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CONCENTRATION, MARKET POWER AND INTERNATIONAL TAX COMPETITION

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Concentration, Market Power and International Tax Competition

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Abstract

Over the past few decades, there has been a notable increase in firms' market power accompanied by a global decrease in Corporate Income Tax (CIT) rates. This paper provides a theoretical framework to shed light on these diverging trends. I develop a general equilibrium model that incorporates imperfect competition and strategic interaction among firms, allowing them to shift profits abroad towards a tax haven. I find that increasing firms' market power enhances their incentives to engage in profit shifting, via larger profits. Profits rise through (i) larger markdowns and (ii) reallocation of market share towards more productive firms. A government, competing to retain firms' profits, set low tax rates to prevent local firms from evading toward tax haven(s). The competition is stronger, i.e. lower tax rates, when firms' market power is higher. Besides, I find that profit shifting widens the disparities among ex-ante heterogeneous firms and endogenously increases the level of market power in the economy, favouring the most productive firms.

Keywords: Tax Competition, Profit Shifting,Market Power, Common Ownership..
Jel Classification: D43, E61, F23, H25, H73, L13.

1 Introduction*

Since the 80s, there has been an increase in firms' market power and a decrease Corporate Income Tax (CIT henceforth) rates. This trend has raised concerns among policymakers, researchers, and the public, as it has significant implications for economic dynamics, income distribution, and government revenues. Figure 1 shows the decline of CIT for both tax-haven and non-haven countries.[1] Noticeably, while tax havens have had lower tax rates throughout the entire period, the gap with non-havens has shrunk. Concurrently, empirical studies such as De Loecker et al. (2020) documented a substantial surge in firms' market power.[2] These studies reveal that markups have risen from 21% to 61% between 1980 and 2016, not solely due to increased overhead costs. The distribution of markups has also shifted, indicating a reallocation of economic activity from low-productivity, low-markup, and high-labor share firms towards high-productivity, high-markup, and low-labor share ones. Additionally, they find that the average revenue-weighted profit rate has gone up by 7 percent between 1980 and 2016, driven by the upper tail of the profits distribution. This evidence is consistent with the idea that the increase in markups and average profits rates is driven partly by the reallocation of economic activity toward high-profit and high-markup firms.

Understanding the drivers behind the rise in market power and the decline in CIT rates is crucial for policymakers and researchers alike. This paper develop a theory of international tax competition that sheds light on the potential relationship among those observed patterns, the declining CIT rates and the rise in market power. Specifically, I argue that by causing higher profits, the rise of market power has strengthened the incentives for multinational corporations (MNCs) to shift profits abroad toward countries running more convenient tax regimes. In turn, MNCs' higher propensity to profit shifting has increased the extent of international tax competition, causing a race to the bottom, which explains the observed downward trend in CIT. Noticeably, according to this theory, increasing profit shifting and international tax competition induced by an increase in firms' market power is self-reinforcing. As I show, more productive firms benefit from profit shifting more than less productive ones, which causes a reallocation of market share that increases their market power even further.[3]

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[1]The sample includes 225 sovereign states and dependent territories worldwide. I classified a jurisdiction as Haven or Non-Haven according to the combination of lists by Hines Jr and Rice (1994) and OECD (2000). The pattern is also coherent with alternative classifications; see Appendix A.

[2]Market power is a significant phenomenon in many vital industries. For example, Berry et al. (1995) document market power in the U.S. automobile industry, Nevo (2001) in the U.S. cereal industry, Koujianou Goldberg and Hellerstein (2013) in the beer market, Wolak (2003) in the electricity market and Evans and Kessides (1993) in the U.S. airline industry.

[3]This self-reinforcing effect is present only in an internal equilibrium or, in other words, when some of the firms locate profits in the large country and some others in the tax haven, i.e. $(0 < J_l < J)$.

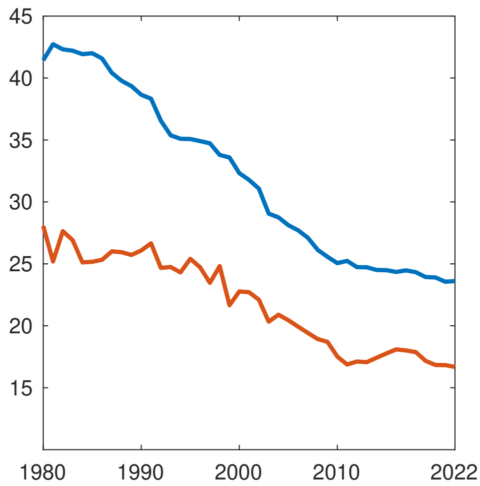

Figure 1: Average CIT rates of havens and non-havens from 1980 to 2022, in percentage. Blue solid line: average CIT rates of Non-Havens countries. Orange solid line: average CIT of Havens countries combining the classification of Hines Jr and Rice (1994) and OECD (2000).

Profit shifting, which plays a central role in the analysis, pertains to the practice of cross-border tax avoidance undertaken by MNCs. Tax avoidance has garnered increasing attention from policymakers, particularly with the recent agreements among OECD countries on the "Statement on a Two-Pillar Solution to Address the Tax Challenges Arising from the Digitalisation of the Economy".[4] A vast literature has attempted to quantify the importance of profit shifting. However, as pointed out by Dharmapala (2019), there has yet to be a consensus on its magnitude. Microeconomic and macroeconomic approaches lead to different estimates. Those based on micro approaches suggest that MNCs shift about 20 per cent of their foreign profits to tax havens. Whereas, aggregate data indicate a much higher percentage, around 40 per cent.[5] More recently, Tørsløv et al. (2022) together with the extension of the time series in Wier and Zucman (2022), find a remarkable increase in global profit shifting from 1975 to 2019 and a constant 37 per cent of multinational profits booked in tax havens. In any case, such evidence suggests that profit shifting is a quantitatively relevant phenomenon. Accordingly, it seems reasonable to think it is one of the determinants of tax competition among countries to attract taxable capital. Moreover, substantial evidence exists documenting a relationship between firms' size and profit shifting. Bernard et al. (2006) study transfer pricing which is a practice that allows MNCs to minimize their tax costs.[6] They find that firms with more market power have more significant price differences and

[4]Dharmapala (2014) recalls the most important official events witnessing the rising political interest in profit shifting. The most updated information on agreements among the OECD members is regularly posted on https://www.oecd.org.

[5]See Dharmapala (2014) for an extensive review of estimation with microeconomic approach; Tørsløv et al. (2018), Cobham and Janský (2018) and Crivelli et al. (2016) for aggregate estimates.

[6]See for example Hirshleifer (1956).

thus shift more profits abroad.[7] Desai et al. (2006) shows that bigger and more internationalized firms are most likely to use tax havens for tax avoidance practices. More recently, using the revocation of the "US Possessions Corporations Tax Credit" (§936) Garrett and Suárez Serrato (2019) confirm that firms making use of tax havens are large, profitable and research intensive. Finally, Wier and Erasmus (2023) emphasize that firms' size is a crucial aspect in evaluating the extent of profit shifting globally and that it may explain the divergence between micro and macro estimates. The theoretical results of this paper are in line with the firms' characteristics associated to profit shifting, outlined by the empirical literature reported.

I develop a general equilibrium model of international tax competition with oligopolistic private good-producing firms à la Azar and Vives (2021). Firms are large relative to the economy and their market power depends upon their ownership structure. There is heterogeneity in terms of productivity and competition a la Cournot, with market power in labor, which is the only production input. Such a one-sector economy with heterogeneous firms nicely reproduces the recently documented reallocation of market share from low-productivity, low-markup, and high-labor share firms towards high-productivity, high-markup, and low-labor share firms.[8]. The firm's owners and workers consume both private and public goods, with the latter produced by the government. The government finances the production of the public good with taxes levied on firms. Firms can shift profits abroad to a tax haven by incurring a fixed cost. As in Krautheim and Schmidt-Eisenlohr (2011), two governments engage in tax competition: the government of the country where firms are initially located and that of the tax haven. By explicitly modeling the strategic interaction between firms and governments, this approach enables me to unveil the effects of an exogenous increase in market power on profit shifting and tax competition. Moreover, the model also shows that profit shifting induces a further endogenous increase in firms' market power, which strengthens the effect on international tax competition spurred by an initial rise of market power.

I characterize the subgame perfect general equilibrium of the model and show how an exogenous increase in market power due to more concentrated common ownership leads to a rise in the profit-shifting practice. The reason is that higher market power results in higher profits, giving firms a stronger incentive to move them abroad. The increase in market power leads to increased profits through two effects. First, it raises firms' markdown on wages and therefore increases the wedge between the marginal product of labor and the wage paid to workers. Second, it triggers a reallocation of market share towards more productive firms, which endogenously raises their profits. The increased incentives to shift profits, caused by higher market power, cause governments to compete more strongly on tax rates. The government of the large country, the residence country of firms' owners and workers, lowers its tax rate on profits to retain the tax base and avoiding firms to undertake profit shifting practices. I also show that profit shifting exacerbates the disparities among already heterogeneous firms. The firms that shift profits abroad and access lower taxation are the most productive ones. By shifting profits away to the tax haven, these companies

[7] In their study, firm's market power is proxied by the firm size, which is measured alternatively by the total employment, firm's share of U.S. exports, and the number of U.S.-based firms exporting the product to a particular country.

[8] See De Loecker et al. (2020) and Autor et al. (2020) for the most recent literature.

strengthen their competitive advantage over the least productive due to lower costs. Because of that, they gain further market share and exert more market power, resulting in lower labor demand and through a general equilibrium effects in lower levels of employment, production, and wages. According to this channel, profit shifting causes an endogenous increase in market power for any given ownership structure in this model.

While the macroeconomic consequences of firms' market power are growingly capturing attention in the literature, general equilibrium theories of international tax competition still rely on models of perfectly or monopolistically competitive firms.[9] Krautheim and Schmidt-Eisenlohr (2011) developed a general equilibrium analysis of international tax competition between a so-called large country and a tax haven. In their model, firms operate under monopolistic competition and their market power is proportional to consumers' preferences, through the "taste for variety" parameter or, in other words, to the elasticity of substitution across product varieties. As a conclusion, when market power is high and heterogeneity across firms' productivity is low, tax competition is relatively low. Instead, when market power is low and heterogeneity across firms' productivity is high, tax competition is the strongest. These results arise from the underlying monopolistic framework, where few firms account for a large share of profits only when market power is low (i.e. high elasticity of substitution across varieties) and heterogeneity is high. In that case, the firms that account for a large share of profits are the most productive and thus also the first to engage in profit shifting. Tax competition is the strongest because, for small tax differentials, the tax base outflow from the large country is large. Whereas, the growing literature on general equilibrium, imperfect competition and strategic interaction across firms shows that, in general, the opposite is true.[10] Within that literature, few firms hold a large share of profits when market power is high. Starting from there, this paper shows that tax competition is the strongest when firms' market power is high because few of them account for a large share of profits. Conversely, tax competition is relatively low when firms' market power is low because the distribution of profits is rather homogeneous across firms.

More broadly, the analysis builds on theoretical works of international tax competition and coordination started with Zodrow and Mieszkowski (1986) and Wilson (1986).[11] Several contributions have analyzed the phenomenon under different aspects. Still, to the best of my knowledge, this is the first time anyone has focused on the impact of market power on international tax competition in a general equilibrium framework. That allows us to study the effects on equilibrium wages, output, and welfare. The empirical evidence qualitatively agrees on the existence and relevance of tax-avoidance practices. However, it is dispersed in its estimates as summarised by Dharmapala (2019).

I borrow heavily from the growing literature on market power. For example, Yeh et al. (2022),

[9] Some partial equilibrium models accounted for imperfect competition and strategic interaction across firms in the analysis of international tax competition. See, for instance, Janeba (1998) and Ferrett and Wooton (2010). Wrede (1994) studies the relationship between firms' and governments' competition in a partial equilibrium model with two firms and two countries.

[10] See De Loecker et al. (2021) and Azar and Vives (2021).

[11] See Keen and Konrad (2013) for an instructive and comprehensive review.

Díez et al. (2021), De Loecker et al. (2020), Hall (2018), and Gutierrez Gallardo and Philippon (2018) document the rise in firms' market power, both in the labor and product markets. Many theoretical contributions have introduced endogenous markups and markdowns in general equilibrium models. A non-exhaustive list includes De Loecker et al. (2021), Azar and Vives (2021), Edmond et al. (2015), and Melitz and Ottaviano (2008). I contribute to this literature by introducing tax competition into a general equilibrium model of oligopolistic firms to study the interplay between market power and tax competition.

The structure of the paper is as follows. Section 2 describes the model setup. Section 3 introduces the possibility firms have to shift profits to a tax haven and outlines firms' and governments' optimal decisions, discussing the equilibrium concept and properties. Section 4 explores the numerical analysis of the model, and Section 5 discusses the results.

2 Model setup

I introduce a government that taxes firms' profits and uses revenues to finance the provision of a public good, in an economy a la Azar and Vives (2021) populated by a finite number J of firms producing a homogeneous private good and a continuum of individuals.[12] Firms are large relative to the economy, while individuals are atomistic. There are two types of individuals. I denote with I_W the mass of workers and I_O the mass of owners. Both workers and owners derive utility from the consumption of the private good produced by firms and the public good provided by the government. Workers earn income by offering labor to firms in exchange for wages while owners do not work and earn their income from the ownership of firms. There are three goods: a private good produced by firms and sold at a price p, leisure with price w, and a public good provided by the government.

2.1 Workers

Workers have identical separable linear preferences over the consumption of private and public goods, and isoelastic over labor as described by the following utility function,

$$U^W(C_i, L_i, G_i) = C_i - \frac{L_i^{1+1/\eta}}{1+1/\eta} + \beta G_i, \tag{1}$$

where the elasticity of labor supply is $\eta > 0$, and $\beta > 0$ is the marginal utility derived from the public good. The consumption of the private good is denoted by C_i while $L_i \in [0, T]$ denotes the level of individual labor supply, and G_i is the individual consumption of the public good. The public good is distributed to workers and consumers that take is supply as given. Workers have a time endowment of T hours and have no other endowments. Given firms' production plans, workers decide how much to work to maximize their utility $U^W(C_i, L_i, G_i)$ subject to

[12] For simplicity, I abstract from labor income taxation because the focus is on the relationship between profit shifting and international corporate tax.

the budget constraint $C_i \leq \omega L_i$, where $\omega \equiv w/p$ is the real wage.
The solution to the workers' problem leads to the following aggregate labor supply:

$$\omega(L) = L^{1/\eta}. \tag{2}$$

Given firms' production plans and the aggregate labor supply function, labor market clearing determines the real equilibrium wage. Given the total level of employment L associated with the real wage ω, the optimal level of workers' consumption of the private good C^W is determined. Note that the public good G does not enter the labor supply decision of workers. The public good is decided and distributed by the government thus, it does not affect workers' decisions. Finally, since the consumption of the public good is frictionless, workers consume the entire amount the government distributes to them. As a result, workers' consumption of the public good, G^W, is always equal to the share of the aggregate supply of the public good assigned to workers.

2.2 Owners

Owners have linear preferences over the consumption of private and public goods described by the following utility function

$$U^O(C_i, G_i) = C_i + \beta G_i. \tag{3}$$

They do not work and earn their income from the ownership of firms.[13] As in Azar and Vives (2021), owners are divided uniformly into J groups: owners in group j own a fraction $1-\phi+\phi/J$ of firm j and ϕ/J of the other firms, where $\phi \in [0, 1]$ is a parameter that measures the level of portfolio diversification in the economy. I define the financial wealth of a representative owner i in group j as

$$W_i = \frac{1-\phi+\phi/J}{1/J}(1-\tau)\Pi_j + \sum_{k\neq j} \phi(1-\tau)\Pi_k, \tag{4}$$

where $\Pi_j = pF(L_j) - wL_j$ are the firm j's nominal profits and τ is the tax rate on firm's profit. Following Azar and Vives (2021), I assume the manager maximizes a weighted average of the indirect utilities of firm j's owners. I denote the indirect utility of the representative owner as $V^O(p, w; W_i) = W_i/p + \beta G_i$ and the real profits of firm j as $\pi_j = F(L_j) - \omega L_j$. Regarding, the consumption of the public good, G_i, the logic developed for workers applies here. The public good is distributed by the government, hence owners always consume all the public good distributed to them. Furthermore, as workers, owners consider the supply of public goods as exogenous. Therefore, since G_i is taken as given, it does not affect the manager's objective function

[13] Owners hold all the firms' shares.

$$
\begin{aligned}
&(1-\phi+\frac{\phi}{J})\left[(1-\phi+\frac{\phi}{J})(1-\tau)\pi_j+\frac{\phi}{J}\sum_{k\neq j}(1-\tau)\pi_k\right] \\
&+\sum_{k\neq j}\frac{\phi}{J}\left[(1-\phi+\frac{\phi}{J})(1-\tau)\pi_k+\frac{\phi}{J}\sum_{s\neq k}(1-\tau)\pi_s\right].
\end{aligned} \tag{5}
$$

After some algebra, the objective function can be rewritten as[14]

$$
(1-\tau)\pi_j+\underbrace{\frac{(2-\phi)\phi}{(1-\phi)^2J+(2-\phi)\phi}}_{\lambda}\sum_{k\neq j}(1-\tau)\pi_k, \tag{6}
$$

where 'λ' weights all the other firms' profits into the objective function of the manager of firm j, due to common ownership. Note that when the portfolio of groups is fully diversified, i.e., $\phi \to 1$, also the weight approaches to one, i.e. $\lambda \to 1$, implying only the most productive firm produce in equilibrium.[15] On the other hand, when there is no diversification at all, i.e., $\phi = 0$, also the weight is equal to zero, i.e. $\lambda = 0$, and each group owns only one firm. In this latter case, there is no common ownership and thus strategic interaction, since managers do not care about other firms' profits. A manager's objective function depends only on real wages, so I can rewrite it as

$$
(1-\tau)[A_jL_j-\omega(L)L_j]+\lambda\sum_{k\neq j}(1-\tau)[A_kL_k-\omega(L)L_k], \tag{7}
$$

where A_j indicates firm j's productivity and L_j is the amount of labor demanded by firm j. The strategic interaction across firms materializes through the effect that the individual labor demand has on the labor market. Since firms are large relative to the economy, their labor demand affects the equilibrium in the labor market and, thus, the real wage paid by all firms. An increase of labor demand by firm j, i.e. L_j, triggers an increase in the real wage ω that will affect firm j's profits, i.e. π_j, but also all other firms' profits, i.e. π_k for $k \neq j$. It is clear from Equation (7) that if all firms are subject to a unique τ, the tax rate does not affect their decision and cancels out in the objective function. In section 3, I introduce the possibility that firms have to shift profits to a tax haven. In that case, firms may face two possibly different tax rates: the tax rate imposed by the government of the country where firms' owners reside, denoted by τ_l, and the tax rate set by the tax haven, denoted by τ_x.

[14] See Appendix B for the derivation of the objective function.

[15] When firms have heterogeneous productivities and CRS technologies, the equilibrium exists when $\lambda < 1$.

2.3 The government

The government collects revenues by taxing firms' profits using a proportional tax rate as the only instrument. Tax revenues finance the public good production, denoted by G, with one-to-one production technology. The government chooses how much of the public good to produce, which implies choosing the tax rate, τ, and how to distribute it to owners, G^O, and workers, G^W, respectively, in order to maximize a weighted sum of a representative owner's and worker's utilities, with weights $\kappa \in [0,1]$ and $1-\kappa$, respectively. Formally, the government solves the following problem

$$\max_{\tau} W(U^W, U^O) = (1-\kappa)\overbrace{\left[C^W - \frac{L^{1+1/\eta}}{1+1/\eta} + \beta G^W\right]}^{U^W} + \kappa \overbrace{\left[C^O + \beta G^O\right]}^{U^O} \quad (8)$$

$$s.to$$

$$G^O + G^W = \tau \Psi \quad (9)$$

where $\Psi \equiv \sum_{j=1}^{J} \pi_j$ is the tax base. Following Krautheim and Schmidt-Eisenlohr (2011), I assume $\beta > 1$ such that that individuals strictly prefer the consumption of the public good over the consumption of the private good.[16] In that case, the welfare-maximizing tax rate in the absence of international tax competition would be $\tau = 1$. Given that all individuals derive more utility from consuming the public good compared to the private good, it would be welfare maximizing to tax away all firms' profits in order to finance the public good production.

In the next section, I will see how the possibility of firms shifting their profits away to a tax haven changes the equilibrium tax rate charged by the government of the country where workers and firms' owners reside, and where all firms are initially located.

3 Profit shifting and international tax competition

Following the approach adopted in Krautheim and Schmidt-Eisenlohr (2011), I introduce the possibility for firms, initially all established in the so-called "large country", to open an affiliate in a foreign country, which I refer to as "tax haven". Opening the affiliate there allows firms to shift profits and pay the tax rate imposed by the tax haven. A tax haven is tiny compared to the country where firms' owners reside. More precisely, I assume that the tax haven is populated by a mass of people close to zero, implying a negligible demand/supply of goods and, thus, a negligible tax base. Therefore, the only source of revenue for the government comes from taxing firms that establish an affiliate there. I assume that the objective of the government of the tax haven is to maximize tax revenues, i.e. the sum of firms' profits located in the tax haven multiplied by the tax rate or $R_x = \tau_x \Psi_x$. I denote the large country with l and the tax haven by x.

[16] It is the simplest way to preserve the incentive for the government to provide the public good, ruling out any trade-off between the public and the private goods.

If firms open an affiliate in the tax haven, they declare zero profits at home (i.e. the large country). Firms can open the affiliate by paying a fixed cost denoted by γ and measured in real resources.[17] The fixed cost represents the investment needed to establish the affiliate in the tax haven and implement the profit-shifting strategy, such as employing tax experts and collecting costly information on tax laws.[18] When $\gamma > 0$, it is straightforward that profit shifting occurs only if the tax differential $\delta = \tau_l - \tau_x > 0$. Moreover, firms with higher productivity and profits are more inclined to pay the fixed cost and shift profits, as they can save more due to the (possibly) lower taxation.

Lemma 1 *When firms can shift profits from a large country toward a tax haven by paying a fixed cost to open an affiliate, the tax haven consistently undercuts the large country such that* $\delta \equiv \tau_l - \tau_x > 0$.

The managers of firms and the two countries' governments play a game structured as follows. In stage one, governments simultaneously choose their tax rate. In stage two, firms' management chooses the production plans and the location of profits. I solve for the equilibrium by backward induction. First, I solve the second stage of the game of imperfect competition across firms, with shareholder representation characterized by firms' production plans and profit location decisions. In that game, the manager of each firm j decides the quantity of labor to demand, L_j, and the location of their profit, a_j. Second, I solve the first stage where governments simultaneously choose the tax rates to impose on firms' profits and, in the case of the government of the large country, also the allocation of the public good among households.

3.1 Firms' subgame - Stage two

The manager of each firm j chooses the optimal production plan given profits location. Then, the manager determines the optimal location choice, a_j, by comparing the values of the optimized profits across locations.

3.1.1 Firm's optimal production plan with profits in the large country

The maximization problem faced by firm j's manager, conditional on the firm paying taxes in the large country, is the following

[17] The fixed costs are in real terms, and they are not tax-deductible, meaning that firms pay taxes on them.

[18] It is reasonable to assume the fixed cost is a deadweight loss for firms and the economy as a whole, in order to avoid any redistributive issue that may affect the welfare analysis. Furthermore, the subsidiary does not add value to the firms' activities and, if any, produces welfare effects on the destination country that I assumed to have a negligible endowment of agents.

$$\max_{L_{jl}} \quad (1-\tau_l)[A_j L_{jl} - \omega(L)L_{jl}] \tag{10a}$$

$$+\lambda \sum_{k\neq j}(1-\tau_l)[A_k L_{kl} - \omega(L)L_{kl}] \tag{10b}$$

$$+\lambda \sum_{k\neq j}[(1-\tau_x)(A_k L_{kx} - \omega(L)L_{kx}) - \gamma], \tag{10c}$$

where A_j is the productivity of firm j; L_{jl} is the labor demanded by firm j while locating profits in the country l; ω is the real wage that depends on the total employment in equilibrium; τ_l and τ_x are the tax rate imposed in the large country and tax haven, respectively; λ is the level of common ownership in the economy, and γ is the fixed cost to open the affiliate in the tax haven.[19] Productivities are not affected by the decision to shift profits abroad since firms always produce and sell their goods in the large country.

In equation (10), line (10a) represents the after-tax profits of firm j subject to the tax rate τ_l; line (10b) is the sum of after-tax profits of all other firms paying taxes in the large country and subject to the tax rate τ_l; line (10c) is the sum of after-tax profits of all other firms paying taxes in the tax haven and subject to the tax rate τ_x. Other firms' profits are weighted by λ that takes into account the ownership group j has in all the other firms.[20]

From the first-order conditions of the maximization problem in (10), given the profits' location decision of all firms and tax rates, the markdown of real wages for firm j is[21]

$$\mu_{jl} \equiv \frac{A_j - \omega(L)}{\omega(L)} = \frac{s_{jl} + \lambda\left[\sum_{k\neq j}\left(\frac{1-\tau_x}{1-\tau_l}\right)s_{kx} + s_{kl}\right]}{\eta}, \tag{11}$$

where $s_{jl} \equiv L_{jl}/L$ is the market share for firm j with profits located in country l; and $\eta \equiv \omega L/\omega'$ is the elasticity of labor supply. Note that when all firms locate their profits in the large country, the markdown of real wages becomes

$$\mu_j \equiv \frac{A_j - \omega(L)}{\omega(L)} = \frac{s_j + \lambda(1-s_j)}{\eta}, \tag{12}$$

since $\sum_{k\neq j} s_{kx} = 0$ given that no firm locates profits in the tax haven, and $\sum_{k\neq j} s_{kl} = 1 - s_j$.

All firms hire workers, produce and sell their products in the large country, and thus operate in the same competitive labor market. Therefore, they must pay the same real wage to workers in equilibrium. Equating the inverse demand of labor of two representative firms paying their taxes

[19] Note that the first subscript denotes the firm, while the second denotes where it locates profits (large country or tax haven).

[20] All profits are reported in real terms. Nominal and real terms lead to the same solution of the maximization problem

[21] See Appendix D for the analytical derivation.

in the large country, I obtain their market share

$$s_{jl} = S_l \left[\frac{A_j}{\bar{A}_l J_l} + \left(\frac{A_j}{\bar{A}_l} - 1 \right) \left(\frac{\lambda \left(\frac{\tau_x - \tau_l}{1-\tau_l} \right)}{1-\lambda} \right) \right] + \left(\frac{A_j}{\bar{A}_l} - 1 \right) \left(\frac{\lambda \left(\frac{1-\tau_x}{1-\tau_l} \right) + \eta}{1-\lambda} \right), \quad (13)$$

as a function of firm j's productivity, the average firm's productivity in the large country $\bar{A}_l$, the common ownership parameter, λ, the tax rates, τ_l, and τ_x, and the aggregate market share of firms locating profits in the large country, $S_l = \sum_{k \neq j} s_{kl}$.[22] Note that S_l will be determined at the end of the next subsection.

3.1.2 Firm's optimal production plan with profits in the tax haven

The maximization problem firm j's manager faces, conditional on the firm opening the affiliate in the tax haven, is the following

$$\max_{L_{jx}} \quad (1-\tau_x)[A_j L_{jx} - \omega(L) L_{jx}] - \gamma \quad (14a)$$

$$+ \lambda \sum_{k \neq j} [(1-\tau_l)(A_k L_{kl} - \omega(L) L_{kl})] \quad (14b)$$

$$+ \lambda \sum_{k \neq j} [(1-\tau_x)(A_k L_{kx} - \omega(L) L_{kx}) - \gamma]. \quad (14c)$$

In the above equation, line (14a) represents the after-tax profits of firm j subject to the tax rate τ_x; Line (14b) is the sum of after-tax profits of all other firms paying taxes in the large country and subject to the tax rate τ_l; Line (14c) is the sum of after-tax profits of all other firms paying taxes in the tax haven and subject to the tax rate τ_x. Lines (14b) and (14c) are weighted by λ that takes into account the common ownership group j has in all the other firms.

From the first-order conditions of the maximization problem (14), given the tax rates and the profits' location decision of all firms, the markdown of real wages for firm j is[23]

$$\mu_{jx} \equiv \frac{A_j - \omega(L)}{\omega(L)} = \frac{s_{jx} + \lambda \left[\sum_{k \neq j} s_{kx} + \left(\frac{1-\tau_l}{1-\tau_x} \right) s_{kl} \right]}{\eta}. \quad (15)$$

Note that, when all firms locate their profits in the tax haven, the markdown of real wages becomes equal to equation 12, because $\sum_{k \neq j} s_{kl} = 0$ since no firms locate profits in the large country, and $\sum_{k \neq j} s_{kx} = 1 - s_j$.

[22] See Appendix D for the analytical derivation.

[23] See Appendix D for the analytical derivation.

Equating the inverse demands of labor of two representative firms paying taxes in the tax haven, I obtain their market share

$$s_{jx} = S_l \left[\left(\frac{A_j}{\bar{A}_x} - 1 \right) \left(\frac{\lambda \left(\frac{\tau_x - \tau_l}{1-\tau_l} \right)}{1-\lambda} \right) - \frac{A_j}{\bar{A}_x (J - J_l)} \right] + \frac{A_j}{\bar{A}_x (J - J_l)} + \left(\frac{A_j}{\bar{A}_x} - 1 \right) \left(\frac{\lambda + \eta}{1 - \lambda} \right), \tag{16}$$

as a function of firm j's productivity, the average productivity in the tax haven, $\bar{A}_x$, common ownership, λ, the tax rates, τ_l, and τ_x, and the aggregate market share of the large country, $S_l = \sum_{k \neq j} s_{kl}$. I determine S_l by equating the inverse demands of labor of firms paying taxes in the large country and the tax haven, plugging in s_{jl} and s_{jx}, which yields[24]

$$S_l = \frac{\bar{A}_l \left(\frac{1-\lambda}{J-J_l} + \eta + \lambda \right) - \bar{A}_x \left(\lambda \frac{1-\tau_x}{1-\tau_l} + \eta \right)}{\bar{A}_x \left[\frac{1-\lambda}{J_l} + \lambda \left(\frac{\tau_x - \tau_l}{1-\tau_l} \right) \right] - \bar{A}_l \left[\lambda \left(\frac{\tau_x - \tau_l}{1-\tau_l} \right) - \left(\frac{1-\lambda}{J-J_l} \right) \right]}. \tag{17}$$

Proposition 1 *In an equilibrium where some firms shift profits and others do not, i.e. $J < J_l^* < 0$, the aggregate market share of firms locating profits in the large country is decreasing in λ and J.*
Proof: *See Appendix E.*

Market shares The market shares conditional on the location decision are obtained by plugging S_l into s_{jl}. The market share of a firm that locates profits in the large country is $s_{jl}(A_j, \bar{A}_l, \bar{A}_x, \eta, \lambda, \tau_l, \tau_x, J_l)$ or in the tax haven is $s_{jx}(A_j, \bar{A}_l, \bar{A}_x, \lambda, \eta, \tau_l, \tau_x, J_l)$. Keeping fixed the endogenous number of firms not shifting profits, i.e. J_l, and such that $0 < J_l < J$, the market shares of a generic firm j depend only on parameters. It depends positively on firm j's productivity A_j; positively (negatively) on the level of common ownership measured by λ if firm j has above-average (below-average) productivity of firms locating profits in the same country; positively (negatively) on the elasticity of labor supply measured by η, if firm j has above-average (below-average) productivity of the whole universe of active firms; and negatively (positively) on the tax rate of the country where the firm (does not) locates profits.

When $J_l = 0$ or $J_l = J$, a firm's market share depends only on its productivity A_j, the average productivity in the economy $\bar{A}$, the elasticity of labor supply, and the level of common ownership λ. In other words, taxation has no amplification effect on the reallocation of market share towards more productive firms since they all pay the same tax rate.

Lemma 2 *A necessary but not sufficient condition for the internal equilibrium to be achieved, where*

[24] See Appendix D for the analytical derivation.

$0 < J_l* < J$, *is that the ratio between average productivities is such that*

$$\frac{\lambda\left(\frac{1-\tau_x}{1-\tau_l}\right)+\eta}{\frac{1-\lambda}{J-J_l^*}+\eta+\lambda} < \frac{\bar{A}_l}{\bar{A}_x} < \frac{\eta+\lambda+\frac{1-\lambda}{J_l^*}}{\lambda\left(\frac{1-\tau_l}{1-\tau_x}\right)+\eta}. \tag{18}$$

The above equation guarantees that the aggregate market share of firms locating profits in the large country is bounded between zero and one.
Proof: *see Appendix I.*

3.1.3 The location of firms' profits

The manager of firm j decides to open an affiliate in the tax haven and pay taxes there if the firm optimized payoff, net of the fixed cost and taxes, is strictly greater than the optimized payoff locating profits in the large country. The associated condition is determined by the following expression:[25]

$$\begin{aligned}(1-\tau_x)\pi_{jx}^* - \gamma + \lambda\left\{\sum_{k\neq j,s}(1-\tau_l)\pi_{kl}^{*'} + \sum_{s\neq j,k}(1-\tau_x)\pi_{sx}^{*'} - \gamma\right\} > \\ (1-\tau_l)\pi_{jl}^* + \lambda\left\{\sum_{k\neq j,s}(1-\tau_l)\pi_{kl}^* + \sum_{s\neq j,k}(1-\tau_x)\pi_{sx}^* - \gamma\right\}.\end{aligned} \tag{19}$$

I implicitly assume the indifferent firm pays taxes at home with probability one, rather than establishing the affiliate in the tax haven and not gaining from it.[26] Condition (19) determines the number of firms that locate profits in the large country, i.e., J_l, and the number of firms that locate profits in the tax haven, i.e., $J - J_l$. Their location decision also defines the tax rate they are subject to.

Proposition 2 *The decision about the location of a firm's profits involves strategic interaction because it depends on the effects on all the other firms profits, through the equilibrium wage, ω^*, and total employment, L^*. Therefore, firm "j" moves its profits to the tax haven if the fixed cost is lower than the gains from shifting or*

$$\gamma < \frac{\Delta\pi_j + \lambda\sum_{k\neq j}\Delta\pi_k}{1-\lambda(J_l^{*'} - J_l^*)}, \tag{20}$$

where $\Delta\pi_j \equiv (1-\tau_x)\pi_{jx}^{*'} - (1-\tau_l)\pi_{kl}^*$ is the differential of firm j's after-tax profits and $\Delta\pi_k \equiv \{[(1-\tau_l)\pi_{kl}^{*'} + (1-\tau_x)\pi_{kx}^{*'}] - [(1-\tau_l)\pi_{kl}^* + (1-\tau_x)\pi_{kx}^*]\}$ is the differential of the other firms' after-tax profits, weighted by the λ coefficient.
Proof: *See Appendix F.*

[25] The condition is reported in real terms. Considering nominal terms does not alter the analysis.
[26] In other words, firms location of profits does not admit mixed strategies.

Firm j's manager open the affiliate in the tax haven and shift profits only if the fixed cost is sufficiently low, i.e. lower than the sum of the payoff differentials for firm j and all the other firms k. Therefore, profit shifting takes place only if the gains are sufficiently high. Using Lemma 1, is possible to say that $\Delta\pi_j > 0$ because, by shifting profits, firm j access lower taxation given that the tax haven always undercuts the large country tax rate. Moreover, firm j increases its production due to the gain in market share granted by the other managers, since it now has lower (marginal) costs. The second term is negative, i.e. $\sum_{k\neq j} \Delta\pi_k < 0$, because the other firms' managers decide to allocate more market share to the firm that shift profits because more profitable due to lower taxation. Hence, managers of firms ks, for $k \neq j$, will not increase their demand for labor and, if anything, they decide to decrease it.

There are three possible outcomes. First, when $J_l = J$ all firms locate profits in the large country and are subject to a tax rate, τ_l. Second, when $0 < J_l < J$ some firms locate profits in the large country and are subject to a tax rate, τ_l, and some firms locate profits in the tax haven being subject to a tax rate, τ_x. Third, when $J_l = 0$ all firms shift profits to the tax haven and are subject to the tax rate, τ_x. In the extreme cases where all firms locate profits either in the large country, $J_l = J$, or in the tax haven, $J_l = 0$, firms' production plans are independent of taxation, and the maximization leads to Azar and Vives (2021) results with heterogeneous firms.

Proposition 3 *In an interior equilibrium where all firms locate profits in the large country or in the tax haven, when $J_l^* = J$ and $J_l^* = 0$ respectively, firms' production plans are independent of taxation since they are subject to the same tax rate which cancels out. As a result, the equilibrium outcome becomes identical to that of Azar and Vives (2021) with heterogeneous firms.*
Proof*: see Appendix G.*

Note that the optimized profits of firm j, and therefore its labor demand, are location specific: the labor demand when firm j locates profits in the large country is different from the labor demand when it decides to locate profits in the tax haven. Given that common ownership causes strategic interaction among firms, a change in labor demanded by a firm influences the other firms' decisions.

3.1.4 Firms' subgame perfect equilibrium

The equilibrium concept follows Azar and Vives (2021), with the additional firms' strategy element: the location of profits that I denote with $a_j \in \{l, x\}$. I define the competitive equilibrium relative to the firms' production plans, a Walrasian equilibrium conditional on the quantities of output and profits' location decision announced by firms. As in Azar and Vives (2021), I proxy firm j's production plan by the quantity L_j of labor demanded, implicitly setting the planned production quantity equal to $F(L_j)$.

Definition 1 *Competitive equilibrium relative to production plans and location decisions: a competitive equilibrium relative to $(L_1, ..., L_J)$ and $(a_1, ..., a_J)$ is a price system and allocation $[\{w, p\}; \{C_i, L_i\}_{i\in I_W}, \{C_i\}_{i\in I_O}]$ such that the following statements hold:*

(i) *For* $i \in I_W$, (C_i, L_i) *maximizes* $U(C_i, L_i)$ *subject to* $pC_i \leq wL_i$*; for* $i \in I_O$, $C_i = W_i/p$.

(ii) *labor supply equals labor demand by firms:* $\int_{i \in I_W} L_i \, di = \sum_{j=1}^{J} L_j$.

(iii) *Total consumption equals total production minus the fixed cost paid by the firms that shift profits:* $\int_{i \in I_W \cup I_O} C_i \, di = \sum_{j=1}^{J} F(L_j) - \sum_{j=J_l+1}^{J} \gamma$.

Firms make production plans and location decision conditional on price functions $\mathbb{W}(\mathbf{L})$ and $\mathbb{P}(\mathbf{L})$, where $\mathbf{L} \equiv (L_1, ..., L_J)$ is the production plan vector, such that $[\mathbb{W}(\mathbf{L})\mathbb{P}(\mathbf{L}); \{C_i, L_i\}_{i \in I_W}, \{C_i\}_{i \in I_O}]$ is a competitive equilibrium. Price functions reflect a firm's expectation about prices' reaction with respect to its and other firms' plans. When a firm's employment and production plans coincide with the expectations of all other firms, the economy is in equilibrium.

Definition 2 *Cournot-Walras equilibrium with shareholder representation is a price function* $(\mathbb{W}(\cdot), \mathbb{P}(\cdot))$, *an allocation* $\{\{C_i^*, L_i\}_{i \in I_W}, \{C_i^*\}_{i \in I_O}\}$, *a set of production plans* $\mathbf{L}^*$ *and profits location decisions* $\mathbf{a}^*$ *such that:*

(i) $[\mathbb{W}(\mathbf{L}^*, \mathbf{a}^*)\mathbb{P}(\mathbf{L}^*, \mathbf{a}^*); \{C_i^*, L_i\}_{i \in I_W}, \{C_i^*\}_{i \in I_O}]$ *is a competitive equilibrium relative to* $\mathbf{L}^*$ *and* $\mathbf{a}^*$,

(ii) *firms' profits location decisions are such that*

$$\begin{cases} a_j = l & if\ (19)\ holds \\ a_j = x & if\ (19)\ does\ not\ hold \end{cases}$$

(iii) *and the production plan vector* $\mathbf{L}^*$ *and the profits' location decision* $\mathbf{a}^*$ *are a pure-strategy Nash equilibrium of a game in which players are the J firms, the strategy spaces of firm* j *are* $L_j \in [0, T]$ *and* $a_j \in [l, x]$ *and the firm's payoff function is*

$$\begin{cases} (1-\tau_l)\pi_{jl} + \lambda \left[\sum_{k \neq j}(1-\tau_l)\pi_{kl} + (1-\tau_x)\pi_{kx} - \gamma\right] & for\ a_j = l \\ (1-\tau_x)\pi_{jx} - \gamma + \lambda \left[\sum_{k \neq j}(1-\tau_l)\pi_{kl} + (1-\tau_x)\pi_{kx} - \gamma\right] & for\ a_j = x \end{cases}$$

Note that profits are reported in real terms and $\pi_j = \Pi_j/p$.

As discussed in subsections 3.1.1 and 3.1.2, the manager of firm j chooses L_j that maximizes the following expressions

$$\begin{cases} (1-\tau_l)\pi_{jl} + \lambda \left[\sum_{k \neq j}(1-\tau_l)\pi_{kl} + (1-\tau_x)\pi_{kx} - \gamma\right] & \text{for } a_j = l \\ (1-\tau_x)\pi_{jx} - \gamma + \lambda \left[\sum_{k \neq j}(1-\tau_l)\pi_{kl} + (1-\tau_x)\pi_{kx} - \gamma\right] & \text{for } a_j = x \end{cases}$$

and then choose a_j according to the profit shifting conditions (19). Following Azar and Vives (2021), I denote by $E_{\omega'} \equiv -\omega'' L/\omega'$ the elasticity of the inverse labor supply's slope. The condition that guarantees a firm's increase in labor demand is met by a reduction in labor demand by the other is $E_{\omega'} < 1$. When firms have heterogeneous productivities and Constant Returns to Scale (CRS) technologies, the equilibrium exists when $\lambda < 1$.[27]

Proposition 4 *Let $E_{\omega'} < 1$; let firms have possibly heterogeneous CRS technologies of the kind $F_j(L_j) = A_j L_j$, with positive productivities ordered as $0 < A_1 \leq ... \leq A_j \leq ... \leq A_J$, for $j = 1, ..., J$; let firms have the possibility to shift profits by opening an affiliate in the tax haven paying a fixed cost $\gamma > 0$, and $\delta = \tau_l - \tau_x > 0$. Then an interior equilibrium exists with $\lambda < 1$. In an interior equilibrium where $L^* \in (0, T)$ and firms locate profits in both countries, i.e. $0 < J_l^* < J$, I have:*

(a) The markdown of real wages for firm j with profits located in the large country is

$$\mu_{jl} \equiv \frac{A_j - \omega(L^*)}{\omega(L^*)} = \frac{s_{jl}^* + \lambda \left[\sum_{k \neq j} \left(\frac{1-\tau_x}{1-\tau_l}\right) s_{kx}^* + s_{kl}^*\right]}{\eta}, \tag{21}$$

where $s_{jl}^* \equiv L_{jl}^*/L^*$ is the equilibrium market share for firm j locating profits in the large country denoted by l; and $s_{kx}^* \equiv L_{kx}^*/L^*$ is the equilibrium market share for firm k locating profits in the tax haven denoted by x.

(b) The markdown of real wages for a firm j with profits located in the tax haven is

$$\mu_{jx} \equiv \frac{A_j - \omega(L^*)}{\omega(L^*)} = \frac{s_{jx}^* + \lambda \left[\sum_{k \neq j} s_{kx}^* + \left(\frac{1-\tau_l}{1-\tau_x}\right) s_{kl}^*\right]}{\eta}. \tag{22}$$

(c) The total level of employment is

$$L^* = \left[\frac{\eta \bar{A}_x}{S_l^*[\lambda(\frac{\tau_x - \tau_l}{1-\tau_x}) - \frac{1-\lambda}{J-J_l}] + \frac{1-\lambda}{J-J_l} + \eta + \lambda}\right]^\eta, \tag{23}$$

which is decreasing in the level of common ownership λ, labor supply elasticity η and number of firms J.

Proof: *see Appendix H.*

The firms that self-select into profit shifting gain further comparative advantage with respect to the ones keeping their profits at home, due to lower taxation on their profits. This further advantage reinforces their market power as (i) they obtain more market share at the expense of least productive firms that do not shift profits and (ii) charge higher markdowns to their workers.

[27] See Appendix C for the analytical proof.

Thus, profit shifting endogenously generates an increase in firms' market power, especially for the more productive. This can be seen clearly from the markdown expression in equations 21 and 22. Since in equilibrium the tax haven always undercuts the large country and thus $\delta > 0$, the ratio of tax rates in μ_{jl} is always lower than zero, i.e. $(1 - \tau_x)/(1 - \tau_l) < 1$. Whereas, the ratio of tax rates in μ_{jx} is always greater than one, i.e. $(1 - \tau_l)/(1 - \tau_x) > 1$.

3.2 Governments subgame - Stage one

Governments simultaneously choose their tax rates, knowing that firms will play their equilibrium strategies characterized in stage two of the game. I now explore the optimal strategies of the two governments.

3.2.1 Optimal behavior of the government of the large country

The government of the large country has a unique tax instrument that is a proportional tax rate on firms' profits. It then employs the tax revenues to produce a public good with a one-to-one production technology, meaning that a unit of real resources is transformed into one unit of the public good without any loss or gain. So, the following equivalence is true $G = \tau_l \Psi_l$, where $\Psi_l = \sum_{j=1}^{J_l} \pi_j$ is the tax base of the large country's government. The government has to maximize its objective function concerning the tax rate τ_l and decide the distribution of the public good, i.e., G^W and G^O, which are the level assigned to workers and owners, respectively. To avoid any redistributive trade-off, I assume that the government attributes equal weights to the utilities of workers and owners, i.e., $\kappa = 0.5$, and it distributes equally the public good, i.e., $G = G^W + G^O$.[28] As anticipated, I want to ensure the government always has the incentives to provide the public good. If the marginal utility of the good public consumption is greater than that of the private good one's, the government will try to tax firms and produce as much public good as possible. On the other hand, if the private good's marginal utility is greater than the public good one's, the government will not tax firms and set $\tau_l = 0$ always. I consider the case when people strictly prefer the consumption of the public good over the consumption of the private one, hence $\beta > 1$. In other words, with that condition, I ensure the government has the incentive to provide the public good and tax firms as much as possible. Departing from the financial autarky case, the optimal tax rate of the large country is not one anymore because the choice of the tax rate affects the tax base that might flow toward the tax haven.

3.2.2 Optimal behavior of the government of the tax haven

As already anticipated, following Krautheim and Schmidt-Eisenlohr (2011) I consider the tax haven to be the limiting case of a tiny country. It has a mass of people close to zero, implying a negligible demand/supply of goods and, thus a little tax base. Its only source of revenue comes from taxing

[28] Studying the redistributive effects and potential inequality issues are behind the scope of the paper. The model is not rich enough, in terms of heterogeneity and channels, to provide insightful explanations on that issues.

firms' profits that establish an affiliate there. Hence, the maximization of welfare for the government is equivalent to the maximization of its tax revenues $R_x = \tau_x \Psi_x$, where $\Psi_x = \sum_{j=J_l+1}^{J} \pi_j$ is the haven tax base. Since firms have to pay a fixed cost to open the affiliate and shift profits, for any $\gamma > 0$ they will shift profits only if $\delta > 0$. That means the tax base for the tax haven is positive only if it plays a lower tax rate concerning the large country. Therefore, for any positive tax rate τ_l played by the large country, the tax haven undercuts and plays a lower tax rate τ_x.

3.2.3 Governments' subgame perfect equilibrium

I now define the tax game equilibrium and then discuss its main properties that will be explored further with the numerical analysis.

Definition 3 *The governments' tax game equilibrium is a set of tax rates $\boldsymbol{\tau}^*$ such that:*

(i) the tax rate vector is a pure-strategy Nash equilibrium of a game in which players are the two governments and their strategy space is $\tau_l, \tau_x \in [0, 1]$;

(ii) the objective function of the tax haven government is to maximize its tax revenues $R_x = \tau_x \Psi_x$;

(iii) the objective function of the large country government is to maximize a weighted-average of people's welfare

$$(1-\kappa)\left[C^W - \frac{L^{1+1/\eta}}{1+1/\eta} + \beta G^W\right] + \kappa\left[C^O + \beta G^O\right], \qquad (24)$$

where the public good distributed equally among owners and owners and it is produced with a one-to-one production technology, i.e. $\kappa = 0.5$ and $G = G^W + G^O = \tau_l \Psi_l$.

Since the fixed cost is a deadweight loss for the economy, and the large country government cares about the aggregate welfare of workers and owners, he wants to prevent firms from shifting profits away to the tax haven. Owners of a single firm have the incentive to shift profits abroad to the tax haven to pay fewer taxes and increase their profits. However, in aggregate, all firms' owners are worse off because shifting profits abroad decreases the aggregate profits, provided that the fixed cost is sufficiently high. In equilibrium, the large country plays the maximum tax rates that allow retaining all the tax base at home, and the tax haven imposes a tax rate equal to zero.

4 Numerical Analysis

The analysis provides comparative statics concerning the parameters of the model. I mainly focus on the level of common ownership λ and the tax differential δ, other than on the number of firms J and labor supply elasticity η.

Parameter	Description	Value
η	The elasticity of labor supply	0.59
β	Marginal utility of the public good	2
J	Number of firms in the economy	6
ϕ	Level of portfolio diversification	0.125
λ	"Effective Sympathy" coefficient	0.049
γ	Fixed cost of shifting profits	0.01
τ_x	Tax rate paid in the tax haven	0.04
τ_l	Tax rate paid in the large country	0.21
κ	Weight on households' welfare	0.5

Table 1: Baseline parameters

I calibrate the baseline simulation with values reported in Table 1.[29] I set the elasticity of labor supply η is 0.59, as suggested by Chetty et al. (2011). I set the parameter of the public good marginal utility β such that the government always has the incentive to provide the public good, as in Krautheim and Schmidt-Eisenlohr (2011). For the level of common ownership, I take the lowest value among the two used by Azar and Vives (2021) in their competition policy exercise. The order of firms' productivities is $A_1 < ... < A_j < ... < A_J$. I take the tax rates from Dharmapala and Hines Jr (2009) and report the tax rate faced by U.S. firms in havens (the tax haven in this setup) and non-havens countries. In Dharmapala and Hines Jr (2009), the tax rate is defined as the minimum between the average effective tax rate for American firms in the sample and the country's statutory corporate tax rate.

4.1 Ownership Structure, Market Power and Profit Shifting

In this section, I study the relationship between profit shifting, ownership structure and the market power of firms in order to answer the following questions: how do the ownership structure and market power of firms shape their incentive to shift profits? Does profit shifting affect the level of market power in the economy?

[29] I give arbitrary values to firms' productivities: $A_1 = 0.78$, $A_2 = 0.79$, $A_3 = 0.80$, $A_4 = 0.81$, $A_5 = 0.82$, $A_6 = 0.83$.

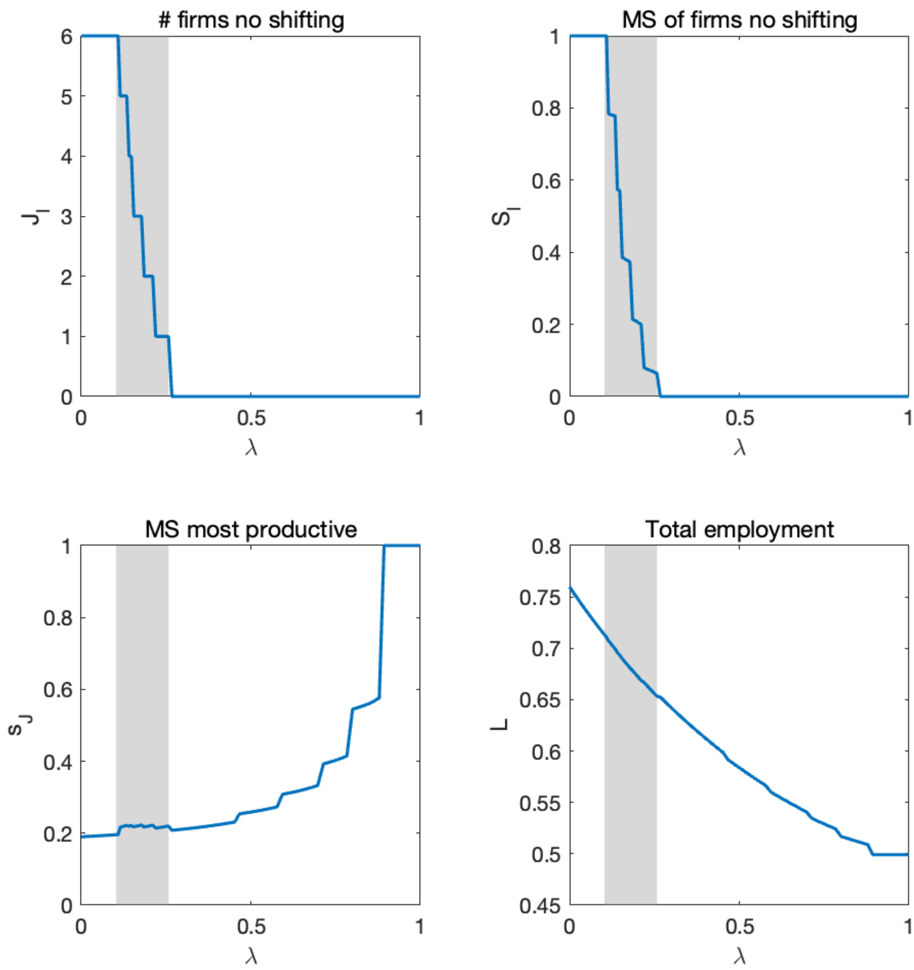

Figure 2: Comparative statics w.r.t. common ownership, i.e. λ. The shaded area represents the values of λ for which the equilibrium number of firms locating profits in the large country is $0 < J_l^* < J$.

Figure 2 shows how variables behave with respect to the level of common ownership and confirm some of the results established in Proposition 4. The number of firms that locate profits in the large country (top-left) and their aggregate market share (top-right) strictly decrease in common ownership. The higher the level of common ownership, the greater the number of firms shifting profits and their market share. Common ownership leads to an increase in firms' market power and thus profits, other than a reallocation of market share from low-productivity, low-markup toward high-productivity, high-markup firms. Therefore, high-profit firms are increasingly willing to pay the fixed cost to shift profits and save due to lower taxation.

The market share of the most productive firm (bottom-left) is increasing in the level of common ownership because there is a reallocation of market share toward high-productivity, high-markup firms. The surges in the shaded area are associated with profit shifting that accentuates the reallocation of market share toward the more productive firms. The higher the tax differential between the two countries, the higher the jumps. The spikes on the right-hand side result from less productive firms ceasing production, reaching a juncture where only the most productive ones maintain a positive market share equal to one.

The total employment in the economy (bottom-right) is decreasing in the level of common ownership. By increasing the concentration level in the economy, market share is reallocated from low-productivity and low-markdown firms toward high-productivity and high-markdown firms. As a result, more productive firms demand less labor and exert more market over the workers. That leads to a contraction of total employment and real wages through a general equilibrium effect. As before, the surges are associated with profit shifting (shaded area, for low values of λ) and stop in production of less productive firms (right part, i.e., for high values of λ).

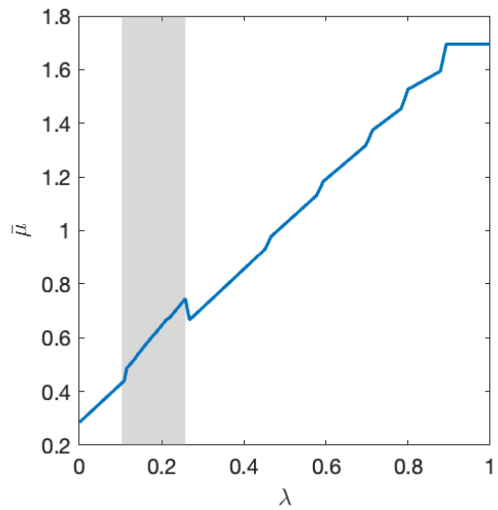

Figure 3: Average markdown and the level of common ownership λ. The shaded area represents the values of λ for which the equilibrium number of firms locating profits in the large country is $0 < J_l^* < J$.

Figure 3 depicts the weighted average markdown for each level of common ownership. The average markdown is weighted by firms' market share, i.e. $\bar{\mu} \equiv \sum_{j=1}^{J} s_j \mu_j$, and is increasing in the level of concentration. When the concentration level is such that some firms locate profits in the large country and others in the tax haven (i.e., $0 < J_l^* < J$), the average markdown jumps upward. That effect is driven by the most productive firms that, shifting profits to the tax haven, have a cost advantage relative to the ones paying taxes in the large country. This cost advantage leads the less productive to give up some market share in favour of the most productive. More productive firms will demand less labor and exert more market power by paying lower wages to workers. Thus, through a general equilibrium effect those firms lower the real wage and increase the average markdown. The spikes associated with higher concentration levels, i.e., for $\lambda > 0.47$, reflect that less productive firms stop producing and give up all their market share to the more productive ones up to the point only the most productive produce and its market share equals one, i.e. $s_J = 1$.

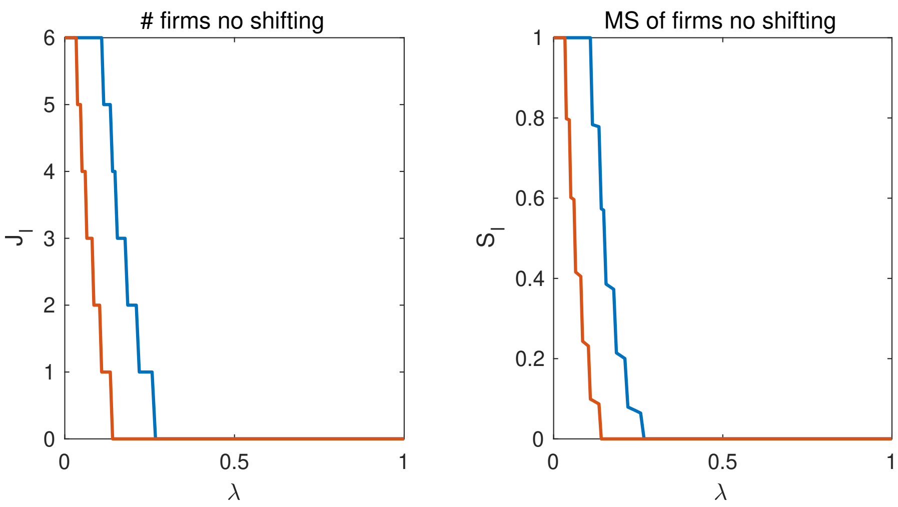

Figure 4: Comparative statics w.r.t. common ownership and tax differential. The blue solid line refers to the baseline simulation and a tax differential equal to $\delta = 0.17$ (i.e. $\tau_x = 0.04$ and $\tau_l = 0.21$); the orange solid line refers to a greater tax differential equal to $\delta' = 0.26$ (i.e. $\tau_x = 0.04$ and $\tau_l = 0.3$).

Whereas, Figure 4 shows the equilibrium outcome of the location decision for different levels of the tax differential. I plot the number of firms locating profits in the large country and their aggregate market shares for two tax differentials: 0.17 and 0.26. Given the level of common ownership, the number of firms locating profits in the large country and their aggregate market share are lower when the tax differential is wider. Since the tax differential is larger, tax avoidance practices become more attractive for firms. Trivially, they are more willing to pay the fixed costs and shift profits toward the tax haven to exploit the lower taxation. To sum up, the number of firms that do not engage in profit shifting, J_l, is decreasing in the level of common ownership λ and tax differential δ, while their market shareS_l, is decreasing in the level of common ownership λ and tax differential δ.

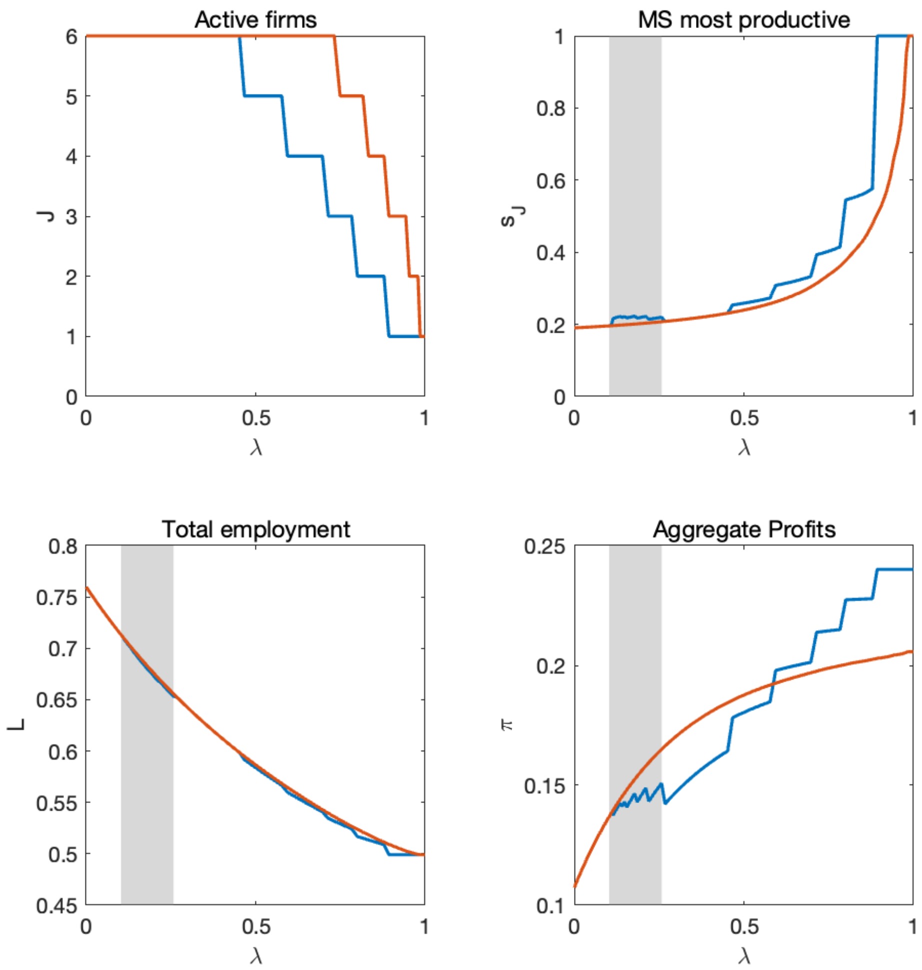

Figure 5: Comparative statics w.r.t. common ownership, with and without profit shifting. The shaded area represents the values of λ for which the equilibrium number of firms locating profits in the large country is $0 < J_l^* < J$. The solid blue line represents the case where there is the possibility to shift profits (i.e., the fixed cost is set at a reasonable level, $\gamma = 0.01$). The solid orange line depicts the case where there is no profit shifting (i.e., the fixed cost is set to be extremely high, $\gamma \to \infty$).

Figure 5 shows the impact of profit shifting on the number of active firms (top-left), the market share of the most productive firm (top-right), the total employment (bottom-left), and the aggregate profits in the economy (bottom-right). The two scenarios differ only in the fixed cost of shifting profits. In one scenario, there is no profit shifting because the fixed cost is such that firms do not find it convenient to shift profits, i.e., $\gamma \to \infty$. While in the other scenario, firms can shift profits because the fixed cost is set at a reasonable level, i.e., $\gamma = 0.01$.

For a sufficiently high level of common ownership, the number of active firms in the economy when there is no profit shifting is higher concerning the case when firms can shift profits. In equilibrium, to have a market share greater than zero, the minimal productivity of a firm locating profits in the tax haven is higher than the minimal productivity of a firm locating profits in the large country. When a firm locates profits in the tax haven has to incur a fixed cost that decreases its profitability. For certain levels of concentration, and thus market power, shifting profits may be convenient for a firm. But, if the concentration is even higher, for that firm is convenient to stop producing and give up its market share in favour of the more productive ones. Therefore, the fixed cost of shifting profits explains why the number of active firms in the economy is lower when there is the possibility of shifting profits.

The market share of the most productive firm (top-right) is greater with profit shifting than without when the level of common ownership is such that: (i) some firms locate profits in the large country and others in the tax haven, i.e. within the shaded area where $0 < J_l^* < J$; (ii) least productive firms do not produce. When $0 < J_l^* < J$, the market share allocated to the most productive is higher because it exploits the cost advantage derived from lower taxation. This leads the least productive firms to give up some market share in favour of the more productive that shift profits: the reallocation of market share depends positively on the tax differential between the two countries. The market share of the most productive is subject to spikes for relatively high levels of common ownership because the least productive firms stop producing. The same argument about active firms applies here. When there is profit shifting, least productive firms stop producing for lower levels of concentration than when there is no profit shifting. In other words, the minimal productivity in the tax haven is higher because the fixed cost of shifting profits decreases firms' profitability.

The opposite is true for the level of total employment (bottom-left). Total employment is lower when the level of common ownership is such that (i) some firms locate profits in the large country and others in the tax haven, i.e. within the shaded area where $0 < J_l^* < J$; (ii) least productive firms do not produce. When concentration is such that only some firms shift profits, i.e., $0 < J_l^* < J$, the employment is lower because a larger market share is allocated to more productive firms that demand less labor. Since more productive firms exploit the cost advantage of lower taxation, they can exert more market power in the labor market. They demand less labor which triggers a decline of equilibrium labor/production and real wages in the economy through a general equilibrium effect. The same applies when least productive firms stop producing. The reallocation of market share toward more productive firms reduces total employment because they demand less labour.

The aggregate profits (bottom-right) are equal in both cases until the point where concentration is such that firms start shifting profits. Aggregate profits decline because a fraction burns away to cover the fixed cost of implementing tax avoidance strategies.[30] Even if aggregate profits decrease, more productive firms pay the fixed cost to increase their profitability while decreasing the profitability of firms paying taxes in the large country. In this specific case, aggregate profits are higher with profit shifting only when the concentration is such that the second least productive firm stops producing. The reason is simple: if less productive firms stop producing and give up market share in favor of the most productive, on aggregate, firms save on fixed costs other than on taxation.

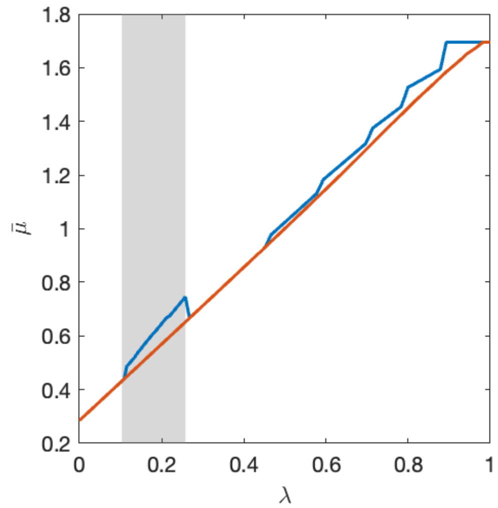

Figure 6: Average markdown and the level of common ownership, with and without profit shifting. The shaded area represents the values of λ for which the equilibrium number of firms locating profits in the large country is $0 < J_l^* < J$. The solid blue line represents the case where there is the possibility to shift profits (i.e. the fixed cost is set at a reasonable level, $\gamma = 0.01$). The orange solid line depicts the case where there is no profit shifting (i.e. the fixed cost is set to be extremely high, $\gamma \to \infty$).

Figure 6 depicts the equilibrium average markdown for each level of common ownership when there is the possibility to shift profits (blue line) and not (orange line). Here, the difference between the profits shifting case and the no-profit shifting case is visible: the average markdown is higher within the shaded area, when $0 < J_l^* < J$, and when less productive firms stop producing and leave the market share to the more productive. As explained while discussing Figure 3, when the common ownership is such that the equilibrium is $0 < J_l^* < J$, the difference is driven by the most productive firms that exploit the cost advantage on taxation and gain more market share. Whereas, when $\lambda \simeq 0.47$, is not convenient for the least productive firm to produce and thus it

[30] The idea of a cost in terms of forgone profits is coherent with the interpretation that the inputs used to shift profits away cannot be used elsewhere to generate added value.

gives up its market share in favour of the more productive ones, which exert higher market power (i.e., higher markdowns). Each jump for $\lambda > 0.47$ corresponds to the stop of production of least productive firms, up to the point where the most productive have a market share equal to one and exert the highest market power in the economy (i.e., the highest markdown). This is the channel through which profit shifting endogenously increases the market power of firms.

I can now answer the research questions I posit earlier in the discussion. How do firms' ownership and market power shape firms' incentives to shift profits? The incentives to shift profits are increasing in the level of concentration and thus market power. The more concentrated the ownership of firms, the higher their market power, which implies higher profits and more market share allocated to more productive firms. These conditions increase the incentives to shift profits, given that, thanks to lower tax rates, firms can save from taxation.

Does profit shifting affect the level of market power in the economy? The level of market power in the economy is higher when there is profit shifting and the equilibrium is such that $0 < J_l^* < J$. When only some firms shift profits, they gain a further competitive advantage with respect to the others paying taxes at home. The competitive advantage derives from the cost-saving technology accessed by paying the fixed cost. That competitive advantage exacerbates the reallocation of market share from firm that cannot access the profit shifting technology (low-productivity and low-markup firms) to firms that access the cost-saving technology (high-productivity and high-markup firms). As high-markup firms have more market share, the market power exerted over workers is higher and thus the weighted average markdown increases.

To sum up, concentration and firms' market power intensify profit shifting via large profits. Profits rise through (i) larger markdowns and (ii) reallocation of market share from low-productivity and low-markup firms toward high-productivity and high-markup firms. The economy-level of market power is higher when only some firms can exploit the profit shifting technology because the reallocation of market share toward high-productivity and high-markup firms is exacerbated.

4.1.1 Further comparative statics: Workers' preferences

Figure 7 shows the comparative statics with respect to the labor supply elasticity. In the model, the labor supply elasticity determines workers' preferences over labor and consumption. Recalling the notation, I denote the labor supply elasticity with $\eta \equiv \omega/(\omega' L)$.

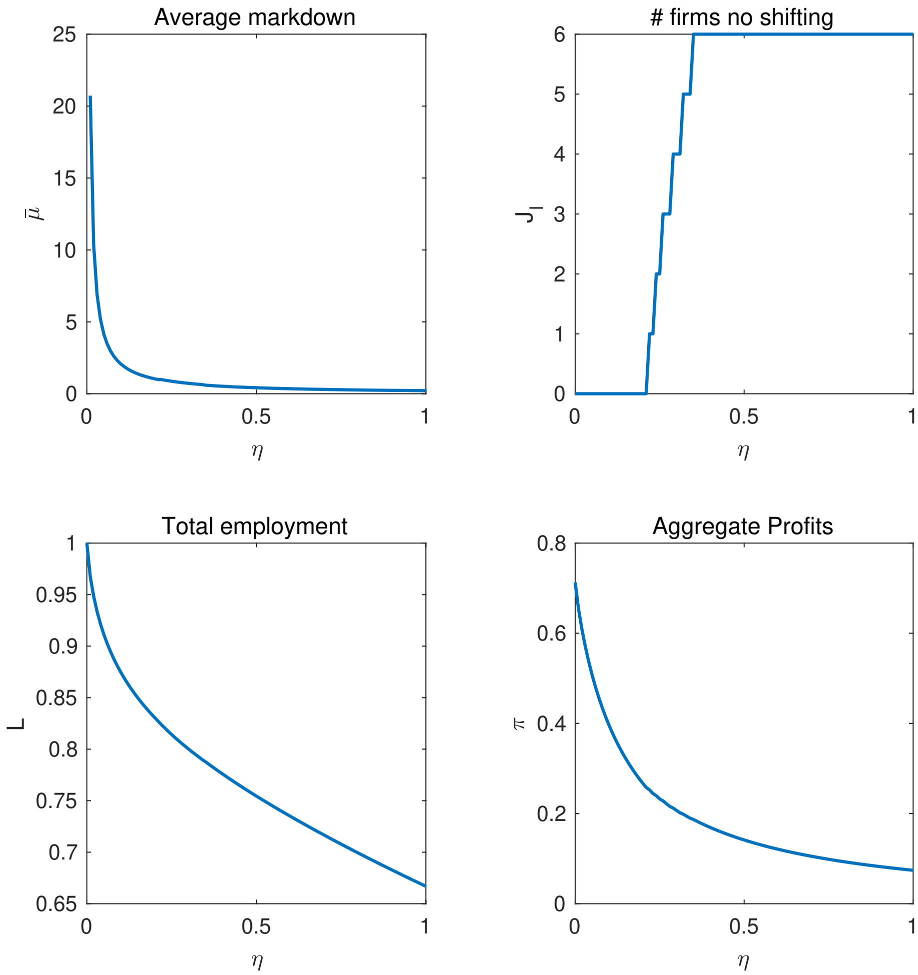

Figure 7: Comparative statics w.r.t. the elasticity of labor supply, i.e. η.

From the top-left panel is clear how the markdown is directly affected by the elasticity of the labor supply. As the labor supply becomes less elastic (in other words, workers' labor supply is steeper and less sensitive to wage changes), the average markdown increases because firms exert more market power. Firms can increase their pressure on workers' wages because the labor supply does not change much with wages. When $\eta \to \infty$, the labor supply curve becomes infinitely elastic, and workers would react firmly to changes in the real wage. As the labor supply elasticity approaches infinity, the equilibrium average markdown goes to one, and the labor market becomes perfectly competitive.

The number of firms paying taxes at home (top-right panel) is increasing in the labor supply elasticity. As workers become more sensitive to wage changes, i.e. the labor supply elasticity increases, the market power exerted by firms and, thus, their aggregate profits decrease. If firms' profits decrease, they will be less inclined to pay the fixed cost and shift profits. Because given a tax differential, lower profits imply a lower advantage in taxation (i.e., reduced intensive margin). Hence, with a more elastic labor supply, more firms pay taxes at home.

The level of total employment (bottom-left panel) and aggregate profits (bottom-right panel) are decreasing in the labor supply elasticity. As before, more sensitive workers decrease the equilibrium level of total employment, and it increases the equilibrium real wage. The market power exerted by firms reduces. Thus, the wedge between the marginal product of labor and the equilibrium wage shrinks, implying lower profits for firms.

4.1.2 Further comparative statics: number of operating firms in the economy

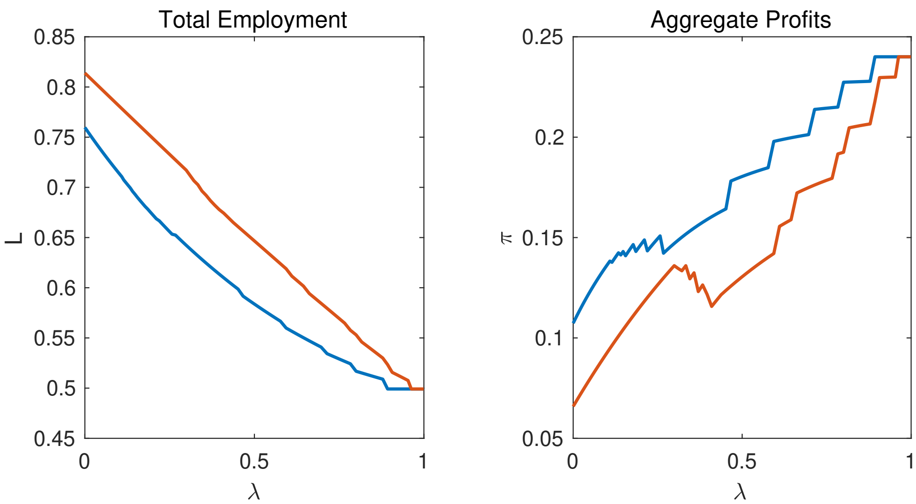

Figure 8: Comparative statics w.r.t. the number of firms, i.e., J. The solid blue line represents the case where there are six firms in the economy. The solid orange line depicts the case where there are twelve firms in the economy.

Figure 8 depicts the total employment (on the left) and aggregate profits (on the right) for any given level of common ownership. There are two scenarios: the solid blue line represents the scenario with six firms in the economy, whereas the solid orange line depicts the scenario with twelve firms. The total employment, which corresponds to total production in this setting, is higher when more firms compete in the same market. With more firms, there will be more demand for labor, and the intersection with the supply curve will determine higher total employment. The difference shrinks as the concentration level grows: less productive firms stop producing, and the number of active firms converges in both scenarios until the most productive firm serves the entire market.

The aggregate profits are lower when more firms compete in the market. Despite the total production increases with the number of firms, their aggregate profits decrease because of the higher competition in the labor market. The increase in competition within the labor market causes an increase in the equilibrium wage. Workers are better off because they benefit from higher competition: the wage is closer to the marginal productivity of labor, and workers bring home a more significant portion of the value they create. In other words, the market power exerted in the labor market by firms is lower, as reflected by the average markdown depicted in Figure 9. Firms are worse off because the increasing competition in the labor market implies an increase in their marginal costs and, thus, a decrease in profits.

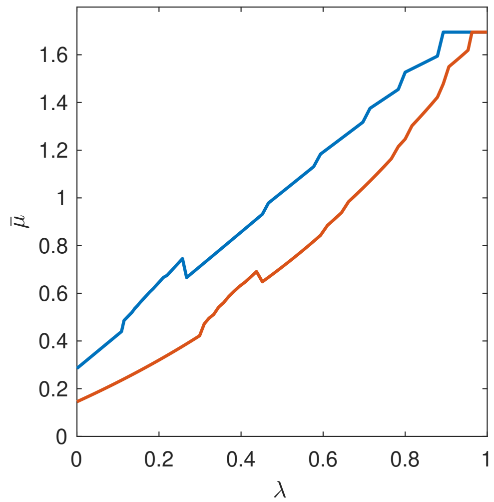

Figure 9: Average markdown and the number of firms. The solid blue line represents the case where there are 6 firms in the economy. The orange solid line depicts the case where there are 12 firms in the economy.

As anticipated before, the market power exerted by firms is lower when there are more competitors in the same market. That is captured by the average markdown depicted in Figure 9 for two scenarios, one with six firms and the other with twelve. The force leading to this result is based on the competition in the labor market: more firms imply higher demand for labor that turns into a higher equilibrium real wage and total employment.

4.2 Ownership Structure, Market Power and International Tax Competition

In this section, I study the relationship between the ownership structure, market power and the governments' tax game in order to provide an answer to the following question: how do the ownership structure and firms' market power affect international tax competition?

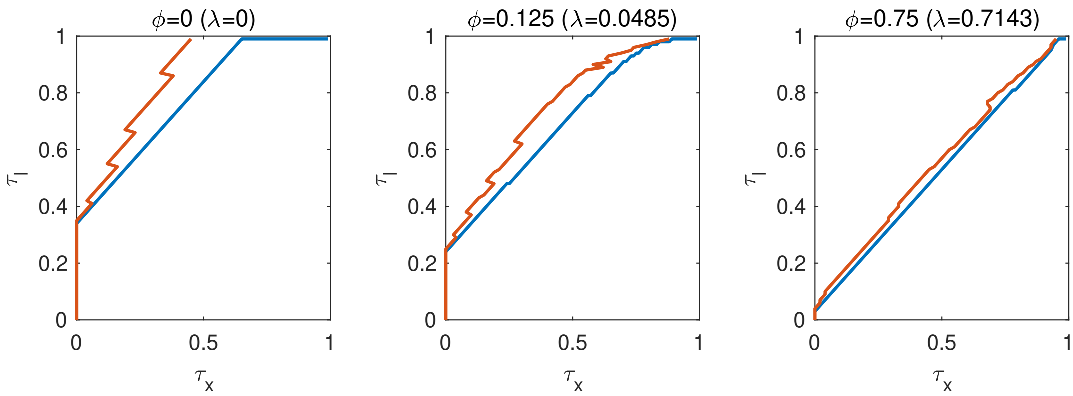

Figure 10: Governments' best replies: large country (blue solid line) and tax haven (orange solid line). Plots for three different levels of common ownership in the economy: (i) $\lambda = 0$ implying no common ownership, each firm behaves independently to the others; (ii) moderate level of common ownership with $\lambda = 0.0485$; (iii) high concentration with $\lambda = 0.7143$.

Figure 10 depicts the governments' best replies under scenarios differing in the level of common ownership and, thus, market power. Across all three scenarios, governments' best replies cross only in one point. The intersection across all three figures corresponds to $\tau_x = 0$ and the large country playing the maximum tax rate such that all firms do not shift profits. Maximizing the welfare of its people leads the large country's government to tax them as much as possible while preventing any firm from shifting profits. By taxing firms, the government collects revenues necessary to produce the public good. Since all people prefer the public good over the private one, the consumption of the former produces greater welfare. For this reason, the government is willing to extract profits from firms (implying fewer resources for the private good consumption of owners) and use them to produce the public good.

Why does the large country's government prevent firms from shifting profit? In principle, lower taxation increases the resources available to firms and owners. However, firms (on aggregate) are worse off with profit shifting because their aggregate profits are lower due to the investment in the affiliate. Lower profits imply littler consumption and welfare for the owners. On the other hand, workers are worse off with profit shifting because firms exert more market power. In other words, exerting more market power means that firms' demand for labor falls, and so does the workers' wage. Profit shifting increases the wedge between the marginal product of labor and the wage, which hurts workers' consumption and, thus, welfare. To sum up, by preventing profit shifting, the large country government preserves the welfare of both owners and workers. Owners' welfare is preserved by preventing firms from incurring costs to shift profits abroad, which results in larger aggregate profits. Workers' welfare is preserved because the market power of the most productive firms is smaller when they do not shift profits abroad.

Why does the increasing the level of common ownership in the economy increases the competition between the two governments to attract or retain capital? More concentration generates more market power and, thus, profits. Higher profits increase the incentives of firms to shift them, making the investment in the tax haven more attractive. This mechanism pushes the competition between the two governments, putting more pressure on the large country that has to lower its tax rate further to prevent profit shifting. Therefore, the equilibrium tax rate played by the large country decreases as the concentration increase. No matter what the tax haven plays, the large country always sets a tax rate that makes firms indifferent between shifting profits and not. Furthermore, the optimal tax rate of the large country decreases as the level of common ownership increases. The reason is that a rise in the parameter λ triggers a reallocation of market share towards more productive firms, which causes an increase in their profits. An increase in their profits implies more incentives to undertake tax-avoidance strategies and transfer everything to the low-tax jurisdiction. To prevent that, the government of the large country has to lower its tax rate such that the most productive is indifferent between shifting and no shifting profits. If the most productive firm is indifferent, all the others will be better off paying taxes at home. Therefore in equilibrium, all firms do not shift profits, and the tax haven cannot do anything because playing $\tau_x = 0$ will not attract any firm: no matter the tax rate, since the tax base is zero. To sum up, when there is no common ownership (i.e. $\lambda = 0$; figure on the left), the equilibrium tax rates are $\tau_l = 0.34$ and $\tau_x = 0$. When there is a low level of common ownership (i.e. $\lambda \simeq 0.04$; graph in the middle), the equilibrium tax rates are $\tau_l = 0.24$ and $\tau_x = 0$. When there is a high level of common ownership (i.e. $\lambda \simeq 0.71$; graph on the right), the equilibrium tax rates are $\tau_l = 0.03$ and $\tau_x = 0$.

5 Conclusions

Since 1980, firms' market power has increased, resulting in a rise in the market share and profits of more productive firms. In addition, since the 80s, government-mandated CIT rates have steadily decreased globally, reflecting fierce competition to attract corporate profits. These trends in market power and CIT motivated this study on how concentration and, therefore, firms' market power influence profit shifting and international tax competition in a general equilibrium model. In the model, firms interact strategically due to common ownership and exert market power in the labor market. Unlike the existing literature on profit shifting and international tax competition, I explicitly considered imperfect competition and the strategic behavior of both firms and governments. This paper shows that an increased ownership concentration in the economy enhances firms' incentives to engage in profit shifting, due to larger profits. Profits rise through (i) larger markdowns and (ii) the reallocation of market share from low-productivity and low-markup firms toward high-productivity and high-markup firms. Larger markdowns mean that firms extract more rent from their workers by paying a wage that is below the marginal productivity of labor. The wedge between marginal productivity of labor and real wage increases with concentration, rising firms' market power. Whereas, the reallocation of market share comes from the strategic interaction among firms which favours the more productive by allocating to them a wider portion of the market. The increase in profits, resulting from the aforementioned forces, increases firms' incentive to shift profits toward the tax haven in order to take advantage of a favourable tax rate. The emerging increase in firms' profits and incentives to shift them toward low-tax jurisdiction, due to increased market power, cause governments to intensely compete in attracting or retaining the tax base. In particular, countries where firms are originally located have to lower their tax rate to hold onto the tax base and prevent firms from engaging in profit shifting.

On the other hand, I have also shown that the possibility of profit shifting exacerbates the differences among already heterogeneous firms and increase the economy-level of market power. If only some firms can shift profits and access lower taxation (in this case, the more productive ones), they gain a further competitive advantage over the least productive ones. Due to these increasing disparities, market share becomes more concentrated toward the most productive which exert more market power. As a result, the economy-level of market power, measured by the weighted average of markdowns in the model, is higher than the counterfactual without profit shifting.

The setup I adopted incorporates only labor market power, ruling out product market power. Analyzing a general equilibrium model that allows studying the effects in the product market could provide additional interesting insights. Furthermore, this static general equilibrium model does not allow for any explanation of the dynamics such as the general decline in CIT rates and the narrowing of the difference between the tax rates applied by tax havens and non-tax havens.

References

Autor, D., Dorn, D., Katz, L. F., Patterson, C., and Van Reenen, J. (2020). The Fall of the Labor Share and the Rise of Superstar Firms*. The Quarterly Journal of Economics, 135(2):645–709.

Azar, J. and Vives, X. (2021). General Equilibrium Oligopoly and Ownership Structure. Econometrica, 89(3):999–1048.

Bernard, A. B., Jensen, J. B., and Schott, P. K. (2006). Transfer Pricing by U.S.-Based Multinational Firms, volume no. w12493 of NBER working paper series. National Bureau of Economic Research, Cambridge, Mass.

Berry, S., Levinsohn, J., and Pakes, A. (1995). Automobile Prices in Market Equilibrium. Econometrica, 63(4):841.

Chetty, R., Guren, A., Manoli, D., and Weber, A. (2011). Are micro and macro labor supply elasticities consistent? a review of evidence on the intensive and extensive margins. American Economic Review, 101(3):471–75.

Cobham, A. and Janský, P. (2018). Global distribution of revenue loss from corporate tax avoidance: re-estimation and country results: Global Corporate Tax Avoidance. Journal of International Development, 30(2):206–232.

Crivelli, E., Keen, M., and de Mooij, R. (2016). Base Erosion, Profit Shifting and Developing Countries. FinanzArchiv, 72(3):268.

De Loecker, J., Eeckhout, J., and Mongey, S. (2021). Quantifying market power and business dynamism in the macroeconomy. National Bureau of Economic Research.

De Loecker, J., Eeckhout, J., and Unger, G. (2020). The Rise of Market Power and the Macroeconomic Implications*. The Quarterly Journal of Economics, 135(2):561–644.

Desai, M. A., Foley, C. F., and Hines, J. R. (2006). The demand for tax haven operations. Journal of Public Economics, 90(3):513–531.

Dharmapala, D. (2014). What Do We Know about Base Erosion and Profit Shifting? A Review of the Empirical Literature. Fiscal Studies, 35(4):421–448.

Dharmapala, D. (2019). Profit Shifting in a Globalized World. AEA Papers and Proceedings, 109:488–492.

Dharmapala, D. and Hines Jr, J. R. (2009). Which countries become tax havens? Journal of Public Economics, 93(9-10):1058–1068.

Díez, F. J., Fan, J., and Villegas-Sánchez, C. (2021). Global declining competition? Journal of International Economics, 132:103492.

Edmond, C., Midrigan, V., and Xu, D. Y. (2015). Competition, markups, and the gains from international trade. American Economic Review, 105(10):3183–3221.

Evans, W. N. and Kessides, I. N. (1993). Localized Market Power in the U.S. Airline Industry. The Review of Economics and Statistics, 75(1):66.

Ferrett, B. and Wooton, I. (2010). Competing for a duopoly: international trade and tax competition. Canadian Journal of Economics/Revue canadienne d'économique, 43(3):776–794.

Garrett, D. and Suárez Serrato, J. C. (2019). How elastic is the demand for tax havens? evidence from the us possessions corporations tax credit. In AEA Papers and Proceedings, volume 109, pages 493–499. American Economic Association 2014 Broadway, Suite 305, Nashville, TN 37203.

Gutierrez Gallardo, G. and Philippon, T. (2018). How eu markets became more competitive than us markets: A study of institutional drift. CEPR Discussion Paper No. DP12983.

Hall, R. E. (2018). New evidence on the markup of prices over marginal costs and the role of mega-firms in the us economy. National Bureau of Economic Research.

Hines Jr, J. R. and Rice, E. M. (1994). Fiscal paradise: Foreign tax havens and american business. The Quarterly Journal of Economics, 109(1):149–182.

Hirshleifer, J. (1956). On the Economics of Transfer Pricing. The Journal of Business, 29(3):172.

Janeba, E. (1998). Tax competition in imperfectly competitive markets. Journal of International Economics, 44(1):135–153.

Keen, M. and Konrad, K. A. (2013). The theory of international tax competition and coordination. Handbook of public economics, 5:257–328.

Koujianou Goldberg, P. and Hellerstein, R. (2013). A Structural Approach to Identifying the Sources of Local Currency Price Stability. The Review of Economic Studies, 80(1):175–210.

Krautheim, S. and Schmidt-Eisenlohr, T. (2011). Heterogeneous firms, 'profit shifting' FDI and international tax competition. Journal of Public Economics, 95(1-2):122–133.

Melitz, M. J. and Ottaviano, G. I. (2008). Market size, trade, and productivity. The review of economic studies, 75(1):295–316.

Nevo, A. (2001). Measuring Market Power in the Ready-to-Eat Cereal Industry. Econometrica, 69(2):307–342.

OECD, O. (2000). Towards global tax co-operation: Progress in identifying and eliminating harmful tax practices. Progress Report to the, 20.

Tørsløv, T. R., Wier, L. S., and Zucman, G. (2018). The missing profits of nations. Technical report, National Bureau of Economic Research.

Tørsløv, T., Wier, L., and Zucman, G. (2022). The Missing Profits of Nations. The Review of Economic Studies. rdac049.

Vives, X. (1999). Oligopoly pricing: old ideas and new tools. MIT press.

Wier, L. and Erasmus, H. (2023). The dominant role of large firms in profit shifting. IMF Economic Review, 71(3):791–816.

Wier, L. S. and Zucman, G. (2022). Global profit shifting, 1975-2019. Technical report, National Bureau of Economic Research.

Wilson, J. D. (1986). A theory of interregional tax competition. Journal of urban Economics, 19(3):296–315.

Wolak, F. A. (2003). Measuring Unilateral Market Power in Wholesale Electricity Markets: The California Market, 1998–2000. American Economic Review, 93(2):425–430.

Wrede, M. (1994). Tax competition, locational choice, and market power. FinanzArchiv/Public Finance Analysis, pages 488–516.

Yeh, C., Macaluso, C., and Hershbein, B. (2022). Monopsony in the us labor market. American Economic Review, 112(7):2099–2138.

Zodrow, G. R. and Mieszkowski, P. (1986). Pigou, tiebout, property taxation, and the underprovision of local public goods. Journal of urban economics, 19(3):356–370.

Appendix A Declining CIT rates

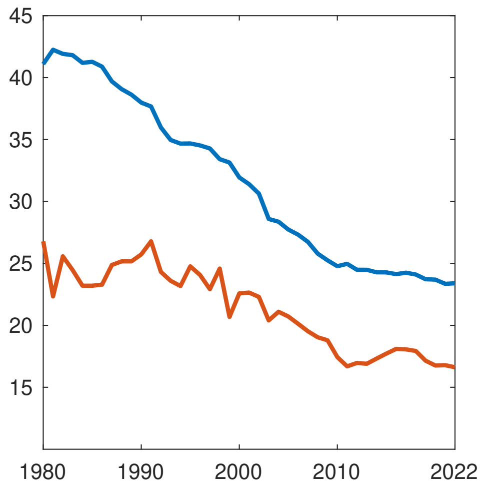

Figure 11: Average CIT rates of havens and non-havens according to OECD (2000) from 1980 to 2022, in percentage. Blue solid line: average CIT rates of Non-Havens countries. Orange solid line: average CIT of Havens countries.

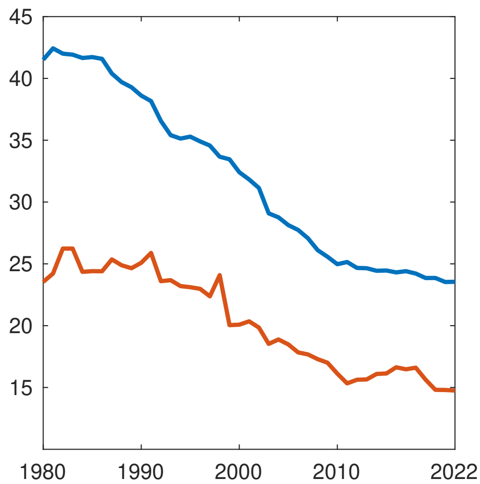

Figure 12: Average CIT rates of havens and non-havens according to Hines Jr and Rice (1994) from 1980 to 2022, in percentage. Blue solid line: average CIT rates of Non-Havens countries. Orange solid line: average CIT of Havens countries.

Appendix B Managers objective function

Recalling managers' objective function

$$\begin{aligned}(1-\phi+\frac{\phi}{J})&\left[(1-\phi+\frac{\phi}{J})(1-\tau)\pi_j+\frac{\phi}{J}\sum_{k\neq j}(1-\tau)\pi_k\right]\\+\sum_{k\neq j}\frac{\phi}{J}&\left[(1-\phi+\frac{\phi}{J})(1-\tau)\pi_k+\frac{\phi}{J}\sum_{s\neq k}(1-\tau)\pi_s\right],\end{aligned}\tag{B.1}$$

we can collect π_j, considering that groups $k \neq j$ have a share equal to ϕ/J in firm j, and π_k, considering that group j but also groups s have a ϕ/J share in firm k, we obtain

$$\begin{aligned}&\left[\left(1-\phi+\frac{\phi}{J}\right)^2+(J-1)\left(\frac{\phi}{J}\right)^2\right](1-\tau)\pi_j\\&+\left[2\left(\frac{\phi}{J}\right)\left(1-\phi+\frac{\phi}{J}\right)+(J-2)\left(\frac{\phi}{J}\right)^2\right]\sum_{k\neq j}(1-\tau)\pi_k.\end{aligned}\tag{B.2}$$

Dividing the above by the expression in squared brackets before the after-tax profits of firm j as

$$(1-\tau)\pi_j+\frac{\left[2\left(\frac{\phi}{J}\right)\left(1-\phi+\frac{\phi}{J}\right)+(J-2)\left(\frac{\phi}{J}\right)^2\right]}{\left[\left(1-\phi+\frac{\phi}{J}\right)^2+(J-1)\left(\frac{\phi}{J}\right)^2\right]}\sum_{k\neq j}(1-\tau)\pi_k.\tag{B.3}$$

and simplifying we obtain

$$(1-\tau)\pi_j+\underbrace{\frac{(2-\phi)\phi}{(1-\phi)^2J+(2-\phi)\phi}}_{\lambda}\sum_{k\neq j}(1-\tau)\pi_k.\tag{B.4}$$

Appendix C Proof of equilibrium existence

I now prove conditions for equilibrium existence of Azar and Vives (2021) when profit shifting is introduced. The objective of the firm's manager, conditional on profits located in the tax haven, is to maximize

$$\max_{L_{jx}} \zeta : \quad (1-\tau_x)[A_j L_{jx} - \omega(L) L_{jx}] - \gamma \tag{C.1a}$$

$$+ \lambda \sum_{k \neq j} (1-\tau_l)(A_k L_{kl} - \omega(L) L_{kl}) \tag{C.1b}$$

$$+ \lambda \sum_{k \neq j} [(1-\tau_x)(A_k L_{kx} - \omega(L) L_{kx}) - \gamma]. \tag{C.1c}$$

The first derivative is given by

$$\frac{\partial \zeta}{\partial L_{jx}} : (1-\tau_x)[A_j - \omega] - \omega' \left\{ (1-\tau_x) L_{jx} + \lambda \left[(1-\tau_l) \sum_{k \neq j} (L_{kl}) + (1-\tau_x) \sum_{k \neq j} (L_{kx}) \right] \right\}; \tag{C.2}$$

where the best response of firm j depends on other firms' aggregate response and tax rates. The cross derivative is given by

$$\begin{aligned} \frac{\partial^2 \zeta}{\partial L_{jx} \partial L_m} : & -\omega'[(1-\tau_x) + \lambda(1-\tau_x) + \lambda(1-\tau_l)] \\ & - \omega''\{(1-\tau_x) L_{jx} + \lambda(1-\tau_l) \sum_{k \neq j} L_{kl} + \lambda(1-\tau_x) \sum_{k \neq j} L_{kx}\}. \end{aligned} \tag{C.3}$$

Denoting $s_{jx} \equiv L_{jx}/L$, without loss of generality I can rewrite as

$$\begin{aligned} & -[(1-\tau_x) + \lambda(1-\tau_x) + \lambda(1-\tau_l)] \\ & - \frac{\omega''}{\omega'} L\{(1-\tau_x) s_{jx} + \lambda(1-\tau_l) \sum_{k \neq j} s_{kl} + \lambda(1-\tau_x) \sum_{k \neq j} s_{kx}\}. \end{aligned} \tag{C.4}$$

If $E_{\omega'} \equiv -\omega'' L/\omega' < 1$ then the cross derivative is negative because

$$[(1-\tau_x) + \lambda(1-\tau_x) + \lambda(1-\tau_l)] > \{(1-\tau_x) s_{jx} + \lambda(1-\tau_l) \sum_{k \neq j} s_{kl} + \lambda(1-\tau_x) \sum_{k \neq j} s_{kx}\}, \tag{C.5}$$

provided that $\tau_x, \tau_l \in [0,1]$ and $\lambda \in [0,1)$. The same holds for the maximization of a firm locating profits in the large country. As in Azar and Vives (2021), Theorem 2.7 of Vives (1999) ensures the existence of an equilibrium.

Appendix D Firms' maximization problem

The objective of a firm's manager is to choose the level of labor L_j and location a_j that maximize a weighted average of its shareholders' indirect utilities. I proceed with the derivation of the optimal response by taking the location of profits as given.

D.1 Profits located in the large country

Provided firm j's profits are located in the large country, I recall the manager's maximization problem

$$\max_{L_{jl}} \quad (1-\tau_l)[A_j L_{jl} - \omega(L)L_{jl}] \tag{D.1a}$$

$$+ \lambda \sum_{k\neq j}[(1-\tau_l)(A_k L_{kl} - \omega(L)L_{kl})] \tag{D.1b}$$

$$+ \lambda \sum_{k\neq j}[(1-\tau_x)(A_k L_{kx} - \omega(L)L_{kx}) - \gamma]. \tag{D.1c}$$

Considering there is a finite number of firms, large relative to the economy, their decision about the level of input to employ affects the aggregate demand of labor and equilibrium real wage. Taking the first derivative I must consider the real wage $\omega(L)$ depends on aggregate labor and in turn it depends on L_{jl} too. Thus, the FOC is given by

$$(1-\tau_l)[A_j - \omega' L_{jl} - \omega] - \lambda \left[(1-\tau_l)\sum_{k\neq j}(\omega' L_{kl}) + (1-\tau_x)\sum_{k\neq j}(\omega' L_{kx})\right]. \tag{D.2}$$

Collecting ω'

$$(1-\tau_l)[A_j - \omega] - \omega' \left\{(1-\tau_l)L_{jl} + \lambda \left[(1-\tau_l)\sum_{k\neq j}(L_{kl}) + (1-\tau_x)\sum_{k\neq j}(L_{kx})\right]\right\}; \tag{D.3}$$

dividing by $1-\tau_l$ and ω

$$\frac{A_j - \omega}{\omega} = \frac{\omega'}{\omega}\left\{L_{jl} + \lambda\left[\sum_{k\neq j}(L_{kl}) + \frac{1-\tau_x}{1-\tau_l}\sum_{k\neq j}(L_{kx})\right]\right\}, \tag{D.4}$$

Denoting the market share of firm j locating profits in the large country as $s_{jl} \equiv L_{jl}/L$, multiplying and dividing the right hand side by L I obtain

$$\frac{A_j - \omega}{\omega} = \frac{\omega'}{\omega} L \left\{ s_{jl} + \lambda \left[\sum_{k \neq j} (s_{kl}) + \frac{1-\tau_x}{1-\tau_l} \sum_{k \neq j} (s_{kx}) \right] \right\}. \tag{D.5}$$

where $\omega' L / \omega = 1/\eta$ is the inverse of the labor supply elasticity. Solving for ω I obtain

$$\omega = \frac{\eta A_j}{s_{jl} + \lambda \left[\sum_{k \neq j} s_{kl} + \frac{1-\tau_x}{1-\tau_l} \sum_{k \neq j} s_{kx} \right] + \eta}. \tag{D.6}$$

Defining $S_l \equiv \sum_{k \neq j} s_{kl}$ as the market share of firms that allocate profits in the large country, I can rewrite the inverse demand of labor for firm j as

$$\omega = \frac{\eta A_j}{s_{jl}(1-\lambda) + \lambda \left[\frac{1-\tau_x}{1-\tau_l} + S_l \left(\frac{\tau_x - \tau_l}{1-\tau_l} \right) \right] + \eta}. \tag{D.7}$$

To find the market share of the representative firm j, which locates profits in the large country, I have to make its inverse demand of labor equal to the inverse demand of another representative firm k locating profits in the large country too:

$$\frac{\eta A_j}{s_{jl}(1-\lambda) + \lambda \left[S_l + \frac{1-\tau_x}{1-\tau_l}(1-S_l) \right] + \eta} = \frac{\eta A_k}{s_{kl}(1-\lambda) + \lambda \left[S_l + \frac{1-\tau_x}{1-\tau_l}(1-S_l) \right] + \eta}. \tag{D.8}$$

Summing across all k paying taxes at home and solving for s_{jl} I get

$$s_{jl} = S_l \left[\frac{A_j}{\bar{A}_l J_l} + \left(\frac{A_j}{\bar{A}_l} - 1 \right) \left(\frac{\lambda \left(\frac{\tau_x - \tau_l}{1-\tau_l} \right)}{1-\lambda} \right) \right] + \left(\frac{A_j}{\bar{A}_l} - 1 \right) \left(\frac{\lambda \left(\frac{1-\tau_x}{1-\tau_l} \right) + \eta}{1-\lambda} \right), \tag{D.9}$$

where J_l is the number of firms locating profits in the large country and $\bar{A}_l = \sum_{k=1}^{J_l} s_{kl}/J_l$ is the average productivity in the large country. Plugging the market share s_{jl} into the inverse demand of firms locating profits to the large country I obtain

$$\omega = \frac{\eta \bar{A}_l}{S_l \left[\frac{1-\lambda}{J_l} + \lambda \left(\frac{\tau_x - \tau_l}{1-\tau_l} \right) \right] + \lambda \left(\frac{1-\tau_x}{1-\tau_l} \right) + \eta}. \tag{D.10}$$

D.2 Profits located in the tax haven

Similarly, I can solve the maximization problem of the manager provided that firm j locates profits into the tax haven

$$\max_{L_{jx}} \quad (1-\tau_x)[A_j L_{jx} - \omega(L)L_{jx}] - \gamma \tag{D.11a}$$

$$+ \lambda \sum_{k \neq j} [(1-\tau_l)(A_k L_{kl} - \omega(L)L_{kl})] \tag{D.11b}$$

$$+ \lambda \sum_{k \neq j} [(1-\tau_x)(A_k L_{kx} - \omega(L)L_{kx}) - \gamma]. \tag{D.11c}$$

The FOC is given by

$$(1-\tau_x)[A_j - \omega' L_{jx} - \omega] - \lambda \left[(1-\tau_l) \sum_{k \neq j} (\omega' L_{kl}) + (1-\tau_x) \sum_{k \neq j} (\omega' L_{kx}) \right]. \tag{D.12}$$

Following the same passages from (D.2) to (D.7), I can obtain the inverse demand of labor for a firm locating profits into the tax haven

$$\omega = \frac{\eta A_j}{s_{jx}(1-\lambda) + \lambda \left[S_l (\frac{\tau_x - \tau_l}{1-\tau_x}) + 1 \right] + \eta}. \tag{D.13}$$

Comparing the inverse demand of two representative firms locating profits in the tax haven, summing across all firms paying taxes abroad and solving for s_{jx} I get

$$s_{jx} = S_l \left[\left(\frac{A_j}{\bar{A}_x} - 1 \right) \left(\frac{\lambda \left(\frac{\tau_x - \tau_l}{1-\tau_l} \right)}{1-\lambda} \right) - \frac{A_j}{\bar{A}_x (J - J_l)} \right] + \frac{A_j}{\bar{A}_x (J - J_l)} + \left(\frac{A_j}{\bar{A}_x} - 1 \right) \left(\frac{\lambda + \eta}{1-\lambda} \right), \tag{D.14}$$

where $\bar{A}_x = \sum_{k \neq j} s_{kx} / (J - J_l)$ is the average productivity of firms locating profits in the tax haven. Plugging the market share s_{jx} into the inverse demand of firms locating profits to the tax haven I obtain

$$\omega = \frac{\eta \bar{A}_x}{S_l \left[\frac{\tau_x - \tau_l}{1-\tau_x} - \frac{1-\lambda}{J-J_l} \right] + \frac{1-\lambda}{J-J_l} + \eta + \lambda}. \tag{D.15}$$

D.3 Aggregate market shares

To find the aggregate market share of the large country S_l, in a candidate equilibrium where firms locate profits in both countries, I have to make the two inverse demands for labor equal:

$$\frac{\eta \bar{A}_l}{S_l\left[\frac{1-\lambda}{J_l}+\lambda(\frac{\tau_x-\tau_l}{1-\tau_l})\right]+\lambda(\frac{1-\tau_x}{1-\tau_l})+\eta}=\frac{\eta \bar{A}_x}{S_l\left[\frac{\tau_x-\tau_l}{1-\tau_x}-\frac{1-\lambda}{J-J_l}\right]+\frac{1-\lambda}{J-J_l}+\eta+\lambda}. \tag{D.16}$$

Solving for S_l I obtain

$$S_l=\frac{\bar{A}_l\left(\frac{1-\lambda}{J-J_l}+\eta+\lambda\right)-\bar{A}_x\left(\lambda\frac{1-\tau_x}{1-\tau_l}+\eta\right)}{\bar{A}_x\left[\frac{1-\lambda}{J_l}+\lambda\left(\frac{\tau_x-\tau_l}{1-\tau_l}\right)\right]-\bar{A}_l\left[\lambda\left(\frac{\tau_x-\tau_l}{1-\tau_l}\right)-\left(\frac{1-\lambda}{J-J_l}\right)\right]}. \tag{D.17}$$

The aggregate market share of firms locating profits in the tax haven is $S_x=1-S_l$.

Appendix E Proof of Proposition 1

Recalling the expression for S_l, which equates the inverse demands for labor of firms paying taxes in the large country with firms shifting profits

$$S_l=\frac{\bar{A}_l\left(\frac{1-\lambda}{J-J_l}+\eta+\lambda\right)-\bar{A}_x\left(\lambda\frac{1-\tau_x}{1-\tau_l}+\eta\right)}{\bar{A}_x\left[\frac{1-\lambda}{J_l}+\lambda\left(\frac{\tau_x-\tau_l}{1-\tau_l}\right)\right]-\bar{A}_l\left[\lambda\left(\frac{\tau_x-\tau_l}{1-\tau_l}\right)-\left(\frac{1-\lambda}{J-J_l}\right)\right]}. \tag{E.1}$$

The first derivative of the above expression with respect to the level of common ownership, i.e. λ, is

$$\frac{\partial S_l}{\partial \lambda}=\frac{(\bar{A}_l-\bar{A}_x)(1-\lambda)(1-\tau_x+\tau_l)}{\{\bar{A}_x[1-\lambda+\lambda(\tau_x-\tau_l)]+\bar{A}_l[1-\lambda-\lambda(\tau_x-\tau_l)]\}^2}. \tag{E.2}$$

The denominator is always a non-negative number since it is squared. Given that the more productive firms sort into the tax haven and shift profits, the average productivity of firms in the tax haven is always greater than the average productivity of the large country, i.e. $\bar{A}_l-\bar{A}_x<0$. Using proposition 1 which establishes that the tax haven always undercuts the large country's tax rate, $(1-\lambda)(1-\tau_x+\tau_l)$ is greater than zero. Therefore, the denominator of the first derivative is always positive and the numerator is always negative, i.e. $(\bar{A}_l-\bar{A}_x)(1-\lambda)(1-\tau_x+\tau_l)<0$, and as a result the first derivative is lower than zero

$$\frac{\partial S_l}{\partial \lambda}<0. \tag{E.3}$$

It is straightforward thinking that the market share of firms locating profits in the large country is decreasing in the level of common ownership, since managers prefer to allocate more market share to more productive firms which also have a cost-saving advantage deriving from lower taxation.

Whereas, the first derivative with respect to the number of firms in the economy, i.e. J, is

$$\frac{\partial S_l}{\partial J} = \frac{\bar{A}_l \bar{A}_x (1-\lambda)^2 (\tau_x - \tau_l)}{(J-J_l)^2 J_l^2 \left[\bar{A}_x (1-\lambda)(1-\tau_l) - \bar{A}_l (1-\lambda)\right]^2}. \tag{E.4}$$

Provided that (i) the denominator is composed by squared terms and thus it is non-negative, (ii) $\bar{A}_x$ and $\bar{A}_l$ are positive constant and $(1-\lambda)^2$ is also positive and (iii) the tax haven always undercuts the large country tax rate such that $\tau_x - \tau_l < 0$, the first derivative of the aggregate market share in the large country with respect to J is negative as well

$$\frac{\partial S_l}{\partial J} < 0. \tag{E.5}$$

Appendix F Proof of Proposition 2

In equilibrium, all firms can adjust their individual demand for labor, i.e. L_k, and the location of their profits, i.e. a_k. Both dimensions have an impact on general equilibrium variables such as the total employment, i.e. L, and the real wage paid to workers, i.e. ω. Therefore, while deciding to move profits to the tax haven, a generic firm j knows that its labour demand will possibly change, i.e. $L_j \neq L_j^{'}$, but also the demand of the other firms, i.e. $L_k \neq L_k^{'}$ for $k \neq j$, and their location of profits which all together influence the equilibrium real wage, i.e. $\omega^{'} \neq \omega$, and the number of firms paying taxes at home, i.e. $J_l^{*'} \neq J_l^*$. The condition that determines the decision about the location of firm j profits is

$$\begin{aligned}(1-\tau_x)(A_j L_j^{'} - \omega^{*'} L_j^{'}) - \gamma + \lambda \left\{ \sum_{k=1}^{J_l^{*'}} (1-\tau_l)(A_j L_k^{'} - \omega^{*'} L_k^{'}) + \sum_{k=J_l^{*'}+1}^{J} (1-\tau_x)(A_j L_k^{'} - \omega^{*'} L_k^{'}) - \gamma \right\} > \\ (1-\tau_l)(A_j L_j - \omega^* L_j) + \lambda \left\{ \sum_{k=1}^{J_l^*} (1-\tau_l)(A_j L_k - \omega^* L_k) + \sum_{k=J_l^*+1}^{J} (1-\tau_x)(A_j L_k - \omega^* L_k) - \gamma \right\}.\end{aligned} \tag{F.1}$$

In order to solve for the fixed cost

$$\begin{aligned}\gamma < (1-\tau_x)(A_j L_j^{'} - \omega^{*'} L_j^{'}) + \lambda \left\{ \sum_{k=1}^{J_l^{*'}} (1-\tau_l)(A_j L_k^{'} - \omega^{*'} L_k^{'}) + \sum_{k=J_l^{*'}+1}^{J} (1-\tau_x)(A_j L_k^{'} - \omega^{*'} L_k^{'}) - \gamma \right\} \\ -(1-\tau_l)(A_j L_j - \omega^* L_j) - \lambda \left\{ \sum_{k=1}^{J_l^*} (1-\tau_l)(A_j L_k - \omega^* L_k) + \sum_{k=J_l^*+1}^{J} (1-\tau_x)(A_j L_k - \omega^* L_k) - \gamma \right\},\end{aligned} \tag{F.2}$$

rearrenging we obtain

$$\gamma < [(1-\tau_x)(A_j L_j^{'} - \omega^{*'} L_j^{'}) - (1-\tau_l)(A_j L_j - \omega^* L_j)] +$$
$$\lambda[\sum_{k=1}^{J_l^{*'}}(1-\tau_l)(A_j L_k^{'} - \omega^{*'} L_k^{'}) + \sum_{k=J_l^{*'}+1}^{J}(1-\tau_x)(A_j L_k^{'} - \omega^{*'} L_k^{'}) - \gamma] -$$
$$[\sum_{k=1}^{J_l^{*}}(1-\tau_l)(A_j L_k - \omega^* L_k) + \sum_{k=J_l^{*}+1}^{J}(1-\tau_x)(A_j L_k - \omega^* L_k) - \gamma]. \tag{F.3}$$

Moving the fixed cost to the L.H.S. we obtain

$$\gamma[1-\lambda(J_l^{*'} - J_l^*)] < [(1-\tau_x)(A_j L_j^{'} - \omega^{*'} L_j^{'}) - (1-\tau_l)(A_j L_j \omega^* L_j)] +$$
$$\lambda[\sum_{k=1}^{J_l^{*'}}(1-\tau_l)(A_j L_k^{'} - \omega^{*'} L_k^{'}) + \sum_{k=J_l^{*'}+1}^{J}(1-\tau_x)(A_j L_k^{'} - \omega^{*'} L_k^{'})] -$$
$$[\sum_{k=1}^{J_l^{*}}(1-\tau_l)(A_j L_k - \omega^* L_k) + \sum_{k=J_l^{*}+1}^{J}(1-\tau_x)(A_j L_k - \omega^* L_k)]. \tag{F.4}$$

Defining the of firm j's after-tax profits as $\Delta\pi_j \equiv (1-\tau_x)\pi_{jx}^{*'} - (1-\tau_l)\pi_{kl}^*$, and the differential of the other firms' after-tax profits, weighted by the λ coefficient as $\Delta\pi_k \equiv \{[(1-\tau_l)\pi_{kl}^{*'} + (1-\tau_x)\pi_{kx}^{*'}] - [(1-\tau_l)\pi_{kl}^* + (1-\tau_x)\pi_{kx}^*]\}$, we can rewrite the above expression as

$$\gamma < \frac{\Delta\pi_j + \lambda\sum_{k\neq j}\Delta\pi_k}{1-\lambda(J_l^{*'} - J_l^*)}. \tag{F.5}$$

Appendix G Proof of Proposition 3

When $J_l^* = J$ and $J_l^* = 0$, firms' production plans are independent of taxation and I obtain the same markdown and level of total employment of Azar and Vives (2021) with heterogeneous firms. Now, I show the equilibrium characterization when all firms locate their profits in the large country, i.e. $J_l^* = J$, and prove that the equilibrium is independent of taxation. The same applies to the case where all firms locate profits in the tax haven.

The maximization problem of a firms manager becomes

$$\max_{L_{jl}} \qquad (1-\tau_l)[A_j L_{jl} - \omega(L)L_{jl}] + \lambda \sum_{k\neq j}[(1-\tau_l)(A_k L_{kl} - \omega(L)L_{kl})], \tag{G.1}$$

because there are no firms placing profits in the tax haven. Thus FOC is given by

$$(1-\tau_l)[A_j - \omega' L_{jl} - \omega] - \lambda \sum_{k\neq j}(1-\tau_l)(\omega' L_{kl}). \tag{G.2}$$

Collecting ω'

$$(1-\tau_l)[A_j - \omega] - \omega' \left[(1-\tau_l)L_{jl} + \lambda(1-\tau_l)\sum_{k\neq j}(L_{kl})\right]; \tag{G.3}$$

dividing by $1-\tau_l$ and ω I obtain

$$\frac{A_j - \omega}{\omega} = \frac{\omega'}{\omega}\left[L_{jl} + \lambda \sum_{k\neq j} L_{kl}\right], \tag{G.4}$$

where tax rates are canceled out since all firms are subject to the same tax rate. Denoting the market share of firm j as $s_{jl} \equiv L_{jl}/L$, multiplying and dividing the right hand side by L I obtain

$$\frac{A_j - \omega}{\omega} = \frac{\omega'}{\omega} L \left[s_{jl} + \lambda \sum_{k\neq j} s_{kl}\right]. \tag{G.5}$$

where $\omega' L/\omega = 1/\eta$ is the inverse of the labor supply elasticity. Note that $\sum_{k\neq j} s_{kl} = 1 - s_{jl}$, since all firms locate profits in the large country and $\sum_{k\neq j} s_{kx} = 0$. Without loss of generality, I can drop the subscripts indicating the location a_j since it is equal for all firms. Solving for ω I obtain

$$\omega = \frac{\eta A_j}{s_j + \lambda(1-s_j) + \eta}. \tag{G.6}$$

To find the market share of the representative firm j I make its inverse demand of labor equal to the inverse demand of another representative firm k:

$$\frac{\eta A_j}{s_j + \lambda(1-s_j) + \eta} = \frac{\eta A_k}{s_k + \lambda(1-s_k) + \eta}. \tag{G.7}$$

Summing across all k and solving for s_j I get

$$s_j = \frac{1}{J}\frac{A_j}{\bar{A}} + \left[\frac{A_j}{\bar{A}} - 1\right]\left(\frac{\eta + \lambda}{1-\lambda}\right). \tag{G.8}$$

where $\bar{A} = \sum_{k=1}^{J} A_k/J$ is the average productivity. Plugging the market share s_j into the inverse demand of labor I obtain

$$\omega = \frac{\eta\bar{A}}{\eta + \lambda + \frac{1}{J}(1-\lambda)}. \tag{G.9}$$

Equating the inverse demand and the inverse supply of labor

$$L^{1/\eta} = \frac{\eta\bar{A}}{\eta + \lambda + \frac{1}{J}(1-\lambda)}, \tag{G.10}$$

I obtain the total level of employment

$$L^* = \left[\frac{\eta\bar{A}}{\eta + \lambda + (1-\lambda)/J}\right]^{\eta}. \tag{G.11}$$

Whereas, the markdown of real wages for firm j is

$$\mu_j \equiv \frac{A_j - \omega(L^*)}{\omega(L^*)} = \frac{s_j^* + \lambda(1-s_j^*)}{\eta}. \tag{G.12}$$

Appendix H Proof of Proposition 4

Given the proof of the existence of equilibrium when $\lambda < 1$ in Appendix C, I prove every point of Proposition 1.

(a) Given a firm locates profits in the large country and $0 < J_l^* < J$, its FOC is given by

$$(1-\tau_l)[A_j - \omega' L_{jl} - \omega] - \lambda \left[(1-\tau_l)\sum_{k\neq j}(\omega' L_{kl}) + (1-\tau_x)\sum_{k\neq j}(\omega' L_{kx})\right]. \tag{H.1}$$

Collecting ω'

$$(1-\tau_l)[A_j - \omega] - \omega' \left\{(1-\tau_l)L_{jl} + \lambda\left[(1-\tau_l)\sum_{k\neq j}(L_{kl}) + (1-\tau_x)\sum_{k\neq j}(L_{kx})\right]\right\}; \tag{H.2}$$

dividing by $1-\tau_l$ and ω

$$\frac{A_j - \omega}{\omega} = \frac{\omega'}{\omega}\left\{L_{jl} + \lambda\left[\sum_{k\neq j}(L_{kl}) + \frac{1-\tau_x}{1-\tau_l}\sum_{k\neq j}(L_{kx})\right]\right\}, \tag{H.3}$$

Denoting the market share of firm j locating profits in the large country as $s_{jl} \equiv L_{jl}/L$, multiplying and dividing the right hand side by L I obtain

$$\frac{A_j - \omega}{\omega} = \frac{\omega'}{\omega}L\left\{s_{jl} + \lambda\left[\sum_{k\neq j}(s_{kl}) + \frac{1-\tau_x}{1-\tau_l}\sum_{k\neq j}(s_{kx})\right]\right\}. \tag{H.4}$$

Provided the equilibrium market share of firm j locating profits in the large country is $s^*_{jl} \equiv L^*_{jl}/L^*$, the inverse of the labor supply elasticity is $\omega' L/\omega = 1/\eta$, I obtain the markdown fo real wage of firm j

$$\mu_{jl} = \frac{A_j - \omega(L^*)}{\omega(L^*)} = \frac{s^*_{jl} + \lambda\left[\frac{1-\tau_x}{1-\tau_l}\sum_{k\neq j} s^*_{kx} + \sum_{k\neq j} s^*_{kl}\right]}{\eta}, \tag{H.5}$$

(b) Given a firm locates profits in the tax haven and $0 < J^*_l < J$, its FOC is given by

$$(1-\tau_x)[A_j - \omega' L_{jx} - \omega] - \lambda\left[(1-\tau_l)\sum_{k\neq j}(\omega' L_{kl}) + (1-\tau_x)\sum_{k\neq j}(\omega' L_{kx})\right]. \tag{H.6}$$

Following the same passages from (H.1) to (H.5), I obtain the markdown of real wages for a firm locating profits in the tax haven

$$\mu_{jx} \equiv \frac{A_j - \omega(L^*)}{\omega(L^*)} = \frac{s^*_{jx} + \lambda\left[\sum_{k\neq j} s^*_{kx} + \frac{1-\tau_l}{1-\tau_x}\sum_{k\neq j} s^*_{kl}\right]}{\eta}. \tag{H.7}$$

(c) I obtain the total level of employment, when $0 < J^*_l < J$, by equating the inverse demand of labor in equilibrium and the inverse labor supply. I recall the inverse demand for labor

$$\omega = \frac{\eta \bar{A}_x}{S^*_l\left[\frac{\tau_x - \tau_l}{1-\tau_x} - \frac{1-\lambda}{J-J_l}\right] + \frac{1-\lambda}{J-J_l} + \eta + \lambda}, \tag{H.8}$$

and the inverse of the labor supply

$$\omega(L) = L^{1/\eta}. \tag{H.9}$$

Note that, the inverse demands for labor of firms locating profits in the large country and the inverse demands for labor of firms locating profits in the tax haven are equal by definition, once S_l^* is plugged in. Furthermore, the inverse demands for labor are independent of the level of labor and they coincide with the real wage offered in equilibrium. Equating the two

$$L^{1/\eta} = \frac{\eta \bar{A}_x}{S_l^* \left[\frac{\tau_x - \tau_l}{1-\tau_x} - \frac{1-\lambda}{J-J_l}\right] + \frac{1-\lambda}{J-J_l} + \eta + \lambda}, \tag{H.10}$$

and solving for L, the total level of employment in equilibrium is

$$L^* = \left[\frac{\eta \bar{A}_x}{S_l^* [\lambda(\frac{\tau_x - \tau_l}{1-\tau_x}) - \frac{1-\lambda}{J-J_l}] + \frac{1-\lambda}{J-J_l} + \eta + \lambda}\right]^\eta. \tag{H.11}$$

Appendix I Proof of Lemma 2

A necessary but not sufficient condition for an internal equilibrium, where $0 < J_l^* < J$, is that the aggregate market share, derived by equating the FOCs of a manager locating profits in the large country and the other one locating profits in the tax haven, is bounded between 0 and 1. Imposing equation D.17 grater than 0 I have that

$$\frac{\bar{A}_l \left(\frac{1-\lambda}{J-J_l} + \eta + \lambda\right) - \bar{A}_x \left(\lambda \frac{1-\tau_x}{1-\tau_l} + \eta\right)}{\bar{A}_x \left[\frac{1-\lambda}{J_l} + \lambda \left(\frac{\tau_x - \tau_l}{1-\tau_l}\right)\right] - \bar{A}_l \left[\lambda \left(\frac{\tau_x - \tau_l}{1-\tau_l}\right) - \left(\frac{1-\lambda}{J-J_l}\right)\right]} > 0. \tag{I.1}$$

and solving for the ratio of average productivities I obtain

$$\frac{\bar{A}_l}{\bar{A}_x} > \frac{\lambda \left(\frac{1-\tau_x}{1-\tau_l}\right) + \eta}{\frac{1-\lambda}{J-J_l} + \eta + \lambda}. \tag{I.2}$$

Imposing equation D.17 lower than 0 I have that

$$\frac{\bar{A}_l \left(\frac{1-\lambda}{J-J_l} + \eta + \lambda\right) - \bar{A}_x \left(\lambda \frac{1-\tau_x}{1-\tau_l} + \eta\right)}{\bar{A}_x \left[\frac{1-\lambda}{J_l} + \lambda \left(\frac{\tau_x - \tau_l}{1-\tau_l}\right)\right] - \bar{A}_l \left[\lambda \left(\frac{\tau_x - \tau_l}{1-\tau_l}\right) - \left(\frac{1-\lambda}{J-J_l}\right)\right]} < 1 \tag{I.3}$$

and solving for the ratio of average productivities I obtain

$$\frac{\bar{A}_l}{\bar{A}_x} < \frac{\frac{1-\lambda}{J_l} + \eta + \lambda}{\lambda \left(\frac{1-\tau_x}{1-\tau_l}\right) + \eta}. \tag{I.4}$$

I proved that for an interior equilibrium where $0 < J_l^* < J$, a necessary but not sufficient condition on average productivities is such that

$$\frac{\lambda\left(\frac{1-\tau_x}{1-\tau_l}\right)+\eta}{\frac{1-\lambda}{J-J_l}+\eta+\lambda} < \frac{\bar{A}_l}{\bar{A}_x} < \frac{\frac{1-\lambda}{J_l}+\eta+\lambda}{\lambda\left(\frac{1-\tau_x}{1-\tau_l}\right)+\eta}. \tag{I.5}$$

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