Corporate Income Tax, Legal Form of Organization, and Employment

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Online Appendix

Appendix A. Static Firm's Problem

The model uses a Cobb-Douglas production function $F(z,k,l) = zk^{\gamma}l^{\theta}$, where $\gamma + \theta < 1$. When an entrepreneur faces no capital constraint, he solves the following problem,

$$\max_{k,l} zk^{\gamma}l^{\theta} - wl - (r+\delta)k.$$

The first order conditions are

$$\gamma z k^{\gamma-1} l^{\theta} = r + \delta, \quad \text{and} \quad \theta z k^{\gamma} l^{\theta-1} = w.$$

The solutions are

$$k^*(z) = z^{\frac{1}{1-\gamma-\theta}} \left(\frac{\theta}{w}\right)^{\frac{\theta}{1-\gamma-\theta}} \left(\frac{\gamma}{r+\delta}\right)^{\frac{1-\theta}{1-\gamma-\theta}};$$

$$l^*(z) = z^{\frac{1}{1-\gamma-\theta}} \left(\frac{\theta}{w}\right)^{\frac{1-\gamma}{1-\gamma-\theta}} \left(\frac{\gamma}{r+\delta}\right)^{\frac{\gamma}{1-\gamma-\theta}}.$$

The resulting optimal profit level can be expressed as

$$\pi^*(z) = (1-\gamma-\theta) \left(\frac{\theta}{w}\right)^{\frac{\theta}{1-\gamma-\theta}} \left(\frac{\gamma}{r+\delta}\right)^{\frac{\gamma}{1-\gamma-\theta}} z^{\frac{1}{1-\gamma-\theta}}.$$

In this case, the optimal profit function $\pi^*(z)$ is only a function of the productivity level z. It is increasing and convex in z.

When an entrepreneur has assets $a < k^*(z)$, and no access to external financing, the firm is capital constrained. For this situation, the firm solves the following problem,

$$\max_{k,l} zk^\gamma l^\theta - wl - (r+\delta)k$$
$$\text{subject to: } k \leq a$$

It is trivial to show that firms would choose $k = a$ in this case. The first-order conditions imply,

$$\theta z a^\gamma l^{\theta-1} = w \quad \Rightarrow \quad l(z,a) = \left(\frac{\theta z a^\gamma}{w}\right)^{\frac{1}{1-\theta}}.$$

Let $\kappa(z,a) = \min\{a/k^*(z), 1\}$, then

$$a = \kappa k^*(z) = \kappa z^{\frac{1}{1-\gamma-\theta}} \left(\frac{\theta}{w}\right)^{\frac{\theta}{1-\gamma-\theta}} \left(\frac{\gamma}{r+\delta}\right)^{\frac{1-\theta}{1-\gamma-\theta}}.$$

Therefore, $\pi(z,a) = \frac{(1-\theta)\kappa^{\frac{\gamma}{1-\theta}} - \gamma\kappa}{1-\theta-\gamma}\pi^*(z)$. The capital-to-output ratios are

$$\begin{aligned}
\frac{k^*(z)}{y^*(z)} &= \frac{z^{\frac{1}{1-\gamma-\theta}} \left(\frac{\theta}{w}\right)^{\frac{\theta}{1-\gamma-\theta}} \left(\frac{\gamma}{r+\delta}\right)^{\frac{1-\theta}{1-\gamma-\theta}}}{\left(\frac{\theta}{w}\right)^{\frac{\theta}{1-\gamma-\theta}} \left(\frac{\gamma}{r+\delta}\right)^{\frac{\gamma}{1-\gamma-\theta}} z^{\frac{1}{1-\gamma-\theta}}} = \frac{\gamma}{r+\delta}; \\
\frac{k(z,a)}{y(z,a)} &= \frac{a}{y(z,a)} = \frac{\kappa}{\kappa^{\frac{\gamma}{1-\theta}}} \frac{k^*(z)}{y^*(z)} = \kappa^{\frac{1-\gamma-\theta}{1-\theta}} \frac{k^*(z)}{y^*(z)} < \frac{k^*(z)}{y^*(z)}.
\end{aligned}$$

Appendix B. Numerical Algorithm for Computing Stationary Equilibrium

The algorithm used to compute the benchmark equilibrium proceeds as follows:

1) Construct a grid for the state variables z and a. The maximum asset level $\bar{a}$ is chosen so that any agent's saving decision $a' < \bar{a}$ never reaches the maximum level in equilibrium.

2) For any given pair of wage rate w and interest rate r, solve for the optimal decision rules $\chi(z,a)$, $n(z,a))$, $a'(z,a)$, and value functions $V(z,a)$ using the endogenous grid method, as proposed in **?**.

3) Given the decision rules, compute the associated invariant distribution over states $\mu(z,a)$.

4) Given the invariant distribution, compute total effective labor demanded L^D, and the total effective labor supplied L^S. The excess labor supply is given by $\Delta_L = L^S - L^D$. In addition, compute total capital demand K^D, and total capital supply K^S. The excess capital supply is given by $\Delta_K = K^S - K^D$.

5) Iterate on both wage rate w and interest rate r until $|\Delta_L|$ and $|\Delta_K|$ are smaller than a pair of given convergence criteria.

6) Once equilibrium w and r are determined, compute total government tax revenue $R^c + R^p$ and total government non-employment transfer B. Back out the excess government revenue $\Delta_R = R^c + R^p - B$ from government's budget constraint.

7) Iterate on the personal income tax function parameter a_2 until $|\Delta_R|$ is smaller than a given convergence criterion.

To compute a counterfactual stationary equilibrium with a new corporate income tax rate τ^c, we also follow the same algorithm described above, in particular steps 2) to 7). With every policy experiment, we vary the corporate income tax rate τ^c, and follow the procedures to find a personal income tax function parameter a_2 such that the excess government revenue $|\Delta_R| = |R^c + R^p - B|$ is close to zero.

The capital-to-output ratios by LFO presented in Table 3 of the paper employ a similar methodology to McGrattan and Prescott (2013). The data sources are summarized below (Year 2011 data are used):

- Capital: NIPA Fixed Assets Accounts. Table 6.1. Current-Cost Net Stock of Private Fixed Assets by Industry Group and Legal Form of Organization. Line 2, Corporate; Line 6, Sole Proprietorships; Line 7, Partnerships.
- National Income: NIPA GDP & Personal Income Accounts. Table 1.13. National Income by Sector, Legal Form of Organization, and Type of Income. Line 3 Corporate Business. Line 19 Sole Proprietorship and Partnerships.

The corporate accounts above are not broken down by types of corporation; we use the IRS Corporation Complete Report to calculate the fraction Corporate outputs and capitals belonging to C corporations.

The IRS Corporation Complete Report Table 2 provides depreciable asset and business receipt accounts for all active corporations. Table 12 provides these accounts for active C corporations (Returns of all active corporations, other than Forms 1120S, 1120-REIT, and 1120-RIC). We approximate the fraction of C corporation output by the fraction of C corporation business receipts, and the fraction C corporation capital by the fraction of C corporation depreciable assets. These two ratios are 75.8 percent and 80.1 percent, respectively. Using these ratios, we can calculate the C corporation National Income and Capital. We calculate the National Income and Capital of pass-through businesses by summing up the respective accounts of "Corporations other than C corporations", "Sole Proprietorship", and "Partnerships."

We calculate capital depreciation using $\delta \times$ "Capital", where δ is the five-year estimated depreciation rate described in the paper. The five-year output level is the sum of five times of "National Income' and calculated five-year capital depreciation. Therefore, the five-year capital-to-output ratios $k/y = \frac{Capital}{Five-Year\ Output}$.

NIPA does not provide a breakdown of accounts by both industry sectors and LFO. To approximate the capital-to-output ratios by LFO in different industry sectors, we use the IRS Corporation Complete Report. In a similar fashion to the above, we can gather data of the total business receipts and assets by corporate types. The IRS also reports total business receipts and assets for all other pass-through businesses, except for sole proprietors (for which IRS only reports business receipts but not assets). We construct the following table reporting asset-to-business receipt ratios for all non-agricultural industry sectors. The pass-through business numbers here do not include sole proprietors.

Table C1. Asset-to-Business Receipt Ratios by Industry Sectors and LFO

Sector	C corporation	Pass-through Business
Mining	2.57	2.28
Utilities	2.83	1.45
Construction	0.71	0.58
Manufacturing	1.57	0.62
Wholesale trade	0.75	0.29
Retail trade	0.55	0.30
Transportation and warehousing	1.11	1.11
Information	2.83	2.09
Finance and insurance	12.38	90.38
Real estate and rental and leasing	3.60	27.61
Professional services	1.24	0.42
Management of companies	84.86	41.87
Administrative services	0.92	0.41
Educational services	1.05	0.53
Health care and social assistance	0.70	0.43
Arts, entertainment, and recreation	1.71	1.34
Accommodation and food services	1.57	0.88
Other services	1.06	0.43

NIPA does not provide a breakdown of accounts by both firm size and legal forms of organization. We once again resort to the IRS Corporation Complete Report to approximate the capital-to-output ratios by LFO in different firm size categories. A further complication is that the publicly available IRS data does not report business assets by corporate types and by business size categories. Instead of calculating business asset-to-receipt ratios, we report capital income to business receipt ratios. In our model, this is equivalent to $\frac{(r+\delta)k}{y}$. Based on NIPA, the capital depreciation rate δ does differ slightly by LFO. The annual depreciation rate is 0.087 for C corporations, and it is 0.082 for pass-through firms. This difference should be even smaller within particular size categories.

For this exercise, we focus on only S corporation and C corporations, due to the limitations of the IRS data. To calculate the capital income for all active corporations, we use the IRS Corporation Complete Report Table 5. Under total deductions, we sum the amount of "Interest paid," "Amortization," and "Depreciation." We can find the same accounts for S corporations in the S corporation Basic Table 4. By subtraction, we can construct the capital income of C corporations. Our calculation of capital income of C corporation here is only partial and does not include portfolio payments to shareholders such as dividend payments. However, portfolio payments are reported in the S corporation Basic Table 4, so we include those in the calculation of S corporation capital income. In other words, our calculations here bias toward S corporations and potentially underestimate the difference between C and S corporations within each size category. Firms sizes are measured by the size of firm business receipts; we report all categories that are available in the IRS data except for the category "Under $25,000." This category is excluded because a significant fraction of firms have zero or negative amount of business receipts. We report the capital income to business receipt ratios for these two corporate types in Table D.

Table C2. Capital Income-to-Business Receipt Ratios by Firm Size and LFO

Size of Business Receipts	C Corp	S Corp
All Firms	0.091	0.039
Under $50,000,000	0.066	0.043
$25,000 to $100,000	0.127	0.095
$100,000 to $250,000	0.078	0.046
$250,000 to $500,000	0.056	0.045
$500,000 to $ 1,000,000	0.050	0.038
$1,000,000 to $2,500,000	0.041	0.036
$2,500,000 to $5,000,000	0.040	0.031
$5,000,000 to $10,000,000	0.046	0.039
$10,000,000 to $50,000,000	0.058	0.032
$50,000,000 or more	0.096	0.032

Appendix D: External Equity Probability

We use the 2003 Survey of Small Business Finance data collected by the Federal Reserve Banks.

The list of variables used are as follows:

- Variable B3: ORGANIZATION TYPE. Survey Question: "For the fiscal year ending [DATE], was [FIRM] considered to be a sole proprietorship, a partnership, an S-corporation, or a C-corporation?"
  - C corporations include 6: C-Corporation
  - S corporations include 5: S-Corporation
  - All others are classified as pass-through firms.
- Variable A0_SIC2_FIN: 2 digit SIC CODE. We only included 20-39: Manufacturing, 50-51: Wholesale Trade, 52-59: Retail Trade, and 70-89: Services.
- Variable M1: PROP-PART GET ADDITIONAL EQUITY. Survey Question for Sole Proprietors and Partnerships: " During the last 12 months, did ([FIRM]) obtain any new equity investment from existing owners, or from new or existing partners, excluding retained earnings?"
- Variable M4: CORP ADDL EQUITY CAPITAL. Survey Question for Corporations: "During the last 12 months, did ([FIRM]) obtain any new equity investment from existing owners, or from new or existing partners, excluding retained earnings?"
- Variable M7_T2: Survey Question: "Did the firm raise equity investment from venture capital firm?"
- Variable M7_T3: Survey Question: "Did the firm raise equity investment from public equity?"
- Variable M8_T2: Survey Question: "Did the firm raise equity investment from Angel/informal capitalists?"

- Construct a dummy $ext = 1$ if the answer to M7_T2, or M7_T3, or M8_T2 is positive.

Results from the three different logit regressions are presented in Table D. Of these regressions, the dependent variable is ext, where $ext = 1$ if a firm raised investment from an external source, and $ext = 0$, if a firm raised investment from none of the three sources listed above. The models are differentiated by the different control variables they use. Model 1 is the basic model, taking into consideration of owner characteristics, and firm credit risk. Model 2 has the same controls as in Model 1 but adding control variables for industry sectors. Model 3 has the same controls as in Model 2 but adding control variables for both regions and firm sizes.

Table D. Logit Regressions on the Source of External Equity by LFO

	MODEL 1	MODEL 2	MODEL 3
C corporation	2.213***	2.071***	8.839***
	(0.486)	(0.450)	(1.654)
Minority Owner Share	0.011***	0.011**	0.015**
	(0.004)	(0.004)	(0.007)
Female Owner Share	−0.006	−0.003	−0.008
	(0.004)	(0.004)	(0.008)
Owner Age	−0.039	−0.050*	−0.408*
	(0.025)	(0.026)	(0.245)
Owner Education	1.057***	1.121***	2.330***
	(0.239)	(0.230)	(0.581)
Owner Experience	0.108***	0.115***	0.443**
	(0.023)	(0.023)	(0.175)
Firm Credit Risk	−1.262***	−1.252***	−0.140
	(0.176)	(0.176)	(0.398)
Industry Dummies	NO	YES	YES
Region Dummies	NO	NO	YES
Firm Size Dummies	NO	NO	YES
Cons	−6.843***	−6.217***	−10.184**
	(1.581)	(1.485)	(6.246)
Obs	617	617	251

Appendix E: Detailed Analysis of Consumption Equivalent Welfare

To evaluate the welfare implications of the model, we consider the value functions in steady states. The per-period utility function as specified in the manuscript is

$$U(c, n, \iota) = \alpha \ln(c) + (1 - \alpha) \ln(1 - n) + \iota\eta.$$

The lifetime utility function for an agent in the benchmark economy of state (z, a) is

$$V^{bench}(z, a) = \sum_{t=0}^{\infty} \beta^{t-1} U(c_t^{bench}, n_t^{bench}, \iota_t^{bench}).$$

To calculate the consumption equivalent welfare, we ask the following question: how much in percentage of consumption $\xi^{ss}(z, a)$ are you willing to pay in all contingencies in all future periods to go to the policy world, or $V^{policy}(z, a) = \sum_{t=0}^{\infty} \beta^{t-1} U(c_t^{bench}(1 + \xi^{ss}(z, a)), n_t^{bench}, \iota_t^{bench})$. Using the utility function specified,

$$\begin{aligned} V^{policy}(z, a) &= \sum_{t=0}^{\infty} \beta^{t-1}[\alpha \ln(c_t^{bench}(1 + \xi^{ss}(z, a))) + (1 - \alpha) \ln(1 - n_t^{bench}) + \iota_t^{bench}\eta] \\ &= \frac{\alpha}{1 - \beta} \ln(1 + \xi^{ss}(z, a)) + \sum_{t=0}^{\infty} \beta^{t-1}[\alpha \ln(c_t^{bench}) + (1 - \alpha) \ln(1 - n_t^{bench}) + \iota_t^{bench}\eta] \\ &= \frac{\alpha}{1 - \beta} \ln(1 + \xi^{ss}(z, a)) + V^{bench}(z, a). \end{aligned}$$

This implies

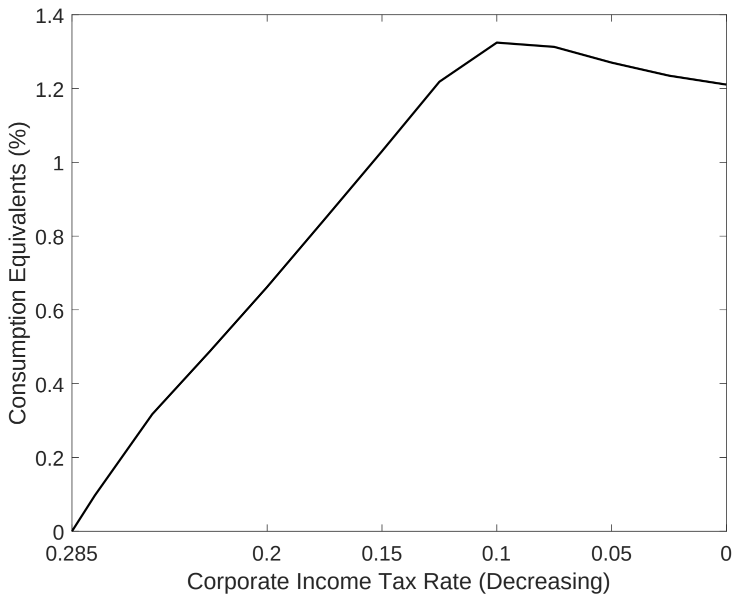
$$\xi(z, a) = \exp\left[\left(\frac{1 - \beta}{\alpha}\right)(V^{policy}(z, a) - V^{bench}(z, a))\right] - 1.$$

If $V^{policy}(z, a) > V^{bench}(z, a)$, then $\xi(z, a) > 0$ (welfare gain); vice versa.

Figure E graphs the average consumption-equivalent welfare for various corporate income tax rates. This graph has an inverse U-shape. The peak occurs at a corporate income tax rate of about 10 percent where the average welfare gain is 1.32 percent. If the corporate income tax is eliminated, the average welfare gain is 1.21 percent.

Establishing the aggregate welfare benefits that could occur from a decrease in the corporate income tax rate is important. Equally important are the distribution welfare impacts from this policy change. Table E reports the consumption-equivalent welfare by agents' occupations in the benchmark economy.

Figure E. Average Consumption Equivalent Welfare in Policy Experiment



Two changes in the corporate income tax rate are examined. One scenario is decreasing the corporate income tax rate to 10 percent, which is the rate that maximizes the aggregate consumption-equivalent welfare. In the other scenario, the corporate income tax is completely eliminated. Both policy changes would enjoy popular support in the economy. Lowering the corporate income tax rate directly lowers the tax obligation of C corporations and increases their after-tax profitability. In each scenario, C corporation entrepreneurs on average have the most to gain, compared with agents of other occupations. The average consumption-equivalent welfare of a C corporation entrepreneur is 8.58% when the corporate income tax rate is 10 percent, and it is 13.58% when the corporate income tax is eliminated. These gains are much larger in magnitude compared with the welfare gain of an average agent in the economy, which are 1.32% and 1.21%, respectively. Moreover, the lower the corporate income tax rate, the higher the consumption-equivalent welfare of a C corporation entrepreneur becomes. All C corporation entrepreneurs would support a corporate income tax cut.

Table E. Welfare By Occupation

Occupation	Proportion of Agents	Average Welfare Gain (%)		Percentage in Favor of Policy Change	
		$\tau^c = 10\%$	$\tau^c = 0\%$	$\tau^c = 10\%$	$\tau^c = 0\%$
Non-employed	0.341	0.81	0.51	100.00	97.06
Worker	0.631	1.57	1.49	100.00	100.00
Pass-through	0.022	0.83	1.40	63.64	41.03
C corporation	0.006	8.58	13.58	100.00	100.00
Overall	1.000	1.32	1.21	99.21	97.66

All workers in the benchmark economy would also support the corporate income tax cut. Workers benefit from an increase in the effective wage rate, which is more than enough to offset the increase in the personal income tax burden. In addition, a small fraction of workers in the benchmark economy who become C corporation entrepreneurs benefit from the reduction in the corporate income tax rate. However, the average consumption-equivalent welfare of a worker is much lower than that of a C corporation entrepreneur. An average worker in the benchmark economy would have a consumption-equivalent welfare of 1.57% when the corporate income tax rate is set at 10 percent, and it is 1.49% when the tax rate is zero. The consumption-equivalent welfare is lower when the corporate income tax is eliminated due to the corresponding increase in the personal income tax burden.

Pass-through businesses in the benchmark economy do not uniformly benefit from a lower corporate tax rate. A sizable fraction of pass-through entrepreneurs in the benchmark economy would change LFO and become C corporation entrepreneurs under the new tax regimes. They support the corporate income tax rate changes because they would benefit from improved access to capital and higher profitability. Other pass-through entrepreneurs would be hurt by the lower corporate income tax rates. Unlike C corporation entrepreneurs, the entrepreneurs who remain as pass-through business owners do not receive any relief in their tax burden when the corporate income tax rate is lowered. A decline in the corporate income tax rate leads to an increase in a firm's labor cost as the effective wage rate increases. In addition, a pass-through entrepreneur faces a higher personal income tax. As a result, they would not be in favor of a corporate income tax cut. Higher personal income taxes and higher labor costs also mean the support for a corporate tax policy change may decline as the cut in the corporate income tax rate becomes larger. About 64 percent of pass-through businesses in the benchmark economy would support lowering the corporate income tax rate to 10 percent. This percentage declines to 41 percent if the corporate income tax is eliminated. The average consumption-equivalent welfare of pass-through firms is positive. The consumption-equivalent welfare for an average pass-through firm in the benchmark economy is 0.83% when the tax rate is lowered to 10 percent, and it is 1.40% when the tax rate is set at zero. The average gain of a pass-through entrepreneur is larger when the corporate income tax rate is zero, because those who switch to operate C corporations would gain disproportionately more with a deeper cut in the corporate income tax.

The average non-employed agent in the benchmark economy is better off under either tax-cut regime. A lower corporate income tax rate stimulates labor demand in the economy. A non-employment agent has a better chance of finding a job in the future. The potential labor earnings also increase because the after-tax effective wage rate becomes higher. As a result, all non-employed agents would support a corporate income tax cut to 10 percent, and 97 percent would support eliminating the corporate income tax. However, the average welfare gain is small due to the increase in the personal income tax collection on non-employment transfers. For a non-employed individual in the benchmark economy, the average consumption-equivalent welfare is 0.81% when the tax rate is 10 percent, and it is 0.51% if the tax is eliminated.