A global view on demographic pressure and labour market participation

Groot, Loek and Peeters, Marga

Utrecht University School of Economics

6 July 2011

A GLOBAL VIEW ON DEMOGRAPHIC PRESSURE AND LABOUR MARKET PARTICIPATION

Loek Groot and Marga Peeters

Utrecht University School of Economics and Brussels[1]

6 July 2011

Abstract

Demographic change across the globe puts pressure on labour markets and public finances. Most studies on ageing focus on the projected development of the old age dependency ratio, being the ratio of persons 65 or older relative to the working age population. This ratio gives a very incomplete picture of the (fiscal) pressure from demographic changes. In this study, besides the share of the dependent population composed of the young and the old, we also include the share of the working age population that is not active on the labour market, labelled as the labour market space. By analysing 21 developing and 29 developed economies across the globe, we cover 75% of the 9.3 billion people that the United Nations projects for the whole world in 2050. A new indicator, relating demographic pressure from fiscal spending to the available space at the labour market, enables us to quantify and compare the *pressure-to-space* across countries over the time span 2010-2050. The indicator points out that Poland, Turkey and Greece are most under pressure. Developing countries, such as Uganda, the Democratic Republic of Congo and Tanzania will experience a very low pressure up to 2050 in case their fiscal spending per young and elderly person remains at the current levels. In most of the countries under high pressure there seems to be room for using the labour market space by, for instance, working more hours or increasing the retirement age, as this will alleviate the fiscal pressure. This suggests a policy trade-off between maintaining publicly financed services to the dependent population and maintaining labour market space.

Keywords: demography, dependency rates, labour market, unemployment, social security, pensions, government spending.

JEL codes: D6, E24, E62, H51, H52, H53, H55, J0, J11, J18, J21, J26, O57.

[1] Correspondence addresses: L.F.M.Groot@uu.nl and huber@TinaMargaPeeters.eu. All your comments are welcome.

CONTENTS

List of figures

List of tables

"Prediction is difficult - especially of the future", ascribed to Mark Twain.

"*… each generation cares twice and is taken care of twice…*" – Bovenberg,, 2008

Après moi, le déluge / Nach mir die Sintflut/ Wie dan leeft, wie dan zorgt

1. INTRODUCTION

After the emergence of the financial crisis, there is increasing concern for the solvency of states. As the policy discussion in the US and the Euro area makes clear, sovereign risk is not only dependent on the current and accumulated government debt as a percentage of GDP. Equally important are the prospects for the future, especially the increasing fiscal burdens of social security and health care for the old aged in ageing societies. Technically, fiscal policy is sustainable as long as there is equalisation of the net present value of primary surpluses and debt obligations (Ley, 2010:6). Analogously, a country is solvent as long as the net present value of its primary surpluses are greater or equal than the net present value of its debt obligations. On the assets side productivity (growth), the size of the workforce and the labour force participation rate largely determine the future stream of tax revenues. On the liability side, the share of the young and old aged in the population determine largely the accumulated government debt and the future stream of government commitments with respect to main categories of public spending such as health care, social security and education. Indeed, population ageing in developed countries, due to a declining fertility rate and a steadily increase in life expectancy worldwide, poses a challenge to the fiscal sustainability of conventional welfare programs such as public pay-as-you-go (PAYG) pension systems, comprehensive and universal health care coverage, child benefits and free education. In general, ageing increases the financial burden of the active working age population and threatens the intergenerational contract, which Bovenberg (2008:601) describes as one where *… each generation invests in the human capital of the next and is taken care of at the end of its life by the generations in which it has invested. Hence, each generation cares twice (once for the previous and once for the next generation) and is taken care of twice (as a child and in old age)*. This statement duly illustrates that the active working age population has to bear the burden, mainly by paying for the education of the younger generation and providing health care and pensions to the elderly.

We will show that the situation in the developing economies in the decades to come is not only characterised by a steadily growing inactive share composed of young and old people, and thus a declining share of the working age population, but also by a rising population share of the old aged and a falling share of the young. As the former is more costly in terms of public pensions

and health care, while the latter is the future labour potential, it implies a gradually upward pressure on per capita fiscal costs imposed on those of working age. Countries where demographic changes worsen the fiscal position have a set of optional measures to cope with the challenges. For instance, countries can raise the official retirement age, abolish early retirement schemes, index retirement pensions at inflation instead of at wage growth, allow more immigration, gradually reform the pay-as-you-go (PAYG) system into a capital funded pension system or increase the public debt when ageing hits.

The demographic dynamics in developing countries delivers a slightly rosier picture. For decades to come, the share of the working age population will be high and increasing. Moreover, whereas in most OECD countries health care and public pension provisions are both comprehensive and universal, only a small minority of the old age in developing countries is entitled to social security and coverage against health care costs (see Bloom and McKinnon 2010:15). Ceteris paribus, both factors imply a lower fiscal burden for the future, which might offer a potentially high "growth dividend" for these nations.

The problem of ageing in the developed countries is commonly summarised in terms of a rising old age dependency ratio (OADR), which expresses that in the future there will be more pensioners for every person of working age. In principle, one can apply the same reasoning to the young. Rising young age dependency ratios (YADR) that we observe for developing countries by definition implies more youngsters for every person of working age. However, this is not the full story. The same economies that will experience steeply rising dependency ratios in the future are characterised by high inactive shares of the working age population, mainly because many of working age population (e.g. housewives, unemployed) do not perform paid work or only part-time because of the existence of easy accessible and generous welfare benefits, such as early retirement and disability schemes. In principle at least, reducing the inactivity among those of working age can relieve part of the fiscal pressure of ageing. So, what is usually left out is that countries may differ not only in the development of the OADR or YADR, but also in the share of the working age population that is actually involved in paid work.

In this paper, we focus on what we call the labour market space as a potential source to cushion the effects of pressing demographic developments. We define *labour market space* as that part of the working age population that is not doing (full-time) paid work. The labour force participation rate measured in full-time equivalents and henceforth its complement – labour market space – is a country-specific system variable in our analyses. A vast number of factors determine whether a country has a high or labour market space. Among them, there is the

generosity and accessibility of the social benefits, labour market rigidities (trade unions, minimum wages, employment protection), habits and norms with respect to female labour participation, active labour market policies, (absence of) early retirement schemes, working hours and holidays legislation, tax-induced financial incentives to paid work. In most Anglo-Saxon countries, with a mean and lean welfare state, flexible labour markets and a strong financial incentive to do paid work, the labour force participation rate is high and thus labour market space is low. Low labour force participation rates and thus a high labour market space characterises other countries, mainly in continental Europe.

The idea behind our analyses is that using the labour market space can at least partly accommodate the (fiscal) pressure from changing demographic structures, which means for most countries around the globe the pressure from an ageing population. For instance, raising the statutory retirement age, cutting early retirement benefits or introducing more active labour market policies may raise the labour force participation rate and thus lower the ratio of inactive and active persons among the working age.

We analyse 50 economies across the globe, 21 developing and 29 developed, that cover 75% of the global population in 2050. The data come from various official sources (OECD, UN, World Bank) we show demographic changes for a large heterogeneous set of both developed and developing countries from 1950 to 2050, pitched against the labour market space. In doing so, we make two heuristic assumptions. First, for each country we fix the ratio of public old age expenditures per old person and GDP per capita to its 2008 level. Therefore, if in some country the public expenditures on pensions and health care per old aged are a certain fraction of GDP per capita in the base year 2008, we maintain this fraction in the projections up to 2050 due to the lack of better information. The same goes for public expenditures on the young, consisting mainly of family support (child benefits) and costs of education. This implies that we freeze the publicly organized generosity of countries with respect to the dependent young and old aged. In this way, we can exclude from the analysis the future growth in (labour) productivity, since GDP per capita is the basis for all monetary variables that we use. Second, since labour market space and the participation rate are system variables that will only change substantially by major changes in the system we take the labour market space as a fraction of the working age population as a country characteristic over time. In an empirical section, we will provide some support for this assumption for the period 1970-2010. Our historical track data show that the variation between countries is the lion share of the total variation in labour market space across countries and over time, while the variation within countries over time is low.

Although we assume space fixed relative to the working age population in the course of future decades, as a fraction of total population it may change due to changes in the population age structure. Ageing countries most likely will respond by taking policy measures to cope with the fiscal challenge of ageing. As demographic pressure is pitched against labour market space in our analyses, we are able to show to what extent countries are facing demographic pressures (measured by the projected old age and young age dependency ratios and the associated fiscal burdens), and the room to cope with these pressures (measured by the projected labour market space). For example, a country with a high labour market space but a high and increasing demographic pressure can easily accommodate, at least in principle, the additional fiscal spending by taking policy measures that raise labour market participation. In sharp contrast, a country with a similar demographic pressure but a low labour market space is in a dire state, because there is little room to increase labour market participation even further. Of course, a host of other factors determines whether a country is able to cope with its demographic dynamics. Here we concentrate on demographics and macro labour market characteristics and postpone for further research the role of finance and migration. We also make suggestions for further research.

The outline of this paper is as follows. Section 2 provides our motivation for studying the demographic pressures in relation to the labour market space and discusses the conceptual issues. Section 3 defines labour market space and demographic pressure and introduces the pressure-to-space *indicator* that we use later on to rank countries. Section 4 illustrates and describes the labour market space and dependencies for a representative sample of countries across the globe. In the sensitivity analysis of section 5, we present sensitivity analyses for the developing economies, as our statistical information is more uncertain for this group. Section 6 presents our reflections on the major policy issues that emerge from the empirical analyses. Section 7 summarizes and concludes.

As we put a great effort in constructing the database, we present it in much more detail in the appendices. Appendix A describes the data sources that we used. Appendix B illustrates the demographic structures, the pyramids, kites and chess pawns, for each of the 50 economies that we analyse for the years 2010 and 2050. It also illustrates the coverage of the countries in our analyses per continent. Appendix C lays down in formulas in which way we derived the most important statistics that we show in graphs and tables in this study. Appendix D gives some additional per country statistics for the full sample period 2010-2050.

2. MOTIVATION AND CONCEPTUAL ISSUES

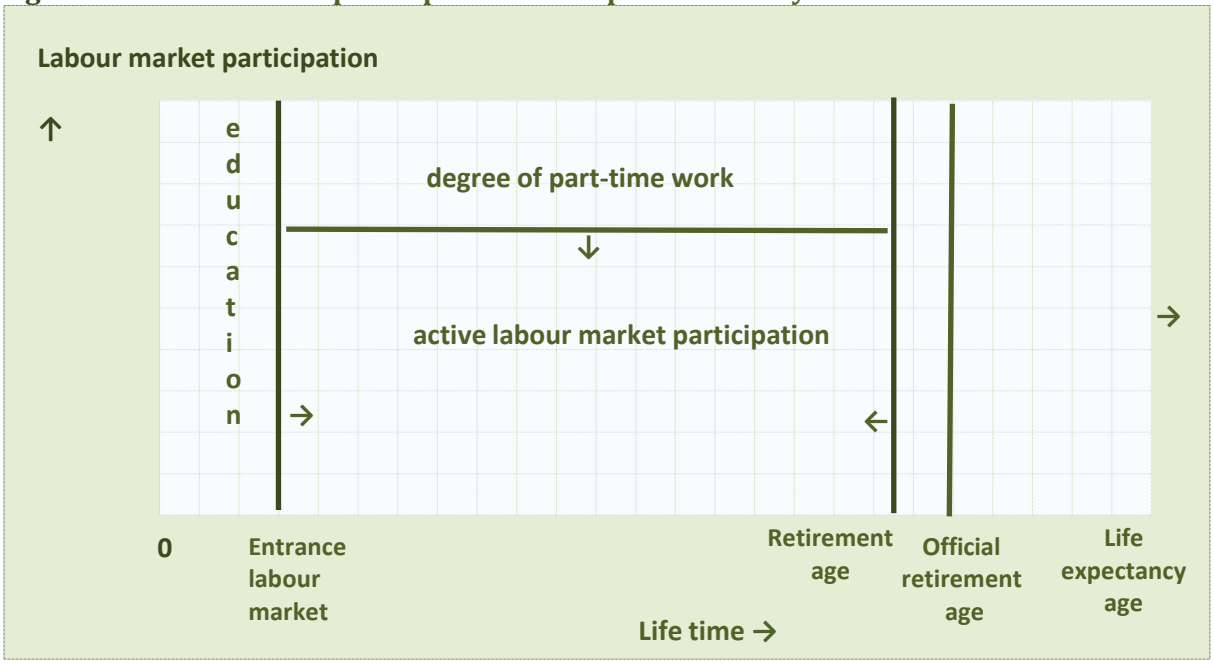
Before the G20-meeting in 2006 (see G20, 2006), there was not much attention for the global picture of projected demographic changes from an international policy point of view. Although there is ample research on the (fiscal) problem of ageing in developed economies, there is only scant attention to the position of developing economies (see Mason *et al.* 2006 and Lee *et al.* 2006 for ageing in Asia). One reason for disregarding developing countries is that these economies still have high fertility rates and a relatively short longevity and that public support for the old and young is still modest. Another reason might be more practical, being the lack of reliable data on the composition of public expenditures. The lack of attention for the international (comparative) perspective may be due to the belief that policy measures to cope with demographic challenges are taken at the national discretion, with little or no room for international coordination.

However, economists point more and more at the potential spillovers of demographic changes. More migration may occur, as immigration at tight domestic labour markets alleviates the pressure in filling job vacancies. For some countries, international financial flows could dry up in case national governments will not be able to maintain fiscal sustainability (see G20, 2006). In some developed economies, shrinking populations and henceforth-shrinking labour market forces will negatively influence domestic economic growth. It might affect global growth too. There are many perspectives to study demography and ageing, e.g. Brooks (2000) focuses on the impact of demographic developments on financial markets, Bloom *et al.* (2004) on public finances and Horioka (2010) on savings.

This paper links the demographic effects on public finance as well as labour market characteristics. The value added of this paper is further that we include developed and developing economies. Alongside all major developed economies, we also investigate the largest developing economies.[2] In sum, we have 50 countries (see Appendix B). The projected population in 2050 for these 50 countries is 7.0 billion, being 75% of the 9.3 billion projected for the whole world. The coverage for 2010 is 79% (5.4 of the 6.9 billion persons worldwide).

[2] We include the G-20 consisting of Argentina, Australia, Brazil, Canada, China, France, Germany, India, Italy, Indonesia, Japan, Mexico, the Republic of Korea (South Korea), Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom and the United States of America. Further to this, we include the OECD countries consisting of the 27 EU economies and the European Free Trade Area (EFTA) countries Iceland, Norway and Switzerland. In addition, Bangladesh, the Democratic Republic of Congo, Egypt, Ethiopia, Kenya, Nigeria, Pakistan, the Philippines, Tanzania and Uganda are included as they are in the top 20 of the most populated countries in 2050 according to the United Nations. Finally, we include Bulgaria and Romania as they fall also in the group of developing economies according to our definition, although being part of the European Union.

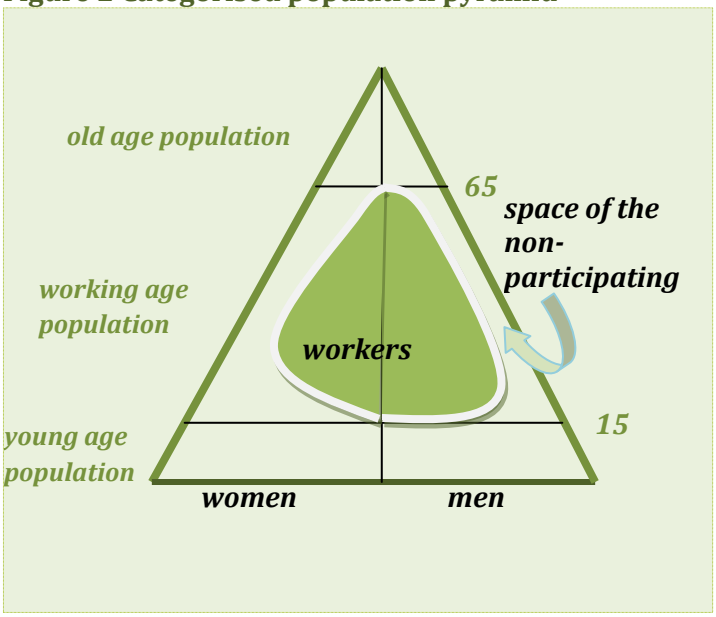
Figure 1 Labour market participation over a person's life cycle



Source: Authors, see also Andersen (2006).

As a starting point for the conceptual analysis of demographic pressure and labour market space, consider the schematic overview of a representative person of the population over the life cycle in Figure 1, categorized into education, (part-time) working and (early) retirement, with age on the horizontal axis. The arrow left shows the tendency that rising education levels increases the age that people enter the labour market. The arrow above indicates the combined effect of a reduction of the working week, the utilisation of (maternity, parental) leaves, part-time work and others factors that contribute to non-participation at the labour market. The arrow at the right pointing to the left illustrates the tendency to retire early. Finally, the arrow at the far right points at the rising average longevity. The combined effect of the tendencies to start working later, to work fewer hours and to retire earlier while longevity is on the rise implies that in a smaller part of total lifetime – the square in the middle representing the active part of the working age population – all expenditures of the population have to be earned. Policy makers can counteract this pressure by a variety of policy measures aimed to push up the active to inactive ratio, such as raising the retirement age and the official number of hours of the full-time workweek or stimulating part-time workers to work more hours. Due to the absence of the relative population shares of the different categories, Figure 1 does not reveal to what extent the demographic structure really burdens the active part of the working age population. We therefore present Figure 2 that provides schematically a population pyramid with roughly the same categories as in Figure 1.

Figure 2 Categorised population pyramid

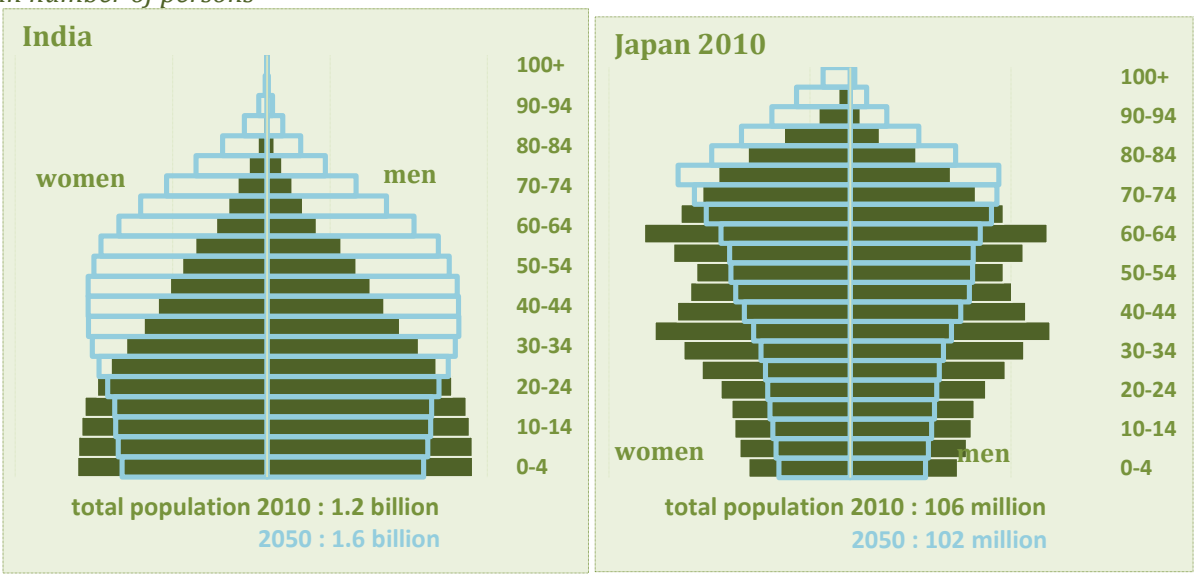


Source: Authors.
Note: Population is divided into young age (*yap*), old age (*oap*) and working age population (*wap*), where the latter is divided into paid workers and the non-participating part of *wap* (denoted by *s*). See Appendix C for the mathematical expressions.

In Figure 2, age is measured on the vertical axis and the population in number of people on the horizontal axes, split into women (left) and men (right). The filled area inside the curved lines for both women and men stands for the labour market participation rate measured in full-time equivalents (*fte*) at different ages. In most countries, labour market participation is higher for men than for women. We assume that all children up to the age of 15 are still attending school. Due to early retirement schemes, the curved lines bend inwards for the cohorts just below 65 year, which we take as the official retirement age.

Our main interest in this study is the area of non-workers or labour market space (denoted by s), being the part of the working age population (wap) that is not participating at the labour market. Examples are students above the age of 15, retirees below the age of 65, the disabled, sick and unemployed on welfare and other jobless people (e.g. housewives). As noted previously, in our subsequent analyses we assume that the area of *s*, and thus employment measured in *fte* as the complement of space, remains constant relative to *wap* whatever population growth or changes in population structure. In effect, we fixed the composition of the working age population into working and non-working (*s*), both measured in *fte*. To see how this works out, compare the actual and projected population of India and Japan in 2010 and 2050 per cohort of 5-years in Figure 3. For the sake of the argument, let us suppose that in 2010 the active working age population is half the total working age population in both countries.

Figure 3 Cohort population pyramid in India and kite in Japan in 2010 and 2050
in number of persons



Source: Authors - based on projections by the United Nations Population Information Network, 2011.
Note: This is the median variant, see appendix B for the other 48 countries in our analyses. See Appendix B for the population structures, varying in shape from normal pyramids for developing to kites and chess pawns for developed economies of the other countries that we use in our empirical analyses.

As there is only a small increase in the share of India's old age population and a much larger decrease in the share of the young, the working age population as a share of the total population will rise. Due to the fixed ratio of non-working and working people in the working age population, the ratio of inactive to active for the whole population will fall. In other words, even if we assume the same participation rate among the work force in 2050 as in 2010, India does not face a rising demographic problem, as there will be sufficient labour supply. Japan is a different story (see right panel). Its kite-shaped population structure in 2010 makes that there is a huge increase in the share of the old-aged, only partially compensated by a decline in the share of the young. The share of the working age population will decline. Therefore, the Japanese inactive-active ratio will rise sharply, unless Japan is able to raise labour force participation.

In the next section, we introduce an index measuring *pressure-to-space*, to identify which countries are most likely to face an increased burden on the working age population because of demographic dynamics in the next four decades. As noted before, this analysis is partial in the sense that countries may have other instruments at their disposal to deal with demographic challenges, among which increasing the government debt or stimulating a migration inflow. One can interpret our results therefore also as a first indication which countries are more likely to resort to these strategies in the more distant future.

3. DEFINING DEMOGRAPHIC PRESSURE AND LABOUR MARKET SPACE

This section defines the various measures of demographic pressure, the labour market space, the inactive-active ratio and the indicator *pressure-to-space*. As illustrated in Figure 2, we split the populations of nations into three categories: *young* people as those that are below 15 years, *old* people as those above the age of 65, and the *working age* population as those between 15 and 65 years with the latter split into working and non-working measured in full-time equivalents.

As is customary in demographic studies, we express the pressure of the old aged as the old age dependency ratio, defined as the number of persons 65 or older relative to the working age population. As argued in the previous section, this dependency ratio gives a very incomplete picture of the actual pressure per (full-time) worker as soon as one takes into account that in some countries a significant part of the working age population is not doing paid work at all, or only part-time, summarized as the labour market space.

The burden per worker of providing public pensions and health care in an economy with an increasing old age dependency ratio is much lower if a large share of the working age are actually (full-time) working compared to when only a small share is working. To stress our point once more, we take this labour market space as a country-specific system variable that can change, but probably only in a significant way if authorities take policy measures that change the underlying system, such as flexibilisation of the labour market or abolishing early retirement schemes.

We stick to the convention by labelling old age and young age dependency ratios as *oadr* and *yadr* respectively (see also Appendix C), and express old age, young age and the non-participating part of the working age population relative to total population as *oap*, *yap* and *s* respectively, where the suffix *p* stands for the share of the total population. The ratio of the inactive and active share of the population (denoted *ia*) in a country *i* in year *t* and its change from year *t* to *T* (holding space fixed) can be expressed as a simple formula with only two factors: the population share of the working age population (*wap*) and the labour market space (*s*). As we derive in Appendix C, it follows that

$$ia_{i,t} = \frac{1}{wap_{i,t}\left(1 - s_{i,t}\right)} - \qquad (1)$$

Ceteris paribus, the lower the population share of the working age population *(wap)* or the higher the share of the potential workforce not inserted into paid work *s*, the higher is the *ia*-ratio. The lower bound for the *ia*-ratio is zero, which applies if and only if everyone is of working age and working full-time. In contrast, the *ia*-ratio goes to infinity in case the space *s* approaches one, having the logic interpretation that almost everybody in the economy is inactive as nobody is working.

The *ia*-ratio can easily attain values higher than two (this is the case for the Belgium, Bulgaria, Denmark, Germany, Italy, the Netherlands, South Africa and Turkey for 1995-2005, see Appendix D), which means that against one person working full-time there are more than two persons not working at all. The *ia*-ratio is already two if half of the population is of working age and among them two thirds work full-time ($1/\{1/2 * (1 - 1/3)\} - 1 = 2$). In macro-economic terms, every full-time worker then cares for himself and two inactive persons. Obviously, in times of demographic change in that the shares of young and old are increasing, the variable space is what policy-makers may wish to reduce by means of their labour market policies. We come back to these policy issues in section 6.

Figure 4 shows the development of the population share of the working aged and the *ia*-ratio over the time span 1950-2050. Since we assumed labour market space to remain constant for the period 2010-2050, the change in the population share of the working age in each country drives entirely the change in the *ia*-ratio after 2010 (see Equation (1)). As the upper panel of the figure shows, there is considerable change in the share of the workforce over time, e.g. for South Korea it falls from 0.72 in 2020 to 0.54 in 2050, which will ceteris paribus lead to an increase in the *ia*-ratio. Except for India and Egypt, all countries show an increasing *ia*-ratio for the next four decades.

Figure 4a. Development of the population share of the working age population

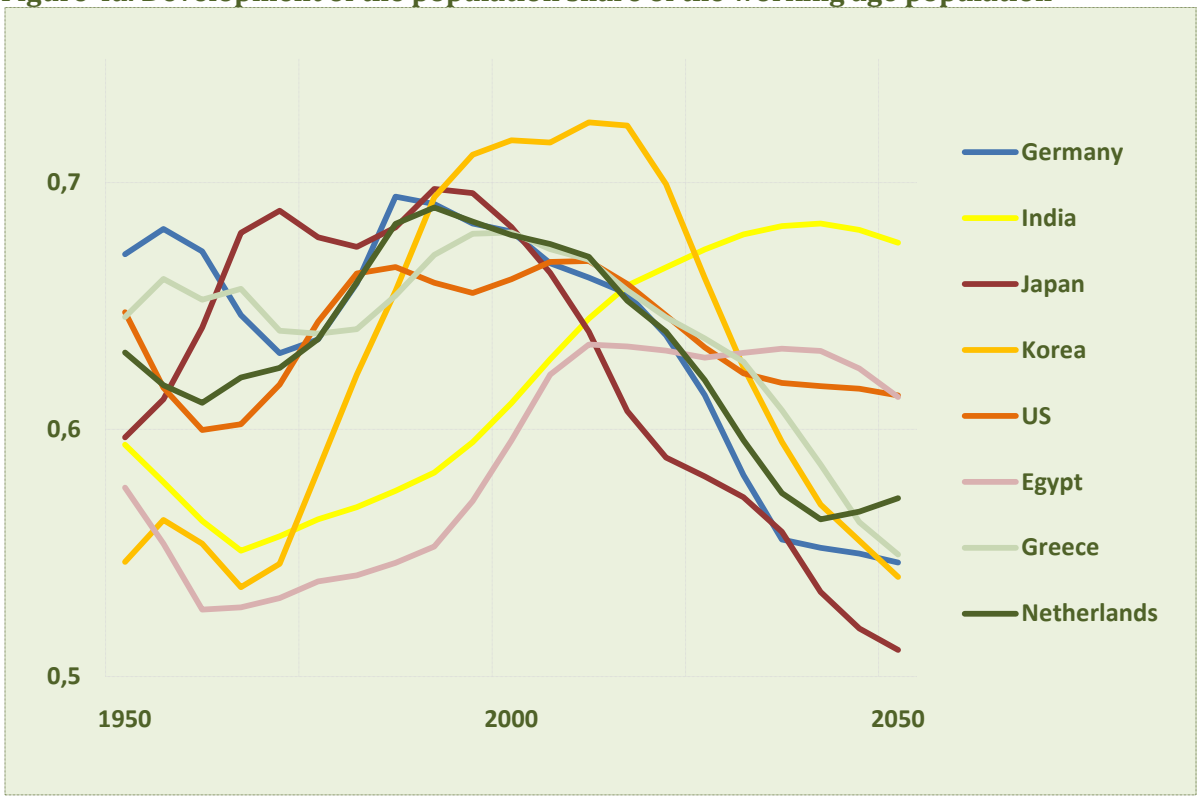
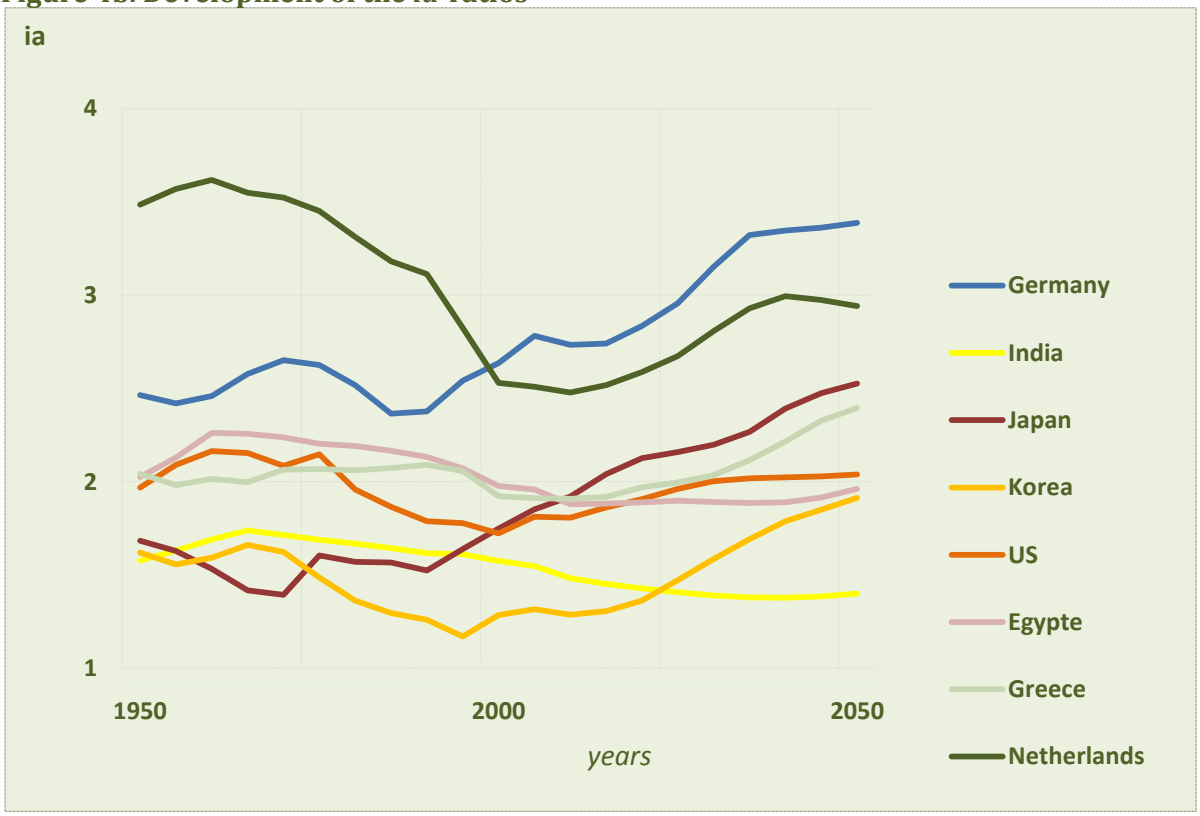


Figure 4b. Development of the *ia*-ratios



Source: Authors - based on projections by the United Nations Population Information Network, 2011.
Note: We keep the labour market space constant for each country during the whole period 2010-2050.

3.1 Demographic pressure

So far, we have only paid attention to the number of persons in different categories. However, the real fiscal pressure coming from the young and old is not only determined by the number of young or old, relative to (the working part of) the workforce, but also by the average cost per person that the government is making relative to GDP per capita. Denoting these costs as YG and OG, it then follows that the fiscal pressure of the young and old relative to GDP are

$$ypres_{i,t} := \frac{YAP_{i,t} * YG_{i,t}}{GDP_{i,t}} \tag{2a}$$

and

$$opres_{i,t} := \frac{OAP_{i,t} * OG_{i,t}}{GDP_{i,t}} \tag{2b}$$

where YAP represents the young age population and OAP the old age population and GDP is the nominal gross domestic product.

In view of the significant changes in demographic structures,, our interest is also in the change in pressure ($\Delta pres$) in year T in comparison with year t, that is

$$\Delta pres_{i,T-t} := pres_{i,T} - pres_{i,t} \tag{3}$$

We wish to analyse future developments of the pressure while we lack reliable information on the costs per old or young person in the future. For this reason, the cost of a young person relative to GDP per capita, denoted by φ_i, and the cost of an old person relative to GDP per capita, denoted as θ_i, are constant over time, [3] but country specific, so

$$ypres_{i,t} = yap_{i,t} * \varphi_i \qquad opres_{i,t} = oap_{i,t} * \theta_i \tag{4}$$

with yap the young and oap old age, both as a ratio of the total population. In this way, the pressure variables reflect the fiscal burdens of (changes in) the age structure of the population.

How much pressure results is thus both depending on the shares of young and old and on the parameters φ and θ which reflects how well the dependent persons are taken care of by public

[3] See also Volker and Werding (2010) that adopt the assumptions for the group of OECD countries.

services relative to GDP per capita. In case of a rejuvenating nation, that is a country with a pyramid age structure with a broad base such as India in 2010 (see the left hand panel of Figure 3), the relatively high fraction yap contributes to the pressure of the young. Analogously, in case of an ageing society, being a country with a kite age structure such as Japan in 2050 (the right hand panel of Figure 3), the pressure-of-the-old increases due to the increasing share of the old aged in the population.

3.2 Labour market space

To calculate the labour market space, we have to know how many persons of the working age population are participating, and how many hours they work. The employment rate (er) is defined as total employment (E) as a percentage of the working age population (WAP), that is

$$er := \frac{E}{WAP} \tag{6}$$

where for convenience sake we have left out the country and time subscripts. We assume that each person between the age of 15 and the official retirement age is part of the working age population (potential labour force). Note that the employment rate incorporates the effect of early retirement, since *ceteris paribus* the closer the effective retirement age (AGE_{ret}) is to the official retirement age ($AGE_{ret,of}$), the higher is the number of employed in the nominator of equation *(6)*.

Under PAYG-systems, it matters to what extent those employed work part- or full-time. Therefore, in the definition of labour market space, we weigh the employment rate by the average number of working hours of the employed relative to full-time maximum working hours

$$s := 1 - \ er \frac{H}{H_{max}} \tag{7}$$

Accordingly, the labour market space is lower, the higher the employment rate and the more close the actual average number of hours worked per year among the employed (H) to the full-time maximum number of hours worked per year (H_{max}). We do not count the officially unemployed as employed. Consequently, the unemployed persons are part of the labour market space.

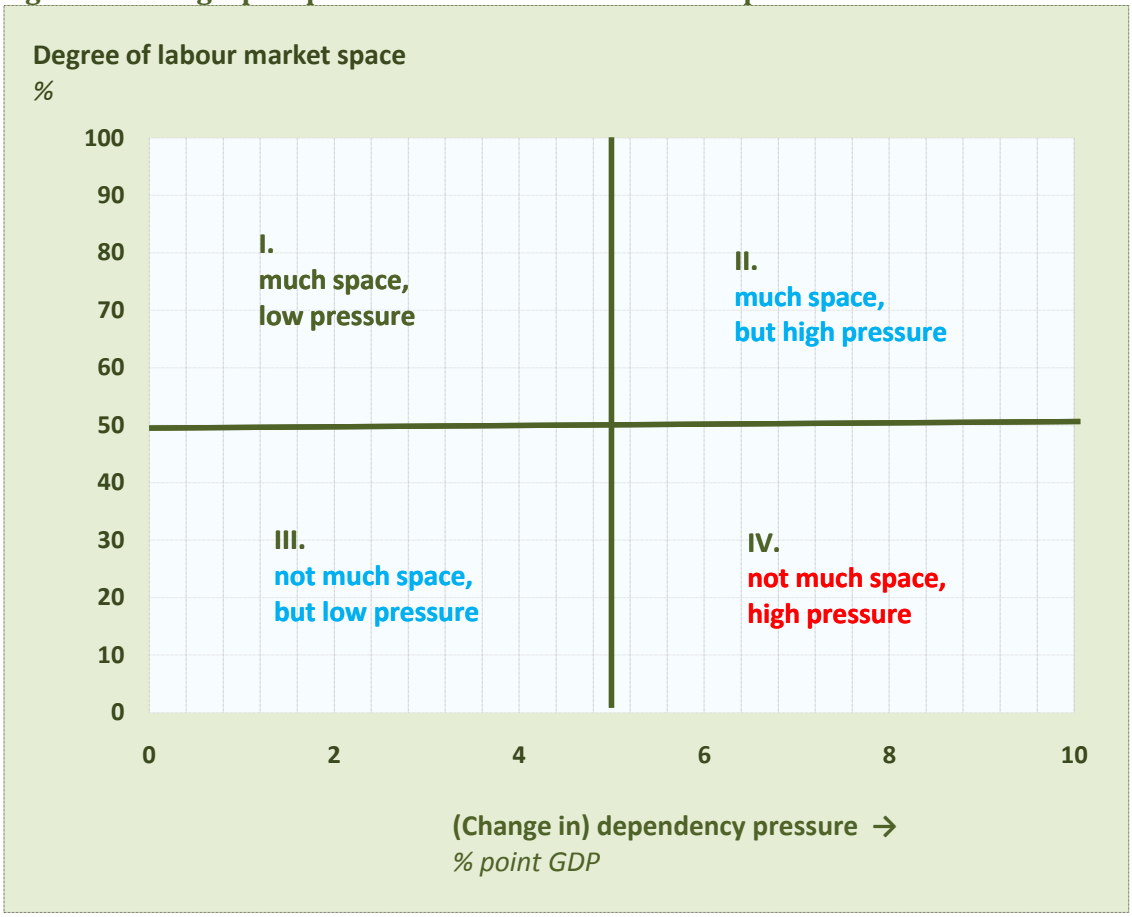
Some remarks are in order. A first point is that the group of people between the ages of 15 and 65 that is not able to work due to a physical or psychological handicap, is part of the labour market space according to our definition. The lack of harmonisation in classification of disabled people across countries makes it difficult for us to exclude this group from the space definition. A second point is that the definition of the working age population as people between 15 and 65 may be too narrow for some countries. In many developed and developing economies, people above 65 are occasionally still working, and children of 15 or below are often working in developing economies.

3.3 Demographic pressure versus labour market space

Figure 4 pitches labour market space on the vertical axis against demographic pressure on the horizontal axis, with four quadrants, each with either a low (high) demographic pressure combined with a low (high) degree of labour market space. First, we take a static view and start with quadrant IV (southeast). This is the case of a high dependency rate in combination with a low degree of labour market space. This is good in so far as the burden of the demographically dependent groups, given the size of the working age population, is spread over many workers, most of them working close to full-time. It is worrisome to the extent that there is not much space to relieve the burden, the more so if demographic pressure will rise further in the future. In quadrant I (north-west), the demographic pressure is low and there is ample room to raise participation and hence potential production. Quadrants II and III are intermediate cases, comparatively better than IV either because pressure is lower (III) or potentially the burden of the pressure can be relieved by reducing space (II), but worse than I because pressure is higher (II) or space to relieve the burden is limited (III).

The situation of a country in quadrant II can be as inconvenient as the situation of a country in quadrant III. In fact, the ample labour market space available in quadrant II can be used to alleviate the burden of high demographic pressure. The absence of much pressure from the dependent population is a fortunate circumstance in quadrant III, but the already tight labour market leaves little room for cushioning an increasing demographic pressure.

Figure 5 Demographic pressure versus labour market space



Source: Authors.
Note: The scaling on the x-axis is indicative. It can be negative in case of dependency pressure changes.

This brings us to the dynamic view. Obviously, countries may move from one quadrant to the other over time and one of the purposes of this paper is to present those movements. Since we assume a constant, although country-specific, labour market space over time, this implies that countries can only move horizontally, so we either have movements from I to II or the other way around and likewise for III and IV. The purport of the empirical analyses, following in the next section, is to see where countries were located in this diagram in the past (1950/1970-2010) and where they will move to in the future (2010-2050). For the past, we expect that labour market space is both country-specific and roughly constant over time. If so, it vindicates our assumption to keep labour market space fixed as well in the future. The year of the measured change in the dependency rate always concerns year T in comparison from year t, where $T > t$, while the degree of the labour market space is always measured in year t even if T is far in the future. The longer the time span between now to the future, the more time the labour market has to adjust to accommodate the change in pressure.

3.4 The indicator pressure-to-space

In our endeavour to compare the pressure of the dependent population in relation to the available labour market space across countries, we define the indicator *pressure-to-space* as:

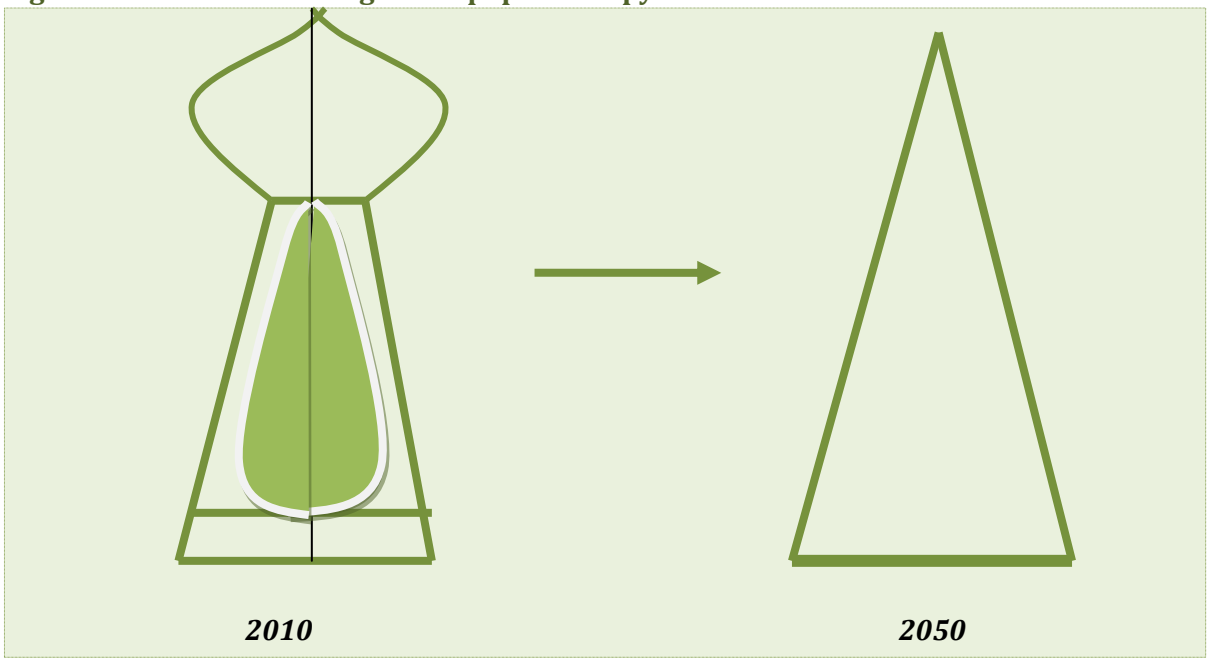
$$PtS_{i,t} := \frac{ypres_{i,t} + opres_{i,t}}{s_{i,t}} \tag{8}$$

Consider the hypothetical chess pawn shaped population pyramid in Figure 6, which we introduce to illustrate both the static and the dynamical view on *pressure-to-space*. The pressure is high and labour market space is low, resulting in a high value for the indicator *pressure-to-space* in 2010, but for sure the exceptional bulge of old aged in 2010 will gradually disappear and the indicator will gradually decline. It illustrates that the dynamics of the demographic structure is important, as a high value for the indicator is less troublesome if one expects it to come down. In a similar vain, for the opposite case, a low indicator value is not a reason to simply sit and wait if one expects it to increase sharply in the future. As Appendix B illustrates, the case is after all not so hypothetical as the demographic structures of Greece and Poland, for instance, are expected to show such a chess pawn form, albeit in 2050.

Reforming the labour market is characterised by piecemeal social engineering and will take considerable implementation time. Even after the implementation of reforms, it will take time before the general equilibrium effects have become fully effective. Thus, in case of expected increasing pressure in the future and ample space at the labour market today, a wise thing to do is to take measures today. Therefore, the pressure variables at some future year T will be compared with the space variable today in our empirical analyses, where T-t equals one, two, three or four decades.

As the hypothetical example above suggests, in addition to the actual level of *pressure-to-space*, also the *change* in *pressure-to-space* is relevant. Some countries face an already high *pressure-to-space* and seem to cope with it. However, countries that will face a major change in pressure for the years to come may consider increasing the labour market participation to cover the additional fiscal costs resulting from the demographic change.

Figure 6 Transition of categorised population pyramid



Source: Authors.

We therefore also measure the change in the *pressure-to-space* indicator, as:

$$\Delta PtS_i := \frac{\Delta ypres_i + \Delta opres_i}{space_i} \tag{9}$$

where Δ refers to the difference from time t to T.

As derived in Appendix C, it holds that

$$PtS_i = (1 - wap_i)\frac{\varphi_i}{s_i} \;\Rightarrow\; \Delta PtS_i = -\Delta wap_i \frac{\varphi_i}{s_i} \tag{10}$$

Consequently, as we assumed that φ and s are country-specific but constant, the *pressure-to-space* indicator only depends on (the change in) *wap*. Accordingly, a rise in the old or young age dependency ratios – which is per definition a decline in the population share of the work force - leads to an upward push of the indicator *pressure-to-space*. However, this upward pressure will be higher the more generously the dependent population is treated (φ is high) and the lower is the labour market space. We come back to this feature in our policy reflections in section 6.

4. A GLOBAL COMPARISON OF PRESSURE-TO-SPACE

This section presents the empirical measures for the key variables of the conceptual analysis and the derived indicators. The key variables are the dependency ratios for the young and old, relevant for the measurement of demographic pressure, and the population share of the workforce in combination with the effective retirement age and average working hours to calculate our measure of the labour market space. For a broad range of countries worldwide, we calculate the inactive-active ratio and the *pressure-to-space* indicator for the time span 2010-2050 according to the formulas presented in the previous section.

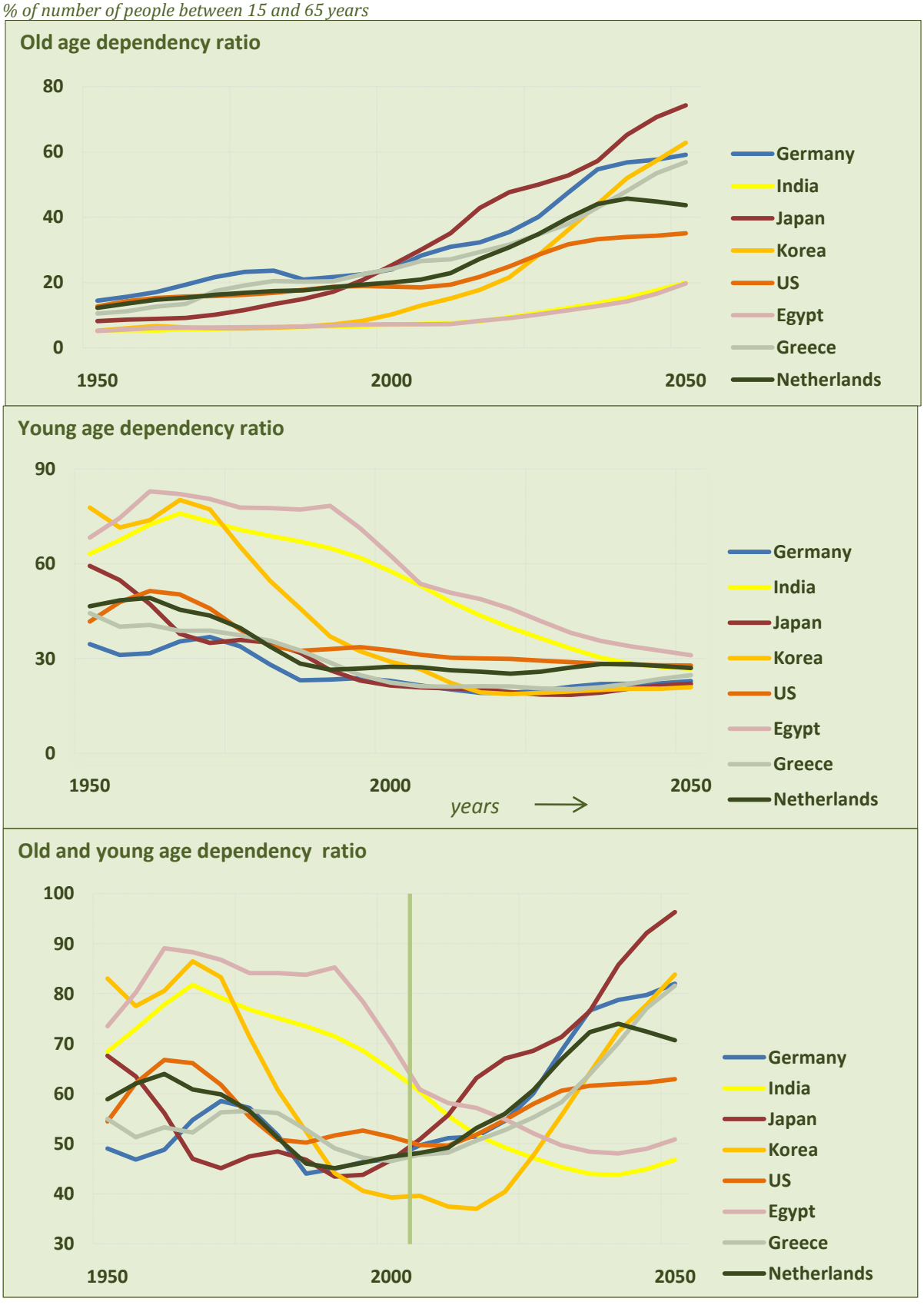
4.1 Demographic pressure across the globe

The dependency ratios in Egypt, Germany, Greece, India, Japan, Korea, the Netherlands and the US are illustrated in Figure 7 for the century 1950 - 2050. As the upper panel shows, the old age dependency ratios increase across the board and diverge after 2010, ranging from 20% for India to 90% for Japan in 2050. This means that in 2050 for each person in India of working age there will just be 0.2 person aged 65 or more, against 0.9 person in Japan. The opposite pattern applies for the young age dependency ratios, gradually declining and converging to around 30% in 2050. Egypt, a developing economy with a very young population, stands out: in 1960, there were almost as many Egyptian children below the age of 15 as there were people of working age and at the turn of the century against every two persons in working age there was still one child. In contrast, Japan's youth dependency ratio has dropped from 60% in 1950 to 20% in 2010 and is expected to stay at this level up to 2050, implying that for each five grown up persons of working age there is only one youngster below the age of 15.

An interesting feature emerging from the lower panel combining both dependency ratios is that almost all our countries, except Egypt and India, reach the lowest point in the period around 2010 (see the vertical line that marks the year 2010). Moreover, as the upper panel shows, in between 1950-2010 all countries are ageing, although developing nations Egypt and India only slightly due to the fall of the young age dependency ratios outweighing the increase of the old age dependency ratio. For 2010-2050, it is the other way around. The gradual decline in the youth dependency rates is outweighed by the increasing old age dependency ratios, leading to rising combined dependency ratios, again except for Egypt and India.

Figure 7 Development of dependency ratios

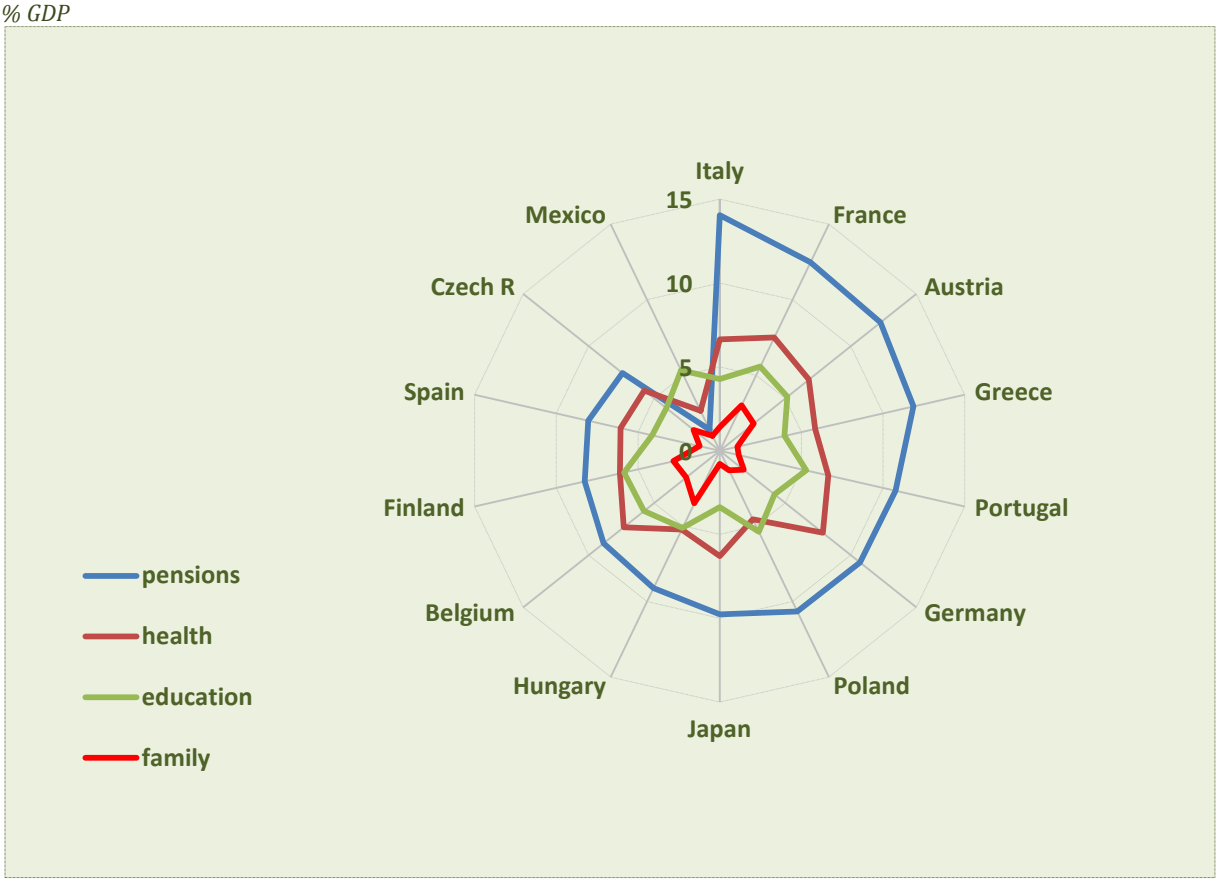
% of number of people between 15 and 65 years



Source: Authors - based on projections by the United Nations Population Information Network, 2011.

Figure 8 Government spending on the young and the old in 2007

% GDP



Source: OECD, Society at a glance (2011).

Note: Pensions include old age and survivors' pensions.

If, from the fiscal point of view, young and old are equally costly, so public pensions and health care per old aged are roughly equal to educational expenditures and child benefits per young, then the lower panel of Figure 7 suggests that the fiscal challenge for the future is not that different from that in the past. For example, South Korea will face a steadily rising dependency ratio up to 2050, but it is roughly similar, albeit in reverse order, to the dependency ratio in the past five decades.

The burden on the working population does not only depend on the relative shares of the young and old aged as pictured in Figure 7, but also on the fiscal costs of family support and educational expenditures for the young and public health care and public pension outlays for the old. Figure 8 illustrates these for a number of countries in our sample for 2005, where the ranking of countries is according to the size of the pension outlays (as a percentage of GDP). As with dependency ratios, there is also considerable heterogeneity in spending relative to GDP.

Italy, France, Austria and Germany rank highest with in between 12-15% of GDP spent on pensions, while Finland, Spain, Czech Republic and Mexico pay the least in terms of public pensions, in between 1 to 5% of GDP. Overall, public health care tends to be the second highest spending category, followed by educational spending, which is close to 5% of GDP for most countries. Family support, although minor compared to the other categories, shows the highest variation across countries.

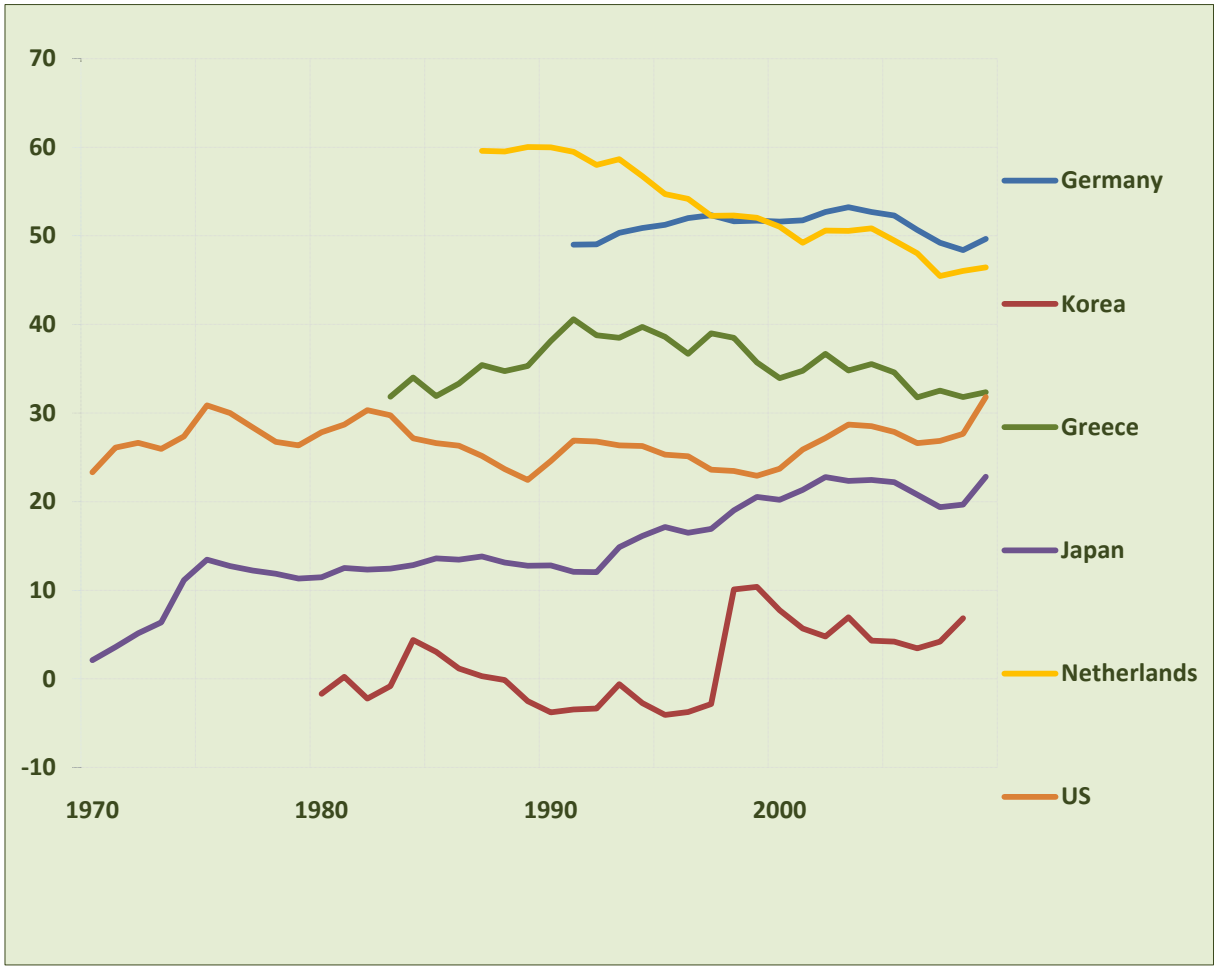
Some caveats are in order to interpret Figure 8. Health care does not concern only the old people, although probably the lion share of these costs are made on behalf of the old as most health care is provided in the last part of people's life. Since we do not have information on the distribution of public health care costs by age categories, we will leave this item out of the analysis and only include them in the sensitivity analysis in section 5. To some extent, government expenditures on family support and education also need not be confined to the young only, but we assume that this is generally the case. Therefore, in our subsequent analysis family support and education costs are attributed to the young.

The expenditure shares in Figure 8 are of course affected by the age composition of the populations, e.g. the high *GDP* share of pensions for Italy is not only due to the relative generosity of public pensions, but also to the current high old age dependency ratio and the high labour market space. Ideally, one would like to have statistics across countries for pensions, health care, education and family support expenditures per old and young aged relative to GDP per capita, but to the best of our knowledge these are not available from comparative public databases.

4.2 Labour market space across the globe

Since World War II, the emergence of part-time work and temporary leaves (maternity, parental), longer educational careers, the introduction of early retirement schemes and other welfare programs for those of working age have contributed to the phenomenon that a considerable part of the workforce is not doing paid work, or only part time, which we summarize in the statistic labour market space. Opposite these labour market loosening tendencies several countries have recently taken measures to stimulate the labour market participation, either with a view to their demographic developments or because of favourable economic conditions.

Figure 9 Labour market space 1970-2008



Source: Authors' calculations on the basis of OECD databases, using equation (7).
Note: Calculations according to formula *(7)* with the maximum number of hours set at 1820 (52 weeks at 40 hours per week) and the official retirement age at 65.

Long term series of the labour market space show that there are some economies with a gradually increasing or gradually decreasing trend (see Figure 9). The labour market space in Japan, for instance, has a gradual increasing trend during the period 1970-2009. It had very little space in 1970 and moved up to 20% in 2007. Also South Korea shows an upward trend. On the other hand, the Netherlands shows a decreasing trend. Most countries, among them the US, Germany and Greece included in Figure 9, show a rather stable path over this long period. Even more interesting than the development of the labour market space over time is its average level by country. The labour market space is consistently very high in Germany and very low in South Korea, where the upward jump at the end of the 1990s can be attributed to the Asian crisis, which caused unemployment to increase dramatically by more than one million people.

We split the total variation in labour market space across countries and over time into between country variation on the one hand and within country variation over time on the other ahand. The findings whos that the former is four times as large as the latter. This provides empirical support for our assumption that labour market space is predominantly a country characteristic, rather constant over time.

4.3 Demographic pressure versus labour market space across the globe

The pressure in relation to the space is illustrated in Figure 10, for the young (upper panel), for the old and for both combined (lower panel). Figure 11 illustrates the *change* in total pressure, again related to the labour market space. In these analyses we assume that the official retirement age is 65 and that the maximum number of working hours equals 2080, implying 52 weeks at 40 hours. As the base year for the labour market space we take 2008 because 2009 is the first recession year after the financial crisis which started in the autumn of 2008 (and 2010 is not yet available). The pressure is measured here at 2020. Because of lack of information on fiscal spending for many of the developing economies, we imposed that fiscal spending to the young and old relative to GDP per capita are equal to the lowest level that we have among our set of countries, being Mexico. Since Mexico is member of the OECD, its fiscal statistics are harmonised with the other OECD countries. In the sensitivity analyses in the next section we come back to this asumption.

The results show that by and large the developing economies tend to cluster at the left while the developed economies are scattered at the right, both for the young age pressure (Figure 10a) and the old age pressure (Figure 10b). Take the case of Egypt. Based on the high share of young people one would expect that the pressure of the young would be high, however, for the fiscal pressure it is not only the population share that counts, but also the amount of public support to the youth relative to *GDP* per capita. Since the latter is very low, Egypt, as well as many other developing countries with high population shares of young people, still end up with a low pressure. For the old age pressure, there is, with the exception of Ethiopia and Uganda, a narrow clustering of the developing countries around pressure levels below 4%, with widely diverging levels of labour market space. The developed countries are all over the place, with Iceland combining a very low old age pressure and little space at the labour market against France and Italy combining high pressure and much labour market space.

Among the developed countries there seems to be at face value a clustering of countries belonging to the same welfare regime type as identified by Esping-Andersen (1990). Countries belonging to the corporatist, continental, welfare regime, such as Austria, Belgium, France, Germany and Italy combine high old age pressure of more than 10% with considerable labour market space (50% or higher). Members of the social-democratic (the Scandinavian countries and the Netherlands) and of the liberal regime (the Anglo-Saxon countries Australia, Canada, Ireland, UK and US) have on average both a lower old age pressure (less than 8%) and less labour market space.[4]

As Figure 8 already illustrated, there is considerable variation among countries in their spending levels in pensions, health care, education and family support as a percentage of GDP. Iceland, for instance, has comparatively very high family costs, which explains why it is located at the right of the upper panel of Figure 10, while Italy, France and Greece rank highest on fiscal spending for the old, locating them at the right in de middle panel of Figure 10.

Figure 11 shows the dynamic perspective of space versus pressure for the next decade. Interestingly, although most countries centre in the middle with modest increases in pressure combined with a high variation in space, some countries show a dauntingly high increase in pressure of 8%-points of GDP in between 2010 and 2020, while a limited but heterogenous set of countries face a decrease in fiscal spending on the dependents during this period.

[4] See Van der Veen and Groot (2006) for a classification of OECD countries according to their degree of (post)productivism and see Goodin and Smitsman (2000) for a convincing case why the Netherlands scores social-democratic rather than corporatist.

Figure 10a Demographic pressure of the young versus the labour market space

labour market space in % and pressure in % of GDP

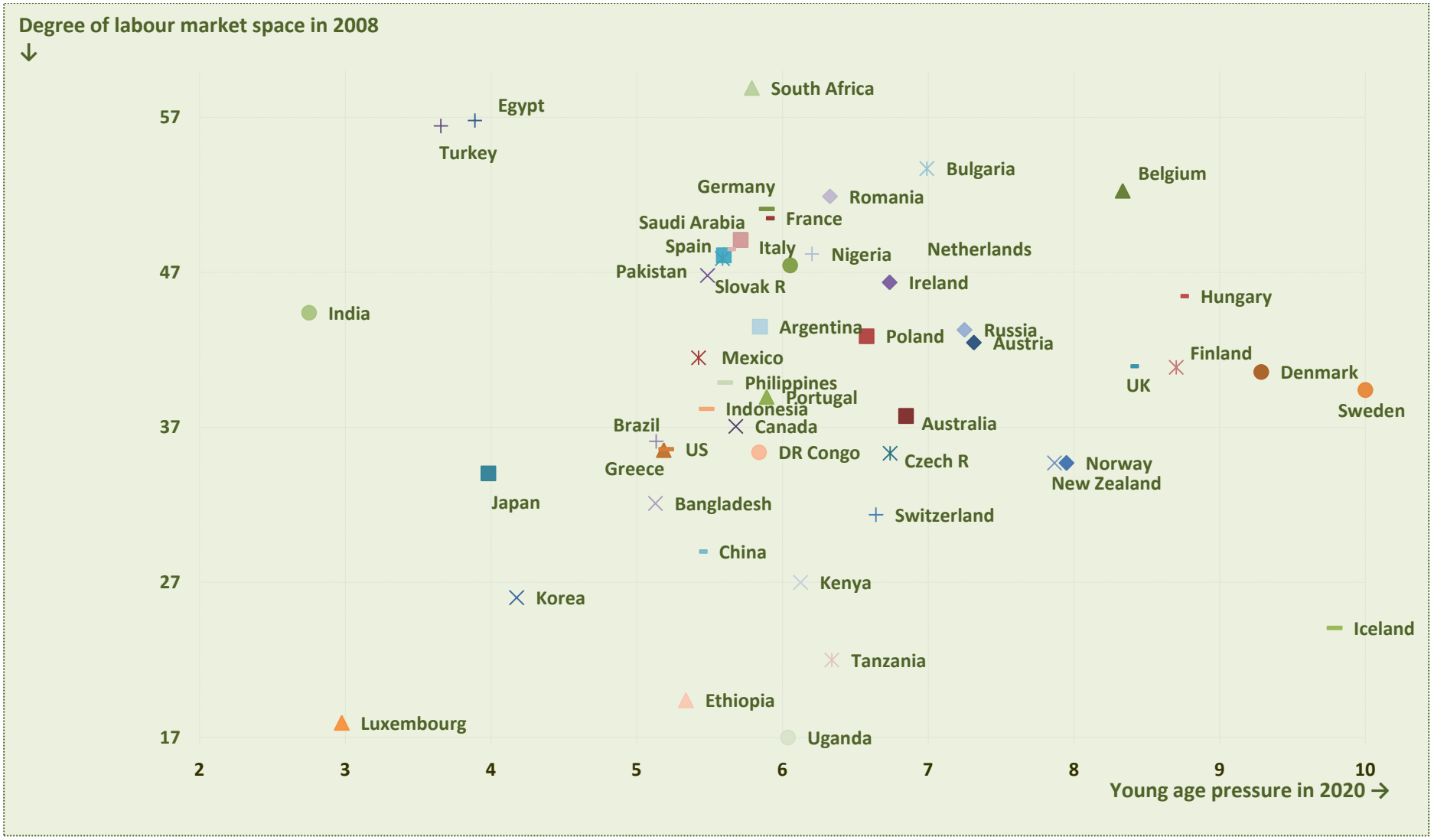


Figure 10b Demographic pressure of the old versus the labour market space

labour market space in % and pressure in % of GDP

Figure 10c Demographic pressure of the young & the old versus the labour market space

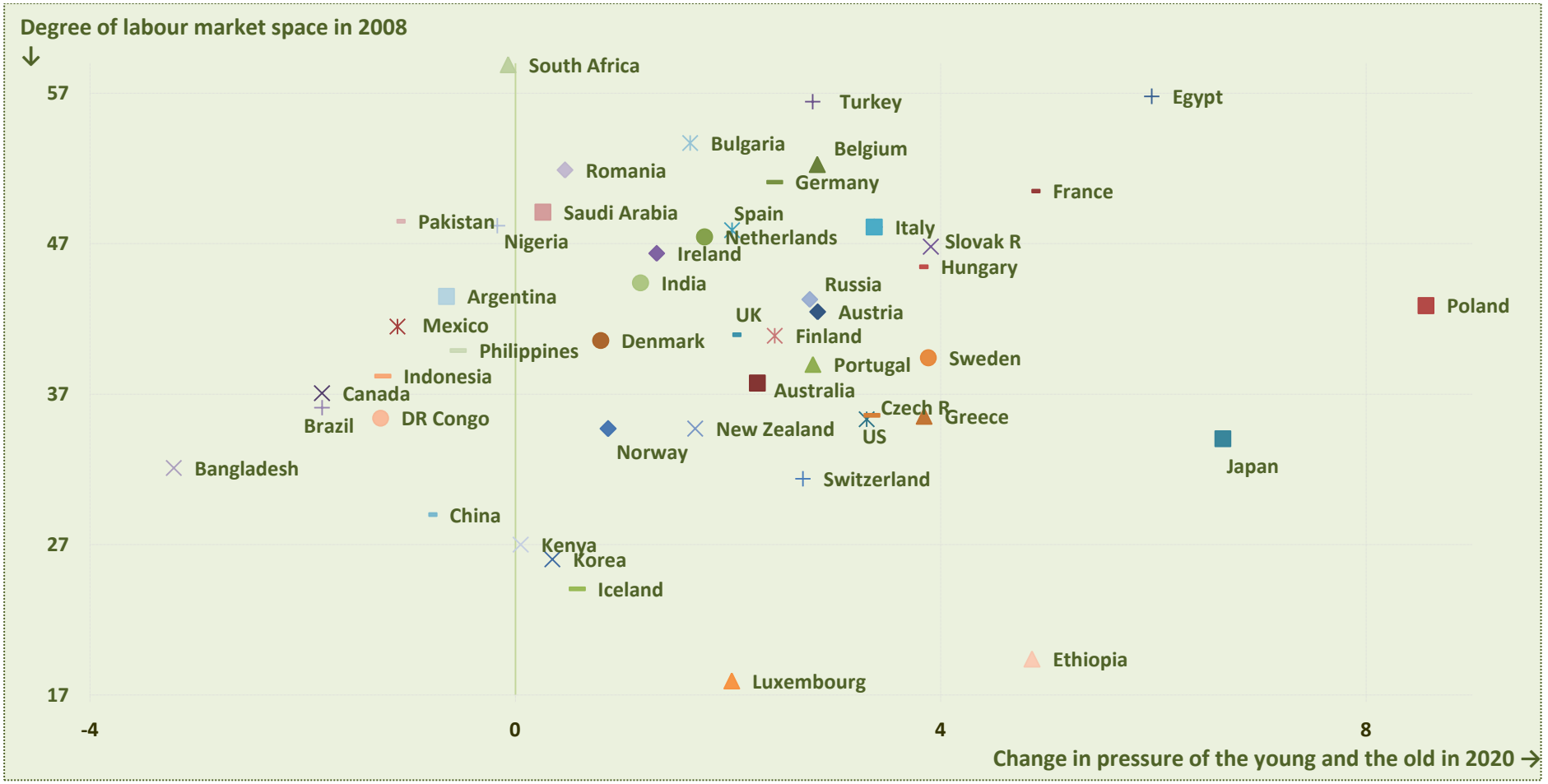
labour market space in % and pressure in % of GDP

Source: Own calculations.

Note: The demographic pressure for the young is calculated according to equation *(2a)* and for the old is calculated according to equation *(2b)*. Health care costs are not included because the break-down of health costs per age category is not available. The labour market space is according to equation *(7)*

Figure 11 Change demographic pressure of the young & old versus the labour market space

labour market space in % and pressure in % of GDP



Source: Own calculations.

Note: The change in demographic pressure for the old is calculated according to equation *(3)*. Health care costs are not included because the break-down of health costs for the elderly only are not available. The labour market space is according to equation *(7)*

4.4 Ranking of countries according to the indicator pressure-to-space

The figures 10 and 11 pitch the (change in) pressure versus the labour market space and are thus the empirical equivalent of Figure 5. Now we want to summarize the graphical information of these figures by ranking the countries by means of the *pressure-to-space* indicator introduced in section 3.4.

Table 1 reports the results for the *pressure-to-space* indicator for the years 2010, 2020, 2030, 2040 and 2050. Table 2 reports the results for the *change* in the indicator, for 2020 in comparison with 2010, for 2030 in comparison with 2020, for 2040 in comparison with 2030 and 2050 in comparison with 2040. Also, Figure 12 shows the ranking for 2020 and 2050, for the changes in the *pressure-to-space* indicator.

Let us concentrate on the changes in the indicator. In case the change is high, there should be a sense of urgency for policy makers to adapt either government spending or the labour market policies to accommodate the upcoming additional fiscal spending. In our opinion the pressure coming from changing costs should prompt (or have prompted) adjustments in the labour market space.

Table 2 shows that Poland ranks highest in 2020, but also in 2050, indicating that the pressure does not vanish in the course of time by the natural demographic development. Japan, on the contrary, ranks third in 2020, but it goes down the ranking in the course of time to place 8 and 9. Countries moving rapidly in the opposite direction are Turkey and Greece. Turkey moves frighteningly from place 17 in 2020, to 12 in 2030, to 7 in 2040 and even up to 2 in 2050. Greece goes less fast upward, but it nonetheless moves from place 13 in 2030 to place 5 and even to the top 3 in 2050.

An interesting feature of Table 1 is that again Poland and Greece rank in the top 3. These countries have thus not only face significant changes in fiscal pressure, but are also already quite under pressure in comparison with the other economies.

As expected, most developing countries rank low in this list. The reason is that we assume their costs of ageing low in these analyses, although we have to keep in mind that their populations are ageing also. We come back to this point in the sensitivity analyses where we make the more realistic assumption that the cost of ageing per person will be higher.

Table 1 Rankings of pressure-to-space of the young & the old

Pressure measured in 2010, 2020, 2030, 2040, 2050 and space in 2008

	2010		2020		2030		2040		2050	
1	Iceland	41	Luxembourg	56	Luxembourg	64	Luxembourg	70	Luxembourg	71
2	Uganda	36	Greece	51	Austria	58	Austria	64	Greece	69
3	Tanzania	29	Iceland	50	Greece	56	Greece	63	Poland	68
4	Ethiopia	28	Austria	50	Poland	55	Portugal	59	Austria	66
5	Sweden	25	Poland	49	Portugal	52	Poland	58	Portugal	64
6	Denmark	23	Japan	48	Switzerland	50	Italy	56	Italy	59
7	Kenya	23	Finland	47	Finland	50	Japan	54	Japan	57
8	N Zealand	23	Portugal	47	Iceland	50	Switzerland	53	Czech R	57
9	Finland	21	Sweden	46	Japan	50	Czech R	51	Switzerland	54
10	Switzerland	21	Czech R	46	Italy	49	Finland	50	Hungary	51
11	UK	20	Switzerland	45	Sweden	48	France	49	Finland	51
12	Hungary	19	Italy	44	Czech R	47	Iceland	49	Iceland	50
13	Czech R	19	Uganda	44	France	46	Sweden	48	France	50
14	China	19	Hungary	43	Hungary	44	Hungary	46	Sweden	48
15	Australia	18	France	41	Denmark	42	Germany	44	Germany	44
16	Norway	18	Denmark	39	Germany	41	Denmark	43	Spain	42
17	Austria	17	N Zealand	38	Uganda	41	N Zealand	41	Denmark	42
18	Russia	17	Ethiopia	36	N Zealand	41	Belgium	41	N Zealand	42
19	Luxembourg	17	Belgium	36	US	39	US	40	Belgium	41
20	DR Congo	16	US	35	Belgium	39	Uganda	39	US	41
21	Korea	16	Tanzania	35	UK	37	UK	38	Turkey	40
22	Bangladesh	16	UK	35	Tanzania	34	Spain	38	Slovak R	39
23	Belgium	16	Germany	35	Ethiopia	34	Canada	34	Uganda	39
24	Poland	15	Spain	30	Canada	34	Slovak R	34	UK	39
25	Canada	15	Norway	30	Spain	33	Tanzania	33	Canada	35
26	Portugal	15	Canada	30	Norway	31	Ethiopia	33	Ethiopia	34
27	US	15	Australia	29	Slovak R	31	Norway	33	Korea	34
28	Greece	15	Kenya	29	Australia	30	Turkey	32	Tanzania	33
29	Ireland	15	Slovak R	28	Korea	29	Korea	32	Norway	33
30	Indonesia	14	Netherlands	26	Netherlands	29	Australia	31	Australia	32
31	Brazil	14	China	26	Kenya	27	Netherlands	31	Netherlands	30
32	Philippines	14	Korea	25	Turkey	26	China	29	China	30
33	Argentina	13	Ireland	24	China	26	Kenya	27	Kenya	29
34	Mexico	13	Turkey	21	Ireland	24	Ireland	26	Ireland	28
35	Bulgaria	13	Bangladesh	21	Bangladesh	21	Bangladesh	22	Bangladesh	25
36	Nigeria	13	Russia	21	Russia	20	Indonesia	21	India	23
37	Netherlands	13	DR Congo	20	Brazil	20	Brazil	21	Indonesia	23
38	Romania	12	Brazil	19	DR Congo	19	Russia	20	Brazil	22
39	Slovak R	12	Indonesia	19	Philippines	19	India	20	Russia	22
40	Japan	12	Philippines	19	Indonesia	19	Philippines	20	Saudi Arabia	22
41	France	12	Mexico	17	Mexico	17	DR Congo	19	Philippines	21
42	Spain	12	Argentina	17	India	17	Mexico	18	Mexico	19
43	Saudi Arabia	12	Bulgaria	16	Argentina	16	Saudi Arabia	17	DR Congo	19
44	Italy	12	Saudi Arabia	16	Saudi Arabia	16	Argentina	16	Bulgaria	17
45	Pakistan	12	Nigeria	16	Bulgaria	15	Bulgaria	16	Romania	17
46	Germany	12	Romania	15	Nigeria	15	Romania	15	Argentina	16
47	South Africa	10	India	15	Romania	15	Nigeria	15	Nigeria	15
48	Egypt	7	Pakistan	15	Pakistan	14	Pakistan	14	Pakistan	15
49	Turkey	6	South Africa	13	South Africa	13	South Africa	13	South Africa	13
50	India	6	Egypt	8	Egypt	8	Egypt	8	Egypt	8

Source: Authors' calculations – see Figure 10.

Table 2 Rankings of the changes in pressure-to-space of the young & the old

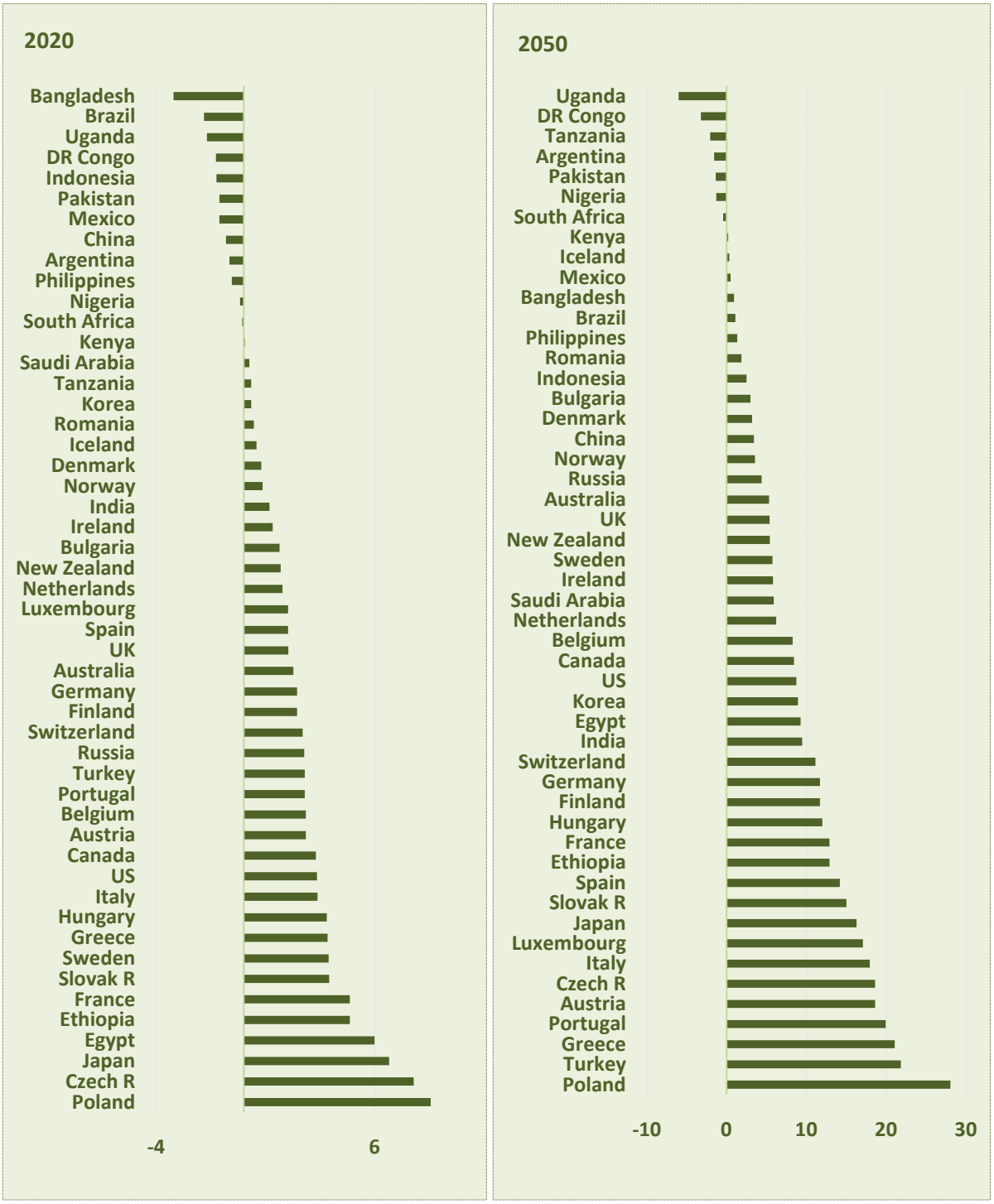
Pressure measured at 2020, 2030, 2040, 2050 in comparison with 2010. Space measured in 2008.

	2020-2010		2030-2010		2040-2010		2050-2010	
1	Poland	8.6	Poland	14.6	Poland	17.4	Poland	28.1
2	Czech R	7.8	Austria	11.0	Austria	16.8	Turkey	21.8
3	Japan	6.7	Luxembourg	9.9	Luxembourg	16.2	Greece	21.1
4	Egypt	6.0	Ethiopia	9.6	Italy	15.5	Portugal	19.9
5	Ethiopia	4.9	France	9.6	Greece	15.3	Austria	18.6
6	France	4.9	Egypt	8.9	Portugal	14.4	Czech R	18.6
7	Slovak R	3.9	Czech R	8.9	Turkey	14.1	Italy	17.9
8	Sweden	3.9	Japan	8.8	Japan	13.5	Luxembourg	17.1
9	Greece	3.8	Finland	8.2	Czech R	12.5	Japan	16.3
10	Hungary	3.8	Germany	8.2	Ethiopia	12.2	Slovak R	15.0
11	Italy	3.4	Italy	8.1	France	12.2	Spain	14.2
12	US	3.4	Turkey	7.9	Finland	11.2	Ethiopia	12.9
13	Canada	3.3	Greece	7.9	Germany	11.2	France	12.9
14	Austria	2.8	Switzerland	7.9	Switzerland	10.8	Hungary	12.0
15	Belgium	2.8	Portugal	7.6	Spain	9.9	Finland	11.7
16	Portugal	2.8	US	7.1	Slovak R	9.2	Germany	11.7
17	Turkey	2.8	Canada	7.0	Egypt	8.7	Switzerland	11.1
18	Russia	2.8	Slovak R	6.8	US	8.1	India	9.5
19	Switzerland	2.7	Belgium	6.2	Belgium	7.9	Egypt	9.3
20	Finland	2.4	Sweden	5.1	Canada	7.7	Korea	9.0
21	Germany	2.4	Spain	4.7	Korea	7.4	US	8.7
22	Australia	2.3	Netherlands	4.6	Hungary	7.1	Canada	8.4
23	UK	2.0	Hungary	4.6	Netherlands	6.8	Belgium	8.3
24	Spain	2.0	Korea	4.5	India	5.8	Netherlands	6.2
25	Luxembourg	2.0	New Zealand	4.2	Sweden	5.5	Saudi Arabia	5.9
26	Netherlands	1.8	UK	3.8	New Zealand	5.1	Ireland	5.8
27	New Zealand	1.7	Australia	3.7	UK	4.9	Sweden	5.8
28	Bulgaria	1.6	India	3.2	Denmark	4.8	New Zealand	5.4
29	Ireland	1.3	Denmark	3.0	Australia	4.4	UK	5.4
30	India	1.2	Norway	2.4	Norway	3.8	Australia	5.3
31	Norway	0.9	Russia	2.3	Ireland	3.1	Russia	4.4
32	Denmark	0.8	Ireland	1.1	China	2.3	Norway	3.6
33	Iceland	0.6	Bulgaria	1.0	Russia	2.2	China	3.4
34	Romania	0.5	Saudi Arabia	0.2	Bulgaria	1.4	Denmark	3.2
35	Korea	0.3	Romania	0.1	Saudi Arabia	1.3	Bulgaria	3.0
36	Tanzania	0.3	Philippines	-0.1	Romania	0.5	Indonesia	2.5
37	Saudi Arabia	0.3	Iceland	-0.1	Indonesia	0.5	Romania	1.9
38	Kenya	0.0	South Africa	-0.1	Philippines	0.4	Philippines	1.3
39	South Africa	-0.1	China	-0.6	Mexico	-0.4	Brazil	1.1
40	Nigeria	-0.2	Nigeria	-0.7	South Africa	-0.5	Bangladesh	0.9
41	Philippines	-0.5	Tanzania	-0.9	Brazil	-0.7	Mexico	0.5
42	Argentina	-0.6	Indonesia	-1.0	Iceland	-1.2	Iceland	0.3
43	China	-0.8	Kenya	-1.1	Nigeria	-1.3	Kenya	0.2
44	Mexico	-1.1	Mexico	-1.4	Kenya	-1.5	South Africa	-0.4
45	Pakistan	-1.1	Argentina	-1.4	Argentina	-1.9	Nigeria	-1.3
46	Indonesia	-1.2	Brazil	-1.4	Tanzania	-1.9	Pakistan	-1.4
47	DR Congo	-1.3	Pakistan	-1.8	Bangladesh	-2.1	Argentina	-1.6
48	Uganda	-1.7	DR Congo	-2.4	Pakistan	-2.2	Tanzania	-2.1
49	Brazil	-1.8	Bangladesh	-3.4	DR Congo	-3.2	DR Congo	-3.2
50	Bangladesh	-3.2	Uganda	-4.4	Uganda	-5.8	Uganda	-6.0

Source: Authors' calculations – see Figure 11.

Figure 12 Ranking according to the pressure-to-space indicator

Changes in pressure are measured in 2020 and 2050 in deviation from 2010, in percentage points. Space is measured in 2008, in percentages.



Source: The calculations are according to equation (9).

5. SENSITIVITY ANALYSES

In addition to the analyses in the previous sections, we now perform some simulations that show the sensitivity of the outcomes to changes in some of the parameters. It is meant to address the gist in the quote "*prediction is difficult - especially of the future*" ascribed to Mark Twain.

In order to make the presentation here insightful and to avoid running into details for each of the countries, we calculate the average of the *pressure-to-space* indicators as provided in Table 1 of the group of developing economies or the group of developed economies. This is our *baseline scenario*. In the scenarios that we present here below, we calculate also the average of the *pressure-to-space* indicators for these groups. The comparison is thereafter between the simulated and baseline scenario results.

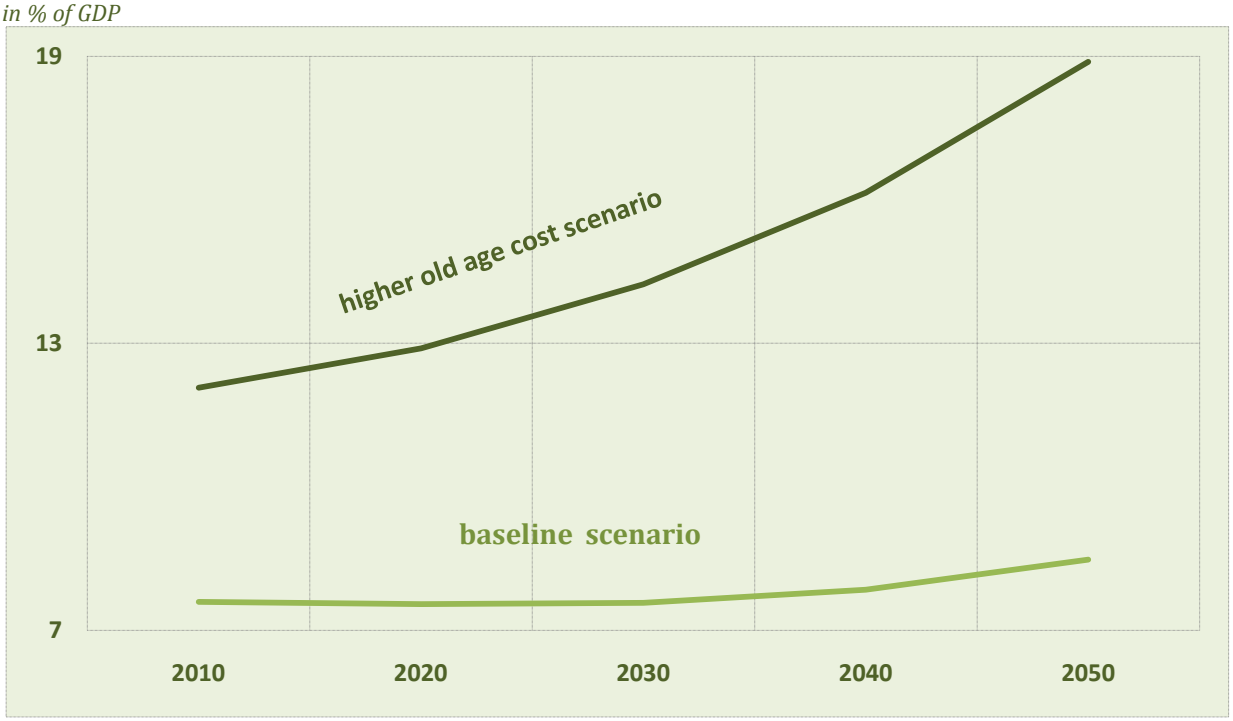
5.1 Increasing the fiscal costs of ageing in the developing economies

Lack of reliable information on fiscal spending on the retired people in the developing economies forced us to make the rather strong assumption to equate the costs for each of these economies to the costs that Mexico reports to the OECD, being 1.4% of GDP. Some of the countries that we classified as "developing" will face much lower public costs than 1.4% of GDP as the old aged, in the absence of public pensions, are taken care of privately in the setting of socalled extended families.

Other countries may incur higher costs, especially if future economic growth is used to provide income protection for the old aged. In case this happens, also the developing economies may face high spending costs. An alternative is to stick to the level of public costs of the old aged as in Mexico, but to assume increasing costs over time to reflect improving protection for the old aged. In line with the assumption that the cost per old aged relative to GDP per capita is kept constant for the countries for which the data are available, we have chosen to set the public pension cost equal to that of Turkey, that spent 6.1% of GDP in 2007. In the scenario that we analyse here, we assume that all developing economies face similar fiscal costs per capita as Turkey, also in the course of time. This scenario amounts to a costs increase of about 400% per capita compared to the scenario where we took the relative low costs of Mexico (comparing 1.4 with 6.1).

Figure 13 Simulating higher old age pressure in the developing economies

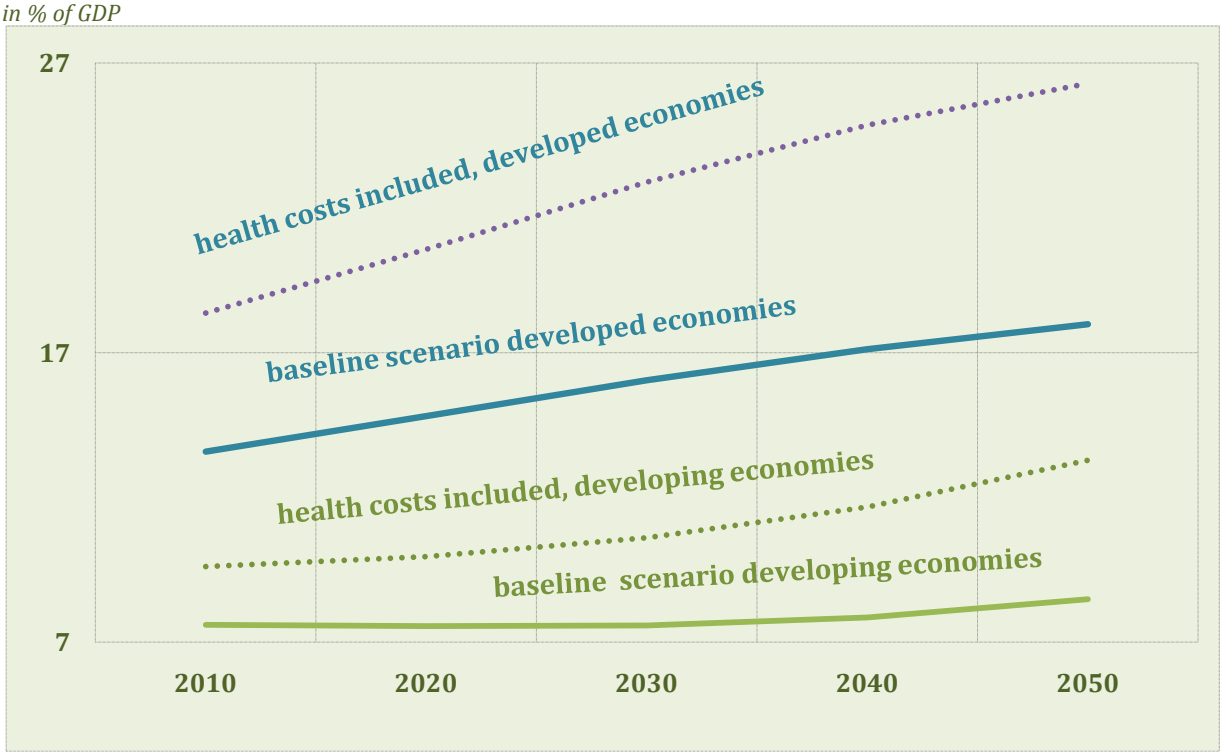
in % of GDP



Source: Authors' calculations.

Figure 14 Simulating higher health costs in developing and developed economies

in % of GDP



Source: Authors' calculations.

Note: The lines are simple averages of the indicator *pressure-to-space* for each of the developing and developed countries.

Figure 13 shows the average old age pressure of the 21 developing countries in our sample called the baseline scenario, along with the simulated higher old age costs scenario. It follows that the higher costs per capita lead to an increase of the pressure of almost 4%-points from 2010 onwards, rising to 12%-points of GDP in 2050, which amounts to a fiscal pressure of 19% of GDP in 2050. While in the baseline scenario the ageing costs were compensated in many countries by the savings in spending on the young due to the gradual decrease in the population share of the young people, the rising costs to provide income support for the old aged dominates in the simulated scenario. Some of the developing countries will even enter the top 10 of our ranking of the *pressure-to-space* (see Table 1) in case this scenario becomes truth. From these results we therefore draw the conclusion that also the developing countries can easily face high costs due to their ageing populations in the course of these period 2010-2050, while their tax and administration systems may not always be advanced enough to raise the required tax revenues.

5.2 Including the costs of health care

In the next scenario we take into account the highly sensitive issue of health care costs. This makes the outcomes more realistic as most of the consumption of health care is taken in the last phase of a person's life. In developed economies on average 80% of all health care costs that is spent over a life time incurs above the age of 65. For this reason, let us indeed assume that a share of 0.8 of the health care costs as reported by the OECD for the developed economies is included in our measure of the pressure of the old (see equation *(2b)*). For the developing economies we maintain the assumption that their health care costs are similar to the costs as reported by Mexico to the OECD for 2007, being 2.6% of GDP, where we also take 80% of these costs.

Figure 14 shows the results. The pressure in the developing economies increases by roughly 3 to 4% points across the board, in comparison with the baseline scenario. In the developed economies, the pressure is already much higher, due to the higher outlays on pensions, family costs and education. When we include health care costs for people above the age 65, it follows that the pressure rises significantly. In the year 2050, it would lead to an additional 10%-points of GDP (from 17% to 27%).

6. POLICY REFLECTIONS

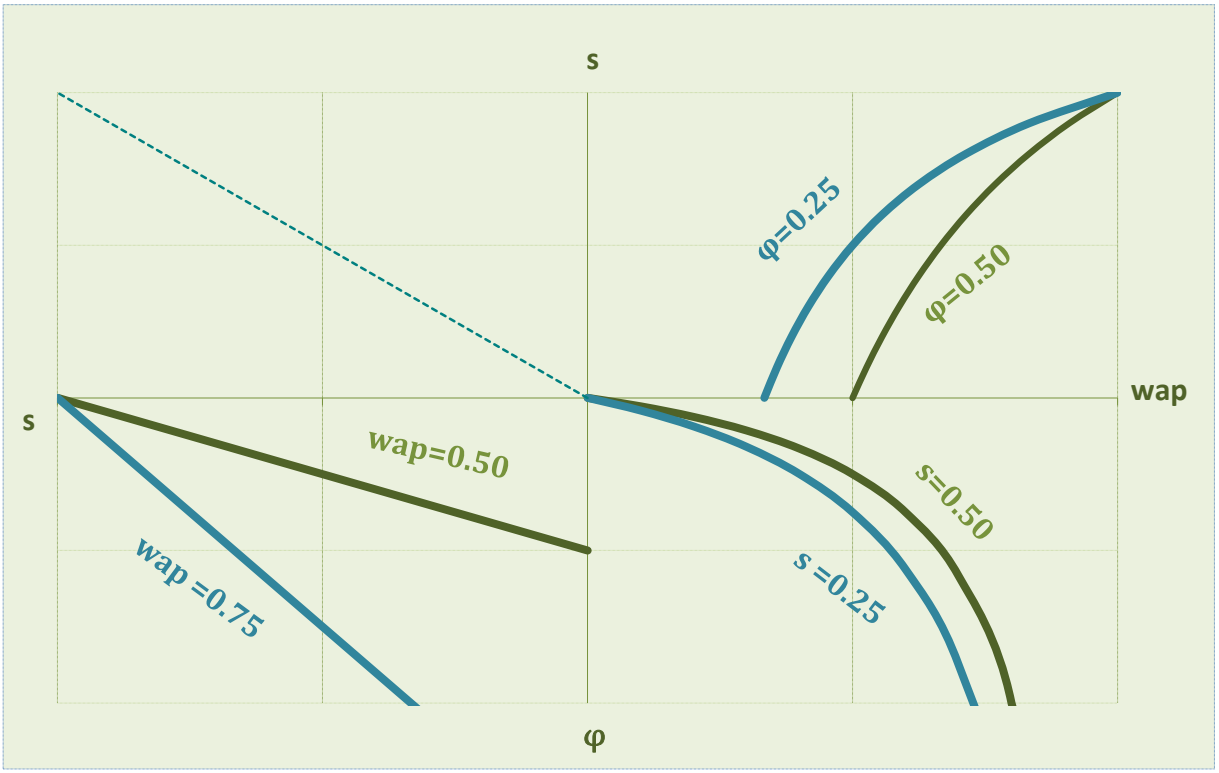
The key drivers of the analysis are the labour market space (*s*), the degree of generosity towards the dependent (φ) and the population share of those of working age (*wap*). As Bloom *et al.* (2010:10) notes, projecting demographic change, although still an inexact science, is easier than to predict social-economic variables as productivity growth, because the former is determined by only a few key parameters (fertility, life expectancy and migration). Therefore, we take the development of *wap* (and its complements *yap* and *oap*, see Appendix C) as uncontroversial and exogenous to the policy-maker.[5] So far we assumed a constant labour market space and fixed the ratio of government expenditures per young and old aged relative to GPD per capita in order to identify which countries, mainly due to ageing, will become most pressurized to change labour market policies or to adjust their social security systems.

We will now drop these assumptions in order to focus on the main policy choices triggered by the changes in the demographic composition of the population. Basically, the policy choice involves a trade-off between maintaining social protection and free or heavily subsidized public services for the young and old on the one hand and maintaining labour market space for the working age population on the other hand. In concrete terms, generous public provisions for the old in the form of adequate pensions and free health care and for the young in the form of child benefits and free education can only be sustained by inserting a high enough fraction of the workforce into paid work who pay the taxes required to finance the public expenditures. Analogously, there is more room for relaxed labour market arrangements – ranging from paid leaves, early retirement schemes, generous and easily accessible unemployment, sickness and disability benefits, waiving the duty to apply for jobs for single parent families with young children to all kinds of arrangements facilitating or stimulating working times below the default of a full-time work week - the lower the fiscal pressure of the young and old aged.

To illustrate the trade-off between generosity to the young and old and maintaining labour market space, the so-called magic quadrant in Figure 15 integrates the three key variables labour market space, the level of generosity and the population share of the working age, based on a balanced budget equation, equalizing tax revenues from income taxes on the employed to the public expenditures on dependents. For the sake of argument, we assume that public

[5] For this reason, we abstract from net migration flows and their impact on the population share of the working aged.

Figure 15 Space, working age population and fiscal costs under a balanced budget



Source: Authors.

expenditures per old and young person are equal to a fraction φ of GDP per capita, so that the balancing budget tax rate is proportional to this generosity paramenter φ (see Appendix C):

$$t * wap_{i,t} * (1 - s_{i,t}) = (yap_{i,t} + oap_{i,t})\varphi_{i,t} \Leftrightarrow \varphi_{i,t} = t * \frac{wap_{i,t}(1 - s_{i,t})}{(1 - wap_{i,t})} \quad (11)$$

The curves in Figure 15 are the product of simulations, where the tax rate is set for convenience at 0.5. In quadrant I (north-east), labour market space (vertical) is pitched against the working age population (horizontal) and the lines represent iso-generosity curves. Suppose the initial case is where half the population is of working age, half of them are at work (in *fte*) and that the public support for the young and old aged is 25% of GDP per capita, so wap = 0.5, s = 0.5 and φ = 0.25. If because of ageing, the population share of the working age goes down, then the generosity towards those of non-working age can only be sustained by moving along the iso-generosity line to the left, so reducing labour market space. In quadrant II (south-east), with wap on the horizontal and φ on the vertical axis, the curves depict all combinations of φ and wap compatible with the same level of space.

Drawing a horizontal line at some arbitrary generosity level φ shows that more labour market space is only possible at higher shares of the working age population, e.g. to keep φ at 25% allows only a space of 0.25 if *wap* is 0,4, but it can be increased to 0.5 if *wap* is 0.5. Moving along the curves in quadrant II shows that at constant levels of space, generosity must fall if the share of the workforce declines. Finally, quadrant III (south-west) shows all possible combinations of space and generosity levels compatible with the same workforce. In general, given the share of the workforce, a higher level of generosity requires a reduction in space. The two *iso-wap* curves nicely illustrate that for the same level of generosity, say φ= 0.25, there is more room for relaxed labour market arrangements, the higher the population share of the workforce.

7. SUMMARY, CONCLUSIONS AND FUTURE RESEARCH

Due to population dynamics, the population shares of young and old are continuously changing, which gives rise to changes in the population share of the working aged. This paper seeks to provide operational measures for comparing countries in terms of demographic pressure and labour market space. Usually the challenge of ageing is expressed in terms of a rising old age dependency ratio, or a combination of the old and young age dependency ratios, but this delivers an incomplete picture of the actual challenges.

We argue that the share of the working age that actually performs paid work, measured in full-time equivalents, is a country-specific system variable that is determined by a complex set of factors such as flexibility of labour markets, cultural norms with respect to female labour participation and working hours' legislation. Inclusion of this country-specific labour market space allows us to calculate the inactive-active ratio and a *pressure-to-space* indicator for 50 countries, among which 21 developing countries, over the period 1950-2050. We included all G20-countries, all other OECD- and EFTA-countries, Bulgaria and Romania, and all countries belonging to the top-10 in world population in 2050, being Bangladesh, Democratic Republic of Congo, Ethiopia, Kenya, Nigeria, Pakistan, Philippines, Tanzania and Uganda. Together, these 50 countries cover three quarters of the world population.

The inactive-active ratios show the development of the number of inactive persons, that is all younger than 15 or older than 65 plus all those of working age not doing paid work, relative to the active persons. For the decades to come, this ratio will increase for all developed economies. The *pressure-to-space* indicator also includes information about the public expenditures on education and family support per young and public pensions per old relative to GDP per capita. Doing so identifies which countries will feel the pressure most, where pressure is higher, the higher the government outlays for education, family support and pensions relative to GDP per capita and the lower the labour market space.

We draw two main conclusions from our empirical analyses.

First, according to the indicator *pressure-to-space* the demographic pressure to labour market space is mounting most for Poland, Greece and Turkey. In case they keep their current fiscal expenditure rates on the young and old constant, their fiscal spending as a percentage of GDP will be 8%-points higher in 2020 than in 2010. The situation is especially precarious for Greece, as it already has a high *pressure-to-space* indicator (and we did not take into account its accumulated public debt). In between 2010 and 2050, the population share of the working aged

will fall from 0.67 to 0.55, while the currently available labour market space is comparatively rather low (0.36 in 2008), mainly due to the high average number of hours worked per worker, according to the OECD statistics. Based on this analysis, one may doubt whether Greece will be able to sustain its public expenditures to the young and old in the future relative to GDP per capita, unless it is able to raise the labour force participation rate.

Second, not only developed economies face a demographic challenge. Despite their higher population growth, developing economies may run into the situation of excessive fiscal spending. A clear example, as already mentioned, is Turkey that ranks second in the increases in fiscal spending in 2050, between Poland and Greece. Its additional fiscal spending will be 8%-points in 2030, 14% in 2040 and 20% in 2050 in comparison with 2010.

Alarmingly, other developing countries may also enter the top 10 of our ranking of *pressure-to-space*. The reason is that we kept the spending costs for the developing countries in our analyses relatively low, at the level of Mexico (1.4% of GDP in 2007). Sensitivity analyses show that assuming higher costs for the developing countries will lead on average to an increase of more than 10%-points in the *pressure-to-space* indicator in 2050 in comparison with our baseline scenario (with the spending costs of Mexico). This would bring some of the developing countries in the top 10 of our ranking of the *pressure-to-space*.

A host of other factors not taken into account in this study are relevant to assess whether a country is able to accommodate its demographic pressure. A highly relevant avenue for further research is the fiscal sustainability of countries, by taking into account financial variables such as the public debt stocks, the accumulated capital account balance and the share of capital funding in pensions benefits. Likewise, net migration flows matter. The indicators developed in this paper can be used to predict future migration flows from countries with a low GDP per capita, high young age dependency ratios and high labour market space towards countries with high GDP per capita, low high young age dependency ratios and low labour market space.

References

Andersen, Torben M., 2006, The Scandinavian model – Prospects and challenges, *International Tax and Public Finance*, 15(1): 45-66.

_____., 2008, Fiscal sustainability and demographics – should we save or work more; CEPR Discussion Paper 7044.

Bloom, David E. and David Canning, 2004, Global demographic change: Dimensions and economic significance, Proceedings, Federal Reserve Bank of Kansas City, issue August, 9-56.

_____, Rick Mansfield and Michael Moore, 2007, Demographic change, social security systems, and savings, *Journal of Monetary Economics*, 54(1): 92-114.

_____ and Roddy McKinnon, 2010, Social security and the challenge of demographic change, Program on the Global Demography of Aging (PGDA), working paper no 61.

Bovenberg , A. Lans., 2008, The life-course perspective and social policies: An overview of the issues, CESifo Economic Studies, 54(4): 593–641.

Brooks, Robin, 2000, What will happen to financial markets when the baby boomers retire?, International Monetary Fund Working Paper 00/18.

Bruni, Michele, 2011, China's new demographic challenge: From unlimited supply of labour to structural lack of labour supply. Labour market and demographic scenarios: 2008-2048, Materiali di Discussione 643, Center for the Analysis of Public Policy, University of Modena and Reggio, Italy.

Bryant, Ralph C. And Warwick J. McKibbin, 1998, Issues in modelling the global dimensions of demographic change, Brookings discussion papers in international economics no. 141.

Esping-Andersen, Gøsta, 1990, Three worlds of welfare capitalism, Cambridge: Polity Press & Princeton University Press.

European Commission DG Economics and Financial Affairs, 2006, The Long-term sustainability of public finances in the European Union. European Economy 4.

Galor, Oded, 2010, The demographic transition: Causes and consequences, Brown University, US.

Goodin, Robert E. and Anneloes Smitsman, 2000, Placing welfare states: The Netherlands as a special test case, *Journal of Comparative Policy Analysis* 2: 39-64.

Hagist, Christian and Berndt Raffelhüschen, 2011, Long-term effects of public pension reform in Norway – A generational accounting analysis, Research Center for Generational Contracts 49.

Heller, Peter S., Assessing a government's exposure to fiscal risk, John Hopkins University.

Horioka, Charles Yuji, 2010, Ageing and saving in Asia, *Pacific Economic Review* 15(1): 46-55.

Horton, Mark, Manmohan Kumar and Paolo Mauro, 2009, The state of public finances: A cross-country fiscal monitor, International Monetary Fund Staff position note SPN/09/21.

International Labour Office (ILO), 2010, Employment and labour market adjustments in G20 countries during 2007-09 and outlook for 2010: A statistical overview. Washington DC, US.

Jarret, Peter, 2011, Pension reforms in Poland and elsewhere: The view from Paris, Center for Social and Economic Research (CASE) Network studies & analyses no 425, Warsaw, Poland.

Kent, Christopher, Anna Park and Daniel Rees (eds.), 2006, Demography and financial markets. G20 Proceedings of a conference held in Sydney, 23-25 July 2006.

Lee, Ronald, Sang-Hyop Lee and Andrew Mason, 2006, Charting the economic life cycle, NBER Working Paper Series 12379.

Ley, Eduardo, 2010, Fiscal (and external) sustainability, World Bank.

Mason, Andrew, Sang-Hyop Lee and Gerard Russo, 2006, Demography of aging across Asia, in: Handbook of Asian Aging, H. Yoon and J. Hendricks (eds.), Baywood Publishing, chapter 2.

Meier, Volker and Martin Werding, 2010, Ageing and the welfare state: Securing sustainability, CES-IFO Working Paper 2916.

Mohamed, Issam A.W., 2011, Challenges of formal social security systems in Sudan, MPRA paper 31611.

OECD Economic Outlook, 2007, Financing social protection: The employment effect, chapter 4.

Peeters, Marga, 2011, Demographic pressure, excess labour supply and public-private sector employment in Egypt – Modelling labour supply to analyse the response of unemployment, public finances and welfare, MPRA paper 31101.

Pissarides, Christopher A., 1998, The impact of employment tax cuts on unemployment and wages: The role of unemployment benefits and tax structure, *European Economic Review* 42: 155-183.

Van der Veen, Robert and Loek Groot, 2006, Post-productivism and welfare states: A comparative analysis, *British Journal of Political Science* 36: 593-618.

World Bank, Public expenditures reports.

Appendix A Data definitions and sources

Variable	*Definition, unity*	*Data source, year*
$AGE_{ret,off}$	Official retirement age, in years	OECD Society at a glance 2011
E	Employment number of people, in million of persons	OECD, 2009
er	Employment to working age population, ratio – for the developing economies	UN Millennium Indicators Database
GDP	Gross domestic product in purchasing power parity	IMF, World Economic Outlook April 2011
H	Average number of actual working, hours per year	OECD
	Number of persons per 5-year cohort, in million of persons	UN
	Public pension costs (old age and survivors), as percentage of GDP	OECD Society at a glance 2011
	Public spending on family, as percentage of GDP	OECD Society at a glance 2011
	Public spending on education	OECD
	Country information on public spending	WB, IMF

Note:
IMF = International Monetary Fund
OECD = Organisation for Economic Cooperation and Development
UN = United Nations
WB = World Bank
Detailed references to statistics' publications appear in the reference list.

Our databases are available upon request.

Appendix B Population structure per country

This appendix illustrates the population structure per 5-year cohorts for each of the countries in our empirical analyses for the years 2010 and 2050. We divide the countries into developing (Figure B1) and developed (Figure B2). The economies in the first group have a GDP per capita lower than 16,000 international US dollar (purchasing power parity) in 2010, which is around 12,000 euro.

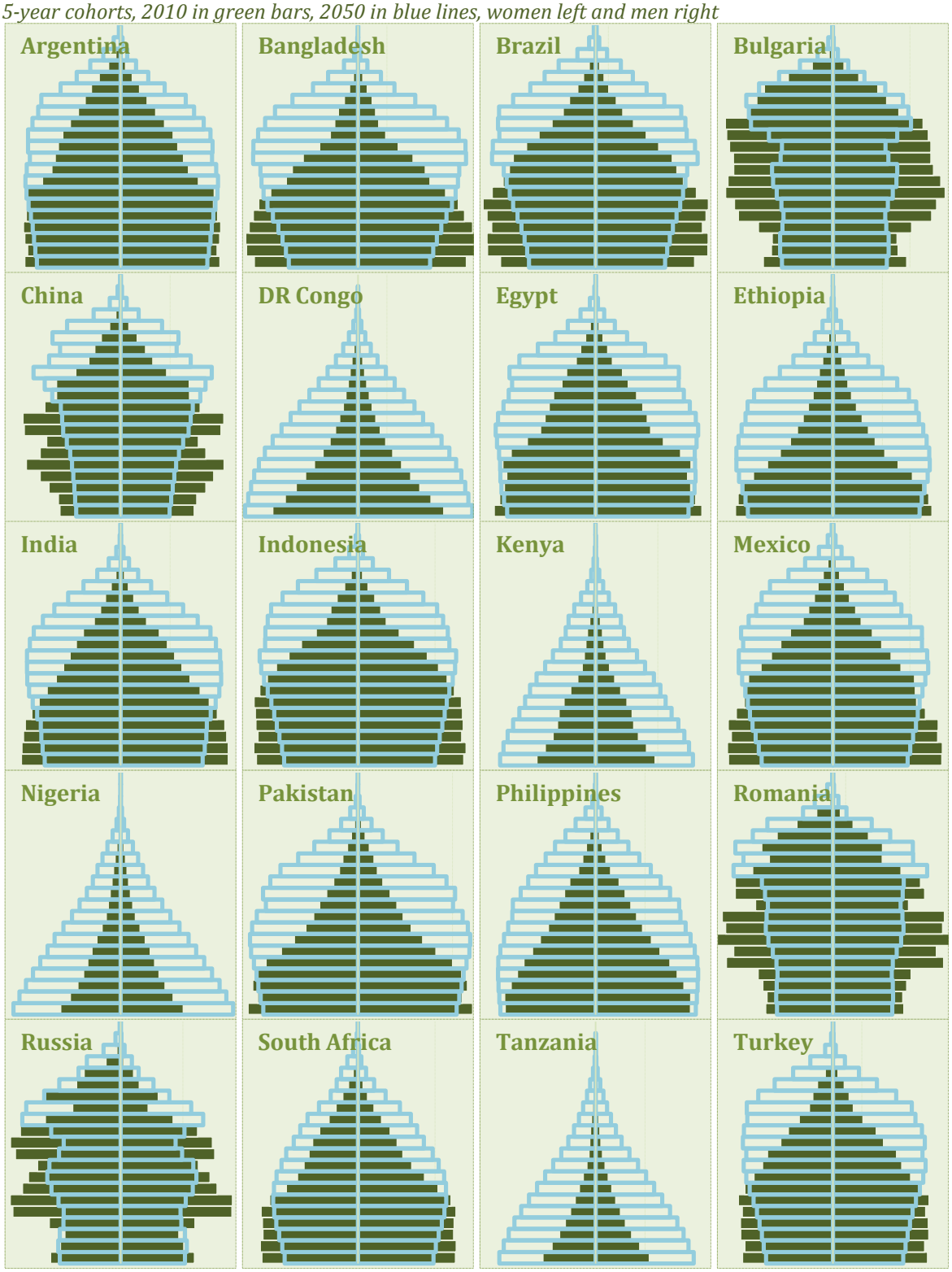
As follows from these figures, most developing economies have a pyramid structure in 2010 while the developed economies have a kite form with their broadest width around the age of 40 to 65 years.[6] Exceptions among the developing countries are Bulgaria and Romania and to a lesser extent China and Russia. Their demographic structure is not a pyramid, as the width of the younger cohorts is smaller than the width of the cohorts of the working age population. The African countries Democratic Republic of Congo, Kenya, Nigeria, Uganda and Tanzania also have a pyramid structure that widens significantly from 2010 to 2050, even at the youngest cohort of 0 to 5 years.

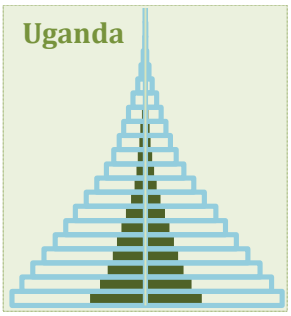
The figures further show that all these populations are ageing, as the cohorts of the old are wider in 2050 than in 2010. Note that due to rising life expectancy, the last cohort in 2050 (those above the age of 100+) shown in the graphs is no longer empty for almost all countries that we have under investigation here.

[6] One of the main economic consequences of a pyramid structure is the excess labour supply, see Bruni (2011) that analyses the case of China or Peeters (2011) that analyses the case of Egypt.

Figure B1 Population structure of the developing economies in 2010 and 2050

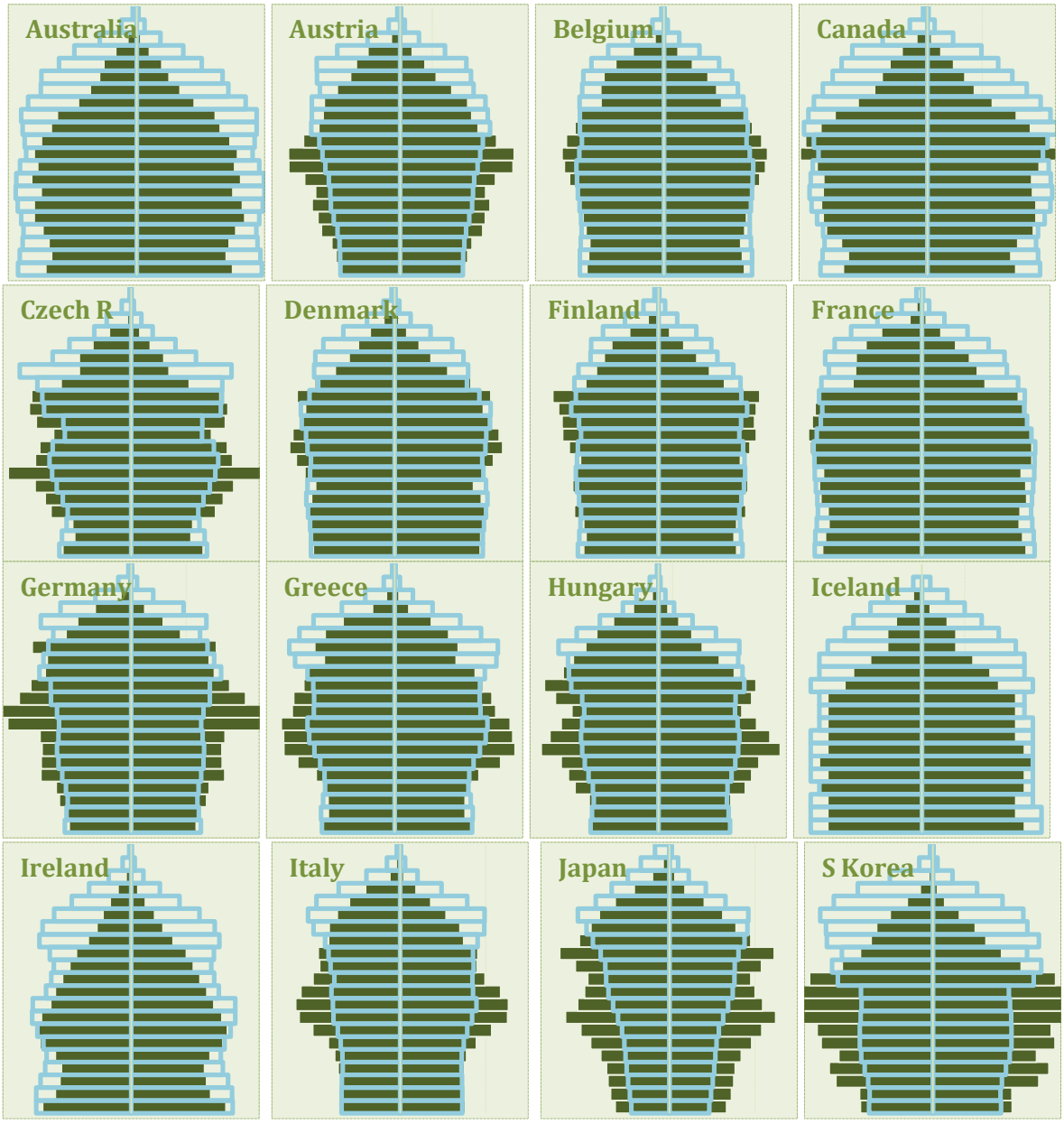
5-year cohorts, 2010 in green bars, 2050 in blue lines, women left and men right

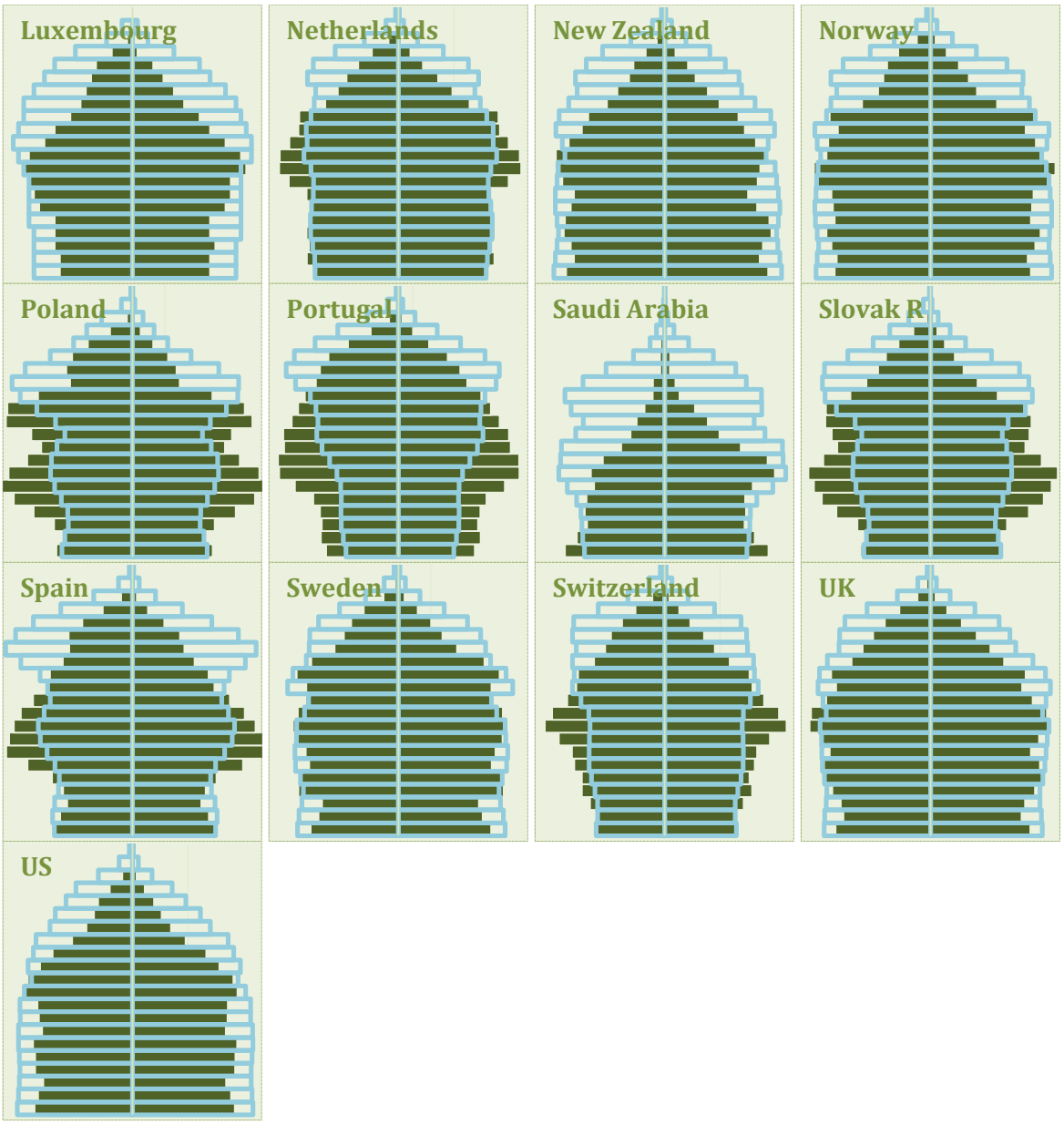




Source: Authors - based on projections by the United Nations Population Information Network, 2011.

Figure B2 Population structure of the developed economies in 2010 and 2050
5-year cohorts, 2010 in green bars, 2050 in blue lines, women left and men right

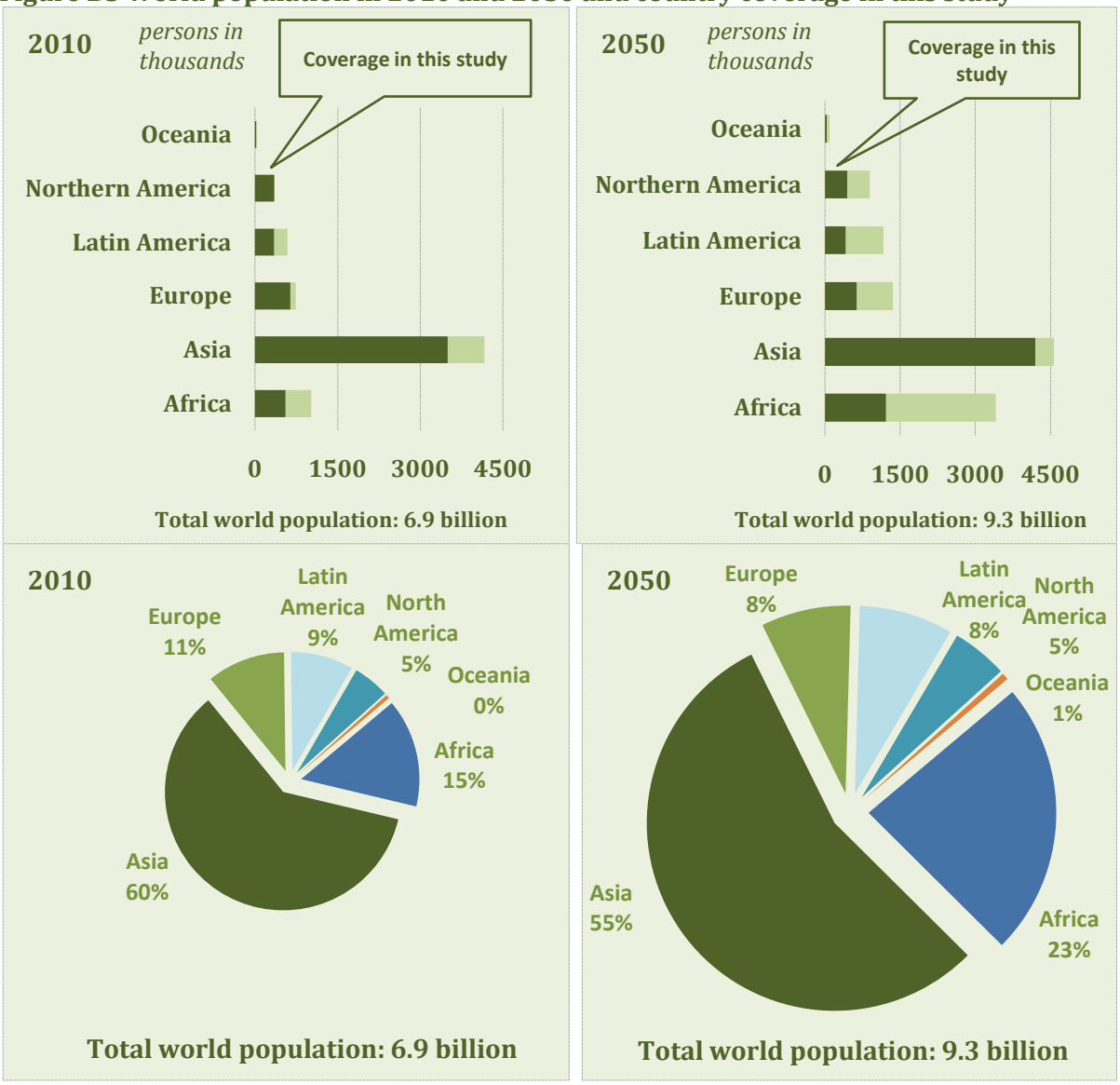




Source: Authors - based on projections by the United Nations Population Information Network, 2011.

These 21 developing economies and 29 developed economies cover 5.4 of the 6.9 billion people worldwide in 2010, which is 79% of the world population. We cover more than 50% of the population of Africa, Asia, Europe, Oceania and North and Latin America, as follows from Figure B3. Population growth during the period 2010-2050 is expected to grow fastest in Africa, in both absolute and relative terms and its world population share increases from 15% to 23%. In this period, the population share of Asia is expected to shrink 5%-points, from 60 to 55%. Europe shrinks 3%-points, from 11 to 8% (see Figure B3).

Figure B3 World population in 2010 and 2050 and country coverage in this study



Source: Authors - based on projections by the United Nations Population Information Network, 2011.

Appendix C The *ia*-ratio and pressure-to-space indicator

As follows from Figure 2, the total population of country *i* at time *t* equals the young, the working age and the old-age population,

$$YAP_{i,t} + WAP_{i,t} + OAP_{i,t} = POP_{i,t} \tag{A1}$$

Dividing both sides by the total population gives

$$yap_{i,t} + wap_{i,t} + oap_{i,t} = 1 \tag{A2}$$

which gives us, for a random country, the distribution of the young, old and working age normalized at one. We therefore normalise the area of the pyramid in Figure 2 to unity, which is convenient for the comparison of the population structures of countries irrespective of their population size.

We define the fraction of the working age population not engaged into paid work measured in full-time equivalents (*fte*) as the labour market space *s*. The population share of the *active* working age in *fte* can then be expressed as

$$wap_{i,t}(1 - s_{i,t})$$

and therefore the fraction of the *total* population that is inactive as

$$1 - wap_{i,t}(1 - s_{i,t})$$

for which reason the ratio of inactive to active (*ia*) ratio is equal to

$$ia_{i,t} = \frac{1}{wap_{i,t}(1 - s_{i,t})} - 1 \tag{1}$$

The indicator *pressure-to-space* was defined as

$$PtS_{i,t} := \frac{ypres_{i,t} + opres_{i,t}}{s_{i,t}}$$

which, using *(5)*, can be expressed as

$$Pts_{i,t} = \frac{yap_{i,t} * \varphi_{i,t} + oap_{i,t} * \theta_{i,t}}{s_{i,t}}$$

Space is country-specific but we assume it to remain constant over time. Moreover, we also fixed the country-specific per capita public expenditures relative to GDP per capita over time, so the equation above boils down to

$$PtS_{i,t} = \left(1 - wap_{i,t}\right) * \frac{\tilde{\varphi}_i}{s_i} \qquad (10)$$

by using (*A2*) and assuming an equal per capita cost for young and old relative to GDP per capita that we denote as $\tilde{\varphi}$. Besides pressure exerted by the young and old age, one might also be interested in the total pressure exerted by all the inactive persons, so including the non-working part of the working age population. The total pressure by the inactive persons per full-time active persons then follows as:

$$iapres_{i,t} = \frac{yap_{i,t} * \varphi_{i,t} + oap_{i,t} * \theta_{i,t} + s_{i,t} * wap_{i,t} * \gamma_{i,t}}{(1 - s_{i,t}) wap_{i,t}} = \frac{(1 - wap_{i,t}(1 - s_{i,t}))\breve{\varphi}_\iota}{(1 - s_{i,t}) wap_{i,t}} = ia_{i,t} * \breve{\varphi}_\iota$$

This indicator gives the fiscal pressure of all the inactive persons (in the numerator) relative to all active persons (denominator) and turns out to be proportional to the *ia*-ratio provided the generosity to the inactive can be summarized into a country-specific weighted variable ($\breve{\varphi}_\iota$).

In section 6, it was implicitly assumed that the non-working share of the workforce are not entitled to social benefits, since in the balance budget equation the tax revenues are used to finance public support to only the young and old:

$$t * wap_{i,t} * (1 - s_{i,t)} = \left(yap_{i,t} + oap_{i,t}\right)\varphi_{i,t} \Leftrightarrow \varphi_{i,t} = t * \frac{wap_{i,t}\left(1 - s_{i,t}\right)}{\left(1 - wap_{i,t}\right)} = t/ia_{i,t} \qquad (11)$$

This equation is the basis for the policy trade-off analysed in section 6 and illustrated in Figure 15. Therefore, given the optimal tax rate (or the politically feasible tax rate), the generosity that can be maintained to the young and old is inversely proportional to the *ia*-ratio. However, assuming that all persons belonging to the labour market space are entitled to public support does not fundamentally change the analysis. The balanced budget equation changes into

$$t * wap_{i,t} * (1 - s_{i,t}) = \left(yap_{i,t} + oap_{i,t} + wap_{i,t} * s_{i,t}\right)\varphi_{i,t} \Leftrightarrow \varphi_{i,t} = t * \frac{wap_{i,t}\left(1 - s_{i,t}\right)}{1 - wap_{i,t}\left(1 - s_{i,t}\right)} \qquad (11')$$

which gives a slightly different curvatures of the lines in Figure 15. However, it does not change the conclusion that there is a trade-off between maintaining public support to the non-working and maintaining labour market space.

Appendix D Inactive-active ratio and pressure young and old

This appendix presents the inactive to active ratios per country for all economies (Figure D1) and the pressure of the young and the old (Figure D2).

Figure D1 Inactive-active ratios per country

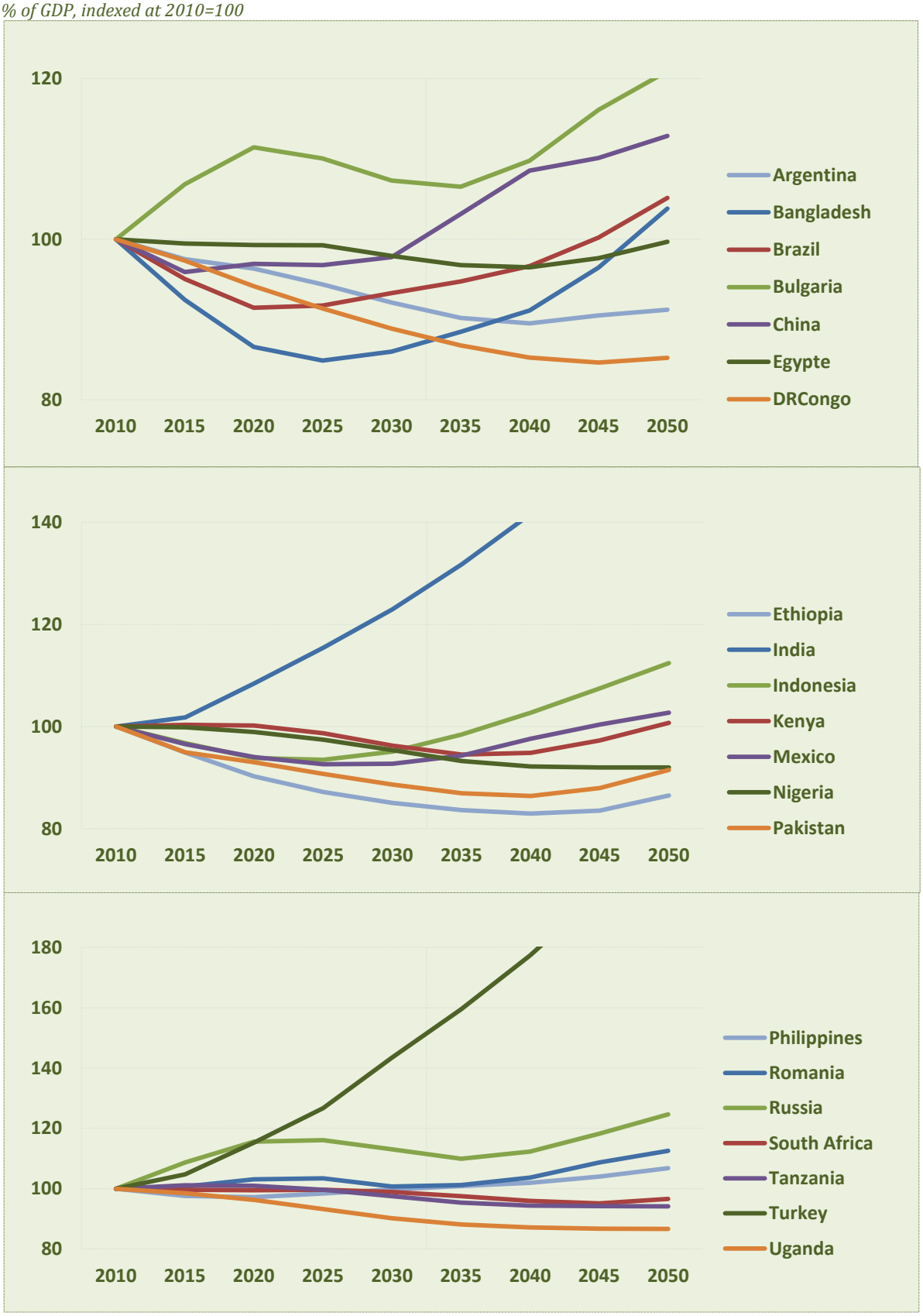
- *Continues on the next page*

- *- Continued from the previous page*

Source: Authors - based on projections by the United Nations Population Information Network, 2011.
Note: The *ia*-ratio is the number of persons below the age of 15 and above 65 in addition to those in the space as a percentage of the total employed persons.

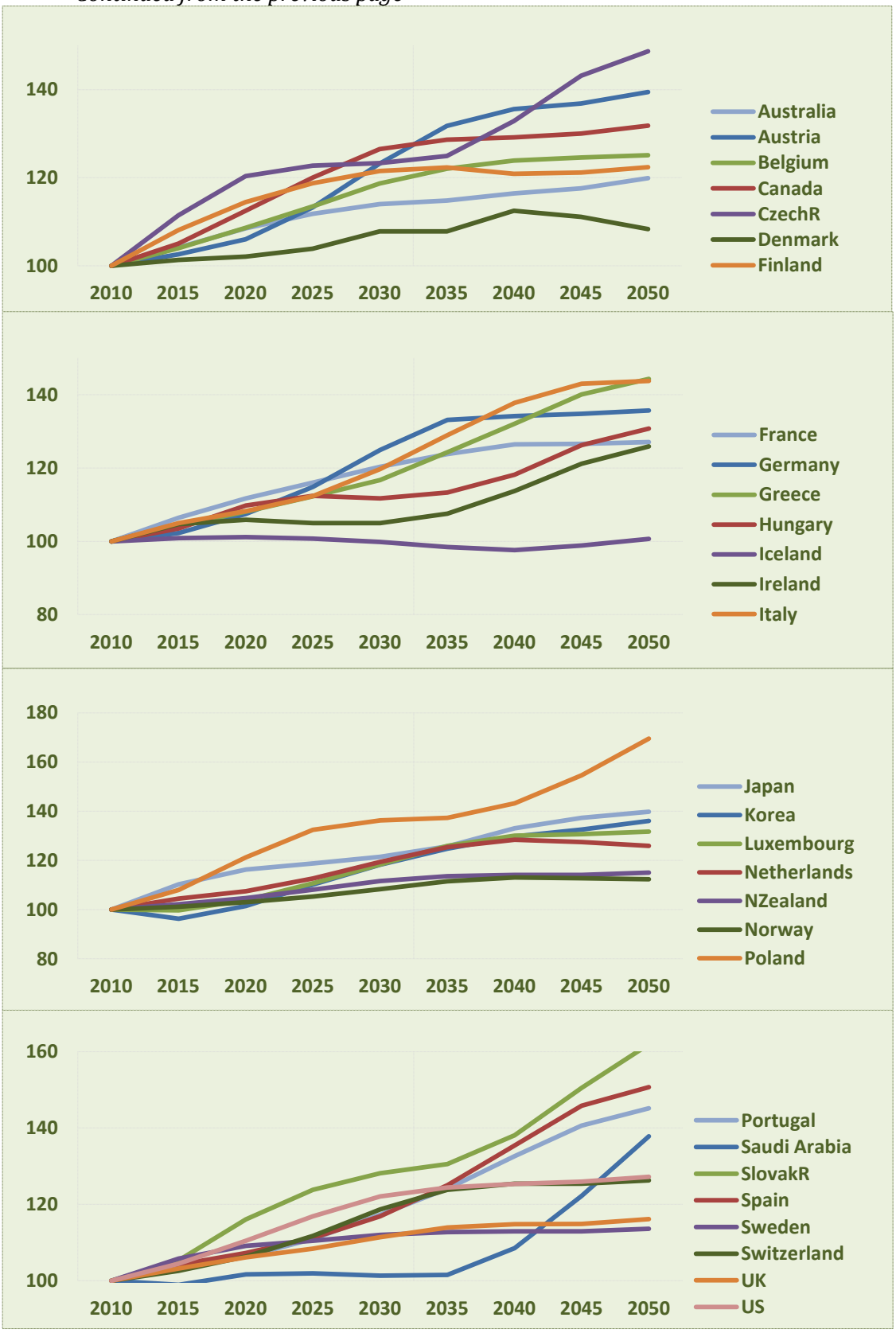
Figure D2 Pressure of the young and the old per country

% of GDP, indexed at 2010=100



- *Continued on the next page*

- *Continued from the previous page*



Source: Authors - based on projections by the United Nations Population Information Network, 2011.
Note: Pressure is measured as the sum of equations *(2a)* and *(2b)*.