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Philipp Krug

Dominika Langenmayr

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Taxing Transitions: Inheritance Tax and Family Firm Succession*

Philipp Krug†
KU Eichstätt-Ingolstadt

Dominika Langenmayr‡
KU Eichstätt-Ingolstadt, CESifo and WU Vienna

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Abstract. In many OECD countries, family firms face lower or no succession taxes if they fulfill continuation requirements. We study the effects of such preferential treatment in a two-generation model. Preferential treatment of continued firms leads to more entrepreneurship and higher wages, as entrepreneurs invest more as they value passing on a larger firm. However, more low-ability heirs continue the firm, leading to efficiency losses. In the presence of financial frictions, richer (but less able) heirs may invest more than buyers from outside.

Keywords. Inheritance taxation, family firms, preferential tax treatment, estate taxation

JEL Codes. H25, D25, J24

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†Chair of Economics, esp. Public Finance, Ingolstadt, Germany. Email: pkrug@ku.de.

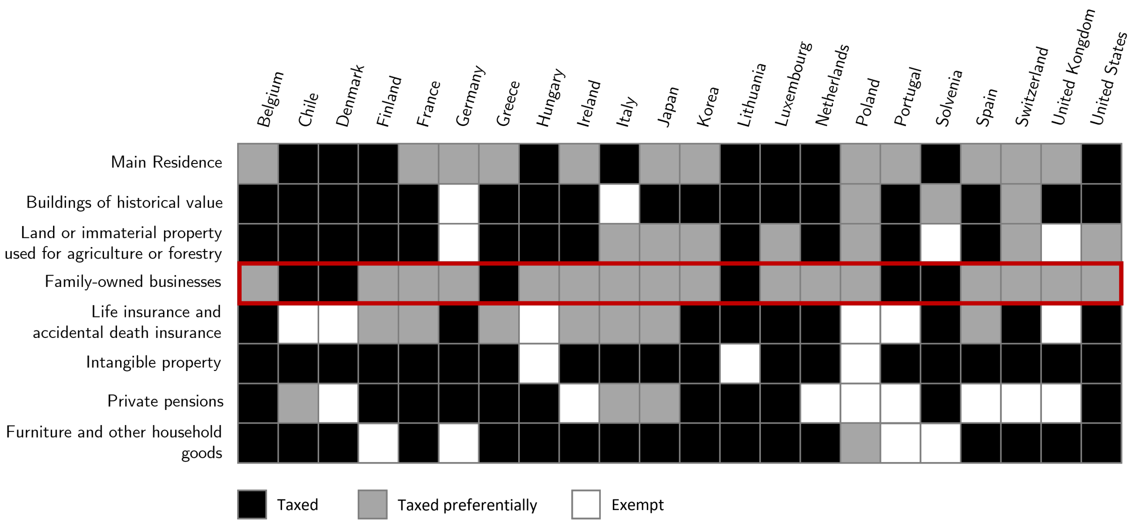
‡Chair of Economics, esp. Public Finance, Ingolstadt, Germany. Email: dominika.langenmayr@ku.de.

1 Introduction

In many countries, including the United States, the United Kingdom, France, or Germany, over half of the stock of private wealth is inherited (Alvaredo *et al.*, 2017). Among the richest, the primary source of wealth is business wealth: In the United States, pass-through business and C-corporation equity account for 46% of the wealth of the top 1% (Smith *et al.*, 2023); in Germany, business assets represent 50% of their wealth (Albers *et al.*, 2022). When debating the use of inheritance taxation to redistribute wealth, the treatment of these business assets is thus a key question. While their contribution to wealth inequality is clear, others argue that inheritance taxes on family firms dampen entrepreneurship and founders' investment.

Among 22 OECD countries that tax inheritances or estates, only six treat closely held businesses similarly to other assets. The other 16 countries impose lower (or no) taxes under certain conditions by reducing tax rates, increasing exemptions, or applying tax caps (see Figure 1). Most often, family firms must be continued for some time to be eligible for preferential tax treatment after succession (OECD, 2021).

Figure 1: Preferential Tax Treatment by Asset Type.



Note: Overview of assets with preferential inheritance tax treatment for the 22 OECD countries with an inheritance or estate tax. *Source:* OECD (2021).

The literature on optimal estate and inheritance taxation (e.g., Farhi and Werning, 2010, 2013; Piketty and Saez, 2013; Kopczuk, 2013) has focused on the optimal design of taxes imposed on all types of intergenerational transfers.[1] Whether inherited family

[1] Cremer and Pestieau (2011) and Bastani and Waldenström (2020) survey this literature.

firms should be treated differently has received little attention in this context. An exception is Grossmann and Strulik (2010), who analyze the desirability of preferential estate tax treatment for continued firms in a model with binary managerial ability. The fundamental trade-off in their model is between the transaction cost of selling post-succession firms to a world market and the efficiency cost of low-ability heirs continuing firms. Calibrating the model with German data, they find adverse effects of this tax treatment on macroeconomic performance.

Our paper adds a different angle to the question of whether family firms should receive favorable inheritance tax treatment, focusing on its interaction with the decision to become an entrepreneur and the related labor market effects. We show that a more favorable treatment of continued firms encourages entrepreneurship but also leads to less-suited heirs continuing firms at the cost of better-suited descendants of workers. The favorable tax treatment of continued firms is equivalent to an additional tax on firms sold by the heir. The heir, however, does not bear the entire tax burden, but is instead able to pass part of it onto the descendants of workers.

In more detail, we set up a non-overlapping two-generation model of parents and children. Individuals differ in their ability to run a firm. Depending on their ability, parents choose their occupation to become an entrepreneur or a worker. Entrepreneurs bequeath their firms and cash to their children. Workers can only leave a cash bequest. Individuals benefit from bequeathing due to a joy-of-giving motive (Andreoni, 1990). In addition, entrepreneurs have a second bequest motive which we call "capitalistic". Entrepreneurs receive utility from knowing that their firm will continue to exist after their death. Utility may be higher if they anticipate their children will take over the firm and establish an entrepreneurial dynasty, rather than sell it. Children also choose their occupations. Heirs of a firm can either continue this firm or sell the firm and become a worker. Descendants of a worker can either be a worker or buy a firm and become an entrepreneur.

The government uses inheritance taxation as the sole tax instrument and redistributes tax revenue as a lump-sum transfer to the children's generation. Inheritance tax rates may discriminate between different forms of bequests. The choice of tax rates has (heterogeneous) direct effects on individuals' utility but also impacts outcomes on the labor market and market for firms, adding indirect effects on individual utility. In addition to achieving welfare-maximizing redistribution, taxes counteract different inefficiencies. Internalizing (potentially heterogeneous) positive externalities from bequeathing calls for lower tax rates.

In an extension, we add financial frictions: We assume that interest rates depend on the individual's equity. Financial frictions add a trade-off between managerial ability and cost of capital to the optimal tax problem: Workers' children have to borrow more, and at higher interest rates, when acquiring a firm than entrepreneurs' children. This lowers demand for firms in the second generation. As the equilibrium price for firms decreases, a larger share of entrepreneurs' children continue the inherited firm. As both financial frictions and the preferential treatment distort the occupational choice in the same direction, financial frictions weaken the case for preferential treatment of continued firms.

Our model aligns with empirical evidence showing that heirs are less-suited managers on average. Bennedsen *et al.* (2007) find a negative causal effect of family transitions on operating profitability using Danish data. Pérez-González (2006) shows similar effects using data on individual CEOs. Studying the Fortune 500, Villalonga and Amit (2006) find that firm value decreases when second-generation CEOs are in office. Also for medium-sized firms, bad management practices closely connected to lower profitability are more prevalent if the eldest son takes over (Bloom and van Reenen, 2007). Adams *et al.* (2018) find that CEOs from Swedish companies differ in cognitive, non-cognitive, and physical characteristics from the rest of the population and that these characteristics strongly predict CEO compensation. However, these traits are less pronounced among CEOs from the founding family who are not the founder.

In addition, as in our model, empirical evidence confirms that higher succession taxes lead to the sale of businesses (Tsoutsoura, 2015; Brunetti, 2006). Tsoutsoura (2015) finds a strong positive effect of preferential succession taxes on firm continuation within the family, exploiting that Greece lowered taxes on intrafamily transfers of businesses in 2002. Moreover, the study underlines the importance of financial frictions: Higher transfer taxes lead to a stronger decline in investments for those firms with lower debt capacity.

The paper proceeds as follows. Section 2 presents our model framework. Section 3 describes the model equilibria. Section 4 analyzes the effects of the taxation, first in the symmetric case of taxing all assets at the same rate and then turning to the effects of differential inheritance taxation. Section 5 introduces financial frictions to the model and discusses welfare effects. Section 6 concludes.

2 Model Framework

2.1 Demographics and Abilities

We consider an economy with dynasties of two generations, namely parents and children. All parents live only in period $t = 1$; each parent has one child; all children live only in period $t = 2$. We normalize the mass of both generations to $M \equiv 1$ each. Individuals in both generations differ in their managerial ability γ to run a firm but have a uniform ability as an employee. This assumption captures that entrepreneurial skills are a specific talent and do not necessarily translate into higher wages as an employee.[2]

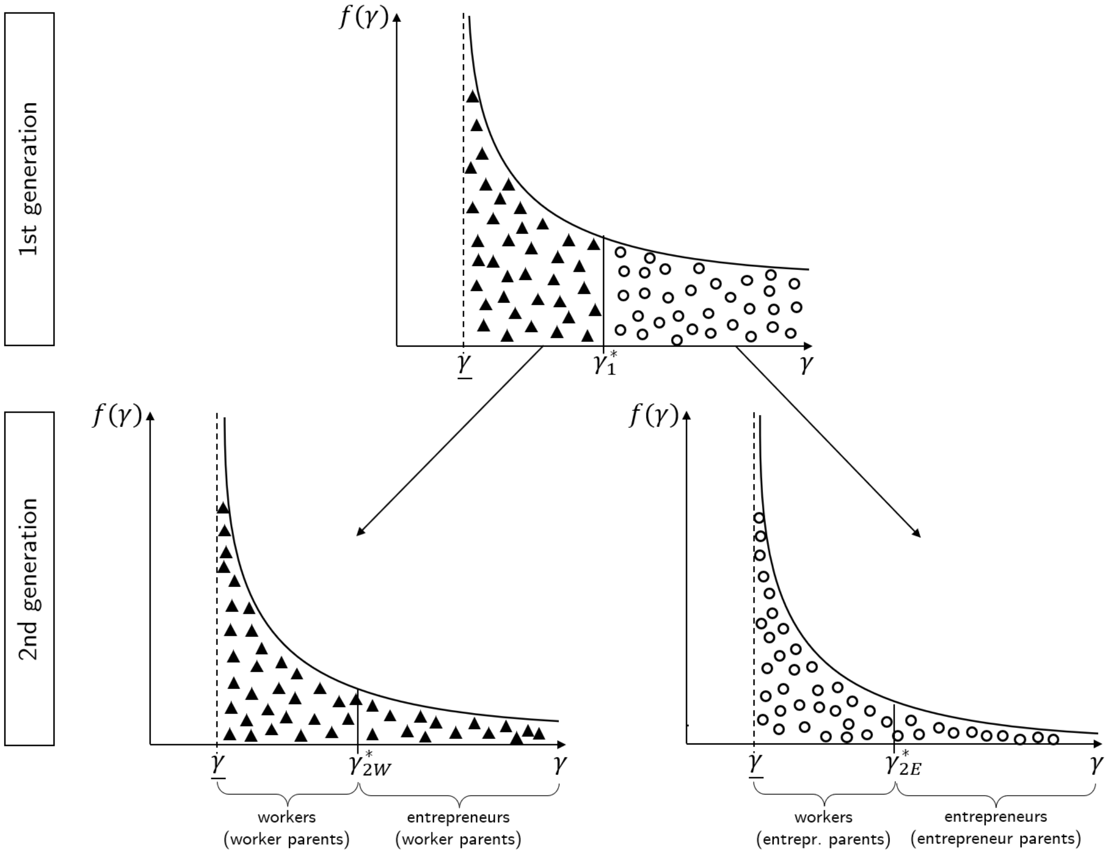
Parents choose their occupation based on their ability. They either become an entrepreneur E or a worker W. Entrepreneurs bequeath their firms, and potentially cash, to their children. Workers can only leave a cash bequest. Children again choose their occupation. Heirs of a firm can either continue this firm—we also call them entrepreneurs—or sell the firm and become a worker. Descendants of a worker can either be a worker, too, or buy a firm and become an entrepreneur.

Figure 2 illustrates the different types of individuals. We assume that managerial ability is distributed according to a Pareto distribution with minimum value $\underline{\gamma} > 0$ and shape value $\epsilon > 1$ such that the density function is $f(\gamma) = \frac{\epsilon \underline{\gamma}^{\epsilon}}{\gamma^{\epsilon+1}}$.[3] This distribution applies to ability in the first generation, ability among descendants of entrepreneurs, and ability among descendants of workers. Hence, we assume that ability is uncorrelated across generations of dynasties. Individuals in the first generation with ability γ_1^* are indifferent between the two occupations. The same holds for workers' children with ability γ_{2W}^* and entrepreneurs' children with ability γ_{2E}^*. Individuals with a higher ability maximize their utility by running a firm; those with a lower ability prefer to be employees.

[2] In line with this assumption, Kucel and Vilalta-Bufí (2016) find that wages of employees do not reward entrepreneurial competencies in Spain.

[3] Thus, there are a large number of small firms and a small number of large firms. See e.g. Axtell (2001) for similar findings for the distribution of firm size in the US.

Figure 2: Types of Individuals.



Note: The upper graph shows the ability distribution in the first generation. Triangles illustrate dynasties in which parents become workers since their ability is lower than the cutoff ability γ_1^*. Circles illustrate dynasties in which parents become entrepreneurs since their ability is higher than the cutoff ability γ_1^*. The bottom left graph shows the ability distribution of workers' children and the bottom right graph shows the ability distribution of entrepreneurs' children. Children with lower abilities than the respective cutoffs γ_{2W}^* and γ_{2E}^* become workers, children with higher ability become entrepreneurs. The cutoffs γ_{2W}^*, γ_{2W}^*, γ_{2E}^* do not necessarily coincide.

2.2 Labor and Capital Market

Firms demand labor L and capital K according to their production function. We assume that the labor supply by workers is inelastic and that each worker provides one unit of labor. We call the wage in period 1 w_1 and in period 2 w_2. We refer to market clearing wages as w_1^* and w_2^*. Firms can borrow capital on an international capital market at the rate r.

2.3 Firms

Firms use a Cobb-Douglas technology to produce output $y(\gamma) = \gamma L^\alpha K^\beta$ with a price per unit normalized to one and $\alpha + \beta < 1$.[4] The entrepreneur's ability γ enters the production function as total factor productivity. We assume that capital depreciates at rate δ. The firm's profit is thus

$$\pi(\gamma, w) = \gamma L^\alpha K^\beta - wL - (r + \delta)K, \tag{1}$$

with $w \in \{w_1, w_2\}$. Profit-maximizing input choices are

$$L^*(\gamma, w) = \left[\gamma \left(\frac{\alpha}{w}\right)^{1-\beta} \left(\frac{\beta}{r+\delta}\right)^{\beta}\right]^{\frac{1}{1-\alpha-\beta}}, \tag{2a}$$

$$K^*(\gamma, w) = \left[\gamma \left(\frac{\alpha}{w}\right)^{\alpha} \left(\frac{\beta}{r+\delta}\right)^{1-\alpha}\right]^{\frac{1}{1-\alpha-\beta}}. \tag{2b}$$

We denote maximized profit by $\pi^*(\gamma, w)$.

In addition to labor and capital, a firm needs a license to operate that can be obtained from the government in period 1 at price P_1. One can think of the price paid for such a license as reflecting the set-up costs of a firm. Entrepreneurs can pass on the license to their children. However, the number of licenses is constant over both generations, so individuals cannot found new firms in the second period. This is because government regulation[5] or the availability of natural resources limits market entry. Modelling these licenses will ensure that firms operate profitably, which is essential for analyz-

[4]Since we assume inelastic labor supply for reasons of simplicity, we need decreasing economies of scale to limit optimal firm size.

[5]In many countries, this is the case e.g. for cabs or doctor's practices.

ing the impact of taxation. Workers' descendants can buy existing licenses offered by entrepreneurs' descendants at price P_2. We refer to the market clearing price as P_2^*.

2.4 Government

The government uses inheritance taxation as the sole tax instrument and redistributes tax revenue as a lump-sum transfer T to the children's generation.[6] Inheritance tax rates may discriminate between different forms of bequests. The government taxes cash bequests at rate τ_c. Firms continued by the heirs are taxed at rate τ_{fc}, and firms sold by the heirs are taxed at rate τ_{fs}. These tax rates only apply to the firm license, while profit is taxed as cash.[7]

2.5 Individual Optimization in the 1st Generation

Individuals in the first generation choose the occupation that maximizes expected utility based on their individual ability γ. Workers and entrepreneurs both receive utility from their own consumption and from bequeathing to their children. A worker's utility function is

$$U^W = (1-\theta)\ln C^W + \theta \ln \left(B^W(1-\tau_c)\right), \tag{3}$$

where C^W is the worker's consumption and B^W the bequest left to the child. θ captures the degree of the joy-of-giving bequest motive. In contrast to pure altruism, this motive does not consider the children's utility but reflects purely the pleasure of helping, i.e., the "warm glow". Denoting the share of income bequeathed to the child by σ^W, we can write $B^W = \sigma^W w_1$ and $C^W = (1-\sigma^W)w_1$. Maximizing utility shows that it is optimal to bequeath an income share $\sigma^{W,*} = \theta$.

Entrepreneurs have two different bequest motives. First, they also bequeath due to a joy-of-giving motive. In addition, they have a second motive which we call "capitalistic": Founders receive utility from bequeathing a firm that continues to exist after

[6] Since we assume that each parent has one child, inheritance and estate taxation coincide. In the case of estate taxation, the donor carries the tax liability, which is based on the total estate. In the case of inheritance taxation, the recipient carries the tax liability.

[7] Without this assumption, entrepreneurs could put their cash in the firm to profit from lower tax rates for firms. In reality, complex rules limiting preferential treatment to active business assets restrict such behavior.

their death.[8] Utility may be higher if they anticipate their child will continue the firm instead of selling it. However, we assume that a founder does not know whether their child will continue the firm or not at the time when they found the firm.[9] Instead, they maximize expected utility by relying on the assumed probability p that the child continues the firm.[10] An entrepreneurs' expected utility is

$$\begin{aligned} U^E(\gamma) = {} & p\left[(1-\theta)\ln C^E + \theta \ln\left(B^E(1-\tau_c)\right) + \eta \ln\left(P_1\left(1-\tau_{fc}\right)\right)\right] \\ & + (1-p)\left[(1-\theta)\ln C^E + \theta \ln\left(B^E(1-\tau_c)\right) + \eta\varrho \ln\left(P_1\left(1-\tau_{fs}\right)\right)\right]. \end{aligned} \tag{4}$$

The first line describes the entrepreneur's utility if the child continues the firm, weighted by probability p. Parameter $\eta > 0$ captures the capitalistic bequest motive. The second line depicts the entrepreneur's utility if the child sells the firm. Parameter $0 \leq \varrho \leq 1$ reflects the parent's preference for the child to continue the firm. For $\varrho = 0$, the capitalistic motive only applies to firms that remain in the family hand. For $\varrho = 1$, the capitalistic motive is concerned with the firm's continued existence, whether it remains in the family's hand or not.[11]

Entrepreneurs bequeath a share σ^E of the firm's profit. We can thus express the cash bequest and consumption as

$$B^E = \sigma^E\left[\pi - (1+r)P_1\right] \quad \text{and} \quad C^E = \left(1-\sigma^E\right)\left[\pi - (1+r)P_1\right], \tag{5}$$

respectively. Profit π depends on the founder's ability γ and the wage in period 1, w_1. To set up the firm, founders have to buy a license at the price P_1. They have to borrow at rate r to finance the license. Entrepreneurs maximize their expected utility by choosing σ^E, L, and K optimally. Profit-maximizing input choices are also utility-maximizing. The optimal profit share to be bequeathed is $\sigma^{E,*} = \theta$ and hence coincides with the labor income share to be bequeathed by workers. Still, the bequest size can be different since labor income w_1 and profit $\pi(\gamma, w_1)$ are different for most individuals.

[8] See for example the extended horizon argument by James (1999) as well as Bertrand and Schoar (2006) for anecdotal evidence.

[9] Usually, people start a business either before children are born or when children are young.

[10] Different tax treatment of continued and sold firm could potentially influence the parent's assessment of the probability that the child continues the firm. We exclude this channel of tax effects in our model to improve analytical tractability.

[11] We assume $P_1(1-\tau_{fc}), P_1(1-\tau_{fs}) > 1$ so that the capitalistic term has a positive utility contribution.

The different tax rates affect individuals' utility levels through different channels, either directly as a component of the indirect utility function or indirectly as a determinant of the equilibrium wage and, in consequence, also of the firms' profits.

Lemma 1. *Let V^W and $V^E(\gamma)$ be the indirect utility of workers and entrepreneurs, respectively. The direct effects of taxation on the utility of the two groups are:*

- *An increase in the cash tax rate τ_c reduces the utility of workers and entrepreneurs equally strongly, i.e., $\frac{\partial V^W}{\partial \tau_c} = \frac{\partial V^E}{\partial \tau_c} < 0$. The effect is stronger the stronger the joy-of-giving motive is, i.e., $\frac{\partial^2 V^W}{\partial \tau_c \partial \theta} = \frac{\partial^2 V^E}{\partial \tau_c \partial \theta} < 0$.*
- *An increase in the tax rate on continued firms, τ_{fc}, and an increase in the tax rate on sold firms, τ_{fs}, reduces the utility of entrepreneurs, i.e., $\frac{\partial V^E}{\partial \tau_{fc}}, \frac{\partial V^E}{\partial \tau_{fs}} < 0$. The effects are stronger the stronger the capitalistic bequest motive is, i.e., $\frac{\partial^2 V^E}{\partial \tau_{fc} \partial \eta}, \frac{\partial^2 V^E}{\partial \tau_{fs} \partial \eta} < 0$. The effect of an increase in τ_{fs} is also stronger the stronger the preference for firm continuation is, i.e. $\frac{\partial^2 V^E}{\partial \tau_{fs} \partial \varrho} < 0$.*
- *The effect of a change in tax rate τ_{fc} on utility decreases with increasing probability of firm continuation, i.e., $\frac{\partial^2 V^E}{\partial \tau_{fc} \partial p} < 0$. In contrast, the effect of a change in tax rate τ_{fs} increases with increasing probability of firm continuation, i.e., $\frac{\partial^2 V^E}{\partial \tau_{fs} \partial p} > 0$.*

Proof. See Appendix A.1.

As tax revenue is not redistributed within the first generation, the utility of affected individuals decreases when tax rates increase. These adverse effects are stronger the stronger the related bequest motives are. A stronger joy-of-giving motive exacerbates the tax rate's negative effect on cash bequests for both workers and entrepreneurs. Similarly, a stronger capitalistic motive leads to a stronger negative effect of the tax rate on continued firms and the tax rate on sold firms. In addition to the bequest motives, the probability of firm continuation by the child influences the effect of tax rates on utility. The higher the probability that a child continues the firm, the stronger the effect of an increase in the tax rate on continued firms on utility since it is more likely that this higher tax rate will apply. The same argument holds vice versa for the tax rate on sold firms.

2.6 Individual Optimization in the 2nd Generation

Individuals in the second generation choose the occupation that maximizes their utility. Therefore, there are four different types of individuals: A worker's child can choose to also become a worker or to become an entrepreneur by buying a firm license. An entrepreneur's child can continue the inherited firm or sell the license and become a worker instead. Individuals in the second generation consume all of their income.

Workers' descendants. Workers' children receive a cash bequest B^W. If the child decides to become a worker, their utility is

$$U_W^W = \ln C_W^W = \ln \left(w_2 + (1 - \tau_c)(1 + r)B^W + T \right). \tag{6}$$

The total budget consists of labor income w_2, the net-of-tax bequest including interest $(1 + r)(1 - \tau_c)B^W$ taxed at rate τ_c and the lump-sum transfer T.[12] Alternatively, workers' children may decide to become entrepreneurs with utility

$$U_E^W(\gamma) = \ln C_E^W = \ln \left(\pi(\gamma, w_2) + (1 - \tau_c)(1 + r)B^W - (1 + r)P_2 + T \right). \tag{7}$$

Entrepreneurs get the firm's profit $\pi(\gamma, w_2)$, the net-of-tax bequest and the lump-sum transfer and have to pay $(1 + r)P_2$ for the firm (license) including interest. They maximize utility by maximizing the firm's profit through optimal input choice $L^*(\gamma, w_2), K^*(\gamma, w_2)$. We define indirect utility $V_E^W(\gamma) = U_E^W(L^*(\gamma, w_2), K^*(\gamma, w_2); \gamma, w_2)$.

Entrepreneurs' descendants. Entrepreneurs' children receive a cash bequest B^E. If the child decides to continue the firm, the utility function is

$$U_E^E(\gamma) = \ln C_E^E = \ln \left(\pi(\gamma, w_2) + (1 - \tau_c)(1 + r)B^E - \tau_{fc}(1 + r)P_2 + T \right). \tag{8}$$

The heir has to pay taxes on the cash bequest at rate τ_c and on the market value of the firm license at rate τ_{fc}. We define indirect utility $V_E^E(\gamma) = U_E^E(L^*(\gamma, w_2), K^*(\gamma, w_2); \gamma, w_2)$. The utility function of a firm heir who decides to become a worker is

$$U_W^E = \ln C_W^E = \ln \left(w_2 + (1 - \tau_c)(1 + r)B^E + (1 - \tau_{fs})(1 + r)P_2 + T \right). \tag{9}$$

The heir receives price P_2 for the sale of the license, which is taxed at rate τ_{fs}.

[12] Note that we assume that the tax liability has to be paid at the beginning of the period. The net-of-tax bequest can then earn interest for the duration of period 2.

3 Model Equilibria

3.1 Equilibrium in the 1st Generation

Given the framework outlined above, we can now define the equilibrium in each generation. The equilibrium in the first generation is given by

1. the ability threshold γ_1^* that divides the population into workers ($\gamma < \gamma_1^*$) and entrepreneurs ($\gamma > \gamma_1^*$),
2. the wage rate w_1^*,
3. entrepreneurial labor demands $L^*(\gamma, w_1^*)$ and capital demands $K^*(\gamma, w_1^*)$, $\forall \gamma > \gamma_1^*$,
4. bequest shares $\sigma^{W,*}, \sigma^{E,*}$,

such that, given government taxes, the following conditions on individual behaviour and labor markets hold.

First, all individuals maximize utility by choosing their occupation. The share to bequeath $\sigma^{W,*}$ maximizes a worker's utility. The share to bequeath $\sigma^{W,*}$ and production factor inputs $L^*(\gamma, w_1^*), K^*(\gamma, w_1^*)$ maximize an entrepreneur's utility. Thus, it must hold that

$$V^E(\gamma_1^*, w_1^*) = V^W(w_1^*). \tag{10}$$

Second, the labor market clears, i.e., total labor demand by entrepreneurs equals total labor supply by workers:

$$\lim_{\bar{\gamma} \to \infty} \int_{\gamma_1^*}^{\bar{\gamma}} L(\gamma, w_1^*) f(\gamma) d\gamma = \int_{\underline{\gamma}}^{\gamma_1^*} f(\gamma) d\gamma.^{13} \tag{11}$$

We can solve equation (10) for γ_1^* and equation (11) for w_1^* (see Appendix A.2). Both equations together implicitly define the threshold ability γ_1^* and the market-clearing wage w_1^* in the first generation. Individuals with $\gamma < \gamma_1^*$ become workers, and individuals with $\gamma > \gamma_1^*$ become entrepreneurs.

3.2 Equilibrium in the 2nd Generation

The equilibrium in the second generation is given by

[13] To make sure that the integral converges, we assume $\epsilon > (1 - \alpha - \beta)^{-1}$.

1. the ability threshold γ^*_{2W} that divides the population of workers' descendants into workers ($\gamma < \gamma^*_{2W}$) and entrepreneurs ($\gamma > \gamma^*_{2W}$), as well as the ability threshold γ^*_{2E} that divides the population of entrepreneurs' descendants into workers ($\gamma < \gamma^*_{2E}$) and entrepreneurs ($\gamma > \gamma^*_{2E}$),
2. entrepreneurial labor demands $L^*(\gamma, w^*_2)$ and capital demands $K^*(\gamma, w^*_2)$, $\forall \gamma \in (\gamma > \gamma^*_{2W}) \cup (\gamma > \gamma^*_{2E})$,
3. the wage rate w^*_2,
4. the price for firm licenses P^*_2,

such that, given government taxes and transfers, the following conditions hold. First, all individuals maximize utility by choosing their occupation. Production factor inputs $L^*(\gamma, w^*_2), K^*(\gamma, w^*_2)$ maximize an entrepreneur's utility. Hence, it must hold that

$$V^W_E(\gamma^*_{2W}, w^*_2) = U^W_W(w^*_2) \quad \text{and} \quad V^E_E(\gamma^*_{2E}, w^*_2) = U^E_W(w^*_2). \tag{12}$$

Second, the labor market clears, i.e., total labor demand by entrepreneurs equals total labor supply by workers:

$$\begin{aligned} &\left(\frac{\underline{\gamma}}{\gamma^*_1}\right)^{\epsilon} \lim_{\bar{\gamma}\to\infty} \int_{\gamma^*_{2E}}^{\bar{\gamma}} L(\gamma, w^*_2) f(\gamma) d\gamma + \left(1 - \left(\frac{\underline{\gamma}}{\gamma^*_1}\right)^{\epsilon}\right) \lim_{\bar{\gamma}\to\infty} \int_{\gamma^*_{2W}}^{\bar{\gamma}} L(\gamma, w^*_2) f(\gamma) d\gamma \\ &= \left(\frac{\underline{\gamma}}{\gamma^*_1}\right)^{\epsilon} \int_{\underline{\gamma}}^{\gamma^*_{2E}} f(\gamma) d\gamma + \left(1 - \left(\frac{\underline{\gamma}}{\gamma^*_1}\right)^{\epsilon}\right) \int_{\underline{\gamma}}^{\gamma^*_{2W}} f(\gamma) d\gamma. \end{aligned} \tag{13}$$

The first line represents the total labor demand by entrepreneurs, and the second line represents the total labor supply by workers. In each line, the first term refers to the group of entrepreneurs' children, and the second one refers to the group of workers' children.

Third, the market for operating licenses clears, i.e. the supply of firm licenses equals the demand for firm licenses:

$$\left(\frac{\underline{\gamma}}{\gamma^*_1}\right)^{\epsilon} \int_{\underline{\gamma}}^{\gamma^*_{2E}} f(\gamma) d\gamma = \left(1 - \left(\frac{\underline{\gamma}}{\gamma^*_1}\right)^{\epsilon}\right) \int_{\gamma^*_{2W}}^{\bar{\gamma}} f(\gamma) d\gamma. \tag{14}$$

4 Effects of Taxation

4.1 Effects in the 1st Generation

The direct effects of taxation on the individuals' utility levels discussed in Lemma 1 also affect the equilibrium ability threshold γ_1^* and the labor market clearing wage w_1^*. Implicitly differentiating the system of equations consisting of the equilibrium conditions (10) and (11) with respect to the three different tax rates allows us to analyze the effect of taxation on market outcomes.

Proposition 1. *The ability cutoff and the wage are independent of the cash tax rate τ_c. If the tax rates on continued or sold firms increase, the ability cutoff rises and the equilibrium wage decreases, i.e.,*

$$\frac{d\gamma_1^*}{d\tau_{fc}}, \frac{d\gamma_1^*}{d\tau_{fs}} > 0 \quad \textit{and} \quad \frac{dw_1^*}{d\tau_{fc}}, \frac{dw_1^*}{d\tau_{fs}} < 0. \tag{15}$$

Proof. See Appendix A.2.

Changes in the cash tax rate affect both groups in the same way. Therefore, the tax rate is irrelevant to occupational choice and does not influence the ability cutoff and labor market outcomes. In contrast, both tax rates on firms affect the equilibrium: When founding a firm, parents do not yet know whether their child will continue the firm. Thus, both tax rates enter their optimization problem. Depending on the probability that the child will continue the firm and on the preference parameter ϱ, the effects of τ_{fc} and τ_{fs} on equilibrium outcomes may differ in size but always go in the same direction. Higher tax rates reduce the incentive to found a firm because of the capitalistic bequest motive. Consequently, more individuals prefer to become a worker: the higher the tax rates, the higher the ability cutoff.

Distorting the occupational choice has consequences for the labor market: A higher ability cutoff increases aggregate labor supply and decreases aggregate labor demand, decreasing the market-clearing wage.

4.2 Intergenerational Effects: Benchmark Case with Uniform Taxation

Inheritance taxation may also affect outcomes for the second generation. First, we consider a benchmark case where the government uses a uniform inheritance tax rate on firms, i.e. $\tau_{fc} = \tau_{fs}$.

Proposition 2. *With a uniform inheritance tax rate, ability thresholds in both generations are equal, i.e.,* $\gamma_1^* = \gamma_{2E}^* = \gamma_{2W}^*$*, and labor market clearing wages are equal, i.e.,* $w_1^* = w_2^*$*. For* $\eta = 0$*, the market clearing prices on the firm market also coincide, i.e.,* $P_2^* = P_1$*. For* $\eta > 0$*, the price in the second generation is lower, i.e.,* $P_2^* < P_1$*.*

Proof. See Appendix A.3.

Without a capitalistic bequest motive, ability cutoffs in the group of workers' descendants and entrepreneurs' descendants coincide and are the same as the cutoff in the parents' generation. Consequently, labor demand and supply are identical in both generations (and, therefore, the equilibrium wage). The marginal buyer of a firm license thus has the same willingness to pay as the marginal entrepreneur in the parent's generation. Therefore, license prices in both periods also coincide. These results hold independently of the taxation of cash bequests if tax rates for continued and sold firms are the same.

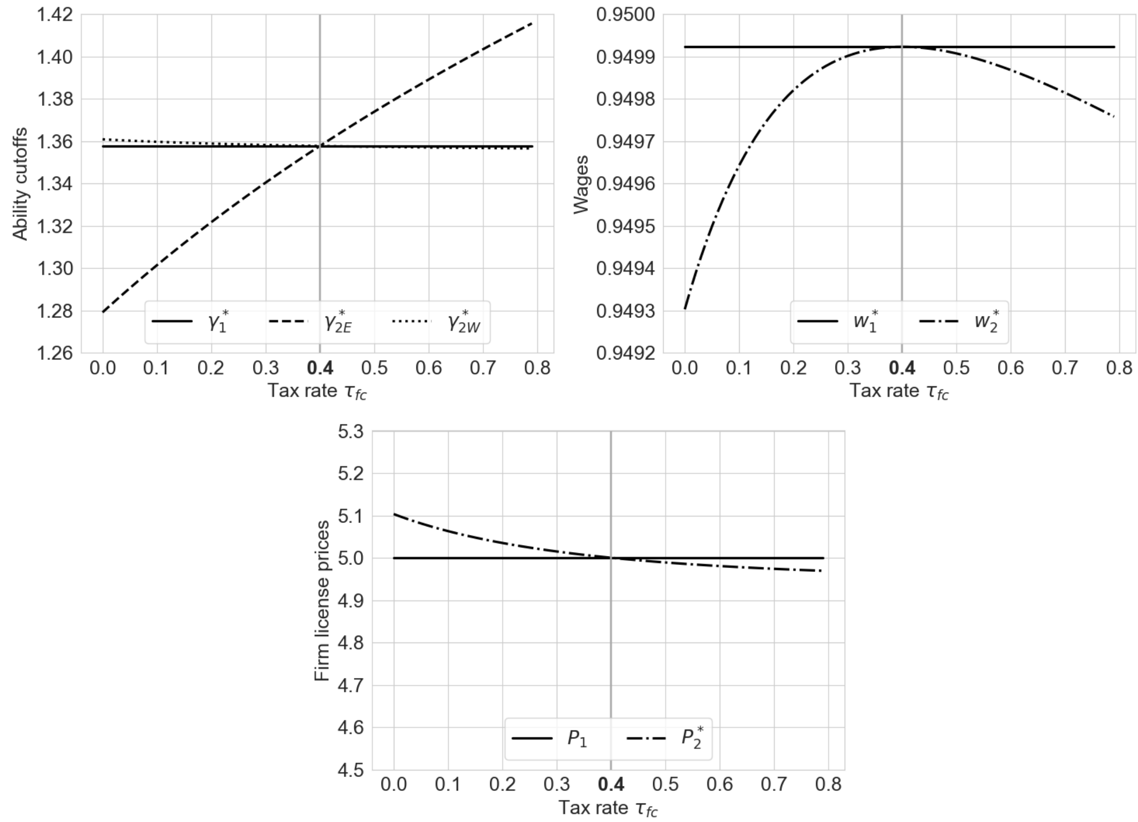
When introducing the capitalistic bequest motive in addition to the joy-of-giving motive, market outcomes only partly coincide across the two generations. While all ability cutoffs coincide and wages are still identical in both generations, the license price in the second generation is lower, i.e., $P_2^* < P_1$. In the first generation, an individual with ability γ_1^* is indifferent between both occupations at the license price P_1. An individual with the same ability in the second generation is indifferent between the two occupations at a lower license price, as there is no additional incentive to manage a firm through a capitalistic bequest motive.[14] The price difference becomes larger for a stronger capitalistic motive.

4.3 Intergenerational Effects: Differential Taxation

We will rely on simulations to analyze the effect of tax rate differentials on occupational choice and market outcomes. In Figure 3, we first investigate the case without a capitalistic bequest motive, i.e., $\eta = 0$. The horizontal axes in the three graphs show the tax rate on continued firms τ_{fc}. The tax rate on sold firms τ_{fs} is set to 0.4, so the left parts of the graphs reflect a preferential treatment of continued firms, and the right parts reflect a preferential treatment of sold firms.

[14] This effect is limited to the market for firms and does not lead to different ability cutoffs because the number of firms in our model is the same in both generations.

Figure 3: Ability Cutoffs, Wages and Prices for $\eta = 0$.



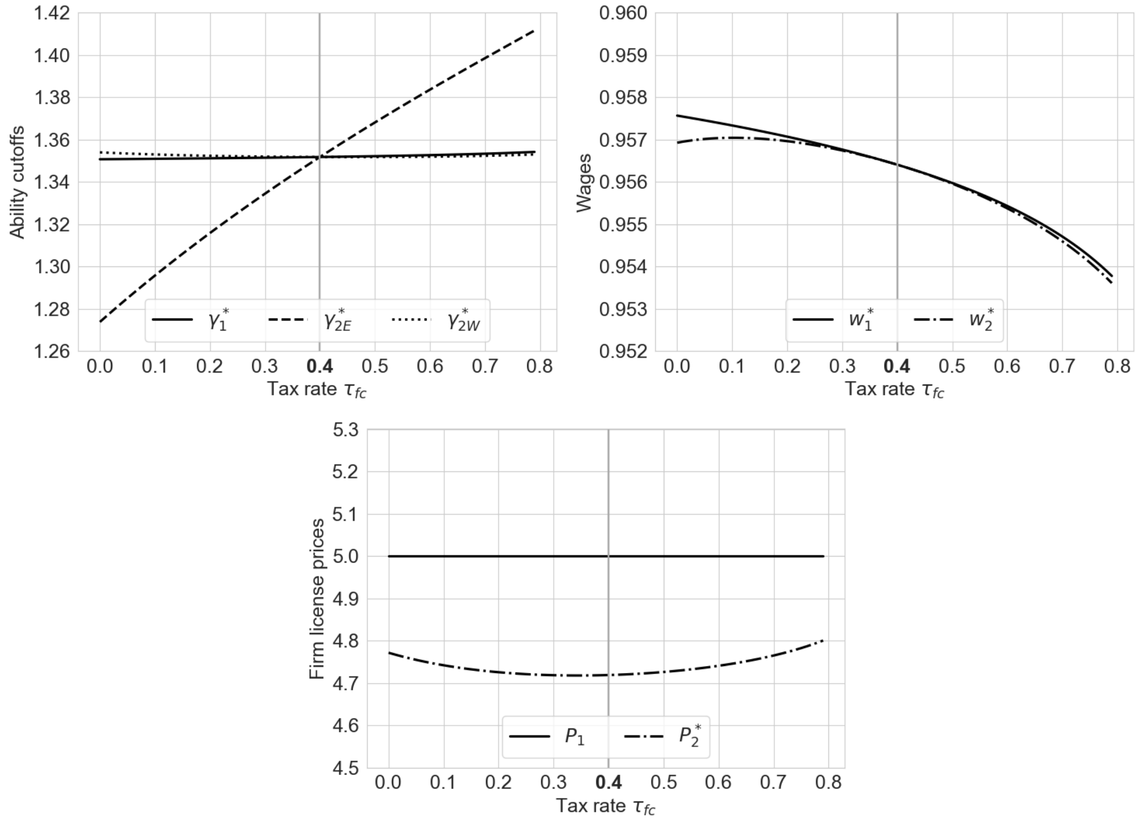
Note: This simulation uses 0.4 for the tax rate τ_{fs} and 5 for the license price P_1. Parameter values for the Pareto distribution are $\epsilon = 12, \underline{\gamma} = 1$. Parameters in the profit function are set to $a = 0.4, b = 0.45, d = 0.1, r = 0.02$. Parameters in the utility functions are $\theta = 0.4, \eta = 0, p = 0.3$.

For $\tau_{fc} = \tau_{fs}$, the three plots show the results from Proposition 2. Ability cutoffs, wages, and license prices coincide in the two periods. The first plot shows how ability cutoffs change for different tax rate differentials. If $\tau_{fc} < \tau_{fs}$, i.e., in the left part of the plot, the ability cutoff among workers' descendants γ_{2W} is above the first generation cutoff γ_1 while the ability cutoff among entrepreneurs' descendants γ_{2E} is below. The lower tax rate on continued businesses increases the incentives to keep inherited firms and makes it worthwhile even for lower-ability heirs. The share of continued firms increases. In the case of $\tau_{fc} > \tau_{fs}$, i.e., in the right part of the plot, differential taxation increases incentives to sell inherited firms, which implies a higher ability cutoff for entrepreneurs' descendants. The cutoffs change differently for each group as they differ in size—there are many more workers than entrepreneurs.

To think about the effects of differential taxation on firm license and labor markets, we model the relationship between the two tax rates as $\tau_{fs} = (1 + \Delta)\tau_{fc}$, where Δ is positive if continued firms are taxed preferentially and negative if sold firms are taxed preferentially. In this sense, τ_{fc} functions as a commodity tax on bequests and $\Delta \cdot \tau_{fc}$ as a separate tax (or subsidy) on sold firms. On whom is the incidence of this additional tax? As the third plot shows, the market-clearing price P_2^* increases with decreasing τ_{fc} for a constant τ_{fs}, which is equivalent to increasing Δ. Hence, part of the additional tax burden is passed on to the firms' buyers.

Concerning the labor market, the upper right plot shows that the wage in the second generation is lower than in first generation if the two tax rates diverge. Since a tax differential distorts occupational choice, managerial ability is used less efficiently. This leads to a lower aggregate labor demand and lower wages.

Figure 4: Ability Cutoffs, Wages and Prices for $\eta > 0$.



Note: This simulation uses 0.4 for the tax rate τ_{fs} and 5 for the license price P_1. Parameter values for the Pareto distribution are $\epsilon = 12, \underline{\gamma} = 1$. Parameters in the profit function are set to $a = 0.4, b = 0.45$, $d = 0.1, r = 0.02$. Parameters in the utility functions are $\theta = 0.4, \eta = 0.5, \varrho = 0.5, p = 0.3$.

Figure 4 shows the same three plots when including the capitalistic bequest motive

($\eta > 0$). The ability cutoff and the wage in the first generation reflect the findings of Proposition 1. The ability cutoff increases with an increasing tax rate τ_{fc} (and constant τ_{fs}), and the wage decreases. As mentioned before, a higher tax implies that only individuals with a higher ability prefer being an entrepreneur. The lower number of firms (and, consequently, lower labor demand) implies that the labor market clears at a lower wage. When comparing ability cutoffs and wages over the two generations, the effects described in the case $\eta = 0$ still apply. Again, as discussed for the uniform tax case in Proposition 2, introducing the capitalist bequest motive impacts the market for firm licenses. The market clearing price P_2^* is consistently lower than P_1 for all tax differentials.[15]

5 Discussion

5.1 Financial Frictions

Interest rates vary with a variety of firm characteristics. An important one within our model framework is the capital structure of firms.[16] Firms with a high debt level may pay higher interest rates on debt as they have a higher risk of financial distress.[17]

A firm's debt level in the second period of our model depends on four aspects. (1) Required capital K^* for production, which follows from profit maximization and depends on individual ability; (2) for workers' children, the cost of acquiring a firm (license); (3) the inherited funds; and (4) the inheritance tax rate.

While lenders on the international capital market cannot observe managerial ability, they can discriminate against borrowers with higher debt levels. We now introduce two different interest rates $r_h > r_l$, to account for heterogeneity in borrowing costs.[18] We

[15]The u-shaped form is the result of different overlapping effects. The number of firms decreases with increasing τ_{fc} and the additional tax burden Δ decreases with increasing τ_{fc}, as does the wage (which is the opportunity cost of buying a license).

[16]Another determinant of the cost of debt are agency conflicts. Anderson *et al.* (2003) show that founding family ownership leads to lower cost of debt because of lower agency cost. However, they find evidence that if founder descendants hold the CEO position, firm performance is worse, counteracting the first effect.

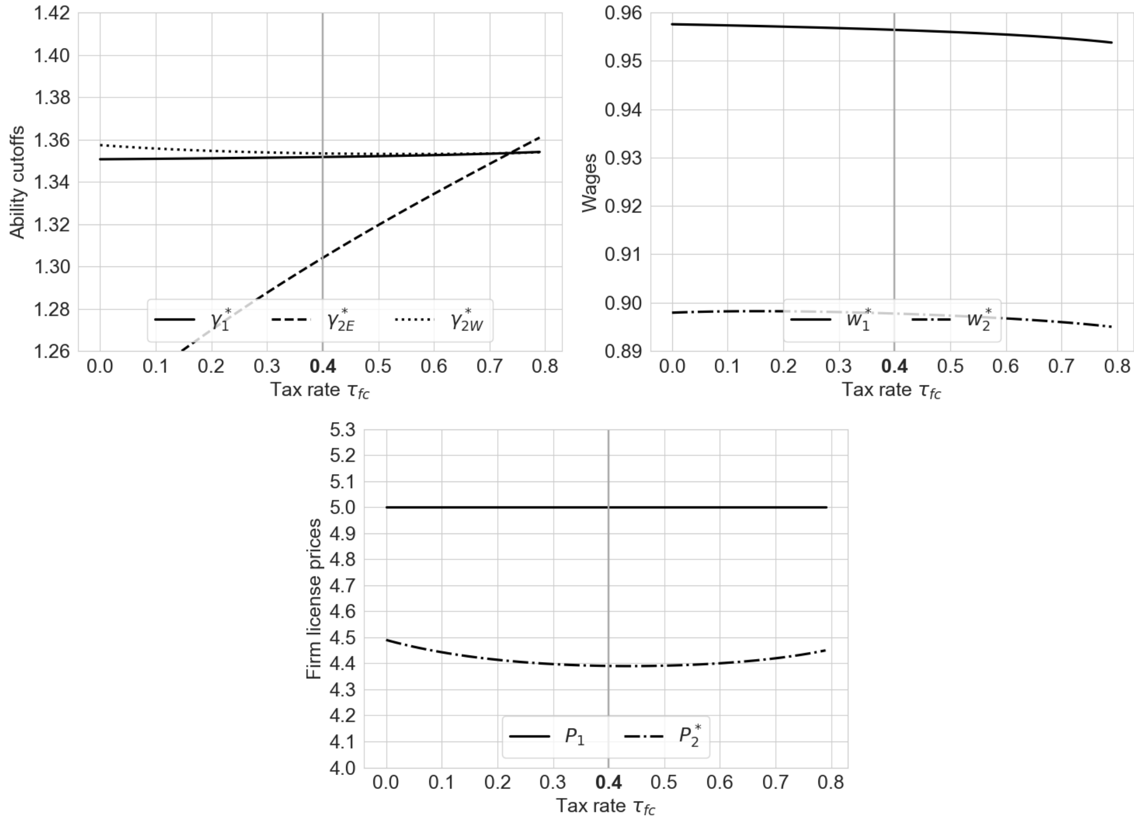
[17]Expected default costs are an important determinant of the total costs of debt (van Binsbergen *et al.*, 2010). They find that having too much debt (relative to the optimum) on the balance sheet leads to an asymmetrically higher cost than having too little debt.

[18]To keep the model tractable, we do not model separately lending by the firm and lending by the individual, nor do we distinguish between lending and borrowing rates. An individual that pays r_l (r_h) for borrowing also earns r_l (r_h) on deposits.

assume that the higher interest rate will be paid by workers' descendants who acquire a firm in the second period, while the lower rate r_l applies for all other borrowers.[19]

How does the model change with financial frictions? To better understand these effects, we repeat the simulations from Figure 4 with financial frictions. Comparing the results in Figure 5 with Figure 4 shows three substantial changes: Financial frictions imply that more entrepreneurs' children continue the firm (lower γ_{2E}^*), that wages for workers in the second generation (w_2^*) are lower, and that the market price for firms in the second generation (P_2^*) is lower.

Figure 5: Ability Cutoffs, Wages and Prices with Financial Frictions.



Note: This simulation uses 0.4 for the tax rate τ_{fs} and 5 for the license price P_1. Parameter values for the Pareto distribution are $\epsilon = 12, \gamma = 1$. Parameters in the profit function are set to $a = 0.4, b = 0.45, d = 0.1, r_l = 0.02$ and $r_h = 0.03$. Parameters in the utility functions are $\theta = 0.4, \eta = 0.5, \varrho = 0.5, p = 0.3$.

How can we explain these changes? As worker's children now have to borrow at higher

[19] Depending on firms' profits, wage levels, bequest motives and firm prices it is certainly possible that not all workers' descendants who acquire a firm have higher financing needs than all entrepreneurs' children who continue the inherited firm. Insofar, this assumption is a simplification.

interest rates, it becomes less attractive for them to buy a firm. This lower demand implies lower prices for firm licenses. Therefore, fewer entrepreneurs' children sell the firm. As a consequences, the average entrepreneur in the second generation has a lower ability, and therefore a smaller firm which requires less labor input. Due to the higher financing cost, firms headed by worker's children are also smaller, again lowering labor demand. These two effects lead to substantially lower wages in the model with financial frictions.

Inheritance taxes exacerbate these effects, as they reduce the equity available to individuals in the second generation. Thus, the negative effect of inheritance taxes on utility is higher when interest rates are higher. For workers, this is because taxes are due at the beginning of the period and thus reduce wealth that earns interest. For entrepreneurs, any tax on the inheritance implies higher financing needs for the company. This borrowing becomes more expensive with a higher interest rate.[20]

Proposition 3. *Higher interest rates exacerbate the negative direct effects of all inheritance tax rates ($\tau_c, \tau_{fc}, \tau_{fs}$) on children's utility.*

Proof. See Appendix A.4.

Taxing continued firms at a lower rate than sold firms, i.e., $\tau_{fc} < \tau_{fs}$, increases the share of firms continued by the heir, which face lower interest rates. However, at the same time, the average ability of firm owners would decrease, leading to an adverse effect on output. Consider the following illustrative example: By marginally increasing the tax differential $\tau_{fs} - \tau_{fc}$, a firm owned by an heir with ability γ_l (paying interest rate r_l) will not be sold anymore to a workers' descendant with ability γ_h (paying interest rate r_h). Since the firm owner now has a different ability and pays a different interest rate, the profit-maximizing firm size also differs.

The intervention increases total income for the firm's owner and employees, i.e.,

$$\pi^* (\gamma_l, r_l) + w_2 L^*(\gamma_l, r_l) > \pi^* (\gamma_h, r_h) + w_2 L^*(\gamma_h, r_h), \tag{16}$$

if

$$\frac{\gamma_l}{\gamma_h} < \left(\frac{r_l + \delta}{r_h + \delta} \right)^{\beta}. \tag{17}$$

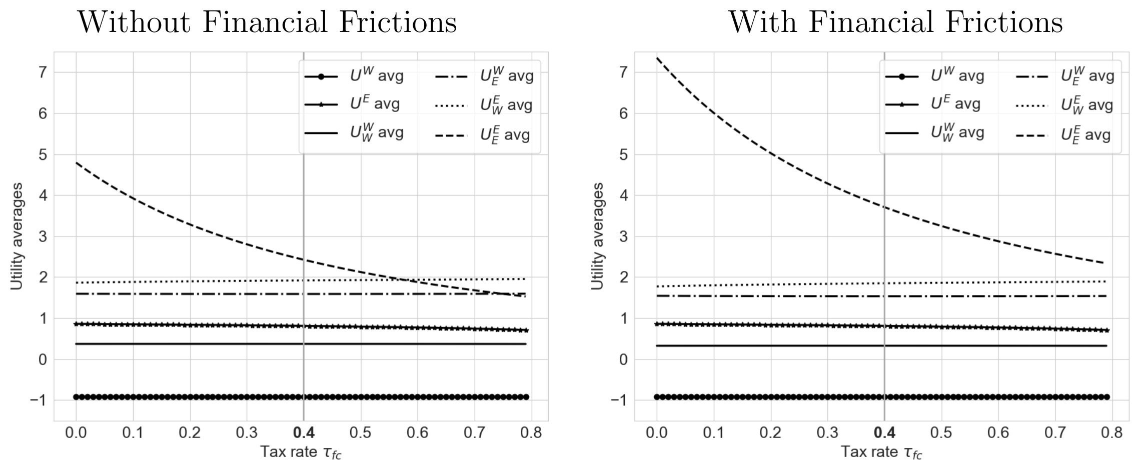
[20]Holtz-Eakin *et al.* (1994a,b) in addition find that frictions in the form of liquidity constraints for entrepreneurs are more severe for those who do not possess private funds, e.g., from bequests received.

5.2 Welfare Effects

We start by analyzing the effects of inheritance taxation on the well-being of individuals belonging to the different groups.[21] Afterwards, we turn to the aggregate welfare effects.

Figure 6 depicts the average utility for all groups in the first and second generation as a function of the tax rate on continued firms. The left panel shows the main model, the right panel the extended model with financial frictions.

Figure 6: Utility Averages by Group.



Note: This simulation uses 0.4 for the tax rate τ_{fs} and 5 for the license price P_1. Parameter values for the Pareto distribution are $\epsilon = 12$ and $\underline{\gamma} = 1$. Parameters in the profit function are set to $a = 0.4, b = 0.45$, $d = 0.1$. Parameters in the utility functions are $\theta = 0.4, \eta = 0.5, \varrho = 0.5$, and $p = 0.3$. In the left panel (without financial frictions), $r = 0.02$, in the right panel (with financial frictions), $r_l = 0.02$ and $r_h = 0.03$.

First, consider the utility of individuals in the first generation in the model without financial frictions (left panel). A favorable tax treatment of continued firms increases the utility of entrepreneurs (U^E). On average, entrepreneurs have a higher utility than workers—a return to their higher ability. They anticipate the tax, and it negatively affects their utility via the capitalistic bequest motives.[22] The tax on continued firms does not affect workers (U^W) directly. However, a preferential tax treatment implies that more individuals become entrepreneurs, and the higher number of firms increases labor demand and thus wages. Figure 6 shows that this effect is small, however.

[21] Note that inheritance taxation also affects the size of the groups in the second generation.

[22] In contrast, the tax rate on cash bequests τ_c affects utility via the joy-of-giving motive.

Let us now turn to workers' children. Those who also become workers (U_W^W) are not directly affected by a preferential tax treatment of firms, but only via the—comparatively small—labor market effects. This group has the lowest utility in the second generation, as both parent and child have low ability draws. The workers' children with high ability draws become entrepreneurs (U_E^W). The effect of the favorable tax treatment on their utility is also small, it arises because the tax rate affects the license price.

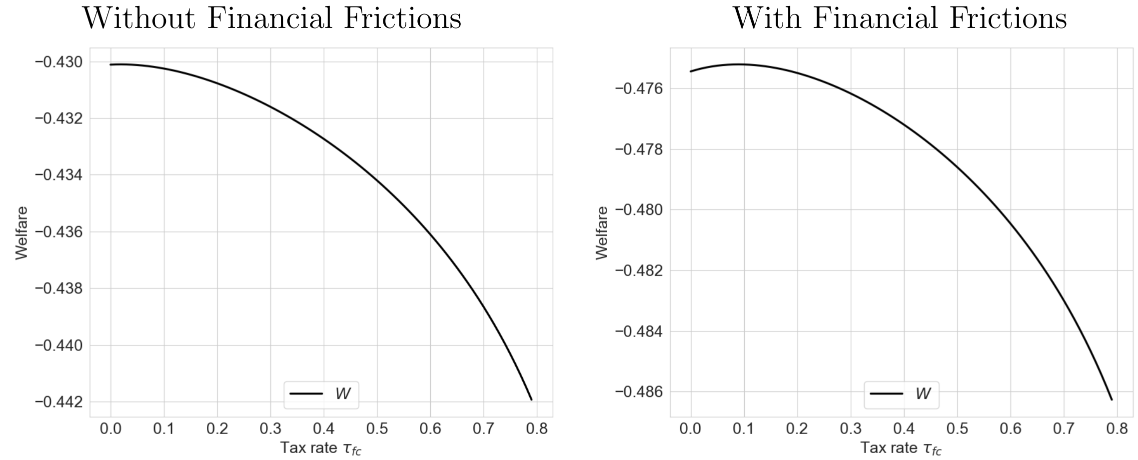
The advantageous (or disadvantageous) treatment of continued firms directly impacts those children of entrepreneurs who continue the firm. Their utility (U_E^E) is strongly decreasing in the tax rate τ_{fc}. In contrast, entrepreneurs' children that become workers (U_W^E) have a higher utility on average when there is a higher tax on continued firms. With high taxes on continued firms, even those inheriting relatively large firms now choose to sell the firm. The remaining entrepreneurs have very high ability, and thus higher utility.

Turning to the simulation with financial frictions (right panel), it becomes clear that the overall pattern remains very similar. Worker's children who become entrepreneurs face higher interest rates and thus have lower utility, and this difference increases with higher inheritance taxes. The simulation shows that this effect is small, however. In contrast, entrepreneurs' children who also become entrepreneurs have a higher utility (U_E^E) than in the absence of financial frictions. As seen in Section 5.1, as fewer workers' children purchase a firm, the average firm has a less-able owner, and thus total labor demand is lower. Wages fall, benefiting entrepreneurs. With financial frictions, entrepreneurs' children have a higher utility (even though also lower-ability heirs continue the firm).

Should the government differentiate tax rates between continued and sold firms? To explore this question further, we now simulate the total welfare in our model economy for different inheritance tax rates. We use the simplest form of a utilitarian social welfare function with equal weights, i.e. sum over all individuals' utilities. Figure 7 reports the results, again for the main model without financial frictions in the left panel and with financial frictions in the right panel. The tax rate on sold firms is again set to 0.4, so that the left part of the graph implies a favorable tax treatment of continued firms.

Generally, overall welfare is higher with a favorable tax treatment on continued firms. As we keep the other tax rates fixed, this reflects the well-known Pigouvian argument for taxing inheritances less (or even subsidizing them) as an inheritance increase the utility of both bequeather and heir. This effect is stronger than the distortions induced

Figure 7: Aggregate Welfare.



Note: This simulation uses 0.4 for the tax rate τ_{fs} and 5 for the license price P_1. Parameter values for the Pareto distribution are $\epsilon = 12$ and $\underline{\gamma} = 1$. Parameters in the profit function are set to $a = 0.4, b = 0.45$, $d = 0.1$. Parameters in the utility functions are $\theta = 0.4, \eta = 0.5, \varrho = 0.5$, and $p = 0.3$. In the left panel (without financial friction), $r = 0.02$, in the right panel (with financial frictions), $r_l = 0.02$ and $r_h = 0.03$.

by taxing sold and continued firms at different rates.

As we model financial frictions by introducing a second, higher, interest rate, overall welfare is lower in the right panel. The trade-off that a too-favorable treatment of continued firms induces less able heirs to become entrepreneurs also becomes clear in this graph: In the very left part of the graph, welfare decreases when τ_{fc} is lowered even further. As discussed in Section 5.1, financial frictions already imply that less-able heirs continue the firm. Thus, financial frictions exacerbate this "cost" of the preferential tax treatment.

Note that these results depend critically on the welfare function and on how the different groups are weighted.[23] In general, entrepreneurs benefit from a beneficial tax treatment on continued firms. The tax advantage for continued firms also lowers total financing costs. On the other hand, differentiating tax rates creates distortions in the labor market and the market for firms. Although the simulations show that these distortions are small on an individual level, they apply to the whole population and can thus entail substantial welfare losses. Redistributive arguments also tend to speak

[23]The welfare effects of inheritance taxes generally depend strongly on the welfare criterion. For example, Fleurbaey *et al.* (2022) show that accidental bequests should be taxed at 100% according to a utilitarian criterion, but subsidized according to the ex-post egalitarian criterion (to compensate the short-lived).

in favor of the less preferential (or even a disadvantageous) treatment of continued firms, as the richest individuals are the most likely to bear the tax.

6 Conclusion

Most OECD countries with an inheritance or estate tax treat continued family firms preferentially. This feature of tax legislation has significant redistributive and efficiency effects.

We show that favorable treatment of continued firms encourages entrepreneurship but also leads to less-suited heirs continuing firms at the cost of better-suited descendants of workers. The favorable tax treatment can be interpreted as an additional tax on firms sold by the heir. The heir, however, does not bear the entire tax burden but instead passes part of it onto the descendants of workers via a higher price for sold firms. In consequence, not only direct effects of taxation on individuals' utility levels exist, but changes in the outcomes of the labor market and the market for firms also add indirect effects.

Moreover, we show that financial frictions change the redistributive effects of inheritance taxation and add an efficiency aspect. Preferential treatment can increase efficiency as firms remain in the hands of those with lower financing costs. It would, however, decrease equality of opportunity, as it makes it more difficult to acquire a firm.

Whether encouraging heirs to continue inherited firms is desirable may also depend on differences between family firms and non-family firms that are beyond the scope of our model. Research documents that family firms cope differently with crises (Ding *et al.*, 2021; Lins *et al.*, 2013) and uncertain political environments (Amore and Minichilli, 2018) than non-family firms. Moreover, family firms offer higher job security to their employees, which comes at the cost of lower compensation (Ellul *et al.*, 2018; Bjuggren, 2015; Bassanini *et al.*, 2013). Preferential rates also offer tax avoidance opportunities (Escobar *et al.*, 2023).

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A Appendix

A.1 Proof of Lemma 1

Inserting $\sigma^{W,*} = \theta$ into the utility function U^W yields indirect utility

$$V^W = (1-\theta)\ln\left((1-\theta)w_1\right) + \theta\ln\left(\theta w_1(1-\tau_c)\right). \tag{A.1}$$

Inserting $\sigma^{E,*} = \theta$ and optimal production factor input $L^*(\gamma, w_1), K^*(\gamma, w_1)$ (see eq. 2a, 2b) into the utility function U^E yields indirect utility

$$\begin{aligned} V^E(\gamma) = p\, &\{(1-\theta)\ln\left[(1-\theta)\left(\pi^*(\gamma)-(1+r)P_1\right)\right] \\ &+ \theta\ln\left[\theta(1-\tau_c)\left(\pi^*(\gamma)-(1+r)P_1\right)\right] + \eta\ln\left[P_1(1-\tau_{fc})\right]\} \\ &+ (1-p)\left\{(1-\theta)\ln\left[(1-\theta)\left(\pi^*(\gamma)-(1+r)P_1\right)\right]\right. \\ &\left. + \theta\ln\left[\theta(1-\tau_c)\left(\pi^*(\gamma)-(1+r)P_1\right)\right] + \eta\varrho\ln\left[P_1(1-\tau_{fs})\right]\right\} \end{aligned} \tag{A.2}$$

with

$$\pi^*(\gamma) = \gamma^{\frac{1}{1-\alpha-\beta}} w_1^{-\frac{\alpha}{1-\alpha-\beta}} (r+\delta)^{-\frac{\beta}{1-\alpha-\beta}} \left(\alpha^{\frac{\alpha}{1-\alpha-\beta}}\beta^{\frac{\beta}{1-\alpha-\beta}} - \alpha^{\frac{1-\beta}{1-\alpha-\beta}}\beta^{\frac{\beta}{1-\alpha-\beta}} - \alpha^{\frac{\alpha}{1-\alpha-\beta}}\beta^{\frac{1-\alpha}{1-\alpha-\beta}}\right). \tag{A.3}$$

Comparative statics with respect to tax rates are

$$\frac{\partial V^W}{\partial \tau_c} = -\frac{\theta}{1-\tau_c} < 0, \quad \frac{\partial V^W}{\partial \tau_{fc}} = \frac{\partial V^W}{\partial \tau_{fs}} = 0 \tag{A.4}$$

and

$$\frac{\partial V^E}{\partial \tau_c} = -\frac{\theta}{1-\tau_c} < 0, \quad \frac{\partial V^E}{\partial \tau_{fc}} = -\frac{p\eta}{1-\tau_{fc}} < 0, \quad \frac{\partial V^E}{\partial \tau_{fs}} = -\frac{(1-p)\eta\varrho}{1-\tau_{fs}} < 0. \tag{A.5}$$

The effect of preference parameter θ on these first derivatives is

$$\frac{\partial^2 V^W}{\partial \tau_c \partial \theta} = \frac{\partial^2 V^E}{\partial \tau_c \partial \theta} = -\frac{1}{1-\tau_c} < 0, \tag{A.6}$$

the effects of preference parameters η and ϱ are

$$\frac{\partial^2 V^E}{\partial \tau_{fc}\partial \eta} = -\frac{p}{1-\tau_{fc}} < 0, \frac{\partial^2 V^E}{\partial \tau_{fs}\partial \eta} = -\frac{(1-p)\varrho}{1-\tau_{fs}} < 0, \frac{\partial^2 V^E}{\partial \tau_{fs}\partial \varrho} = -\frac{(1-p)\eta}{1-\tau_{fs}} < 0, \tag{A.7}$$

and the effects of probability p are

$$\frac{\partial^2 V^E}{\partial \tau_{fc} \partial p} = -\frac{\eta}{1-\tau_{fc}} < 0, \frac{\partial^2 V^E}{\partial \tau_{fs} \partial p} = \frac{\eta \varrho}{1-\tau_{fs}} > 0. \tag{A.8}$$

A.2 Proof of Proposition 1

Setting $V^E(\gamma, w_1) = V^W(w_1)$ and solving for γ yields

$$\gamma = \left(\frac{w_1 P_1^{-p\eta-(1-p)\varrho\eta}}{(1-\tau_{fc})^{p\eta}(1-\tau_{fs})^{(1-p)\varrho\eta}} + (1+r)P_1 \right)^{1-\alpha-\beta} \frac{w_1^{\alpha}(r+\delta)^{\beta}}{X(\alpha,\beta)^{1-\alpha-\beta}} \tag{A.9}$$

with

$$X(\alpha,\beta) = \alpha^{\frac{\alpha}{1-\alpha-\beta}} \beta^{\frac{\beta}{1-\alpha-\beta}} - \alpha^{\frac{1-\beta}{1-\alpha-\beta}} \beta^{\frac{\beta}{1-\alpha-\beta}} - \alpha^{\frac{\alpha}{1-\alpha-\beta}} \beta^{\frac{1-\alpha}{1-\alpha-\beta}}. \tag{A.10}$$

The labor market clears for

$$\lim_{\bar{\gamma}\to\infty} \int_{\gamma_1}^{\bar{\gamma}} L^*(\gamma, w_1) f(\gamma) d\gamma = \int_{\underline{\gamma}}^{\gamma_1} f(\gamma) d\gamma. \tag{A.11}$$

Solving (A.11) for the wage rate gives

$$w_1 = \alpha \left(\frac{\beta}{r+\delta} \right)^{\frac{\beta}{1-\beta}} \left(1 - \frac{1}{\epsilon(1-\alpha-\beta)} \right)^{-\frac{1-\alpha-\beta}{1-\beta}} \left(\underline{\gamma}^{-\epsilon} \gamma_1^{\epsilon - \frac{1}{1-\alpha-\beta}} - \gamma_1^{-\frac{1}{1-\alpha-\beta}} \right)^{-\frac{1-\alpha-\beta}{1-\beta}}. \tag{A.12}$$

Rewriting (A.9) and (A.12) we obtain the following system of equations:

$$\begin{aligned}
&F(\gamma_1, w_1; \tau_{fc}, \tau_{fs}) \\
&= \gamma_1 - \left(\frac{w_1 P_1^{-p\eta-(1-p)\mu\eta}}{(1-\tau_{fc})^{p\eta}(1-\tau_{fs})^{(1-p)\varrho\eta}} + (1+r)P_1 \right)^{1-\alpha-\beta} \frac{w_1^{\alpha}(r+\delta)^{\beta}}{X(\alpha,\beta)^{1-\alpha-\beta}} \\
&G(\gamma_1, w_1) \\
&= w_1 - \alpha \left(\frac{\beta}{r+\delta} \right)^{\frac{\beta}{1-\beta}} \left(1 - \frac{1}{\epsilon(1-\alpha-\beta)} \right)^{-\frac{1-\alpha-\beta}{1-\beta}} \left(\underline{\gamma}^{-\epsilon} \gamma_1^{\epsilon - \frac{1}{1-\alpha-\beta}} - \gamma_1^{-\frac{1}{1-\alpha-\beta}} \right)^{-\frac{1-\alpha-\beta}{1-\beta}}
\end{aligned}$$

We use the matrix notation

$$M = \begin{bmatrix} F_{\gamma_1} & F_{w_1} \\ G_{\gamma_1} & G_{w_1} \end{bmatrix}, \quad M_{\gamma_1,\tau_{fc}} = \begin{bmatrix} F_{\tau_{fc}} & F_{w_1} \\ G_{\tau_{fc}} & G_{w_1} \end{bmatrix}, \quad M_{\gamma_1,\tau_{fs}} = \begin{bmatrix} F_{\tau_{fs}} & F_{w_1} \\ G_{\tau_{fs}} & G_{w_1} \end{bmatrix},$$

$$M_{w_1,\tau_{fc}} = \begin{bmatrix} F_{\gamma_1} & F_{\tau_{fc}} \\ G_{\gamma_1} & G_{\tau_{fc}} \end{bmatrix}, \quad M_{w_1,\tau_{fs}} = \begin{bmatrix} F_{\gamma_1} & F_{\tau_{fs}} \\ G_{\gamma_1} & G_{\tau_{fs}} \end{bmatrix}.$$

For the effect of a change in the tax rates on the first generation ability cutoff, Cramer's rule yields

$$\frac{d\gamma_1^*}{d\tau_{fc}} = -\frac{\left|M_{\gamma_1,\tau_{fc}}\right|}{\left|M\right|} > 0 \quad \text{and} \quad \frac{d\gamma_1^*}{d\tau_{fc}} = -\frac{\left|M_{w_1,\tau_{fs}}\right|}{\left|M\right|} > 0,$$

given the parameter assumptions we make throughout Chapter 2. Similarly, the effects of a change in the tax rates on the first generation wage are

$$\frac{dw_1^*}{d\tau_{fc}} = -\frac{\left|M_{w_1,\tau_{fc}}\right|}{\left|M\right|} < 0 \quad \text{and} \quad \frac{dw_1^*}{d\tau_{fs}} = -\frac{\left|M_{w_1,\tau_{fs}}\right|}{\left|M\right|} < 0.$$

A.3 Proof of Proposition 2

First, we show that $\gamma_1^* = \gamma_{2W}^* = \gamma_{2E}^*$ holds for $\tau_{fc} = \tau_{fs}$. Solving $U_W^W(\gamma_{2W}, w_2) = V_E^W(\gamma_{2W}, W_2)$ for P_2 yields

$$P_2 = \frac{\pi^*(\gamma_{2W}, w_2) - w_2}{1+r}. \tag{A.13}$$

Solving $U_W^E(\gamma_{2E}, w_2) = V_E^E(\gamma_{2E}, P)$ for P yields

$$P_2 = \frac{\pi^*(\gamma_{2E}, w_2) - w_2}{(1+\tau_{fc} - \tau_{fs})(1+r)}. \tag{A.14}$$

From combining equations (A.13) and (A.14), it follows for $\tau_{fc} = \tau_{fs}$ that

$$\gamma_{2W}^* = \gamma_{2E}^*. \tag{A.15}$$

Using the condition for clearance on the market for firm licenses, i.e.

$$\left(\frac{\underline{\gamma}}{\gamma_1^*}\right)^{\epsilon} \int_{\underline{\gamma}}^{\gamma_{2E}^*} f(\gamma)d\gamma = \left(1 - \left(\frac{\underline{\gamma}}{\gamma_1^*}\right)^{\epsilon}\right) \int_{\gamma_{2W}^*}^{\bar{\gamma}} f(\gamma)d\gamma, \tag{A.16}$$

we can express the ability threshold in the first generation as

$$\gamma_1^* = \left(\frac{1 - \left(\frac{\underline{\gamma}}{\gamma_{2E}^*}\right)^\epsilon}{\left(\frac{\underline{\gamma}}{\gamma_{2W}^*}\right)^\epsilon} + 1 \right)^{\frac{1}{\epsilon}} \underline{\gamma}. \tag{A.17}$$

From (A.15) and (A.17) follows

$$\gamma_1^* = \gamma_{2W}^* = \gamma_{2E}^*. \tag{A.18}$$

We denote this uniform ability threshold by γ^*.

The labor market in the second generation clears for

$$\begin{aligned} &\left(\frac{\underline{\gamma}}{\gamma_1^*}\right)^\epsilon \lim_{\bar{\gamma}\to\infty} \int_{\gamma_{2E}^*}^{\bar{\gamma}} L(\gamma, w_2) f(\gamma) d\gamma + \left(1 - \left(\frac{\underline{\gamma}}{\gamma_1^*}\right)^\epsilon\right) \lim_{\bar{\gamma}\to\infty} \int_{\gamma_{2W}^*}^{\bar{\gamma}} L(\gamma, w_2) f(\gamma) d\gamma \\ &= \left(\frac{\underline{\gamma}}{\gamma_1^*}\right)^\epsilon \int_{\underline{\gamma}}^{\gamma_{2E}^*} f(\gamma) d\gamma + \left(1 - \left(\frac{\underline{\gamma}}{\gamma_1^*}\right)^\epsilon\right) \int_{\underline{\gamma}}^{\gamma_{2W}^*} f(\gamma) d\gamma. \end{aligned} \tag{A.19}$$

Integrating and simplifying yields

$$\begin{aligned} &1 - \left(\frac{\underline{\gamma}}{\gamma_1^*}\right)^\epsilon \left[\left(\frac{\underline{\gamma}}{\gamma_{2E}^*}\right)^\epsilon - \left(\frac{\underline{\gamma}}{\gamma_{2W}^*}\right)^\epsilon\right] - \left(\frac{\underline{\gamma}}{\gamma_{2W}^*}\right)^\epsilon \\ &= \left(\frac{\alpha}{w_2}\right)^{\frac{1-\beta}{1-\alpha-\beta}} \left(\frac{\beta}{r+\delta}\right)^{\frac{\beta}{1-\alpha-\beta}} \frac{\epsilon \underline{\gamma}^\epsilon}{\epsilon - \frac{1}{1-\alpha-\beta}} \\ &\left[\left(\frac{\underline{\gamma}}{\gamma_1^*}\right)^\epsilon (\gamma_{2E}^*)^{\frac{1}{1-\alpha-\beta}-\epsilon} + \left(1 - \left(\frac{\underline{\gamma}}{\gamma_1^*}\right)^\epsilon\right) (\gamma_{2W}^*)^{\frac{1}{1-\alpha-\beta}-\epsilon}\right]. \end{aligned} \tag{A.20}$$

Inserting (A.18) into (A.20) and rearranging gives $w_2^* = w_1^*$.

Maximized profit for entrepreneurs being indifferent between both occupations is

$$\pi^*(\gamma^*, w_2^*) = (\gamma^*)^{\frac{1}{1-\alpha-\beta}} (w_2^*)^{-\frac{\alpha}{1-\alpha-\beta}} (r+\delta)^{-\frac{\beta}{1-\alpha-\beta}} X(\alpha, \beta). \tag{A.21}$$

Using $\gamma_1^* = \gamma^*$ and $w_1^* = w_2^*$ in (A.9) gives

$$\gamma^* = \left(\frac{w_2^* P_1^{-p\eta-(1-p)\varrho\eta}}{(1-\tau_{fc})^{p\eta}(1-\tau_{fs})^{(1-p)\varrho\eta}} + (1+r) P_1 \right)^{1-\alpha-\beta} \frac{(w_2^*)^\alpha (r+\delta)^\beta}{X(\alpha,\beta)^{1-\alpha-\beta}}. \tag{A.22}$$

Setting $\eta = 0$ and $\tau_{fc} = \tau_{fs}$, inserting (A.22) into (A.21) and rearranging yields $P_1 = P_2^*$ through (A.13) or (A.14).

For the case of $\eta > 0$, we can look at the total derivative of equation (A.13), which is

$$dP_2^* = \frac{\partial P_2^*}{\partial \gamma_1^*} d\gamma_1^* + \frac{\partial P_2^*}{\partial w_1^*} dw_1^* \tag{A.23}$$

using $\gamma_{2W}^* = \gamma_1^*$ and $w_2^* = w_1^*$. Dividing (A.23) by $d\eta$ and inserting derivatives yields

$$\frac{dP_2^*}{d\eta} = (1+r)^{-1} \left[\frac{\partial \pi^*}{\partial \gamma_1^*} \frac{d\gamma_1^*}{d\eta} + \left(\frac{\partial \pi^*}{\partial w_1^*} + 1 \right) \frac{dw_1^*}{d\eta} \right]. \tag{A.24}$$

Using Cramer's rule equivalent to Appendix (A.2), we find that

$$\frac{d\gamma_1^*}{d\eta} < 0 \quad \text{and} \quad \frac{dw_1^*}{d\eta} > 0. \tag{A.25}$$

Together with the derivatives of the profit function, $\frac{\partial \pi^*}{\partial \gamma_1^*} > 0$ and $\frac{\partial \pi^*}{\partial w_1^*} > 0$, this proves that $\frac{\partial P_2^*}{\partial \eta} < 0$. From $P_1 = P_2^*$ for $\eta = 0$ it follows that $P_1 > P_2^*$ for $\eta > 0$.

■

A.4 Proof of Proposition 3

Cross partial derivatives with respect to tax rates and interest rate are negative:

$$\frac{\partial U_W^W}{\partial \tau_c \partial r_l} = -\frac{(w_2 + T)\, B^W}{\left(w_2 + (1-\tau_c)\,(1+r_l)\, B^W + T\right)^2} < 0 \tag{A.26a}$$

$$\frac{\partial U_E^W}{\partial \tau_c \partial r_h} = -\frac{(\pi(\gamma, w_2) + T)\, B^W - (1+r_h)\,\frac{\partial \pi(\gamma, w_2)}{\partial r_h} B^W}{\left(\pi(\gamma, w_2) + (1-\tau_c)\,(1+r_h)\, B^W - (1+r_h)P_2 + T\right)^2} < 0 \tag{A.26b}$$

$$\frac{\partial U_E^E}{\partial \tau_c \partial r_l} = -\frac{(\pi(\gamma, w_2) + T)\, B^E - (1+r_l)\,\frac{\partial \pi(\gamma, w_2)}{\partial r_l} B^E}{\left(\pi(\gamma, w_2) + (1-\tau_c)\,(1+r_l)\, B^E - \tau_{fc}(1+r_l)P_2 + T\right)^2} < 0 \tag{A.26c}$$

$$\frac{\partial U_W^E}{\partial \tau_c \partial r_l} = -\frac{(w_2 + T)\, B^E}{\left(w_2 + (1-\tau_c)\,(1+r_l)\, B^E + (1-\tau_{fs})\,(1+r_l)P_2 + T\right)^2} < 0 \tag{A.26d}$$

$$\frac{\partial U_E^E}{\partial \tau_{fc} \partial r_l} = -\frac{(\pi(\gamma, w_2) + T)\, P_2 - (1+r_l)\,\frac{\partial \pi(\gamma, w_2)}{\partial r_l} P_2}{\left(\pi(\gamma, w_2) + (1-\tau_c)\,(1+r_l)\, B^E - \tau_{fc}(1+r_l)P_2 + T\right)^2} < 0 \tag{A.26e}$$

$$\frac{\partial U_W^E}{\partial \tau_{fs} \partial r_l} = -\frac{(w_2 + T)\, P_2}{\left(w_2 + (1-\tau_c)\,(1+r_l)\, B^E + (1-\tau_{fs})\,(1+r_l)P_2 + T\right)^2} < 0 \tag{A.26f}$$

■