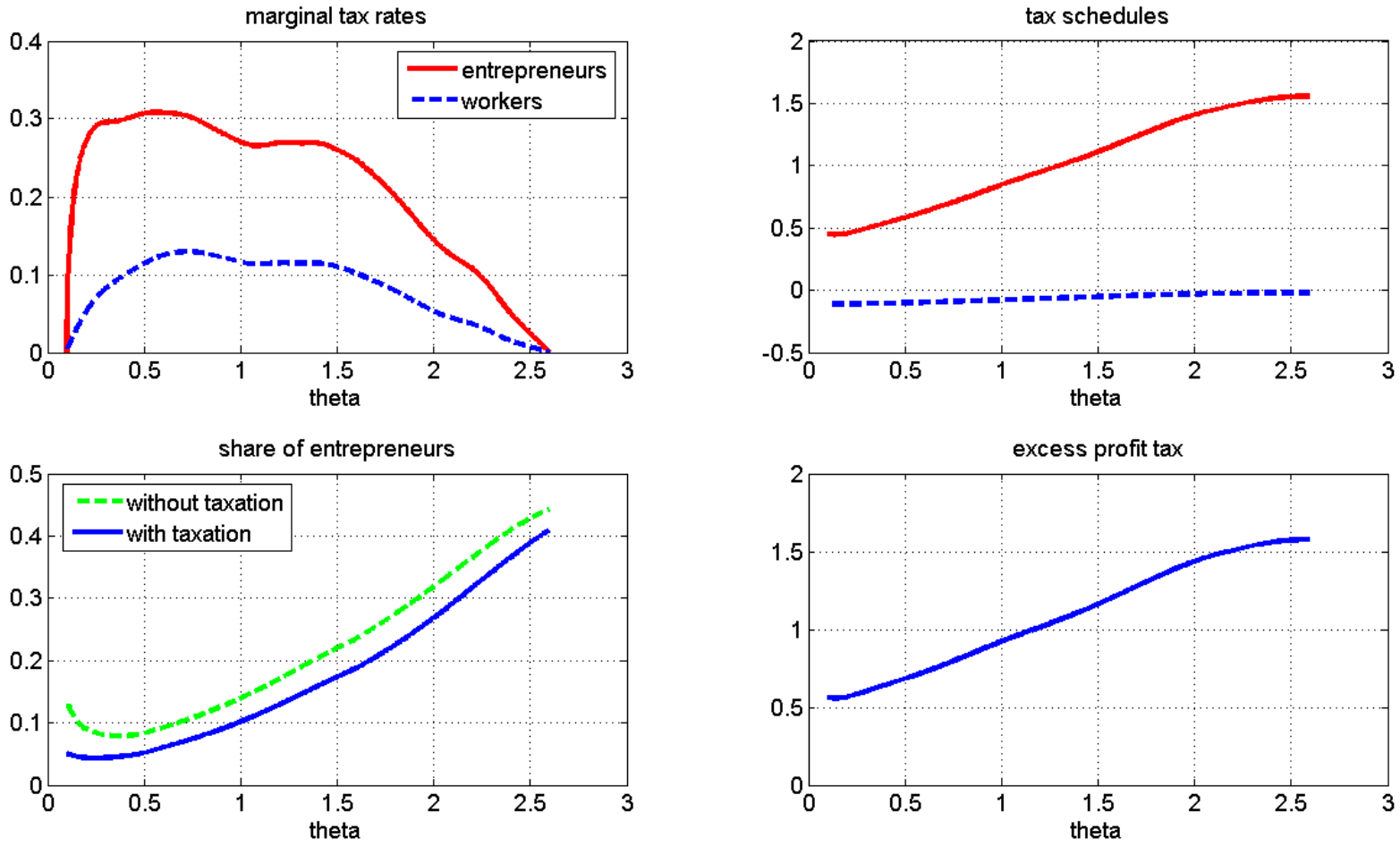


Pareto weights $\rho_\Theta = 2$, $\rho_\Phi = 2$

$\rightarrow$ Redistribution in both dimensions

$\rightarrow$ w falls by 12% as a result of tax policy

Numerical Illustration: Higher ε



Pareto weights $\rho_\Theta = 2$, $\rho_\Phi = 2$, increased elasticity $\varepsilon = .5$ rather than $\varepsilon = .25$
$\rightarrow$ Lower optimal marginal tax rates

Introducing Credit Markets

Suppose each entrepreneur has to invest I to set up a firm

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- Workers supply fixed amount of labor l and get utility $v_W = wl$
- Entrepreneurs hire labor and produce stochastic profits

$$\pi = Y(L) - wL + \epsilon, \quad \epsilon \sim H_\epsilon(\epsilon|\theta)$$

$H_\epsilon(\epsilon|\theta) \succeq_{MLRP} H_\epsilon(\epsilon|\theta')$ for $\theta > \theta'$

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$\Rightarrow$ Entrepreneurs' expected utility $\int(\pi - R_\theta(\pi))dH(\pi|\theta) - \phi$

$\Rightarrow$ Given any $\{R_\theta(\pi)\}$, all entrepreneurs hire the same L s.t. $Y_L = w$

$\Rightarrow$ Can work with $H(\pi|\theta)$ directly, with support Π

Credit Market Equilibrium I

Definition

A credit market equilibrium is a set of contracts $\{R_\theta(\pi)\}$ such that
(i)

$$\int_\Pi (\pi - R_\theta(\pi))\, dH(\pi|\theta) \geq \int_\Pi (\pi - R_{\theta'}(\pi))\, dH(\pi|\theta) \;\; \forall \theta, \theta' \in \Theta, \tag{IC}$$

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Restrict to contracts s.t. (i) $0 \leq R_\theta(\pi) \leq \pi$ (limited liability), and
(ii) $R_\theta(\pi)$ non-decreasing (monotonicity)

Credit Market Equilibrium II

Proposition

Under Assumption 1, the credit market equilibrium is such that only the single contract $R^*(\pi) = \min\{\pi, z^*\}$ is offered and z^* solves

$$\int_{\Theta} G(\tilde{\phi}_{z^*}(\theta)) \left[\int_{\Pi} \min\{\pi, z^*\} dH(\pi|\theta) - I \right] dF(\theta) = 0$$

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- Debt contracts put the maximal repayment in low-profit states

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Intuition:

- By MLRP, low-skill borrowers have more probability weight in low-profit states
- Debt contracts put the maximal repayment in low-profit states

$\longrightarrow$ Debt contracts are least attractive to low-skill borrowers

$\longrightarrow$ Any deviation would attract a lower quality borrower pool and earn negative profits

Efficiency of Occupational Choice

Efficiency: type (θ, ϕ) should become entrepreneur if and only if

$$\int_{\Pi} \pi dH(\pi|\theta) - I - \phi \geq v_W$$

$\Rightarrow$ Efficient critical cost value $\tilde{\phi}_e(\theta) = \int_{\Pi} \pi dH(\pi|\theta) - I - v_W$

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Corollary

There exists a skill-type $\tilde{\theta}$ s.t. $\int_{\Pi} \min\{\pi, z^*\} dH(\pi|\tilde{\theta}) = I$ and

$$\tilde{\phi}_{z^*}(\theta) > \tilde{\phi}_e(\theta) \;\; \forall \theta < \tilde{\theta}$$

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Cross-subsidization in the credit market leads to occupational misallocation:

- Excessive entry of low-skilled types into entrepreneurship
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- Excessive entry of low-skilled types into entrepreneurship
- Insufficient entry of high-skilled types

$\Rightarrow$ Too many and too few entrepreneurs simultaneously

Corrective Tax Policy

Lemma

If the profit tax $T(\pi)$ is such that after-tax profits $\hat{\pi} \equiv \pi - T(\pi)$ are increasing, then the credit market equilibrium given $T(\pi)$ is a single debt contract $R_{z_T^*}(\hat{\pi}) = \min\{\hat{\pi}, z_T^*\}$, where z_T^* solves

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If the tax policy $T(\pi)$ is introduced such that $\pi - T(\pi)$ is increasing and, for all $\theta \in \Theta$,

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Regressive profit tax counteracts cross-subsidization and restores efficiency

Conclusion

Uniform profit and income taxation...

- ... provides some justification for trickle down based arguments
- ... calls for additional tax distortions, e.g. on inputs

Role of differential profit and income taxation in ...

- ... removing pecuniary externalities from uniform taxation
- ... correcting inefficient sorting into occupations with credit market frictions