On tax competition, international migration, and occupational choice

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Abstract

The aim of the paper is to analyze tax competition with internationally mobile individuals who make occupational choices. Two types of migration are distinguished, namely entrepreneur and worker migration. When the competing jurisdictions put a sufficiently high valuation on public good expenditures, entrepreneurship migration increases joint welfare relative to autarky. However, in case of labor migration, tax competition can decrease joint welfare independently of how much the jurisdictions value public expenditures.

Keywords: migration, tax competition, occupational choice, social welfare
JEL classification: F22; H24; H73; J24; J61

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1 Introduction

With the deepening of economic globalization, migration and its welfare implications become a hot topic widely debated by economists and politicians. Generally, migration is perceived as originating from low wage countries moving to high wage countries. However, evidence shows that migrants often participate in entrepreneurial activities more than natives do (OECD, 2010). This is for example the case in Central and Eastern Europe (CEE). In 2007, the percentage of Poland's workers in self-employment[1] were 29.2% for foreign born and 11.2% for natives. For the Slovak Republic, the shares were respectively 12.60% for natives and 26.4% for foreign born. This relatively high share of foreign-born entrepreneurs can partially be explained by the fact that Central East European region offers relatively low labor costs[2] and a favorable tax environment[3].

In the following, we do not consider the case of lower-skilled migrants who generally lack access to wage employment (Naudé et al. 2017) and thus decide to create their own small business. This paper rather focuses on opportunity driven entrepreneurs who can choose their occupation and thus start a new business for profit seeking reasons. These immigrants are often higher skilled (OECD, 2010). Consequently, one major difference between migrant workers and migrant entrepreneurs is that the former expect higher net wages while the latter expect higher profits (Ndoen et al., 2002).

More and more, OECD countries compete to attract talented migrants including foreign entrepreneurs (OECD, 2019). The OECD has quantified Indicators of Talent Attractiveness (OECD, 2019) designed to capture[4] the

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[1] In this paper, self-employed, entrepreneur used as synonyms.

[2] Indeed, according to Eurostat (2019) data for 2018, average hourly labor costs in the European Union is estimated at EUR 27.4 and EUR 30.6 in the euro zone. For example, in Poland and Slovakia, the average hourly labor cost amounted to EUR 10.10 and EUR 11.6, respectively.

[3] According to Podviezko et al. (2019), in the past two decades corporate income tax decreased on average from 35.5% to 27.3% in the EU old-member countries, and from 29.4% to 18.4% in the new-member countries, namely the Baltic states, and former socialist countries. These countries had to create attractive conditions for investing businesses by creating low tax rates.

[4] OECD quantified the "indicators of talent attractiveness," comparing countries on how attractive they are to three key groups: Potential migrants who are 1) highly educated; 2) entrepreneurs, and 3) aspirant international students.

strengths and weaknesses of OECD countries regarding their capacity to attract talented migrants including entrepreneurs. This quantitative tool considers multidimensional aspects of talent attractiveness[5] given that the determinants that motivate skilled individuals to relocate rely on qualitative and pecuniary motivations (Tuccio, 2019). Among the latter, earnings and tax opportunities play a significant role. For example, Switzerland owes its high attractiveness for foreign businesses and entrepreneurship to the lowest corporate taxes of the whole OECD area (OECD/Bertelsmann Stiftung, 2019). Moreover, recent empirical evidence shows that personal taxation can impact the geographic mobility of people especially for high-income workers and professions (Kleven et al., 2019).

Historically, the theoretical tax competition (Zodrow and Mieszkowski, 1986; Wildasin, 1988) has focused on inter-jurisdictional capital mobility. In these models, individuals do not cross-border to decide where to live and to work. Although most of the tax competition literature has been concerned with capital mobility (Boadway and Tremblay, 2012), standard models have been extended to labor mobility. For example, in Braid (1996), individuals can commute to work anywhere in a local jurisdiction of a same metropolitan area while capital is freely mobile within and between metropolitan areas. The jurisdictions in a metropolitan area compete in mobile workers and capital and the strategic variables are source-based taxes on capital and labor. Another seminal paper is Wilson (1995), in which the author analyzes tax competition with perfectly mobile capital and workers and considers the case where there are scale economies in the provision of public goods. Wildasin (2011), considers tax competition in a dynamic framework where labor and capital are complementary imperfectly mobile production factors. In a recent paper, Gabszewicz et al. (2016) analyze tax competition in a model of labor migration when individuals are heterogeneous with respect to their home attachment. In this model, the competing jurisdictions have asymmetric productive efficiencies and different population sizes.

Considering that mobile individuals are looking for the jurisdiction that provides the best mix of public goods and taxation roots back to Tiebout (1956). In this vein, Brueckner (2000) merges the classical tax competition model with the original Tiebout framework. He assumes that individuals

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[5]The OECD quantitative framework retains seven groups of factors, namely quality of opportunities, income and tax, future prospects, family environment, skills environment, inclusiveness, and quality of life.

3

not only decide where to invest capital, but also where to work and consume. However, when tax competition deals with migration, it hardly distinguishes between labor and entrepreneurship migration.

The aim of the present paper is to analyze tax competition with internationally mobile individuals who make occupational choices. To this purpose, we develop a two-country model where jurisdictions differ with respect to the level of talent of their residents. We consider that one jurisdiction is predominantly populated by higher talented individuals relative to the other. For sake of simplification, we assume that high talented individuals are living in one country and low talented in the other country. Moreover, individuals can move to a foreign jurisdiction where they decide to be entrepreneurs or workers. In our paper, we limit ourselves to the following cases. If low talented people move to a high talent jurisdiction, they decide to be workers. When high-talented individuals move, they decide to be entrepreneurs in the receiving country. Migrating workers are attracted by higher wage rates net of tax and moving costs, whereas migrating entrepreneurs are lured by higher profits net of tax and moving costs. Each jurisdiction sets an income tax rate that maximizes domestic welfare that reflects private and public expenditures.

Migration is driven by two forces. The first results from differences between talents, which translates into salary discrepancies across the two jurisdictions. The second is due to strategic tax decisions. In this last case, the jurisdiction try to influence the migration flows. Consequently, welfare changes are induced by a joint combination of migration and tax effects. In order to assess the specific welfare contribution of tax competition, we first characterize the closed economy case as a benchmark. Then, we consider that jurisdictions allow individuals to migrate while supposing that the tax rates remain unchanged relative to autarky. In the following, migration without tax competition will be called the free market case (Ottaviano and van Ypersele, 2005).

The present paper is closest to Schmitt and Soubeyran (2006) who analyze the allocation of two types of individuals differentiated by talent between two countries where they choose to be workers or entrepreneurs. These authors highlight the existence of an equilibrium with (one or two-way) international migration, when countries' talent endowments are sufficiently different. In their paper, the unique reason for migration results from ability differences. Our paper goes beyond this by considering that people can migrate and choose their occupation as a reaction to tax differentials.

4

We can summarize the main results of the paper as follows. The welfare effect of opening up the economies to free market migration depends on the type of migration we consider. When we focus on labor migration, the jurisdictions' joint welfare increases relative to the closed border case for any autarky tax rate. The reason is that migration results in higher joint (net) income and higher joint tax revenue. However, entrepreneurship migration is welfare increasing only if the autarky tax rates are low enough. In this case, higher net income resulting from migration can be outbalanced by lower joint tax revenues. Consequently, entrepreneurship migration without tax competition can be welfare reducing relative to autarky, which is not the case for labor migration.

After introducing tax competition, our model yields the following changes. When the competing jurisdictions put a sufficiently high valuation on public good expenditures, entrepreneurship migration increases joint welfare relative to the closed border case, for any autarky tax rate. However, in case of labor migration, tax competition can decrease joint welfare independently of how much the jurisdictions value public expenditures.

The above results lead to an interesting corollary. Tax competition increases joint welfare relative to free market migration in case of entrepreneurship migration if the jurisdictions put a sufficiently high valuation on public good expenditures. However, with labor migration, tax competition can be welfare worsening relative to free market migration even if public good expenditures are highly valued.

The underlying intuition can be explained as follows. First, the higher ability region has a higher income tax rate, which reflects the inter-jurisdictional difference in individual earnings. If tax rates can be set strategically, the source country could mitigate emigration by underbidding the destination country. This contributes reducing the welfare loss in the country of emigration without decreasing too much the welfare in the destination country.

However, tax underbidding is difficult to achieve for the low ability jurisdiction given that its autarky tax rate is already the lowest one. By contrast, when the source country is the high ability country, which is the case for entrepreneurship migration, there is more room for tax underbidding.

We contribute to the tax competition literature in the following ways. The existing literature focuses on one side, on tax competition with migration and on the other side, on migration with occupational choices. To the best of our knowledge, the present paper is the first attempt to combine these

two strands of literature into one model. A particularly interesting result we obtain in this context is that tax competition can be globally welfare improving. This contrasts with the findings in the traditional literature. In an influential paper, Kanbur and Keen (1993) who analyze tax competition between two tax revenue maximizing jurisdictions of uneven size, conclude that joint welfare is strictly reduced relative to the closed economy situation.

More specifically, we also contribute to policy issues by highlighting the fact that tax competition can be welfare increasing if entrepreneurship migration is promoted by the competing jurisdictions.

Our paper is organized as follows. The next section sets up the model. Section 3 considers high ability and low ability migration. Free market situation is studied in section 4. Section 5 investigates the equilibrium of tax competition with two types of migration. Welfare implications of tax competition are explored in section 6. Section 7 concludes.

2   The Model

Consider two jurisdictions h and f of equal population size. Total population is normalized to 1. Individuals living in each country are heterogeneous according to their willingness to emigrate in a foreign country, where they can choose to become a worker or an entrepreneur. We consider that the home preference of people is evenly distributed over the interval $[0, \frac{1}{2}]$ in country h and over $[\frac{1}{2}, 1]$ in country f. The closer an individual's type is to $\frac{1}{2}$, the easier she can emigrate. In other words, an individual of type $x \in [0, 1]$ who wants to emigrate abroad incurs a "moving" cost that equals $\left| x - \frac{1}{2} \right|$. It follows that home preference heterogeneity involves imperfect international mobility.

The individuals can choose to become a worker or an entrepreneur. If they become an entrepreneur in country j $(j = h, f)$, they run one firm that hires n_j workers and produces an output y_j with a convex technology given by

$$y_j = A_j n_j^\alpha \quad j = h, f \quad and \quad 0 < \alpha < 1, \tag{1}$$

where A_j stands for the ability of an individual living in country $j = h, f$. Ability is uniform in each country but can be different across countries. In this case, $A_h \neq A_j$.

We assume for the moment that the two countries are closed. Because

6

the population in each country is composed of workers and entrepreneurs we can write $\frac{1}{2} = N_j + N_j n_j$ $(j = h, f)$, where N_j $(j = h, f)$ is the number of entrepreneurs in country j. Each entrepreneur in country j $(j = h, f)$ pays a wage rate w_j to each of its workers and maximizes its profit $\Pi_j = y_j - w_j n_j$ with respect to n_j. It follows that the wage rate equals $w_j = A_j n_j^{\alpha - 1} \alpha$ $(j = h, f)$.

Each individual can freely choose between becoming an entrepreneur or a worker. The number of entrepreneurs N_j $(j = h, f)$ and workers n_j are determined when people are indifferent between both occupations. This occurs when n_j is such that the profit Π_j equals the wage rate w_j. Solving for this condition, we get

$$n_j = \frac{\alpha}{1 - \alpha}, w_j = A_j \beta \tag{2}$$

with $\beta = \alpha \left(\frac{1-\alpha}{\alpha}\right)^{1-\alpha}$ and $\beta \in (\frac{1}{2}, 1)$ because $0 < \alpha < 1$. The number of entrepreneurs N_j^c results[6] from the labor market clearing condition, i.e., $N_j^c(1 + n_j^c) = \frac{1}{2}$ for country j $(j = h, f)$. It follows that

$$N_j^c = \frac{1}{2}(1 - \alpha). \tag{3}$$

Before we assume that individuals can move across the border, we focus on global welfare when individuals are internationally immobile (autarky). Denote by m_j the per capita income that equals the wage rate or a firm's profit in country j. Consequently, we can write $m_j = \Pi_j = w_j = A_j \beta$. Per capita consumption in country j is denoted by c_j. Each country levies a per capita tax t_j $(j = h, f)$ on earnings, which equally applies to the workers and entrepreneurs. Per capita income net of tax is $\Pi_j - t_j = w_j - t_j$, or

$$m_j - t_j = A_j \beta - t_j. \tag{4}$$

If we assume that there is a minimum consumption level c_m , we can write that $m_j - t_j = c_j \geq c_m$. We assume that social welfare in country j when the jurisdictions are closed is given by[7]

$$W_j^c = \frac{1}{2}(m_j - t_j) + \lambda T_j,$$

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[6] The superscript "c" stands for closed economy.

[7] The form of the above objective functions is a special case of the quasi-linear indirect utility function $V_i = x_i y_i + \lambda v(g_h)$, where $v'(g_h) > 0$ and $v''(g_h) = 0$. Note that we use the same specification as in Cai and Treisman (2005).

where $\frac{1}{2}(m_j - t_j)$ is the net national income generated in country j, which is supposed to be spent on private consumption in country j and $T_j = \frac{1}{2}t_j$ $(j = h, f)$ is the total tax revenue in country j. If we consider that jurisdictions are not self-interested governments, we can assume that the collected taxes are used to finance public consumption. The parameter λ measures the jurisdictions' preference for public goods relative to private consumption. We assume that λ is equal across countries and impose that $\lambda > 3$. It is convenient to prove that $W_i \to T_i$ (up to a constant factor) when $\lambda \to +\infty$.[8]

We can write the welfare function of country j $(j = h, f)$ as follows

$$W_j^c = \frac{1}{2}\left[m_j + t_j\left(\lambda - 1\right)\right].$$

Given that $\lambda > 3$, welfare is maximized when the tax rate t_h^c (t_f^c) is highest. This rate is the one which leaves each individual consumer with the minimal consumption level c_m that equals $(1 - \mu)m_j$ with $0 < \mu \leq 1$. We assume that u is equal across countries. The higher the value of μ is, the higher the autarky tax rate will be. As we will see later in the paper, the parameter μ is critical in determining the welfare implications of both tax competition and free market case. It follows that $t_j^c = \mu m_j$ in country j $(j = h, f)$. For the ease of presentation, we normalize A_f to 1. We then set $A_h = \rho A_f = \rho$. Consequently, the parameter ρ $(= \frac{A_h}{A_f})$ indicates the individual ability in country h relative to country f. Without loss of generality, we set $\alpha = \frac{1}{2}$ and hence $\beta = \frac{1}{2}$.

The social welfare in countries h and f become respectively

$$W_h^c = \frac{1}{4}\rho\left[1 + (\lambda - 1)\mu\right], \tag{5}$$

$$W_f^c = \frac{1}{4}\left[1 + (\lambda - 1)\mu\right].$$

Global welfare $W^c = W_h^c + W_f^c$ becomes $W^c = \frac{1}{4}(1 + \rho)\left[1 + \mu(\lambda - 1)\right]$. Note that W^c is increasing in μ and thus, the highest level of global welfare obtained in autarky equals

$$\overline{W}^c = W^c(\mu = 1) = \frac{\lambda}{4}(\rho + 1).$$

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[8]Indeed, we can write $V_i = a\frac{1}{2}(m_j - t_j) + bT_j$ where $a \geq 0$ and $b > 0$ measure respectively the preference of the governments for private and public consumption spending. Because we can write $W_j = a\left[\frac{1}{2}(m_j - t_j) + \lambda T_j\right]$ where $\lambda = \frac{b}{a}$, it follows that $W_j \to T_j$ (up to a constant factor) when $a \to 0$ $(\lambda \to \infty)$.

This case will be useful when we compare autarky with international migration.

3   International mobility

We now assume that the jurisdictions open up their economies to international mobility. Without loss of generality we consider that individuals move from country f to h.

In our model, people may migrate because of ability differences and/or because the existence of tax differences. In the second case, the two jurisdictions can interact by choosing strategically their tax rates. Given that we wish to understand how tax competition impacts welfare relative to autarky we have to separate these two migration causes. For this purpose, we have first to focus on the case (free market mobility) where tax rates faced by individuals are given and not affected by migration. Then, we introduce strategic tax policies intended to maximize domestic welfare. In each case, we compare the impact on welfare relative to the closed economy situation. Thus, we will be capable of determining whether tax competition improves or not social welfare relative to autarky.

Moreover, migrants can be high or low ability individuals. As we shall see, high ability people may be induced to migrate to establish themselves as entrepreneurs in a low ability country where labor is relatively cheap. Low ability people however, may wish to move to a high ability country in order to increase their salary.

Consider that an individual of type $x \in [0,1]$ living in f who decides to stay at home or go abroad. If she produces at home she earns the net income $m_f(A_f) - t_f$. If she decides to move out, she earns $m_h(A_f) - (x - \frac{1}{2}) - t_h$, where $(x - \frac{1}{2})$ is the "moving" cost of the individual x. The individual of type x who is indifferent between moving out or staying at home satisfies the condition

$$m_f(A_f) - t_f = m_h(A_f) - (x - \frac{1}{2}) - t_h.$$

Hence, the share of individuals having an occupation in country h equals

$$x = m_h(A_f) - m_f(A_f) + t_f - t_h + \frac{1}{2}. \qquad (6)$$

Given that migration goes from country f to h, it follows that $x - \frac{1}{2} >$

0. We assume that migration is partial, which means that a fraction of individuals stays in the source country.

3.1 High ability migration

In the following, migrants are supposed to be high ability individuals. We further assume that the entrepreneurs live in the country where they exploit their firm. We consider that high ability individuals move from country f to h and consequently, we have to assume that $A_f > A_h$ or $\rho < 1$. Because the immigrants are by assumption a fraction of their source population, there will be less high ability individuals than low ability individuals in the destination country. For the high ability migrants it will be more advantageous to be entrepreneur and hiring low ability workers than being hired as workers by low ability entrepreneurs. We further suppose that the population of migrants is relatively small compared to that of the receiving country such that all the immigrants with ability A_f are entrepreneurs and the local population with ability A_h are workers and entrepreneurs[9]. Moreover, the small number of immigrants relative to the local population implies that the wage rate is given to the incoming entrepreneurs.

Consequently, the workers' wage rate is determined by the occupational choice of the local population. The income of the local population in country h is $m_h(A_h) = \frac{1}{2}A_h = \frac{\rho}{2}$. Each incoming entrepreneur chooses, for a given wage rate $m_h(A_h)$, the number of employees $n_h(A_f)$ that maximizes the following profit function

$$\Pi_h(A_f) = y_h(A_f) - m_h(A_h)n_h(A_f),$$

where $y_h(A_f) = A_f n_h^{\frac{1}{2}}(A_f)$.

It follows that the optimal number of workers is $n_h(A_f) = \frac{1}{\rho^2}$. Accordingly, the entrepreneurial profit with ability A_f is

$$\Pi_h(A_f) = m_h(A_f) = \frac{1}{2\rho}.$$

It follows that the personal income of the immigrants in country h is higher than that of the local population, namely $m_h(A_f) > m_h(A_h) = \frac{\rho}{2}$

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[9]In our setting, if high ability immigrants decide to become both entrepreneurs and workers, the wage rate will be the same as in the sending country. In that case, high ability individuals will have no incentive to start a business in the receiving country.

given that $\rho < 1$. Moreover, the profit of high-skilled entrepreneurs increases in country h relative to their country of origin $(m_h(A_f) > m_f(A_f) = \frac{1}{2})$ if $\rho < 1$.

The share of individuals having a professional activity in country h equals

$$x = \frac{1}{2\rho} + t_f - t_h.$$

As assumed above, we impose $\frac{1}{2} < x < 1$. Note that the size $n_h(A_h)$ of a local firm in country h is the same as in the closed economy case. The number of local entrepreneurs in country h is N_h^o ("o" stands for open economy) and the number of incoming entrepreneurs is $x - \frac{1}{2}$. Hence, the labor market clearing condition in country h is $N_h^o [1 + n_h(A_h)] + (x - \frac{1}{2}) [1 + n_h(A_f)] = x$. It follows that the number of local entrepreneurs in the two countries are $N_h^o = \frac{\rho^2 + 1 - 2x}{4\rho^2}$ and $N_f^o = \frac{1-x}{2}$, respectively.

3.2 Low ability migration

Now we consider that migrants are low ability individuals. Because there is partial migration from the source country, the destination country will have relatively more people after immigration. Given that the immigrants are lower skilled $(\rho > 1)$, they find it more beneficial to be hired as workers by native entrepreneurs. Because the population in country h exceeds the number of immigrants and that an entrepreneur has to hire at least one worker, the natives in country h will be workers and entrepreneurs.

It follows that income per capita (m_h) in country h will be determined by the occupational choice of the natives. Given that we set $A_f = 1$, $A_h = \rho > 1$, it follows that $m_h(A_f) = m_h(A_h) = \frac{1}{2}\rho$. Income per capita in country f does not change relative to the closed economy case, $m_f(A_f) = \frac{1}{2}$.

The share of individuals having a professional activity in country h equals

$$x = \frac{\rho}{2} + t_f - t_h.$$

The number of entrepreneurs N_h^o in country h satisfies the labor market clearing condition $N_h^o [1 + n_h(A_h)] = x$. It follows that the number of entrepreneurs are $N_h^o = \frac{x}{2}$ and $N_f^o = \frac{1-x}{2}$ in country h and f, respectively.

4 Free market mobility and welfare

In this section, we analyze the welfare implications of entrepreneur and labor migration without tax competition relative to autarky. First, we assume that the tax rates imposed in case of free mobility are the same as in autarky. Considering this assumption, we analyze under which condition on μ free market migration is welfare improving relative to autarky.

Then, we consider the maximum welfare that can be attained in autarky (for $\mu = 1$) as a benchmark and check if for any tax rate, global welfare obtained with free mobility can improve relative to this benchmark. As we will see hereafter, this allows to determine the contribution of tax competition to welfare changes.

4.1 Entrepreneur migration

As above, we consider migration from country f to h and thus we assume $\rho < 1$. As in the closed economy case, the tax rates in countries h and f are respectively $t_h^m = \mu m_h = \frac{1}{2}\mu\rho$ and $t_f^m = \mu m_f = \frac{1}{2}\mu$. The superscript "$m$" stands for the free market case.

The share of individuals having an occupation in country h equals

$$x^m = \frac{1}{2\rho} + \frac{1}{2}\mu - \frac{1}{2}\mu\rho.$$

Migration from country f to h requires $\frac{1}{2} < \frac{\mu - 2 + \sqrt{\mu^2 + 4}}{2\mu} < \rho < 1$ and $\mu \in [0, 1]$.

The welfare functions of countries h and f are respectively

$$
\begin{aligned}
W_h^m &= \frac{1}{2}(m_h(A_h) - t_h^m) + (x^m - \frac{1}{2})(m_h(A_f) - t_h^m) + \lambda x^m t_h^m, \quad (7) \\
W_f^m &= (1 - x^m)(m_f(A_f) - t_f^m) + \lambda(1 - x^m)t_f^m,
\end{aligned}
$$

respectively. We denote global welfare under free market by[10] $W^m(\mu) = W_h^m + W_f^m$.

Entrepreneur immigration is welfare increasing in the receiving jurisdiction (country h) relative to autarky, whereas the source country will be relatively worse off. Indeed, the inflow of entrepreneurs generates in country h

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[10]We show that $W^m = -\frac{1}{4}(\lambda - 1)(\rho - 1)^2\mu^2 + \frac{1}{4\rho}(\rho^2 - 5\rho - \lambda + 3\lambda\rho + 2)\mu + \frac{1}{4\rho^2}(\rho^3 + 2\rho^2 - 2\rho + 1)$.

a higher level of total net income and a larger tax base relative to autarky. However, the outflow of individuals in country f leads to a lower net income and tax revenue relative to autarky.

The global welfare difference between free market and autarky equals

$$W^m - W^c = \frac{1}{4\rho^2} (\rho - 1)^2 (\mu\rho + 1) [1 - \mu\rho (\lambda - 1)].$$

It follows that free market migration improves global welfare relative to autarky it the tax rates are low enough, which means that $\mu < \overline{\mu} = \frac{1}{\rho(\lambda-1)} < 1$. The underlying reasons can be explained as follows. First, free market migration from country f to h increases global net income because the profit of the migrant entrepreneurs increases. However, the tax levied on the migrants decreases. Indeed, in country h the tax rate is $t_h^m = \frac{1}{2}\mu\rho$, while the applicable rate is $t_f^m = \frac{1}{2}\mu$ in the source country. This causes a global tax loss. When the tax rates are low enough, $\mu < \overline{\mu}$, the net income increase exceeds the loss in tax revenue and global welfare improves. Note that the more the jurisdictions value public goods expenditures relative to private goods (λ increases), the lower $\overline{\mu}$ will be. In other words, the likelihood that free market improves global welfare relative to autarky is reduced when λ increases. This is not surprising because the tax loss as a share of joint welfare increases with λ.

We can summarize by the following proposition.

Proposition 1 *In case of free entrepreneurship migration, joint welfare improves relative to the closed economy case only if the autarky tax rates are sufficiently low. However, the more the jurisdictions value public goods expenditures relative to private goods the less it is likely that free entrepreneurship migration improves on autarky.*

4.2   Labor migration

Again, we assume that workers migrate from country f to h. Thus, we assume that $\rho > 1$. As above, the free market tax rates are $t_h^m = \mu m_h = \frac{1}{2}\mu\rho$ and $t_f^m = \mu m_f = \frac{1}{2}\mu$.

The economically active population in country h is

$$x^m = \frac{1}{2}\rho + \frac{1}{2}\mu - \frac{1}{2}\mu\rho.$$

Migration from country f to h requires that $1 < \rho < \frac{2-\mu}{1-\mu}$ and $\mu \in [0, 1]$.

13

The welfare functions of countries h and f are respectively

$$
\begin{aligned}
W_h^m &= x^m(m_h - t_h^m) + \lambda x^m t_h^m, \qquad\qquad (8)\\
W_f^m &= (1 - x^m)(m_f - t_f^m) + \lambda(1 - x^m)t_f^m.
\end{aligned}
$$

As in the case of free entrepreneur migration, welfare increases in the receiving country relative to autarky while the source country is relatively worse off.

For tax rates that remain unchanged relative to autarky, global welfare improves with free migration. This can be explained as follows. First, the migrant workers increase their net income in the receiving country. Moreover, they pay higher taxes ($t_h^m = \frac{1}{2}\mu\rho > t_f^m = \frac{1}{2}\mu$ with $\rho > 1$) relative to their country of origin. For given autarky tax rates, global tax revenue increases. Taken together, these two effects lead to a global welfare increase relative to the closed border case for all autarky tax rate μ.

Proposition 2 *In case of free labor migration, global welfare improves relative to autarky for all $\mu \in [0,1]$*

It follows that opening up the economies to labor migration is welfare increasing for any autarky tax rate, which is not the case for entrepreneur migration (proposition 1).

5 Tax competition

In this section, we analyze the equilibrium tax rates of the game and the corresponding social welfare, assuming that individuals migrate because of ability differences and tax incentives.

5.1 Competing for migrant entrepreneurs

Now, we focus on high-skilled mobility with tax competition. In other words, jurisdictions h and f use the tax instrument to compete for entrepreneurs. In this case, income in country h is $m_h(A_h) = \frac{1}{2}\rho$ for native workers and entrepreneurs and $m_h(A_f) = \frac{1}{2\rho}$ for immigrant entrepreneurs with $\rho < 1$. Income per capita is $m_f(A_f) = \frac{1}{2}$ in country f. First, we determine the equilibrium of the game and then we study how tax competition can impact occupational choices and the resulting social welfare.

The government of country j $(j = h, f)$ maximizes its welfare W_j by setting the tax rate t_j for a given rate t_i of country i $(i \neq j)$.

The welfare functions of countries h and f are given as follows

$$W_h = \frac{1}{2}(\frac{1}{2}\rho - t_h) + (x - \frac{1}{2})(\frac{1}{2\rho} - t_h) + \lambda x t_h,$$

$$W_f = [t_h - t_f - \frac{1}{2}(\rho^{-1} - 1) + \frac{1}{2}]\left[\frac{1}{2} + (\lambda - 1)t_f\right],$$

with $x = \frac{1}{2\rho} + t_f - t_h$. Note that the above objective functions are concave in the own tax rates for $\lambda > 3$.

The FOCs with respect to t_h and t_f yield the best response functions

$$t_h = \frac{1}{2}(t_f + \frac{1}{2}\frac{\lambda - 2}{\lambda - 1}\rho^{-1}),$$

$$t_f = \frac{1}{2}(t_h + \frac{1}{2}\frac{\lambda - 2}{\lambda - 1} - \frac{1}{2\rho} + \frac{1}{2}).$$

The equilibrium tax rates are

$$t_h^* = \frac{1}{3}[\frac{1}{2}\frac{\lambda - 3}{\lambda - 1}\rho^{-1} + \frac{3}{2} - \frac{1}{2}\frac{\lambda}{\lambda - 1}], \tag{9}$$

$$t_f^* = \frac{1}{3}[\frac{1}{2}\frac{\lambda - 3}{\lambda - 1} + \frac{3}{2} - \frac{1}{2}\frac{\lambda}{\lambda - 1}\rho^{-1}].$$

In this case we have $t_h^*, t_f^* > 0$ when $\rho > \frac{\lambda}{2(2\lambda - 3)}$, which is smaller than 1 if $\lambda > 3$. Further, we impose that $t_h^* < m_h(A_h)$, $t_h^* < m_h(A_f)$ and $t_f^* < m_f$, which requires that $\underline{\rho} < \rho < 1$ with $\underline{\rho} = \frac{1}{6(\lambda - 1)}(2\lambda - 3 + \sqrt{16\lambda^2 - 60\lambda + 45})$. Since $\underline{\rho} > \frac{\lambda}{2(2\lambda - 3)}$, in the following we impose $\underline{\rho} < \rho < 1$.

It follows that $t_f^* - t_h^* = \frac{(2\lambda - 3)(1 - \rho^{-1})}{6(\lambda - 1)} < 0$ and $x^* = \frac{\lambda(\rho^{-1} - 1)}{6(\lambda - 1)} + \frac{1}{2}$. To guarantee that individuals migrate from country f to country h, we require that $\frac{1}{2} < x^* < 1$. This is fulfilled when $\underline{\rho} < \rho < 1$ and implies that $t_f^* < t_h^*$. In other words, country h is attractive to migrant entrepreneurs in terms of low labor costs but not in terms of taxes. What happens is the following. The receiving country taxes more than the origin country because it is able to take partly advantage of the higher income immigrants are able to earn. The source country f taxes less because it tries to partially limit activity outflows to the country h. However, notwithstanding the fact that $t_h^* > t_f^*$

the net income of immigrant entrepreneurs will be relatively higher in the receiving country h.

It is interesting to see whether the total number of entrepreneurs increases in the receiving country. When there is tax competition, the equilibrium number of local entrepreneurs is $N_h^* = \frac{\rho^2+1-2x^*}{4\rho^2}$. The number of immigrant entrepreneurs is $x^* - \frac{1}{2}$. In autarky, there are $N_h^c = \frac{1}{4}$ entrepreneurs in country h.

Given the difference $N_h^* + (x^* - \frac{1}{2}) - \frac{1}{4}$, it results[11] that the number of entrepreneurs in country h increases when the ability difference is small $(\rho \in (\frac{\sqrt{2}}{2}, 1))$ and decreases when the ability difference is large $(\rho \in (\underline{\rho}, \frac{\sqrt{2}}{2}))$. Indeed, from above we know that the size of the firm run by an immigrant entrepreneur is $n_h(A_f) = \frac{1}{\rho^2} > 1$ and the size of each local firm equals $n_h(A_h) = \frac{1}{2}$. It follows that the larger the difference in abilities, the more individuals will be workers. The size of the total population in country h being given (equal to $\frac{1}{2}$), there will be less local people who decide to become entrepreneurs. Consequently, the total number of entrepreneurs shrinks. Otherwise, if the difference in abilities is small $(\rho \in (\frac{\sqrt{2}}{2}, 1))$, the scale of each firm is such that their total number increases.

Let's now calculate the equilibrium social welfare in both countries. For this purpose, we substitute the equilibrium tax rates t_h^* and t_f^* into the above welfare equations and obtain

$$W_h^* = \frac{1}{36(\lambda-1)}[\frac{\lambda^2}{\rho^2} + \frac{1}{\rho}(9(\lambda-1)\rho^2 + (4\lambda^2 - 15\lambda + 9)) + (2\lambda-3)^2] \quad (10)$$

$$W_f^* = \frac{1}{36\rho^2(\lambda-1)}(3\rho + \lambda - 4\lambda\rho)^2.$$

5.2 Competing for migrant workers

Now, we assume that jurisdictions h and f use the tax instrument to compete for workers and $A_h > A_f$ $(\rho > 1)$. Income per capita in country h is $m_h(A_f) = m_h(A_h) = \frac{1}{2}\rho$ and $m_f(A_f) = \frac{1}{2}$ in country f. Moreover, we can write $x = t_f - t_h + \frac{1}{2}(\rho - 1) + \frac{1}{2}$. First, we determine the equilibrium of the game and then we analyze how tax competition can impact the occupational choices

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[11]It is easy to show that the difference $N_h^o + (x^* - \frac{1}{2}) - \frac{1}{4} = \frac{1}{12}\frac{\lambda(1-\rho)(2\rho^2-1)}{\rho^3(\lambda-1)}$ is positive when $\rho > \frac{\sqrt{2}}{2}$.

and the resulting welfare. Note that in this scenario, migrants and the local population are paid the same wage.

Government j ($j = h, f$) maximizes its welfare function $W_j = x_j (m_j - t_j) + \lambda x_j t_j$ (with $x_h = x$ and $x_f = 1 - x$) by setting its tax rate t_j for a given tax rate t_i of country i ($i \neq j$). The objective functions are concave in tax rates for $\lambda > 3$.

After maximizing the respective welfare functions we obtain the following equilibrium tax rates

$$t_h^* = \frac{1}{6(\lambda - 1)} (2\lambda - 3 + (\lambda - 3)\rho), \tag{11}$$

$$t_f^* = \frac{1}{6(\lambda - 1)} (4\lambda - 6 - \lambda\rho).$$

It follows that $t_h^*, t_f^* > 0$ when $\rho < \overline{\rho} = \frac{1}{\lambda}(4\lambda - 6)$, which is larger than 1. Furthermore, $t_h^* < m_h$ and $t_f^* < m_f$ if $\rho > \frac{1}{2\lambda}(2\lambda - 3)$, which is smaller than 1. We thus assume that $1 < \rho < \overline{\rho}$.

The tax differential is $t_f^* - t_h^* = \frac{(2\lambda - 3)}{6(\lambda - 1)}(1 - \rho) < 0$ and the active population of the receiving country is $x^* = \frac{\lambda}{6(\lambda - 1)}(\rho - 1) + \frac{1}{2}$. It is easy to see that individuals migrate from country f to country h, $\frac{1}{2} < x^* < 1$, when $1 < \rho < \overline{\rho}$. This implies that $t_h^* > t_f^*$. That is, country h is attractive to migrant workers in terms of high wages although the tax rate is higher than in country f. The reasons of this result are the same as above when we analyzed tax competition with entrepreneur migration.

The total number of entrepreneurs in the receiving country increases relative to autarky since the scale of the firm is unchanged and the total population in country h increases.

The equilibrium social welfare in both countries are

$$W_h^* = \frac{1}{36(\lambda - 1)} (\lambda\rho + 2\lambda - 3)^2, \tag{12}$$

$$W_f^* = \frac{1}{36(\lambda - 1)} (\lambda\rho - 4\lambda + 3)^2.$$

6   Welfare gain and tax competition

In this section, we first investigate whether migration with tax competition can improve welfare relative to the closed economy case for any autarky tax

rate μ. To this purpose, we compare welfare resulting from tax competition with the highest welfare level that can be realized in autarky, namely when $\mu = 1$.

However, welfare changes can result from a joint combination of migration and tax effects. Therefore, in a second step we try to assess the specific welfare contribution of tax competition relative to free market migration.

6.1   Entrepreneur migration

Remember that in this case we impose $\underline{\rho} < \rho < 1$, which means that h is the low ability country. Let's first consider the receiving country h and remember that $\overline{W}_h^c = W_h^c(\mu = 1)$.

After calculations, the welfare difference $\Omega(\rho) = W_h^* - \overline{W}_h^c$ becomes

$$\Omega(\rho) = \frac{A\lambda^2 + B\lambda + C}{36\rho^2\,(\lambda - 1)},$$

with $A = 4\rho^2 - 9\rho^3 + 4\rho + 1$, $B = 3\rho\left(6\rho^2 - 4\rho - 5\right)$ and $C = 9\rho\left(-\rho^2 + \rho + 1\right)$. It follows that $A > 0$, $C > 0$ for $\underline{\rho} < \rho < 1$. Hence, $\Omega(\rho)$ and the polynomial $A\lambda^2 + B\lambda + C$ have the same sign. We see that $\Delta = B^2 - 4AC > 0$ for $\underline{\rho} < \rho < 1$. The roots of $W_h^* - \overline{W}_h^c = 0$ equal[12] $\lambda_1(\rho) < \underline{\lambda}$ (with $\underline{\lambda} = 3$) and $\lambda_2(\rho)$, respectively. Consequently, if $\lambda > \lambda_2$ it follows that $W_h^* - \overline{W}_h^c > 0$. Moreover, we show that $\frac{\partial \lambda_2(\rho)}{\partial \rho} > 0$, $\lambda_2(\underline{\rho}) - \underline{\lambda} < 0$, and $\lim\limits_{\rho \to 1}\left(\lambda_2 - \underline{\lambda}\right) > 0$. Consequently, there exists one unique value $\widehat{\rho}$ $(\underline{\rho} < \widehat{\rho} < 1)$ such that $\lambda_2 = \underline{\lambda}$. Thus, for $\rho \in (\underline{\rho}, \widehat{\rho})$, we have $\lambda_2 < \underline{\lambda}$ and given that $\lambda > \underline{\lambda}$, it follows that $A\lambda^2 + B\lambda + C > 0$. In other words, if the ability difference between the two countries is large enough $(\underline{\rho} < \rho < \widehat{\rho})$, we have $W_h^* - \overline{W}_h^c > 0$.

If the individual ability difference across the countries is relatively small, $\widehat{\rho} < \rho < 1$, the sign of $W_h^* - \overline{W}_h^c$ crucially depends on the value of λ. Specifically, we have $W_h^* - \overline{W}_h^c > 0$ when $\lambda > \lambda_2$ and $W_h^* - \overline{W}_h^c < 0$ when $\underline{\lambda} < \lambda < \lambda_2$.

The intuition is the following. When the difference in individual abilities across countries is sufficiently large (ρ is small), the inflow of entrepreneurs increases total income in the receiving country. Interestingly, this income

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[12]We show that $\lambda_1(\rho) = \frac{3\rho\left(4\rho - 6\rho^2 + 5\right) - 3\sqrt{\rho\left(5\rho + 12\rho^2 - 8\rho^3 + 4\rho^4 - 4\right)}}{2(1-\rho)(5\rho + 9\rho^2 + 1)}$ and $\lambda_2(\rho) = \frac{3\rho\left(4\rho - 6\rho^2 + 5\right) + 3\sqrt{\rho\left(5\rho + 12\rho^2 - 8\rho^3 + 4\rho^4 - 4\right)}}{2(1-\rho)(5\rho + 9\rho^2 + 1)}$.

18

effect increases with ρ. Because tax competition puts pressure on the competing jurisdictions, the equilibrium tax rates will be lower than the autarky rates. However, the tax base in the receiving country h is broadened relative to autarky. Consequently, the impact of migration on the tax revenue of the receiving country can be positive or negative according to the parameters ρ and λ.

Let's first focus on the coefficient ρ. Because we have $\frac{\partial t_h^*}{\partial \rho} < 0$, we can show that, for a given value of λ, the tax revenue effect in country h is positive when ρ is sufficiently small[13]. When $\underline{\rho} < \rho < \widetilde{\rho}$ the revenue effect is positive and negative when $\rho < \widetilde{\rho} < 1$. Consequently, when $\underline{\rho} < \rho < \widetilde{\rho}$ the income and tax revenue effects are positive and the welfare of the receiving country increases relative to the maximum welfare in autarky.[14]

If the difference in the individual abilities is small (ρ is large), the income effect will be weak. However, if the valuation of public goods in the welfare function is high (λ is large enough), the equilibrium tax rate in country h, will be relatively high since $\frac{\partial t_h^*}{\partial \lambda} > 0$. It is then possible to show that the equilibrium tax revenue increases in λ, namely $\frac{\partial}{\partial \lambda}(t_h^* x^*) > 0$[15]. It follows that tax competition improves welfare in country h relative to autarky when $\mu = 1$.

In country f, the outflow of population induces negative income and negative tax revenue effects. Consequently, tax competition decreases the welfare of the source country relative to autarky when $\mu = 1$.

We can now state the following proposition.

Proposition 3 *In case of tax competition, immigration of entrepreneurs is welfare increasing in the receiving country relative to the closed-border case for any autarky tax rate if at least one of the following conditions is satisfied:*

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[13]The tax revenue difference under competition and autarky is, $\Psi(\rho) = t_h^* x^* - \frac{1}{2} t_h^c (\mu = 1) = \frac{(\lambda - 3\rho + 2\lambda\rho)(\lambda - 3\rho + 2\lambda\rho - 3)}{36\rho^2 (\lambda - 1)^2} - \frac{1}{4}\rho$. It is then possible to show that the expression $\Psi(\rho)$ is positive for $\rho = \underline{\rho}$ and decreases with ρ. Consequently, for a given value of λ we have $\Psi(\rho) > 0$ when $\underline{\rho} < \rho < \widetilde{\rho}$, and $\Psi(\rho) < 0$ when $\rho < \widetilde{\rho} < 1$. Furthermore, $\widetilde{\rho}$ increases with λ, $\frac{\partial \widetilde{\rho}}{\partial \lambda} > 0$.

[14]It is possible to show that we can have $\widetilde{\rho} \gtrless \widehat{\rho}$. If $\widetilde{\rho} < \widehat{\rho}$ but $\rho \in (\widetilde{\rho}, \widehat{\rho})$, although the revenue effect is negative it is dominated by the positive income effect so that $W_h^* - W_h^c > 0$.

[15]Indeed, $\frac{\partial}{\partial \lambda}(t_h^* x^*) = \frac{1}{36\rho^2 (\lambda - 1)^3} \left(2(2\lambda - 3)\rho^2 + 2(2\lambda - 3)\rho + (\lambda + 3)\right) > 0$. In other words, the tax revenue of country h increases in λ for a given value of ρ.

(a) the difference in the individual ability between the two countries is large enough.

(b) the competing jurisdictions put a sufficiently high relative valuation on public goods.

Now, we analyze whether the international flow of high ability entrepreneurs can improve joint welfare $W^* = W_h^* + W_f^*$ relative to the closed-border case for any tax rate that can prevail in autarky. To this purpose, we consider the following difference

$$W^* - \overline{W}^c = \frac{\widehat{A}\lambda^2 + \widehat{B}\lambda + \widehat{C}}{36\rho^2\,(\lambda - 1)}, \qquad (13)$$

with $\widehat{A} = 11\rho^2 - 9\rho^3 - 4\rho + 2 > 0$, $\widehat{B} = 9\rho\,(-3\rho + 2\rho^2 - 1) < 0$ and $\widehat{C} = 9\rho\,(2\rho - \rho^2 + 1) > 0$ for $\rho \in (0,1)$. It follows that $\Delta = \widehat{B}^2 - 4\widehat{A}\widehat{C} > 0$ for $\underline{\rho} < \rho < 1$. The two real roots of $W^* - \overline{W}^c = 0$ are[16] $\widehat{\lambda}_1(\rho) < \underline{\lambda}$ and $\widehat{\lambda}_2(\rho) > \underline{\lambda}$, respectively. Therefore, we have $W^* - \overline{W}^c > 0$ if $\lambda > \widehat{\lambda}_2$ and $W^* - \overline{W}^c < 0$ if $\underline{\lambda} < \lambda < \widehat{\lambda}_2$.

Consequently, when λ is sufficiently large, the welfare gain in the receiving country outweighs the welfare loss in the source country.

Further, we can prove that $\frac{\partial \widehat{\lambda}_2}{\partial \rho} > 0$. This implies that the higher the difference of ability between the two jurisdictions (the value of ρ is relatively small), the smaller the value of $\widehat{\lambda}_2$ will be. Consequently, if λ is large enough, migration with tax competition is welfare increasing relative to the closed border case for any tax rate that can prevail in autarky. Note that with tax revenue maximizing[17] jurisdictions, there is always welfare dominance of tax competition relative to autarky.

The following proposition concludes.

Proposition 4 *Entrepreneurship migration with tax competition increases joint welfare relative to the closed economy case for any autarky tax rate if the competing jurisdictions put a sufficiently high valuation on public good expenditures.*

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[16]We show that $\widehat{\lambda}_1(\rho) = \frac{9\rho\left(3\rho - 2\rho^2 + 1\right) - 3\sqrt{\rho\left(9\rho + 50\rho^2 - 23\rho^3 + 8\rho^4 - 8\right)}}{2(1-\rho)(9\rho^2 - 2\rho + 2)}$ and $\widehat{\lambda}_2(\rho) = \frac{9\rho\left(3\rho - 2\rho^2 + 1\right) + 3\sqrt{\rho\left(9\rho + 50\rho^2 - 23\rho^3 + 8\rho^4 - 8\right)}}{2(1-\rho)(9\rho^2 - 2\rho + 2)}$.

[17]Note that in this case $\lambda \longrightarrow \infty$.

From proposition 1, we know that opening up the economies to free entrepreneurship migration can be welfare-reducing relative to autarky. However, allowing for tax competition entrepreneur migration is welfare dominant relative to autarky when λ is large enough. Consequently, the corollary of proposition 1 and 4 is that tax competition can contribute by itself to global welfare gains in case of entrepreneurship migration. Moreover, when the competing jurisdictions maximize their tax revenue respectively, entrepreneurship migration always increases joint welfare relative to autarky.

This last result appears at odds with classical tax competition models (see for example, Kanbur and Keen, 1993).

The following proposition results from the above discussion.

Proposition 5 *In case of entrepreneurship migration, tax competition increases joint welfare relative to free market migration when the competing jurisdictions put a sufficiently high valuation on public good expenditures.*

The underlying intuition can be explained as follows. In the free market case, the source country f has not the opportunity to adjust its tax rate to retain individuals from moving out into country h. With tax competition this becomes feasible. First, note that the free market (or autarky) tax rate in country f is higher than in country[18] h, which in addition to the labor cost advantage in country h encourages high ability individuals to emigrate. However, when we allow for tax competition we get the reverse situation, namely the tax rate will be lower in the source country $(t_f^* < t_h^*)$. As a consequence, it is easy to show that emigration of high ability individuals shrinks with tax competition relative to free market migration[19].

It follows that the welfare loss incurred by country f will be less than in case of free market migration. This gain will compensate the smaller increase of welfare in the receiving country h relative to the free market solution. As a result, the global effect of tax competition will increase joint welfare.

6.2 Labor migration

We now assume that jurisdictions h and f use the tax instrument to compete for workers. This case requires that $A_h > A_f$ $(\rho > 1)$. First, we compare

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[18]It is easy to show that $t_f^m - t_h^m = \frac{1}{2}\mu(1-\rho) > 0$.

[19]Indeed, it is easy to calculate that $x^* - x^m = \frac{1}{6}(\rho - 1)\frac{2\lambda - 3 + 3\mu\rho(\lambda - 1)}{\rho(\lambda - 1)} < 0$, given that $\rho < 1$ and $\lambda > 3$.

welfare changes when the countries h and f open up to tax competition.

Consider country h. Remember that the highest autarky welfare that can be attained in country h is $\overline{W}_h^c = \frac{1}{4}\rho\lambda$. The difference between the level of welfare resulting from tax competition (W_h^*) and the highest autarky welfare equals

$$W_h^* - \overline{W}_h^c = A\rho^2 + B\rho + C, \tag{14}$$

where $A = \frac{\lambda^2}{36(\lambda-1)} > 0$, $B = -\frac{\lambda}{36}\frac{5\lambda-3}{\lambda-1} < 0$ and $C = \frac{(2\lambda-3)^2}{36(\lambda-1)} > 0$. Solving $W_h^* - \overline{W}_h^c = 0$ for ρ we obtain two real roots[20] $\rho_h^1 < 1$ and $\rho_h^2 > \overline{\rho}$, respectively.

According to the sign of the coefficients A, B and C, it follows that $W_h^* - \overline{W}_h^c < 0$ for $1 < \rho < \overline{\rho}$. In other words, tax competition decreases welfare in country h relative to autarky when $\mu = 1$. When we consider the source country f, tax competition is always welfare reducing relative to autarky when $\mu = 1$ because emigration reduces total net income and tax revenue.

However, when the autarky tax rates are low enough (μ low enough), tax competition can in case of labor migration increase welfare relative to autarky. We can prove this in the following way.

We know that in autarky joint welfare $W^c(\mu)$ increases in μ while global welfare resulting from tax competition W^* is independent of μ. Hence the difference $\Psi(\mu) = W^* - W^c(\mu)$ is decreasing in μ. Moreover, we proved above that joint welfare W^* can never be higher than the maximum level of welfare realized in autarky $(\overline{W}^c)$. Because $W^c(\mu = 0) = \frac{1}{4}(\rho + 1)$, we can write

$$\Psi(\mu = 0) = A\rho^2 + B\rho + C,$$

where $A = \frac{\lambda^2}{18(\lambda-1)} > 0$, $B = -\frac{1}{36(\lambda-1)}\left(4\lambda^2 + 9\lambda - 9\right)$, and $C = \frac{1}{36(\lambda-1)}\left(20\lambda^2 - 45\lambda + 27\right)$. We verify that $\Delta = B^2 - 4AC < 0$ if $\lambda > 3$. It follows that $\Psi(\mu = 0) > 0$ for $\lambda > 3$.

Now, knowing now that $\Psi(\mu = 0) > 0$, $\Psi(\mu = 1) < 0$ and $\Psi'(\mu) < 0$, it follows that there exists one unique $\mu = \widehat{\mu}$ such that $\Psi(\mu) = 0$. Further, we can prove[21] that there exists a lower bound $\underline{\mu}$ such that $\underline{\mu} < \widehat{\mu}$ that satisfies $t_j^* < t_j^c$ $(j = h, f)$ and $\Psi(\mu = \underline{\mu}) > 0$.

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[20]We obtain that $\rho_h^1 = \frac{1}{2\lambda}\left(5\lambda - 3 - 3\sqrt{(\lambda-1)(\lambda+3)}\right)$ and $\rho_h^2 = \frac{1}{2\lambda}\left(5\lambda - 3 + 3\sqrt{(\lambda-1)(\lambda+3)}\right)$.

[21]We show that $t_j^* < t_j^c = \mu m_j$ $(j = h, f)$ if $\mu > \underline{\mu} = \frac{2\lambda-3}{3\rho(\lambda-1)} + \frac{\lambda-3}{\lambda-1}$. Further we see that $\Psi(\mu = \underline{\mu}) > 0$.

22

To sum up, tax competition with labor migration decreases joint welfare relative to autarky if μ is large enough $(\mu > \widehat{\mu})$. Otherwise $(\underline{\mu} < \mu < \widehat{\mu})$, it increases joint welfare.

In proposition 2 we proved that free labor migration improves joint relative to autarky for all μ. Consequently, in case of labor migration, tax competition can deteriorate joint welfare relative to free market migration. This is different from the result we got in the case of entrepreneurship migration, where tax competition contributes to joint welfare improvement.

From the above consideration we can deduce the following conclusion.

Proposition 6 *When the autarky tax rate is high $(\mu > \widehat{\mu})$, tax competition increases global welfare relative to the closed border case only if there is entrepreneurship migration.*

The intuition underlying this result can be explained as follows.

In case of entrepreneurship migration, the autarky tax gap between the countries f and h is positive $(t_f^m - t_h^m > 0)$, while it is negative in case of labor migration $(t_f^m - t_h^m < 0)$. In this last case, country f has less room for underbidding the tax rate of country h relative to the former case. In addition, the tax gap $t_f^m - t_{fh}^m = \frac{1}{2}\mu(1 - \rho)(\rho > 1)$ becomes even more negative when μ increases. Thus, it is increasingly difficult to underbid the tax rate of country h when μ rises. Consequently, when μ is high enough[22], the jurisdiction f will no more be able to retain further emigration by using its tax variable. Even worse, tax competition will further increase labor emigration, as we can show that $x^* - x^m > 0$ for $\mu > \frac{2\lambda-3}{3\lambda-3}$. Accordingly, if μ is high enough, the welfare loss due to tax competition increases in country f, which is not compensated by the welfare gain in country h. Joint welfare decreases with tax competition relative to free market migration.

7   Conclusion

In this paper, we investigate the welfare implications of tax competition, assuming that individuals can choose their occupation as workers or entrepreneurs across two countries. Migration can be induced by inter-jurisdictional ability and tax differences. To assess the contribution of tax competition on

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[22]This is true when $\mu > \frac{2\lambda-3}{3\lambda-3}$.

welfare, we consider as benchmarks, the autarky case with no migration and the free market migration without tax competition.

The paper sheds new light on migration when different types of occupational choices can de decided. In particular, it demonstrates that the welfare implications of tax competition differ, whether we consider entrepreneurship or labor migration. In case of entrepreneur migration, tax competition can improve joint welfare relative to the closed border case for any autarky tax rate, which is not true for labor migration. Finally, if autarky tax rates are relatively high, the only way tax competition can improve joint welfare is to allow for entrepreneurship migration. It follows that the results of the paper can have some policy relevance.

Possible extensions can be made in future work. One way is to include heterogenous types of individuals within each jurisdiction. That is, one can assume that each country is populated by both high ability and low ability population. In this case, migration driven by tax differentials across countries will possibly result in two-way migration as in Schmitt and Soubeyran (2006). The other direction is to consider the effects of migration driven by tax differentials on wages, unemployment, and welfare in the competing countries.

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