

Education policies, brain drain and the Bhagwati tax

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Abstract

The Bhagwati brain drain tax proposal dating back to more than thirty years ago has been criticized from different viewpoints. In particular, recent literature has pointed out that this tax would hamper accumulation of human capital by reducing gains from skilled migration. In this paper, it is argued that when taking into account social externalities of human capital, and optimal policies implemented by a government caring only for left behind residents, a brain drain tax tends rather to foster the investment in human capital and increase residents' income and welfare. The Bhagwati tax could even be universally welfare improving. In fact, if the tax is paid by migrants in addition to the ordinary income taxation, their larger fiscal burden might be outweighed by a higher human capital and gross income. Alternatively, if the transfer is financed by the destination country, its fiscal losses might be outweighed by the advantage of more skilled immigrants.

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1. Introduction

More than thirty years ago, in a series of contributions¹ Jagdish Bhagwati proposed a tax on skilled migrants' income, later named brain drain tax or "Bhagwati tax". The basic purpose of this tax was to compensate (at least partially) origin countries for possible losses deriving from skilled migration. As known, the sources of these losses are several: distortions in labour markets, reductions of the tax base, inefficiencies in the tax system connected to the possibility of reducing or eliminating the fiscal burden by moving abroad, human capital positive externalities forgone with brain drain. This paper focuses only on this latter possible consequence of migration, providing a reappraisal on the ability of a Bhagwati tax to limit the negative effects of brain drain².

The recent theoretical debate has mainly developed around two questions: Does actually skilled migration contribute to exacerbate human capital deficiencies in poor countries? And, if so, is the Bhagwati tax a suitable instrument to curtail the consequent losses? Concerning the first question, in the last decade a new strand of literature on brain drain has disputed the traditional tenet that skilled migration be necessarily detrimental for origin countries, by emphasizing the existence of possible advantages³ which may offset the loss connected to human capital flight. Emigrants' remittances, return migration and diaspora externalities for example are argued to give rise to several positive effects on origin economies through the contribution to income, the promotion of good practices, the establishment of networks facilitating trade and investment linkages and the diffusion of knowledge and technology. However the most important beneficial feedback of skilled migration has been identified in the increased incentive to invest in human capital prompted by migration perspectives. According to this view⁴, higher returns to human capital abroad encourage individuals to invest in human capital more than they would do in a closed economy. But since a share of workers ultimately does not migrate, their behaviour increases aggregate human capital in the home country and, through its positive externalities, benefits the local economy. In the presence of valuable effects of brain drain, its overall impact on sending countries human capital, income and welfare is ambiguous. Therefore, determining the sign of the net effect of brain drain has become the task of an increasing bulk of empirical investigations⁵.

The hypothesis of a beneficial brain drain clearly undermines the opportunity of levying a Bhagwati tax, since this latter would hamper gains from emigration and the favourable effects on

¹ The Bhagwati tax was originally proposed in Bhagwati and Dellafar (1973) and then more in detail in Bhagwati (1976). Other references are reported in Wilson (2006).

² Commander et al. (2003) review the literature on skilled migration and distortions in labour markets. The problem of fiscal losses deriving from brain drain is analyzed, among others, by Lucas (2005). The effects of migration on fiscal competition are considered for example by Egger et al. (2007). Some possible distortions induced by migration in the tax system are illustrated by Wilson (2006). In this paper I will not address these issues.

³ Docquier and Rapoport (2009) examine some of the main channels through which skilled migration may positively affect human capital of origin countries.

⁴ The original contributions are due to Mountford (1997), Stark et al. (1997, 1998), and Vidal (1998).

⁵ See for example Beine et al. (2001, 2007, 2008) and Docquier and Rapoport (2009).

human capital accumulation. But even in the case of detrimental brain drain, a number of issues challenge the actual feasibility and effectiveness of this tax, considering the severe legal, administrative and practical difficulties that its implementation would encounter⁶. Since collecting taxes on citizens living abroad is difficult as they are easily evaded, Bhagwati proposed that host (developed) countries or an international authority would collect the tax and then route revenues to origin (underdeveloped) countries. However destination countries are likely to be little willing to levy and transfer a Bhagwati tax because on one hand taxing poor migrants can be perceived as odious and discriminatory and on the other they can be reluctant to miss a share of fiscal revenues.

This paper considers skilled migration in an economy characterised by a government affecting human capital formation through subsidies to education. The analysis is directed at theoretically assessing the relevance of human capital incentives connected to migration and the possible role of a Bhagwati tax. In the real world, public intervention in education is massive. Education policies are widespread and pervasive, particularly in rich countries but also in less developed countries. Recent data by OECD (2008) show that in developed countries more than 85% of the direct cost of education is financed by public sources (for EU countries more than 90%). Concerning less developed countries, the share of total education expenditure from public sources is more variable (also because of the heterogeneity of indicators) but often larger than 70%⁷. This evidence clearly suggests that choices on human capital formation can not be adequately considered without taking account of government behaviour since the human capital stock is ultimately determined by education policies at least as much as by private preferences.

Recent literature deals with possible interactions between education policies and skilled migration. Stark and Wang (2002) show that migration, by stimulating human capital formation, could be a good substitute for education policies. So by controlling migration rate, government can target optimal human capital without any need to subsidize schooling. Docquier et al. (2008) construct a more general and realistic model allowing for distortions and costs connected to both controlling on emigration and handing out and financing education subsidies. When tax perception costs are higher than emigration control costs, the result of Stark and Wang (2002) holds; when instead tax costs are lower, optimal emigration is zero and the optimal education subsidy is decreasing with migration rate (this happens also when emigration rate is exogenously given). In this latter case skilled migration turns out to curb human capital accumulation so that, as Docquier

⁶ These practical difficulties have led to look for alternative ways to induce migrants to pay a brain drain tax. See for example the “voluntary brain drain tax” proposed by Wilson (2008).

⁷ World Bank (2009) reports the share of total education expenditure from public sources for a sample of countries (average over the years in brackets): Burkina Faso (1999-2002) 76.5; Cambodia (1999-2001) 36.3; El Salvador (1999-2003) 84.9; Gambia (1999-2004) 69.3; Ghana (2004) 89.0; Guinea (1999-2002) 78.1; Kosovo (2000-2004) 76.9; Lebanon (2004) 37.7; Malawi (2004) 72.0; Mozambique (2000-2001) 65.2; Nicaragua (2002-2006) 76.4; Niger (2000-2002) 82.9; Tajikistan (2005-2006) 86.2; Timor-Leste (2001-2002) 32.5; Turkey (2002) 62.3; Uganda (2003) 87.7; West Bank and Gaza (2000-2003) 35.7.

et al. (2008) conclude, “the beneficial brain drain hypothesis hardly resists a normative analysis”. Unlike these previous works, the present paper allows for groups with different talent and attitude to migrate and an explicit rationale for the government objective function. Also, it argues that the Bhagwati tax may positively affect the welfare of left behind residents not by discouraging migration and reducing the incentive to human capital accumulation but by suitably altering the relevant social welfare function.

More in detail, I assume that private choices on human capital are affected by a social planner through balanced budget education subsidies. The government aims at maximising the probability of being re-elected which depends on the ex-post welfare of resident citizens, the only ones who are admitted to vote. In a closed economy (i.e. with a zero migration rate), with social externalities deriving from the economy-wide average human capital, government will subsidize education to increase human capital accumulation toward the socially optimal level. In the presence of a chance of migration, as government cares only for left behind residents welfare, the socially optimal individual human capital is unaltered and subsidies are lower, since the gap between individual and government target is smaller. If brain drain occurs (i.e. if more skilled than unskilled workers migrate), the mean value of human capital decreases and both residents’ social welfare and per capita income do so too: brain drain is unambiguously detrimental. In this case, a Bhagwati tax could serve to internalise benefits from migration and induce the social planner to pursue a higher optimal human capital. Moreover, the brain drain tax might be beneficial for all agents. In fact, for migrants a larger fiscal burden could be outweighed by higher human capital and gross income, while destination countries could find it profitable to transfer (a part of) taxes on migrants’ income to origin countries in exchange for more skilled immigration.

The rest of the paper is organised as follows. After this introduction, section 2 builds on Stark and Wang (2002) to develop a simple closed economy model with human capital externalities and positive government education subsidies. Section 3 allows for migration and a different attitude to migrate for talented and untalented workers, and studies the joint effects of education policies and migration. Section 4 introduces the Bhagwati tax and shows its positive effects on residents’ human capital and welfare. In addition the conditions under which this tax can be universally welfare improving are derived. Section 5 summarizes the main conclusions of the paper.

2. The closed-economy model

Consider an economy populated by n workers, distinct into two possible types $\theta \in \{\nu, \mathcal{G}\}$, where ν and \mathcal{G} stand respectively for untalented and talented, with $\Pr(\theta = \mathcal{G}) = q < 1$. Workers live three periods. In the first period they are born, get aware of their own type and invest in education

to accumulate human capital h_θ , which is universally observable (assume it is revealed by school marks). The cost function of forming human capital $c_\theta = \frac{1}{2k_\theta} h_\theta^2$ is assumed to be increasing and convex in the amount of human capital accumulated and decreasing with individual talent k_θ . Without loss of generality, I assume that $k_\theta = k_0 < 1$ for $\theta = v$, and $k_\theta = 1$ otherwise.

Government may influence individual choices on human capital accumulation by granting subsidies s_θ in the form of vouchers proportional to the cost of human capital c_θ (i.e. vouchers entitle to a reduction of s_θ % on education cost). Education policies are assumed to be budget balanced, as subsidies are entirely financed by taxes t_θ proportional to human capital⁸, i.e.

$$\frac{s_\theta}{2k_\theta} (h_\theta)^2 = t_\theta h_\theta \quad \forall \theta, \quad (1)$$

with $0 \leq t_\theta \leq 1$ and $0 \leq s_\theta \leq 1$.

In the second period, individuals work and get a wage ω_θ possibly net of income taxes. For simplicity, leisure is assumed not to affect utility so that the number of worked hours can be considered fixed and normalised to 1. I assume a linear production function with externalities accruing from the economy-wide average human capital⁹ $Y = n[q(\beta h_g + \lambda \bar{h}) + (1-q)(\beta h_v + \lambda \bar{h})]$, where β and λ respectively denote private and social returns to human capital ($\beta > \lambda \geq 0$) and $\bar{h} = qh_g + (1-q)h_v$ is the average human capital. The marginal productivity of an additional talented worker (i.e. the effect of an increase in nq on Y) is equal to the wage $\omega_g = \beta h_g + \lambda \bar{h}$, and likewise, the wage of untalented workers is $\omega_v = \beta h_v + \lambda \bar{h}$. Wages therefore turn out depend upon both individual and the average level of human capital.

Individual welfare is $W_\theta = (\beta - t_\theta)h_\theta + \lambda \bar{h} - \frac{1-s_\theta}{2k_\theta} h_\theta^2$, i.e. the wage net of taxes on

human capital minus the cost of human capital net of subsidies. Notice that $0 \leq W_\theta \leq W_\theta^U$. The first inequality is imposed by the workers' budget constraint. Welfare amounts to W_θ^U when a

⁸ Notice that each group (and all workers belonging to the group, if they have the same human capital) pays taxes equal to the subsidies it has received. In this way the allocation effects of policies (we are interested in) are disentangled from redistributive issues.

⁹ Human capital externalities are widely recognised in the literature at least since Lucas (1988) and Azariadis and Drazen (1990). For an interpretation of microeconomic mechanisms generating these externalities see Acemoglu (1996). A theoretical and empirical survey is supplied by Klenow and Rodriguez-Clare (2005).

partisan government maximises the welfare of type θ workers by implementing a set of subsidies and taxes such that $h_\theta = \widehat{h}_\theta$, i.e. human capital of group θ is at its optimal value and $h_{-\theta} = h_{-\theta}^{\max}$, i.e. human capital of the other group is at its highest value compatible with the budget constraint.

For example, $W_g^U = (\beta - \widehat{t}_g)\widehat{h}_g - \frac{1 - \widehat{s}_g}{2}\widehat{h}_g^2 + \lambda q\widehat{h}_g + \lambda(1 - q)h_v^{\max}(\widehat{t}_v, \widehat{s}_v, \widehat{h}_g)$ is the highest feasible welfare that type \mathcal{G} individuals obtain when government mostly favours them by forcing the other group to invest h_v^{\max} so as to maximize positive externalities.

In the third period elections are made. The government in charge aims at being re-elected. Workers observe their actual ex-post welfare and decide whether to vote for it or for an alternative competitor. The probability of re-election positively depends on the welfare of talented and untalented workers.

As a useful benchmark, let us first look at the case in which no education policies are implemented (i.e. $s = t = 0$). If government sets zero subsidies and taxes, the individual welfare is simply

$$W_\theta = \beta h_\theta + \lambda \bar{h} - \frac{1}{2k_\theta} h_\theta^2. \quad (2)$$

Rational workers choose optimal private human capital by maximizing (2) given their own type. Since social returns are not internalised in their decision (the impact of individual choices on average human capital is negligible), optimal human capital is immediately derived as $\widehat{h}_g^P = \beta$ for type \mathcal{G} workers and $\widehat{h}_v^P = k_0\beta$ for type \mathcal{V} . The fact that $\widehat{h}_g^P > \widehat{h}_v^P$ points out that talented individuals find it profitable to invest more in human capital and become skilled workers whereas untalented prefer to remain unskilled. The average human capital turns out to be $\bar{h}^P = q\beta + (1 - q)k_0\beta = \beta Q$, with $Q \equiv q + (1 - q)k_0$, while the individual welfare is

$$\widehat{W}_\theta^P = \beta\left(\frac{k_\theta\beta}{2} + \lambda Q\right).$$

Let us now consider a government whose purpose is to be re-elected, so that its action is mainly devoted to maximize the probability of re-election $\Pi(W_\theta, q)$ ¹⁰, which can be written as the mean value of the conditional probabilities that talented and untalented vote for the incumbent government, i.e. $\Pi(W_g, W_v, q) = q\Pi_g + (1 - q)\Pi_v$, where Π_θ is the probability that an

¹⁰ In a deterministic approach, government would be re-elected by simply maximizing the welfare of median voter (who is of type \mathcal{G} if $q > 1/2$ and of type \mathcal{V} if $q < 1/2$) at the cost of a (possibly strong) reduction in the welfare of the minoritarian group. The stochastic approach here followed seems to be more realistic as it implies a less partisan attitude.

individual votes for the incumbent government given she belongs to group θ . For the sake of simplicity, I assume that for both θ 's: $\Pi_\theta = 0$ for $W_\theta = 0$; $\Pi_\theta = \pi_\theta W_\theta > 0$ for $0 < W_\theta < W_\theta^T$, and $\Pi_\theta = \Pi_\theta^T < 1$ for $W_\theta \geq W_\theta^T$, i.e. that the probability of voting for the incumbent never exceeds the upper threshold Π_θ^T , and is linearly dependent on W_θ in the interval $(0, W_\theta^T)$. Finally, $W_\theta^U < W_\theta^T \forall \theta$ is also assumed.

The parameter π_θ measures the impact of changes in welfare on the probability of voting for the incumbent government. In the absence of ideological preferences, it seems sensible to assume $\pi_g = \pi_v = \pi$. In this case, maximising the probability of re-election amounts to maximize the average welfare (i.e. the social welfare function):

$$W^G = q \left(\beta h_g - \frac{1}{2} h_g^2 \right) + (1-q) \left(\beta h_v - \frac{1}{2k_0} h_v^2 \right) + \lambda q h_g + \lambda (1-q) h_v. \quad (3)$$

Simple calculations show that $\arg \max_{h_g} W^G \equiv \hat{h}_g^G = \beta + \lambda$, $\arg \max_{h_v} W^G \equiv \hat{h}_v^G = k_0(\beta + \lambda)$

and then $\bar{h}^G = Q(\beta + \lambda) > \bar{h}^P$. Not surprisingly, public intervention induces to magnify the investment in human capital of both groups, due to the internalization of positive externalities both inside each group and between groups. In order to push private workers to form a larger human capital, the government grants subsidies and levies taxes seconding constraint (1), so that the

optimal human capital becomes $\hat{h}_\theta^P = \frac{k_\theta(\beta - t_\theta)}{1 - s_\theta}$. The solution of the system formed by

equations (1) and $\hat{h}_\theta^P = \hat{h}_\theta^G \forall \theta$ yields $\hat{s}_\theta = \frac{2\lambda}{\beta + \lambda} \forall \theta$ and $\hat{t}_\theta = \lambda \forall \theta$, i.e. the amount of

subsidy and tax rates which allow government to accomplish its targets¹¹. Social welfare is now

$$\hat{W}^G = \frac{(\beta + \lambda)^2}{2} Q > \hat{W}^P = \beta \left(\frac{\beta}{2} + \lambda \right) Q \quad \text{while} \quad \text{per capita income is}$$

$$\hat{y}^G = (\beta + \lambda)^2 Q > \hat{y}^P = \beta(\beta + \lambda) Q.$$

All this can be summarised by

¹¹ Unlike what happens in the case of migration (see the following section), here subsidy and tax rates are equal for both types of workers as only two out of four equations are independent.

Proposition 1. *In a closed economy, education policies adopted by a government aiming at being re-elected give place to positive education subsidies and increase average human capital and per capita income.*

It is worthwhile to notice that, although \hat{h}_θ^G maximises social welfare (3), education policy does not necessarily maximises the individual welfare $\hat{W}_\theta^G = \frac{(\beta^2 - \lambda^2)k_\theta}{2} + Q\lambda(\beta + \lambda)$. Simple but tedious calculations show that with respect to the no-policy case, average welfare is increased by the quantity $\frac{Q\lambda^2}{2}$. However, different types of workers have different gains, amounting to $\lambda^2\left(Q - \frac{k_0}{2}\right)$ for untalented and $\lambda^2\left(Q - \frac{1}{2}\right)$ for talented. This latter is lower than the former and negative for $k_0 < \frac{1-2q}{2(1-q)}$. The interpretation is straight: the increase in human capital leads individuals to face additional costs and benefits partly due to the positive externality. Since the rise of human capital in response to subsidies is stronger for talented, the externality is greater for untalented. The less talent have untalented, the lower externalities are brought to talented workers by education policy.

3. Migration

Let us now consider migration. In the second period, before starting to work, individuals make the decision on where to work, i.e. whether to emigrate or staying at home. Emigration cost is m_ρ . Let in destination country be the production function identical to that of source country, the average level of human capital not lower than in source country $\bar{h}' \geq \bar{h}$, and private and social returns to human capital be respectively measured by the coefficients $\alpha > \beta$ and $\eta > \lambda$.

To introduce brain drain in the model, I assume that m_ν is so high to deter unskilled workers from migrating. Also, I consider two types of skilled workers $\rho \in \{\nu, \mu\}$, where ν and μ stand respectively for immobile and mobile, with $\Pr(\rho = \mu) = p$. If the worker belongs to the ν type, her migration cost is as high as m_ν and she will not migrate. Instead, in case $\rho = \mu$, the migration cost $m_{g\mu} = m_0$ is so low that she surely migrates. Assuming that the worker realizes her own type ρ only after she has finished to form human capital, talented will expect to migrate with

probability p ¹². As a consequence, the optimisation problem of talented boils down to

$$\max E(W_g) = [(\alpha p + \beta(1-p) - t_g)]h_g + (1-p)\lambda\bar{h} + p(\eta\bar{h}' - m_0) - \frac{1-s_g}{2}h_g^2, \text{ whence the}$$

private optimal human capital turns out to be $\tilde{h}_g^P = \frac{\beta - t_g + p(\alpha - \beta)}{1 - s_g}$, and in the case of no

policy intervention simply $\tilde{h}_g^P = [\beta + p(\alpha - \beta)]$. Conversely, the untalented still maximises

$$W_v = (\beta - t_v)h_v + \lambda\bar{h} - \frac{1-s_v}{2k_0}h_v^2 \text{ so that, without education policies, } \tilde{h}_v^P = \hat{h}_v^P = k_0\beta. \text{ This}$$

allows to write:

Proposition 2. *Without education policies, a positive probability of migrating for skilled workers increases the pre-emigration average human capital and has ambiguous effects on the after-emigration average human capital and residents' social welfare.*

Proof. The pre-migration average human capital is

$$q[\beta + p(\alpha - \beta)] + (1-q)k_0\beta = Q\beta + pq(\alpha - \beta) > \bar{h}^P \text{ while its after-migration value is}$$

$$\tilde{\bar{h}}^P = \frac{q-pq}{1-pq}[\beta + p(\alpha - \beta)] + \frac{1-q}{1-pq}k_0\beta = Z\beta + pz(\alpha - \beta), \text{ where } z \text{ is the share of}$$

talented over total staying behind population $z \equiv \frac{q-pq}{1-pq} < q$, and $Z \equiv z + k_0(1-z) < Q$. The

difference $\tilde{\bar{h}}^P - \bar{h}^P = pz(\alpha - \beta) - (Q - Z)\beta$ is a measure of the net brain gain. It is increasing in α and k_0 and decreasing in β . Residents' social welfare turns out to be affected as well by the

¹² More formally, the migration condition may be written $(\alpha - \beta)h_g > m_{g\mu} + \lambda\bar{h} - \eta\bar{h}'$. To simplify the analysis, $m_{g\mu} \leq (\eta\bar{h}' - \lambda\bar{h})$ is assumed, so that for any positive h_g , the migration condition holds. Alternatively, one could assume that m_g be uniformly distributed over the interval $(0, m_v)$. In this case the probability that a skilled worker migrates is calculated as $p(h_g) = \frac{(\alpha - \beta)h_g - \lambda\bar{h} + \eta\bar{h}'}{m_v}$ and the optimal human capital can be shown to be

$$\tilde{h}_g^P = \frac{m_v\beta}{m_v - (\alpha - \beta)^2} + \frac{(\alpha - \beta)(\eta\bar{h}' - \lambda\bar{h})}{m_v - (\alpha - \beta)^2}. \text{ Since the SOC imposes } m_v > (\alpha - \beta)^2, \text{ it follows } \tilde{h}_g^P > \hat{h}_g^P.$$

With respect to the following analysis, this alternative framework implies (non crucial) changes in education subsidies but not in optimal h_g^G so that propositions below are (qualitatively) unaltered.

quantity $\tilde{W}^P - \hat{W}^P = pz(\alpha - \beta)\left(\lambda - \frac{p(\alpha - \beta)}{2}\right) - (Q - Z)\beta\left(\lambda + \frac{\beta}{2}\right)$ which again may take either sign; it is increasing in α and k_0 and decreasing in β ¹³.

Proposition 2 confirms the ambiguity of the effect of potential migration on the human capital and welfare of sending countries. Higher investments in human capital are fuelled by prospective higher returns but this does not necessarily involve a brain gain, as some skilled workers go abroad. Stark and Wang (2002) consider the migration rate p as an instrument to maximise the welfare gain from migration. In the present framework instead the probability to migrate is exogenous and government is assumed to use education subsidies.

Let us consider then the behaviour of the social planner. As in the case of closed economy, its purpose consists in being re-elected. Elections take place after migration, and migrants do not take part in elections. This last hypothesis is extreme but to some extent realistic: especially in not developed countries emigrants may lose their voting rights, or more often keep them only formally without actually exerting them. In this case, the probability that government is re-elected becomes $\Pi(W_\theta^R, z) = z\Pi_g + (1 - z)\Pi_v$ where W_θ^R is the welfare of residents. As only the welfare of staying behind population appears in the probability of re-election, government can disregard emigrants' interests (or at least consider their utility not as relevant as that of residents). A different concern of government for residents and migrants is quite widely accepted in the literature¹⁴. As a matter of fact, as Mirrlees (1982) pointed out, even in a democratic political system, including all humans wellbeing in the social welfare function is "surely morally defensible but (...) not what an adviser to a democratic state is expected to be guided by".

Using the same simplifying assumptions as in the case of closed economy allows to write the planner objective function as $W^G = zW_g^R + (1 - z)W_v$ or, substituting for W_g^R and W_v ,

$$W^G = z\left(\beta h_g - \frac{1}{2}h_g^2\right) + (1 - z)\left(\beta h_v - \frac{1}{2k_0}h_v^2\right) + z\lambda h_g + (1 - z)\lambda h_v. \quad (4)$$

Maximising (4) yields $\tilde{h}_g^G = \beta + \lambda$ and $\tilde{h}_v^G = k_0(\beta + \lambda)$ and therefore $\tilde{h}^G = z(\beta + \lambda) + (1 - z)k_0(\beta + \lambda) = Z(\beta + \lambda)$. Social welfare is easily calculated to be $\tilde{W}^G = Z \frac{(\beta + \lambda)^2}{2}$. The government achieves its objectives by paying different subsidies and

¹³ Provided that $\lambda > p(\alpha - \beta)$, a condition on which we come back later.

¹⁴ See for example Wilson (2006), Egger et al. (2007) and Docquier et al. (2008).

levying different taxes to unskilled and skilled workers¹⁵. The former receive subsidies and pay taxes at rates respectively equal to $\tilde{s}_v = \frac{2\lambda}{\beta + \lambda}$ and $\tilde{t}_v = \lambda$ while for the latter

$$\tilde{s}_g = \frac{2(\lambda - p(\alpha - \beta))}{\beta + \lambda} \text{ and } \tilde{t}_g = \lambda - p(\alpha - \beta).$$

These results allow to state

Proposition 3. *If skilled workers migrate with a positive probability and $\lambda > p(\alpha - \beta)$, a government aiming at being re-elected sets positive education subsidies and thus increases individual and average human capital and social welfare.*

Proof: $\tilde{h}_v^G > \tilde{h}_v^P$ proves that unskilled individuals' human capital increases. $\lambda > p(\alpha - \beta)$ is a sufficient condition for the following four inequalities to hold: $\tilde{s}_g > 0$; $\tilde{h}_g^G > \tilde{h}_g^P$;

$$\tilde{h}^G - \tilde{h}^P = z(\lambda - p(\alpha - \beta)) + (1 - z)k_0\lambda > 0; \quad \tilde{W}^G - \tilde{W}^P = \frac{z}{2}(\lambda - p(\alpha - \beta))^2 + (1 - z)k_0 \frac{\lambda^2}{2}.$$

To understand the meaning of Proposition 3, consider that in the absence of policies, non emigrating skilled workers form human capital \tilde{h}_g^P which comes out to be too large when the potential migration does not take place. As government cares only for staying behind residents, its policy offsets the excessive amount of human capital $p(\alpha - \beta)$ with its social return λ . If this latter is larger than the former, the impact on skilled individuals' (and *a fortiori* on average) human capital is positive.

Moreover

Proposition 4. *Compared to the case of closed economy, a positive probability of migrating for skilled workers (i) reduces optimal unit education subsidy increasingly with p , (ii) does not alter individual human capital and decreases (iii) average human capital, (iv) social welfare and (v) per capita income increasingly with p .*

¹⁵ The fact that government learns which type θ a worker is only after she completes her education might induce workers to disguise their type in order to have a higher subsidy or pay a lower tax. It can be shown that the advantage of passing themselves off as the other type equals $\frac{p^2(\alpha - \beta)^2(\beta + \lambda)}{2(\beta - \lambda)}$ for talented and $k_0 \frac{p^2(\alpha - \beta)^2(\beta + \lambda)}{2(\beta - \lambda + 2p(\alpha - \beta))}$ for untalented. However, since at the end of the first period cheating is revealed without costs, government can avoid it by simply introducing sanctions at least equal to these quantities.

Proof: 4.(i) is proved by and $\tilde{s}_v - \hat{s}_v = 0$ and $\tilde{s}_g - \hat{s}_g = -\frac{2p(\alpha - \beta)}{\beta + \lambda}$. 4.(ii) follows from

$$\tilde{h}_\theta^G = \hat{h}_\theta^G. \text{ 4.(iii) derives from } \tilde{h}^G - \bar{h}^G = (Z - Q)(\beta + \lambda) = -(1 - k_0) \frac{pq(1 - q)}{1 - pq} (\beta + \lambda)$$

and 4(iv) from $\tilde{W}^G - \hat{W}^G = (Z - Q) \frac{(\beta + \lambda)^2}{2} = -(1 - k_0) \frac{pq(1 - q)}{1 - pq} \frac{(\beta + \lambda)^2}{2}$. Finally, 4.(iv)

is demonstrated by calculating $\tilde{y}^G - \hat{y}^G = (Z - Q)(\beta + \lambda)^2 = -(1 - k_0) \frac{pq(1 - q)}{1 - pq} (\beta + \lambda)^2$.

Notice that $\frac{\partial(p/(1 - pq))}{\partial p} > 0$.

Proposition 4 allows to make several remarks. First, as shown by 4(i), migration hampers education policies by reducing optimal subsidies. The reason is that migration makes the gap between individual optimal human capital and government target smaller. As in Docquier et al. (2008) the optimal education subsidy is decreasing with migration rate, consistently with the evidence that poor high-emigration countries tend to invest in human capital accumulation less than richer countries.

Second, migration does not alter individual human capital as government subsidies are tailored to promote the same investment as in the case of closed economy. The reason is that residents do not have any advantage from migration of their countrymen who therefore end up with forming a suboptimal level of human capital. This has two relevant implications which will be addressed in the next section. The first is that internalising migration advantages might be a way to increase government human capital target and then to reduce underinvestment of migrants. The second is the negative externality that a suboptimal migrants' human capital involves for destination countries. As we will see, these two facts in turn imply that a Bhagwati tax designed as a voluntary transfer of a share of migrants' income taxes to origin from destination countries may be beneficial even for these latter. By embodying part of the gains of migration in the welfare of origin countries' residents, the transfer may serve to promote a higher investment in human capital of migrants and a positive externality outweighing the fiscal loss.

Third, migration unambiguously leads to a detrimental brain drain and a welfare loss since policies completely crowd out the positive incentive effects connected to potential migration. This is a significant result. In a similar vein, Docquier et al. (2008) rule out the case of beneficial brain drain; however, while in their model the welfare loss of emigration is simply due to the lower

population size, here the impact of migration and policies on residents' average human capital and welfare is directly accounted for.

Finally, migration implies a lower income. Poverty is widely recognised as one of the main determinants of large migration phenomena. Proposition 4(v) points out an opposite causal relationship: the higher migration rate, the less per capita income. If both relations are true, poor countries may be trapped in a chain of low income, high migration, low human capital investments, lower income and so on.

4. Education policies and the Bhagwati tax.

Assume that a share of migrants' income be transferred to workers staying behind in the source country. As migrants' income depends on their human capital, this could be an additional channel through which human capital accumulation would favour residents by magnifying their revenues from nationals abroad. In this section a Bhagwati tax transferring income from migrants to home country is introduced to study its effects in the presence of education policies.

Assume that a Bhagwati tax is levied so that migrants' income is reduced by the rate $\tau < 1$ such that $\alpha(1 - \tau) > \beta$ and that the relative fiscal revenue is transferred to residents of the origin country. The expected welfare of talented individuals will turn out to be

$$E(W_g) = p((\alpha h_g + \eta \bar{h}') (1 - \tau) - m_0) + (1 - p)(\beta h_g + \lambda \bar{h} + T) - t h_g - \frac{1 - s_g}{2} h_g^2, \quad \text{where}$$

$$T = \frac{pq}{1 - pq} \tau (\alpha h_g + \eta \bar{h}')$$

is the average amount of transfers received by a resident. As T is considered by individuals as a positive externality¹⁶, optimal human capital of skilled workers turns

$$\text{out to be } \tilde{h}_g^P = \frac{\beta - t + p(\alpha(1 - \tau) - \beta)}{1 - s_g}, \quad \text{or without education policies simply}$$

$$\tilde{h}_g^P = \beta + p(\alpha(1 - \tau) - \beta). \quad \text{Conversely, even if benefitted from positive transfers as well, unskilled still will have } \tilde{h}_v^P = k_0 \beta.$$

Unlike private agents, the social planner can not consider transferred inflows as externalities. This implies that the social welfare function to maximise is now

$$W^G = z \left((\beta + \lambda) h_g - \frac{1}{2} h_g^2 \right) + (1 - z) \left((\beta + \lambda) h_v - \frac{1}{2k_0} h_v^2 \right) + \frac{pq}{1 - pq} \tau (\alpha h_g + \eta \bar{h}') \quad (5)$$

where the last addend accounts for the positive impact that migration exerts on residents' average welfare through the transfer sent back to the source country. Maximizing (5) yields

¹⁶ This means that residents do not consider T as positively related to their investment in human capital.

$$\tilde{h}_g^G = \beta + \lambda + \frac{pq}{1-pq} \alpha \tau, \quad \tilde{h}_v^G = k_0(\beta + \lambda) \quad \text{and therefore} \quad \tilde{\tilde{h}}^G = Z(\beta + \lambda) + \frac{pq}{1-pq} z \alpha \tau.$$

The values of subsidy and tax rates suitable to get the policy target are now

$$\tilde{s}_g = 2 \frac{(1-p)(\lambda - p(\alpha(1-\tau) - \beta)) + \alpha \tau p}{(1-p)(\beta + \lambda) + \alpha \tau p} \quad \text{and} \quad \tilde{t}_g = \lambda - p(\alpha(1-\tau) - \beta) + \frac{\alpha \tau p}{1-p} \quad \text{for}$$

talented, and again $\tilde{s}_v = \frac{2\lambda}{\beta + \lambda}$ and $\tilde{t}_v = \lambda$ for untalented. As a consequence we can state

Proposition 5. *Without education policies, the Bhagwati tax (i) reduces the average human capital and (ii) has ambiguous effects on residents' welfare. When an education policy aiming at maximising residents' welfare is implemented, the Bhagwati tax increases (iii) education subsidies, (iv) average human capital and (v) residents' welfare.*

Proof. 5.(i) follows from $\tilde{h}_g^P < \tilde{\tilde{h}}_g^P$ and $\tilde{h}_v^P = \tilde{\tilde{h}}_v^P$. 5.(ii) is proved by calculating

$$\tilde{W}^P - \tilde{\tilde{W}}^P = \frac{pq\tau\alpha}{1-pq} \left(\beta + p(\alpha(1-\tau) - \beta) + \frac{\eta}{\alpha} \bar{h}' \right) + zp \left(p(\alpha - \beta)^2 - p(\alpha(1-\tau) - \beta)^2 - \lambda(\alpha\tau) \right)$$

5.(iii) derives from $\tilde{s}_g - \tilde{\tilde{s}}_g = 2p\tau\alpha \frac{(\beta + p(\alpha - \beta) + (1-p)(\beta + \lambda))}{((1-p)(\beta + \lambda) + p\tau\alpha)(\beta + \lambda)}$ and $\tilde{s}_v = \tilde{\tilde{s}}_v$. 5.(iv)

follows from $\tilde{h}_g^G > \tilde{\tilde{h}}_g^G$ and $\tilde{h}_v^G = \tilde{\tilde{h}}_v^G$. Finally, by substituting optimal human capital in (5) and (4), it is easily found the change in residents' welfare is positive, i.e.

$$\tilde{W} - \tilde{\tilde{W}} = \frac{pq}{1-pq} \alpha \tau \left(\beta + \lambda + \frac{\eta \bar{h}'}{\alpha} + \left(1 - \frac{z}{2}\right) \frac{pq}{1-pq} \alpha \tau \right)$$

Proposition 5 points out that the crowding out effects of the Bhagwati tax on human capital take place as long as government does not implement its policy. When it does, the preferences of migrants are neutralised by subsidies and taxes so that the optimal human capital (of both migrants and non migrants) increases, mirroring the fact that the tax transfers a part of migrants' higher gains abroad to residents. Not surprisingly, residents' welfare increases as well, as staying behind workers take advantage from both the transfer and a higher human capital.

The final question concerns the hypothesis that in this context a Bhagwati tax might be universally welfare improving, i.e. it may benefit (although to a different extent) all individuals i.e. origin country's residents and migrants, and destination country's workers. This possibility can be ruled out when no education policies are enacted. In this case, the Bhagwati tax reduces migrants' human capital to a suboptimal level and in addition charges them with an additional fiscal burden,

so that they will surely be worse off. Alternatively, if the Bhagwati tax is not additional, i.e. if the transfer is financed by a part of ordinary income taxation of newcomers, the migrants' welfare is not affected (as neither their human capital no their after-tax income is changed) but destination countries residents are surely worse off because they forgo a part of fiscal revenues.

The answer to this question is supplied by the following two propositions.

Proposition 6. *In the presence of optimal education policies, a Bhagwati tax at rate $\tau^* > 0$ paid by migrants in addition to ordinary income taxation is universally welfare improving if (i)*

$$\alpha > \frac{\beta + \lambda}{2} + \sqrt{\left(\frac{pq(\beta + \lambda)}{1 - pq}\right)^2 + \frac{4pq(\beta + \lambda + \bar{h}')}{1 - pq}}$$

Proof. Since the impact of a Bhagwati tax on the welfare of the origin country is positive (see Proposition 5), we need to check only ΔW_D and ΔW_M i.e. the effect of the tax on the welfare of destination country residents and migrants. Regarding the first, assume that

$$W_D = \alpha h_D - \frac{h_D^2}{2} + \eta \bar{h}', \text{ where } \bar{h}' = \psi h_D + (1 - \psi) h_g \text{ and } \psi \text{ is the share of native population in}$$

the destination country after migration has occurred. The change in welfare due to the Bhagwati tax

$$\text{is calculated as } \Delta W_D = \eta \Delta \bar{h}' = \eta(1 - \psi) \frac{pq}{1 - pq} \alpha \tau > 0. \text{ For what concerns migrants, the}$$

change in their welfare is

$$\Delta W_M = \frac{pq}{1 - pq} \alpha \tau \left(\alpha - \beta - \lambda - \frac{pq}{2(1 - pq)} \alpha \tau \right) - \tau \left(\beta + \lambda + \frac{pq}{1 - pq} \alpha \tau + \bar{h}' \right). \text{ At } \tau = 0,$$

$$\Delta W_M = 0 \text{ and } \frac{\partial \Delta W_M}{\partial \tau} = \alpha \frac{pq}{1 - pq} (\alpha - \beta - \lambda) - (\beta + \lambda + \bar{h}'). \text{ It follows that if condition 6(i)}$$

holds, there is an interval of values for $\tau^* > 0$ such that $\Delta W_M > 0$.

Finally, let us look at the alternative case in which a unilateral transfer from destination to origin country of the same amount as T (and then proportional to migrants' human capital) is financed by diverting a part of the ordinary fiscal revenues on migrants' income rather than by an additional tax. In this case, migrants would not undergo a discriminatory treatment with respect to residents. Destination country would suffer from a fiscal loss but it could also be benefited from the incentive given to origin country toward a higher investment in human capital.

Proposition 7. *In the presence of optimal education policies, a unilateral transfer equal to the amount of the Bhagwati tax at rate $\tau^* > 0$ is universally welfare improving if (i)*

$$\alpha > \frac{\eta \bar{h}'(1-pq)}{\psi(1-\psi)pq\eta - (1-pq)(\beta + \lambda)} \text{ and (ii) } \alpha > (\beta + \lambda) \frac{2(1-pq)}{2(1-pq) - pq\tau^*}$$

Proof. In this case, $\Delta W_M = \frac{pq}{1-pq} \alpha \tau \left(\alpha - \beta - \lambda - \frac{pq}{2(1-pq)} \alpha \tau \right)$ (obviously larger than in

Proposition 6) and $\Delta W_D = (1-\psi) \frac{pq}{1-pq} \alpha \tau \left(\eta - \frac{\alpha \tau}{\psi} \right) - \frac{\tau}{\psi} (\alpha(\beta + \lambda) + \eta \bar{h}')$ (conversely

lower). At $\tau = 0$, $\Delta W_D = 0$ and $\frac{\partial \Delta W_D}{\partial \tau} = \alpha \eta \frac{pq}{1-pq} (1-\psi) - \frac{1}{\psi} (\alpha(\beta + \lambda) + \bar{h}')$. It follows

that if condition 7.(i) holds, there is an interval of values for $\tau^* > 0$ such that $\Delta W_D > 0$. If at

$\tau = \tau^*$ condition 7.(ii) holds, $\Delta W_M > 0$.

5. Concluding remarks.

The Bhagwati brain drain tax proposal dating back to more than thirty years ago has been criticized from different viewpoints. In particular, recent literature has pointed out that this tax would hamper accumulation of human capital by reducing gains from skilled migration. In this paper, it is argued that when taking into account social externalities of human capital, and optimal policies implemented by a government caring only for left behind residents, a brain drain tax tends rather to foster the investment in human capital and increase residents' income and welfare. The Bhagwati tax could even be universally welfare improving. In fact, if the tax is paid by migrants in addition to the ordinary income taxation, their larger fiscal burden might be outweighed by a higher human capital and gross income. Alternatively, if the transfer is financed by the destination country, its fiscal losses might be outweighed by the advantage of more skilled migrants.

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