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Abstract

The paper provides an equilibrium analysis of how countries compete for migrants. The type of competition (tax or transfer competition) depends on whether the competing countries have similar policy preferences. With symmetric preferences, countries compete in taxes for migrants. With asymmetric preferences, migration competition takes place in income support levels. The results are robust to the degree of mobility and to whether high-income or low-income households are mobile. The results are relevant, e.g., for federal policies that tackle inefficient migration competition and for evaluating whether a country may wish to adopt unilateral 'migration-purchase' policies.

JEL-Code: H700, J200, F200.

Keywords: migration, redistribution, income taxation, government strategy, endogenous type of competition.

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1 Introduction

Immigration is a prevalent policy issue in many countries. The creation of the European Union (EU) and, in particular, the 1992 Single Market Initiative have lowered the costs of migration among EU member states. The recent EU Eastern Enlargement has contributed to this trend and has led to non-negligible migration flows to core EU member states.[1] Similarly, immigration in the United States (US) and, in particular, low-skilled immigration from Mexico is significant in scale and the associated economic and fiscal consequences are controversially debated in US politics.[2] Migration flows do not leave public policies unaffected. Most notably, migration and tax-transfer systems are inherently intertwined. Migrants decide on the country of residence also with an eye to how generous social assistance payments are and how heavily the government taxes market incomes.[3] This provides incentives for governments to compete in these fiscal instruments to attract beneficial migrants and to limit undesirable welfare migration.[4]

This paper provides an analysis of how governments behave in fiscal competition for migrants. In particular, it not only characterizes the level of taxes and transfers and their efficiency implications (as in previous literature), but also in which of the two fiscal variables governments compete for migrants. Competition in taxes or transfers arises endogenously in our analysis and the precise form of competition depends on which interest dominates government policy-making. We show that when governments have symmetric preferences, presenting the interest of either high-income or low-income households living within their jurisdictions, then countries compete in taxes. Albeit the equilibrium mode of competition is identical for the two policy objectives, the economic incentives underlying the result in

[1] See, e.g., Dustmann, Frattini and Halls (2010) for an evaluation of immigration flows from the recent EU accession countries to the United Kingdom (UK). The share of immigrants from accession countries as a proportion of the UK working-age population increased from 0.01 per cent to 1.3 per cent by the beginning of 2009. As to stocks of immigrants, Peri (2008) reports that immigrants as a share of the native population are on average 5 per cent for EU15 countries. The corresponding numbers for classical immigration countries are 27.5 per cent (Australia), 19.1 per cent (Canada), 23 per cent (Switzerland), and 13.5 per cent (US).

[2] See Borjas and Katz (2007) and Chiquiar and Hanson (2005) for a discussion of the effects of immigration on the US economy.

[3] Empirical evidence on welfare-induced migration is provided in Borjas (1999), Gelbach (2004), McKinnish (2007), Fiva (2009) and Peri (2009), among others.

[4] Migration competition links tax and transfer levels across jurisdictions. For instance, Figlio, Kolpin and Reid (1999) and Saavedra (2000) estimate the interdependence of welfare benefits among US states. They find that welfare benefits are positively related to the benefit levels in neighboring states. This is consistent with the notion that migration provides a downward pressure on welfare spending. See Brueckner (2000) for a review of the literature, also summarizing estimates of earlier empirical studies for the US.

the two cases are diametrically distinct. While a government that focuses on the interest of high-income households chooses income taxes as its strategic variable in order to make transfer policy in the neighboring countries less generous, a government that focuses on low-income households competes in income taxes to raise the amount of per-capita transfers in neighboring countries. Differently, when countries pursue distinct policy objectives, the equilibrium prediction is that countries compete in transfers. We further show that the results are robust to whether high-skilled or low-skilled households are mobile and to whether migration is costly, as long as moving costs are not prohibitively high.

Clarifying which type of competition governments opt for is helpful in precisely predicting the redistributive and efficiency effects of migration competition. In particular, the two endogenously arising modes of competition give rise to distinct policy implications. For instance, tax and transfer competition impair efficiency of policy choices differently. Understanding the type of competition is hence crucial for the design of corrective policies, which e.g. federal governments devise for lower-level governments that compete for migrants. Transfer competition will lead to larger inter-state fiscal externalities. The matching rate of the Pigouvian grant should correspondingly be adjusted compared with tax competition to prevent an 'under-correction' of externalities. Further, absent a central authority, countries may adopt unilateral policies to control migration. These policies might become ineffective in influencing migration flows when policy makers erroneously judge the form of competition in which neighboring countries engage. For instance, high-income countries might voluntarily pay transfer to low-income countries in order to limit low-skilled migration.[5] As shown in the paper, such 'migration-purchase' policies may be perceived to be neutral for migration flows provided the low-income country competes in transfers. In this case, the receiving county may use the inflow of transfers to lower taxes on rich households. Incomes of low-income households will most likely not change and so do their incentives to migrate. It is only when the receiving country competes in taxes that transfers to low-income households might be conjectured to rise in order to balance the budget. Incentives to migrate will be diluted, as intended by the unilateral transfer policy.

[5]For instance, transfer payments between EU member states might be interpreted in this vein. EU structural funds are intended to increase per-capita income in low-income regions in the EU, see Boldrin and Canova (2003). Thereby, the funds potentially limit migration flows to high-income regions. The same type of reasoning likely applies to equalization transfers within a federation (such as Australia, Canada and Germany, for instance) and, more broadly, to development aid. See, e.g., Myers (1990) for a theoretical treatment of voluntary 'migration-purchase' policies.

The issue of how migration influences policy choices is widely analyzed in the literature. Existing studies focus on the effect of migration on the level of taxes and transfers and the associated redistributive and efficiency implications (e.g., Epple and Romer, 1991; Wildasin, 1991; Cremer and Pestieau, 1998; Hindriks, 1999; Razin, Sadka and Swagel, 2002 and Poutvaara, 2007).[6] The literature does not analyze the type of competition governments opt for by assuming that governments compete in either taxes or transfers. Wildasin (1989) and Koethenbuerger (2011) look at the type of competition governments engage in. However, they do not lean themselves to the behavior of governments in the presence of migration, the inherent role of preference (a)symmetries and to how strategic behavior may undermine the effectiveness of well-established policy tools.[7]

The observation that the policy objective of governments matters for the structure of fiscal policies and the induced migration outcomes conforms with previous literature. For instance, Mansoorian and Myers (1997) show that the efficiency of migration competition depends on which metric the government uses in evaluating fiscal policies.[8] The implications of the governments' policy objectives for the type of fiscal competition (tax vs. transfer competition) have not been established yet.

Cremer and Pestieau (1998) and Cremer and Goulão (2011) analyze competition in social insurance systems when benefits might be uniform (Beveridgean system) or related to income (Bismarckian system). They assume that taxes are strategically set and transfers adjust residually. Interestingly, they look into the strategic choice of the type of social insurance (Beveridgean vs. Bismarckian). For instance, Cremer and Goulão (2011) show that when a government is only interested in insuring low-income households against income shocks, it may strategically choose to deviate from the straightforward choice of a Bismarckian system and may opt for a Beveridgean system. The papers differ from this analysis in terms of the dimension of migration competition that is endogenously chosen by jurisdictions. We focus on the choice between tax and transfer competition.

The paper shows how governments try to make their countries more or less attractive as a migration magnet. It thereby sheds light on one dimension of how governments try to

[6] See Cremer and Pestieau (2004) for a review of the literature.

[7] Wildasin (1989) analyzes the type of fiscal competition when capital is mobile. Wildasin adopts a representative household framework, as common in the capital tax competition literature. Koethenbuerger (2011) equally adopts a representative agent model. Different to Wildasin, Koethenbuerger assumes that resources are immobile.

[8] Boadway (2004) provides a discussion of the literature.

get a competitive advantage over other countries. The policy is presumably complementary to other policies that countries strategically use in international competition, such as trade policy, for instance. However, the structure of government incentives underlying the findings is qualitatively different to that known from strategic trade policy (Brander, 1995). When adopting strategic trade policy by, e.g., granting export subsidies, a country shifts the best responses of its domestic firms, just to gain a competitive advantage vis-à-vis foreign firms. In our setting, a country strategically manipulates the other countries' policy best responses when choosing how to compete for migrants.[9]

The paper is organized as follows: Section 2 introduces the basic model, followed by a characterization of government behavior, for a given type of migration competition, in Section 3. Section 4 analyzes the endogenous emergence of tax or transfer competition, and Section 5 discusses extensions of the basic model. Section 6 provides a discussion of the findings. Finally, Section 7 summarizes the results and draws some concluding remarks.

2 Model

We set up a canonical model of migration. Consider two potentially asymmetric jurisdictions. There are high-income and low-income households in both jurisdictions. Each household supplies a fixed amount of labor that is normalized at unity. High-income households in jurisdiction i receive a wage w_i^h and pay taxes T_i. Differently, low income households earn a wage income w_i^l and receive a public transfer payment z_i. Output in each jurisdiction is produced using the production function $f_i(l_i^h, l_i^l)$ where l_i^h and l_i^l denote the number of high-income and low-income households that reside in jurisdiction i. The production function has constant returns to scale and exhibits a positive and declining marginal productivity of the two inputs. Both inputs are thereby complements in production.

We start out with the assumption that low-income households are mobile between the two jurisdictions while high-income households are immobile. Low-income households migrate until their gross income is equalized, i.e. $w_1^l + z_1 = w_2^l + z_2$.[10] The migration equilibrium

[9] In existing studies of migration competition (adhering to tax or transfer competition), changes in the level of fiscal variables do not shift policy best responses. Instead, countries 'move along' the other countries' policy best responses when altering their own policy.

[10] The arbitrage condition implies that households do not migrate into the welfare state. They are integrated into the labor market. For instance, Dustmann, Frattini and Halls (2010) document that in the UK migrants from the recent EU accession countries are on average more skilled than the UK workforce and do not have lower labor force participation rates than natives. Further, the migration arbitrage condition assumes that

condition and the migration flow condition $dl_i^l + dl_j^l = 0$ imply

$$\frac{dl_i^l}{dz_i} > 0 \quad \text{and} \quad \frac{dl_j^l}{dz_i} < 0. \tag{1}$$

A more generous transfer payment in jurisdiction i incentivizes low-income households to migrate from jurisdiction j to jurisdiction i. Given our assumption about mobility, we may set $l_i^h = 1$ without loss of generality. Low-income households receive a competitive wage in each jurisdiction. High-income households receive the residual output share:

$$w_i^l = df_i/dl_i^l \quad \text{and} \quad w_i^h = f_i(\cdot) - w_i^l l_i^l. \tag{2}$$

The output share w_i^h might also be interpreted as income accruing to some fixed, non-labor inputs that are supplied by high-income households, such as land. Taxes and transfer payments are linked via the budget constraint

$$T_i = z_i l_i^l. \tag{3}$$

Each jurisdiction non-cooperatively decides on the level of its taxes and transfer payments. The government chooses the policy instruments so as to maximize the well-being of the immobile households that is determined by the income level $y_i^h = w_i^h - T_i$. The view may be motivated by the stronger incentives of immobile households to shape political decisions since their well-being is more closely tied to the jurisdiction in which they live. Also, turnout rates are found to be higher for high-income households. Later on, we will account for the possibility that low-income households determine policy incentives. Conceptually, both views might also be borne out of a political environment in which the median voter (either high-income or low-income) is politically decisive. See Epple and Romer (1991), Cremer and Pestieau (1998), and Razin, Sadka and Swagel (2002), for instance.

Each jurisdiction has the two instruments T_i and z_i at its disposal, but can only decide on one instruments while the other instrument adjusts so as to balance the public budget (3). As it will turn out, deciding on taxes or transfers leads to different income levels for high-income households and the government thus prefers one over the other. In the following we characterize the choice of the instrument with which governments compete for migrants. To this end, we allow for the following sequence of decisions:

migrants have access to the tax-transfer system of the destination country as natives have. This corresponds to the eligibility rules that apply to native households that migrate within the EU and the US, for instance.

Stage 1: Jurisdictions simultaneously choose whether to chooses taxes or transfers in competition.

Stage 2: Jurisdictions simultaneously choose the level of the policy variable chosen at the first stage.

Stage 3: Low-income households decide to migrate and firms choose labor demand.

Stage 4: Production takes place, wages $\{w_i^h, w_i^l\}_{i=1,2}$ are paid, taxes $\{T_i\}_{i=1,2}$ are collected, transfers $\{z_i\}_{i=1,2}$ are paid out to households, and households consume.

We solve the game backwards to characterize a subgame-perfect equilibrium (in pure strategies) in the choice of the strategic policy instruments.

3 Implications of different modes of competition

Given the two strategies a jurisdiction can use to compete for migrants, we can distinguish between four policy regimes. For instance, in a (T_i, T_j)-regime both jurisdictions strategically choose the tax rate to compete with each other. In such an environment, jurisdiction i chooses the tax rate to solve

$$\max_{T_i} \quad y_i^h = w_i^h - T_i \quad \text{s.t.} \quad (1), (2) \text{ and } (3), \tag{4}$$

taking the tax rate T_j as given. The first-order condition is

$$-f_i'' \, l_i^l \, \Omega_i|_{dT_j=0} \left. \frac{dz_i}{dT_i} \right|_{dT_j=0} = 1, \tag{5}$$

where

$$\Omega_i|_{dT_j=0} = \frac{dl_i^l}{dz_i} + \frac{dl_i^l}{dz_j} \left. \frac{dz_j}{dz_i} \right|_{dT_j=0} \tag{6}$$

is the change in the number of low-income households in jurisdiction i. The tax rate choice balances the marginal effect migration has on the wage income of high-income households and the fiscal costs these households have to bear at the margin. The migration response $\Omega_i|_{dT_j=0}$ includes the direct effect of a higher transfer payment z_i and the repercussion that follows from the migration-induced response in jurisdiction j's transfer payment. In particular, a more generous transfer payment in jurisdiction i reduces the number of transfer recipients in jurisdiction j. Since jurisdiction i perceives jurisdiction j to keep the tax rate constant, the budgetary adjustment is conjectured to take place on the expenditure side in form of a rise

in transfer payments z_j, as captured by the term $\frac{dz_j}{dz_i}\Big|_{dT_j=0} > 0$. Formally, the term follows from differentiating the budget constraint (3) (re-indexed to j) for a given tax rate T_j, while taking the migration flow (1) into account. Thus,

$$\frac{dz_j}{dz_i}\Big|_{dT_j=0} = -\frac{z_j \frac{dl_j^l}{dz_i}}{l_j^l + z_j \frac{dl_j^l}{dz_j}} > 0. \tag{7}$$

Inserting (7) into the migration response (6) and using (1) gives

$$\Omega_i|_{dT_j=0} = \frac{\frac{dl_i^l}{dz_i} l_j^l}{l_j^l + z_j \frac{dl_j^l}{dz_j}} > 0. \tag{8}$$

The overall migration flow to jurisdiction i is positive, reflecting the second-order nature of the budgetary repercussion in jurisdiction j and its effect on migration.

The third term on the left hand side of (5), $\frac{dz_i}{dT_i}\Big|_{dT_j=0}$, captures the rise in transfer payments in response to a higher tax rate. Totally differentiating (3), using the migration flow condition (1) and noting the budgetary adjustment (7), which a policy change in jurisdiction i generates through the rise in jurisdiction j's transfer level, yields

$$\frac{dz_i}{dT_i}\Big|_{dT_j=0} = \frac{1}{l_i^l + z_i \underbrace{\left(\frac{dl_i^l}{dz_i} + \frac{dl_i^l}{dz_j} \frac{dz_j}{dz_i}\Big|_{dT_j=0} \right)}_{=\Omega_i|_{dT_j=0}}} > 0. \tag{9}$$

The bracketed term in the denominator equals the total migration flow in response to the transfer change in the two jurisdictions, $\Omega_i|_{dT_j=0}$. Following (8), the migration response is positive, implying that z^i and T^i are positively related.

In a (z_i, T_j)-regime, jurisdiction i chooses the transfer payment directly and the tax rate residually follows from the budget constraint (3). Formally, the tax rate change $\frac{dT_i}{dz_i}\Big|_{dT_j=0}$ is the inverse of (9). Hence, the first-order condition for z_i is (5) multiplied by the residual variation in the tax rate, $\frac{dT_i}{dz_i}\Big|_{dT_j=0}$. It becomes evident that condition (5) still describes optimal policy. Conditional on the tax rate T_j, tax-transfer policy in jurisdiction i is thus independent of whether jurisdiction i chooses to compete in taxes or transfers.

Jurisdiction i's policy choice will change when the neighboring jurisdiction competes in transfers rather than taxes. For instance, in a (T_i, z_j)-regime jurisdiction i chooses its tax rate so as to solve (4), but now taking the amount of transfers z_j as given. The resulting

first-order condition is

$$-f_i'' l_i^l \, \Omega_i|_{dz_j=0} \left.\frac{dz_i}{dT_i}\right|_{dz_j=0} = 1, \tag{10}$$

where $\Omega_i|_{dz_j=0} = \frac{dl_i^l}{dz_i}$ is the migration flow associated with a higher transfer payment in jurisdiction i. Different to the migration response $\Omega_i|_{dT_j=0}$ in the first-order condition (5), the response only includes the direct effect of a rise in z_i. An outflow of migrants in jurisdiction j reduces expenditures in that region. Unlike in the (T_i, T_j)-regime, jurisdiction j balances the budget by lowering the tax rate rather than increasing transfer payments. The adjustment leaves the migration flow unaffected. In fact, given that jurisdiction j will not try to keep some of the low-income households by raising the transfer payment, more low-income households will migrate to jurisdiction i and increase the gross income of high-income households in this jurisdiction, i.e.

$$\Omega_i|_{dz_j=0} > \Omega_i|_{dT_j=0} \, . \tag{11}$$

As such, when facing a jurisdiction that fixes transfer payments, jurisdiction i finds it more beneficial to attract migrants through fiscal policy. As captured by the third term in (10), a counteracting incentive effect is that tax revenues have to be shared among more migrants which implies that the rise in jurisdiction i's per-capita transfer z_i in response to a hike in its tax rate becomes more modest. Concretely, differentiating (3), while noting (1), and comparing the resulting term with (9) yields

$$\left.\frac{dz_i}{dT_i}\right|_{dT_j=0} > \left.\frac{dz_i}{dT_i}\right|_{dz_j=0} = \frac{1}{l_i^l + z_i \frac{dl_i^l}{dz_i}}. \tag{12}$$

The more modest transfer rise dilutes incentives to compete for migrants, c.f. conditions (5) and (10). The diluting effect, however, is a consequence of the migration response differential (11) and, thereby, is a second-order effect. It attenuates the impact of the migration flow differential (11) on policy incentives, but does not offset it.[11]

Finally, when jurisdiction i chooses the transfer payment strategically ((z_i, z_j)-regime), the relevant first-order condition is condition (10) multiplied by $\left.\frac{dT_i}{dz_i}\right|_{dz_j=0}$. The latter term is the residual adjustment in the tax rate and is the inverse of the right-hand side of the

[11] Formally, using $\Omega_i|_{dz_j=0} = \frac{dl_i^l}{dz_i}$, (8), (9) and (12) shows that

$$\Omega_i|_{dz_j=0} \left.\frac{dz_i}{dT_i}\right|_{dz_j=0} > \Omega_i|_{dT_j=0} \left.\frac{dz_i}{dT_i}\right|_{dT_j=0}.$$

inequality in (12). The first-order condition naturally coincides with (10). For a given level of z_j, it provides identical policy incentives for the same reason as the two regimes (T_i, T_j) and (z_i, T_j) are equivalent for jurisdiction i in terms of policy incentives. Thus,

Proposition 1: *(i) For a given choice of the policy variable in jurisdiction j, jurisdiction i chooses the same tax-transfer policy in a (T_i, a_j)-regime and in a (z_i, a_j)-regime, $a \in \{T, z\}$. (ii) In a (a_i, z_j)-regime, jurisdiction i is incentivized to choose a higher tax rate and transfer payment compared with a (a_i, T_j)-regime, $a \in \{T, z\}$.*

The intuition for part (i) is that, fixing the strategic policy variable of jurisdiction j, it is immaterial whether the rise in transfer payments z_i follows directly from a rise in the expenditure category or indirectly from budgetary adjustments in response to a rise in the tax rate. It only matters in which variable the neighboring jurisdiction competes; c.f. part (ii) of Proposition 1. The neighboring jurisdiction may exploit the interdependence when choosing how to compete for migrants, as analyzed next.

4 Choosing how to compete

In analyzing the equilibrium choice of the strategic policy variable, we compare the income level y_i^h in the four policy regimes characterized in the last section. In particular, we analyze whether, starting from one of the four regimes, a jurisdiction can increase the income of the high-income population by changing the policy variable. In doing so, we solve for the subgame-perfect equilibrium choice of the policy variable in which jurisdictions compete. In the sequel, we assume existence, uniqueness and stability of the equilibrium at stage 2 of the game which is associated with each of the four policy regimes.

First consider that jurisdiction j uses transfers as the strategic policy variable. When jurisdiction i initially adopts the same policy variable, but switches to the tax rate T_i, jurisdiction j will find it less beneficial to compete for migrants and will reduce its transfer payment, c.f. part (ii) of Proposition 1. Likewise, when jurisdiction j competes in taxes for migrants, the switch by jurisdiction i will incentivize jurisdiction j to reduce the tax rate and thereby its transfer payment to low-income households. In both cases, the change in income y_i^h, which is associated with the switch in jurisdiction i's policy variable, is due to the drop

in z_j. Formally, the change in income follows from differentiating y_i^h w.r.t. z_j:

$$\frac{dy_i^h}{dz_j} = -f_i'' l_i^l \left(\frac{dl_i^l}{dz_i} \left. \frac{dz_i}{dz_j} \right|_{dT_i=0} + \frac{dl_i^l}{dz_j} \right). \tag{13}$$

The term $\left. \frac{dz_i}{dz_j} \right|_{dT_i=0}$ is given by (7), re-indexed appropriately. The income change in (13) is evaluated for a given tax rate T_i. Jurisdiction i sets the tax rate optimally and, thereby, reacts optimally to the change in the amount of per-capita transfers z_j. By an application of the envelope theorem, jurisdiction i's tax rate adjustment and the associated change in transfers z_i have no effect on the change in income.

Using the migration flow condition $dl_i^l + dl_j^l = 0$ to rearrange (13) yields

$$\frac{dy_i^h}{dz_j} = f_i'' l_i^l \, \Omega_j|_{dT_i=0} < 0. \tag{14}$$

From (8), the income change is negative. High-income households thus benefit from the reduced transfer payment in the neighboring jurisdiction. It leads to an inflow of migrants which increases their income. Since the incentive to choose the tax rate as the strategic policy variable applies independently of the neighbor's choice, jurisdictions have a dominant strategy which is to compete in taxes.

Proposition 2: *Consider that policy decisions are taken so as to maximize the income of immobile, high-income households. Then, in a subgame-perfect equilibrium, jurisdictions decide to compete in taxes for migrants.*

Some comments are in order to show that using (14) is a valid strategy to characterize the equilibrium mode of competition. First, as shown above, the income level y_i^h is independent of whether jurisdiction i competes in taxes or transfers, for a given level of the policy variable of the neighboring jurisdiction (part (i) of Proposition 1). Thus, the change in jurisdiction i's policy variable has no effect on income per-se. Income only changes through the induced change in transfers in the neighboring jurisdiction, as captured by (14).

Second, the switch in jurisdiction i's policy variable changes jurisdiction j's first-order condition from (10) to (5). This implies a jump in the level of z_j and correspondingly in jurisdiction i's tax-transfer policy and income level y_i^h. Still, the marginal income change in (14) is informative as to the sign of the induced discrete income change in jurisdiction i. Figure

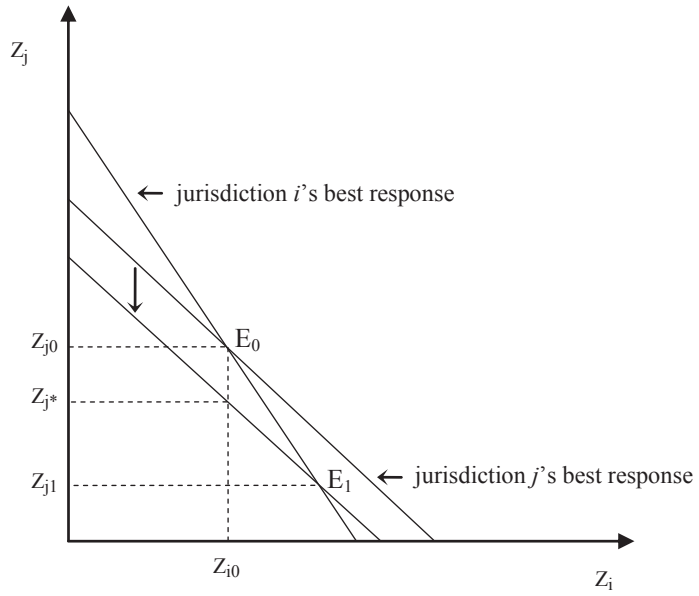

Figure 1: Best Responses.

1 illustrates the discrete jump in transfers when jurisdiction i switches its policy variable from z_i to T_i. The initial stage-2 equilibrium is point E_0. The switch undermines jurisdiction j's incentive to spend on transfers which shifts its best-response function downwards and, thereby, shifts the new equilibrium to point E_1.[12] Eq. (14) allows us to infer the change in income y_i^h when moving along jurisdiction i's best response from the initial equilibrium E_0 to the new equilibrium E_1. Precisely, (14) shows that the change in income when z_j marginally increases is negative. Since (14) holds at any point between E_0 and E_1, the total change in income between both equilibrium points is positive.

As a final remark, the change in transfer payments z_j which we use to evaluate (14) is the change that is directly implied by jurisdiction j's change in policy incentives, for a given value of z_i. The change differs from the total change in jurisdiction j's transfer payments. The sign of the direct change, however, is a sufficient statistic for the sign of the total change. More concretely, the total change in z_j can be decomposed into a change that directly follows from the shift in the best-response function (transfer difference $z_{j0} - z_{j*}$ in Figure 1) and one that depends on how transfer payments of the two jurisdictions interact on the way to the new equilibrium E_1 (transfer difference $z_{j*} - z_{j1}$). In Figure 1, the interaction effect reinforces

[12]Note, given the conditional equivalence of jurisdiction i's policy incentives (see part (i) of Proposition 1), the locus of its best response is unaltered.

the direct effect and the sign of the direct effect trivially predicts the sign of the total effect. More importantly, when the interaction effect is opposite in sign, (14) still predicts the sign of the total effect. Since, by assumption, the equilibrium is stable, a counteracting interaction effect will attenuate, but not neutralize the direct effect. Thus, independently of whether transfers are strategic substitutes, as drawn in Figure 1, or strategic complements, the sign of the total income change can be inferred from (14).

5 Extensions

Before turning to two extension in detail, we will briefly mention two modifications that are frequently considered in the literature and yield the same equilibrium outcome as in the previous section.

Contrary to what we assume above, migration might be costly due to pecuniary costs that are associated with migration or due to non-pecuniary costs that take the form of psychological disutility from not living in the home country (e.g., Mansoorian and Myers, 1993). To the extent that migration costs are non-prohibitive, these considerations change the magnitude of the migration response (1), but not the sign of the response. The latter is crucial for the fiscal incentives in any of the four policy regimes and, in particular, for the differential in policy choices across the regimes. As a consequence, Proposition 1 and 2 remain valid with this modification.

One may equally envision a reversed pattern of household mobility than the one assumed above. Depending on the economic environment, it might be the high-income households that primarily migrate when compared with low-income households. To accommodate this concern, we might swap the role of the two households types and assume that high-income households migrate and that low-income households are immobile and decide on the level of taxes and transfers. Since the basic model only distinguishes between two production factors that are complementary in production, the change in the pattern of household mobility amounts to a re-interpretation of the model where high-income households become low-income households and vice versa. Formally, this requires to adjust the income superscripts appropriately and to set $z_i = -T_i$ and, conversely, $T_i = -z_i$. The equilibrium prediction of the model is the same. The two jurisdictions compete in taxes.

5.1 Low-income households set government policy

Policy choices may primarily reflect the interest of low-income households. Although turnout rates tend to be decreasing in income and resources needed to gain a sufficiently strong political representation of interests may be less readily available to low-income voters, they may still outnumber high-income voters, thereby gaining a decisive influence on policy making. In what follows, we assume that the government is interested in maximizing the income of low-income households y_i^l.[13]

The modification of the model changes the objective function that the government uses to select the level of taxes and transfers and to evaluate whether it prefers to strategically set taxes or transfers. However, the migration flow in response to policy changes, its impact on wages and the budgetary implications of fiscal policy are qualitatively unaffected by the change in government motivation. They still follow from (1), (2) and (3). Thus, jurisdiction i chooses the tax rate to solve

$$\max_{T_i} \quad w_i^l + z_i \quad \text{s.t.} \quad (1), (2) \text{ and } (3), \tag{15}$$

taking the neighbor's policy variable a_j, $a \in \{T, z\}$, as given. The first-order condition is

$$\left(f_i^{''}\ \Omega_i|_{da_j=0} + 1\right) \left.\frac{dz_i}{dT_i}\right|_{da_j=0} = 0 \quad \Leftrightarrow \quad f_i^{''}\ \Omega_i|_{da_j=0} + 1 = 0. \tag{16}$$

Condition (16) captures how tax policy and the associated migration flow influence the wage rate of the poor and transfers in jurisdiction i. Low-income households enjoy a higher transfer payment, but have to accept a lower wage income due to more immigration. To analyze how jurisdiction i's policy incentives depend on jurisdiction j's choice of policy variable, we can make use of the migration responses in (11). Based on the response differential, the first term in (16) is larger when jurisdiction j chooses transfers ($dz_j = 0$) rather than taxes ($dT_j = 0$). Thus, when jurisdiction j strategically chooses income taxes, the migration inflow does not depress the wage income of the poor too much. As such, jurisdiction i has stronger incentives to use tax-transfer policy when $dT_j = 0$. This changes part (ii) of Proposition 1 to:[14]

[13] A recurrent political issue is whether immigrants are immediately granted voting rights and, thereby, to what extent their interests influence policy-making. See, e.g., Michel, Pestieau and Vidal (1998). In the model at hand, we could assume that a certain fraction of low-income households are natives that are entitled to vote. Since their interest is aligned with the interest of immigrants, maximizing income of native, low-income voters results in maximizing y_i^l.

[14] Part (i) of Proposition 1 extends to the modified government objective function. When jurisdiction i

Proposition 3: *Assume that each government maximizes the income of low-income households living in its jurisdiction. In a (a_i, z_j)-regime, the government in jurisdiction i chooses a lower tax rate and transfer payment compared with a (a_i, T_j)-regime, $a \in \{T, z\}$.*

At stage 1 of the game, the two jurisdictions choose their policy variables non-cooperatively. When both jurisdictions initially compete in transfers and jurisdiction i switches to taxes as the policy variable, then, following Proposition 3, jurisdiction j chooses a higher level of taxes and transfers. As before, the same change in jurisdiction j's tax-transfer policy occurs when jurisdiction j competes in taxes and jurisdiction i switches from transfers to taxes as the policy variable.[15] The induced change in income of low-income households in jurisdiction i follows from differentiating y_i^l w.r.t. z_j:

$$\frac{dy_i^l}{dz_j} = f_i'' \left(\frac{dl_i^l}{dz_i} \frac{dz_i}{dz_j}\bigg|_{dT_i=0} + \frac{dl_i^l}{dz_j} \right) + \frac{dz_i}{dz_j}\bigg|_{dT_i=0}. \tag{17}$$

The transfer adjustment changes the number of migrants which influences the wage income w_i^l (first-term) and the transfer income of low-income household in jurisdiction i (second term), for a given tax rate T_i. Note, any variation in T_i has no effect on income at the margin which is an implication of the envelope theorem. Using the migration flow condition $dl_i^l + dl_j^l = 0$ to rearrange the first term in (17) yields

$$\frac{dy_i^l}{dz_j} = -f_i'' \, \Omega_j|_{dT_i=0} + \frac{dz_i}{dz_j}\bigg|_{dT_i=0} > 0. \tag{18}$$

From (8), the migration flow to jurisdiction j is negative which implies w_i^l to increase, as depicted by the first term in (18). Further, following (7), the transfer effect is positive since less transfer recipients share the same budget for transfers. Hence, the rise in z_j boosts the wage rate and leaves a higher level of transfers to low-income households in jurisdiction i. Consequently, jurisdiction i has a dominant strategy which is to compete in taxes.

Proposition 4: *Assume that governments maximize the income of low-income households in their jurisdictions. Then, in a subgame-perfect equilibrium, jurisdictions choose to*

chooses transfers, the first-order condition is (16) multiplied by $dT_i/dz_i|_{da_j=0}$, $a \in \{T, z\}$. The term is given by the inverse of (9) and (12), respectively. Straightforwardly, policy incentives are identical for a given choice of jurisdiction j's policy variable.

[15] Note, part (i) of Proposition 1 continues to hold, see footnote 14. Hence, jurisdiction j's policy incentives only depend on the choice of the neighbor's policy variable and not on its own choice.

compete in taxes.

The equilibrium prediction of Proposition 4 is identical to the finding in Proposition 2. However, the economic incentives underlying the results are diametrically different. They are different both in terms of the spill-over that a switch in a jurisdiction's policy variable exerts on the neighboring jurisdiction and how the neighbor's policy response spills back to the switching jurisdiction. The common starting point for the two results is that, when jurisdiction i chooses to set taxes strategically instead of transfers, then jurisdiction j conjectures that less migrants will come following a rise in its transfers. The reason is that jurisdiction i will raise its transfers as well which keeps some of the low-income households, that would otherwise migrate, in jurisdiction i. Jurisdiction j welcomes the reduced migration response provided it seeks to advance the interest of low-income households, just because migration depresses the wage income of low-income households. Tax-transfer policy becomes more beneficial, with the consequence that jurisdiction j will choose higher transfers. The policy change spills back to jurisdiction i. Less households will migrate to jurisdiction i in response to the higher transfer in jurisdiction j. This raises the income of low-income households and, thus, jurisdiction i benefits from using taxes as the strategic variable. A reversed type of reasoning applies when jurisdiction j promotes the interest of high-income households. In this case, jurisdiction j's transfer payments reduce when jurisdiction i chooses taxes strategically instead of transfers. The spill-back is beneficial to jurisdiction i since the wage income of high-income households rises with the level of migration. As such, the final outcome is independent of which income group the government favors, but the adjustments leading to the outcome are opposite. The sensitivity of the structure of adjustments to the preference of governments might also entail a different equilibrium choice of policy variables, as shown below.

5.2 Asymmetric government preferences

So far, we have assumed that the two governments have symmetric preferences, either both favoring high-income or low-income households. Governments might equally pursue asymmetric interests in the sense that one government targets low-income households while the other government targets high-income households. We can readily analyze the equilibrium choice of policy variables in the asymmetric setting with the help of the formal analysis and

the taxonomy of the associated spill-overs and spill-backs that are explained above. Below, we refrain from reiterating the formal analysis and resort to a verbal description of the interplay of spill-overs and spill-backs to determine the equilibrium choice of policy variables.

Assume that jurisdiction i maximizes y_i^h, while jurisdiction j maximizes y_j^l. When jurisdiction i chooses taxes as a policy variable instead of transfers, then government j conjectures that tax-transfer policy will lead to less migration to jurisdiction j. Since jurisdiction j represents the interest of low-income households, the less pronounced migration response is beneficial, just because it less strongly downward pressures the wage income of low-income households. Incentives to provide transfers become stronger which spills back to jurisdiction i. There, more low-income households emigrate which lowers the wage income of high-income households in that jurisdiction. As such, choosing taxes as a policy variable reduces the income of the government's preferred household group. Interchanging the governments' objectives and reiterating the line of reasoning shows that a government that pursues the interest of low-income households also has no incentive to choose taxes as its policy variable. If it so chooses, the neighboring jurisdiction will lower transfers which will negatively spill back. Hence, both governments have a dominant strategy which is to compete in transfers. Thus,

Proposition 5: *Assume that the two governments have asymmetric preferences in the sense that one government maximizes the income of low-income households while the other government maximizes the income of high-income households. Then, in a subgame-perfect equilibrium, jurisdictions choose to compete in transfers.*

The two jurisdictions have different policy preferences and, in consequence, both the spill-over and the spill-back that a jurisdiction triggers by a switch of its policy variable are opposite in sign for the two jurisdictions. Interestingly, the opposite signs neutralize each other in forming strategic incentives. Independently of their preferences, jurisdictions decide to engage in transfer competition.

6 Discussion

The two forms of competition provide different incentives to jurisdictions. This has implications for policies that an overarching institution, such as a federal government, might wish

to choose and also for policies that a country might consider to implement unilaterally.

As a consequence of the diverging policy incentives, the inter-state externality of local policy will differ under the two regimes.[16] To infer the difference in the externality and how corrective policy by a federal government should respond to it, we determine how the sum of household income in jurisdiction j, $y_j^h + l_j^l y_j^l$, changes following a rise in z_i. The focus on aggregate income is for illustrative simplicity. The basic insight, that the Pigouvian grant should be differently designed in both competition regimes, extends to other metrics that a federal government might use to aggregate the interests of the two income groups.[17]

Noting the wage equations in (2) and the budget constraint (3), the marginal externality is

$$\left.\frac{d\left(y_j^h + l_j^l y_j^l\right)}{dz_i}\right|_{da_j=0} = \Omega_j|_{da_j=0}\, w_j^l, \tag{19}$$

where $a \in \{T, z\}$ is the fiscal variable in which countries compete and, therefore, which is held constant in jurisdiction j. A rise in the transfer level z_i increases emigration from jurisdiction j which increases the market income of its low-income households.[18] The externality is felt differently in jurisdiction j under the two forms of competition. Recall from (11) that, with tax competition, jurisdiction j's transfer payments increase which keeps some the potential migrants in the jurisdiction. The externality associated with the migration response is less pronounced relative to transfer competition and so is the matching component of the Pigouvian grant that the federal government devises for jurisdiction i.

In the absence of a central authority, jurisdictions may voluntarily pay transfers to other jurisdictions in order to control the level of immigration. Jurisdictions may consider such a policy beneficial provided it alleviates the negative consequences of immigration for the public budget and domestic wages. In our setting, there might be a rationale for unilateral transfer

[16] Policies also exert an intra-state externality on the income group that is not included in the government's objective function. As in the literature on fiscal federalism, we focus here on inter-jurisdictional externalities and the proper federal corrective policy to address these.

[17] With inter-jurisdictional migration, the federal government might deny any demand for corrective policies. This holds when the federal government only cares about the per-capita income of the mobile population in jurisdiction j and the government in jurisdiction i also maximizes the per-capita income of the mobile household in its jurisdiction. This might arise if, e.g., low-income households are mobile and the federal government is Rawlsian. The two objectives are connected through the migration arbitrage condition $w_1^l + z_1 = w_2^l + z_2$ which ensures that the externality, as evaluated by the federal government, is zero. The result does not hold when, e.g., the federal government cares about the total income of the mobile population in jurisdiction j or when it cares about the income of immobile households as well. See Mansoorian and Myers (1997).

[18] The wage rates of high-income and low-income households adjust in opposite directions. The effect on total income cancels out with constant returns to scale in production.

payments in situations in which the income of the mobile households enters the government objective function since immigration lowers the wage income of low-income households. As a necessary condition for voluntary transfers to deter immigration, the recipient government has to spend the transfer in a way that keeps potential migrants in its jurisdiction. When jurisdictions compete in taxes, the recipient government is conjectured to balance the budget in response to a unilateral transfer payment by increasing income support for potential migrants. Migration incentives are diluted, as intended by the voluntary transfer.[19] Differently, the donor jurisdiction conjectures the recipient jurisdiction to lower taxes on the rich, immobile households when the two jurisdictions compete in transfers. Migration incentives of households in the recipient jurisdiction remain unchanged. In consequence, a jurisdiction will not find it in its interest to voluntarily pay transfers in order to 'purchase' its preferred flow of migrants.

7 Concluding remarks

The economic effects of migration and how governments should respond to them are prevalent policy issues in many developing and developed countries. In particular, governments are tempted to strategically adjust their tax-transfer systems in order to influence migration flows in a beneficial way. The paper sheds light on the way countries compete for migrants by characterizing in which fiscal instrument such competition takes place. As it turns out, governments will compete in taxes when they care about the same income type living in the respective country. With asymmetric policy concerns, countries will compete in transfers instead. Understanding the equilibrium mode of competition is helpful, e.g., in appropriately designing federal corrective policies and in evaluating the effectiveness of unilateral 'migration-purchase' policies, which are frequently observed in real-world policy making.

Our analysis can usefully be extended along several dimensions. For instance, one may consider a richer set of policy instruments by including brain drain taxes in addition to residence-based income taxes and transfer payments. The extension might be of particular interest when studying migration from developing countries to developed countries.[20] Also, the degree of household mobility is exogenous. To endogenize the degree of mobility, one may

[19] Note, the positive income transfer adjustment is only a necessary condition for a donor country to pay transfers voluntarily. See, e.g., Myers (1990) for a more detailed analysis of when donor countries make transfers and recipient countries are also willing to accept them.

[20] Such a tax has been advocated by Baghwati (1972).

focus on high-skilled migration and allow for investments in eduction that make households mobile, as in Wildasin (2000). We leave these interesting extensions as well as other possible extensions to future research.

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