Externalities from International Labor Migration: Efficacy of a Brain Drain Tax in the Euro-Mediterranean Region

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Abstract

This paper uses a two-region, two-period overlapping generations model with international labor mobility to examine the efficacy of using tax policy to internalize the externalities created by international labor migration. While a brain drain tax has a substantial limiting effect on labor migration and a small negative effect on per worker growth, it is found to be a viable solution to the negative externality problem. It is also found that the brain-drain tax can raise substantial tax revenue for the SMCs which could be used to enhance human capital in the region.

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1. Introduction

Euro-Mediterranean Region countries have strong demographic differences. Within the Middle East and North Africa (MENA) part of this region, Arab countries have higher fertility and population growth rates and a significantly younger age structure than other countries and regions. The 2002 Arab Human Development Report notes that this can present a "demographic gift or a demographic curse" depending on whether the high population growth and fertility can be transformed into human wealth through capital investments and technological progress. Similarly, in a recent study, Dhonte, Bhattacharya and Yousef (2000) argued that the expected "explosion" in working-age population in the Middle East present challenges as well as opportunities for these countries. These unique demographic characteristics show stark contrast to the European counterparts where countries are going through a serious population aging trend.[1] Table 1 shows the significant demographic differences between MENA countries, 9 Southern Mediterranean Countries[2] as a subgroup of MENA countries and 19 European countries. Population projections show that MENA countries stand out as the group that is clearly different from the European countries particularly until 2060. Southern Mediterranean countries have by and large similar population characteristics to the general MENA group. MENA and Southern Mediterranean Countries (SMCs) have and will continue to have significantly younger populations than the European countries while this gap between these countries is expected to close to a large extent by 2060. It's also noteworthy that SMCs are expected to have a considerable increase in their working-age population (population 15-64) between 2000 and 2030 relative to both European countries and the general group of MENA countries.

[1] See Heller (2003) and CSIS (2002) for recent discussions on the aging trend in developed countries.
[2] These are Algeria, Egypt, Jordan, Lebanon, Libya, Morocco, Syria, Tunisia, and Turkey. Israel is not included in this group due its demographic similarity to more developed countries.

<Insert Table 1 here>

One important outcome of the demographic differences mentioned above has been substantial labor migration from the Southern Mediterranean to the European countries in the North.[3] According to the United Nations' 2005 revision of international migration trends, Europe has been host to about 34 per cent of all migrants in 2005. Fargues (2006) showed that "Europe is the single largest destination of first-generation Arab emigrants, and hosts 59% of all such emigrants worldwide" (Fargues, 2006: 8, 25). While such labor migration has been driven mainly by economic and demographic differences between these two regions, it has created important externalities. These externalities took the form of negative externalities through brain drain in the SMCs and both positive externalities through brain gain and negative externalities through congestion and social problems for the European countries.[4] Bhagwati (1972, 1976a, 1976b) argued that taxing this brain drain could be a solution to the negative externality problem. He also argued that the current system of income taxation based on residence instead of citizenship leads to representation of immigrant workers in home countries without taxation. This brain-drain tax idea is resurfacing again in the recent literature where several papers have argued the virtues of such a tax for developing countries (Desai, Kapur and McHale, 2004; Straubhaar, 2000).

This paper puts international labor migration into a global externalities framework that has recently been popularized by Kaul *et al*. (1999, 2006). At the same time, the

[3] These demographic differences can also lead to capital flows between regions. See Börsch-Supan, Ludwig and Winter (2005), Tosun (2008) and Tosun (2003) for studies on examining the link between population aging and capital flows.

[4] One may argue that workers' remittances to the SMCs are positive externalities from labor migration to Europe. However, these are pecuniary externalities and hence do not fall under the category of technological externalities examined by the public finance literature.

paper contributes to the literature on brain drain taxation that dates back to Bhagwati's original proposal in mid-1970s. The paper uses a two-region, two-period overlapping generations model with international labor mobility to examine the efficacy of using tax policy to internalize the externalities created by international labor migration. The goal is to examine the human capital, growth and welfare consequences of labor movements and a "brain-drain tax" similar to what was originally proposed by Bhagwati (1972).

The paper is structured as follows. The next section gives a description of a two-region, two-period overlapping generations model with international labor mobility. This is followed by a transition analysis in section 3 that shows results from a numerical simulation exercise. Section 4 shows the budgetary implications of the brain drain tax and discusses issues related to the administration of such a tax. The last section presents summary and concluding remarks.

2. The Two-Region Model of Brain Drain and Taxation

The model builds on a two-period overlapping generations model first developed by Diamond (1965)[5]. To examine open economy issues, the standard framework is extended to a two-region model with international labor mobility similar to Galor (1986, 1992) and Crettez *et al.* (1996, 1998)[6]. Labor mobility has a dual effect in the sense that it exhibits the characteristics of capital as well. Young migrant workers contribute to the economy both as laborers through their human capital, and as savers through their supply of capital. Another major extension is modeling the link between human capital accumulation and tax policy to address the brain drain and taxation issues. Brain-drain tax is assumed to be just the home country's income tax rate imposed on the migrant

[5] However, the earliest overlapping generations models are described by Allais (1947) and Samuelson (1958). Children are not modeled in a two-period model.
[6] A two-country model with international capital mobility is shown by Buiter (1981).

workers. Hence, it is really not a separate tax. For clarity, the model is presented for one region only. This is followed by a description of the two-region world equilibrium.

2.1. Households

Individuals live for two periods and seek to maximize a utility function based on discretionary consumption in the first and second period of their lives,

$$U = \ln C_{jt} + \left(\frac{1}{1+\delta}\right)\ln C_{jt+1}, \tag{1}$$

here *j* indexes individuals, C_{jt} is consumption when young, C_{jt+1} is consumption when old, and δ is the pure rate of time preference. The period-specific budget constraints in the first and the second periods are:

$$\text{First period: } C_{jt}\left(a_j\right) + S_{jt}\left(a_j\right) = \left(1-\tau_t\right) w_t l_t\left(a_j\right)$$

$$\text{Second Period: } C_{jt+1}\left(a_j\right) = \left(1+\left(1-\tau_{t+1}\right) r_{t+1}\right) S_{jt}\left(a_j\right), \tag{2}$$

where $S_{jt}\left(a_j\right)$ is first period saving, w_t is the wage rate individual *j* faces, $l_t\left(a_j\right)$ is effective labor,[7] where a_j is the ability level of individual *j*, r_{t+1} is the rate of return to capital, τ_t is the rate of income taxation that is applied to both capital and labor income. This tax is used entirely to finance a productivity enhancing public program. For simplicity, this public program will be referred to as "education" throughout the text.[8] The goal is to highlight the strong link between this type of government spending and

[7]Here, young supplies one unit of time to the economy. Note that, making the allocation of time between "schooling" and supplying labor endogenous does not change this analysis.

[8] It should be noted that any other government program that is directed towards increasing the labor productivity of young could easily be used.

human capital accumulation, which is considered to be one of the most important avenues for economic growth.[9]

It is assumed that there is a continuous distribution of abilities that is replicated in each new generation. The ability level of individual *j* is indexed by a_j, which ranges from 0 to 1. The density function of abilities is denoted by *f(a)* where by definition:

$$\int_0^1 f(a)\,da = 1 . \tag{3}$$

Human capital is accumulated from the interaction of ability level (a_j) of the individual and government spending per young (g_t^e) on education:

$$l_t(a_j) = \Phi\left[a_j g_t^e + 1\right]^{\psi}, \tag{4}$$

where, Φ denotes an index on human capital efficiency and ψ is a parameter indicating the return to human capital from the inputs (a_j and g_t^e).[10] The form of the human capital function is chosen so that even individuals with the lowest ability $(a_j = 0)$ will contribute to the economy in terms of human capital (see Holtz-Eakin, Lovely, and Tosun 2004). From the maximization of (1) subject to (2) and (4); we get the familiar first order condition:

$$C_{jt}(a_j) = \frac{1+\delta}{\left(1+r_{t+1}\left(1-\tau_{t+1}\right)\right)} C_{jt+1}(a_j). \tag{5}$$

Using (5) and (2), we derive the optimal saving of an individual *j*:

$$S_{jt}(a_j) = \frac{1}{2+\delta}\left(1-\tau_t\right) w_t l_t(a_j). \tag{6}$$

[9] Tosun (2005) introduced a social security program in the model by having an exogenously fixed level of social security spending. An income tax that is earmarked for social security adjusts through the periods to balance the social security budget. Thus, there are separate taxes for education and social security spending with voters deciding only on the education tax rate. The results from that paper showed that modeling social security in this way only affected the magnitude of the effects, not the qualitative results.

[10] ψ should be less than or equal to unity to prevent increasing returns from government spending.

Saving of an individual depends on net labor earnings but it is independent of the interest rate. This is due to the Cobb-Douglas form of the utility function. Given (5) and (6), it is straightforward to derive consumption functions in each period:

$$C_{jt}\left(a_j\right)=\frac{1+\delta}{2+\delta}\left(1-\tau_t\right)w_t l_t\left(a_j\right)$$

$$C_{jt+1}\left(a_j\right)=\frac{\left(1+r_{t+1}\left(1-\tau_{t+1}\right)\right)\left(\left(1-\tau_t\right)w_t l_t\left(a_j\right)\right)}{2+\delta}. \tag{7}$$

2.2. Political Process of Tax Policy and Brain Drain

To make the process of tax policy determination for education rich, interesting, yet tractable, a median-voter framework with voter heterogeneity is used.[11] This framework suggests that public sector responds to voter preferences over the long period (thirty years) assumed in the two-period overlapping generations model. Voter heterogeneity is introduced by assuming a distribution of genetic ability levels for the working generation.[12] The ability level of the individual will, in turn, determine the value she receives from education.

The consumption and saving decisions, as seen section 2.1, depend on human capital, which is in turn determined by government spending (see equation 4). By plugging these into (1), we get the indirect utility function, which each voter maximizes, in determining his or her preferred tax rate, subject to the government budget constraint

[11] The political process is modeled through a median voter framework because the conditions for the median voter theorem are satisfied. The choice of voters is over a single dimension since the preferred education tax rate is the only choice variable, and the voter preferences are single peaked. The property of single-peakedness has been demonstrated to ensure existence of a voting equilibrium (Black 1948).

[12] While not very realistic, uniform distribution is used for its simplicity in deriving analytical results.

for this type of government spending $(\tau_t y_t = g_t^e)$.[13] The preferred tax rate of individual *j* when young is:

$$\tau_{jt}\left(a_j\right) = \frac{a_j \psi y_t - 1}{\left(1+\psi\right) a_j y_t} \ . \tag{8}$$

Equation (8) is the tax rate each individual prefers based on her ability level. This preferred tax rate is increasing in both ability level a_j and in income per young. In addition, because the old do not derive any benefit from publicly provided education and there are no bequests in the model, they incur a cost without enjoying any benefits. Therefore, their preferred education tax rate will always be zero, regardless of their ability.

Total population in each period is $N_{t-1} + N_t$ where N_t is composed of both newly born nationals and migrant workers. Given this, the median voter is defined by

$$N_{t-1} + N_t \int_0^{a_m} f\left(a\right) da = \frac{N_{t-1} + N_t}{2}, \tag{9}$$

where a_m is the ability level of the median voter.

With lower population growth (due to lower fertility or labor outflow), the median voter becomes a person with lower ability (see Appendix), and the preferred tax rate of the median voter is lower. This, in turn, leads to a lower government spending on public education which has a negative impact on human capital accumulation. Hence, for example, the impact of labor outflows on human capital in the SMCs would be two fold: first through loss of total human capital from emigration of workers and second through reduced average human capital for each remaining worker. While the former effect is the typical brain drain argument, the latter is an additional brain drain effect from loss of

[13] It is assumed in each period that government uses the entire revenue from this tax to finance the public good for all young equally, regardless of their ability level (Bearse, Glomm, and Ravikumar 2000).

productive political participation of young workers in home country. This latter effect is a novel aspect of the model which has not been widely addressed in the previous literature. A brain drain tax enables representation with taxation. By paying the home country's income tax, migrant workers are allowed to vote for the tax rate and thereby help improve the provision of education in the home country.

2.3. Producers

Each country produces a single good using a Cobb-Douglas production technology.

$$Y_t = \Lambda K_t^{\alpha} H_t^{1-\alpha} \ , \tag{10}$$

here Λ is the productivity index, K is capital stock and H is aggregate supply of human capital. The aggregate supply of human capital is:

$$H_t = N_t \int_0^1 l(a)\, f(a)\, da. \tag{11}$$

Human capital per worker, using (4) and (11), is

$$h_t = \Phi \int_0^1 (ag_t + 1)^{\psi} \ f(a)\, da. \tag{12}$$

Competitive factor markets require that real wage and interest rates are equal to the marginal products of labor and capital respectively. Therefore, factor demand equations are:

$$w_t = (1-\alpha)\Lambda \left(\frac{k_t}{h_t}\right)^{\alpha} \tag{13}$$

$$r_t = \alpha\Lambda \left(\frac{k_t}{h_t}\right)^{\alpha-1} \ . \tag{14}$$

Here, $k_t = K_t / N_t$ and $h_t = H_t / N_t$ are capital stock per worker and human capital per worker, respectively.

Using (6) and (12), saving per worker can be expressed as

$$s_t = \left(\frac{1}{2+\delta}\right)(1-\tau_t) w_t \Phi \int_0^1 (a g_t + 1)^{\psi} f(a)\, da. \tag{15}$$

2.4. International Equilibrium with and without the Brain Drain Tax

In the absence of international capital mobility, capital market equilibrium requires that saving in each period equals to accumulated capital in the following period. Capital market equilibrium conditions for each region can be depicted as

$$k_{t+1}^A = \frac{N_t^A s_t^A}{N_{t+1}^A} \tag{16}$$

$$k_{t+1}^B = \frac{N_t^B s_t^B}{N_{t+1}^B}, \tag{17}$$

where, superscripts *A* and *B* denote regions.

To close the dynamic model, international labor market equilibrium must be specified. In the case of perfect international labor mobility, international labor market equilibrium requires

$$N_{t+1}^A + N_{t+1}^B = \left(1+\eta_{t+1}^A\right) N_t^A + \left(1+\eta_{t+1}^B\right) N_t^B. \tag{18}$$

where, η_{t+1}^A and η_{t+1}^B are the population growth rates in region A and region B, respectively. In the perfect labor mobility model, labor income is taxed where income is

earned. Thus, source based income taxation is used for both regions.[14] This implies that net-of-tax wage rates are equalized in equilibrium. Therefore, the international labor flow constraint is:

$$w_{t+1}^{A}\left(1-\tau_{t+1}^{A}\right)=w_{t+1}^{B}\left(1-\tau_{t+1}^{B}\right). \tag{19}$$

It is assumed that only the members of the young generation moves between regions. Both regions are assumed to have "uniform" ability distributions, which mean that migration does not have any effect on the ability distribution in these regions.[15]

When a brain drain tax is imposed, the international labor flow condition above changes. To see this change, assume that region A is Europe and region B is the Southern Mediterranean. In that case, the income tax rate of region B will be imposed as a brain drain tax on the workers that migrate to region A.[16] Hence, labor from region B will flow to region A according to the following condition:

$$w_{t+1}^{A}\left(1-\tau_{t+1}^{A}-\tau_{t+1}^{B}\right)=w_{t+1}^{B}\left(1-\tau_{t+1}^{B}\right) \tag{20}$$

The model incorporates the interaction of household behavior, firm behavior, political process, and international labor flows. The model explained above will be used to examine the labor flows between two regions that have strong population differences such as Europe and Southern Mediterranean and the impact of these flows on the human capital accumulation in both regions.

[14]Under a source system, labor income is taxed where income is earned. The model tax treaties of the OECD and the United Nations both give source countries the first rights to tax income accrued within their borders.

[15] A more realistic case is allowing for migration of workers that have certain abilities (unskilled vs. skilled). However, this would conflict with the uniform ability distribution which assumes that ability levels in the distribution are chosen at random.

[16] It's assumed here that brain drain tax is a tax that is only imposed by the SMCs (region B). This is in line with the main negative externalities argument based on brain drain from the SMCs.

3. Aging Europe and Brain Drain from SMCs

3.1. Closed Economy and Labor Mobility Simulation Results

Simulations in this section are based on the population projections for European countries and the SMCs derived from the 2002 revision of the "World Population Prospects" published by the United Nations (United Nations, 2002a). The simulations will be shown for two 30-year periods, 2000–30 and 2030–60 and for the entire period 2000–60. The average population growth rates for the 1970–2000 period are used as a starting point.

A critical parameter in the model is the elasticity of human capital with respect to government spending on education and ability level (ψ). Laitner (2000b) used a human capital function that is similar to (4) and set his human capital elasticity with respect to education equal to 0.1967. Based on an initial value of the ability of the median voter, Laitner's estimate corresponds approximately to $\psi = 0.4$ in our model. However, series of studies (and updates) by Psacharopoulos (1985, 1994 and 2004) estimated a significantly higher rate of return to education for low income and developing countries compared to developed countries. Hence, $\psi = 0.5$ is chosen as a compromise given Laitner's estimate and the SMCs used in population projections.

We start with the "perfect labor mobility model" where there is perfect international labor mobility with migrant labor participating in the political system of the host country but not the home country. Based on the population projections for the two regions, labor migrates from the SMCs to the European countries. Figure 1 shows this in reference to the change in the number of workers in both regions. European countries experience a major boom in foreign workers, particularly between 2000 and 2030. This boom is almost about six times greater than the growth attributed to the native worker

population. Figure 2, on the other hand, shows that the SMCs send labor to Europe and thus experience significantly lower domestic labor growth despite a high population growth.

<Insert Figure 1 and Figure 2 here>

We now compare this to our alternative "labor mobility model with brain drain tax" where migrant workers participate in the political system of both host and home countries but at the same time remit the additional income tax (brain drain tax) to the home country. Figure 3 shows that this leads to a significant decrease in the number of workers migrating to Europe in both periods. Figure 4 mainly confirms this by showing that the growth in the number of workers lost to out-migration of workers is very small compared to the overall growth in number of workers. Apparently, brain drain tax acts as a significant migration control mechanism.

<Insert Figure 3 and Figure 4 here>

3.2. Model Comparisons

To understand the economic and fiscal impact of brain drain through labor flows, we first compare the perfect labor mobility model to a closed economy model. These simulation results are shown in columns (1)-(4) of Tables 2 and 3. Table 2 shows the per worker values of selected economic variables. European countries benefit from labor migration from the SMCs particularly in terms of education spending per worker and human capital per worker. However, they are adversely impacted by the large influx of foreign workers in the 2000-2030 period. The benefits of the labor migration to Europe are even clearer when we look at the aggregate economic values shown in Table 3. The aging Europe clearly benefits from the economic expansion made possible by the

contributions of migrant workers as laborers, savers and participants in the policymaking that determines the provision of the productivity enhancing public good (education). SMCs, on the other hand, suffer economically (lower capital, human capital and income growth) mainly due to loss of workers to the European countries. As mentioned before, the impact of the loss of workers on human capital in the SMCs are two fold: first through loss of total human capital from outflow of workers and second through reduced average human capital for each remaining worker which is due to the loss of productive political participation of young workers in the home country. We see the clear evidence of this in the sharp decreases in the income tax rate in the SMCs in both periods.

The next comparison is with the labor mobility model with brain drain tax. Simulation results for this model are shown in columns (5) and (6) of Tables 2 and 3. European countries seem to benefit from such a tax through smaller labor flows that lead to more stable changes in the per worker values of their economic variables, particularly in capital per worker and income per worker. On the other hand, their aggregate economic expansion is also less pronounced. Hence, while the brain drain tax has a negative impact on the overall economic activity in European countries, it also triggers a relatively more stable economic growth by limiting large influx of workers. For the SMCs, the brain drain tax improves on both the human capital per worker and total human capital accumulation. While it seems to limit economic growth slightly in per worker terms, it contributes significantly to aggregate economic expansion as seen in Table 3. By limiting harmful out-migration of workers, the brain drain tax functions like a Pigouvian tax which is considered a first-best solution to the negative externality problem.

5. Budgetary Implications of the Brain Drain Tax and Some Administration Issues

Simulations in the previous section give us an idea about the budgetary implications of such a tax for the SMCs. Considering the results for number of migrants, the income tax rate in the SMCs and the income per worker in the European countries, the share of the brain drain tax in total income tax revenues in the SMCs is calculated as 2% for the 2000-2030 period and 3% for the 2030-2060 period. Using actual tax revenue figures from the International Monetary Fund's Government Finance Statistics (GFS), these shares translate to about $1.3 billion in average annual income tax revenue for total of SMCs until 2030 and about $2.8 billion until 2060.[17] These are sizeable revenues that SMCs can potentially use to provide enhanced education to the existing workforce and in turn help improve human capital accumulation in the SMCs. A recent study by Desai, Kapur and McHale (2004) shows a similarly substantial potential revenue gain to India from such taxation. However, there can be significant issues related to the administration and use of such a brain drain tax. First, this tax requires a tax system based on citizenship (the American model) rather than residence in the SMCs. Currently, these countries use a residence-based income tax system and switching to a citizenship-based system would bring significant administrative costs. Involvement of international institutions and creation of new international migration regimes have also been discussed (Straubhaar, 2000; Pastore, 2005). Additionally, government sector inefficiencies due to corruption in the SMCs could also become a hindrance to the productive use of this new revenue stream.

[17] GFS revenue figures come from IMF (2003) and are for eight of the nine SMCs. Libya is excluded due to lack of data. Tax revenues are averaged for the last three available years (1995-97) and then converted to constant 1995 dollars.

6. Conclusions

This paper put international labor migration into a global externalities framework using the brain drain taxation as one solution to internalize negative externalities from labor migration. The paper used a two-region, two-period overlapping generations model with international labor mobility to examine the efficacy of using such tax policy. While a brain drain tax has a substantial limiting effect on labor migration and a small negative effect on per worker growth, it is found to be a viable solution to the negative externality problem created by labor migration. It can also raise substantial tax revenue for the SMCs which could be used to enhance human capital in the region. Administrative costs involved with the tax system required to implement a brain-drain tax constitute the biggest obstacle to the use of such a tax.

References

Allais, M.
1947 *Economie et Intérêt* (Paris: Imprimerie Nationale).

Bearse, P., G. Glomm, and B. Ravikumar
2000 "On the Political Economy of Means-Tested Education Vouchers," *European Economic Review*, Vol. 44, pp. 904–15.

Bhagwati, J. N.
1972 "The United States in the Nixon Era: The End of Innocence," *Daedalus*.

Bhagwati, J. N.
1976a *Taxing the Brain Drain, Vol. 1: A Proposal,* Amersterdam: North-Holland.

Bhagwati, J. N.
1976b. *The Brain Drain and Taxation, Vol. 2: Theory and Empricial Analysis,* North-Holland
.
Bhagwati, J. N., and Dellafar
1973 "The Brain Drain and Income Taxation," *World Development* 1.

Black, D.
1948 "On the Rationale of Group Decision-Making," *Journal of Political Economy,* Vol. 56, pp. 23–34.

Börsch-Supan, A., A. Ludwig and J. Winter
2005 "Aging, Pension Reform and Capital Flows: A Multi-Country Simulation Model," NBER Working Paper No. 11850. Cambridge, MA: National Bureau of Economic Research.

Buiter, W. H.
1981 "Time Preference and International Lending and Borrowing in an Overlapping Generations Model," *Journal of Political Economy*, Vol. 89, No. 4, pp. 769–97.

Center for Strategic and International Studies
2002 "Meeting the Challenge of Global Aging: A Report to World Leaders from the CSIS Commission on Global Aging," CSIS Panel Report (March) (Washington: The CSIS Press).

Crettez, B., P. Michel, and J. Vidal
1996 "Time Preference and Labor Migration in an OLG Model with Land and Capital," *Journal of Population Economics*, Vol. 9, pp. 387–403.

———
1998 "Time Preference and Capital Mobility in an OLG Model with Land," *Journal of Population Economics*, Vol. 11, pp. 149–58.

Desai, Mihir A., D. Kapur and J. McHale

2004 "Sharing the Spoils: Taxing International Human Capital Flows," *International Tax and Public Finance,* Vol.11, pp.1-31.

Diamond, P. A.
1965 "National Debt in a Neoclassical Growth Model," *American Economic Review,* Vol. 55, pp. 1126–50.

Fargues, P.
2006. "International Migration in the Arab Region: Trends and Policies," contributed paper, United Nations Expert Group Meeting on International Migration and Development in the Arab Region, Beirut, 15-17 May, 2006.

Galor, O.
1986 "Time Preference and International Labor Migration," *Journal of Economic Theory*, Vol. 38, pp. 1–20.

———
1992 "The Choice of Factor Mobility in a Dynamic World," *Journal of Population Economics*, Vol. 5, pp. 135–44.

Heller, P. S.
2003 *Who Will Pay? Coping with Aging Societies, Climate Change, and Other Long-Term Fiscal Challenges*, (Washington: International Monetary Fund).

Holtz-Eakin, D., M. E. Lovely, and M. S. Tosun
2004 "Generational Conflict, Fiscal Policy, and Economic Growth," *Journal of Macroeconomics*, Vol. 26, No. 1, pp. 1–23.

International Monetary Fund
2003, *Government Finance Statistics CD-ROM* (Washington).

Kaul, I. and P. Conceicao
2006 *New Public Finance*. The United Nations Development Programme. Oxford University Press: New York.

Kaul, I., P. Conceição, K. Le Goulven, and R. U. Mendoza
2003 *Providing Global Public Goods: Managing Globalization.* New York: Oxford University Press.

Kaul, I., I. Grunberg, and M. A. Stern
1999 *Global Public Goods: International Cooperation in the 21st Century.* New York: Oxford University Press.

Pastore, F.
2005 "The Policies for the Management of International Migrations from the 20th to the 21st Century: A Tale of Territorial Sovereignties and People on the Move," *Genus*, 61 (3-4): 347-367.

Samuelson, P. A.
1958 “An Exact Consumption-Loan Model of Interest with or without the Social Contrivance of Money,” *Journal of Political Economy*, Vol. 66, pp. 467–82.

Straubhaar, T.
2000 “Why Do We Need a General Agreement on Movements of People (GAMP)?” in *Managing Migration: Time for a New International Regime?*, ed. Ghosh, Bimal, Oxford, UK: Oxford University Press: 110-136.

Tosun, M. S.
2003 “Population Aging and Economic Growth: Political Economy and Open Economy Effects,” *Economics Letters*, Vol. 81, No. 3, pp. 291–96.

_____
2005 “Global Aging and Fiscal Policy with International Labor Mobility: A Political Economy Perspective,” IMF Working Paper, WP 05/140. Washington D.C.: IMF.

_____
2008 “Endogenous Policy Formation and Capital Market Transmissions in the Presence of Demographic Shocks,” *Journal of Economic Dynamics and Control*, Vol. 32, No. 6, pp. 2031-2060.

United Nations
2006 *Trends in Total Migrant Stock: The 2005 Revision*, Department of Economic and Social Affairs, Population Division, http://esa.un.org/migration.

United Nations
2002 *World Population Prospects: The 2002 Revision*, Department of Economic and Social Affairs, Population Division (New York: United Nations).

Table 1. Demographic Differences Between Europe and Middle East and North Africa

	2000		2030		2060	
	Share of Population 15 - 64 (%)	Share of Population 65 and Older (%)	Share of Population 15 - 64 (%)	Share of Population 65 and Older (%)	Share of Population 15 - 64 (%)	Share of Population 65 and Older (%)
Austria	61.86	15.50	56.40	26.33	48.75	31.59
Belgium	59.62	17.01	54.63	25.02	51.02	27.92
Cyprus	57.34	11.49	56.57	19.82	52.46	26.51
Denmark	61.54	14.99	55.31	23.59	53.36	25.20
Finland	60.54	14.93	53.15	25.81	51.33	27.33
France	58.63	15.96	54.32	23.63	52.18	26.88
Germany	62.39	16.31	54.86	26.42	50.39	28.43
Greece	60.89	17.50	57.37	25.87	48.82	32.44
Iceland	57.45	11.70	56.36	20.00	52.45	26.38
Ireland	58.21	11.31	58.46	17.64	53.40	25.03
Italy	62.33	18.07	56.00	28.22	48.40	33.17
Luxembourg	61.61	13.79	59.44	18.23	54.23	24.13
Netherlands	62.16	13.62	55.74	23.28	53.22	25.24
Norway	58.93	15.36	55.22	23.26	52.04	27.32
Portugal	61.10	15.61	58.87	22.48	51.25	29.00
Spain	62.19	16.79	58.33	25.45	47.69	34.05
Sweden	58.60	17.40	53.47	25.17	50.01	28.91
Switzerland	61.86	15.99	52.47	29.78	48.92	31.13
United Kingdom	58.90	15.86	57.18	21.11	52.98	25.15
Algeria	49.26	4.12	62.12	8.71	56.44	20.89
Bahrain	59.97	2.51	63.56	10.78	58.73	19.39
Djibouti	43.54	3.00	49.95	4.38	59.60	7.92
Egypt	48.01	4.45	58.07	8.03	59.03	16.63
Iran (Islamic Republic of)	46.85	4.46	62.42	8.39	54.63	23.04
Iraq	44.32	2.80	54.98	4.96	60.82	12.06
Jordan	47.33	2.82	60.28	6.19	58.94	16.98
Kuwait	64.84	1.34	63.24	11.84	57.25	21.18
Lebanon	53.45	6.10	62.34	10.76	55.45	22.31
Libyan Arab Jamahiriya	50.32	3.53	61.96	8.19	56.48	20.43
Morocco	51.80	4.25	60.41	8.92	57.77	18.57
Oman	50.29	1.99	55.20	5.92	59.29	12.64
Qatar	64.54	1.55	57.86	15.23	59.28	17.99
Saudi Arabia	48.49	2.53	57.67	6.04	60.64	13.91
Syrian Arab Republic	44.54	2.92	60.06	6.24	58.34	17.72
United Arab Emirates	64.75	1.21	59.12	16.25	54.97	23.19
Tunisia	53.24	5.64	62.02	11.61	53.62	24.78
Turkey	52.70	5.47	62.01	10.76	56.27	21.50
Yemen	37.37	2.37	42.29	2.66	55.15	5.11
Average of 19 European Countries	60.32	15.22	56.01	23.74	51.21	28.20
Average of 19 MENA Countries	51.35	3.32	58.71	8.73	57.51	17.70
Average of 9 Southern Medit. Countries	50.07	4.37	61.03	8.82	56.93	19.98

Source: United Nations (2002).

Table 1. Cont'd

	Average Annual Population Growth Rate in % (2000-2030)	Average Annual Population Growth Rate in % (2030-2060)
Austria	-0.08	-0.39
Belgium	0.08	-0.17
Cyprus	0.49	-0.09
Denmark	0.09	-0.21
Finland	0.05	-0.28
France	0.30	-0.09
Germany	-0.03	-0.21
Greece	-0.10	-0.49
Iceland	0.57	-0.04
Ireland	0.82	0.10
Italy	-0.35	-0.69
Luxembourg	1.33	0.61
Netherlands	0.28	-0.13
Norway	0.33	-0.10
Portugal	-0.10	-0.43
Spain	-0.07	-0.44
Sweden	0.07	-0.20
Switzerland	-0.24	-0.61
United Kingdom	0.31	0.08
Algeria	1.53	0.39
Bahrain	2.06	0.59
Djibouti	2.04	1.37
Egypt	2.03	0.74
Iran (Islamic Republic of)	1.40	0.44
Iraq	3.17	1.25
Jordan	2.39	0.75
Kuwait	2.89	0.58
Lebanon	1.16	0.17
Libyan Arab Jamahiriya	1.84	0.54
Morocco	1.53	0.44
Oman	3.34	1.35
Qatar	1.38	0.26
Saudi Arabia	3.17	1.18
Syrian Arab Republic	2.45	0.80
United Arab Emirates	1.46	-0.03
Tunisia	0.99	0.11
Turkey	1.15	0.22
Yemen	6.03	3.35
Average of 19 European Countries	0.20	-0.20
Average of 19 MENA Countries	2.21	0.76
Average of 9 Southern Mediterranean Countries	1.68	0.46

Source: United Nations (2002).

Table 2. Model Comparisons 1/
(per worker values)

		Closed Economy Model (No Labor Mobility)		Perfect Labor Mobility Model with Migrants Voting Only in Host Country		Labor Mobility Model with Migrants Voting in Both Countries and Income Tax on Brain Drain	
	Time Periods	European Countries (1)	SMCs (2)	European Countries (3)	SMCs (4)	European Countries (5)	SMCs (6)
Number of workers	2000–2030	22.2	97.2	150.2	46.8	27.7	95.0
	2030–2060	9.1	36.0	27.3	23.8	16.7	34.0
	2000–2060	33.3	168.2	218.5	81.7	49.1	161.4
Capital stock per worker	2000–2030	6.2	144.8	-49.2	119.7	-0.5	65.4
	2030–2060	-1.6	97.4	44.6	67.8	9.2	82.2
	2000–2060	4.5	383.3	-26.6	268.8	8.6	201.3
Human capital per worker	2000–2030	-2.7	18.6	-2.4	5.2	0.4	7.3
	2030–2060	-25.8	7.7	-7.5	-2.6	-12.1	2.3
	2000–2060	-27.8	27.7	-9.7	2.5	-11.8	9.8
Income per worker	2000–2030	0.2	50.6	-21.3	34.1	0.1	23.7
	2030–2060	-18.5	31.5	7.2	16.6	-5.6	23.8
	2000–2060	-18.4	98.1	-15.7	56.4	-5.5	53.1
Income tax rate	2000–2030	-6.2	1.5	20.6	-15.3	0.8	-3.4
	2030–2060	-40.8	-9.2	-22.2	-19.8	-21.6	-14.7
	2000–2060	-44.4	-7.8	-6.2	-32.1	-21.0	-17.5
Education spending per worker	2000–2030	-6.1	53.3	-5.4	13.9	0.8	19.8
	2030–2060	-51.8	19.3	-16.7	-6.5	-26.1	5.8
	2000–2060	-54.7	82.8	-21.2	6.6	-25.5	26.7

Source: Computed by author.
1/ All numbers refer to percentage changes between the years indicated in the time period.

Table 3. Model Comparisons 1/
(aggregate values)

		Closed Economy Model (No Labor Mobility)		Perfect Labor Mobility Model with Migrants Voting Only in Host Country		Labor Mobility Model with Migrants Voting in Both Countries and Income Tax on Brain Drain	
	Time Periods	European Countries (1)	SMCs (2)	European Countries (3)	SMCs (4)	European Countries (5)	SMCs (6)
Number of workers	2000–2030	22.2	97.2	150.2	46.8	27.7	95.0
	2030–2060	9.1	36.0	27.3	23.8	16.7	34.0
	2000–2060	33.3	168.2	218.5	81.7	49.1	161.4
Total capital stock	2000–2030	29.8	382.8	27.0	222.5	27.0	222.5
	2030–2060	7.3	168.5	84.0	107.7	27.5	144.2
	2000–2060	39.2	1196.4	133.7	570.0	61.9	687.7
Total human capital	2000–2030	18.9	134.0	144.3	54.4	28.2	109.3
	2030–2060	-19.0	46.5	17.7	20.6	2.6	37.1
	2000–2060	-3.7	242.6	187.6	86.2	31.5	186.9
Total income	2000–2030	22.4	197.1	96.9	96.9	27.8	141.4
	2030–2060	-11.1	78.9	36.4	44.3	10.2	65.9
	2000–2060	8.7	431.5	168.6	184.0	40.8	300.3
Income tax rate	2000–2030	-6.2	1.5	20.6	-15.3	0.8	-3.4
	2030–2060	-40.8	-9.2	-22.2	-19.8	-21.6	-14.7
	2000–2060	-44.4	-7.8	-6.2	-32.1	-21.0	-17.5
Total education spending	2000–2030	14.7	202.3	136.8	67.2	28.8	133.6
	2030–2060	-47.4	62.2	6.0	15.8	-13.7	41.8
	2000–2060	-39.7	390.3	151.0	93.6	11.1	231.3

Source: Computed by author.
1/ All numbers refer to percentage changes between the years indicated in the time period.

Figure 1. Composition of the Change in Number of Workers in Europe (Perfect Labor Mobility)

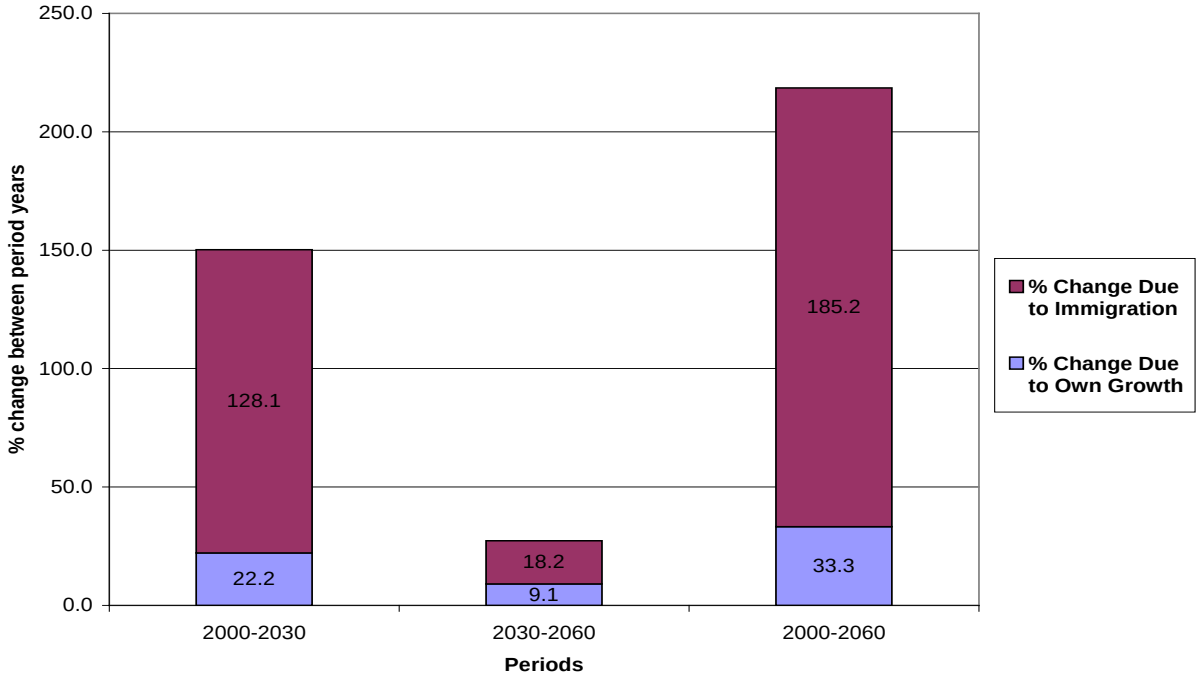


Figure 2. Composition of the Change in Number of Workers in SMCs (Perfect Labor Mobility)

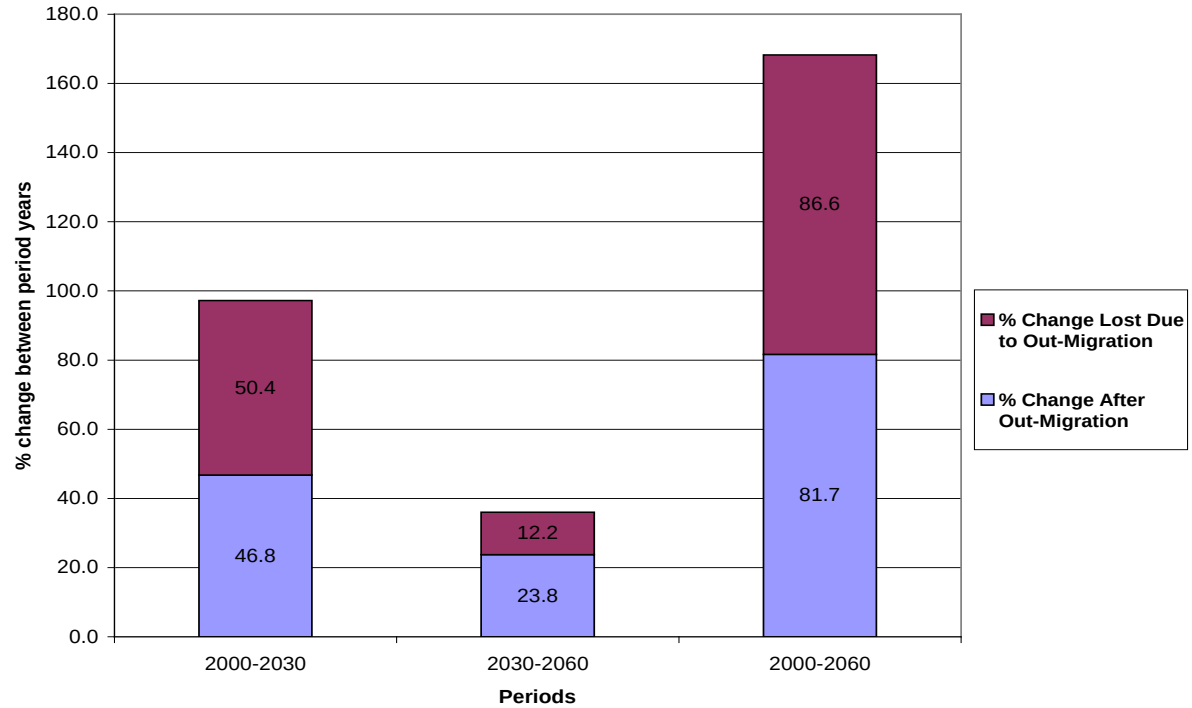


Figure 3. Composition of the Change in Number of Workers in Europe (Labor Mobility w/Brain Drain Tax)

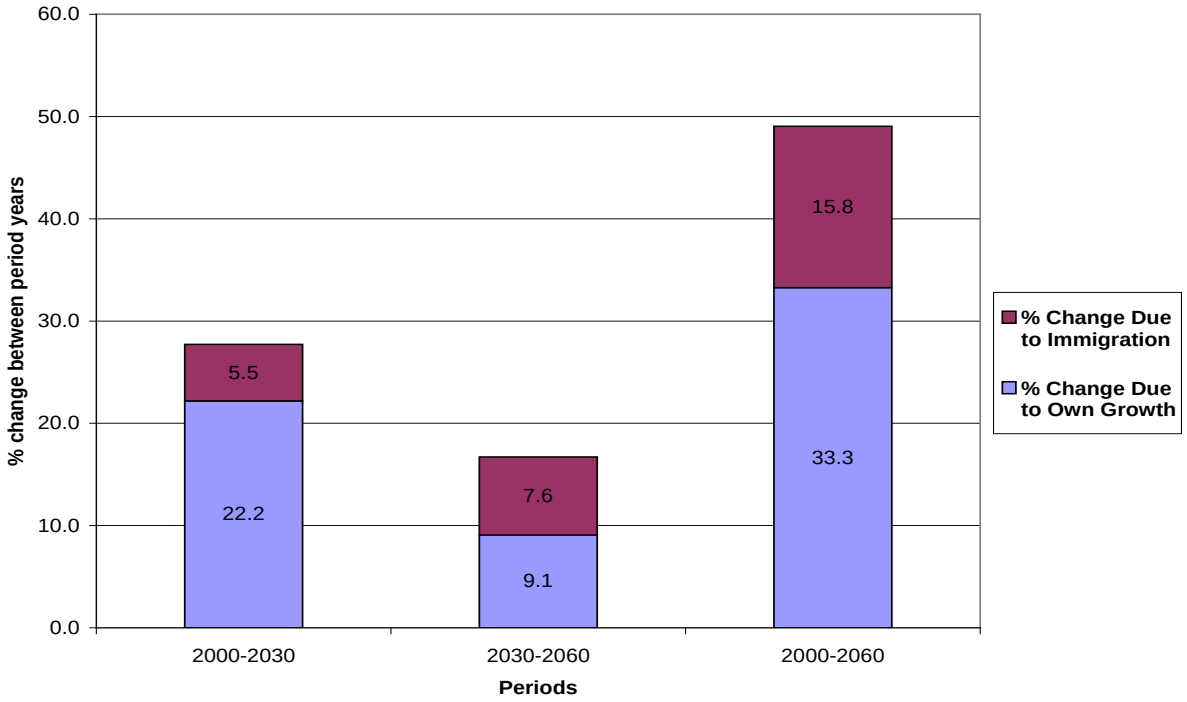
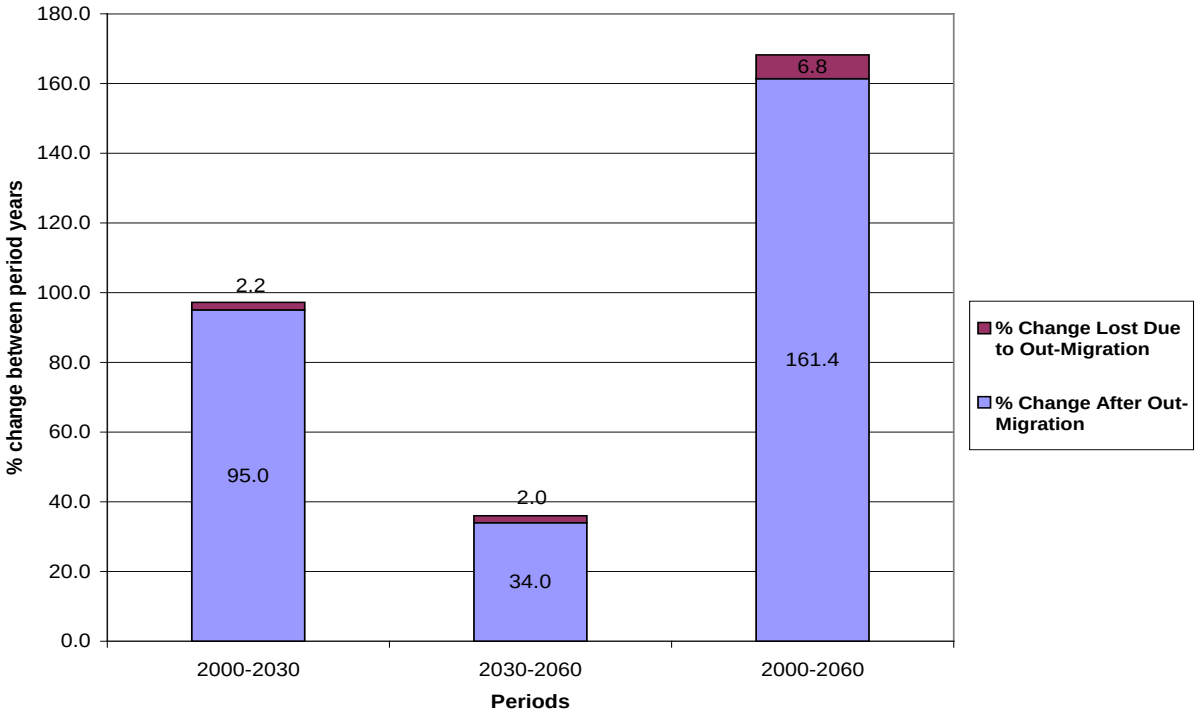


Figure 4. Composition of the Change in Number of Workers in SMCs (Labor Mobility w/Brain Drain Tax)



APPENDIX: THE EFFECT OF INCREASING DEPENDENCY RATIO ON THE ABILITY LEVEL OF THE MEDIAN VOTER

Recall that median voter is defined by $N_{t-1} + N_t \int_0^{a_m} f(a)\,da = \frac{N_{t-1} + N_t}{2}$. Rewriting this: $N_{t-1} + N_t F(a_m) - N_t F(0) = \frac{N_{t-1} + N_t}{2}$, which can be rearranged as:

$F(a_m) - F(0) = \frac{N_t - N_{t-1}}{2N_t}$. Differentiating both sides we get, $F'(a_m)\,da_m = \frac{\hat{N}_t - \hat{N}_{t-1}}{2(1+\eta^*)}$,

where $\hat{N}_t = \frac{dN_t}{N_t}$, $\hat{N}_{t-1} = \frac{dN_{t-1}}{N_{t-1}}$, and $1+\eta^* = \frac{N_t}{N_{t-1}}$ evaluated at the initial steady state.

Finally this can be rearranged as $da_m = \frac{\hat{N}_t - \hat{N}_{t-1}}{\underset{(+)}{F'(a_m)}\,2(1+\eta)}$ which is negative when $\hat{N}_t < \hat{N}_{t-1}$.