Corporate Income Tax, Legal Form of Organization, and Employment

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A dynamic stochastic occupational choice model with heterogeneous agents is developed to evaluate the impact of a corporate income tax reduction on employment. In this framework, the key margin is the endogenous entrepreneurial choice of legal form of organization (LFO). A reduction in the corporate income tax burden encourages adoption of the C corporation legal form, which reduces capital constraints on firms. Improved capital re-allocation increases overall productive efficiency in the economy and therefore expands the labor market. Relative to the benchmark economy, a corporate income tax cut can reduce the non-employment rate by up to 7 percent.

Since the inception of the corporate income tax in 1909, the appropriateness of this tax as a government revenue instrument has been debated in both the policy and academic arenas. Economists have invested considerable efforts in understanding the incidence of a corporate income tax as well as its impact on firm decisions. Over the last few years, concerns with the corporate income tax have been focused on its potential negative effects on employment. Politicians have suggested that a cut in the corporate income tax rate could be an engine for job creation. This paper addresses the question "Will a decline in the corporate income tax generate jobs?"

The economic literature on the corporate income tax is voluminous.[1] Much of the literature views the corporate income tax as a tax on capital. The main focus of early works is to identify the incidence of the tax burden on factor inputs. This is exemplified by Harberger (1962)'s seminal paper, as well as Feldstein (1978), Feldstein and Slemrod (1980), and Shoven (1976). A capital tax is

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[1] See Auerbach (2006) for a more comprehensive overview of this literature.

inherently distortionary, and the literature finds that lowering the corporate income tax can improve economic efficiency. However, it is often assumed, as is the case in Harberger (1962), that the existence of the corporate income tax does not affect the aggregate labor and capital supply in the economy. The earlier literature pays less attention to how the corporate income tax affects aggregate factor supplies in the economy, in particular the aggregate labor supply. Moreover, some of the early work, such as Bradford (1981), Jorgenson (1963), and King and Fullerton (1984), examine the treatment of capital depreciation, investment incentives, dividends, and capital gains. Among them, Stiglitz (1976) stresses that some of the costs associated with corporate capital financing, such as interest payments on debts, are corporate tax deductible. Stiglitz argues that, without uncertainty, the corporate income tax becomes non-distortionary in this institutional context. So a natural question arises: "How can a corporate income tax reduction generate additional jobs?"

In this paper, we argue that a reduction in the corporate income tax can result in job growth, even when this tax is treated as a tax on pure corporate profit (i.e., all labor and capital costs are tax deductible). To evaluate the potential employment effect of a corporate income tax, this paper develops a dynamic stochastic occupational choice model with heterogeneous agents. Agents in the economy are able to choose between being non-employed, a worker, or an entrepreneur. Model dynamics are introduced in a manner similar to Hopenhayn and Rogerson (1993), which allow consideration of firm entry, exit, and size distribution. In addition, the model considers the corporate income tax implications of job creation, destruction, and reallocation across firms.

Two key elements allow the model to generate employment effects. The first key margin is a firm's choice of the legal form of organization (LFO). A firm chooses to be either a pass-through business or a C corporation. The motivation to include the LFO choice is that this decision can have important implications for employment, productivity, and growth of a firm. In the United States, 75 percent of the firms were of the pass-through legal form in 2011, and they hired nearly half of all workers. Pass-through firms include sole proprietorships, partnerships, limited liability firms, and S corporations. Although many legal differences exist between the pass-through legal form and the C corporation legal form, our model focuses on the essential trade-off a firm must face when choosing the LFO. A disadvantage of a firm filing as a C corporation is that the firm is subject to double taxation. A C corporation must pay the corporate income tax on its corporate profits. If remaining profits are distributed to shareholders, these profits are subject to the personal income tax. On the other hand, if a firm files as a pass-through entity, all profits are passed through to the business owners who are subject only to the personal income tax. The LFO choice also has implications for the access to capital. Pass-through entities are subject to legal restrictions on

access to capital. Legally, a pass-through entity can have no more than 100 shareholders and no foreign, institutional, or corporate shareholders. This type of firm cannot issue preferred stock, which limits its ability to attract "deep-pocket" investors such as venture capitalists. Given these restrictions, pass-through businesses are more likely to be capital constrained compared with C corporations. Data are examined across industry sectors and firm size classes to provide evidence that capital constraints indeed differ by LFO.

To understand the importance of endogenizing the choice of LFO, consider a representative firm faced with fixed input factor prices in a static perfectly competitive environment. If the firm is a pass-through entity and not subject to the corporate income tax, a change in the corporate income tax rate would not impact the firm's hiring decisions. If the firm is organized as a C corporation and all capital and labor costs are tax deductible, a change in the corporate income tax rate does not distort the relative input prices of capital and labor. In this situation, the firm's output level and employment decisions are not affected in the static environment. However, if the firm is allowed to choose between LFO, a reduction in the corporate income tax rate would encourage a pass-through firm to become a C corporation in an environment of a high corporate income tax rate. As a result of the change in LFO, this firm would have additional access to capital, allowing expansion of operations and hiring of additional workers.[2]

A second key element in the model is individual heterogeneity. Similar to Lucas (1978), agents in the model economy are heterogeneous in both productivity and asset holdings. Productivity evolves according to an exogenous first-order Markov process, while asset saving decisions are endogenous in the model. An agent makes occupational decisions after knowing his current productivity shock and asset holdings. Hence, there is no uncertainty over occupational choice in the current period. Because of these heterogeneities, the corporate income tax can distort individual occupational decisions.

A distortion in the occupational decision can impact the allocation of capital among firms in the economy. Ideally, marginal products of capital should be equalized across all firms in the economy. This means, more-productive firms would utilize more capital than less-productive firms. In our model, entrepreneurs finance their operations either by using personal wealth or by accessing the external capital market. More-productive entrepreneurs, with small individual personal wealth, are more likely to be capital constrained without external capital. If these firms choose the pass-through

[2]A firm's ability to change LFO is an empirically important margin. For example, the State of Kansas enacted a tax cut package that eliminated the state income tax on pass-through entities in 2012. From 2012 to 2014, 393,814 entities took advantage of this tax policy change. As a result, the total pass-through income reported by those entities had increased by 11%. This indicates that LFO decisions are responsive to income tax rate changes. (See "Testimony: Reexamining Kansas' Pass-through Carve-out," Tax Foundation, January 19, 2017.)

legal form to avoid double taxation, their access to a wider set of capital markets could be restricted. A high corporate income tax rate can cause an inefficiency by leaving some high marginal-return-to-capital firms without sufficient access to capital. The higher the corporate income tax rate, the more severe such capital misallocation would become. Because access to capital is central in our analysis of the employment effect, a distortion in capital allocation, caused by the corporate income tax, would impact the overall labor demand in the economy.

In addition, a reduction in the corporate income tax can lead to the entry of new C corporations. This happens when workers with managerial talents, faced with a lower corporate income tax, decide to become C corporate entrepreneurs. From this perspective, the corporate income tax is effectively a tax on entrepreneurship, and it is an entry deterrent on firms.[3] Empirically, the jobs generated by new entry firms can be important for the long-term labor market outlook. Haltiwanger, Jarmin and Miranda (2013) finds that younger firms, conditional on survival, are the key to employment growth compared with mature firms. While the new entry firms positively affect labor demand, they would also have, albeit more subtle, impacts on labor supply. As some workers leave the labor market to become entrepreneurs, labor supply in the economy would inevitably be negatively affected. This necessarily creates job openings to be filled by previously non-employed agents in the economy.

The model is calibrated to match key economic statistics such as the non-employment rate, the wealth distribution, and measures relating to the size distribution of firms and firm dynamics. Using the calibrated model, this paper quantitatively evaluates the impact that lowering the corporate income tax rate has on firm LFO choices, economic output, consumption, capital utilization, wealth distribution, and welfare, as well as employment and aggregate productivity. A series of policy experiments are conducted with respect to the corporate income tax rate. The policy changes are assumed to be revenue neutral, so the government must adjust the personal income tax to offset changes in revenue from the corporate income tax. With a lower corporate income tax rate, a significant fraction of firms switch from pass-through entities to C corporations. These firms, facing less severe capital constraints, increase in size and hire additional workers. Due to changes in LFO and new entry, the fraction of C corporations in the economy would increase significantly. If the corporate income tax is eliminated, the fraction of C corporations in the economy would increase by more than 20 percentage points compared with the calibrated benchmark economy. The fraction of employment by pass-through entities would be dwarfed by that of C corporations,

[3]The model reflects the recent developments in the literature on small business, where Hurst and Pugsley (2011) show a significant fraction of entrepreneurs choose to own businesses due to non-pecuniary reasons and never intend to grow their firms. Precisely, the model includes a non-pecuniary benefit for entrepreneurs owning their own businesses.

which would hire about 94 percent of all workers in the economy. Because a higher fraction of firms have better access to capital, the economy experiences an increase in output, consumption, and capital formation. The decline in the corporate income tax burden does increase the wealth gap. The increase in the wealth Gini coefficient is about 2 percent.

As expected, a reduction in the corporate income tax rate leads to moderate job growth. An increase in aggregate labor demand raises the effective wage level in the economy, which leads to more employment. If the corporate income tax would be eliminated, the model predicts that the non-employed population would decrease from 34.1 percent to 31.7 percent, about a 7 percent fall in the relative non-employment rate. Interestingly, productivity misallocation due to distortions in occupational choice is relatively moderate. With the elimination of the corporate income tax, total factor productivity (TFP) would increase by about 0.9 percent.

A welfare analysis is conducted to examine various corporate income tax regimes. A reduction in the corporate income tax rate does not always improve welfare. This is a result of the revenue neutrality assumption. A decrease in the corporate income tax rate can result in an increase in the personal income tax rate to compensate for the loss of the corporate income tax revenue. This creates a negative impact on economic welfare. Similar to Fehr et al. (2013), we find that the lower corporate income tax rate leads to increases in output, capital, consumption, and wages. They find that a cut of the tax rate to 9 percent can maintain revenue neutrality. We find that a cut of the tax rate to about 10 percent maximizes average economic welfare. With the tax cut, the widening of the corporate income tax base allows the government to maintain revenue neutrality without large increases in the personal income tax burden. In the meantime, workers have improved welfare as after-tax wages are higher, and C corporate entrepreneurs are better off because of the reduced corporate income tax liability. Therefore, an overwhelming majority of the population would be in favor of the corporate income tax cut.

The findings in this paper contribute to the literature on the corporate income tax. This paper shows that corporate tax policy is intimately linked to the employment rate in the economy, particularly through its impact on the LFO choice. A large portion of the literature on the corporate income tax treats this tax as a tax on capital income. The effect on labor demand comes from the distortion of relative input factor costs. The literature has pointed out that a capital tax can affect per capita hours worked in the economy. For example, taking a comprehensive view, McGrattan (2012) includes all types of capital taxes paid by businesses. She finds that changes in tax rates on dividend income and undistributed profits had a particularly large effect on investment and consequently hours worked during the Great Depression. This paper takes a simpler view of the

corporate income tax. All capital costs are fully deductible in our model, so the direct distortion of the tax on relative input factor costs within a firm is minimal. This allows us to focus on the distortion of the corporate income tax on the LFO choice. This distortion can have a large impact on the employment level in the economy. In particular, the non-employment rate reduction due to a corporate income tax cut can be more than twice as large if our model takes into full consideration entrepreneurs' endogenous LFO choices.

Because our results rely heavily on entrepreneurial choices of the LFO, this paper also relates to the literature on how organization form responds to the corporate income tax policy. Earlier works, such as Harberger (1962), have a fixed demarcation between corporate and non-corporate sectors. While not allowing choices over organizational forms, Bradford (1978) and Harberger (1995) argue that raising the corporate tax causes capital outflow, leaving abundant amounts of labor, and hence reduces the equilibrium pre-tax wage. Gravelle and Kotlikoff (1989), noticing the deficiency of this approach, endogenize the choice of organizational form. Later works, such as Gordon and MacKie-Mason (1994), Gordon and Slemrod (2000), Kotlikoff and Miao (2010), and Mackie-Mason and Gordon (1997) follow this trend and explicitly allow incorporation decisions in the model. The mechanisms through which the corporate income tax affects incorporation decisions can be different. For example, Kotlikoff and Miao (2010) show that the corporate income tax impacts entrepreneurs' incorporation decisions by affecting business risk sharing. Similar to Gordon and MacKie-Mason (1994) and Mackie-Mason and Gordon (1997), firms in our model do not choose to incorporate to avoid the burden of double taxation. In their papers, firms' incorporation decisions hinge upon the income tax progressivity. In contrast, in this paper, firms choose to incorporate because pass-through businesses are more likely to be capital constrained compared with C corporations. Empirically, Gordon and MacKie-Mason (1994), Goolsbee (1998), and Mackie-Mason and Gordon (1997) have generally found no major shifts between organizational forms in response to tax changes. One reason is that the historical variation in federal corporate tax rates had been almost negligible. The notable exception is Goolsbee (2004), who uses cross-sectional variation in state corporate tax rates to measure the organizational response. The predicted LFO changes in response to changes in the corporate income tax rate in this paper is in line with the findings in Goolsbee (2004).[4]

The main mechanism through which our model generates an employment effect is the lessening of

[4]Employing the Gruber and Saez (2002) bunching approach to examine the elasticity of the corporate tax income in the United Kingdom, Devereux, Liu and Loretz (2014) examine the decision on whether to declare firm income as either corporate profit or personal income in response to the corporate income tax rate change. They find the elasticity of the share of income recorded as corporate profits is small and positive with respect to the difference between personal and corporate income tax rates. This is indirect evidence of an organizational response due to a change in the corporate income tax rate.

restrictions on firms' access to capital. In this vein, our paper shares similarity to the strand of the literature that includes Anagnostopoulos, Cárceles-Poveda and Lin (2012), Chetty and Saez (2005), and Gourio and Miao (2010), who examine the effect of dividend and capital gain tax reforms in 2003. These papers enrich the understanding of how double taxation on corporate earnings affects investment efficiency. Gourio and Miao (2010), for example, show that cutting dividend tax and capital gains tax increases aggregate productivity due to reducing the friction in the reallocation of capital across firms. Cutting taxes in their setting encourages firms to issue more equity and break away from liquidity constraints, while cutting taxes in our setting encourages firms to switch LFO and gain wider access to capital. The respective focuses of those papers are very different from the focus of this paper. While the aforementioned papers focus on investment efficiency, this paper focuses on employment and organizational form responses. However, this paper does share a similar feature - namely, firm heterogeneity plays a central role in the analysis. The existence of heterogeneity makes it possible that more-efficient capital allocation can improve aggregate productivity.

In analyzing overall economic productivity, our paper also contributes to the literature on productivity misallocation across heterogeneous firms. There is a long strand of papers studying how productivity misallocation can potentially affect firm employment decisions. One example is Hopenhayn and Rogerson (1993), who find that a firing tax can distort the allocation of labor across firms, and this can lead to a TFP loss of 5 percent. Also related to our paper, Guner, Ventura and Xu (2008) use a version of the Lucas (1978) model to study size-dependent policies and misallocation. Empirically, many recent papers, such as Hsieh and Klenow (2009), Midrigan and Xu (2014), and Restuccia and Rogerson (2008), have estimated TFP losses due to productivity misallocation. From this perspective, our paper shares similarities with two papers.[5] Erosa (2001) shows financial costs of raising capital can affect entrepreneurial occupational choice and therefore cause misallocation of financial assets. In our paper, the corporate income tax has a similar role in distorting LFO choices. Midrigan and Xu (2014) study and evaluate how financial friction can determine TFP. Importantly, our paper, as in Midrigan and Xu (2014), incorporates two channels through which TFP can be affected by capital market imperfection. In our model, the corporate income tax first distorts firm entry decisions and second generates dispersion in marginal returns to capital across existing firms of different tightness of capital constraints. Interestingly, because of these two channels, we find that the effect of a reduction on the corporate income tax on overall

[5]Many other papers also document the implications of credit market imperfection and TFP - for example, Amaral and Quintin (2010), Buera, Kaboski and Shin (2011), and Caselli and Gennaioli (2013). See Restuccia and Rogerson (2013) for a more detailed overview.

economic efficiency is non-monotone. On one hand, a reduction in the corporate income tax rate encourages existing firms to adopt the C corporation legal form and reduces productivity misallocation through loosening capital constraints. On the other hand, the reduction in the tax rate induces entry by low-productivity firms, hence causing sizable efficiency loss. Because of the two counter-balancing forces, we find that the elimination of the corporate income tax has a relatively small overall effect on TFP, an increase of only about 0.9 percent.

The remainder of the paper is organized as follows. Section I presents the model and defines a stationary equilibrium. Section II lends empirical support to the modeling of capital constraints. Section III details the calibration procedure and analyzes the calibration results of the benchmark model. Section IV considers policy experiments, discusses the implications on employment and productivity, analyzes the importance of LFO choices, and provides welfare analyses. Section V concludes.

I. The Model

In this paper, a dynamic stochastic occupational choice model is developed. Time is discrete and infinite, indexed by $t = 0, 1, 2, ...$[6] The economy consists of a unit measure of heterogeneous agents, a financial intermediary and a government. Next, the decisions of each type of agent in the model is described, and then the stationary equilibrium is defined.

A. Agents

Agents are heterogeneous in their productive talents and asset holdings. They can choose between being non-employed, a worker, or an entrepreneur. An entrepreneur can decide whether to operate the firm as a pass-through business or as a C corporation.

Each agent is endowed with one unit of time that can be allocated between work n and leisure $l = 1 - n$. The work-leisure decision is discrete. Either an agent works full time $n = \overline{n}$ or spends all the time in leisure $n = 0$. Agents discount the future at rate $\beta \in [0, 1]$.

Agent heterogeneity is reflected through the agent's state variables, which include the agent's productivity z and asset level a. Productivity evolves according to an exogenous first-order Markov process that is independent across agents, where $\rho(z'|z)$ denotes the probability of receiving productivity z' tomorrow conditional on today's productivity being z.

While productivity evolves exogenously, agents make asset holding decisions endogenously. Each period, after observing current productivity z and asset level a, an agent decides on the asset

[6]For notational convenience, we suppress the time subscript t in the following model description.

holding next period a'. There is a non-borrowing constraint such that a' must be non-negative. The interest rate for asset savings is r.

Agent occupational choice decision χ is defined over a set of choices. An agent can alternatively choose to be non-employed, in which case $\chi = N$, become an employed worker, $\chi = E$, or be an entrepreneur. The entrepreneurship decision, depending on both agent productivity z and asset level a, is modeled similar to Cagetti and De Nardi (2006) and Quadrini (2000). In addition, this model allows for LFO choices. An entrepreneur can organize a firm as a pass-through entity, then $\chi = P$, or as a C corporation, in which case $\chi = C$. At the beginning of a period, agents make occupational decisions after observing their current-period state variables z and a.

An agent's occupational choice also determines labor supply n. If an agent decides to be non-employed, $\chi = N$, then all time is allocated to leisure and $n = 0$. Otherwise, for $\chi \in \{E, P, C\}$, an agent is assumed to work full time, or $n = \bar{n}$.

Agent preference $u(c, n, \iota)$ depends on current consumption level c, working hours n, and entrepreneurial choice ι. In particular, we assume agents value consumption c, leisure $1 - n$, and the opportunity to be an entrepreneur. The utility function takes the form

$$u(c, n, \iota) = v(c, n) + \iota \cdot \eta.$$

The indicator ι shows whether or not an agent is an entrepreneur. If $\iota = 0$, an agent is either non-employed or a worker. On the other hand, $\iota = 1$ indicates that the agent is operating either a pass-through entity or a C corporation. Entrepreneurship is accompanied by a constant increase in utility $\eta \geq 0$. Hurst and Pugsley (2011) refers to this additional utility as the agent's non-pecuniary benefits from owning a business. This aids in explaining the empirical pattern first documented by Hurst and Pugsley (2011) that a large number of small businesses never intend to grow larger. For the purpose of this paper, the magnitude of η is calibrated to match the size distribution of firms in the model economy.

All agents, regardless of occupational types, are subject to a personal income tax. If m is taxable personal income, then the total tax is given by a personal income tax function $T^p(m)$. C corporate profits are subject to a corporate income tax. If π is the C corporate profit, then the total tax is given by a corporate income tax function $T^c(\pi)$.

We next describe the agent's problem under each of the occupations $\chi \in \{N, E, P, C\}$.

Non-employed Agent. — An agent, choosing to be non-employed, receives a lump-sum transfer, b, from the government each period. This transfer and any interest income earned, ra, are subject to the personal income tax.

An agent's value function depends on productivity z and asset level a. If an agent is non-employed, the post-occupational-choice value function is denoted as $W^N(z,a)$, which is given by

$$\begin{aligned} W^N(z,a) &= \max_{c\geq 0, a'\geq 0} \; u(c,1,0) + \beta E_{z'|z} V(z',a') \\ \text{subject to:} &\quad c = (b+ra) - T^p(b+ra) + a - a'. \end{aligned} \tag{1}$$

Employed Worker. — If an agent decides to become an employed worker, he earns a wage w on effective labor $z\overline{n}$. Total income of this agent is comprised of earnings $wz\overline{n}$ and interest income ra. Both sources of income are subject to the personal income tax. The workers' value function, $W^E(z,a)$, is defined as

$$\begin{aligned} W^E(z,a) &= \max_{c\geq 0, a'\geq 0} \; u(c,1-\overline{n},0) + \beta E_{z'|z} V(z',a') \\ \text{subject to:} &\quad c = (wz\overline{n}+ra) - T^p(wz\overline{n}+ra) + a - a'. \end{aligned} \tag{2}$$

Entrepreneur. — The income of an entrepreneur depends on the firm's profit generated from production activities. All entrepreneurs have the same production function $F(z,k,l)$, which is increasing in productivity z, capital k, and labor l. Firms hire labor at wage rate w. Capital costs include both costs of depreciation and opportunity cost. Capital depreciates at rate δ. The opportunity cost of using a unit of capital is r, which is the return to saving a unit of asset. A firm's profit in a given period is defined as

$$\pi(z,k,l) = F(z,k,l) - (r+\delta)k - wl.$$

An entrepreneur can operate a firm either as a pass-through business or a C corporation. The choice of LFO depends on two essential differences. First, the profits of C corporations are subject to both the corporate income tax and the personal income tax, while the profits of pass-through businesses are passed through to their owners and only subject to the personal income tax. Double taxation is a clear disadvantage of electing the C corporation legal form. On the other hand, C corporations face less restriction on accessing capital. Empirical evidence supporting this claim is presented in Section II.

An entrepreneur self-finances the capital input of the firm or receives external capital from an financial intermediary. Firms receive external financing offers in a probabilistic fashion. The advantage of being a C corporation is that the chance of a C corporation receiving external financing offers (φ^c) is higher than that of a pass-through business (φ^p). We assume, upon receiving the offer, an entrepreneur can raise as much external capital as the firm requires. A firm without an external financing offer must self-finance all the firm's capital input, so $k \leq a$.

This difference between external financing probabilities φ^c and φ^p is a key feature in our model. The difference in φ^c and φ^p is intended to capture the varying capital constraints faced by firms of different LFO. The value of φ is strictly between zero and 100 percent, which indicates that firms can access external financing but the access is not unlimited. In our framework, when the difference between φ^c and φ^p is large enough to overcome the disadvantage of double taxation, some entrepreneurs, especially those with high managerial talent z and limited personal wealth, would find it optimal to elect the C corporation legal form for their businesses.

Next, optimization problems for both the pass-through and the C corporate entrepreneurs are specified.

A Pass-through Entrepreneur is not subject to the corporate income tax. However, both entrepreneurial and interest incomes are subject to the personal income tax. If a pass-through firm self-finances, the value of an entrepreneur is

$$
\begin{aligned}
(3) \qquad W^{P,self}(z,a) &= \max_{c\geq 0, a'\geq 0, k\geq 0, l\geq 0} \; u(c, 1-\overline{n}) + \beta E_{z'|z} V(z', a') \\
&\text{subject to:} \quad c = (\pi(z,k,l) + ra) - T^p(\pi(z,k,l) + ra) + a - a'; \\
&\qquad\qquad\quad k \leq a.
\end{aligned}
$$

On the other hand, if a pass-through firm receives external financing, the entrepreneur no longer faces the capital constraint $k \leq a$. The value of the entrepreneur is

$$
\begin{aligned}
(4) \qquad W^{P,ext}(z,a) &= \max_{c\geq 0, a'\geq 0, k\geq 0, l\geq 0} \; u(c, 1-\overline{n}) + \beta E_{z'|z} V(z', a') \\
&\text{subject to:} \quad c = (\pi(z,k,l) + ra) - T^p(\pi(z,k,l) + ra) + a - a'.
\end{aligned}
$$

The ex-ante value function of a pass-through business before knowing whether it is offered an

external financing opportunity is

$$W^P(z,a) = (1-\varphi^p)W^{P,self}(z,a) + \varphi^p W^{P,ext}(z,a). \tag{5}$$

A C corporation Entrepreneur's corporate profits are subject to double taxation. Profits are taxed both at the corporate level and the personal level. In addition, any interest income earned ra is subject to the personal income tax.

If a C corporation self-finances, the value of the entrepreneur is

$$\begin{aligned} W^{C,self}(z,a) = & \max_{c\geq 0, a'\geq 0, k\geq 0, l\geq 0} \quad u(c, 1-\overline{n}) + \beta E_{z'|z} V(z', a') \\ \text{subject to: } & c = (\pi(z,k,l) - T^c(\pi(z,k,l)) + ra) - T^p(\pi(z,k,l) - T^c(\pi(z,k,l)) + ra) + a - a'; \\ & k \leq a. \end{aligned} \tag{6}$$

If a C corporation receives external financing, the value of the entrepreneur is

$$\begin{aligned} W^{C,ext}(z,a) = & \max_{c\geq 0, a'\geq 0, k\geq 0, l\geq 0} \quad u(c, 1-\overline{n}) + \beta E_{z'|z} V(z', a') \\ \text{subject to: } & c = (\pi(z,k,l) - T^c(\pi(z,k,l)) + ra) - T^p(\pi(z,k,l) - T^c(\pi(z,k,l)) + ra) + a - a'. \end{aligned} \tag{7}$$

Similarly, the ex-ante value function of a C corporation is

$$W^C(z,a) = (1-\varphi^c)W^{C,self}(z,a) + \varphi^c W^{C,ext}(z,a). \tag{8}$$

Production occurs after entrepreneurial decisions are made and external financing shocks are realized. Therefore, entrepreneurs' optimal production input choices are static. In addition, both labor and capital input costs are assumed to be fully deductible in the corporate income tax by assumption.

The optimal input decisions can be fully derived analytically. When a firm is not capital constrained, either through external financing or by having enough personal wealth to self-finance, the optimal capital and labor choices depend only on the entrepreneur's productivity z and not on his asset level a. The optimal capital and labor choices are denoted as $k^*(z)$ and $l^*(z)$, and the optimal profits as $\pi^*(z)$. If a firm is capital constrained, or $a < k^*(z)$, a self-financing entrepreneur's asset holding a would affect the firm's optimal capital and labor choices $k(z,a)$ and $l(z,a)$, as well as its optimal profit $\pi(z,a)$. Analytical solutions with a Cobb-Douglas produc-

tion function $F(z,k,l) = zk^{\gamma}l^{\theta}$ are presented in Appendix A. In the appendix, we show that $\pi(z,a) = \frac{(1-\theta)\kappa^{\frac{\gamma}{1-\theta}} - \gamma\kappa}{1-\theta-\gamma}\pi^*(z)$, where $\kappa = \min\{a/k^*(z), 1\}$ measures the tightness of a firm's capital constraint. Firms with relatively high z or relatively low a have relatively low κ and are more capital constrained. A low κ leads to lower profits, so this type of firm benefits more from having external financing and is more likely to choose the C corporation legal form.

VALUE FUNCTION. — In the beginning of a period, given productivity z and asset position a, an agent makes the occupational decision that maximizes the ex-ante value function over different choices of being non-employed, an employed worker, a pass-through entrepreneur, or a C corporate entrepreneur:

$$V(z,a) = \max\{W^N(z,a), W^E(z,a), W^P(z,a), W^C(z,a)\}. \tag{9}$$

Solving the problem determines the optimal occupational choice decisions, $\chi(z,a)$, consumption choices, $c(z,a)$, asset saving decisions, $a'(z,a)$, and labor supply decisions, $n(z,a)$.

DISTRIBUTION. — Let $\mu(z,a)$ denote the invariant cross-sectional distribution measure of agents with productivity z and asset a. The evolution of this distribution depends on the endogenous asset choice $a'(z,a)$ and the exogenous Markov process of the productivity z. For any set of future asset levels $\mathcal{A}$ and any future productivity z', the following equation must be satisfied in the stationary equilibrium:

$$\mu(z', \mathcal{A}) = \int_{z,a} 1_{\{a'(z,a)\in\mathcal{A}\}}\rho(z'|z)\mu(dz, da). \tag{10}$$

B. Financial Intermediary

A financial intermediary behaves competitively and earns zero profit. The behavior of the financial intermediary is fairly mechanical in our model. It extends external financing offers in a random and probabilistic fashion based on a firm's declared LFO. A pass-through business has a φ^p chance of receiving the external financing offer, and a Corporation has a φ^c chance of receiving the offer. Then as long as a firm accepts the external financing offer, the financial intermediary raises all needed capital. The model abstracts away from any financing costs. In equilibrium, the interest rate on savings r adjusts until the capital market is cleared.

C. Government

The government collects revenue from a personal income tax and a corporate income tax. The personal income tax applies to all agents, including the non-employed, workers, and the two types of entrepreneurs. Labor, entrepreneurial, and interest incomes, as well as government transfers to the non-employed agents, are subject to the personal income tax, given by the tax function $T^p(y)$. The total personal income tax revenue is defined as

$$\begin{aligned} R^p \quad = \quad & \int_{z,a} [1_{\{\chi(z,a)=N\}} T^p(b + ra) + 1_{\{\chi(z,a)=E\}} T^p(wz\overline{n} + ra) \\ & + 1_{\{\chi(z,a)=P\}} \left[(1-\varphi^p) T^p(\pi(z,a) + ra) + \varphi^p T^p(\pi^*(z) + ra)\right] \\ & + 1_{\{\chi(z,a)=C\}} \left[(1-\varphi^c) T^p(\pi(z,a) - T^c(\pi(z,a)) + ra) + \varphi^c T^p(\pi^*(z) - T^c(\pi^*) + ra)\right]] \mu(dz, da). \end{aligned}$$

In the above equation, each indicator function $1_{\{\chi(z,a)\}}$ represents a particular occupational type $\chi(z,a)$ that is subject to either the personal or the corporate income tax. C corporate profits are subject to the corporate income tax $T^c(\pi)$, while profits from pass-through businesses are exempted. The total corporate income tax revenue is defined as

$$R^c = \int_{z,a} 1_{\{\chi(z,a)=C\}} ((1-\varphi^c) T^c(\pi(z,a)) + \varphi^c T^c(\pi^*(z))) \mu(dz, da).$$

The total revenue from the two sources is used to finance lump-sum transfers b to the non-employed. The aggregate transfers B is defined as

$$B = \int_{z,a} 1_{\{\chi(z,a)=N\}} b \mu(dz, da).$$

The government follows a balanced budget policy in equilibrium,

$$B = R^p + R^c. \tag{11}$$

D. Timing of Events

The timing of events within a period proceeds as follows:

1) An agent enters a period with productivity z and assets a;

2) The occupational decision χ is made;

3) The financial intermediary makes random external financing offers, and firms receive offers;

4) Production occurs. All agents receive their respective earnings;

5) The government levies taxes to finance transfers and exogenous government spending;

6) Consumption and saving decision are made; and

7) Agents draw new productivity shocks, and the period ends.

E. Labor Market

The effective labor supply from an employed worker is his productivity z times the hours worked $\overline{n}$. We aggregate over all employed workers to obtain the total labor supply,

$$L^S = \int_{z,a} 1_{\{\chi(z,a)=E\}} z\overline{n}\mu(dz, da).$$

Both pass-through firms and C corporations demand labor. Aggregating labor demand across entrepreneur types gives the measure of total labor demand. That is,

$$\begin{aligned} L^D \quad = \quad & \int_{z,a} [1_{\{\chi(z,a)=P\}}((1-\varphi^p)l(z,a) + \varphi^p l^*(z)) \\ & +1_{\{\chi(z,a)=C\}}((1-\varphi^c)l(z,a) + \varphi^c l^*(z))]\mu(dz, da). \end{aligned}$$

In equilibrium, the wage w clears the labor market, so

$$L^S = L^D. \tag{12}$$

F. Capital Market

Capital supply in the market is the sum of all agents' assets, which is defined as

$$K^S = \int_{z,a} a'(z,a)\mu(dz, da).$$

Both pass-through firms and C corporations demand capital. Aggregating capital demand across entrepreneurs under different organizational forms gives the total capital demand,

$$\begin{aligned} K^D &= \int_{z,a} [1_{\{\chi(z,a)=P\}}((1-\varphi^p)k(z,a)+\varphi^p k^*(z)) \\ &\quad +1_{\{\chi(z,a)=C\}}((1-\varphi^c)k(z,a)+\varphi^c k^*(z))]\mu(dz,da). \end{aligned}$$

In equilibrium, the interest rate r clears the capital market, so

$$K^S = K^D. \tag{13}$$

G. Equilibrium Definition

A stationary equilibrium consists of a set of agents' decision rules, $\chi^*(z,a)$, $c^*(z,a)$, $a'^*(z,a)$, $n^*(z,a)$, a wage rate w^*, an interest rate r^*, and a distribution $\mu^*(z,a)$, such that given a personal income tax function $T^p(\cdot)$, a corporate income tax function $T^c(\cdot)$, and non-employment transfer b:

1) The decision rules $\chi^*(z,a)$, $c^*(z,a)$, $a'^*(z,a)$, $n^*(z,a)$ solve the agent's optimization problem as stated in equations (1), (2), (5), (8), and (9);

2) The distribution $\mu^*(z,a)$ as defined in equation (10) reproduces itself;

3) The government budget condition as stated in equation (11) is satisfied;

4) The labor market as expressed in equation (12) is cleared; and

5) The capital market as expressed in equation (13) is cleared.

Both labor and capital markets are cleared. Hence, by Walras' law, the goods market also clears in the equilibrium. Appendix B outlines the algorithm for solving the model.

II. Empirical Evidence of Different Capital Constraints by LFO

In the model framework described in the previous section, the difference in capital constraints by LFO is a key margin in understanding why some entrepreneurs choose to operate C corporations. As previously mentioned, the legal codes of the United States have imposed restrictions on pass-through businesses' sources of capital. For example, they cannot have more than 100 shareholders, they cannot issue preferred stocks to attract venture capitals, and they are excluded from investments

by corporate, partnership, and foreign investors. This section provides empirical support to show that, due to these restrictions, a pass-through business is more likely to be capital constrained than a C corporation. Evidence is provided to show that the difference in capital constraints by LFO is robust across different industry sectors and firm size classes.

A. Capital-to-Output Ratio by LFO

In the model, entrepreneurs make static profit maximization decisions.[7] When a firm is not capital constrained, its optimal choice of capital input $k^*(z)$ and optimal output $y^*(z)$ are only functions of the entrepreneur's productivity level z, holding other parameters fixed. In this setting, an unconstrained firm's capital-to-output ratio is determined by the output elasticity of capital γ and marginal cost of capital $r+\delta$,

$$\frac{k^*(z)}{y^*(z)} = \frac{\gamma}{r+\delta}.$$

When an entrepreneur faces capital constraints and $a < k^*(z)$, we can similarly derive

$$\frac{k(z,a)}{y(z,a)} = \frac{a}{y(z,a)} = \kappa(z,a)^{\frac{1-\gamma-\theta}{1-\theta}} \frac{\gamma}{r+\delta},$$

where $\kappa(z,a) = \min\{a/k^*(z), 1\}$ measures the tightness of a firm's capital constraint. As long as $\kappa < 1$, the capital-to-output ratio is $\frac{k(z,a)}{y(z,a)} < \frac{k^*(z)}{y^*(z)}$. Therefore, the tighter the capital constraint a firm faces, the lower its capital-to-output ratio. Because κ is increasing in asset holding a and decreasing in productivity shock z, a firm would have a lower capital-to-output ratio if its owner has relatively higher productivity and/or relatively lower personal wealth to finance the firm's operation.

In the model, a firm's capital constraint is removed once it receives external financing. On average, external financed firms should have higher capital-to-output ratios compared with self-financing firms. Because the model postulates different probabilities of receiving external financing for firms of different LFO, the average capital-to-output ratios are likely to be different by LFO status. Of course, it is not necessarily always the case a priori that C corporations have a higher average capital-to-output ratio than pass-through businesses. For example, entrepreneurs with enough personal wealth ($a \geq k^*(z)$) can choose to self-finance pass-through businesses, while facing no capital constraints at all. However, if it is empirically documented that C corporations have higher capital-to-output ratios than pass-through businesses, then one can deduce that C corporations are indeed less capital constrained. Then the assumption that C corporations have a higher probability

[7] Appendix A provides a more detailed derivation of the analytical results shown in this subsection.

of receiving external financing ($\varphi^c > \varphi^p$) is a reasonable one.

Data available in the National Income and Product Accounts (NIPA) from the U.S. Bureau of Economic Analysis and the Corporation Complete Report from the Internal Revenue Service (IRS) are used to calculate the average capital-to-output ratios by LFO. Our model period is five years. Hence, the five-year average capital-to-output ratio is 0.306 for pass-through firms and 0.371 for C corporations. The procedure used to determine the capital-to-output ratios by LFO is similar to that of McGrattan and Prescott (2013).[8] The details are presented in Appendix C.

Different industries have very different production technologies and hence very different capital-to-output ratios. It is possible that C corporations are disproportionately concentrated in industry sectors with relatively high-capital-intensity production technologies. In this case, a higher average C corporation capital-to-output ratio is merely reflecting the inter-industry technology differences, rather than capital constraint differences across different LFO. For robustness, a proxy measure of the capital-to-output ratios by LFO across different industry sectors is examined. The estimated annual capital-to-output ratios across all major non-agricultural industry sectors is presented in Appendix C.[9] As can be seen in Table C1 of the Appendix, although this ratio clearly varies across industry, the capital-to-output ratios of C corporations are consistently higher than those of pass-through businesses in almost all industry sectors.[10] The only exceptions are the "Finance and insurance" and "Real estate" sectors, where capital-to-output ratios are larger in the pass-through sector. A possible explanation is that firms in these sectors handle tremendous amounts of loans and investment products (such as mortgages) for their clients, which are counted as part of their operating assets. Smaller pass-through businesses, such as small real estate partnerships, or limited liability insurance companies are disproportionately affected. The capital-to-output ratios are likely to be distorted for these pass-through businesses.

C corporations have higher capital-to-output ratios not only when controlling for industry sector, but also when controlling for firm size. Firm size can be a concern as it is well documented that firm size is positively correlated with the capital-to-output ratio. Adding to the concern is that large firms in the U.S. are almost exclusively C corporations. This suggests that the documented capital intensity difference between C corporations and pass-through businesses could simply reflect the difference in the efficiency scales of large corporate firms versus small pass-through businesses.

[8] These numbers are lower than many other estimates of capital-to-output ratios in the literature, because household durables (such as residential housing) are excluded from the private fixed asset calculations.

[9] Data limitation has restricted us to use business asset-to-receipts ratios calculated from the 2011 IRS data to proxy for capital-to-output ratios. In addition, the IRS does not report assets for Sole Proprietors, so our calculation of pass-through businesses do not include them.

[10] C corporation capital-to-output ratios are also higher in almost all the sub-industry sectors. For example, this is true for all 20 sub-industry sectors in the manufacturing industry, from "Food manufacturing" to "Petroleum product manufacturing."

To alleviate this concern, a proxy measure of the capital-to-output ratios by LFO across different firm size categories is presented in Appendix C.[11] As can be seen in Table C2 of the Appendix, the C corporate sector is dominated by large corporations, as firms with $50 million or more in business receipts generate 90 percent of all the sales. In contrast, firms with $50 million or more in business receipts generate only 38 percent of the sales in the pass-through sector. As expected, the capital-to-output ratio is higher for larger corporate firms. When the data are segmented into different size categories, C corporations consistently have higher capital-to-output ratios compared with pass-through businesses in every size category.

The empirical evidence supports the notion that C corporations have higher capital-to-output ratios than pass-through businesses after controlling for either industry sector or firm size category. Hence, the capital-to-output data suggest that C corporations face less severe constraints on capital than pass-through businesses.

B. Probability of Small Businesses Receiving External Equity by LFO

An alternative approach to provide support for the assumption concerning the relative probability of receiving external financing is to examine the sources of business finance. Most large firms in the U.S. are publicly traded C corporations, which receive a large amount of public equity. But this is not sufficient to show C corporations have more opportunity to receive external equity. The financing of small businesses needs to be examined as well. In particular, empirical evidence is presented in this section to show that (1) a sizable fraction of small businesses are capital constrained and require external financing; and (2) among these small businesses, the probability of receiving external funding varies by LFO. In particular, C corporations are more likely to receive external investment.

The 2003 Survey of Small Business Finance data, collected by the Federal Reserve System, is used for this analysis. These survey data contain only businesses with 500 employees or fewer, thus excluding large corporate firms. The survey includes questions on the organizational type of the business, whether the business raised additional equity, and the sources of the additional equity raised. Additional information on these data is available in Appendix D. For the following analysis, we restrict our attention to three major industry sectors: manufacturing, wholesale and retail trade, and services.

Capital constraints are one of the most important reasons for a business to raise additional equity.

[11] The IRS does not report assets by both size of businesses and LFO. This data limitation has restricted us to use capital-income-to-business-receipts ratios calculated from the 2011 IRS data to proxy for the capital-to-output ratios. We provide a more detailed discussion of this in Appendix C.

A total of 6.1 percent of all the firms surveyed reported raising additional equity. Among these, 7.4 percent of all the C corporations and 5.7 percent of all the pass-through businesses raised additional equity. Because firms can raise capital by other means (such as loans), and firms could have raised capital in non-survey years, these numbers should be considered as a lower bound estimate of the fraction of firms who require additional capital.

The survey provides firms' sources of additional equity. By excluding sources of equity, such as equity from existing owners, employees, or family members, this analysis focuses on small businesses that raised equity from three external sources, namely, (1) venture capitalists, (2) public stock offerings, and (3) angel investors. Of these sources, pass-through firms are barred by law from receiving external funding from (1) and (2), so they can raise external equity only from angel investors, who are affluent private informal investors.

Summary statistics of the percentage of firms' external equity sources by both LFO and industry sectors are presented below.

Table 1—External Equity Sources by LFO

	Overall		Manufacturing		Wholesale & Retail Trade		Services	
	S	C	S	C	S	C	S	C
Venture Capital	0.0%	2.8%	0.0%	7.1%	0.0%	0.0%	0.0%	3.5%
Public	0.0%	1.2%	0.0%	3.9%	0.0%	0.0%	0.0%	1.0%
Angel	6.0%	11.2%	0.0%	25.9%	2.4%	0.0%	12.5%	13.7%
External Equity	6.0%	14.2%	0.0%	36.8%	2.4%	0.0%	12.5%	15.6%

In the survey data, among pass-through businesses, only S corporations raised external equity. In cases where an S corporation had additional equity, only 6.0 percent raised capital from an external source. In contrast, 14.2 percent of small C corporations raised additional equity from external sources. In the capital-intensive manufacturing industry, over one third of the C corporations surveyed used external equity, while no S corporations used any external equity. One might suspect that few manufacturing firms use the S corporate form, but this is not the case. In Manufacturing, the number of S corporations is about half that of C corporations. While significantly smaller than the C corporate sector, the S corporate sector is a significant part of the Manufacturing industry. In contrast, almost no firms in Wholesale and Retail Trade use external financing. The only exception is the 2.4 percent of the S corporations that have private angel investors. This sector is the only place where S corporations can potentially use more external finance than C corporations. In Services, a higher percentage of C corporations consistently use more external equity than S

corporations. The percentage differential is smaller than what is observed in Manufacturing.

Table D of the Appendix presents results from three logit regression models. These models control for owner characteristics, firm credit risks, industry sector, geographic region, and firm sizes. Consistent with Table 1, the regression results indicate that C corporations have a higher chance of receiving external financing than pass-through businesses. These regression models indicate that C corporations are as much as 8 times more likely to receive external equity financing as pass-through firms. The evidence on external equity financing by LFO suggest that, even for small businesses, C corporations are less likely to be capital constrained.

III. Calibration

This section provides the details on the calibration of the model, presents some motivation behind the choices of calibration targets, and discusses the implications of the calibration results.

A. Model Specification

The model period is five years. The reason for using a five-year model is twofold. First, changes to a firm's LFO status can occur over a few years. For instance, when a C corporation converts to a S corporation, this firm could still pay C corporation taxes on some of its income (i.e., selling of appreciated assets). The Small Business Jobs Act of 2010 stipulates that the recognition period of status conversion is 5 years. Therefore, using five-year periods in the model is appropriate as the model abstracts from these complex tax treatments during the conversion period. In addition, individual agents in the model make occupational decisions based on their current period asset position and productivity draw. The model abstracts away from direct intertemporal dependency of occupational status. Hence, to avoid high-frequency temporary occupational changes, it is preferable in our calibration to use a five-year model period.

The logarithm of productivity z follows an AR(1) process with autocorrelation ϱ_z and standard deviation σ_z, or $\log(z') = \varrho_z \log(z) + \varepsilon$, where $\varepsilon \sim N(0, \sigma_\varepsilon^2)$. Numerically, the method developed in Tauchen (1986) is used to construct a first-order Markov process approximation.

Agent per-period utility is assumed to have the functional form [12]

$$u(c, n, \iota) = \alpha \log(c) + (1 - \alpha) \log(1 - n) + \iota \cdot \eta.$$

Agents value consumption c and leisure $1 - n$. The relative importance of consumption to leisure is given by the parameter α. The indicator function ι identifies whether an agent is an entrepreneur. Entrepreneurs receive non-pecuniary benefit $\eta \geq 0$ from running their own businesses. The value of η is calibrated to match empirical targets, such as the firm size distribution.[13]

To allow for progressivity in the personal income tax, the personal income tax function proposed by Gouveia and Strauss (1994) is employed. Given any income m, the total personal income tax is

$$T^p(m) = a_0 \left(m - \left(m^{-a_1} + a_2 \right)^{-\frac{1}{a_1}} \right),$$

where (a_0, a_1, a_2) are parameters. In this functional form, parameter a_0 is the limiting average tax rate when $m \to \infty$, and parameter a_1 captures progressivity. In particular, when $a_1 = 0$, the personal tax system is purely proportional, $T^p(m) = a_0 m$; when $a_1 > 0$, the average taxes are strictly increasing in income m. This functional form is adopted by recent papers on optimal taxation, such as Conesa and Krueger (2006) and Conesa, Kitao and Krueger (2009). Following the approach in these papers, we use parameter values of $a_0 = 0.258$ and $a_1 = 0.768$ from the original estimation of Gouveia and Strauss (1994). The parameter a_2 is chosen so that the government budget constraint is balanced in the equilibrium.

The corporate income tax obligation is assumed to be proportional to profits, or $T^c(\pi) = \tau^c \cdot \pi$. A corporate income tax function could be estimated to take into account the progressivity in the U.S. corporate tax code. However, the legislative corporate tax rates are not applicable due to

[12] This functional form is a special case of the following function

$$u(c, n, \iota) = \frac{(c^\alpha (1 - n)^{1-\alpha})^{1-\xi} - 1}{1 - \xi} + \iota \cdot \eta,$$

which is a constant-relative-risk-aversion transformation of the Cobb-Douglas utility function. This preference specification is consistent with balanced growth. One of the focuses of this paper is the employment effect of a change in the corporate income tax rate. The employment effect is largely dependent upon agents' labor supply decisions, which is a function of real wages in the economy. In this preference specification, the relative share of working to leisure is constant with respect to wages, so the income effect of an increase in wage cancels out with the substitution effect. In the special case, the CRRA parameter ξ is set to be 1. Calibration exercise with this more general form of utility function yields a CRRA parameter ξ close to 1. Fixing the CRRA parameter $\xi > 1$, our policy experiments give similar qualitative results.

[13] In an alternative calibration exercise, agents are allowed to have different non-pecuniary benefits η's. In particular, we normalize $\eta = 0$ for one group of the population and set $\eta > 0$ for another group. However, for the purpose of this paper, the size of the employment change in the policy experiment does not change very much if such possibility is allowed. This is because most of the employment effect is caused by entrepreneurs' actions, either by switching LFO or entering the market. If two groups are allowed, the overwhelming majority of entrepreneurs under any corporate tax policy come from the group with $\eta > 0$. For the simplicity of the state space and computation, agents have the same non-pecuniary benefits $\eta > 0$ in the model.

the myriad of corporate tax loopholes. To avoid dealing with issues of legislative versus effective corporate tax rates, the proportional tax assumption seems appropriate. The average effective corporate income tax rate τ^c is estimated and assumed to be the same for all C corporations.

The production function is assumed to have a Cobb-Douglas functional form $F(z,k,n) = zk^{\gamma}n^{\theta}$. Parameters γ and θ are the capital and labor intensity parameters, respectively. To ensure an interior solution, the production function is assumed to have decreasing returns to scale and $\alpha+\beta < 1$.

B. Independently Calibrated Parameters

In the model, an agent is either non-employed with leisure being 1 or working full time with leisure being $1-\overline{n}$. We set $\overline{n}$ by assuming that individuals have 98 hours a week of substitutable time not spent eating, sleeping, or engaged in other personal care. If an agent spends 40 hours a week working full time, $\overline{n}$ approximately equals 0.4. The calibration of $\overline{n}$ is similar to others' treatments in the literature, such as Hansen and Imrohoroglu (1992).

The corporate income tax rate τ^c is set to be the average effective tax rates from 2000-2010, which is calculated based on NIPA and the Corporation Complete Report from the IRS. Following similar definitions in Mertens and Ravn (2013), the average corporate income tax rate is the federal, state, and local taxes on corporate income (NIPA Table 3.1 line 5) excluding tax on Federal Reserve Banks (NIPA Table 3.2 line 8) divided by the corporate income tax base; the corporate income tax base is the total income subject to tax from all active corporations, other than those filing forms 1120S, 1120-REIT, and 1120-RIC (IRS Complete Report Table 12 line 81). Based on our calculation, the average effective corporate income tax rate is 28.5 percent.

The depreciation rate δ is the total depreciation of private fixed assets by corporate firms, partnerships, and sole proprietorships (NIPA Fixed Asset Table 6.4 line 2, 6, and 7) divided by the total private fixed assets of corporate firms, partnerships, and sole proprietorships (NIPA Fixed Asset Table 6.1 line 2, 6, and 7). The estimated annual depreciation rate is 8.2 percent. Hence, the five-year capital depreciation rate is 35 percent. Table 2 summarizes the set of parameters that are independently calibrated.

Table 2—Parameters Calibrated Independently

Description	Parameter	Value	Source
Full-time Hours Worked	$\overline{n}$	0.40	data
Corporate Income Tax Rate	τ^c	0.285	data
Depreciation Rate on Capital (5 year)	δ	0.35	data
Limiting Avg. Personal Income Tax Rate	a_0	0.258	Gouveia and Strauss (1994)
Personal Income Tax Progressivity Parameter	a_1	0.768	Gouveia and Strauss (1994)

C. Calibration Results

The remaining parameters in the model are calibrated jointly in the benchmark stationary equilibrium. These parameters and their calibrated values are summarized in Table 3.

Table 3—Parameters Calibrated Jointly in Equilibrium

Description	Parameter	Value
Production Function Parameter on Capital	γ	0.241
Production Function Parameter on Labor	θ	0.643
Productivity Persistence	ϱ_z	0.821
Standard Deviation of Productivity	σ_z	0.245
Cobb-Douglas Utility Parameter on Consumption	α	0.501
Discount Rate (5 year)	β	0.770
Non-employment Lump Sum Transfer	b	0.238
Pass-Through Business External Financing Probability	φ^p	0.462
C corporation External Financing Probability	φ^c	0.717
Entrepreneurial Non-pecuniary Benefit	η	0.305

A set of empirical moments are carefully chosen to help pin down these parameters. These data moments discipline the model so as to capture certain significant economic aspects central to our policy experiments. A comparison of the data and model moments is presented in Table 4.

Table 4—Data and Model Moments

Targeted Moments			
Statistics	Data	Model	Error
Non-Employment Fraction	0.334	0.341	2.1%
Average Workers per Firm	21.807	21.778	−0.1%
Fraction of C corporations	0.228	0.226	−0.9%
Employment % of C corporations	0.548	0.561	2.4%
Pass-Through Capital-Output Ratio (5 year)	0.306	0.313	2.3%
C corporation Capital-Output Ratio (5 year)	0.371	0.376	1.3%
Fraction of New Firm Entry (5 year)	0.344	0.330	−4.1%
Emp. Fraction of New Entry Firm (5 year)	0.114	0.118	3.5%
Fraction of Small Business ($<$ 20 Employees)	0.875	0.789	−9.8%
Employment Fraction of Small Business	0.192	0.184	−4.2%
Wealth Gini Index	0.816	0.845	3.6%
Percentage of Wealth in Top 1%	0.340	0.424	24.7%
Percentage of Wealth in Top 10%	0.714	0.784	9.8%
Percentage of Wealth in Top 20%	0.834	0.886	6.2%
Percentage of Wealth in Top 40%	0.950	0.955	0.5%
Percentage of Wealth in Top 60%	0.990	0.979	−1.1%

The benchmark model fits the data well. In particular, almost all the model moments are within

a 10 percent difference from the targeted data moments, the only exception is the percentage of wealth held by the most wealthy individuals. Next, the choices and fits of target moments are discussed, as well as their relationship to the calibrated model parameters.

Importantly, the calibrated model is able to match a number of job market and LFO statistics. The average number of workers per firm in the data is 21.807, which is calculated from the 2011 County Business Patterns of the Statistics of U.S. Businesses published by the U.S. Census Bureau. This data source reports "Number of Firms" and "Employment" by both employment size and LFO. The same data source reports that 22.8 percent of all the businesses in the U.S. are C corporations, and they hire 54.8 percent of all the employees. The calibrated model matches these targets closely. In the model, the average number of workers per firm is 21.8, the fraction of C corporations is 22.6 percent, and the employment fraction of C corporations is 56.1 percent.

The calibration of production function parameters is fairly standard. The calibrated values of labor intensity parameter $\theta = 0.643$ is within the range of the values found in recent literature, such as Gomes (2001) and Gourio and Miao (2010). The calibrated values of capital intensity parameter $\gamma = 0.241$ is lower than those found in the literature (for example, $\gamma = 0.311$ in Gourio and Miao (2010)). This is because in obtaining target capital-to-output ratios, we exclude household durables (such as residential housing) from the private fixed asset calculations. If we use $\gamma = 0.311$, the annual capital-to-output ratios would be close to 3, which is the value typically employed in the literature.

To balance government budget in the equilibrium, the tax function parameter is calibrated to be $a_2 = 0.725$.

The persistence parameter ϱ_z of the productivity Markov process and the standard deviation σ_z of the productivity shock distribution are calibrated to match data moments of firm dynamics, such as the fraction of entry firms and the employment fraction of entry firms. The firm entry and exit dynamics are governed by the productivity process, and only agents with relatively high productivity level z choose to operate firms in our model. In the stationary equilibrium, the fraction of new firm entrants is the same as the fraction of exiting firms. As a result, the calibration targets include only firm entry statistics from the 2011 Longitudinal Business Database (LBD) from the U.S. Census. Because the model period is 5 years, all the firms aged less than or equal to five years are considered entry firms in our calculation. In 2011, 34.4 percent of all the firms were established in the previous 5 years, and these firms hire about 11.4 percent of all the workers over the five-year period. The calibrated value of the persistence parameter is $\varrho_z = 0.821$ and the standard deviation

parameter is estimated to be $\sigma_z = 0.245$.[14]

The model is also calibrated to match small business statistics, such as the fraction of small businesses and the employment fraction of small businesses. These target moments are computed from the 2011 County Business Patterns of the Statistics of U.S. Businesses, which is published by the U.S. Census Bureau. A "small business" is defined as a firm with 20 employees or fewer. This is the definition employed in Hurst and Pugsley (2011). In the U.S. economy, 87.5 percent of all firms are classified as small businesses and they hire about 19.2 percent of all the employees.[15]

The utility parameter α and the discount rate β are related to agents' asset saving decisions. These parameters are calibrated to match the Gini coefficient for wealth and the wealth distribution. The wealth Gini index of 0.816 and the wealth distribution listed in Table 4 is sourced from J. Diaz-Gimenez, A. Glover, and J.-V. Rios-Rull (2011). The calibrated value of the utility parameter is $\alpha = 0.501$, and the calibrated 5-year discount rate is $\beta = 0.67$, which implies a discount rate of about 0.95 per annum. The model over-predicts the fraction of wealth held by the top 1 percent, suggesting that the very wealthy agents are accumulating assets faster than in the data. As a result, the model economy has a higher level of wealth inequality than in the data. This points to a limitation of our model as we do not incorporate a stock market or firms distributing dividend income. All the profits earned by large corporations are distributed directly to its entrepreneur. Highly talented entrepreneurs with sufficient access to capital can accumulate assets very quickly. In other words, our model has a higher return to "talent" than in the real economy. In a later discussion, we show that most of the employment effect and productivity misallocation in our model comes from new entry firms and pass-through businesses switching to be C corporations. These firms are usually not publicly traded. Large public firms would still remain large public firms with a corporate tax policy change. This abstraction, while it greatly simplifies our analysis, does not change the key margins in our model.

The non-employment lump-sum transfer payment b is calibrated to match the non-employed fraction of population in the United States. The non-employed population consists of individuals who do not currently hold a job. This includes unemployed workers and those who are out of the labor force. Unemployed workers who are actively seeking a new job are considered a part of the labor force. The model period of five years is longer than the average unemployment duration of six months. Because this paper is interested in long-term policy implications, the non-employment

[14] In comparison with recent papers, such as Gourio and Miao (2010), the standard deviation parameter is similar, but the persistence parameter is slightly higher. This is largely due to the 5-year period assumption.

[15] Our model generates measures of workers, instead of numbers of workers, hired by firms. By calculating average worker per firm and measures of workers and firms in the model, we can construct a measure of worker average effective labor. Then, for each firm, we divide the measures of workers by the average effective labor to calculate the number of workers.

rate instead of unemployment rate is used in the calibration. The employed civilian labor force as a percentage of population (persons 16 years of age and over, 65 years of age and under) in the year 2011 is 66.6 percent, as reported in the Labor Force Statistics of the Current Population Survey by the Bureau of Labor Statistics. So the non-employed fraction of population used in our calibration is 33.4 percent. The calibrated parameter value is $b = 0.238$.

In reality, the government does not have a transfer program specifically designed for non-employed persons. To see if the calibrated parameter b makes sense, its calibrated value is compared with two closely related government benefit programs. A related program is unemployment insurance, which is available to workers who recently lost their jobs and are actively seeking employment. According to the U.S. Department of Labor guidelines and statistics, an unemployed person is paid up to 26 weeks (half-year) for an average of around \$1,200 per month.[16] In 2011, the BLS reports the average monthly salary was \$3,769. This means that the ratio of annual maximum unemployment insurance to average annual salary is around 16 percent. Of course, non-employment includes individuals who are not actively seeking jobs. For these individuals who are not employed and have no other incomes, the Supplemental Nutrition Assistance Program (food stamps) can be used as another measure of comparison. Based on the U.S. Department of Agriculture guidelines, households without income are eligible to receive food stamps with a maximum value equivalent to the cost of foods in the USDA Thrifty Food Plan.[17] In 2011, the monthly cost of the Thrifty Food Plan for a family of 4 is \$544.50, which is 14.4 percent of the average monthly salary in that year. In our model, the average wage of a worker is 1.63, so the non-employment transfer of $b = 0.238$ is 14.6 percent of the average wage. This means the calibrated value of non-employment transfer is in line with unemployment insurance and the food stamp programs offered by the U.S. government.

Two important parameters in the model are a pair of external financing probability parameters φ^p and φ^c. The capital-to-output ratios by LFO are used to pin down these parameters. As detailed in Section II.A, both NIPA and IRS data are used to calculate the capital-to-output ratios. The five-year capital-to-output ratios are 0.306 and 0.371 for pass-through firms and C corporations, respectively. This calibration indicates that $\varphi^p = 46.2\%$ and $\varphi^c = 71.7\%$. Hence, C corporations are more than 55 percent more likely to receive external financing offers than pass-through businesses in the model.

Hurst and Pugsley (2011) document that most small businesses are very different from large

[16]Unemployment insurance varies by state. It is calculated based on the person's salary in a previous job. On average in the U.S., unemployment insurance replaces about 46.6 percent of an unemployed person's salary in 2011, according to https://workforcesecurity.doleta.gov. Our tabulation of unemployment insurance is on an annual basis, which takes into account that the transfer would only last up to 26 weeks or half a year.

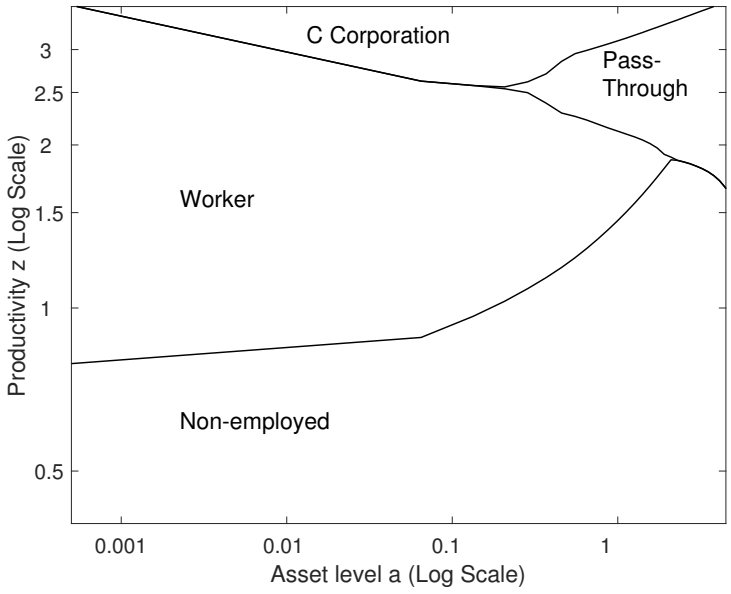
[17]For more detailed information, please refer to https://www.cnpp.usda.gov.

corporate firms, as they seldom intend to grow into a large enterprise. In fact, based on the survey results from the Panel Study of Entrepreneurial Dynamics, Hurst and Pugsley (2011) report that 50.5 percent of the entrepreneurs own businesses for non-pecuniary reasons. To see if our calibrated parameter of non-pecuniary benefits is reasonable, the model is re-simulated after setting the parameter $\eta = 0$, while holding all other parameters fixed. This change results in the number of entrepreneurs falling by 55.1 percent, which is slightly higher than what is reported in Hurst and Pugsley (2011). Furthermore, the effect of the non-pecuniary benefit on owning businesses differs by LFO. Removing the non-pecuniary benefit would reduce the number of pass-through business owners by 63.6 percent and reduce the number of C corporations by 28.6 percent. In the model and in the data, C corporations on average are larger in size than pass-through businesses. Our results, hence, are consistent with the findings in Hurst and Pugsley (2011), in that non-pecuniary benefits disproportionately affect small businesses.

D. Occupational Choice in Benchmark Economy

The benchmark model provides insights into the behavior of agents in the economy. The relationship between productivity and asset (or capital) levels is examined to better understand the occupational choice decision. In Figure 1, the occupational choice decision is presented as a function of both productivity level z (Y-axis) and asset level a (X-axis). Both axes are in log scale.

Figure 1. Occupational Choices in Benchmark Economy



Agents choose to be non-employed for two reasons. For the vast majority of the non-employed

agents, very low productivity draws forced them to choose a fixed non-employment lump-sum transfer b over an effective labor wage $wz\bar{n}$. However, some very wealthy individuals also choose to be non-employed. This is a result of their preference toward leisure. These individuals are very small in number. Of all the non-employed individuals, less than 0.02 percent have wealth in the top 1 percent of the wealth distribution.

A majority of the agents (61.2 percent) are workers. A typical worker is moderately talented so that their wage earning is higher than the non-employment transfer. For a fixed asset level, they are not talented enough to choose to be an entrepreneur. In other words, the opportunity cost of forgoing their wage income is greater than their likely income from operating a business. Employed workers are usually not the most wealthy agents in the economy, as wealthier individuals find it more attractive to either own businesses or simply not work and enjoy leisure.

Entrepreneurs who can self-finance a large portion of their business typically find the pass-through business form to be more attractive, as they can avoid double taxation. Not all pass-through businesses rely on self-financing. A majority of pass-through entrepreneurs are capital constrained ex ante, but find double taxation to be too prohibitive to choose the C corporation legal form. On average, a constrained pass-through entrepreneur's personal wealth accounts for about only 8.6 percent of the optimal level of capital required by his firm.

Conditional on having the same productivity, pass-through entrepreneurs usually have higher personal wealth than C corporation owners. However, despite having less than one-third of the number of pass-through businesses, C corporations hold about 60 percent of the total capital demanded. This is a result of C corporation entrepreneurs generally having higher productivity levels along with a better chance of accessing external capital. All C corporate entrepreneurs are capital constrained ex ante and choose the C corporation form to increase the chance of receiving external financing. Two types of agents prefer to be entrepreneurs operating a C corporation. They are either the very talented managers, or they face severe capital constraint. These two conditions are not mutually exclusive; in fact, talented managers who intend to operate large-scale firms are more likely to face stringent capital constraint. In the model, the average C corporate entrepreneur's personal wealth accounts for about 0.03 percent of the optimal level of capital required by his firm. Because some C corporations do not receive external financing offers, these firms are severely capital constrained. As a result, the model is able to generate a distribution of small C corporations.

IV. Policy Experiment

In this section, we use the benchmark model to study the aggregate impact of a decline in the corporate income tax rate. In the policy experiment, we vary the corporate income tax rate from the benchmark rate of 28.5 percent all the way to zero, while holding the calibrated parameters fixed. Throughout the policy experiment, the personal income tax parameter a_2 is allowed to vary so that the government budget remains balanced. Wage and interest rates adjust to clear both the labor and capital markets, allowing the general equilibrium effects to be reflected in the new equilibrium. The main focus is on the impacts of a corporate income tax rate change on employment and productivity.

A. Aggregate Policy Effects

The aggregate policy effects from lowering the corporate income tax are summarized in Table 5.

Table 5—Effects of Lowering the Corporate Income Tax

	Benchmark	Change in Corporate Income Tax Rate		
	τ^c =28.5%	τ^c =20%	τ^c =10%	τ^c =0%
Panel A				
Fraction of C Corp.	22.6%	34.4%	44.5%	56.0%
		(52.2%)	(96.9%)	(147.8%)
Emp. Fraction of C Corp	56.1%	68.5%	82.5%	94.3%
		(22.1%)	(47.1%)	(68.1%)
Avg. Worker per Firm	21.778	21.557	21.167	20.643
		(−1.0%)	(−2.8%)	(−5.2%)
Panel B				
Labor (L)	0.313	0.314	0.317	0.320
		(0.3%)	(1.3%)	(2.2%)
Capital (K)	0.263	0.266	0.274	0.281
		(1.1%)	(4.2%)	(6.8%)
Output (Y)	0.625	0.633	0.644	0.650
		(1.3%)	(3.0%)	(4.0%)
Consumption (C)	0.533	0.539	0.549	0.553
		(1.1%)	(3.0%)	(3.8%)
Panel C				
Wealth Gini	0.845	0.843	0.852	0.864
		(−0.2%)	(0.8%)	(2.3%)
Panel D				
Non-Employment Rate	34.1%	33.0%	32.3%	31.7%
		(−3.3%)	(−5.3%)	(−7.0%)

Note: The percentage changes from to the benchmark statistics are included in the parentheses.

Panel A focuses the effect of a policy change on firm behaviors and examines how a decline in the corporate income tax rate impacts the share of C corporations, the employment share of C corporations, and the average size of firms. In the table, the percentage changes from the benchmark values appear in parentheses.

The most direct effect of lowering the corporate income tax is on the size of the C corporate sector. As can be seen, both the number of firms that file as a C corporation and the fraction of employment by C corporations increase as the corporate income tax rate declines. These changes are expectedly large. In comparison with the benchmark equilibrium, if the corporate income tax is eliminated, the fraction of C corporations in the economy more than doubles from 22.6 percent to 56.0 percent. As a result, the C corporate sector would account for more than 94 percent of the employment in the economy, compared with 56.1 percent in the benchmark economy.

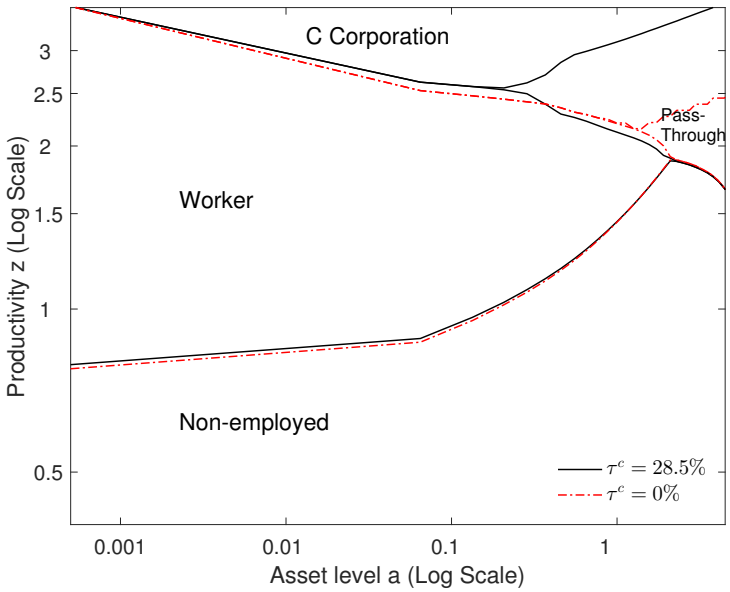
The increase in the share of C corporations comes from two sources. First, a significant fraction of pass-through firms switch LFO and become C corporations. Lowering the corporate income tax lessens the burden of double taxation. The C corporate legal form becomes more attractive to entrepreneurs, as C corporations have a higher chance of receiving external financing. In fact, at the zero corporate income tax rate, the remaining pass-through businesses are entirely self-financing. Noticeably, these pass-through firms are small in size, and they hire only a very small fraction of the overall employed labor (less than 6 percent) in the economy.

Second, the decline in the corporate tax burden encourages some workers to quit their jobs and become C corporate entrepreneurs. These agents have moderately high productivity, but relatively low wealth. In the benchmark economy, these individuals' opportunity costs of forgoing their wage income are too high compared with their expected earnings from operating a self-financing pass-through business. However, the decline in the corporate income tax rate decreases the double taxation burden and thus raises their expected earnings of running an externally financed C corporation. When the expected after-tax corporate profit becomes higher than their effective labor income, they become C corporate entrepreneurs. In the model, if the corporate income tax is eliminated, the increase in overall entrepreneurship is about 5 percent. Most of the new entrepreneurs operate small businesses, so the fraction of small business correspondingly increases by 4.6 percent. This contributes to the overall decrease in average firm size when the corporate income tax rate is lowered. As seen in Table 5, the average number of workers per firm drops by 5.2 percent compared with the benchmark economy when the corporate income tax is eliminated.

The two aforementioned sources of the C corporate sector expansion are illustrated in Figure 2, where agents' occupational choices are examined in the benchmark economy relative to an

economy without a corporate income tax. The relative importance of the two margins is measured in Subsection IV.C.

Figure 2. Occupational Choices in Policy Experiment



Panel B of Table 5 focuses on the aggregate implication of a corporate income tax cut on the economy. Both aggregate output and aggregate consumption increase. The elimination of the corporate income tax would increase aggregate consumption by 3.8 percent and aggregate output by 4.0 percent. The demand for capital would increase by 6.8 percent while the demand for effective labor would increase by 2.2 percent. This means most of the aggregate output increase is caused by firms' more intensive use of capital. The expansion of the C corporate sector is the main reason behind the increase in the demand for capital. The C corporate legal form loosens a firm's capital constraint. More firms would have increased access to capital, as a lower corporate income tax rate leads to an expansion in the C corporation sector. The large increase in capital demand suggests that the corporate income tax potentially distorts capital allocation among firms. We discuss the implications of this distortion on productivity in Subsection IV.D.

Panel C of Table 5 presents the implication of a reduction in the corporate income tax on the wealth distribution. Decreasing corporate income tax skews the wealth distribution to the right. The Gini coefficient increases from 0.845 to 0.864. As a share of the total wealth in the economy, the wealth of the top 1 percent of individuals increases from 42.4 percent to 44.7 percent, and the wealth of the top 10 percent of individuals increases from 78.4 percent to 81.6 percent. Lowering the corporate income tax allows more talented entrepreneurs to keep a larger fraction of their corporate

profits. For instance, entrepreneurs who are in the top 5 percent in terms of productivity have on average 17 percent higher asset holdings when the corporate income tax is eliminated. This is the main reason behind the increase in the wealth Gini. However, this does not necessarily mean that less-talented agents are worse off. For those who have productivity in the bottom 5 percent, their asset holdings increase by 2 percent when the corporate income tax is eliminated.[18]

Panel D of Table 5 reports the employment effect from a reduction in the corporate income tax rate. If the corporate income tax rate is reduced to zero, the model finds that the fraction of non-employed individuals decreases from 34.1 percent to 31.7 percent. This is a reduction of 2.4 percentage points or 7.0 percent in the non-employment rates relative to the benchmark economy.[19] This suggests that jobs can be created by reducing the corporate income tax rate. The causes of the observed employment effect are discussed in Section IV.B.

An important issue is whether the model can reasonably predict firms' LFO responses to a corporate income tax rate change. Previous literature, such as Gordon and MacKie-Mason (1994), Mackie-Mason and Gordon (1997), and Goolsbee (1998), find very little movement between LFO caused by a corporate tax rate change. Part of the reason is that these papers use time-series data, where the variation in corporate tax rates has been small historically. Goolsbee (2004) uses cross-sectional census data across states and industries in the retail trade sector and finds that the relative taxation of corporate to personal income plays an important role in the share of firms, employment and sales by C corporations versus pass-through entities.[20] He finds that an increase in the corporate tax rate level by 0.1 decreases the C corporations share of all firms by 0.25 and the employment share of C corporation by 7-15 percent. In this model, when the tax rate is increased by the same amount, the C corporation fraction goes down by about 0.12, and C corporate employment share goes down by 13 percent. The smaller response from the model is partially a result of Goolsbee (2004) restricting his empirical analysis to the retail sector, which is likely to generate a larger response. In this paper, no restriction is made with respect to firms being in a specific sector. In addition, Goolsbee (2004) finds little evidence that a change in the corporate income tax rate impacts relative operating ratios of corporate versus non-corporate sectors, such as labor intensity. In our model, *an increase of 0.01 in the corporate income tax rate* changes the relative ratio of average effective labor demand to output between the two LFO by a negligible

[18]Not all agents have an increase in asset holding. Those pass-through entrepreneurs with moderate productivity, who remain as pass-through entrepreneurs after the elimination of the corporate income tax, would on average have 11 percent less in asset holdings.

[19]The employment effect found in this paper is relatively robust with respect to the specifications of the external financing probability parameters. If the parameter φ^p is increased by 10 percent, while φ^c remains unchanged, the decrease in relative non-employment rate changes from 7.0 percent to 7.3 percent. Similarly, he parameter φ^c is increased by 10 percent, while φ^p remains unchanged, the decrease in relative non-employment rate changes from 7.0 percent to 7.5 percent.

[20]His analysis of pass-through entities include partnerships and sole proprietorships, but not S corporations.

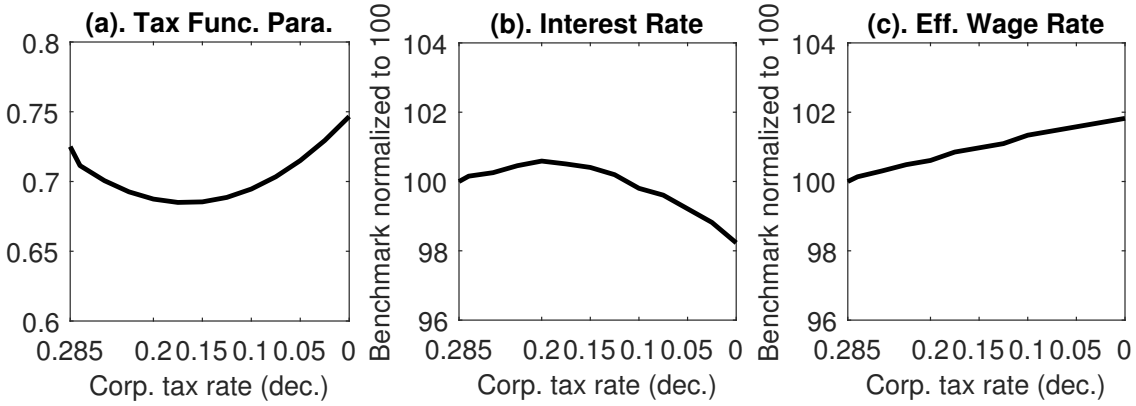
amount (less than 0.1 percent). This suggests that, in both the data and the model, the distortions caused by the corporate income tax are primarily due to changes in LFO rather than within any particular organizational form.

B. Personal Income Tax and Input Factor Prices

Besides affecting entrepreneurial choices of LFO, a change in the corporate income tax rate indirectly affects agents' occupational decisions through its effects on other important economic variables. Of particular importance are the personal income taxation, interest rate, and wages. In this subsection, the implication of the changes in these variables are considered, with particular focus on how employment could be affected.

The decline in the corporate income tax rate would necessarily change the government revenue collected from C corporations. In the policy analysis, the assumption is that the government would maintain a balanced government budget. In practice, this is accomplished by adjusting the personal income tax function parameter a_2. In particular, the higher the parameter a_2, the more personal tax is collected for a given income, and vice versa. The changes required in this parameter for various changes in the corporate income tax rate are depicted in Panel (a) of Figure 3.

Figure 3. Policy Effects on Wage, Interest Rate, and Personal Income Tax



A decline in the corporate income tax rate does not always result in a loss of government revenue. If the decline in the corporate income tax rate is small, the increase in corporate entrepreneurship and the subsequent increase in corporate taxable income outweighs the decline in the corporate income tax rate. This would result in an increase in tax revenue. Consequently, the government would be able to cut the personal income tax (a lower a_2), while maintaining a balanced budget. As the reduction in the corporate income tax rate becomes larger, resulting in a loss of total tax

revenue, the government must then increase personal income tax collection to maintain the policy's revenue neutrality. In the extreme case of the elimination of the corporate income tax, as shown in Figure 3, the personal income tax function parameter increases from 0.725 in the benchmark economy to 0.750 when the corporate income tax is zero. To give some perspective of such an increase, for a typical non-employed agent with no other income except for the government transfer of 0.238, his personal income tax would increase by 2.7 percent. Because this type of agent has the lowest possible individual tax base, this increase represents the largest possible percentage increase in tax bills. This shows that the relative increase in personal income tax collection is modest. Under most of the corporate tax cut regimes in our policy analysis, the government is able to balance its budget without increasing the personal income tax burden on individual households in the economy.

Panel (b) of Figure 3 shows the implications of a change in the corporate income tax rate on the interest rate. The interest rate would increase with a moderate decline of the corporate income tax rate. As mentioned, a reduction in the corporate income tax rate leads to more C corporations in the economy. C corporate firms are less capital constrained and have wider financial access to external capital. This results in an increase in the demand for capital and raises the interest rate. However, as can be seen in Panel (b) of Figure 3, the interest rate actually decreases by about 2 percent when the corporate income tax is eliminated. This is because the increase in supply for capital would more than offset the increase in demand. The elimination of the C corporate income tax burden along with its distortionary effects would result in agents holding and saving more assets, thus increasing the supply for capital in the economy. Compared with the benchmark economy, agents on average save 5.2 percent more assets (a') in the economy without the corporate income tax. This increase in capital supply puts downward pressure on interest rates and would dominate the capital demand response in the limiting case when the corporate income tax rate is set at zero.

The most important factor in an agent's employment decision is the wage rate. As can be seen in Panel (c) of Figure 3, the effective wage rate is monotonically increasing with a decline in the corporate income tax rate. As previously discussed, the decline in the corporate income tax rate encourages the formation of C corporations, which in turn drives up the total labor demand in the economy. Hence, employees receive higher compensation per effective unit of labor. In considering this result, three aspects of the model must be discussed. Firstly, all entrepreneurs are considered working full-time, so the switching between workers and entrepreneurs does not change the non-employment rate. Secondly, the model predicts that most of the employment effect comes

from non-employed agents switching to be workers, which is shown in Figure 2. Although the personal income tax burden (parameter a_2) does slightly increase when the corporate income tax is eliminated, tax avoidance has little to do with the change in the non-employment rate. The model, as in the U.S. tax code, assumes that the non-employment transfer b is subject to personal income tax. This means that if the effective wage $wz\bar{n}$ is higher than the non-employment transfer b, an agent with a given amount of interest income ra would have a higher after-tax income from being a worker than being non-employed regardless of the changes to the personal income tax function. Therefore, an increase in effective wage rate w is a sufficient cause of a non-employed agent becoming a worker. Thirdly, a higher effective wage increases the marginal cost of labor, which has disproportionate negative effects on more labor-intensive pass-through firms. A higher wage rate also increases the opportunity costs of entrepreneurship. As a result, some of the least profitable pass-through business owners choose to become workers in this new tax regime.

To analyze the general equilibrium effect on input factor prices, a separate policy simulation is conducted holding the effective wage rate fixed at the level in benchmark economy. Compared with the general equilibrium setting, an elimination of the corporate income tax in this setting leads to an increase in the demand for capital that is 2.6 times higher and the increase in the demand for labor that is 7 times higher. These results indicate that the general equilibrium price feedback effect is important in the analysis of the corporate tax reform. This is consistent with the findings in the literature, such as Gourio and Miao (2010).

C. Employment Effect Decomposition

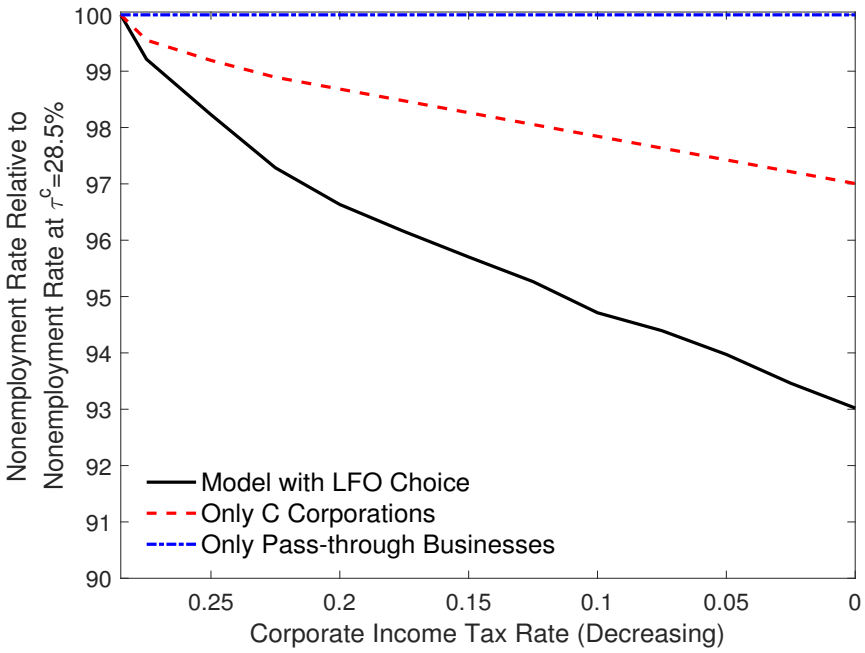
Section IV.A shows that lowering the corporate income tax encourages the formation of additional C corporations and subsequently leads to a higher employment rate in the economy. The increase in the number of C corporations is the result of pass-through business entrepreneurs switching LFO and the entry of newly formed C corporations by previous non-entrepreneurs. In this section, the observed employment effects are decomposed into both channels and evaluated.

Figure 4 examines the responsiveness of the non-employment rate to a corporate income tax rate change. In this figure, the non-employment rate change for a given corporate income tax rate τ^c is normalized by the non-employment rate in the benchmark economy, where the corporate income tax rate is 28.5 percent.[21] The solid black line shows how the relative non-employment rate changes with a decline in the corporate income tax rate. As can be seen, if the corporate income tax rate is reduced to zero, the non-employment rate is reduced by about 7 percentage points relative to

[21] Figure 4 graphs $\frac{\text{non-employment rate}(\tau^c)}{\text{non-employment rate}(\tau^c=28.5\%)}$ for each possible corporate tax rate in the policy analysis.

the non-employment rate in the benchmark economy. The same information is also summarized in Panel C of Table 5.

FIGURE 4. RESPONSIVENESS OF NON-EMPLOYMENT RATE TO CORPORATE TAX RATE CHANGE



To ascertain the relative importance of the two aforementioned channels of employment effect, two cases are examined. One case restricts all firms to be organized only as pass-through businesses, while the other case restricts all firms to be organized only as C corporations. For each case, the restricted model is recalibrated and then the non-employment responses to changes in the corporate income tax rate are examined and compared with the unrestricted case.

The blue dashed-dotted line in Figure 4 represents the non-employment rate changes in the first restricted model. If firms are not allowed to be organized as C corporations, not surprisingly, changes in the corporate income tax rate have no effect on the non-employment rate at all. Clearly, any employment effect of the corporate income tax policy can only come from having C corporations in the economy. The second restricted model, where firms are restricted to be only C corporations, is more interesting because it allows for C corporation formation from upstart non-entrepreneurs, but does not allow for switching between LFO. The non-employment rate changes in this case is represented by the red dashed line in Figure 4. As indicated, the non-employment rate falls when the corporate income tax rate is lowered. However, the decline is much less compared with the case where a LFO choice is possible. If the corporate income tax is eliminated in an economy with only C corporations, the normalized non-employment rate declines by 3 percent, compared with 7

percent in an economy where the LFO choice is available.[22]

This result shows the importance of considering LFO choices in the corporate tax policy analysis. In particular, the decline in the non-employment rate due to a corporate income tax cut can be more than twice as large when entrepreneurs' endogenous LFO choices are taken into full consideration.

D. Effects on Aggregate Productivity

A change in LFO, from a pass-through business to a C corporation, can reduce a firm's capital constraint. As a result of better access to capital, a firm's productivity may increase, which can lead to additional hiring. Thus, the employment effect is the symptom of improved capital allocation. In this section, we discuss the impact of the corporate income tax on capital reallocation and productivity.

A mismatch exists between agents' entrepreneurial talents and their initial wealth. Ideally, the financial market should channel capital from less-talented agents to more-talented entrepreneurs who are capital-constrained . Capital reallocation would continue until the marginal returns to capital are equalized across firms in the economy. In the model, the corporate income tax does not directly distort the capital input choice within a firm. The distortion occurs when managerially talented entrepreneurs with little personal wealth choose the pass-through legal form in order to avoid double taxation. The adoption of the pass-through legal form limits the flow of external capital into a firm and leads to inefficiency in the reallocation of capital. The severity of capital constraints faced by pass-through entrepreneurs determines the magnitude of productivity loss from the misallocation of capital in the economy. A decline in the corporate income tax rate improves the efficiency of capital reallocation. For example, the fraction of capital-constrained entrepreneurs decreases from 38.4 percent in the benchmark economy to 28.9 percent in an economy where the corporate income tax is removed.

Besides the distortion to LFO choice, the corporate income tax can serve as a barrier to firm entry. As can be seen in Figure 2, the threat of double taxation may keep agents of relatively lower productivity from becoming entrepreneurs. In the benchmark economy, such an individual's effective wage is high enough so that remaining a worker is more attractive than operating a capital-constrained pass-through business. This agent's productivity, however, is not high enough to compensate for the income loss due to the double taxation. Hence, the choice of the C corporate legal form is not dominating, even with a better access to capital. If the corporate income tax rate

[22] Alternatively, the benchmark model's parameters are used to simulate the restricted model's non-employment rate response without recalibration. The response to a lowering of the corporate income tax is even smaller in that case. The non-employment rate drops by only 1.6 percent when the corporate income tax is eliminated.

is reduced, the tax burdens of becoming an entrepreneur are lower. In this environment, this agent may quit his job and choose to operate a C corporation. This also means that the new entry C corporate firms are likely to be less productive than the existing firms. This can be seen in Table 6, where the average managerial quality per firm, defined as $Z^* = \frac{\int_{\chi z, a \in \{P,C\}} z\mu^*(z,a)}{\int_{\chi z, a \in \{P,C\}} \mu^*(z,a)}$, falls with a decline in the corporate income tax rate. If the corporate income tax is eliminated, the average managerial quality of a firm declines by 1.6 percent.

Table 6—Corporate Income Tax and Measures of Productivity

	Benchmark	Change in Corporate Income Tax Rate		
	τ^c =28.5%	τ^c =20%	τ^c =10%	τ^c =0%
Average Managerial Quality (Z^*)	2.379	2.371	2.359	2.340
		(−0.3%)	(−0.8%)	(−1.6%)
Average Effective Labor (n^*)	0.511	0.508	0.505	0.503
		(−0.6%)	(−1.1%)	(−1.5%)
Average Labor Productivity (Y/L)	1.997	2.016	2.032	2.031
		(1.0%)	(1.7%)	(1.7%)
$TFP_1 = Y/(L^\theta K^\gamma)$	1.820	1.834	1.841	1.836
		(0.8%)	(1.2%)	(0.9%)
$TFP_2 = Y/(Z^* L^\theta K^\gamma)$	0.765	0.774	0.781	0.785
		(1.1%)	(2.1%)	(2.6%)

Note: The percentage changes from to the benchmark statistics are included in the parentheses.

These new entrepreneurs leave their prior jobs, thus creating job vacancies that are available to previously non-employed agents from the benchmark economy. The non-employed agents are less productive. Replacing some of the most productive workers with some of the least productive workers means that the average labor productivity, defined as $n^* = \frac{\int_{\chi z, a \in \{E\}} z\bar{n}\mu^*(z,a)}{\int_{\chi z, a \in \{E\}} \mu^*(z,a)}$, declines. As can be seen in Table 6, the average labor productivity declines by 1.5 percent when the corporate income tax is eliminated.

In Section IV.A, the decline in the corporate income tax rate leads to more employment in the C corporate sector. The prior result suggests that getting more people to work comes with the cost that the new and less managerially talented entrepreneurs are paying higher wages to recruit less-productive workers.

The decline in the corporate income tax rate does make the allocation of capital more efficient in the economy. However, less-productive firms are allowed to operate in the market. To better understand the implications of these two counteracting forces, three measures of aggregate productivity in the model economy are constructed. One measure is aggregate output per effective labor, Y/L. With this measure, aggregate effective labor, L, takes into account the decline in average labor productivity due to more-productive workers being replaced by less-productive workers. Table

6 indicates that a non-monotonic relationship exists between aggregate output per effective labor and the corporate income tax rate. Aggregate output per effective labor increases with a moderate reduction in the corporate income tax rate, but declines when the tax rate reduction becomes large. This suggests that allowing better access to capital can improve aggregate productivity. However, an increase in access to capital to lower-productivity entrepreneurs can lower aggregate productivity in the economy.

In addition, we provide two measures of TFP. First, suppose the relationship between aggregate output, Y, aggregate capital, K, and aggregate effective labor, L, can be written as $Y = TFP_1 \cdot K^{\gamma}L^{\theta}$, where γ and θ are the calibrated capital and labor intensity parameters of the production function. As can be seen in Table 6, compared with the measure of aggregate output per effective labor, a non-monotonic relationship between aggregate productivity and the corporate income tax rate is more apparent with this TFP measure. In particular, TFP_1 increases by 1.2 percent relative to the benchmark economy when the corporate income tax rate is 0.10. However, TFP_1 increases by only 0.9 percent when the corporate income tax is set to zero.[23]

The model allows two channels for capital market imperfections to impact TFP. They are the capital misallocation channel and the entry distortion channel. As previously discussed, a decline in the corporate income tax rate can lead to entry of low-productivity firms and a potentially lower Z^*. To measure aggregate productivity loss due to capital misallocation, a second measure TFP_2 is constructed to take into account the decline in average managerial quality of firms Z^*. With this measure, aggregate labor in the economy is defined as $(Z^*)^{1/\theta} \cdot L$, and aggregate output is defined as $Y = TFP_2 \cdot K^{\gamma} \cdot (Z^* \cdot L^{\theta})$. As can be seen in the last row of Table 6, TFP_2 increases monotonically with a decline in the corporate income tax rate. More efficient capital reallocation can increase aggregate productivity in the economy by 2.6 percent.

Like many results in the literature, as in Hsieh and Klenow (2009), Restuccia and Rogerson (2008), and Restuccia and Rogerson (2013), the above results highlight the importance of agent heterogeneity in measuring productivity misallocation. The corporate income tax generates dispersion in marginal returns to capital across existing firms due to different tightness of capital constraints by LFO. In addition, an increase in the employment rate need not be uniformly correlated with an increase in productivity. In fact, as less-talented entrepreneurs enter the market, the average managerial quality falls, which could cause TFP to fall. The idea that the entry margin counteracts with the productivity misallocation margin is similar to that in Midrigan and Xu

[23]All the computations of Table 6 assume that the government maintains a balanced budget by varying the personal income tax parameter a_2 . Doing away with this assumption changes the results very little. For example, Table 6 has $TFP_1 = 1.836$ when $\tau^c = 0$. If parameter $a_2$is held fixed, $TFP_1 = 1.838$ when $\tau^c = 0$.

(2014).

E. Welfare

This section considers the welfare implications of lowering the corporate income tax rate. A decline in the corporate income tax rate has an ambiguous effect on aggregate welfare. On one hand, C corporations benefit from such a reduction as they can retain more of their profits. On the other hand, the corporate tax revenue may decrease, which requires an increase in the personal income tax revenue to maintain a balanced government budget. The increase in personal income taxation can adversely impact all agents in the economy. In this section, both aggregate and distributional welfare effects are evaluated quantitatively by comparing the consumption-equivalent welfare values between stationary equilibria under different corporate income tax rates.

Let $V^{bench}(z,a)$ be lifetime utility for an agent in state (z,a) in the benchmark economy, and let $V^{policy}(z,a;\tau^c)$ be its counterpart in a stationary equilibrium with a policy change in the corporate income tax rate τ^c. For each agent, the percent of consumption he is willing to forgo in all contingencies and in all future periods in order to live in the counterfactual economy is determined. This consumption-equivalent welfare $\xi(z,a;\tau^c)$ is such that[24]

$$V^{policy}(z,a;\tau^c) = \sum_{t=0}^{\infty} \beta^{t-1}[\alpha \ln(c_t^{bench}(1+\xi(z,a;\tau^c))) + (1-\alpha)\ln(1-n_t^{bench}) + \iota_t^{bench}\eta].$$

If the consumption-equivalent welfare $\xi(z,a;\tau^c)$ is positive, then the agent is better off in the counterfactual economy with the new corporate income tax rate τ^c. If it is negative, the agent has incurred a welfare loss after the policy change.[25]

Figure 5 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.

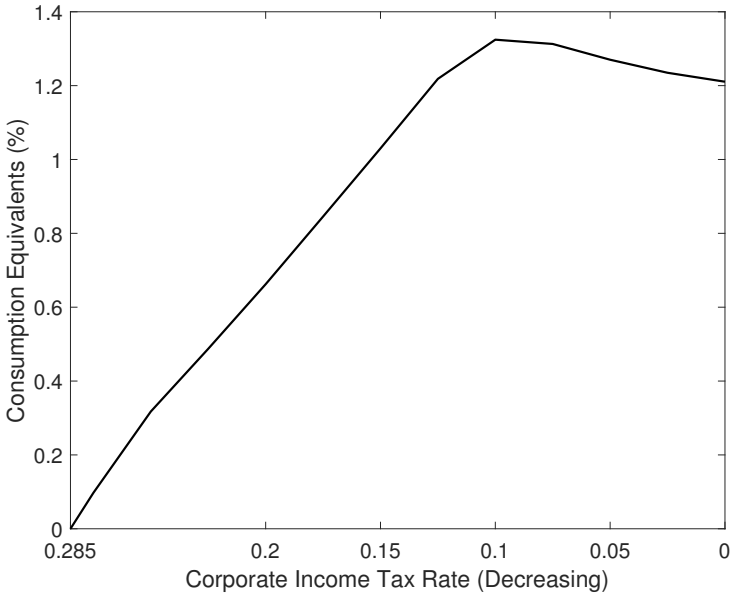
Establishing the aggregate welfare benefits that could occur from a decrease in the corporate income tax rate is important. Equally important are the distribution welfare impacts from this policy change. Table 7 reports the consumption-equivalent welfare by agents' occupations in the

[24]The analytical derivation of $\xi(z,a;\tau^c)$ is given in Appendix E.

[25]It is also possible to compare ex-ante welfare. Suppose all agents are born into steady states with zero assets and draw their productivity z from the invariant distribution implied by the Markov process. The ex-ante consumption-equivalent welfare can then be calculated by $\Xi(\tau^c) = \int_z \xi(z,a=0;\tau^c)G(dz)$. In our analysis, the ex-ante consumption-equivalent welfare is monotonically increasing with a decline in the corporate income tax rate. With zero corporate income tax, the ex-ante consumption-equivalent welfare is 1.91 percent.

benchmark economy. 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 corporate entrepreneurs on average have the most to gain, compared with agents of other occupations. The average consumption-equivalent welfare of a C corporate 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 corporate entrepreneur becomes. All C corporate entrepreneurs would support a corporate income tax cut.

Figure 5. Average Consumption Equivalent Welfare in Policy Experiment



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 corporate 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 corporate 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.

Table 7—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

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 corporate 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 corporate 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.

In general, a large majority of agents (more than 97%) would support a corporate income tax cut. The corporate income tax reform in our model improves production efficiency by lessening capital constraints for a significant fraction of the firms in the economy. Better production efficiency leads to a higher aggregate output and a larger average corporate profit in the economy. As a result, the corporate tax base in the economy becomes larger, and the government does not need to rely on a large increase in the personal income tax collection to maintain a balanced budget. A higher wage rate also means that the mass working-class households are likely to support the tax reform. In addition, higher aggregate productivity leads to an increase in wealth for a large fraction of the population, so we don't see a large redistribution of wealth from the poor to the wealthy, as in papers like Domeij and Heathcote (2004).[26]

V. Conclusion

This paper develops a dynamic stochastic occupational choice model with heterogeneous agents and incorporates endogenous entrepreneurial decisions with respect to legal form of organization. Taking into consideration the general equilibrium effect under the assumption of revenue neutrality, a calibrated model is employed to evaluate the impact of a reduction in the corporate income tax rate. Both LFO switching and new firm entry lead to a significant increase in the relative size of the C corporate sector. Because the C corporation legal form offers better access to capital, the expansion of the C corporate sector increases economic output, consumption, and capital formation. Decreasing the corporate income tax burden also moderately increases the wealth gap.

A reduction in the corporate income tax rate leads to moderate job growth. If the corporate income tax would be eliminated, the model predicts that the non-employed population would decrease from 34.1 percent to 31.7 percent, about a 7 percent fall in the relative non-employment

[26] An important contribution of Domeij and Heathcote (2004) is that they take into account transitional dynamics and show that comparing welfare across steady states can be misleading. Although transitional dynamic analysis is omitted here, we have analyzed transitional dynamics of our model under a slightly different specification in a previous version of the paper. The welfare implications change little. In particular, a vast majority (80 percent) of the agents in the economy would support the elimination of the corporate income tax.

rate. Endogenous LFO choice is a key margin in explaining the employment effect. In particular, the non-employment reduction due to a corporate income tax cut can be more than twice as large if a model takes into full consideration entrepreneurs' endogenous LFO choices.

In the economy, the corporate income tax distorts firm entry decisions and generates dispersion in marginal returns to capital across existing firms due to different tightness of capital constraints. Interestingly, the effect of a reduction of the corporate income tax rate on overall economic efficiency is non-monotonic. Because of the two counterbalancing forces, eliminating the corporate income tax has a relatively small overall effect on TFP (an increase of only about 0.9 percent). The productivity loss due to capital misallocation caused by the corporate income taxation is estimated to be 2.6 percent.

A welfare analysis is conducted to examine the different corporate income tax regimes. A reduction in the corporate income tax rate does not always improve welfare. Average welfare is maximized with a 10 percent corporate income tax rate. With a lower corporate income tax rate, the widening of the corporate income tax base allows the government to maintain revenue neutrality without large increases in the personal income tax burden. At the same time, workers' welfare improves due to higher after-tax wages, and C corporation entrepreneurs are better off due to the reduction in the corporate income tax liability. An overwhelming majority of the population would be in favor of the corporate income tax cut in this environment. Specifically, 99 percent of the population would support a corporate income tax cut to 10 percent, and 97.7 percent would be in favor of the elimination of the corporate income tax.

An important contribution of the paper is to point out the importance of considering LFO choice when evaluating the corporate income tax policy. For future research, two aspects of the LFO choice can be further explored. C corporations can finance business operations using retained earnings. Firm-owned capital, in a dynamic environment, can aid faster firm growth. This offers an alternative explanation why firms choose to be C corporations. The current model can also be extended to analyze the sources of corporate finance and LFO choices. For debt financing, we can consider the possibility of firm default. Corporations, including both C and S corporations, have limited liabilities. Better management of future default risk offers another possible reason for firms to incorporate. For equity financing, the model can incorporate modeling of shareholders. The corporate income tax can potentially affect the risk of equity issuing and investment efficiency, which in turn affect a firm's LFO choices. In both aspects, the main challenge is the complexity in modeling firms' ownership structure across periods while taking into account possible changes in LFO, which we hope to overcome in future papers.

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