Skilled migration and education policies: Is there still scope for a 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 contributions, Jagdish Bhagwati proposed a tax on skilled migrants' income, later named "Bhagwati tax"[1]. That proposal was grounded on the idea that skilled migration be detrimental for origin countries, and therefore the basic purpose of the tax was to discourage that kind of migration and (at least partially) compensate source countries for resulting losses.

The harmfulness of skilled migration for origin countries has been long an undisputed tenet of economic theory, whence the label "brain drain". The literature has actually identified many kinds of losses associated to this phenomenon: 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, and above all human capital positive externalities forgone with brain drain[2]. At least since Lucas (1988) and Azariadis and Drazen (1990), human capital externalities have been widely recognised by economists[3]: as the benefits of human capital affect not only the productivity of human capitalist but spill over the entire economy, skilled migration has been argued to reduce welfare of stahing behind natives.

However, although well founded on the ground of both efficiency and equity, the huge difficulties of a practical application of the Bhagwati tax have always been evident[4]. Who should pay the tax, how and when? And above all, who could effectively collect tax revenues? Since collecting taxes on citizens living abroad is difficult as evasion is very easy, Bhagwati and Dellafar (1973) put forward the hypothesis that host (developed) countries could be charged with the task of collecting the tax and then routing revenues to origin (underdeveloped) countries. But destination countries are likely to be little willing to levy and transfer a tax on skilled immigrants for a number of reasons. If the Bhagwati tax was additional to ordinary taxation, it could damage the country in the competition for skilled migrants[5], without mentioning that taxing migrants more than residents would be perceived as odious and discriminatory and could sometimes be even forbidden by constitutional laws. On the other hand, destination countries' governments would be probably reluctant as well to treat a portion of the ordinary tax on migrants' income as Bhagwati taxation and transfer it to origin countries, as this would imply missing a share of fiscal revenues. An additional

[1] The Bhagwati tax (or alternatively "brain drain tax") was originally proposed in Bhagwati (1972) and then more in detail in Bhagwati and Partington (1976). Other references are reported in Wilson (2006).

[2] Only this latter issue is addressed in this paper. For a survey on the literature about skilled migration and distortions in labour markets, see for example Commander et al. (2003). 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 in the tax system are illustrated by Wilson (2006).

[3] An interpretation of microeconomic mechanisms generating these externalities is provided by Acemoglu (1996). For a theoretical and empirical survey on the topic, see Klenow and Rodriguez-Clare (2005).

[4] The difficulties of the implementation of a Bhagwati tax 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).

[5] The prospect of a battle for brains (i.e. a competition to attract skilled workforce) among advanced economies in the close future is gaining increasing attention among scholars. On this issue, see for example Bertoli *et al.* (2009).

argument is that non benevolent origin countries' governments could abuse transfers, by using resources for wasteful expenditures. This concern, justified or not, would be another obstacle to the practical implementation of a Bhagwati tax, probably even allowing for the intermediation of international authorities.

More recently, a new strand of literature has confuted the belief that skilled migration be necessarily detrimental for origin countries, thus undermining even the theoretical basis of the Bhagwati tax. A number of contributions have emphasized positive effects of skilled migration on origin countries' welfare, possibly offsetting losses connected to human capital flight[6]. Emigrants' remittances, return migration and diaspora externalities for example are argued to exert a beneficial impact 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. A further beneficial feedback of skilled migration (particularly relevant to this paper) has been identified in the increased incentive to invest in human capital prompted by migration perspectives. According to this view[7], 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.

Summing up, skilled migration is not necessarily detrimental for source countries and it might even favour (rather than hamper) human capital accumulation. Moreover, taxing brain drain involves severe legal, administrative and practical problems. Is there then any scope left to a Bhagwati tax? The answer of this paper is positive. Its simple argument is that the Bhagwati tax might induce governments caring only for voters' welfare to take into account the benefits which skilled migrants enjoy in virtue of a higher human capital. Since a share of migrants' larger income abroad is gained by left behind residents through the tax, government internalises part of migration benefits and implements education policies more oriented to human capital accumulation.

To develop this point, we need to consider skilled migration in an economy characterised by public education policies affecting human capital formation. 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

[6] Docquier and Rapoport (2009) examine some of the channels through which skilled migration may positively affect human capital of origin countries. An increasing bulk of empirical investigations has recently developed to assess the net overall impact of brain drain on sending countries' human capital, income and welfare; see for example Beine et al. (2001, 2007, 2008) and Docquier and Rapoport (2009).

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

than 70%[8]. This evidence clearly suggests that choices on human capital formation can not be adequately considered without taking account of government behaviour since human capital is ultimately determined by education policies as much as by private preferences.

Recent literature has dealt with possible interactions between education policies and skilled migration. For example, Justman and Thisse (1997) and Poutvaara (2004 and 2008) show that labour mobility reduces the incentive for national public funding of internationally applicable education; Egger et al. (2007) analyze the incentives for national governments to provide higher education in the presence of migration and argue that international coordination tends to increase public education expenditure compared to non-cooperation; Mendolicchio *et al.* (2009), dealing with a two-sector economy with a sufficiently large difference between total factor productivities, demonstrate that education subsidies in the low skill sector increase expected total surplus, while subsidies in the high skill sector reduce it. More relevant to this paper, 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 framework realistically allowing for distortions and costs connected to both controlling on emigration and handing out and financing education subsidies. In their model, the result of Stark and Wang (2002) holds when tax perception costs are higher than emigration control costs; when instead taxation 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 et al. (2008) conclude, "the beneficial brain drain hypothesis hardly resists a normative analysis".

The distinctive features of this paper are the existence of groups of workers with different talent and attitude to migrate and an explicit rationale for the government objective function. Private choices on human capital are assumed to be 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 supposed 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 subsidizes education to increase human capital accumulation toward the socially optimal level. The chance to migrate does not alter the socially optimal individual human capital, as government cares only for left behind residents welfare. With

[8] 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.

respect to the closed economy, subsidies are lower since the gap between individual and government target is smaller. If skilled migration 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: migration is unambiguously detrimental and brain drain takes place. In this case, a Bhagwati tax could be levied, aiming not at discouraging migration and reducing the incentive to human capital accumulation but at internalising benefits from migration and leading the social planner to pursue a higher human capital. Notably, in this framework the Bhagwati tax could be beneficial for all agents so that the practical difficulties that its implementation encounters might be in part alleviated. 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 share 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 $\theta \in \{\upsilon, \vartheta\}$, where υ and ϑ stand respectively for untalented and talented, with $\Pr(\theta = \vartheta) = q < 1$. 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 and decreasing with individual talent k_θ. Without loss of generality, I assume that $k_\theta = k_0 < 1$ for $\theta = \upsilon$, and $k_\theta = 1$ otherwise.

Government may influence individual choices on human capital accumulation by granting subsidies 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) financed by taxes proportional to human capital. Education policies are assumed to be budget balanced, i.e. subject to the constraint that aggregate

subsidies are at most equal to aggregate taxes. As customary in this kind of models (see Stark and Wang (2002)), I assume that government respects the budget constraint by choosing suitable values for unit subsidies s_θ and taxes t_θ such that[9],

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

with $0 \le t_\theta \le 1$ and $0 \le s_\theta \le 1$. In equilibrium 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 are disentangled from redistributive issues.

In the second period, individuals work and get a wage ω_θ net of human capital (and possibly other) 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. For the sake of simplicity, a linear production function is assumed with externalities accruing from the economy-wide average human capital[10] $Y = n[q(\beta h_\vartheta + \lambda\bar{h}) + (1-q)(\beta h_\upsilon + \lambda\bar{h})]$ for $h_\vartheta > 0$ and $h_\upsilon > 0$, where β and λ respectively denote private and social returns to human capital ($\beta > \lambda \ge 0$) and $\bar{h} = qh_\vartheta + (1-q)h_\upsilon$ 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 $\omega_\vartheta = \beta h_\vartheta + \lambda\bar{h}$, and likewise, the wage of untalented workers is $\omega_\upsilon = \beta h_\upsilon + \lambda\bar{h}$. 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 net wage minus the cost of human capital net of subsidies. Notice that $0 \le W_\theta \le W_\theta^U$. The first inequality is imposed by the workers' budget constraint. The threshold W_θ^U is reached when the human capital of the other group of workers is at the highest value compatible with their budget constraint $W_{-\theta} = 0$ so as to produce the largest externalities on type θ workers' wage. As long as a strictly positive welfare is feasible for each group, the welfare of any worker is strictly less than W_θ^U.

In the third period elections are held. The incumbent government aims at being re-elected to the next term. Workers decide whether to vote for it or for an alternative competitor, making their

[9] 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.

[10] Many of the following results would be qualitatively unaltered by using a logarithmic production function as in Stark and Wang (2002), at the cost of considerable additional awkwardness.

decision dependent on the value of their actual ex-post welfare, which in turn depends on government behaviour. As in our case the focus is not on electoral accountability (like in the strand of literature originated by Besley and Coate, 1997) but rather on the representation of heterogeneous voters' interests, issues such as information asymmetries and politician misbehaviour are ruled out[11]. As a consequence, to maximise re-election probability, government has to be genuinely committed to maximise 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

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

Individual workers of type θ choose their optimal private human capital by maximizing (2). Since the impact of the individual choice on average human capital is negligible, $\bar{h}$ is taken as given and social returns are not internalised in the workers' decision. In this case, optimal human capital is immediately derived as $\hat{h}_\vartheta^P = \beta$ for type ϑ workers and $\hat{h}_\upsilon^P = k_0\beta$ for type υ. Not surprisingly, $\hat{h}_\vartheta^P > \hat{h}_\upsilon^P$ i.e. talented individuals find it profitable to invest in human capital more than untalented. So the former become skilled workers whereas the latter rationally prefer to remain unskilled. Substituting optimal human capital back into $\bar{h}$ and (2), we immediately get the average human capital $\bar{h}^P = q\beta + (1-q)k_0\beta = \beta Q$, with $Q \equiv q + (1-q)k_0$. Optimal individual welfare and average welfare are easily calculated to be respectively $\hat{W}_\theta^P = \beta(\frac{k_\theta \beta}{2} + \lambda Q)$ and $\hat{W}^P = \beta(\frac{\beta}{2} + \lambda)Q$.

Let us now consider an incumbent government whose intent is to be re-elected. Let $\Pi(W_\vartheta, W_\upsilon, q) = q\Pi_\vartheta + (1-q)\Pi_\upsilon$ be its re-election probability, equal to the mean value of the conditional probabilities Π_θ that talented and untalented vote it. The stochastic approach can be justified in several ways. The actual welfare and the past performance of government are usually not the unique criteria on which voters' decisions are based. Even in this case, the assessment of the incumbent ability may be affected by exogenous circumstances independent of government behaviour. In the same way, the perceived competencies and political preferences (in favour of one

[11] The possibility that groups (skilled and unskilled; migrants and residents) may influence government behaviour through lobbying activities or financial incentives like in the approach of "protection function" (Grossman and Helpman, 1994; Eicher and Osang, 2002) is also excluded.

or the other group) of competitors may vary and affect re-election chances. Finally, there is an argument of realism, as in a deterministic approach, government would tend to be very (probably too) partisan: in order to be re-elected, it would maximize the welfare of median voter (who is of type ϑ if $q > 1/2$ and of type υ if $q < 1/2$) at the cost of a (possibly strong) reduction in the welfare of the minority group.

For both θ's, I assume that $\Pi_\theta(W_\theta) = \pi_\theta W_\theta$ is a continuous linear function increasing in W_θ with support $\left[0, W_\theta^T\right]$, where $W_\theta^T \geq W_\theta^U \ \forall\theta$, with $\Pi_\theta(0) = 0$, $\Pi_\theta(W_\theta^T) = 1$. The parameter π_θ measures the impact of changes in welfare on the probability that group θ electorate vote the incumbent government. In the absence of ideological preferences, it seems sensible to assume $\pi_\vartheta = \pi_\upsilon = \pi$. In this case, maximising the probability of re-election amounts to maximize the average welfare (i.e. the social welfare function):

$$W^G = q\left(\beta h_\vartheta - \frac{1}{2}h_\vartheta^2\right) + (1-q)\left(\beta h_\upsilon - \frac{1}{2k_0}h_\upsilon^2\right) + \lambda q h_\vartheta + \lambda(1-q)h_\upsilon. \qquad (3)$$

Simple calculations show that $\arg\max_{h_\vartheta} W^G \equiv \hat{h}_\vartheta^G = \beta + \lambda$, $\arg\max_{h_\upsilon} W^G \equiv \hat{h}_\upsilon^G = k_0(\beta + \lambda)$ and then $\bar{h}^G = Q(\beta + \lambda) > \bar{h}^P$.

As expected, 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 targets[12]. Social welfare is now $\hat{W}^G = \frac{(\beta + \lambda)^2}{2} Q > \hat{W}^P$ while per capita income is $\hat{y}^G = (\beta + \lambda)^2 Q > \hat{y}^P = \beta(\beta + \lambda)Q$.

These results can be summarised by

[12] 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 of the system (1) and $\hat{h}_\theta^P = \hat{h}_\theta^G \ \forall\theta$ are independent.

Proposition 1. *In a closed economy, a government aiming at being re-elected sets positive education subsidies and thus increases average human capital, social welfare and per capita income.*

It is worthwhile to notice that, although $\hat{h}_\theta^G$ 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 introduce migration in the analysis. In the second period, after forming human capital and before starting to work, individuals make the decision on where to work, i.e. whether to migrate or staying at home. Suppose that migration involves a fixed cost m_θ. 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 coefficients α and η, such that $\alpha > \beta$ and $\eta > \lambda$.

To introduce brain drain in the model, I assume that m_υ 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_υ and she will not migrate. Instead, in case $\rho = \mu$, the migration cost $m_{\vartheta\mu} = m_0$ 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 [13]. After migration takes place, the share of talented over total staying behind population will be $z \equiv \frac{q - pq}{1 - pq} < q$. Analogously to Q, let us define $Z \equiv z + k_0(1 - z) < Q$.

The chance of migrating makes the optimisation problem of talented to boil down to maximise

$$\max E(W_\vartheta) = \left[(\alpha p + \beta(1-p) - t_\vartheta)\right]h_\vartheta + (1-p)\lambda\bar{h} + p(\eta\bar{h}' - m_0) - \frac{1 - s_\vartheta}{2} h_\vartheta^2, \qquad (4)$$

whence the private optimal human capital turns out to be $\tilde{h}_\vartheta^P = \frac{\beta - t_\vartheta + p(\alpha - \beta)}{1 - s_\vartheta}$, and in the case of no policy intervention simply $\tilde{h}_\vartheta^P = \left[\beta + p(\alpha - \beta)\right]$. Conversely, the untalented still maximises

$$W_\upsilon = (\beta - t_\upsilon)h_\upsilon + \lambda\bar{h} - \frac{1 - s_\upsilon}{2k_0} h_\upsilon^2 \qquad (4')$$

so that without education policies, $\tilde{h}_\upsilon^P = k_0\beta$. The pre-migration average human capital is $Q\beta + pq(\alpha - \beta)$ while its after-migration value is $\tilde{\tilde{h}}^P = Z\beta + pz(\alpha - \beta)$.
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 in Appendix.

Proposition 2 confirms the ambiguity of the effect of potential migration on the human capital and welfare of sending countries. As shown in the Appendix, the after-migration average

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[13] More formally, the migration condition may be written $(\alpha - \beta)h_\vartheta > m_{\vartheta\mu} + \lambda\bar{h} - \eta\bar{h}'$. For the sake of simplicity, let $m_{\vartheta\mu} \leq (\eta\bar{h}' - \lambda\bar{h})$ hold, so that for any positive h_ϑ, the migration condition holds. Alternatively, one could assume that m_ϑ be uniformly distributed over the interval (0, m_υ). In this case the probability that a skilled worker migrates is calculated as $p(h_\vartheta) = \frac{(\alpha - \beta)h_\vartheta - \lambda\bar{h} + \eta\bar{h}'}{m_\upsilon}$ and the optimal human capital can be shown to be $\tilde{\tilde{h}}_\vartheta^P = \frac{m_\upsilon\beta}{m_\upsilon - (\alpha - \beta)^2} + \frac{(\alpha - \beta)(\eta\bar{h}' - \lambda\bar{h})}{m_\upsilon - (\alpha - \beta)^2}$. Since the SOC imposes $m_\upsilon > (\alpha - \beta)^2$, it follows $\tilde{\tilde{h}}_\vartheta^P > \hat{h}_\vartheta^P$.
With respect to the following analysis, this alternative framework implies (non crucial) changes in education subsidies but not in optimal h_ϑ^G so that propositions below remain (qualitatively) unaltered.

human capital $\tilde{\bar{h}}^P$ is the sum of two addends: the first is lower than $\bar{h}^P$ because skilled migration tends to reduce average human capital, while the second accounts for the positive impact of migration perspectives on human capital (the expected private emigration premium to human capital $p(\alpha-\beta)$), thus offsetting to some extent the first effect. So, the difference $\tilde{\bar{h}}^P - \bar{h}^P$ is a measure of the net brain gain: it is increasing in α and decreasing in β as both enter the differential return to human capital and the latter in addition is proportional to the closed economy optimal average human capital. Therefore 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. Consequently, the change in welfare $\tilde{W}^P - \hat{W}^P$ is ambiguous as well. 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 thus government gets social optimum by using education subsidies.

Let us consider then the behaviour of the government. As in the case of closed economy, its purpose consists in being re-elected. Since elections are held after migration, some migrants may not take part in elections. This because on one side many migrants lose contact with their origin country and are little interested in going to the polls and on the other, especially in less developed countries, voting from abroad is unfeasible and participation in elections requires to face the cost of going back home. For simplicity, let us suppose that no migrant votes: in this case, only the welfare of staying behind population will be relevant for re-election and so government will disregard emigrants' welfare. Re-election probability can be therefore written as $\Pi(W_\theta^R, z) = z\Pi_\vartheta + (1-z)\Pi_\upsilon$, where W_θ^R is the welfare of residents.

A different concern of benevolent governments for residents and migrants is quite widely accepted in the literature[14]. Mirrlees (1982) pointed out that 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". Here the greater attention of social planner for residents' interests is justified by the different attitude to affect political competition through voting between residents and migrants.

Keeping the same assumptions on Π_θ as in the case of closed economy, we can write the planner objective function as $\pi W^G = \pi z W_\vartheta^R + \pi(1-z)W_\upsilon$. This is maximised when

$$W^G = z\left(\beta h_\vartheta - \frac{1}{2}h_\vartheta^2\right) + (1-z)\left(\beta h_\upsilon - \frac{1}{2k_0}h_\upsilon^2\right) + z\lambda h_\vartheta + (1-z)\lambda h_\upsilon \qquad (5)$$

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

is maximised, i.e. for $\tilde{h}_{\vartheta}^{G} = \beta + \lambda$ and $\tilde{h}_{\upsilon}^{G} = k_0(\beta + \lambda)$. Hence, the optimal average human capital turns out to be $\tilde{\bar{h}}^{G} = z(\beta + \lambda) + (1 - z)k_0(\beta + \lambda) = Z(\beta + \lambda)$ and social welfare is easily calculated to be $\tilde{W}^{G} = Z\dfrac{(\beta + \lambda)^2}{2}$. The government achieves its objectives by paying different subsidies and levying different taxes to unskilled and skilled workers[15]. The former receive subsidies and pay taxes at rates respectively equal to $\tilde{s}_{\upsilon} = \dfrac{2\lambda}{\beta + \lambda}$ and $\tilde{t}_{\upsilon} = \lambda$ while for the latter $\tilde{s}_{\vartheta} = \dfrac{2(\lambda - p(\alpha - \beta))}{\beta + \lambda}$ and $\tilde{t}_{\vartheta} = \lambda - p(\alpha - \beta)$.

These results allow to state

Proposition 3. *If the social return is not lower than the expected private emigration premium to human capital, i.e. if* $\lambda \geq p(\alpha - \beta)$, *a government aiming at being re-elected sets non negative education subsidies, thus increasing average human capital and per capita income. Conversely, if* $\lambda < p(\alpha - \beta)$, *education subsidies for skilled are negative and the effect on average human capital and per capita income is ambiguous. In any case education policies increase residents' welfare.*

Proof in Appendix.

The meaning of Proposition 3 is clear. In the absence of migration, the government subsidizes human capital increasingly with its social return (Proposition 1). Migration stimulates human capital accumulation as well by the expected private emigration premium to skilled workers (Proposition 2). But human capital $\tilde{h}_{\vartheta}^{P}$ is (ex-post) too large for non migrating skilled workers: that is why government which cares only for staying behind residents reduces subsidies for skilled and may even make them negative. This justifies why policies may even imply a reduction of average human capital and per capita income if $\lambda < p(\alpha - \beta)$. In any case however education policies raise the value of residents' welfare function $\tilde{W}$.

More generally, from the perspective of a source country, a comparison between the case of closed economy and the one of migration is made by

[15] As long as individuals are assumed to consume only after paying taxing, there is no incentive for them to disguise their type θ because government learns which type workers belong to as soon as they complete their education and can therefore effectively introduce sanctions at least equal to expected gains from cheating. An interesting extension could explicitly deal with the problem of suitable incentives for truthtelling.

Proposition 4. *Compared to the case of closed economy, in the presence of education policies, a positive probability of migrating for skilled workers (i) reduces average 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.*
Proof in Appendix.

Proposition 4 makes several important points. 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 a result, 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 relatively less than richer countries. A similar result is obtained by Justman and Thisse (1997), Docquier et al. (2008) and Demange *et al.* (2008).

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. As a consequence, these latter 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 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 ex-ante 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 bring about a positive externality outweighing the fiscal loss.

Third, migration unambiguously leads to a detrimental brain drain and a welfare loss since education policies completely crowd out the positive incentive effects connected to potential migration. A similar result is obtained by Docquier et al. (2008); however, while in their model the welfare loss of emigration is simply due to the lower population size, here the effects of migration and education policies on residents' average human capital and welfare are directly accounted for.

Finally, migration is found to imply lower average human capital, welfare and income. While poverty has been widely recognised as one of the main determinants of large migration phenomena, Proposition 4 points out an opposite causal relationship: the higher migration rate, the lower education subsidies, the lower human capital and per capita income. If both these causal

relations are at work, poor countries run a strong risk to 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.

In this section a Bhagwati tax is considered in order to understand whether it can positively affect the welfare of source countries, as originally maintained by Bhagwati, and in addition to identify possible conditions under which a Bhagwati tax might be universally welfare improving, i.e. beneficial to residents and migrants of origin countries as well as to destination countries. This latter point is especially relevant to the end of practical application of the tax, because if everybody was better off with the tax, difficulties of implementation could be more easily overcome.

Assume that a Bhagwati tax $\tau(\alpha h_\vartheta + \eta\bar{h}')$, where $\tau < 1$ is the tax rate and $(\alpha h_\vartheta + \eta\bar{h}')$ is migrants' income, be levied on pqn migrants, and paid (possibly in addition to ordinary income taxes) to destination countries. These latter collect the fiscal revenues and then transfer it to $(1-pq)n$ natives staying at home country, receiving each a transfer[16] of $T = \phi\tau(\alpha h_\vartheta + \eta\bar{h}')$, where $\phi \equiv \frac{pq}{1-pq}$ is the ratio between migrants and staying behind residents' in the origin country. Since T and τ enter individual and social welfare ((4), (4') and (5)), the Bhagwati tax turns out to affect decisions on human capital accumulation.

In particular, the expected welfare of talented and untalented individuals can be now respectively written as

$$E(W_\vartheta) = p\left((\alpha h_\vartheta + \eta\bar{h}')(1-\tau) - m_0\right) + (1-p)(\beta h_\vartheta + \lambda\bar{h} + T) - t_\vartheta h_\vartheta - \frac{1-s_\vartheta}{2}h_\vartheta^2 \qquad (6)$$

where, in order to keep a productivity advantage for the foreign economy, $\alpha(1-\tau) > \beta$ is assumed, and

$$W_\upsilon = (\beta - t_\upsilon)h_\upsilon + \lambda\bar{h} + T - \frac{1-s_\upsilon}{2k_0}h_\upsilon^2 \qquad (6')$$

As shown by (6) and (6'), the Bhagwati tax allows staying behind population to take a share of migration gains off the pocket of migrants through transfers T. This means that a greater human capital favours not only migrants who enyoy a higher return abroad but even residents by magnifying their revenues from nationals abroad.

[16] The simplifying hypothesis of lump-sum transfers is not crucial. What really matters is that fiscal revenues sent back to origin countries enter welfare of staying behind residents. For example, the funds raised by the Bhagwati tax could be used by destination countries to finance schools and universities in the source country.

Maximising (6) and (6') yields private optimal human capital[17] $\breve{h}_{\vartheta}^{P} = \dfrac{\beta - t_{\vartheta} + p(\alpha(1-\tau)-\beta)}{1-s_{\vartheta}}$, (or simply $\breve{h}_{\vartheta}^{P} = \beta + p(\alpha(1-\tau)-\beta)$ in case no education policies are implemented) and $\breve{h}_{\upsilon}^{P} = k_0 \dfrac{\beta - t_{\upsilon}}{1-s_{\vartheta}}$ ($\breve{h}_{\upsilon}^{P} = k_0\beta$ without education policies).

Unlike private agents, the social planner does not consider transferred inflows as externalities. Thus substituting for T in the social welfare function, a government aiming at being re-elected maximises

$$W^{G} = z\left((\beta+\lambda)h_{\vartheta} - \frac{1}{2}h_{\vartheta}^{2}\right) + (1-z)\left((\beta+\lambda)h_{\upsilon} - \frac{1}{2k_0}h_{\upsilon}^{2}\right) + \phi\tau(\alpha h_{\vartheta} + \eta\bar{h}') \qquad (7)$$

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. Socially optimal human capital from (7) are respectively $\breve{h}_{\vartheta}^{G} = \beta + \lambda + \phi\alpha\tau$ for skilled and $\breve{h}_{\upsilon}^{G} = k_0(\beta+\lambda)$ for unskilled. The average human capital turns out to be $\breve{\bar{h}}^{G} = Z(\beta+\lambda) + z\phi\alpha\tau$. The values of subsidy and tax rates suitable to get the policy target $\breve{h}_{\vartheta}^{G}$ and $\breve{h}_{\upsilon}^{G}$ are now $\breve{s}_{\vartheta} = 2\dfrac{(1-p)\big(\lambda - p(\alpha(1-\tau)-\beta)\big) + \alpha\tau p}{(1-p)(\beta+\lambda) + \alpha\tau p}$ and $\breve{t}_{\vartheta} = \lambda - p(\alpha(1-\tau)-\beta) + \dfrac{\alpha\tau p}{1-p}$ for talented, and again $\breve{s}_{\upsilon} = \dfrac{2\lambda}{\beta+\lambda}$ and $\breve{t}_{\upsilon} = \lambda$ for untalented. As a consequence we can state

Proposition 5. *Without education policies, a Bhagwati tax (i) reduces the average human capital and (ii) has ambiguous effects on residents' welfare. With education policies (implemented by a government aiming at being re-elected), a Bhagwati tax increases (iii) education subsidies, (iv) average human capital and (v) residents' welfare.*

Proof in Appendix.

Proposition 5(i)-5(ii) points out the possible negative effects of the Bhagwati tax on human capital and welfare of source countries. Human capital decreases because the expected private emigration premium is lowered by the tax. The impact on residents' welfare is ambiguous: on one side, human capital is pushed down while on the other residents receive transfers from abroad thanks to the Bhagwati tax. When optimal education policies are implemented, the effects of a

[17] T is assumed to be considered a positive externality by individuals because they do not take into account the effect of their investment in human capital on transfers.

Bhagwati tax significantly change (Proposition 5(iii) to 5(v)). In this case, the weight of expected private emigration premium (included the additional diminishing effect of the Bhagwati tax) on human capital accumulation is neutralised by education subsidies and taxes. On the other hand, the Bhagwati tax transfers a part of migrants' higher gains abroad to residents. Since transfers to residents are proportional to human capital of migrants, the optimal level of education subsidies and human capital increases. Finally, residents' welfare increases as well, as for staying behind workers the advantage of receiving the transfer prevails over the excess effort connected to additional human capital.

The last question concerns the hypothesis that in the presence of education policies a Bhagwati tax might be universally welfare improving, i.e. it may benefit to some extent all individuals, origin country's residents and migrants, and destination country's workers. It is worthwhile to notice that without education policies this can never occur because in this case migrants are forced to suboptimally investing in human capital and in addition loose a share of their income. When education policies are implemented, the Bhagwati tax raises origin countries residents' welfare (Proposition 5). As migrants' human capital is larger than it would be without the tax, destination countries are benefitted as well (assuming that the cost of transferring fiscal revenues is low enough). Therefore for the Bhagwati tax to be universally welfare improving, we only need to identify the conditions under which for migrants the benefit deriving from a higher human capital is not less than the cost connected to the payment of the tax.

Proposition 6. *In the presence of optimal education policies, if the private return to human capital in the host country and the share of migrants on population in the source country are sufficiently large, a Bhagwati tax levied at rate* $\tau^* > 0$ *increases migrants' welfare and is therefore universally welfare improving.*
Proof in Appendix.

According to Proposition 6, a Bhagwati tax may be beneficial even for migrants (and therefore for all), provided that the return to human capital and the number of migrants relative to population be high enough. Again, the interpretation of this result is straight. Both a relatively large number of migrants ϕ and a large return to human capital α imply that the impact of education policies on human capital is bigger. In addition a big α also implies that the advantage for migrants of having a larger human capital stock is greater. In these circumstances, migrants are ex-ante better off when a Bhagwati tax is levied. Obviously, this can not prevent them from behaving opportunistically, i.e. enjoying a larger human capital and income thanks to the Bhagwati tax, but still evading the tax. However, if a Bhagwati tax was not longer seen as discriminatory and ethically

deplorable, migrants could less easily renege on a pledge made when receiving education subsidies to pay the tax once migrated.

Another possible way to implement a Bhagwati tax does not involve any additional fiscal burden for migrants. In this case, destination countries would voluntarily forgo a part of fiscal revenues coming from ordinary taxation on migrants' income, to transfer it to origin countries. If the transferred share of fiscal revenues is equal to Bhagwati taxation $npq\tau(\alpha h_{\vartheta} + \eta\bar{h}')$, all nationals of origin countries would be better off (with respect to the previous case, residents' welfare would be unaltered, while migrants would have the same human capital without paying the tax). The reason for which destination countries' governments could accept to make a Bhagwati transfer is that the benefit resulting from the increase in the human capital of immigrants might offset the cost of lower fiscal revenues. Proposition 7 points out the conditions under which this may occur.

Proposition 7. *In the presence of optimal education policies, if private and social returns to human capital in the host country and the share of migrants on population in the source country are sufficiently large, a transfer equal to the overall amount of a Bhagwati tax levied at rate* $\tau^* > 0$ *increases destination countries' welfare and is therefore universally welfare improving.*
Proof in Appendix.

The intuition behind Proposition 7 is again based on the impact that a large share of migrants and a large return to human capital have on the effectiveness of education policies on the investment in human capital by migrants. The importance of social return can be easily explained: the greater η, the larger the effect of a bigger human capital of migrants on destination countries residents' welfare.

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 case the tax is paid by migrants in addition to the ordinary income taxation, if the private return to human capital in the

host country and the share of migrants on population in the source country are sufficiently large, it is proved that the larger fiscal burden borne by migrants can be outweighed by higher human capital and gross income. Difficulties would remain in practically implementing a Bhagwati tax, especially because prosecution for the evasion of this tax is more difficult than for other tax offences. However, if the Bhagwati tax can be shown to be beneficial even for migrants, moral justifications of evasion based on the principle that this tax is discriminating would be seriously challenged and this might have effects on the propensity to evade.

Alternatively, should the transfer be financed by the destination country, if private and social returns to human capital in the host country and the share of migrants on population in the source country are sufficiently large, the fiscal losses suffered by the governments of hosting countries might be outweighed by the advantage of having more skilled immigrants. In this case, international cooperation and aids to poor high-migration countries by rich target countries would have a rational self-interest basis. Restrictive migration policies are costly; financing education in poor countries to employ more skilled immigrants might be more profitable for all.

Appendix

Proof of Proposition 2.

The pre-migration average human capital $Q\beta + pq(\alpha - \beta)$ is clearly greater than $\bar{h}^P$. The difference $\tilde{\bar{h}}^P - \bar{h}^P = pz(\alpha - \beta) - (Q - Z)\beta$ has ambiguous sign. Migration affects residents' social welfare as well by the 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.

Proof of Proposition 3.

The inequality $\lambda \geq p(\alpha - \beta)$ is a sufficient condition for the following three inequalities to hold:

$$\tilde{s}_\vartheta = \frac{2(\lambda - p(\alpha - \beta))}{\beta + \lambda} \geq 0;$$

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

$$\tilde{y}^G - \tilde{y}^P = (\beta + \lambda)\left[z(\lambda - p(\alpha - \beta)) + (1 - z)k_0\lambda\right] > 0.$$

Notice that the individual human capital is increasing for unskilled $\tilde{h}_\upsilon^G > \tilde{h}_\upsilon^P$ and non decreasing for skilled $\tilde{h}_\vartheta^G \geq \tilde{h}_\vartheta^P$.

If $\lambda < p(\alpha - \beta)$, it will clearly follow $\tilde{s}_\vartheta < 0$, while the differences $\tilde{\bar{h}}^G - \tilde{\bar{h}}^P$ and $\tilde{y}^G - \tilde{y}^P$ will have ambiguous sign.

Finally, $\tilde{W}^G - \tilde{W}^P = \frac{z}{2}(\lambda - p(\alpha - \beta))^2 + (1 - z)k_0\frac{\lambda^2}{2}$ is always positive.

Proof of Proposition 4.

4.(i) is proved by $\tilde{s}_\upsilon - \hat{s}_\upsilon = 0$ and $\tilde{s}_\vartheta - \hat{s}_\vartheta = -\frac{2p(\alpha - \beta)}{\beta + \lambda}$. 4.(ii) follows from $\tilde{h}_\theta^G = \hat{h}_\theta^G$. Noting that $\frac{\partial(p/(1 - pq))}{\partial p} > 0$, 4.(iii) is demonstrated by calculating $\tilde{\bar{h}}^G - \bar{h}^G = (Z - Q)(\beta + \lambda) = -(1 - k_0)\frac{pq(1 - q)}{1 - pq}(\beta + \lambda)$, 4(iv) from

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

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

Proof of Proposition 5

5.(i) follows from $\breve{h}_{\vartheta}^P < \tilde{h}_{\vartheta}^P$ and $\breve{h}_{\upsilon}^P = \tilde{h}_{\upsilon}^P$. 5.(ii) is proved by calculating

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

5.(iii) derives from $\breve{s}_{\vartheta} - \tilde{s}_{\vartheta} = 2p\tau\alpha\frac{(\beta + p(\alpha-\beta) + (1-p)(\beta+\lambda)}{((1-p)(\beta+\lambda) + p\tau\alpha)(\beta+\lambda)}$ and $\breve{s}_{\upsilon} = \tilde{s}_{\upsilon}$. 5.(iv) follows from $\breve{h}_{\vartheta}^G > \tilde{h}_{\vartheta}^G$ and $\breve{h}_{\upsilon}^G = \tilde{h}_{\upsilon}^G$. Finally, by substituting optimal human capital in (7) and (5), it is easily found that the change in residents' welfare is positive, i.e. $\breve{W}^G - \tilde{W}^G = \phi\alpha\tau\left((1+z)(\beta+\lambda) + \frac{\eta\bar{h}'}{\alpha} + (1-\frac{z}{2})\phi\alpha\tau\right)$.

Proof of Proposition 6.

The change in migrants' welfare due to the introduction of the Bhagwati tax is $\Delta W_M = -\alpha\tau\left[\beta + \lambda + \frac{\eta}{\bar{h}'} - \alpha\phi(1-\tau)\right]$. At $\tau = 0$, $\Delta W_M = 0$ and $\frac{\partial \Delta W_M}{\partial \tau} = \alpha^2\phi - \alpha(\beta+\lambda) - \eta\bar{h}'$. It follows that if α and ϕ are sufficiently large, there is an interval of values for $\tau^* > 0$ such that $\Delta W_M > 0$.

Proof of Proposition 7.

Assume that in destination country individual welfare is $W_D = \alpha h_D - \frac{h_D^2}{2} + \eta\bar{h}'$, where h_D is residents' individual human capital, $\bar{h}' = \psi h_D + (1-\psi)h_{\vartheta}$ is the average human capital (which accounts for immigrants' human capital) and ψ is the share of native over total population. A transfer equal to a Bhagwati tax at rate τ brings about a change in welfare ΔW_D equal to the difference between $\eta(1-\psi)\phi\alpha\tau$ (the gain deriving from rising immigrants' human capital h_{ϑ}) and the additional individual cost of the transfer. This latter, in case population is equal to n (as in

the source country), amounts to $pq\tau\left[(\alpha+\eta(1-\psi))(\beta+\lambda+\phi\alpha\tau)+\eta\psi h_D\right]$. At $\tau=0$, $\Delta W_D=0$ and $\frac{\partial \Delta W_D}{\partial \tau}=\alpha\left[\frac{(1-\psi)}{1-pq}-\frac{\beta+\lambda}{\eta}\right]-\left[\psi h_D+(1-\psi)(\beta+\lambda)\right]$. It follows that if α, η and pq are sufficiently large, there is an interval of values for $\tau^*>0$ such that $\Delta W_D>0$.

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