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Migration and Global Environmental Change

PD7: Environment, migration and the demographic deficit

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Abstract

The paper considers whether migration is a valid policy approach in the context of a demographic deficit and the impact of environmental change on this relationship. The question is addressed in three stages. There is now considerable evidence that migration is a valid policy approach for addressing the challenge of an ageing population. Encouraging economically driven in-migration, particularly of skilled migrants, increases fertility, population size and the working age population, at least in the short term. In addition, it appears to have a positive effect on innovation and growth. Our understanding of the relationship between environmental change and age structural change in the context of migration is more limited. The paper argues that the impact of global ageing – or age structural changes in population composition – on environmentally driven migration will be to increase the demand for skilled migration. Thus those in environmentally challenged zones with skills may find it easier to relocate under conditions of age structural change, than under circumstances without perceived demographic deficits in working age populations. The reciprocal aspect to this is whether environmental change will have an impact on population composition. The paper argues that environmentally driven migration will operate through changing the scale, flow and destination of global skilled migration and thus increase the impact on the population composition of both the host and the source countries. In terms of scale, environmentally driven skilled migrants will join with economic migrants. In terms of flow and destination, environmental change may alter the current assumption that Asia, and the more economically advanced parts of Latin America and Africa, will prove in the future to be more attractive destinations for skilled migrants, who will increasingly be able to select where they place their skills, to the detriment of Europe. However, these scenarios overlook the increasingly different degrees of challenging environments between regions. It is already accepted that the challenges which climate change may bring will impact upon sustainable economic development in a number of regions, specifically those in the south. In some regions this may restrain economic growth and thus the economic magnets for attracting skilled migrants. Furthermore, skilled migrants may select less challenging environments within which to relocate. Thus Asian cities in particular may begin to lose out to European cities, which are situated in less environmentally challenging zones, and so impact upon migration flows and destinations. This will then further impact upon the population composition of the receiving countries. Finally, the migration of skilled workers, whether economically or environmentally driven or both, will under the coexistence of environmental change with global ageing increasingly leave behind vulnerable older people in environmentally challenged zones.

1. Introduction

While there is a growing body of research independently addressing migration and ageing populations and migration and environmental change, there is limited material on ageing and environmental change, and negligible material that considers migration, ageing populations and environmental change. As Harper (2011a,b) points out, while there has been considerable discussion around the impact of changing population size on the environment, the question of population density and distribution has been addressed mainly in terms of local impact, and that of population composition has been broadly absent from the debate.

The paper addresses the question as to whether migration is a valid policy approach in the context of a demographic deficit and the impact of environmental change on this relationship. The question is addressed in three stages. It will consider the evidence that in-migration to countries with ageing population structures reduces the burden from the so-called demographic deficit. It will consider the impact of global ageing – or age-structural changes in population composition – on environmentally driven migration, and it will explore whether environmental change will have an impact on population composition.

The paper employs the model developed in Harper (2011a) as an analytical framework to guide the exploration of these questions (Figure 1).

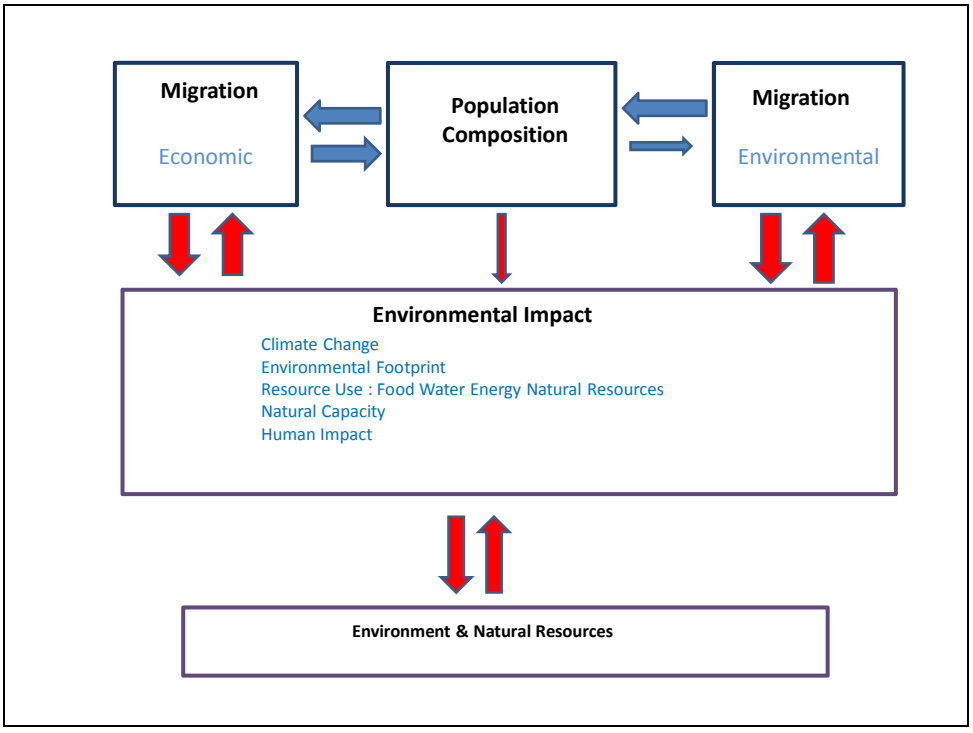

Figure 1. Migration, population composition and environmental impact

This model chooses to distinguish between economic and environmentally driven migrants with the caveat that this distinction is much debated in literature. It thus proposes that we can divide global migration flows into those arising from economic factors, and those stimulated by environmental change. Population composition has a reciprocal relationship with both, though composition impact has a slightly lower impact on driving environmental migration than it does

economic. Both forms of migration, and population composition itself, directly impact upon the environment, though to different degrees.

The paper will primarily focus on the situation of the UK, while recognising that only a few studies isolate the UK from the rest of the European Union (EU). In addition, the years 2030 and 2050 will be taken, as UN projections currently stop at 2050. All projections in this report, unless otherwise stated, refer to UN 2008 medium variant projections. The assumptions behind this are:

- fertility: all projections set to converge at 1.85 but not necessarily by 2050;
- mortality: based on UN models of life expectancy;
- migration: future paths of international migration are set on the basis of past trends, projection levels kept constant; and
- zero-migration: set to zero from 2010 to 2015.

Assumptions are listed in full at http://esa.un.org/unpp/index.asp?panel=4.

2. Changing population composition

In order to address the relationship between migration and the so called ‘demographic deficit’ it is necessary to understand the complex population dynamics behind this, including the demographic drivers of fertility and mortality, the demographic transition and the resulting demographic dividends and dependencies.

The current demographic profile of most regions of the world is population ageing – or more accurately age-structural transition – associated with the late stage of the *demographic transition* (Bloom *et al*. 2003; Pool, 2005). There is significant debate both around the drivers of this transition and the identification of a *second demographic transition* (Bongaarts, 1998; Bucht, 1996; Cliquet, 1991; Lutz, 2004; Van de Kaa, 1987; Vaupel, 1996). Typically associated with economic development, this is the decrease in both mortality and fertility rates. Mortality rates fall first, including infant mortality, enabling the survival of large birth cohorts into adulthood. Then population growth levels off, and the profile of the population ages, as late life mortality rates fall and individuals survive to increasingly older ages.

Taking an age-structural change perspective allows us to view population change in terms of a shift between providers and dependents – the dependency ratio – and how this will typically move from a large percentage of young to a large percentage of old dependents during the demographic transition. With all these projections we must remember the caveat of changing productivity patterns within the age groups, and in particular of presuming non-productivity at fixed ages, as future cohorts may well have different entry and exit ages.

These ratios comprise elderly dependency ratios (EDR), the number of persons of working age (aged 15 to 64) per person aged 65 or over; youth dependency ratios (YDR), the number of persons of working age (aged 15 to 64) per person aged 15 or under; and total dependency ratios (TDR), the number of those aged 15 to 64 with those outside this age range. It must of course be noted that these accepted broad age categories are in practice a mere proxy for productivity/non-productivity. While some authors have taken the shift in EDR from 7% to 14%

as a measure of the move of a population into an aged population, Harper (2006) proposes that the shift in TDR from YDR to EDR may be useful in determining when a population reached demographic maturity. Europe became mature by this measure in 2000, Asia is predicted to reach maturity by 2045.

The next decade will thus see a rapid shift towards increased EDRs in most industrialised countries. The EU-25 Elderly Dependency Ratio is set to double and reach 51% by 2050, as the working-age population (15–64 years), decreases by 48 million between now and 2050, and the EU-25 will change from having four to only two persons of working age for each citizen aged 65 and above (European Commission, 2006).

A population with a large percentage of young productive adults has the potential to produce a *demographic dividend.* This usually occurs late in the demographic transition when a series of large birth cohorts are followed by a set of far smaller ones as birth rates fall. This results in a decrease in young dependents, and thus a fall in the YDR. This is accompanied by a substantial increase in the potential labour force and the potential for high savings rates, particularly as the consumption needs of large numbers of dependent children is reduced. In addition, this enables families to concentrate their resources on fewer children, with higher survival probabilities increasing the expected return to investments in children and furthermore releases capital for investment in production (Bloom et al. 2003; Holzmann, 2005). This can lead to greater per capita output and economic growth through an enhanced labour force and high investment rates producing the 'demographic dividend'. In addition, this allows the society to increase its aggregate per capita income level before the time the population becomes mature, and to accumulate assets which can be can be drawn upon to help finance the consumption needs of an elderly population (Heller, 2006).

The so-called demographic deficit, while a contested concept, but one which is generally accepted in the economic literature, caused by these age-structural changes is perceived to herald negative implications for both nations and regions (Lee and Mason, 2010). There is a series of assumptions behind this view which coalesce around two broad themes:

- Demographic decline leads to decline in economic activity.
- Demographic ageing leads to economic burden due to increased requirement for pensions and health care.

3. Migration and the demographic deficit

Recent advances have been made in the understanding of the relationship between migration and the demographic deficit. Migration has a potentially strong and long-lasting impact on population growth and structure through the interaction between the number of migrants, their relatively young age structure and their higher fertility. As a result, immigration has increasingly become perceived as a potential means to prevent population decline, maintain the size of the labour force and thus the support ratio, and slow down structural population ageing.

The debate can be examined at various levels of analysis:

- directly via the impact of migration
    - on future fertility increases

  - on population size
  - on direct labour replacement through increasing the working age population

- indirectly via the effect of migration
  - on innovation and growth
  - on employment and welfare

and at two temporal levels – short-term and long-term gains and negatives.

There is general consensus that immigration to both the UK and Europe will in the short term achieve immediate increases in total fertility rates, population growth and labour market contribution. However, these are unlikely to achieve full replacement level, to be unsustainable over the longer term, and indeed may eventually contribute to a worsening of the demographic deficit, as the total fertility rates of the immigrant population falls and they age in place. The impact on innovation, economic growth, employment in general and welfare are more complex and contested.

3.1 Migration and fertility

Immigration raises the number of births in the host country in the short term (Andersson, 2004, Andersson, 2005). First generation immigrant women usually have higher levels of period fertility than host-country women, though this effect appears to diminish by the second generation. Several inter-related factors (Genereux, 2007; Sobotka, 2008) have been identified in relation to the differential fertility of migrant groups.

The initial high fertility is seen to be related to the

- socioeconomic characteristics of immigrants such as education, income, level of integration and rates of intermarriage which may be conducive to higher fertility;
- culture, norms and values in the region of origin which may promote higher fertility;
- perceived relationship between migration, marriage and child-bearing, such as those migrant women who migrate for marriage and family reunion (Booth, 2010; Milewski, 2007) and those who undertake childbearing on arrival in the host country making up for the childbearing which was postponed or interrupted in the period shortly before and during migration (Milewski, 2007); and
- impact of minority status, whereby there is some evidence that higher fertility may be a defensive response among more disadvantaged communities with strong ethnic or religious consciousness (Coleman, 1994; McQuillan, 2004) or distinct ethnic factors exist which maintain fertility within the group over several generations (Frank, 2005).

Migrant fertility rates and expectations decline to reach levels close to the host-country rate within a period of time between one decade and a single generation (Kulu, 2005; Toulemon, 2004). This subsequent fall in fertility may be related to

- assimilation into the host community (Coleman, 2006);
- non-assimilation but adoption of socioeconomic and cultural norms;
- fertility limitation among some groups of migrants as a way of achieving higher social mobility (Forste, 1996);
- lower fertility among recent migrants, linked to the disruption effect migration may have on partnership formation and childbearing; and
- national welfare policies, employment patterns and other institutional factors which facilitate an adjustment of migrants' fertility to 'local' fertility patterns (Sobotka, 2008).

Research has also indicated that migrants may indirectly contribute to increases in the host country fertility. For example, young male migrants may increase the pool of men available in the marriage market of the host country, or female migrant carers may free native women from caring responsibilities, to allow them to bear children (Roig Vila, 2007).

In addition, as Coleman (1994) points out, the overall higher level of migrant total fertility rate (TFR) masks the heterogeneity among different groups of migrants. For example, migrant women from Bangladesh, Morocco, Pakistan and parts of sub-Saharan Africa typically have a TFR exceeding that of native populations in Europe, while those from Eastern Europe and the Caribbean have a TFR similar to Western European countries.

Some demographers also caution around issues of calculation and projection

- Migrants' period fertility rates, or their TFR, are complicated by the inter-relation between the events of migration and fertility (Toulemon 2004; Andersson 2004). Period fertility measures are based on the assumption that fertility is a function of age; however, the fertility rates of female immigrants appears more closely linked to the timing of migration rather than age (Sobotka, 2008).
- Some estimates and projections show that the long-term contribution of immigrants to childbearing is frequently underestimated when conventional methods of analysis are used (Jonsson, 2004).
- The concept of replacement-level fertility is increasingly being replaced by the notion of net-replacement rates, which reflect both mortality and migration (Preston, 2007; Smallwood, 2005). Coleman (2008) suggests that an index of population replacement should take into account the effective contribution from net immigration to the size of each native birth cohort, and the age structure and the fertility contributions of the original population and of the net immigrant population. Estimates of total fertility of the population combined with the contribution of immigration give the level of replacement.

The proportion of births to immigrant women provides some indication of the importance of immigrants for fertility. This measure is a function of past immigration levels, the age composition of immigrants, and their fertility rates. A measure of the current impact of immigrant fertility on the UK can be accessed through a comparison of births to immigrant women compared with those to UK born mothers. The TFR of UK-born mothers is 1.84, of non-UK-born mothers is 2.48, resulting in a combined TFR of 1.96. Births to immigrant women

currently account for around one-quarter of all live UK births, rising over the past decade from 14% in 1999 to 25% by 2009 (ONS, 2009). Immigrants are thus contributing substantially to the total number of UK births. However, the ‘net effect’ of the higher fertility of migrants on the period total fertility of the UK and other EU countries is small. It should be noted, however, that while the ‘net effect’ of the higher fertility of immigrants on the total fertility of particular countries may be relatively small, the higher fertility of migrants, is typically not accounted for in projection scenarios.

3.2 Migration and age-structural transition

In demographic terms, there is general agreement that migration will not prevent the age-structural transition and the so-called demographic deficit but may slightly alleviate it (Coleman, 2002; Espenshade et al. 1982; Espenshade, 2001; Feld, 2000; Lesthaeghe, 2000; Pollard 1973, Saczuk, 2003). Migration can, however, at very high levels, avert future decline in the total population (UN, 2000) and in the population of working age (Coleman, 2004; Coleman, 2008).

The second focus has thus been on the direct impact of migration on the working age population and on the potential support ratio. It is projected that if migration rates stay largely at their current levels, the working-age population in Organization for Economic Cooperation and Development (OECD) countries will rise by 1.9% between 2010 and 2020, compared to the 8.6% growth seen between 2000 and 2010 (IOM, 2010). The International Organization for Migration (IOM) reports further predict that while the incoming (20–24) working-age cohorts in OECD countries were some 32% larger on average than the outgoing retiring (60–64) ones in 2005, the situation in 2015 will be substantially different, with the incoming labour force cohorts being scarcely 2% larger (see Figure 2). By 2020 they will be some 9% smaller. For almost half of OECD countries, the outgoing cohorts will be larger than the incoming ones in 2015.

Several papers have attempted to estimate the future net migration required in the EU to keep work force numbers stable:

- The United Nations (UN, 2000) report used standard cohort-component projections to calculate that between 1995 and 2050, an average annual net migration of around 1.4 million people was required to keep the proportion of the working-age population in the European Union stable, and 48,000 per year for the UK.

- Holzmann (2005) forecasts for Europe and Russia combined, a migration of 3.3 million annually until 2025 and 4.1 million annually between 2025 and 2050 (see paper for assumptions and methods).

- Prskawetz et al. (2006) produces a variety of scenarios using standard and zero migration projections to conclude that without mass immigration of around 100 million it would require a significant increase in labour force participation rates for all EU countries and a rise in retirement ages of 10 years by 2050 to compensate for the impact of demographic aging on the work force.

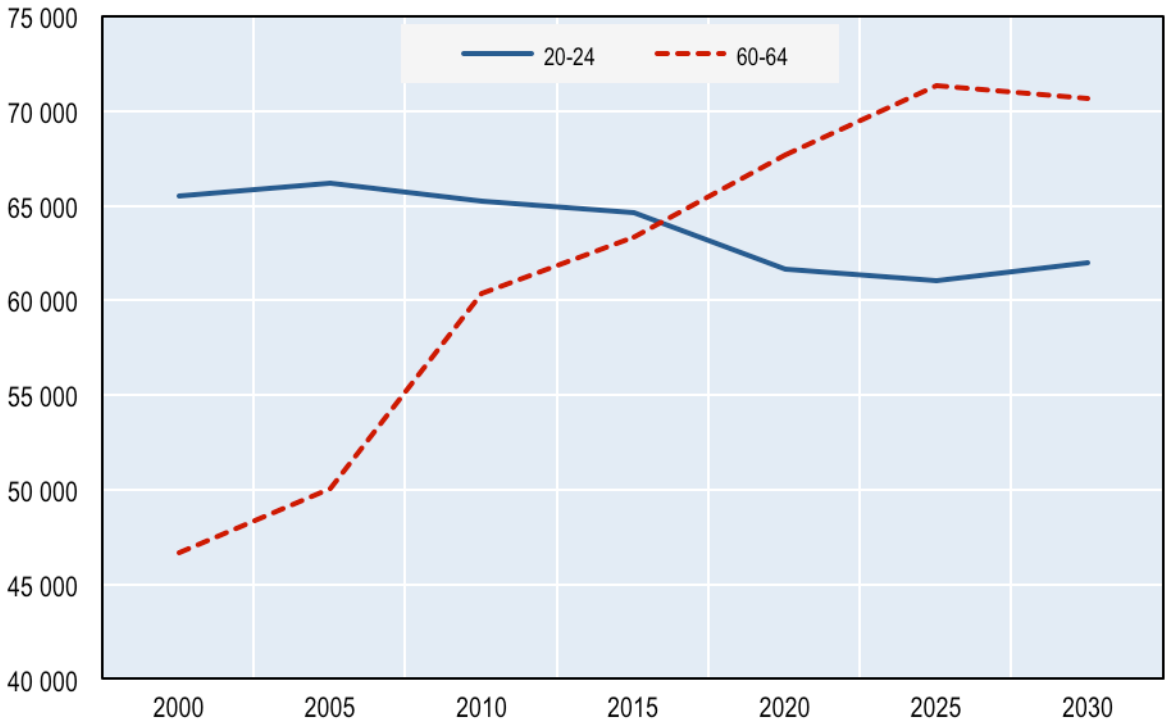

Figure 2. Observed and projected size of the incoming (20–24) and outgoing (60–64) working-age cohorts in OECD countries, 2000-2030

Source: UN World population 2008

Excludes Mexico and Turkey, Reproduced from IOM 2010

Reports that focus mainly on direct labour market impacts appear more optimistic about its effects. Bijak et al. (2007) and the International Migration Outlook (OECD, 2010) suggest that migration has a strong impact, at least in the short term, in recruiting workers. In Bijak *et al*'s (2007) projection of European labour force over the next 50 years, the comparison of the aggregate indicators for 2002 and 2052 suggests that while plausible immigration cannot offset population and labour force ageing, higher immigration and higher economic activity can slow the negative economic consequences of structural ageing, ideally in combination with increased fertility.

An important contribution to our understanding of the relationship between fertility, migration and age-structural change comes from the work of Lutz and Scherbov (2007) as they attempt to model the impact of migration through presenting two different sets of probabilistic population projections for the EU-25, both are based on identical assumptions about the future range of fertility and mortality, but with different migration assumptions (Figure 3). This compares a 'regular' scenario which considers the full range of uncertainty in future migration as it looks plausible from today's perspective with a 'no migration' scenario – the purely hypothetical, unrealistic case of Europe being entirely closed to migration is examined. The assumptions made closely resemble those of the Eurostat projections and a detailed documentation and description of methods are given in Scherbov and Mamola (2006).

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Year	Total population (in millions)	Proportion 65+
2004	457 0.	0.165
2025 ‘regular’	471 (457-485)	0.227 (0.214-0.239)
‘No migration’	451 (441-462)	0.234 (0.222-0.247)
2050 ‘regular’	460 (417-506)	0.320 (0.272-0.365)
‘No migration’	413 (376-450)	0.341 (0.291-0.384)

Source: Lutz and Scherbov (2007)

Figure 3. Total population (in millions) and proportion above age 65 in the EU-25 (medians with 80% uncertainty ranges), ‘regular’ and ‘no migration’ cases

- In the ‘regular’ case the total population of the EU-25 is still likely to increase somewhat until around 2020 and then start to decline, thus reaching 471 million in 2025, followed by a decline to 460 million in 2050. Thus even in the case of significant immigration, on average 800,000 per year, the population size in the EU-25 is likely to be about the same level in 2050 as it is today.

- In the ‘no-migration’ case the median commences an immediate moderate decline followed by a steep decline after 2030, reaching 451 million by 2025, and 413 million by 2050, a fall of 40 million across the EU.

In terms of age structure, the proportion of the population aged 65 or above is almost certain to increase under all conditions, with or without migration, the median reaching 32% in the ‘regular’ case and to 34.1% in the ‘no migration’ case by 2050. As the study concludes, any meaningfully assumed level of immigration, even when combined with high fertility and low gains in life expectancy, cannot stop a very significant increase in the proportion of the elderly. This, they argue, is because 88% of the increase is already embedded in the current age structure and is due to continued low fertility and increasing life expectancy.

In a second set of analysis, they present 25 scenarios that combine five different fertility levels with five different migration levels for the EU-25. Here again, even continued massive immigration to Europe makes little difference for the old-age dependency ratio.

The analysis shows that there is a clear compensatory relationship between fertility and migration, as indicated by the following two example scenarios in which the same old-age dependency ratio is achieved by 2050:

- A TFR of 1.2 combined with a migration gain of two million per year yields the same as a TFR of 1.6 and a migration gain of only half a million.

- A TFR of 1.6 combined with a migration gain of two million per year yields the same as a TFR of 2.0 and a migration gain of only half a million.

Thus an increase in the fertility rate of 0.1 children has about the same effect as an additional 375,000 immigrants per year.

An important point to consider, however, is that the impact of migration is more pronounced under very low assumed fertility. Such a scenario is supported by Dalla Zuanna (2006) research in north-west Italy which suggests that in this very low fertility region, significant and continuous immigration may slow population ageing.

3.3 Migration and fiscal contribution

Migration can affect the sustainability gap of public finances. First, the net tax contributions of migrants directly affect the governmental budget balance; if the net contribution of migrants is positive, the sustainability gap declines. Second, immigration increases the number of potential tax payers, on whom future tax increases can be levied. Thus migration can reduce the sustainability gap by increasing the tax base, even if the migrants' contributions to the present budget are negative (Brücker, 2002a). However, research by Fehr et al. (2004) on the USA, Japan and the EU suggest that even a significant expansion of immigration, will do little to alter the predicted major capital shortages, tax rises, and reductions in real wages that can be expected as countries progress through the demographic transition. Similarly Bonin et al. (2000) conclude that even high immigrant inflows only partially remove the intergenerational fiscal imbalance induced by ageing in Germany. However, they do suggest that an active migration policy favouring high-skilled immigrants may considerably enlarge the positive impact of immigration on the tax burden of native residents and decrease the fiscal burden of future resident generations.

A key question is whether immigrants are more or less likely than natives to use the provision of the welfare state (Barrett, 2007; Borjas, 1996; Brücker *et al*., 2002b) and/or whether immigrants assimilate into or out of the welfare state (Borjas, 1991; Hansen, 2003). Generational accounting assesses the intertemporal sustainability of public finances by calculating both the expected taxes and expenditures of public finances, based on long-term projections of the underlying fiscal and demographic variables. In the German case (Bonin *et al*. 2000) there is a large fiscal gain for the host population in admitting migrants, with the authors projecting between a 30% and a 40% decrease in the net tax burden depending on the range of migration flows. This they suggest arises from the migrant age structure which denotes little demand on public sector finances, and the future potential cohort size of their descendants, who will share the future tax burden of the country. It also, however, predisposes that the immigrant does not leave the country, and under this scenario the ageing of the migrant will then have future implications for public spending on old age welfare. However Rendall's (2004) study of the UK suggests that almost half of overseas-born immigrants to the UK emigrate again within 5 years. This process of return migration among the UK's overseas-born immigrants will lower the UK's old-age dependency ratio in at least the immediate future as they will not age in the UK.

A generational accounting approach has also been taken in studies which calculate the net present value of the fiscal contribution of migrants (Bonin, 2000; Brücker, 2002a; Storesletten, 2000). Again, drawing on Germany as a case example, Brücker (2002a) reveals how as a consequence of relative low human capital endowments, the net present value of the income earned by migrants is around 20% below that of natives. While transfers for unemployment

exceed those of natives by 65% these are counteracted by relatively low transfers made to migrants by German pension schemes. As a result, the net contribution of the representative migrant to the public finances amounted in 2001 to some 50,000 euros. As Brücker points out, given that it can be expected that future migrants will arrive with higher human capital endowments through education and training, the net contribution per migrant to the public budget will increase. However, Feld (2005) and Macdonald (2001) caution that there is considerable diversity in the labour markets and welfare regimes of nations which means that individual national effects will apply.

Several cross-sectional studies have tried to estimate the fiscal contribution of migrants relative to natives but have neglected the demographic impact (Blau, 1984; Riphahn, 1998; Simon, 1984; Simon, 1994; Steinmann, 1994). Others assess the impact of migration on pay-as-you-go pension systems by considering its impact on the demographic structure of the population, but do not consider the overall impact of migration on the revenues and expenditures of public finances and social security systems (Börsch-Supan; 1994, Felderer, 1994).

A more broad study of the UK is that undertaken by Dustmann *et al.* (2010). Using a dynamic model (Storesletten, 2000) they assess the fiscal consequences of migration to the UK from the Central and Eastern European countries that joined the EU in May 2004 (A8 countries). This showed that those migrants with at least one year of residence, and thus legally entitled to benefits, are 59% less likely than natives to receive state benefits or tax credits and 57% less likely to live in social housing. Even if A8 immigrants had the same demographic characteristics as natives, they would still be 13% less likely to receive benefits and 29% less likely to live in social housing. They also conclude that A8 immigrants made a positive contribution to the public finances despite the fact that the UK has been running a budget deficit over the last few years. This is because they have a higher labour force participation rate, pay proportionately more in indirect taxes and make much less use of benefits and public services. The conclusion that, overall, migrants make a net contribution in the UK is reached in several other studies: Home Office (Gott, 2002) ; Institute for Public Policy Research (Sriskandarajah, 2005).

3.4 Migration, GDP and economic growth

An important broader question is the macroeconomic consequences of population ageing. Several studies have indicated a negative impact of age-structural transitions on economic growth (Holzmann, 2005; IMF, 2003; Martins *et al.* 2005). Conversely, there is some evidence that immigration can improve competitiveness and productivity. Several studies have highlighted the role of migrants in encouraging new investment, improving efficiency and increasing innovation and entrepreneurship, although there are clear regional and temporal differences (Poot *et al.* 1988; Poot, 2008; Quispe-Agnoli; 2002, Saiz, 2003). It is argued, for example, that growing social or ethnic diversity due to immigration encourages innovation and entrepreneurship through increasing creativity (Audretsch, 2004), though this may also be related to the slower labour force growth associated with an ageing population which then leads to a higher relative price of labour and therefore provides a greater incentive to innovate (Romer, 1990). Borjas (2001) argues that immigrants are more responsive to regional wage differentials and therefore help the labour market to attain an efficient allocation. Blanchflower and Shadforth (2009) in their analysis of the consequences of migration from Eastern Europe on the UK economy suggest that immigration may have slowed wage inflation through the ‘fear of unemployment’ mechanism.

Immigration also increases the size of the local economy, which can potentially lead to more competition and efficiency. In addition, international migration can indirectly affect regional

competitiveness through the trade and international linkages that result from a country's diasporas remaining in touch with their country and region of birth. Poot (2008), for example, suggests that immigration has a positive effect on trade between the source country of the immigrants and the host country, as immigrants tend to have a preference for the products from their home countries, and furthermore can reduce transaction costs of bilateral trade with their home countries either through individual characteristics such as business contacts or through more generic traits such as language. Other studies have suggested that immigration may result in a negative trade balance, for while immigrants expand exports to their native country, they also stimulate imports from this country (Ching, 2000; Wagner *et al*. 2002). This last study used Canadian data to postulate that the effect on imports was triple that on exports. Similarly, the potential role of the diasporas in economic development is being increasingly recognised (Cervantes, 2002;Henoch, 2006).

Most European studies take the EU (15, 25 or 27) and do not necessarily single out the UK as a specific case. However, the recent paper by Barrell *et al*. (2010) does consider the impact on gross domestic product of increased EU migration to the UK. Just considering an increase in migration from Poland and Lithuania, this analysis suggests that while in the short term there is a temporary rise in unemployment (in contrast to findings from other studies, Blanchflower *et al*. 2007), in the longer term GDP per capita rises as the population of working age increases relative to the population as a whole.

In conclusion, it is clear that while different economies and welfare regimes will interact with migrant workers to different degrees, migration is a valid policy approach in the context of a demographic deficit, particularly for the UK. Migrant workers fill both the demand for highly skilled workers and the gap in unskilled employment arising from young people's unwillingness to undertake these jobs, particularly in the growing personal care sector. Indeed the role of migrants as carers in this sector is becoming increasingly important (Leeson, 2010). The evidence is that migrants contribute to public welfare such as pensions and health care but usually do not draw on them, at least immediately.

4. Changing age composition and environmental migration

There has been a growing awareness that environmental changes, including climate change, result in migration. Several authors have predicted that as environmental changes increase, migratory pressures will also increase (IPCC, 2007a). Recent papers, however, have emphasised that the environmental refugee scenario may be overstated and that environmentally related migration is complex and related to the temporality and kind of environmental change (Adepoju *et al*. 2010; Warner 2010; Bardsley and Hugo, 2010; Tocali, 2009; Barnett and Weber, 2010; Skeldon, 2009). The majority of people in environmentally disadvantaged regions will not have the resources to make permanent long-distance relocations.

> Predicting the impact of climate change on population distribution and movement is fraught with difficulties. However, it seems unlikely that the alarmist predictions of hundreds of millions of environmental refugees will translate into reality. What is more likely is that the current trends of high mobility, linked to income diversification, will continue and intensify. Past experiences suggest that short-distance and short-term movements will probably increase, with the very poor and vulnerable in many cases unable to move'.

(Tacoli, 2009)

However, throughout this next section it must be noted that while demographic ageing has a momentum of its own and we can say things about future directions with a reasonable degree of certainty, the impact of environmental change is altogether a 'known unknown'. That is, environmental change will occur but its impact on migration is likely to be variable.

4.1 Will global ageing influence environmental migration?

The first question is whether changing population composition will influence environmentally driven migration. There is general agreement that the response to sudden climatic events will result in short-term temporary moves. As Tacoli (2009) points out much of the earlier literature following on from the IPCC 2007 report overlooked the fact that migration requires financial resources and social support, both of which may decline with climate change, which may thus result in fewer rather than more people being able to move. However, populations facing longer-term environmental change will have time to plan and may make more permanent moves, if they have the resources to do so and there are institutional structures in place to allow them to relocate. Coastal cities, for example, are significant hubs of potential skilled migrants. Here the role of sea-level rise is of particular significance. Sea-level rise of a few metres could result in widespread loss of coastal and deltaic areas such as Bangladesh, the Nile, Yangtze and Mekong Delta regions (Hare *et al*. 2011). For example, as Hare *et al.* (2011) further report, a sea-level rise of 0.5 metres has been projected to result in the total number of people exposed to flooding risk in 136 port cities globally increasing by more than threefold to around 150 million people. The top 10 cities exposed in terms of population are Kolkata, Mumbai, Dhaka, Guangzhou, Ho Chi Minh City, Shanghai, Bangkok, Rangoon, Miami and Hai Pho'ng. Similarly, Hare *et al*. (2011) project that a sea-level rise and increased water temperatures will accelerate beach and coastal erosion and cause degradation of natural coastal defences, which would impact negatively on water supply, fisheries productivity and tourism industries in many small island countries and other regions. These changes will, it is argued, potentially lead to long-term sustained out-migration of those migrants with the skills and resources to relocate.

The impact of global ageing on environmental migration is that there will be an increased demand for global skills and thus those in environmentally challenged zones with skills may, it is suggested, find it easier to relocate. In other words, the two streams of migration – economic and environmental – will merge under these conditions as long-term, long-distance skilled migrants moving from environmentally challenged zones join the growing group of skilled migrants moving in response to the economic demands of ageing regions in order to compensate for their demographic deficits, the latter process described by the OECD (2010) and Bijak *et al*. (2007). As noted earlier, migrant workers fill both the demand for highly skilled workers and the gap in unskilled employment. This argument relates to those with skills.

Interestingly there is little knowledge of age-related migration under conditions of environmental change, such as drought (Raskin *et al*. 2002; MEA, 2005) and the literature on environmental refugees has generally ignored age specific relationships.

4.2 Will environmental change alter global ageing?

The second question is whether environmentally driven migration will have an impact on population composition. Leading on from the discussion above, which highlighted the manner in which global ageing would lead to an increase in the demand for skilled migrants from

environmentally challenged areas, it the question of which regions of the world will be best placed to attract these skills. As the paper has discussed, the impact of the upcoming age-structural shifts is to create a future potential skills shortage with increased competition for skills. From the UK and European perspective, attracting key skills will be crucial over the coming decades. Yet future projections also suggest that Europe's ability to attract skilled migrants will decline as it competes with North America, Oceania and Asia. As Holzmann (2005) points out, the European share of global working-age population (WAP) has fallen from around 25% in 1950 to 14% in 1995, projected to fall to 9% in 2025 and 6% by 2050. In 2010 the WAP comprised 70% of Europe's population, with older and younger dependents equal in size, and representing a TDR of 46:100 workers, the lowest recorded figure for Europe since World War II. As was earlier discussed, the EU TDR will increase to 73:100 workers by 2050. These projections assumed a natural fall in the net flow of migrants to Europe as a whole. This was based on the assumption that the proportion of global migrants to North America and developed Oceania increases from 50% to 80% by 2025, to the detriment of European flows.

This argument is based on the assumption that Asia, in particular China, and the more economically advanced parts of Latin America and Africa, will prove to be more attractive destinations for skilled migrants who increasingly will be able to select where they place their skills. It thus overlooks a future in which different regions of the world will not only have different economic profiles, but also increasingly different degrees of challenging environments within which to live. In particular, it is already accepted that the challenges which climate change may bring will impact upon sustainable economic development in a number of regions, specifically those in the south, potentially causing significant problems in areas as diverse as health, water supply, agriculture, infrastructure damages and financial and other economic services (IPCC, 2007; Shalizi and Lecocq, 2010). Climate shocks have already had large impacts on economic growth in many Asian and Central American countries, (IMF, 2003) and it is recognised that an increase in the frequency and magnitude of such shocks due to climate change will reduce their chances of getting out of them or will magnify the national consequences for economic growth (Shalizi and Lecocq, 2010).

Coastal cities will again be especially significant here as their potential for economic growth is reduced through the impact of climate change (Huq *et al.* 2007). Hare *et al.* (2011) report that on an asset base, the most vulnerable cities were found to be Miami, Guangdong, Greater New York, Kolkata, Shanghai, Mumbai, Tianjin, Tokyo, Hong Kong and Bangkok (Nicholls *et al.* 2008). Thus Asian cities in particular, which under the above World Bank scenarios provide future new magnets attracting skilled migrants, may, it is suggested, for example, begin to lose out to European cities, which are situated in less environmentally challenging zones.

Two other key factors are access to water and food. Increasing aridity in a number of regions such as southern USA, parts of Africa, the Mediterranean basin and Australia, may, it is suggested, make them less attractive to live in. In addition, while some regions, such as Australia, USA and the European Mediterranean may have the capacity to mitigate such factors as drought and aridity (Iglesias *et al*. 2010), others such as the African Mediterranean may not (Shalizi and Lecocq, 2010; Sissoko *et al*. 2010). In relation to food production, as Hare *et al*. (2011) point out, climate change will induce strong contrasts between world regions, by causing yield increases in some and decreases in others, to an extent that will not be easily solved by international markets (Battisti and Naylor, 2009). Significant risks to food and water security are predicted for South Asia (Lal, 2010; Mirza, 2010), northern Africa (Sissoko *et al*. 2010; Ben Mohamed 2011; Iglesias *et al*. 2010) and parts of Russia (Dronin and Kirilenko, 2010). In addition, even Australia, with its long experience of coping with highly variable climate, may find it challenging to adapt to future abrupt climate shifts and intensifying droughts (Risbey, 2010).

Finally, other potentially economically attractive magnets for skilled migrants will face increasing vulnerability to other climate-induced shocks such as more intense tropical cyclones (Bender *et al*. 2010; Knutson *et al*. 2010), which will have an impact on local infrastructure and thus economic growth.

The economic literature suggests that European countries will only be able to attract these skills and benefit from them if they provide skills development, training and employment which correspond to real market need. However, this overlooks the probability that according to current climate predictions (IPCC, 2007), many northern and western European countries will provide environmentally attractive locations in which to live. It is likely that the UK and its immediate neighbours will thus have an advantage in being able to attract highly skilled migrants from environmentally challenged locations. However, southern European, Mediterranean countries, which will face a larger demographic deficit, will not have this advantage, and indeed may well be sources of out-migration if some of the climate scenarios come to pass.

The impact of environmental change on ageing populations is that there will be a potential increase in those with skills wishing to leave environmentally challenged zones and these migrants will join with economic migrants in relocating to possibly otherwise less economically attractive zones, such as Europe. This will, to a degree, reduce the impact of the demographic deficit in these countries. However, environmentally induced migration to Europe is likely to have only a short-term impact upon the European demographic deficit. As these migrants are unlikely to return to the source countries, in the longer term they will contribute to the ageing of the population. In addition, they may bring with them inappropriate skills for the European economy, or they may bring a skills surplus.

However, other countries, for example, parts of Asia and southern Europe, will face both an upcoming demographic deficit and environmentally challenged future, if climate change makes parts of Asia uncompetitive in the global skills market, as some sources have suggested. In addition, economically induced out-migration will be added to by environmentally induced skills out-migration, which will further reduce the proportion of skilled, low-fertility working age people. Demographically this may proportionately increase the higher-fertility low-skilled population, and the potential support ratios of the regions.

In addition, the migration of skilled workers, whether economic or environmentally driven, will, under circumstances of both environmental change and global ageing, increase the numbers of vulnerable dependent older people potentially trapped in environmentally challenged regions. Many of these regions are in less developed and least developed countries, who will also experience population ageing over the next few years. It is predicted that by 2050 the global number aged over 60 will triple to reach two billion. The numbers of those aged 80 and above will show an even greater increase, rising from 70 million to 395 million by 2050. Currently two-thirds live in less-developed countries, with the absolute numbers of older people aged 60 and over in these regions increasing 3-fold in the first 30 years of the millennium to reach over one billion by 2030. There are 55 million Africans over 60, 42 million in sub-Saharan Africa. The numbers will increase to reach 90 million by 2025 and near 212 million by 2050. Fifty-nine million live in Latin America and the Caribbean; already 600 million live in the region of East Asia and the Pacific. By this definition, the region of East Asia and the Pacific is already the oldest world region and by 2050 will alone hold two-thirds of the world’s two billion elders.

The evidence is that older people are particularly vulnerable to both long-term climate changes, such as drought, famine and increased temperature rises, and to extreme climatic events (Haq *et al*. 2008). Decreased mobility, changes in physical and mental capacity and limited access to

social and economic resources limit the adaptive capacity of older people (Fernandez *et al*. 2002; Hyer *et al*. 2006; Donner and Rodriguez, 2008). In addition, many will increasingly live isolated and alone in large cities, which are particularly vulnerable to heat sink effect and sea-level rise (Haq *et al*, 2008) This vulnerability is further increased when the number of younger able-bodied people is reduced through out-migration. There is thus potentially a new humanitarian migration stream of old vulnerable individuals who may undergo assisted moves to less environmentally challenged locations.

5. Conclusion

Most countries of the world, with the exception of small parts of Asia and sub-Saharan Africa, will undergo age-structural transitions by 2050. This will result in a fall in the proportion of young dependents and those of working age, and a rise in older dependents. This change in global population composition is occurring, however, in the context of climate change. The paper has argued that environmentally driven migration will operate through changing the scale, flow and destination of global skilled migration and thus increase the impact on the population composition of both the host and source countries. In terms of scale, environmentally driven skilled migrants will join with economic migrants. In terms of flow and destination, environmental change may alter the assumption that Asia, and the more economically advanced parts of Latin America and Africa, will prove to be more attractive destinations for skilled migrants, as environmental change may restrain economic growth and thus the economic magnets for attracting skilled migrants. In addition, the migration of skilled workers will under circumstances of environmental change and global ageing increasingly leave behind vulnerable older people in environmentally challenged zones.

In the UK migration may well have some impact in alleviating the so-called demographic deficit, but it is only in combination with significant increases in fertility, which is unlikely, that future working age populations can be fully replenished. However, migration in combination with increased productivity and extended working lives will have a positive impact, as migrants currently increase national total fertility rates in the short term, especially those from Asia and Africa. In addition, current migrants from Eastern Europe pay proportionately more in indirect taxes and make much less use of benefits and public services and are likely to return to their source countries before becoming old and dependent. In the UK migrant workers fill both the demand for highly skilled workers and the gap in unskilled employment arising from young people’s unwillingness to undertake these jobs, particularly in the increasing old-age personal care sector. They also contribute to the UK economy through enhancing gross domestic product by encouraging new investment, improving efficiency and increasing innovation and entrepreneurship, and thus protect it to a degree from the sustainability gap of public finances brought on by population ageing, Given the structural ageing of most world regions, the UK will have to increase its global skills competitiveness in order to attract future migrant skills which it will need to sustain its economy. Here, future climate change may, it is suggested, bring a competitive advantage to the UK, as it is likely to be environmentally attractive to those with skills and resources looking to migrate away from environmentally challenged areas.

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