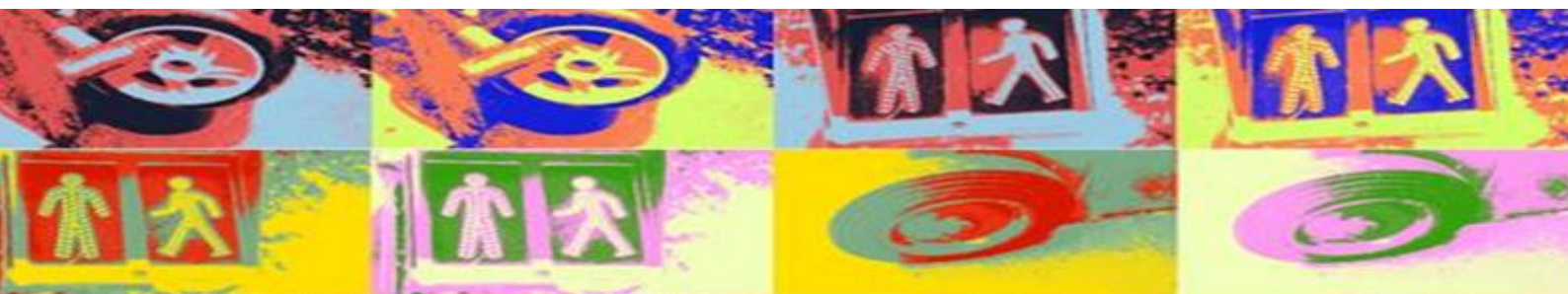# The Future of International Migration to OECD Countries
Regional Note
North Africa

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OECD

Foreword

In the course of the project 'The Future of International Migration' carried out by the OECD/IFP Secretariat in 2008/2009 a number of regional notes were commissioned from leading experts to help shed light on the diversity of situations and future migration trends in different parts of the non-OECD world. The aim of the regional notes was to provide a largely qualitative, personal assessment of the likely evolution in factors in the principal non-OE CD regions which could influence outflows of people either in the form of intra-regional migration or, of particular significance to this exercise, to OE CD countries, through to 2025/2030. More specifically, the experts were asked to give some consideration to the most likely trajectory that outward migration might take in the years ahead, together with some speculation about possible "wildcards" (unexpected events or developments which could impact significantly on pressures to migrate to OE CD countries).

A regional note on India/Pakistan/Bangladesh was written by Prof. Binod Khadria, (Jawaharlal Nehru University, New Delhi). Sub-Saharan Africa was covered by Laurent Bossard (OE CD Club de Sahel). Jeff Ducanes and Manolo Abella (ILO Regional Bureau, Bangkok) submitted a note on China and South East Asia/Asia Pacific. A note on North and East Africa was prepared by Flore Gubert and Christophe Jalil Nordman (DIAL , IRD, France). Jorge Martinez Pizzaro (CEPAL , Chile) drafted a note on Latin America. The Russian Federation and Eastern and South East Europe were covered by Prof. Dietrich Thränhardt (University of Münster, Germany). Prof. Philippe Fargues (European University Institute, Italy) provided information on the Middle East and North Africa. These papers can be found on the OE CD/IFP webpage (www.oecd.org/futures).

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Introduction

The Middle East and North Africa region probably represents one of the most remarkable regions of the world with respect to international migration, with several co-existing "migration systems" (labour-exporting countries in the Maghreb and Mashreq, labour-importing Gulf Cooperation Council states, both labour-exporting and transit countries, etc.). Within the Maghreb, Morocco, Tunisia and Algeria have been experiencing massive labour emigration to Europe since the sixties. Successive governments in these countries have actively facilitated this mobility in order to manage unemployment levels and attract the maximum financial resources into the national economy with emigrants' remittances. Some have even made emigration an integral part of the growth strategies in their national development plans even when, from 1973 onwards, European governments one after another closed their doors to the immigration of workers (Fargues, 2007). This is particularly true for Morocco where emigration has always been considered as an export that should be promoted for the benefit of the country. Tunisia and Algeria initially followed a similar policy but both encouraged their emigrants to return in the seventies (Baldwin-Edwards, 2005).

The objective of this regional note is to assess the likely evolution of the various factors (economic, demographic and environmental) which could influence the movement of people out of Algeria, Morocco and Tunisia in the next twenty years, either in the form of intra-regional migration or to OECD countries.

In Part I, we first provide a picture of past and current migration trends from Algeria, Morocco and Tunisia to OECD countries. We then propose an explanation of these migration behaviours using the results of a recent report investigating the determinants of past and current migration flows from the Middle East and North African (MENA) countries to OECD countries (Gubert and Nordman, 2008). In particular, the influence of economic, demographic and political factors on the size and composition of migration flows from North Africa to OECD countries over the period 1990-2002 is put forward using two complementary econometric analyses (cross-sectional and panel data analyses of migration flows). These analyses provide a guide for identifying the key factors that are likely to shape future migration flows from Algeria, Morocco and Tunisia.

In Part II, we discuss the economic and demographic prospects in Algeria, Morocco and Tunisia focusing on the key determinants identified previously as important driving forces of future migration trends (GDP per capita, poverty levels and demographic factors such as the populations' age structure in origin countries).

In Part III, an attempt to assess the impact of climate change on future migration patterns in the Maghreb is carried out. More specifically, this section looks at ways that climate change might lead to increased forced migration, presents some predictions for numbers of future climate migrants, examines the uncertainties with these predictions and lays out different tentative scenarios on future numbers of forced migrants.

The different findings of these investigations are finally drawn together in a concluding section.

Part I – Explaining past migration behaviour to predict future migration flows

Migration flows from Algeria, Morocco and Tunisia are mainly oriented towards OECD countries and have always been so. According to official migration statistics provided by each of these three countries, respectively 92.5%, 84.7% and 82.5% of emigrants from Algeria, Morocco and Tunisia reside in Europe and only 6.2%, 9.2% and 13.9% in other Arab countries (Fargues, 2005). In the discussion that follows, the focus will thus be on the levels and trends of migration from the Maghreb to the OECD.

1- Overview of current migration patterns from Algeria, Morocco and Tunisia to OECD countries

Despite serious problems with data on migration and migrants, the database of Docquier and Marfouk (2005) on the stocks of international migrants in OECD countries by country of origin allows to draw a picture of the levels and trends of migration from Morocco, Algeria and Tunisia to OECD countries.[i] Based on the 1990 and 2000 round of censuses held in each OECD country, this database provides a detailed, comparable and reliable picture of immigrant populations within OECD countries.[ii]

Numbers of Algerians, Moroccans and Tunisians in OECD countries

Among the North African communities in Europe, the Moroccans are the most numerous: they accounted for 49% in 1990 and 56% in 2000 of immigrants originating from the three countries (Algeria, Tunisia, Morocco; Figure 1). While the numbers of Algerians and Tunisians did not change substantially during the nineties in France, the Netherlands, Belgium and Germany, the number of Moroccans increased over the period as a result of family reunification and of the regularization of immigrants with illegal status in Italy and Spain.

In terms of their geographical distribution, Moroccan nationals are predominantly found in France, followed by Spain, the Netherlands and Italy (Table 1a). They are thus widely distributed over all European countries. By contrast, emigration from Algeria is very concentrated towards France (Table 1b): 84.2% of Algerians residing in an OECD country live in France, despite a diversification of migration flows from Algeria in the last thirty years. This picture holds true for Tunisian nationals (Table 1c): although the Tunisian community was the first to establish in Italy and was also the most numerous, it has been overtaken by the Moroccan community since the end of the eighties. As a result, Italy ranks second after France as a destination for its emigrants, followed by Germany.

Figure 1 – Stocks of immigrants from Algeria, Morocco and Tunisia in OECD countries, 1990 and 2000
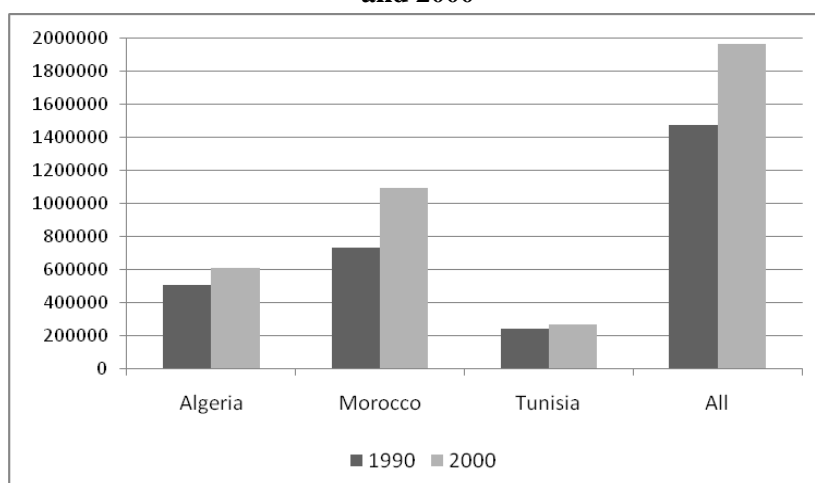
Source: Docquier and Marfouk (2005), Authors' calculations.

Distribution of migrants by education level

Interesting features also emerge regarding the distribution of migrants by education level (Tables 1a, 1b and 1c). With the exception of Germany, Moroccans, Tunisians and Algerians in Europe are largely low-educated individuals with only primary education. For all three countries, the composition of migrant stocks by education level is highly contrasted between Europe and North America: as an illustration, respectively 84.1% and 72.8% of Algerian migrants are highly educated in Canada and the United States, but only 10% in Europe's main destination countries (France, Spain and Belgium). Two factors explain this diversity. The first one is the period of migration, insofar as the earlier the migrating cohort, the less educated it tends to be. The second one is related to the migration and labour market policies prevailing in destination countries, the latter being clearly biased towards the highly-educated in North America.

Table 1a – List of main destination countries of Moroccans within OECD countries

Main destination countries	Share in total stocks within OECD	Composition by level of education		
		Tertiary education	Secondary education	Primary education
1. France	38.8%	12.9%	7.8%	79.3%
2. Spain	19.8%	4.7%	28.6%	66.7%
3. The Netherlands	13.5%	5.1%	16.0%	78.9%
4. Italy	9.9%	6.0%	18.4%	75.5%
5. Belgium	6.3%	8.4%	16.1%	75.5%
6. Germany	3.9%	27.5%	11.4%	44.3%
7. United States of America	2.7%	64.5%	30.0%	5.5%
Total	94.9%			

Source: Docquier and Marfouk (2005), Authors' calculations.

Table 1b – List of main destination countries of Algerians within OECD countries

Main destination countries	Share in total stocks within OECD	Composition by level of education		
		Tertiary education	Secondary education	Primary education
1. France	84.2%	10.2%	5.8%	84.1%
2. Spain	3.3%	9.9%	46.8%	43.3%
3. Canada	2.3%	84.1%	6.5%	9.4%
4. Belgium	1.8%	8.4%	16.1%	75.5%
5. United States of America	1.6%	72.8%	22.6%	4.5%
Total	93.2%			

Source: Docquier and Marfouk (2005), Authors' calculations.

Table 1c – List of main destination countries of Tunisians within OECD countries

Main destination countries	Share in total stocks within OECD	Composition by level of education		
		Tertiary education	Secondary education	Primary education
1. France	69.9%	12.3%	7.4%	80.3%
2. Italy	12.2%	3.8%	18.1%	78.1%
3. Germany	4.9%	27.5%	11.4%	44.3%
4. Belgium	2.2%	8.4%	16.1%	75.5%
5. United States of America	2.1%	63.7%	29.3%	7.0%
6. Switzerland	2.1%	24.4%	61.1%	4.9%
Total	93.3%			

Source: Docquier and Marfouk (2005), Authors' calculations.

Even though emigrants from Algeria, Morocco and Tunisia are mainly low-educated individuals, the expatriation rate of the highly-educated (the so-called "brain drain") is rather high in all three countries: estimates vary from 17 to 19.5% in the case of Algeria, from 9.4 to 18.0% in the case of Morocco and from 12.5 to 21.4% in the case of Tunisia.

In the following section, we disentangle the possible determinants of migration, notably for the highly-educated individuals. We show that their motives include not only high-wage differentials between Maghreb and Europe, but also general labour market and social conditions in home and host countries (such as unemployment rates), and demographic pressure in origin and destination countries.

2- Main push and pull factors of past migration flows

This section presents the main results of a recent report investigating the influence of economic, demographic and political factors on the size and composition of past and current migration flows from the MENA region to OECD countries (Gubert and Nordman, 2008). The focus is on both the

supply-side and demand-side determinants of migration patterns. Some of the questions that are addressed in the report are the following: what have been the main driving factors of migration from MENA to OECD countries for the last ten or twenty years? Are they mainly economic or demographic? Given destination countries' restrictive immigration policies, do current flows still respond to economic incentives? Answers to these questions relating to past migration flows are helpful to identify the main factors that are likely to shape future migration flows from Algeria, Morocco and Tunisia.

Migration theory

Migration theory provides a useful guide to identify the variables that might be expected to influence migration pressure and observed migration patterns.

- Economic factors such as (expected) earnings differentials

In neoclassical economic approaches (see, e.g., Sjaastad, 1962; Borjas, 1987), migration is a consequence of differentiated economic opportunities across regions or countries, especially earnings differentials. Individual i is more likely to migrate the higher the destination wage, the lower the home wage and the lower the fixed migration cost. Every individual evaluates the returns and costs in a different way so that migration may be worthwhile for some individuals in a country and not for others.

Todaro (1969) proposed an alternative formulation of neoclassical migration models in which prospective migrants maximize their *expected* income. Assuming a random job-allocation process, expected income is given by the wage times the employment rate (or 1 minus the unemployment rate).

Nearly all empirical tests of the Todaro's expected-income hypothesis use aggregate data on migration flows and wages and find a statistically significant positive effect of income or wages in the destination country on the migration decision, or of the income differential between the sending and the receiving countries, and a negative effect of income in the sending country. Evidence on the influence of unemployment rates both in the sending and in the receiving countries is more mixed. Some studies find a positive influence of the probability of employment in the destination country on the migration decision. Other studies find that individuals are attracted to regions with shortage of jobs. In Gubert and Nordman (2008), difference in economic opportunities between origin and host countries are captured by the level of GDP per capita in both the host and the origin countries, and by unemployment rates in the destination country.

- Self-selection of migrants

Emigrants are not a random sample of a country's population. This aspect has played an important role in the "brain drain" debate concerning emigration of the highly-educated and its negative consequences for sending country's economy. One should expect that potential migrants make some rough comparison of their wages in the home country and their expected wages in the destination country. Hence, the relative wage on observable and unobservable abilities in home and host country determines the type of selection, while the level of income affects the volume of migration. A natural belief is that we may observe differentiated effects of the private rate of returns to schooling in the host country on the emigration rates of high-educated and low-educated workers.

- Push and pull factors of migration

There is a general consensus that there are factors in sending and destination countries which determine whether an existing migration "potential" results in "actual" migration. For factors concerning the home country, one refers to the so-called "push" factors; for those concerning the host country one uses the term "pull" factors. Important push factors for developing countries are population growth and the corresponding unemployment, poverty and political instability. Pull factors are mainly high wages in the receiving countries, their social security systems, and political stability, as well as a potential past colonial relationship or common culture between host and origin countries. To control for these push and pull effects as determinants of migratory flows, one can make use of bilateral "cultural distance" indicators between the host and origin countries (colonial relationship, common language), and variables indicative of potential demographic pressure, such as population density, urban population growth or the age structure of the populations. Gubert and Nordman (2008) also account for political and civil factors in the sending country, as well as proxies for the "welfare magnet" and "network" effects in the host country.

Estimating the determinants of migration from the Maghreb: a gravity approach

In its most basic form, the gravity model approach consists of explaining the total emigration from one country of origin to a country of destination by using the economic characteristics (population and GDP per capita) of each of the two countries and the bilateral geographic characteristics (distance, common border, access to sea, common language). Additional characteristics of the countries of origin and destination may be included to account for immigration policies and other relevant factors. In Gubert and Nordman (2008), demographic indicators (such as the share of youth in the population, age dependency ratios, population density, urban and total population growth), unemployment rates, education and literacy rates, private returns to education specific to each OECD country, labour productivity growth, the level of political rights and civil liberties in origin countries and a proxy for the welfare magnet effect (namely the level of public social expenditure devoted to unemployment compensation) are included among the set of regressors.

Two complementary econometric analyses are carried out. First, a cross-sectional data analysis builds on Docquier and Marfouk's database on international migration which provide data on the stocks of MENA immigrants in all OECD countries by educational attainment in 1990 and 2000. Second, a panel data approach makes use of annual migration flows provided by the Migration Policy Institute.

In order to synthesize the key findings of the report, Table 2 reports the signs and significance levels of the effects of the determinants of migration from MENA countries using the alternative gravity models described above. Column 1 displays the results obtained using the cross-sectional analysis of total expatriation rates, while column 2 reports the findings stemming from the panel data analysis of yearly emigration rates (inflows).[iii]

- Effects of bilateral country characteristics

Regarding the total expatriation rate in 2000 (column 1), distance between two countries, colonial relationship and sharing a common language are all significant determinants of migration decision. These three bilateral characteristics also have the expected signs. Considering separate regressions for each education group, few interesting indications emerge as well. First, expatriation rates from the

MENA region are not sensitive to the presence of a common border between host and origin countries, which is not a surprising result given the limited number of such cases. Second, the linguistic commonality plays only a role for the most educated workers, whose jobs may involve professional skills in which fluently speaking a language is important. Last, the effects of geographic proximity and historical links are significant for all education groups. However, the group of highly-educated workers appears to be less sensitive to distance than the two other groups, suggesting that highly-educated people are better equipped to seize good job opportunities in distant countries.

Using yearly emigration rate as the dependent variable (column 2) does not substantially change the results, except for the variable relating to past colonial relationship. The latter does not appear as a significant determinant of annual migration flows.

Table 2 – The Determinants of Migration from MENA Countries Using Gravity Models

Method and dependent variables	Cross-sectional analysis of total bilateral expatriation rates in 2000 (1)	Panel data analysis of yearly emigration rates for 1990-2002 (2)
Bilateral characteristics		
Ln (distance)	-	---
Common Border	*n.i.*	+++
Common Language	++	+++
Ever in colonial relationship	++	
Island in couple (0, 1 or 2)		
Host Country specific characteristics		
Log(GDP per capita in host)	+++	---
Population density in host	+++	
Share of population aged 15-24 in host	---	---
Age dependency ratio in host	+++	--
Urban population growth in host	++	++
Log(Mean education in host)	-	
Private return to education in host	+++	*n.i.*
Total unemployment rate in host	*n.i.*	
Unemployment rate (1994) for primary level in host	+	*n.i.*
Unemployment rate (1994) for secondary level in host	---	*n.i.*
Unemployment rate (1994) for tertiary level in host	+++	*n.i.*
Labour productivity growth in host	+++	
Share of public expenditure related to unemployment in host	+++	+
Origin country specific characteristics		
Log(GDP per capita in origin)		
Population density in origin	---	--
Share of population aged 15-24 in origin		

Age dependency ratio in origin		+
Urban population growth in origin		+
Literacy rate in origin		
Political rights in origin (scale 1 to 7 for high to low rights)		+
Civil liberties in origin (scale 1 to 7 for high to low liberties)		

Source: Gubert and Nordman (2008).

Note: +++, ++, + mean respectively positive and significant effect at the 1%, 5% and 10% confidence interval (respectively, ---, --, -, mean negative effects). *n.i.* means variable not included in the model while an empty box means insignificant effect at the usual confidence interval (10%). For the precise definitions of the dependent and explanatory variables, see Gubert and Nordman (2008).

- ▪ Push and pull effects of migration (country-specific characteristics)

From the estimation of the push and pull determinants of the expatriation rate from MENA to OECD countries (column 1), a first noticeable result is that pull effects are more significant on average than push effects despite immigration restrictions in most destination countries. This is the case with the impact of the GDP per capita in the host country, which is highly significant and positive, while the effect of the GDP per capita in the origin country is not significantly different from zero in the baseline regressions.

However, this finding is somewhat contrasted if one considers the expatriation rates of the different education groups separately. For low-educated migrants for instance, GDP per capita in the sending country operates as a push effect, suggesting that a higher GDP per capita is associated with a higher expatriation rate among low-educated individuals. This result might be consistent with the idea that very low levels of per capita GDP in the source country increase incentives to leave, yet make it difficult to overcome poverty constraints. Expatriation rate is lower for the least educated individuals because they are too poor to afford the fixed costs of migration. This is consistent with the idea that fixed migration costs (such as transportation costs and housing) constitute huge barriers to migration especially for low-educated people originating from poor countries. **These findings suggest that upcoming migration flows of low-educated workers from Algeria, Morocco and Tunisia may be responsive to future trends in origin countries' GDP per capita contrary to those of highly educated workers.**

Going back to specification (1), all the variables introduced to account for demographic pressure in host and sending countries are found significant in almost all regressions. Here again, a striking result is that pull effects are generally stronger and more significant than push effects. In particular, the old age dependency ratio (population aged 65 and over divided by working-age population) and the urban population growth in the origin country are found to play no role at all. Population density and the share of population aged 15-24 in the origin country are found to be significant, however, but not in all specifications. More specifically, the expatriation rate of the most educated migrants is the most reactive one to the population density in the origin country. **One interpretation of this finding is that the brain drain is responsive to demographic pressure in the origin country.**

Turning to the demographic characteristics of the destination country, population density, urban population growth and the age dependency ratio are all found to significantly increase the size of the expatriation rate, while the share of the population aged 15-24 is found to decrease it. Moreover, the effect of population density in the host country is stronger on the expatriation of the highly educated. The same holds true for the effects of urban population growth and the age dependency ratio.

As expected, the share of population aged 15-24 in the host country exerts a negative effect on expatriation rates. This result might be explained by the demand side of international migration: destination countries with a rising share of elderly (and a decreasing share of young individuals) in their population might be tempted to "import" population from other countries to compensate for population aging.

Another notable finding concerns the private returns to education in the destination country. This variable is indeed found to be highly significant in all regressions. The size of the estimated coefficients also indicates that the reward for education is an important determinant of expatriation rates across countries. Moreover, not surprisingly, the magnitude of the effect increases with the education category. **Hence, the brain drain is also responsive to economic incentives in the destination country.**

Let us now turn to the impact of the unemployment rates by education category in the host country. Introducing these variables in the models is revealing because, according to Todaro (1969)'s theory, low (high) unemployment rate in the destination (source) country will cause higher immigration flows. Besides, Gubert and Nordman (2008) disentangle this effect by education level, since they benefit from differentiated rates in host countries in 1994 across three education groups, which correspond to the three categories of migrants. Interestingly, the traditional prediction mentioned above is not always supported by the data. For instance, the unemployment rate among low-educated workers in the host country exerts a positive impact on the expatriation rate of low-educated individuals originating from the MENA region. This result might be explained by the existence in the sample of host countries with both high unemployment rates and generous welfare allowances. Because they have restricted access to unemployment benefits and social assistance, immigrants have a lower reservation wage than natives and accept to take up low-skilled, low-status and low-paid work. Many professions (construction, transport, and agriculture) have indeed become associated with immigrant or ethnic minority workers.

At the same time, the unemployment rate among the intermediate educated individuals in the host country is found to decrease the expatriation rate of individuals originating from the MENA region, be they educated or not. This finding is well explained by standard theory, namely, the fact that high unemployment rate in the destination country will cause lower immigration flows.

Finally, the unemployment rate among the highly-educated individuals in the host country is found to increase the expatriation rates of individuals from the MENA region. This last finding is somewhat puzzling, but it is robust and consistent across regressions. A first explanation would be that the migration decision of highly-educated individuals in LDCs is based on intermediary job opportunities in the host country rather than on high-level job opportunities, given the lack of transferability of human capital internationally. However, this does not totally explain the positive correlation between the unemployment rate among the highly educated in the host country and the expatriation rates. Another argument relates to the persistence of welfare magnet effects mentioned above, *i.e.*, host

countries with high unemployment rates are also those with generous welfare states. The welfare magnet effect would then more than counteract the disincentives to migration induced by poor job opportunities in skilled jobs in the host country.

Column (2) reports the estimates of the basic specification with year, sending and receiving countries' dummy variables using panel data. Findings with regard to pull economic factors in destination countries suggest that (log) GDP per capita as a measure of gross income and unemployment rate as a proxy for employment opportunities have respectively a significant negative and no significant impact on migration flows once destination and origin countries' fixed effects are controlled for. By contrast, welfare state attractors, measured by the level of public social expenditure devoted to unemployment compensation expressed as a percentage of GDP, are found to have a positive impact on migration inflows.

Turning to the demographic variables, the share of population aged 15-24 in the host country is found to exert a negative effect on migration flows. This result, which is similar to the one obtained using cross-sectional data, is consistent with the idea according to which **migration is partly demand-driven and used by some countries to compensate for population aging.**

Findings also suggest that **lower degrees of political rights in the country of origin create emigration incentives.** Political instability or a climate of insecurity can not only drive individuals to emigrate but also encourage governments to adopt a benign attitude towards the departure of individuals dissatisfied with their lot, as such persons could cause social unrest.

To summarize, Gubert and Nordman (2008) emphasize the relevance of pull factors to explain the magnitude of expatriation rates from the MENA region to OECD countries despite restrictive immigration policies in most destination countries. Next to economic factors (income levels, returns to education, labour productivity growth), demographic determinants in particular appear to be strong predictors of migration flows. The results also support the idea that different forces are at work concerning the migration of high-educated and low-educated individuals. Push and pull factors have a notably different impact according to the type of migration considered.

Can we use these estimates to project migration patterns from the Maghreb over the next two or three decades? Since migration streams are strongly conditioned by migration policies and since migration policies cannot be projected, a negative answer to this question would be surely more reasonable than a positive one. Still, it may be valuable to use these estimates to say something about future migration pressure. In the discussion that follows, we assess the likely evolution of the various factors (economic, demographic, environmental, etc.) which could influence the movement of people out of North African countries (Algeria, Morocco and Tunisia) in the next twenty years.

Part II – Economic and Demographic Prospects in Algeria, Morocco and Tunisia

In what follows, we discuss economic and demographic prospects in Algeria, Morocco and Tunisia. We particularly focus on the key factors identified previously as potential driving forces of future migration trends (GDP per capita, poverty levels and demographic factors such as the populations' age structure in origin countries).

1 - Economic Prospects

Growth performance and living standards prospects

It is no need to say that most of the existing economic projections for the years to come need sharp revisions after the financial turmoil that started in September 2008. This is likely to be so for the World Bank near-term GDP projections for the MENA region. At the time the projections were undertaken, in early 2008, the profile for growth in the MENA region for the period 2008-2010 was anticipated to be shaped by a number of factors among which a slowdown of industrial-country demand, primarily in the United States, Europe and Japan, and high and rising oil prices, tied in part to a robust demand in emerging markets, but also more tightly to disappointing developments in non-OPEC supply combined with continued supply restraint by OPEC. Oil exporters (such as Algeria) were assumed to benefit for a time, and to support regional MENA growth at a faster 5.9% pace in 2008. Assuming a stabilization of the global environment by 2009, the MENA region was expected to be able to maintain growth momentum centred on 5.5% in years 2009 and 2010, with domestic conditions and efforts at reform varying markedly across the economies of the region.

**Figure 2 – Real GDP growth for Algeria, Morocco and Tunisia (2000-2010)**
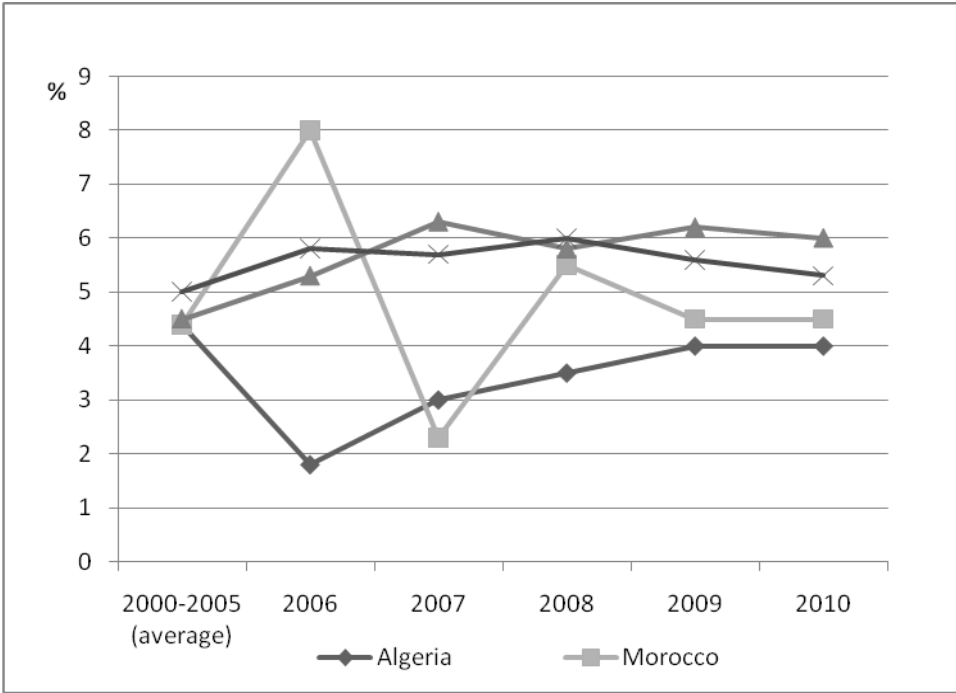
Source: World Bank (2008). *Note*: estimate for 2008, forecast for 2009 and 2010.

Figure 2 represents estimates and projections of real GDP growth for Algeria, Morocco and Tunisia for the period 2000-2010. The graph indicates that the real GDP growth rate was on average above 4% for Morocco and Tunisia over the past eight years. GDP growth in Algeria rebounded from 1.8% in 2006 to 3.0% in 2007, and this pace is forecast to be maintained for the years 2008-2010. Algeria and Morocco experienced a more erratic GDP growth rate as economic growth in these two countries is mainly driven by weather conditions (*i.e.* occurrence or not of drought), while economic growth in Algeria is driven by hydrocarbon prices. According to the World Bank (2008), continued effort to

increase hydrocarbon output in Algeria, through the implementation of the government's investment plan, should underpin investment and consumption, carrying GDP growth back to a 4% range.

In Tunisia, total GDP rose at over 4% per year and per capita GDP growth averaged 2% during the two decades of the eighties and nineties (Figure 3). This performance certainly places Tunisia above the average growth performance recorded in developing countries. While GDP per capita (in constant 2000 US$) of Morocco and Tunisia were comparable in 1965 (respectively, 618 and 730 US$), that of Tunisia was nearly two times greater than that of Morocco in 2005 (respectively, 1,356 and 2,412 US$). Algeria's GDP per capita was in an intermediate position in 2005 (2,121 US$). Linear projections until 2050[iv] illustrate that, in 2020, Tunisia may have a GDP per capita equivalent to that of Turkey in 2005 (3,450 US$). By contrast, in 2030, Morocco may benefit from a GDP per capita close to that of Jordan in 2005 (2,085 US$).[v]

Figure 3 – Evolution of the GDP per capita (constant 2000 US$)
**Period 1965-2005 and linear projections until 2050**
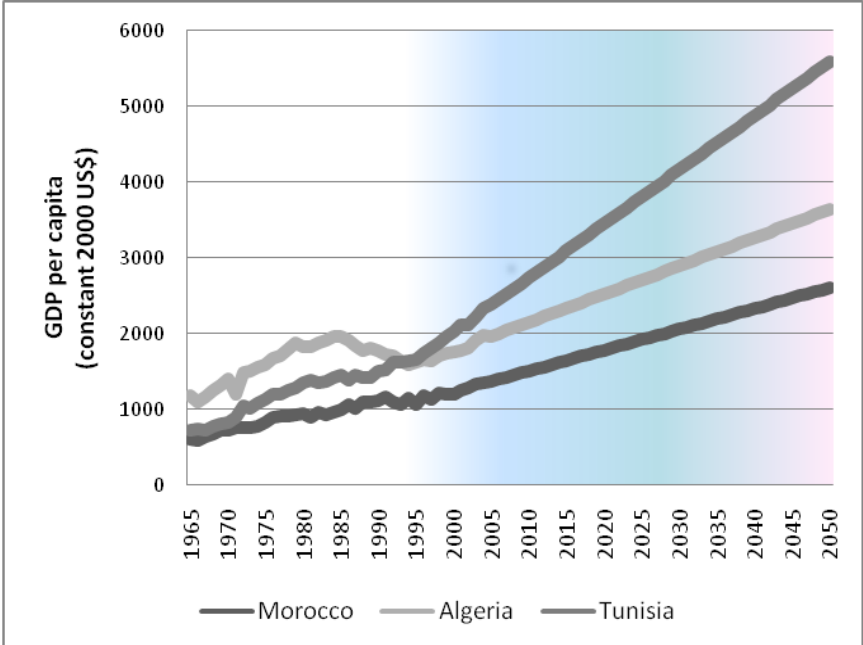
Source: World Development Indicators (2006); authors' computations.
Note: GDP per capita are predicted following a linear projection from 2006 to 2050 using the period 1995-2005.

The financial turmoil of September 2008 is most likely to affect world growth prospects in the near future, however. In particular, it is likely to affect global and regional investor confidence and should be taken into account as a risk to any forecast. For example, markets for manufactures and services (tourism) may suffer from a pronounced slowdown linked to the ripple effects of current financial difficulties in the United States and the Euro Area. Then, a significant credit crunch may have the consequence of slowing down growth across the OECD as well as developing countries, which will in turn decline abruptly the demand for crude oil and refined petroleum products. This may lead to a sharp fall off in oil price (which is already observed), with attendant effects for incomes and growth, especially for Algeria, an important crude oil exporter.

Comparing different scenarios for per capita GDP growth

Jorgenson and Vu (2008) introduce a framework for projecting economic growth that takes into account the contribution of Information and Communication Technology (ICT). Indeed, the potential contribution to economic growth of investments in ICT assets and of the ICT producing sector is often ignored in standard projections.[vi] They then apply this framework to forecast the growth of productivity, GDP, and per capita GDP over the 2006-2016 period for 122 economies. Figure 4 reports their projections of GDP per capita growth for Algeria, Morocco and Tunisia following three scenarios for the more uncertain variables of their models ("base-case", "pessimistic" and "optimistic").[vii]

Figure 4 – Projections of GDP per capita growth, 2006-2016
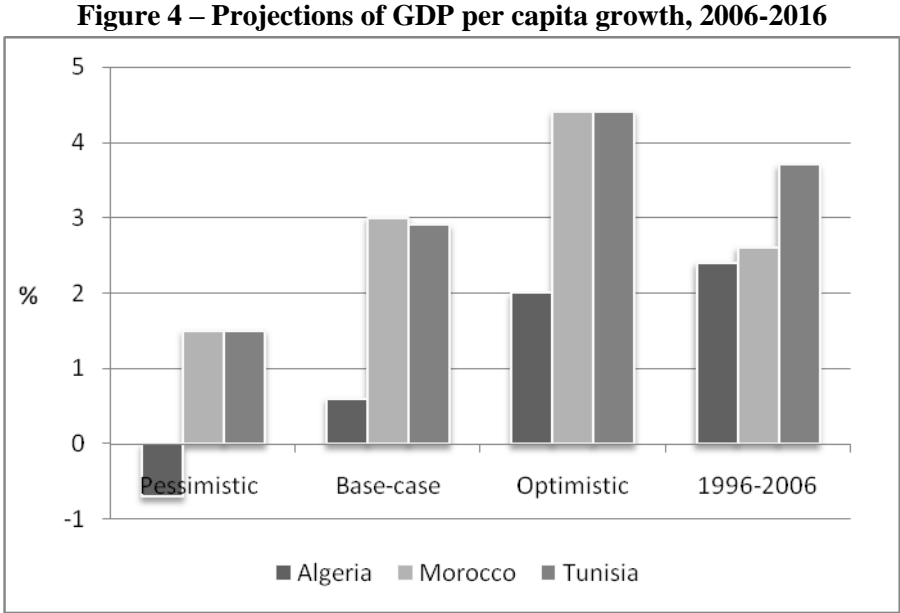
Source: Jorgenson and Vu (2008).

The base-case projections for the 2006-2016 period show that GDP per capita growth is expected to increase by about 3% for Morocco and Tunisia while that of Algeria will know a much slower pace at only 0.6%. The pessimistic scenario provides rates equal to +1.5% for Morocco and Tunisia, while a decreasing GDP per capita growth is obtained for Algeria (-0.7%). Finally, the optimistic scenario forecasts 4.4% and 2% for Morocco and Tunisia and Algeria respectively.

From these different projections, given that past expatriation rates of low-educated workers in the Maghreb have been shown to be positively responsive to the levels of GDP per capita in origin countries (see Part I, Section 2), **we conjecture sustained migration flows of low-educated workers in the next decade compared to the last twenty years**. With a pessimistic scenario concerning per capita GDP growth, the inflow of low-educated Algerian emigrants may however slow down in the coming years.

Poverty trends and projections

14

- Trends for MENA

The MENA region is particularly vulnerable to a food price crisis, given existing poverty levels within the region. At the aggregate level, the region benefits from low levels of poverty, with only 1.5% of the population living on less than $1 a day (World Bank, 2007; see Figure 5). However, there are tremendous disparities across and within countries in the region[viii]. Within countries, poverty exists in deep pockets, most often in rural areas. Also, the degree of poverty vulnerability is very high in the region, meaning that large proportions of people live just barely above the poverty line. Overall, while less than 2% of the region's population lives on less than $1 a day in 2002 (Figure 5), some 20% lives on less than $2 a day[ix]. With such profound clustering of large numbers of the population around the poverty line, rising global food prices represent a serious risk to wide-scale poverty in the MENA region. This vulnerability to poverty is an important factor to consider if one wants to estimate future migration flows from the MENA region. However, as discussed previously (see Part I, Section 2), the consequences of income shocks on the individuals' migration decision are rather difficult to predict. In the discussion that follows, therefore, one should not draw a direct link between poverty prospects and future emigration trends in Algeria, Morocco and Tunisia, but rather consider the poverty projections as indicators of possible *changes* in future migration pressure from these countries compared to the pattern observed in the recent period.

Poverty forecasts for the MENA region (Figure 5) indicate that, in 2015, the proportion of the MENA population living on less than $1 a day will be less than 1% while that of people living on less than $2 per day will reach about 10%.

Figure 5 - Population living below the poverty lines in the MENA region
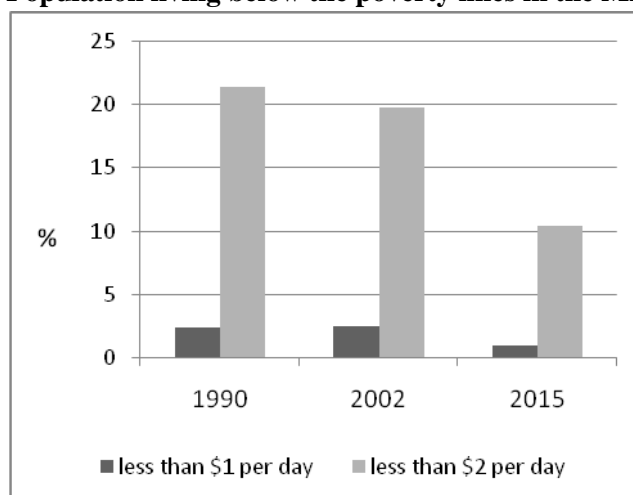

Source: World Bank (2005).

- Trends for Morocco

According to surveys on living standards and household consumption, the poverty line at $1 a day (PPP) has no statistical significance in Morocco: the proportion of people living below this line was equal to 0.8% in 1990 and to 0.6% in 2001 (OMD, 2005). This rate is even smaller in urban areas where it is only 0.1%. By contrast, poverty measured with the line of 2$ a day was 16.8% in 1990. It

diminishes to 9.7% in 2004, recording a fall of 42.2%. Its incidence remains, however, higher in rural areas (respectively, 24.8% and 16.4% for 1990 and 2004).

Office of the Moroccan *Haut Commissariat au Plan* carried out a survey in 2001 on consumption and household expenditures. The data collected made it possible to update the vulnerability[x] and poverty lines following the approaches recommended by the Food and Agriculture Organization (FAO), the World Health Organization (WHO) and the World Bank. **Figure 6** reports that, at the national level, absolute poverty decreased from 12.5% to 7.5% between 1985 and 2004; relative poverty diminishes from 21% to 14%; and vulnerability dropped from 24% to 17.3%.

Figure 6 – Evolution of relative, absolute and food poverty[xi] in Morocco between 1985 and 2015
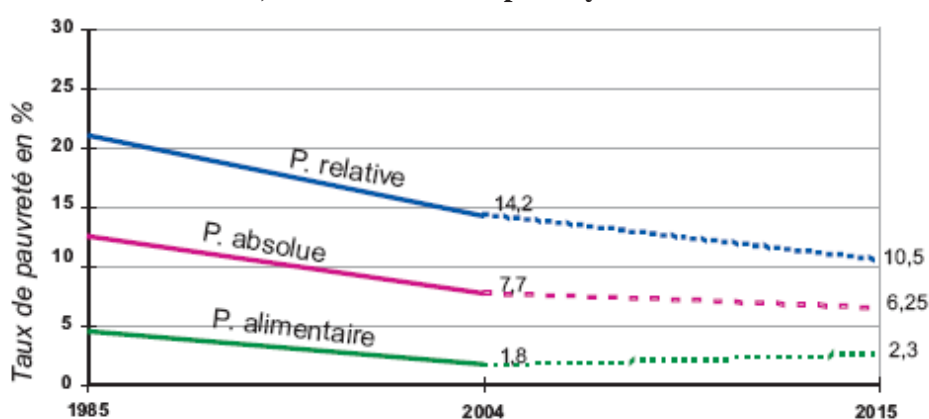
Source: OMD – Morocco (2005, p. 14).

However, this decline in poverty measures did not have the same rhythm in rural and urban areas, and in all the regions of Morocco. In urban environment, the share of relative poverty amounted to 13.3% in 1985, and reduced to respectively 10.4% and 7.9% in 1994 and 2004. By contrast, in rural areas, this share did not register any significant reduction, amounting to 26.8%, 23.0% and 22.0% respectively for the years 1985, 1994 and 2004. As for absolute poverty, it decreased in towns from 6.8% in 1985 to 3.5% in 2004; and from 18.8% to 12.8% in rural areas. Vulnerability was reduced from 17.7% in 1985 to 12.4% in 1994 in urban areas, and respectively from 29.1% to 23.5% in rural environment. At the regional level, the decreasing trend of poverty between 1985 and 2004 was more pronounced in the most developed areas than in other regions, with the noticeable exceptions of the three Saharan areas where relative poverty lost roughly 20 percentage points between 1985 and 2004 (from 29.4% to 9.8%).

Poverty projections for Morocco up to 2015 are reported in Figure 6. They show that, following the decreasing trend of poverty since 1985, the considered poverty lines (relative, absolute and food) should reach respectively 10.5%, 6.25% and 2.3% of the overall population in 2015.

▪ Trends for Algeria

According to figures presented in OMD – Algeria (2005), the poor population is almost equally distributed between the urban and the rural areas. However, poverty is more profound in rural environment (in terms of incidence, depth and severity), although a tendency to the urbanization of poverty is detected.

Figure 7 reports the proportion of population with less than one dollar a day and shows that it decreased steadily from 1.9% in 1988 to 0.8% in 2000, *i.e.* a reduction of more than 50%. Hence, the first Objective of the MDGs[xii] was already reached in 2000. By 2015, following this trend, it is likely that extreme poverty will also be eradicated.

Figure 7 – Proportion of population with less than one dollar (PPP) in Algeria
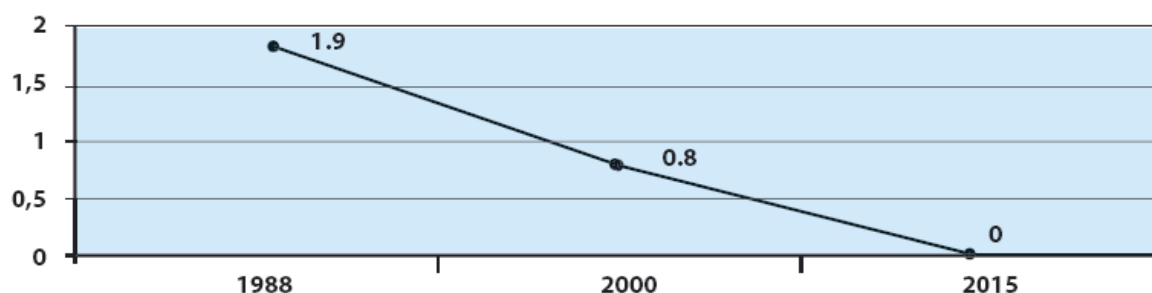
Source: OMD – Algeria (2005, p. 18).

Like for Morocco, this threshold is however too low for a country like Algeria. If one uses the food threshold[xiii] to measure the first indicator of the OMD, which is equivalent to 1.5 dollar PPP, one would obtain the following tendency: 3.6% in 1988, 5.7% in 1995, 3.1% in 2000 and 1.6% in 2004. With this food poverty line, the objective of 2015 is already achieved in 2004. By contrast, using a general poverty line (approximately 2 dollars PPP) and applying the rhythm of fall observed between 1988 and 2004 until 2015 (an annual average of -0.7%), the objective of reduction by half (to reach 4%) will not be obtained.

- Trends for Tunisia

In the 1980s, poverty was already lower in Tunisia than in the other countries of the region. The number of poor declined from about 40% of the population in the 1960s to 11% by 1985 and further to 7.4% in 1990 (World Bank, 1995). A further drop was obtained with poverty incidence reaching 4% in 2000 (Muller, 2007a). Other measures of social welfare have also improved.

However, Muller (2007b) shows that using a lower poverty line, which identifies the very poor, the proportion of the very poor in Tunisia has stabilized during 1990-95. In addition, when using a higher poverty line, poverty incidence appears to have increased. Households around and above the higher poverty line are increasingly vulnerable. Indeed, given that the distribution of consumption is quite steep near the poverty line, many households can be vulnerable to sliding back into low incomes. The main cause of this pattern is a prolonged drought leading to a severe drop in agricultural production over 1993-95, which was most likely accompanied by a deterioration in income inequality. Hence, the relative stability or the slight degradation in the global picture of the poverty incidence contradicts the widespread perception that poverty should fall in Tunisia as soon as economic growth can be sustained.

All poverty lines show that most of the poverty is in the rural areas (Muller, 2007b). The proportion of the poor observed in rural areas has somewhat diminished (71.8% in 1990 and 70.9% in 1995 with the lower line, respectively 62.19% and 59.97% with the upper line), which is consistent with the secular rural-urban migration of the poor in Tunisia. Nevertheless, the number of the poor is still twice as high in the rural areas than in the urban areas. The share of large cities in the total number of the poor has collapsed. This tendency has been compensated by a surge in the other urban areas.

To conclude, from past poverty trends in Algeria, Morocco and Tunisia and assuming that these countries will remain on the same pace of poverty reduction in the next decade, we conjecture no significant changes in the migration pressure from these countries due to poverty in the ten coming years. However, vulnerability to poverty remains important in these countries. This further indicates that poverty prospects have to be considered with cautious, especially given the ongoing unstable financial and economic situations.

2 - Demographic trends and labour force projections in Algeria, Morocco and Tunisia

The impact of the population factor on migration pressure depends on both scale and structural effects. Quoting Giubilaro (1997), the scale effect "*bears upon a country's entire population at global level causing an increase in the expenditure necessary to its development*". Population growth indeed means additional demand for social welfare, education, health care services and community facilities. The social welfare budget has consequently to be increased if only to maintain present living standards. Moreover, any change in the population age structure modifies the constraints that burden a country's economy. An absolute increase in the proportion of the working-age population, for example, intensifies pressure on the labour market while an increase in the share of the very young population calls for additional social welfare spending.

Population growth

Since the mid 1950s, the Maghreb countries have been in the process of demographic transition characterized by high birth rates and falling death rates (Figure 8). As a result, the population of these countries has increased enormously since then. It has been multiplied by 3.8 in Algeria, 3.4 in Morocco and 2.9 in Tunisia.

Figure 8 – Evolution of birth and death rates in Maghreb countries, 1950-
2050
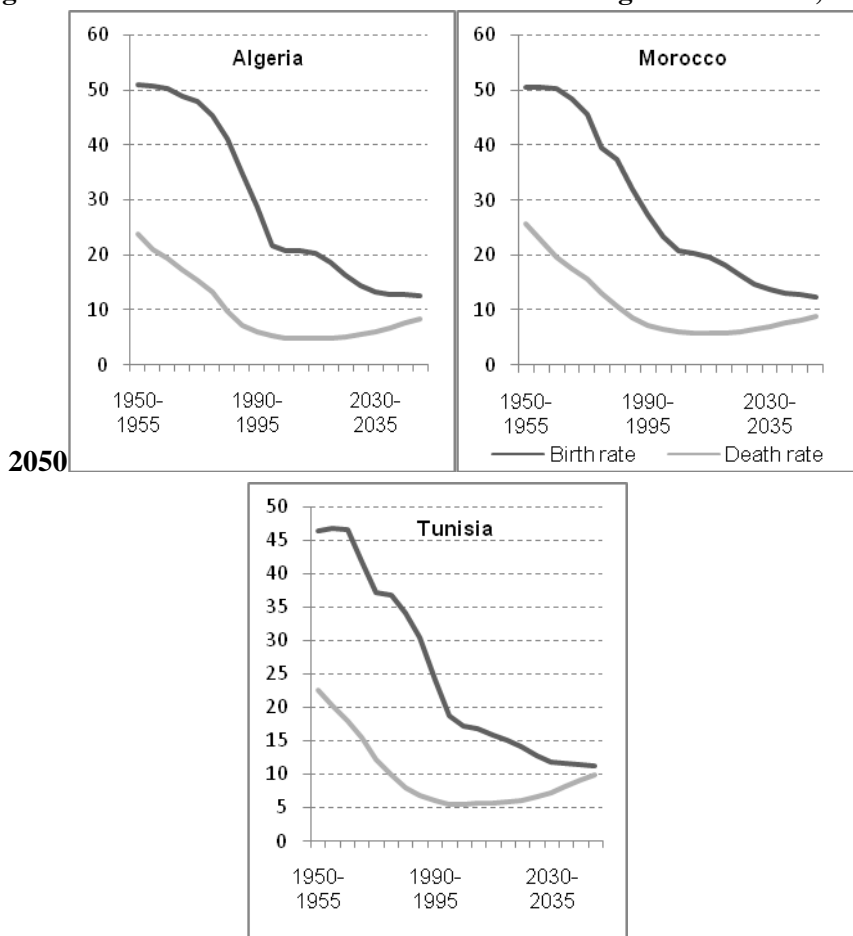
Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2006 Revision* and *World Urbanization Prospects: The 2005 Revision*.

In Algeria and Morocco, annual growth rates reached a peak in the years 1970-1980 after which they started to decline (Table 3). The decline started a bit later for Tunisia, but has been faster since then as a result of an active policy to control demographic pressure and a change in the status of women (Giubilaro, 1997). If population growth rates continue to drop as is projected by the United Nations, the population of the three countries will be about to stabilize by 2050. From now on, however, it will continue to substantially expand (Figure 9). According to the average population growth variant, it is projected to increase by 27.6 million between 2000 and 2030 (+14.2 in Algeria, +10.4 in Morocco and +3.0 in Tunisia), with the largest increase occurring in the 25-59 age group (+20.6 million) (Figure 10). **Demographic pressure will therefore remain high and probably increase in the coming decades**.

Table 3 - Annual population growth rate by ten-year period, 1950-2050 (in %)

	1950-1960	1960-1970	1970-1980	1980-1990	1990-2000	2000-2010	2010-2020	2020-2030	2030-2040	2040-2050
Algeria	2.12	2.44	3.19	3.00	1.90	1.51	1.38	0.97	0.62	0.42
Morocco	2.65	2.79	2.48	2.40	1.51	1.17	1.12	0.81	0.51	0.30
Tunisia	1.80	1.96	2.33	2.44	1.53	1.09	0.94	0.68	0.36	0.14
All	2.30	2.52	2.75	2.66	1.68	1.31	1.22	0.87	0.54	0.34

Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2006 Revision* and *World Urbanization Prospects: The 2005 Revision*.

Note: Figures relating to years 2010 to 2050 were computed using the medium-fertility variant of the UN demographic projections.

Figure 9 – Projected population, 2000-2050 (in thousands)
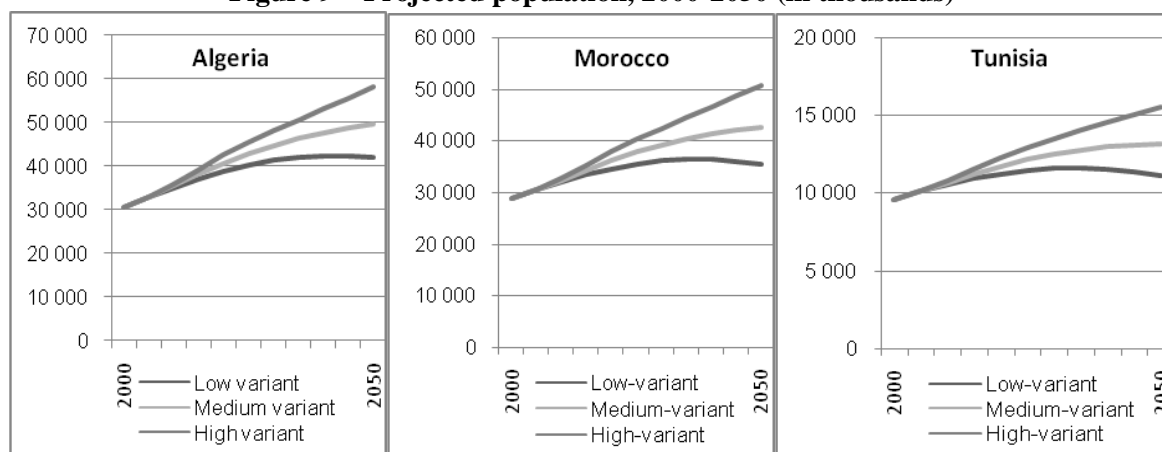
Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2006 Revision* and *World Urbanization Prospects: The 2005 Revision*.

Figure 10 – Projected change in population by age group between 2000 and 2030 (in thousands)
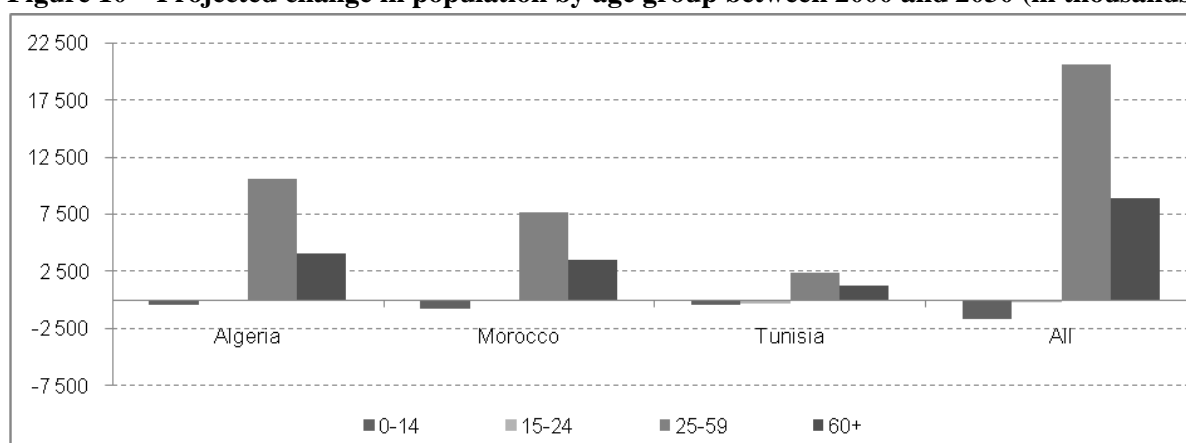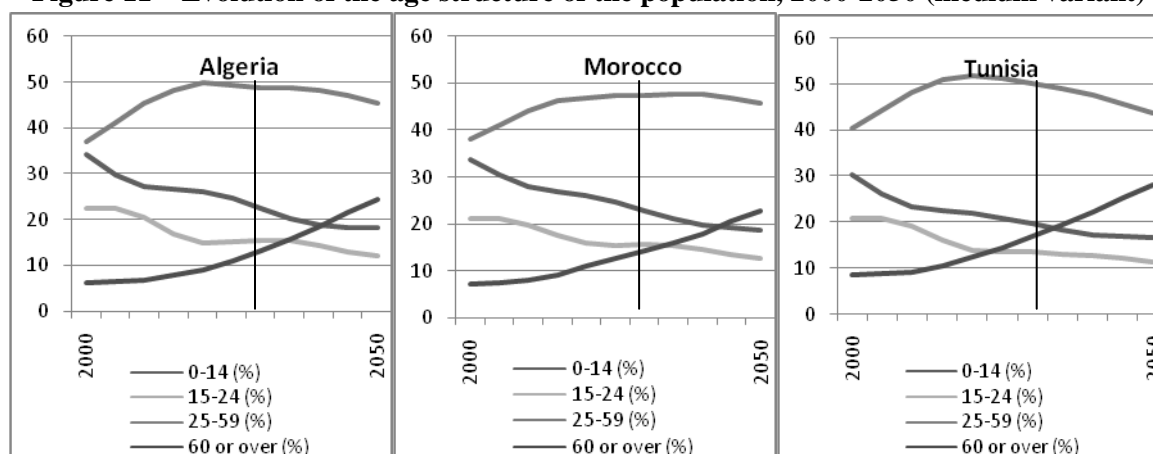

Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2006 Revision* and *World Urbanization Prospects: The 2005 Revision*.

Population structure

The demographic transition which Algeria, Morocco and Tunisia experienced has had strong repercussions on the age structure of their population. The first part of this transition, characterized by lower mortality rates, caused a considerable increase in the number of very young individuals among the total population. The second phase now in progress, characterized by declining birth rates, has first resulted in a decrease in the share of the very young population. This was followed by a decrease in the share of the 5-14 group while at the same time an **increase of the share of the working-age group (15-64)** (the most likely age group to migrate) and, subsequently, of the elderly group (Figure 11). Given such changes in the population age structure, it is likely that Algeria, Morocco and Tunisia will be confronted with the same aging problem as Europe, as individuals in their forties today will start to retire from 2030 onwards. Before that date, however, it is also likely that **the labour market will be subject to heavy pressure for several years**, especially **as the expansion of the working age population is coupled with rising labour force participation rate among young male and female workers**. According to estimates and projections of the ILO over the period 1980-2020, indeed, the economically active population should increase by 10.1 million in Algeria between 2005 and 2020 (+37.7% vs. 23.7% for the whole population), 7.4 million in Morocco (+31.7% vs. 18.7% for the whole population) and 2.6 million in Tunisia (+33.7% vs. 15.9% for the whole population) (ILO, 2008).

**Figure 11 – Evolution of the age structure of the population, 2000-2050 (medium variant)**

Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2006 Revision* and *World Urbanization Prospects: The 2005 Revision*.

From now on, governments should thus work to improve the quality of education and training and facilitate the entry of the youth into economically active life. The trends revealed in the Maghreb region during the past years actually show a worsening of the disequilibrium between labour supply and demand. According to Giubilaro (1997), there have been fewer than 100,000 new jobs created each year in Algeria since 1985 (compared to an annual increase of almost 200,000 persons in the active population) and 124,000 new jobs created each year in Morocco between 1982 and 1990 (compared to an annual increase of almost 160,000 persons in the active population). In the case of

Tunisia, the rate of absorption of the additional labour supply was estimated at 84% for the 1992-1994 period by the Tunisian Ministry of Economic Development, but the additional labour supply is likely to have been underestimated as only persons aged 18 to 59 were considered as belonging to the active population. While the active population has increased at a faster rate than the total population, the actually employed active population has increased less rapidly, resulting in a deteriorated employment market situation. The observed high-level in the rate of unemployment can be attributed mainly to the difficulties for first-job seekers to find a job rather than to lay-offs of employed workers. As a consequence, unemployment is concentrated among youth: in Morocco, Algeria and Tunisia, youth unemployment is estimated at 37%, 66% and nearly 68% of total unemployment respectively. Unemployment rates are also much higher for those with intermediate and higher education in Algeria and Tunisia, suggesting a relative scarcity of skilled jobs (Figure 12). Given the evolution and current situation of the different sectors of employment, it is likely that their capacity for employment creation will not be enough to meet the needs of new job seekers in the near future. **This might suggest that the number of potential migrants will be on the rise in the next two decades, as international migration has traditionally provided a solution to labour-market disequilibrium in the past. However, given the age structure of the population, this migration potential is likely to rapidly decline from 2030 onwards.**

Figure 12 – Distribution of the Unemployed by Level of Education (%)
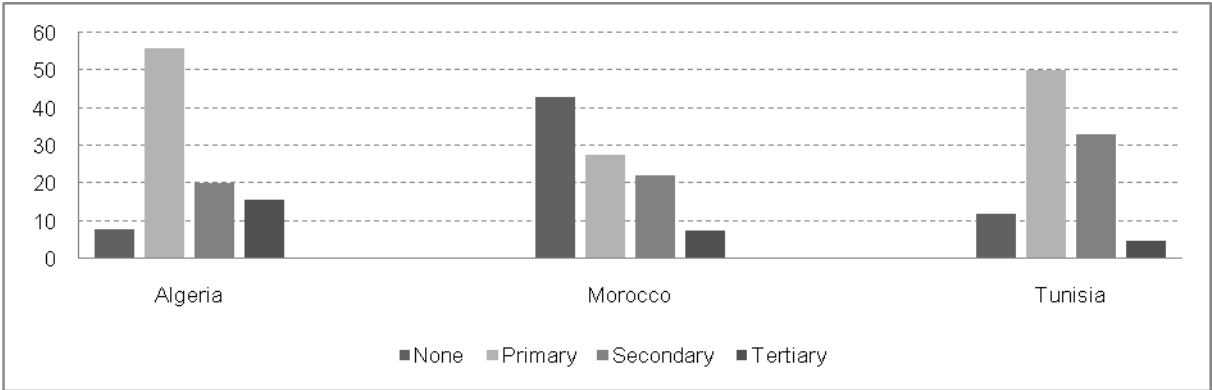
*Source:* Graph reproduced from Dyer (2005).

On a more positive side, the increase in the share of the working-age group implies a decrease in the rate of demographic dependence, as measured by the ratio between persons under 15 or over 65 and those of working age. While in 1970 there was one person of non-active age for every person of active age in each country, there will be one inactive person for every two active persons by 2010-2015. This could have some positive effects on the three countries' development capacities under the condition that persons of working age manage to find work.

Urbanization

The distribution of the population over rural and urban areas generally has significant effects on labour markets and migration pressure. As suggested by Figure 13, countries of the Maghreb have seen the share of their urban population rapidly increase since the 1950s, and this phenomenon is projected to be sustained in the next two decades. Roughly equal to 22% in 1950, the share of the urban population

in Algeria was around 60% in 2000 and is projected to amount to nearly 75% in 2025. The same trend is observed in Morocco. Interestingly enough, urbanization in Algeria and, to a lesser extent in Morocco, has been mainly due to migration flows from rural areas towards medium-sized towns. As revealed by Figure 12 indeed, the share of the Algerian population residing in agglomerations of more than 750,000 inhabitants has been quite stable over the 1950-2000 period and is projected to remain so in the next two decades. This is also true in the case of Morocco, where this share increased between 1950 and 1980, before stabilizing. These stylized facts suggest that a process of decentralization of economic areas and decision-making has been at play in these two countries. **The proliferation of new urban centres of medium size has been attracting an increasing proportion of rural migrants and has acted as buffers for internal and international migration**, in a context marked by a virtual halt to emigration abroad (Giubilaro, 1997).

Figure 13 – Estimates and projections of urban population, 1950-2025 (%)
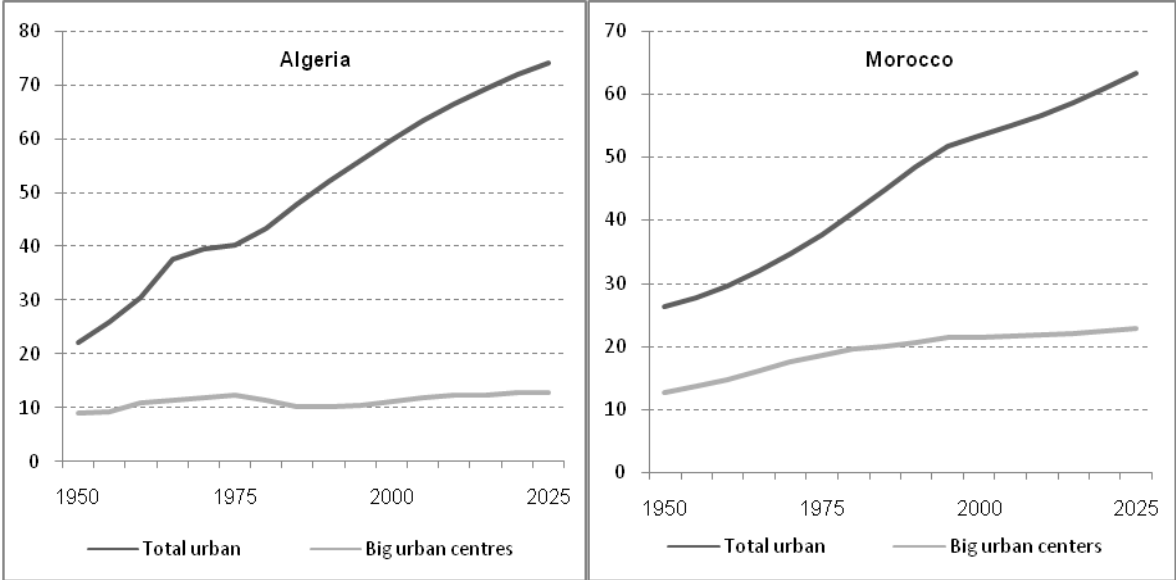
Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2006 Revision* and *World Urbanization Prospects: The 2007 Revision*, http://esa.un.org/unup,

Note: Big urban centres are agglomerations of more than 750,000 inhabitants. In the case of Algeria, there are two such agglomerations, namely El Djazaïr (Algiers) and Wahran (Oran). In the case of Morocco, the list includes Dar-el-Beida (Casablanca), Fès, Marrakech and Rabat. Disaggregated data for Tunisia are not available.

Part III –Climate change and future migration patterns

Assessing the impact of climate change on future migration patterns in the Maghreb is quite challenging. While it is generally accepted that increased natural disasters and chronic environmental degradation due to climate change will induce population movements, the question of the size of these population movements and of the form they will take, in general and in the case of the Maghreb in

particular, remains unanswered. The consequences of climate change on migration actually depend on a variety of factors: not only do they depend on the projected meteorological impacts of climate change in terms of raised sea levels, altered precipitation patterns and more frequent and fierce storms, but also strongly on the ability of individuals, households and communities to anticipate, cope with, resist and recover from climate-related disasters. Estimating the number of people who will be forced to move over the long term as a direct result of climate change thus requires some hazardous (heroic?) extrapolations.

With these caveats in mind, this section looks at ways that climate change might lead to increased forced migration. It then presents some predictions for numbers of future climate migrants, examines the uncertainties with these predictions and lays out different tentative scenarios on future numbers of forced migrants. The discussion heavily draws on two background papers that were commissioned by the World Bank Group for the "Social Dimensions of Climate Change" workshop held in March 2008 (Raleigh et al., 2008; Brown, 2007) and on a study entitled "Climate Change and Energy in the Mediterranean" undertaken by Plan Bleu (Plan Bleu, 2008).

Projected overall impact of climate change in the Maghreb

According to various reports from the Intergovernmental Panel on Climate Change (IPCC), climate change will make certain parts of the world much less viable places to live by causing food and water supplies to become more unreliable and increasing the frequency and severity of floods and storms. Because of their geographical situation, the Mediterranean region in general and the Maghreb countries in particular will be particularly concerned by a strong increase in temperature, a decrease in rainfall and a rise in sea level. Based on the climate models developed for the region, a temperature increase of 1°C and a reduction of rainfall likely to reach 10% by 2020 are anticipated. On the longer term, this climate situation will worsen, with an anticipated rise of 3°C and 5°C in 2050 and 2100, respectively, accompanied by a drop in rainfall ranging from 20% to 50% for these same time frames (Rousset and Arrus, 2006). Besides, the frequency of extreme events (drought periods, in particular) will intensify, just as abrupt temperature variations (Nyong, 2006; Stern, 2006). Lastly, coastal zones will undergo the adverse consequences of sea level rises. Flood risks are set to increase, generating a degradation of coastal infrastructures, loss of arable land and displacement of the populations (Nicholls and al., 1999).

As clearly stated in the report "Climate Change and Energy in the Mediterranean" undertaken by Plan Bleu (Plan Bleu, 2008), however, the major problem faced by Southern Mediterranean countries (SMCs) lies in the fact that, due to their intermediate economic development level and the vulnerability of their environment, they are all the more sensitive to the future climate changes. The arguments provided by the report are as follows:

"*First, many countries among SMCs are passing to the last stage of their demographic transition. The population will, accordingly, multiply in the years to come, thus multiplying the needs in water and food. The increase in the working population will change the modes of consumption, which will result in an increase in the needs in matter of energy, infrastructure and housing. The coastal cities will, therefore, be over-strained due to incapacity to accommodate the flows of migrants in terms of public utilities and sanitation conditions in particular. The massive and precarious urbanization will result in an increasingly greater risk-taking especially in terms of exposure to the climate of the new housing sites.*

Secondly, the SMCs derive several resources from agricultural production, which is highly dependent on climate conditions. Water reserves will decrease and the needs will increase. This will, then, give rise to difficulties in terms of food security, a vector of proliferation of epidemics. The countries will, thus, be led to increasingly resort to imports. In the absence of a dedicated policy, this dependence on foreign countries may grow stronger with the increasing energy demand.

Besides, their environment being already subject to high temperatures and being vulnerable, the losses in terms of ecosystem are, therefore, likely to be felt. This phenomenon will have consequences on the poorest populations which use the services offered by the land for subsistence (subsistence products...) and will, in addition, translate into a reduction of tourism. The increase in inequalities will not only be felt in the widening gap between North and South, but also within the countries themselves. The social groups to be most affected are already the poorest ones (farmers, fishermen, populations living in precarious housing and in risky zones...) who have least financial resources to adapt to the climate and who remain the least prepared to respond."

One of the difficulties Maghreb countries will have to deal with in particular relates to water. New estimates of water scarcity calculated by the World Resources Institute in collaboration with the University of New Hampshire show that some 41% of the world's population, or 2.3 billion people, now live in river basins under "water stress" meaning that per capita water supply is less than 1,700 m³/year. Assuming that current water consumption patterns continue unabated, projections show that at least 3.5 billion people—or 48% of the world's projected population—will live in water-stressed river basins in 2025 (see Figure 14). Water scarcity will be particularly severe in Algeria, Morocco and Tunisia, leading to problems with local food production and economic development unless the region is wealthy enough to apply new technologies for water use, conservation, or re-use.

Figure 14 - Projected annual renewable water supply per person by river basin, 2025
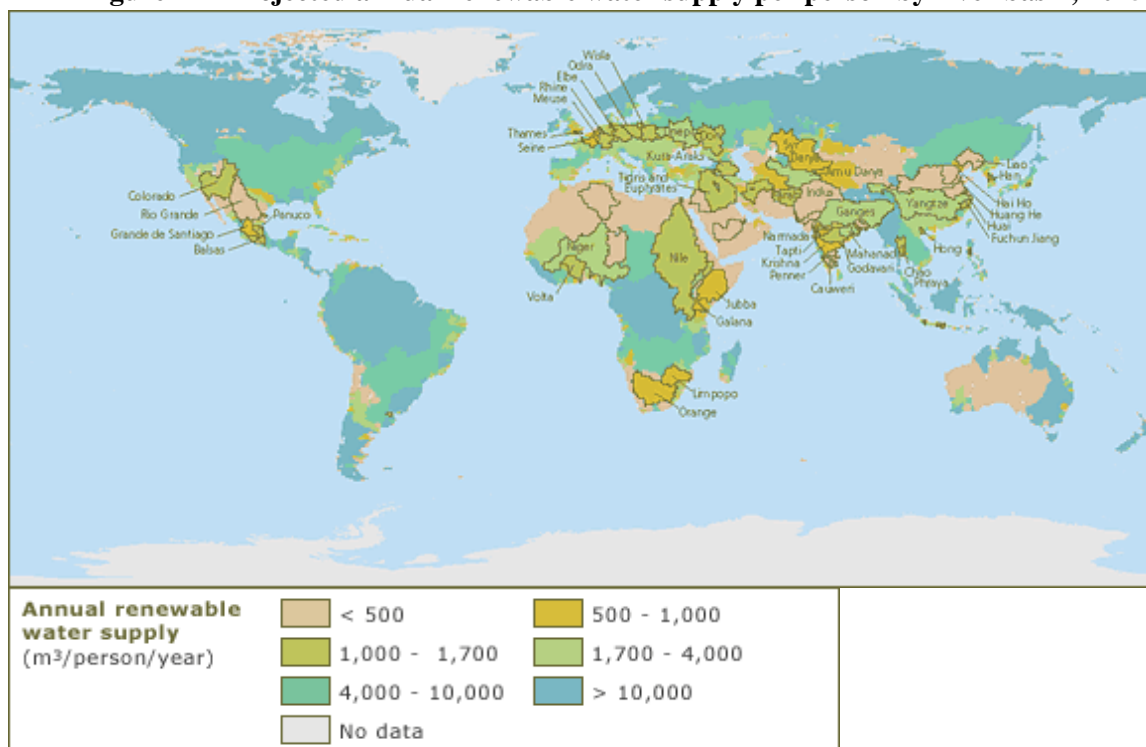
Source: World Resources Institute - PAGE, 2000

Sectoral economic impact of climate change in the Maghreb

The potential economic impact of climate change partly depends on each country's part of the production that is dependent on the climate. As a preliminary step, Table 5 provides an overview of the share of each sector of activity in Algeria's, Morocco's and Tunisia's GDP. It is of course impossible from these figures to appreciate the vulnerability of these economies to climate change. Still, they show that the specialization of the production varies from one country to another, suggesting that the impact of climate change will not be even across the region.

**Table 5 - Percentage distribution of value-added, 2007**

	Agriculture, hunting, forestry, fishing	Mining, Manufacturing, Utilities	Manufacturing	Construction	Wholesale, retail trade, restaurants and hotels	Transport, storage and communication	Other Activities
Algeria	9	52	5	8	10	7	14
Morocco	14	21	16	6	14	7	37
Tunisia	12	25	18	6	17	12	28

Source: http://unstats.un.org/unsd/database.htm

- Agriculture

In most Southern Mediterranean countries and in Algeria, Morocco and Tunisia in particular, a significant share of the working population is to be found in the agricultural sector (Figure 15). These are the countries for which the value-added in the agricultural sector is the highest, and thus the countries in which a substantial segment of society will be concerned by the difficulties related to climate change.

Figure 15 – Agricultural population in Mediterranean countries: past and projected trends
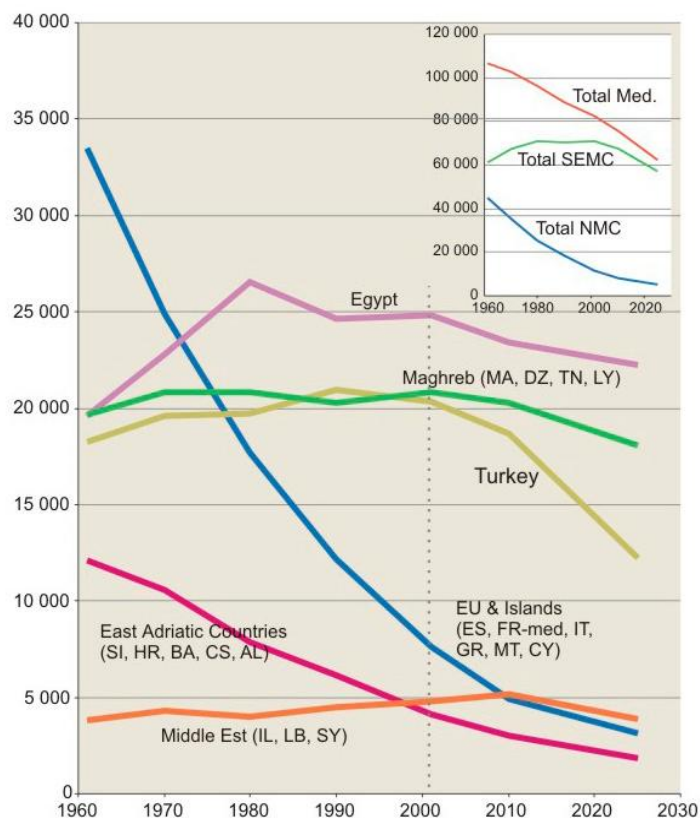
According to some projections based on the Cropwat model, the reduction in yields could range from 10% in normal years to 50% in dry years in Morocco in 2020, for crops requiring significant water resources.[xiv] With one projected dry year every three years in 2020, the agricultural production at the national level is anticipated to decrease by 30%. In the case of Algeria, the reduction in yields is projected to decrease from 5% to 14% for the same time frame (Rousset and Arrus, 2006). Climate change will also impact on the vegetable production: yields are projected to decrease by 10% to 30% in Algeria by 2030, and 40% in Morocco (Bindi and Moriondo, 2005). The anticipated costs of climate change for Maghreb countries are thus significant. Stern (2006) estimates at 5% the reduction in world grain production that would follow a temperature rise of 2°C. This impact is anticipated to be multiplied in the MENA region: grain production in this region could experience a decrease in the range of 15% to 35%.**The reduction of agricultural production is likely to induce a decrease in wages and employment of the population for which agriculture is the main source of income. This may be followed, in the short term, by a displacement of the rural area to already over-populated cities, and, in a longer term, to richer countries.**

- Energy and Industry

As suggested by Plan Bleu (2008), the industry sectors, and particularly the energy sector, will be seriously concerned by climate change. Climate change will have an impact not only on the supply side but also on the demand side, as the increase in temperatures will cause a reduction in demand on energy for heating but an increase in air-conditioning needs for the summer season. The energy needs

for water treatment could also prove to be a significant factor of an accelerated growth of total demand, in a context of growing water scarcity.

On the supply side, climate change may have direct economic impacts (on the infrastructures, production or renewable resources) or indirect impacts through increases in energy prices at the international level.

- Coastal areas

The impact of climate change on coastal areas will induce very high costs for the Mediterranean region as far as a large majority of the population and of economic activity is concentrated in the major cities on the coastline. Indeed, among the coastal cities, there are many capitals (Tunis and Algiers) and, further South, Rabat and Casablanca, which are key activities centres. This phenomenon is likely to be exacerbated in the coming years due to high demographic growth and because of a significant rural migration which will intensify in view of the increasing difficulties of the agricultural sector.

According to Dasgupta et al. (2007), a one-meter sea-level rise would impact 3.2% of the population of the whole MENA region, 1.5% of its GDP, 1.9% of its urban population and 3.3% of its wetlands. With a five-meter sea-level rise, the projected percentage of exposed population would be much higher (Figure 16). As highlighted by Plan Bleu (2008), fixed capital losses are also likely to be particularly high as several transport infrastructures are located within the 10km coastline area (roads, ports, etc.) in order to meet the increasing needs of both inhabitants and tourists, together with tourist facilities (marinas, restaurants), factories and heavy infrastructures. Anticipated losses for the coastal areas induced by an average climate change of 2°C range are estimated at around 4 billion US dollars in the Middle East (Mendelson et al., 2000).

Figure 16 - Impact of a 5-meter sea-level rise in the MENA region
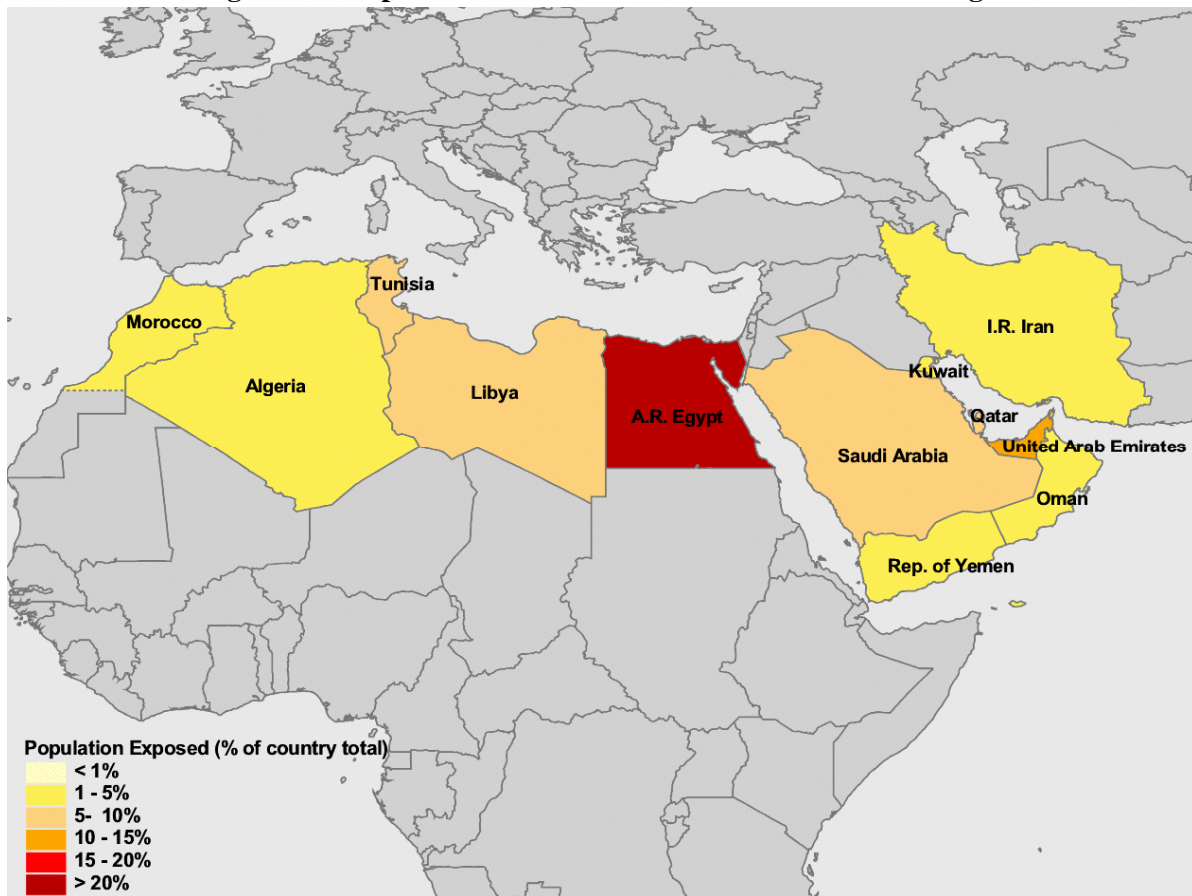
Source: Dasgupta et al., (2007)

- Tourism

Tourism has a significant weight in the total income of most of the economies of the Mediterranean region, the most attractive countries being Turkey, Egypt, Morocco and Tunisia. National and international tourism is expected to grow threefold by 2025 in the region. However, this sector is particularly vulnerable to climate change as the region already experiences high temperatures and a lack of water resources during the summer season. Moreover, most of the tourist activities are concentrated in the coastal cities (90% in the case of Tunisia) which are prone to experiencing major problems due to sea-level rise and intensification of extreme events (Plan Bleu, 2008).

Climate change and forced migration in the Maghreb: views from the past.

While it is almost impossible to predict accurate figures for future climate-triggered population movements, data on the effects of previous chronic and sudden disasters are available. Table 6 presents figures on the human impact and related costs of disasters that occurred in Algeria, Morocco and Tunisia over the 1990-2008 period. As suggested by the table, environmental hazards (droughts, earthquakes and floods) affect the most people. This is likely to be related to their spatial coverage. However, even if figures in absolute numbers are substantial, they are relatively small when expressed

as a share of the population. In addition, experience from the past suggests that those made homeless have a high propensity to return to their homes following a disaster.

Table 6 - Human impact and related costs of disasters recorded during the 1990-2008 period

	Costs (US$)				Total affected(*)			
	Algeria	**Morocco**	**Tunisia**	**Total**	**Algeria**	**Morocco**	**Tunisia**	**Total**
Drought	0	900 000	0	900 000	0	275 000	0	275 000
Earthquake (seismic activity)	5 060 929	400 000	0	5 460 929	241 309	13 465	0	254 774
Epidemic	0	0	0	0	568	0	0	568
Extreme temperature	0	809	0	809	0	0	0	0
Flood	353 917	266 200	242 800	862 917	175 950	126 367	185 500	487 817
Industrial Accident	800 000	0	0	800 000	74	12	0	86
Insect infestation	0	0	0	0	0	0	0	0
Mass movement wet	0	0	0	0	696	0	0	696
Miscellaneous accident	0	0	0	0	73	163	0	236
Storm	0	50	0	50	15	0	0	15
Transport Accident	0	0	0	0	436	911	223	1 570
Wildfire	0	0	0	0	0	0	0	0
Total	**6 214 846**	**1 567 059**	**242 800**	**8 024 705**	**419 121**	**415 918**	**185 723**	**1 020 762**

Source: EM-DAT (http://www.emdat.be/)

Note: For a disaster to be entered into the database, at least one of the following criteria must be fulfilled: (1) 10 or more people reported killed; (2) 100 people reported affected; (3) declaration of a state of emergency; (4) Call for international assistance. (*) Affected people include injured people (people suffering from injuries as a direct result of a disaster), homeless (people needing immediate assistance for shelter), and people requiring immediate assistance during a period of emergency (among which displaced and evacuated people).

Overall, it seems that the impact of climate change on migration will mostly be an indirect one. By altering the capacity of some key economic sectors to generate growth (e.g. tourism or agriculture), climate change may encourage people to migrate.

Conclusions

In this regional note, we have assessed the likely evolution of various factors (economic, demographic, and environmental) deemed to influence the movement of people out of Algeria, Morocco and Tunisia in the next twenty years, either in the form of intra-regional migration or to OECD countries.

The first part of this investigation made use of the results of a recent report analyzing the determinants of past migration flows from the MENA region to OECD countries (Gubert and Nordman, 2008).

These estimates were then used to identify the key factors of past migration trends. Among them, we found that the origin countries' GDP per capita exerted a significant push effect in the MENA region, in particular for low-educated workers who need to overcome poverty constraints in order to afford the fixed costs of migration. Demographic pressure was also found to be a strong predictor of past migration patterns. In particular, highly educated migrants, representing the so-called brain drain, were more responsive to demographic pressure in their origin country, as well as to economic incentives in their destination country. However, more generally, migration was found to be mainly demand-driven, and used by some OECD countries to compensate for population aging.

We then examined in turn the evolution and prospects of the key push effects of migration, namely economic and demographic factors, in order to predict future migration pressure from Algeria, Morocco and Tunisia. The findings of this assessment can be summarised in the following way:

- Given the likely evolution of Algeria's, Morocco's and Tunisia's GDP per capita, sustained migration flows of low-educated workers from these countries may be anticipated in the next decade compared to the flows observed during the last twenty years. With a pessimistic scenario concerning per capita GDP growth, the inflow of low-educated Algerian emigrants may however slow down in the coming years.

- From past poverty trends in Algeria, Morocco and Tunisia and assuming that these countries will know the same pace of poverty reduction in the next decade, we conjecture no significant changes in the migration pressure from these countries due to poverty in the ten coming years. However, vulnerability to poverty remains important in these countries, which further indicates that poverty prospects have to be considered with caution, especially given the ongoing financial and economic turmoil.

- Given the important changes in Algeria's, Morocco's and Tunisia's population age structure, demographic pressure in these countries will remain high and will possibly increase in the coming decades. For instance, it is likely that these countries will be confronted with the same aging problem as Europe, as individuals in their forties today will start to retire from 2030 onwards. Before that date, however, it is also probable that the labour market will be subject to heavy pressure for several years, especially as the expansion of the working age population is currently coupled with rising labour force participation rate among young male and female workers. This suggests that the number of potential migrants will be on the rise in the next two decades, as international migration has traditionally provided a solution to labour market disequilibrium in the past. However, given the age structure of the population, this migration potential is likely to rapidly decline from 2030 onwards.

This note finally attempted to assess the impact of climate change on future migration patterns in the Maghreb. Two factors may explain why the anticipated costs of climate change for Algeria, Morocco and Tunisia will necessarily be significant:

- First, a significant share of the working population in these countries is found in the agricultural sector. Potential water scarcity (due to increase in temperature and decrease in rainfall) will then be particularly severe in Algeria, Morocco and Tunisia, leading to problems with local food production and economic development. The resulting reduction of agricultural production is likely to induce a decrease in wages and employment of the population for

which agriculture is the main source of income. This may be followed, in the short term, by a displacement of the rural area to already over-populated cities, and, in a longer term, to richer countries.

- Second, a large majority of the population and of economic activity is concentrated in the major cities and the coast line. Then, the impact of climate change on coastal areas (the rise in sea level) is likely to be exacerbated due to high demographic growth and because of a significant rural migration which will intensify in view of the increasing difficulties of the agricultural sector.

Despite these important consequences of climate change, experience from the past in Algeria, Morocco and Tunisia suggests that, while environmental hazards (droughts, earthquakes and floods) affect the most people, those made homeless have a high propensity to return to their homes after a disaster. This may then mitigate the role of climate change in shaping future migration patterns from these countries.

References

Baldwin-Edwards M. (2005), "Migration in the Middle East and Mediterranean", Regional Study prepared for the Global Commission on International Migration, Mediterranean Migration Observatory, University Research Institute for Urban Environment and Human Resources, Panteion University, 42p.

Bindi, M., and Moriondo, M. (2005), "Impact of a 2°C global temperature rise on the Mediterranean region: Agriculture analysis assessment", *in* C. Giannakopoulos, M. Bindi, M. Moriondo, P. Le Sager & T. Tin, *Climate change impacts in the Mediterranean resulting from a 2°C global temperature rise*, WWF report.

Borjas, G. J. (1987), "Self-selection and the Earnings of Immigrants", *American Economic Review* 77, pp. 531–53.

Brown, O. (2007), "Climate Change and Forced Migration: Observations, Projections and Implications", Background paper for the 2007 Human Development Report, 34p.

Dasgupta, S., Laplante, B., Meisner, C., Wheeler, D. and Yan, J. (2007), "The Impact of Sea Level Rise on Developing Countries: A Comparative Analysis", World Bank Policy Research Working Paper 4136, February 2007.

Docquier, F. and Marfouk, A (2005), "International Migration by Educational Attainment (1990-2000) - Release 1.1", in C. Ozden and M. Schiff (eds), *International Migration, Remittances and Development*, McMillan and Parlgrave: New York.

Dumont, J-C. and Lemaître, G. (2005), "Counting Immigrants and Expatriates in OECD Countries: a New Perspective", OECD Social, Employment and Migration Working Papers n°25, 39p.

Dyer, P. (2005), "Labor Supply, Unemployment and the Challenge of Job Creation in the Maghreb", Draft, World Bank.
(http://siteresources.worldbank.org/INTTUNISIA/Resources/Rapport+WB+Maghreb+EmploiANGLAIS.pdf)

Fargues, P. (2005), "How Many Migrants from, and to, Mediterranean Countries of the Middle East and North Africa?", Analytic and Synthetic Notes 2005/16, European University Institute, Robert Schuman Centre for Advanced Studies.

Fargues, P. (ed.) (2007), *Migrations méditerranéennes*, rapport 2007, Cooperation project on the social integration of immigrants, migration, and the movement of persons, financed by the ECMEDA Programme, Florence: EUI-RSCAS, CARIM Consortium, 2007.

Giubilaro, D. (1997), "Migration from the Maghreb and migration pressures: current situation and future prospects", ILO International Migration Paper 15, ILO: Geneva.

Gubert, F. and Nordman, C.J. (2008), "Migration from MENA to OECD Countries: Trends, Determinants and Prospects", in *Shaping the Future: A Long-Term Perspective of People and Job Mobility for the Middle East and North Africa*, Washington DC: The World Bank, forthcoming.

ILO (2008), Economically Active Population Estimates and Projections (5th edition) (http://laborsta.ilo.org/applv8/data/EAPEP/EAPEP_E.html)

Koettl, J. (2007), "Prospects for Management of Migration Between Europe and the Middle East and North Africa.", OECD, mimeo.

Jorgenson, D. and Khuong, V. (2008), "Projecting Global Economic Growth An Information Technology Contribution-Based Approach", Lee Kuan Yew School of Public Policy Working Paper, SPP13-08, National University of Singapore (http://www.spp.nus.edu.sg/wp/2008/wp0813.pdf)

Mendelson, R., Morrisson W., Schlesinger, M.E. and Andronova N.G. (2000), "Country-specific market impacts of climate change", *Climatic Change* 45, pp.553-569.

Muller, C. (2007a), "Anti-Poverty Transfers without Riots in Tunisia", DIAL Working Paper, DT/2007-08.

Muller, C. (2007b), "Poverty Change in Tunisia", *The Korean Journal of Economics*, Vol. 14, No.2 (Autumn).

Nicholls, R.J, Hoozemans, F.M.J., Marchand, M. (1999), "Increasing flood risk and wetland losses due to global sea-level rise: regional and global analyses", Global Environmental Change 9, S69-S87.

Nyong, A. (2006), "Africa's Vulnerability to Climate Variability and Change", OECD Global Forum on Sustainable Development on the Benefits of Climate Change Policies, Paris, 6-7 July 2006.

Objectifs du Millénaire pour le Développement (2005), *Rapport National 2005 – Maroc*, Royaume du Maroc, September.

Objectifs du Millénaire pour le Développement (2005), *Rapport National 2005 – Algérie*, Gouvernement Algérien, ISBN : 9947-0-0961-0, July.

Plan Bleu (2008), "Climate Change and Energy in the Mediterranean".

Raleigh, C., Jordan, L., and Salehyan, I. (2008), "Assessing the Impact of Climate Change on Migration and Conflict", The Social Development Department, World Bank, mimeo.

Rousset, N., Arrus, R. (2006), "L'agriculture du Maghreb au défi du changement climatique : quelles stratégies d'adaptation face à la raréfaction des ressources hydriques?", Communication à WATMED 3, 3ème Conférence internationale sur les Ressources en Eau dans le Bassin Méditerranéen, Tripoli (Liban), 1 -3 novembre 2006.

Sjaastad, L.A. (1962), "The Costs and Returns of Human Migration." *Journal of Political Economy* 70, pp.80–93.

Stern, N. (2006), "The Economics of Climate Change", The Stern Review. Cambridge: Cambridge University Press.

Todaro, M.P. (1969), "A Model of Labor Migration and Urban Unemployment in Less Developed Countries", *American Economic Review*, 69, pp.486-499.

UN (2007), *World Urbanization Prospects: The 2005 Revision*, Population Division of the Department of Economic and Social Affairs, New York, 2007.(http://esa.un.org/unpp/)

UN (2007), *World Population Prospects: The 2006 Revision*, Population Division of the Department of Economic and Social Affairs, New York, 2007 (http://esa.un.org/unpp/)

World Bank (1995), "Republic of Tunisia Poverty Alleviation: Preserving Progress while Preparing for the Future. Volume I, Main Report", Report No. 13993-TUN, August.

World Bank (2005), "Global Economic Prospects 2006: Economic Implications of remittances and Migration", Report No. 34320, Washington DC: The World Bank.

World Bank (2007), *World Development Indicators*, Washington DC: The World Bank.

World Bank (2008), *Economic Developments and Prospects: Regional Integration for Global Competitiveness*, Middle East and North Africa Region, Washington DC: The World Bank.

ⁱ The construction of this database was financially supported by the World Bank. It is based on successive rounds of censuses held in each OECD country. Are considered as migrants all working-aged (25 and over) foreign-born individuals living in an OECD country, where foreign-born individuals are those individuals born abroad with foreign citizenship at birth (see Docquier and Marfouk, 2005 for further details). Of course, only legal migrants are recorded, so that the figures provided in this section should be considered as lower-bound estimates of migrants' stocks.

ⁱⁱ The database of Dumont and Lemaître (2005) is another very good source of information on migrant stocks in OECD countries. However, it delivers information on migrant stocks in 2000 only.

ⁱⁱⁱ Note that the analysis of the determinants of the expatriation rates is performed using alternative specifications for the dependent variable: total expatriation rate and expatriation rates of the low-educated, medium-educated and high-educated migrants. By so doing, the models allow the explanatory variables to have different effects on the expatriation rate of each education group. In Table 3, only the results obtained with total expatriation rate as the dependent variable are reported.

^{iv} Our assumption is simply a linear trend following the actual figures of the period 1995-2005.

^v Note however that these projections do not take into account the remarkable growth performances of Morocco for the years 2006 and 2008.

^{vi} Current mainstream forecast methodologies use the neoclassical model: output and productivity growth are projected based on varying assumptions concerning the dynamics of the three main sources of growth: capital, labour, and total factor productivity (TFP).

^{vii} These variables include the capital quality growth, the growth rates of the reproducible capital stock, the TFP growth generated by non-ICT sectors, and the TFP growth in the ICT-producing sector.

^{viii} For instance, while there is virtually no poverty in some of the oil exporting nations of the Gulf Cooperation Council (GCC), more than a third of the population lives below the poverty line in the Republic of Yemen.

^{ix} For example, only 3% of Egyptians live below $1 a day, but some 43% live on less than $2 a day; in the Republic of Yemen, 10% of the population lives on less than $1 a day, but a full 45% of the population lives on less than $2 a day.

^x Vulnerability can be defined as the proportion of population subject to a risk of poverty.

^{xi} Food poverty refers to household-level hunger. Households in food poverty do not have enough food to meet the energy and nutrient needs of all of their members.

^{xii} To reduce by half the proportion of people living on less than a dollar a day.

^{xiii} The food poverty line is determined using a minimum need of 2100 calories per person and per day.

^{xiv} Cropwat is a decision support system developed by the Land and Water Development Division of FAO for planning and management of irrigation.