Demographic Change Across the Globe

Maintaining social security in ageing economies

Marga Peeters and Loek Groot

Introduction

Fiscal pressure arising from rising public expenditure due to ageing populations is mounting in developed but also in developing economies. As the share of the workforce in the total population shrinks, workers become increasingly burdened with higher fiscal costs (pensions, healthcare, education and family costs). This paper relates public expenditure on the proportion of dependent people in an economy to the labour market situation, in view of the changing demographic structure. A key variable in our analyses is labour market space, defined as the directly available room in the labour market, and it comprises the people who are of working age and eligible for employment, but who are not working (full-time). The degree of fiscal pressure in an economy on the working population arising from demographic changes can be alleviated by using labour market space more optimally.

The process of projecting demographic change, although still an inexact science, depends on only a few key parameters (fertility, life expectancy

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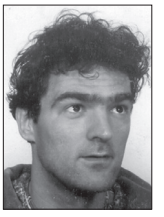

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and migration, see e.g. Bloom *et al.* 2007; Bloom & McKinnon 2010). In our analysis, we use UN projections up to the year 2100 and relate them to current labour market information. Our analysis covers 50 major countries, split into developed and developing countries, according to their level of GDP per capita. We cover 75% of the world population and our data set is described in more detail in Groot and Peeters (2011).

The aim of this paper is to investigate to what extent and when the sustainability of social security is at risk due to demographic change, in relation to available labour market space. Recently, a large number of studies have focused on the demographic challenge of ageing and the implications for public finances (see e.g. Bryant & McKibbin 1998; European Commission 2006; Lee *et al.* 2006; Börsch-Supan *et al.* 2008; Bovenberg 2008; Heller 2008; Horton *et al.* 2009; Galor 2010; Ley 2010; Bruni 2011). However, most studies do not pay explicit attention to the role of the unused potential in the labour market, which we have labelled as existing labour market space (see e.g. Andersen 2006, 2008; Hagist & Raffelhüschen 2011; among others). More labour market space gives an economy more room to manoeuvre. The distinction between developing and developed economies is crucial here. Developed economies on the whole are ageing more rapidly than developing economies. Moreover, they incur far higher family, education, health and pension costs per capita. We study both groups of countries and run scenario analyses to analyse the impact of increases in health and pension costs (for the developing economies) as well as a higher retirement age.

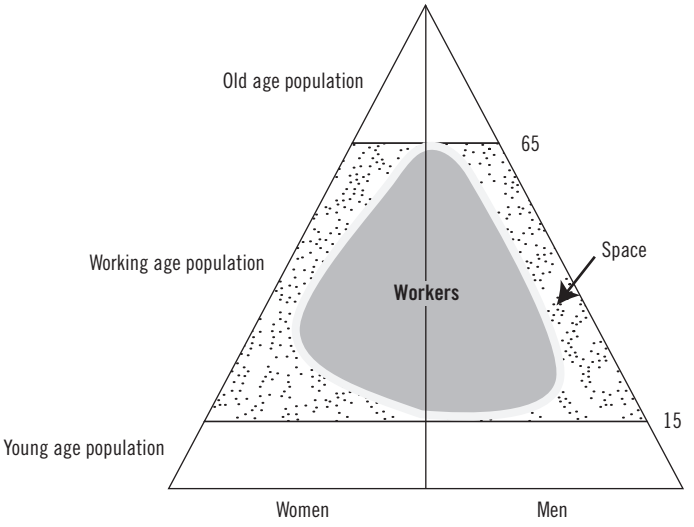
The outline of this paper is as follows. The first section specifies and quantifies labour market space, demographic pressure and the indicator *pressure-to-space*, which is used later on to rank countries. After that, we describe the main statistics, such as dependency ratios, pressure and labour market space, for the two groups of developing and developed economies, and also present the ranking measured by pressure-to-space across countries for several decades. Next, we report on empirical tests of the correlation between pressure and space in a cross-section analysis of the countries, as well as testing the causality between pressure and labour market space. The following section presents the results of a scenario analysis, and we conclude with some policy issues and suggest avenues for future research.

The pressure-to-space indicator

The indicator for *demographic-pressure-to-labour-market-space* specifies the fiscal pressure mounting from the dependent part of the population in relation to the non-working share of the working age population (see also Groot & Peeters 2011).[1]

As illustrated in Figure 1, we split the population of each nation into three categories: *young* people (*YAP*), defined as those under 15 years; *old* people, defined as those above 65 (*OAP*); and the *working age* population (*WAP*), defined as those between 15 and 65 years. The labour market space is the share of the working age population that is not working measured in full-time equivalents. According to this definition, people enter the labour market at 15 and leave it at 65, an assumption that we will loosen afterwards (see below).

Figure 1: Categorised population pyramid



Source: authors

Note: A population is divided into the young (*YAP*), old (*OAP*) and working age people (*WAP*), where the latter is divided into workers measured in full-time equivalents and those in the space (*s*). The surface area of the triangle is set to unity, so that $YAP + WAP + OAP = 1$.

[1] For country i at time t the pressure to space ratio is defined as

$$PtS_{i,t} := \frac{ypres_{i,t} + opres_{i,t}}{space_{i,t}} \quad (1)$$

with *ypres* and *opres* the fiscal costs of the young and the old population, respectively, and *space* the labour market space.

The number of young and old people, relative to the working part of the labour force, and the average government spending per old and young person defines the degree of fiscal pressure in an economy.[2] Fiscal costs on young people consist of family costs and education. Fiscal costs for old people consist of state pensions and healthcare costs. Labour market space depends on the employment rate and the average number of hours per worker.[3]

A vast number of factors determine whether a country has a high or low labour market space. Examples are the generosity and accessibility of social benefits, labour market rigidities (trades 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, and tax-induced financial incentives to paid work. In most Anglo-Saxon countries, with a lean-and-mean 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 larger labour market space, characterises other countries, mainly in continental Europe.

In our empirical analysis (see the next section) we set the maximum number of hours worked equal to 2,080 (=52*40) hours per year for the developed economies. Due to lack of data on working hours for the developing economies, the ratio of hours to the maximum number of hours

[2] The total fiscal costs thus have a volume and price effect. Denoting the nominal fiscal spending for each young person as *YG* and for each old person as *OG*, it follows that the two terms in the nominator in equation (1) are specified as

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

and

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

with *YAP* and *OAP* the number of young and old persons and *GDP* the nominal gross domestic product.

[3] Labour market space can be defined as the complement of the employment rate (*er*) weighted by the average number of working hours (*H*) of the employed relative to full-time maximum working hours (H_{max})

$$space_{i,t} := 1 - er_{i,t} \frac{H_{i,t}}{H_{\max}} \tag{3}$$

with the employment rate equal to the ratio of the number of employed persons (*E*) and the working age population (*WAP*)

$$er_{i,t} := \frac{E_{i,t}}{WAP_{i,t}} \tag{4}$$

is set equal to 1, and thus only the employment rate determines labour market space.

Each person between the age of 15 and 65 is part of the working age population. The employment rate incorporates the effect of early retirement, since the closer the effective retirement age is to the age of 65, the higher the number of employed. Note that unemployed and non-working disabled persons are part of the defined labour market space.

Some countries already face a high *pressure-to-space* and seem able to cope with it, probably because the fiscal costs (high pressure) are shouldered by many workers (low space). More salient are the economies that face a major change in pressure for the years to come. To alleviate the pressure and to cover additional fiscal costs resulting from coming demographic change, they can try to increase labour market participation by implementing labour market reforms. Labour market reforms are typically a process of piecemeal social engineering and take considerable implementation time. Even after the implementation of reforms, it takes time before the general equilibrium effects have become fully effective. Thus, the pressure variables at some future year T will be compared in this paper with the space variable at time t (today) in our empirical analyses, where the time gap $T - t$ equals a range of one up to nine decades. In measuring the change in fiscal pressure between time periods a simplifying assumption is that the cost of provision for dependent people, both young and old, although varying among countries, is held constant as a proportion of *GDP* per capita within a country over time.[4]

By assuming constant, but country-specific, generosity towards the young and old over time, the pressure variables reflect the changing fiscal burdens entirely due to changes in the age structure of the population.

[4] We measure the change in the pressure at time T in comparison with the pressure and space in period t as

$$\Delta_{T-t} PtS_i := \frac{\Delta_{T-t} ypres_i + \Delta_{T-t} opres_i}{space_i} \tag{5}$$

with $\Delta_{T-t} xpres_i := xpres_{i,T} - xpres_{i,t}$ $(x = y,o)$.

We keep the cost of young people and old people relative to *GDP* per capita (productivity), denoted by φ_i, and θ_i respectively, constant over time but country specific, so

$$\Delta_{T-t} ypres_i = \varphi_i * \Delta_{T-t} yap_i \qquad \Delta_{T-t} opres_i = \theta_i * \Delta_{T-t} oap_i \tag{6}$$

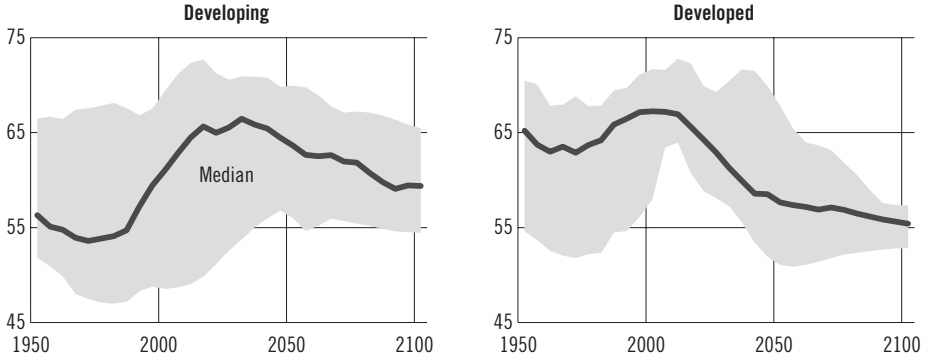
with *YAP* the share of the young and *OAP* the share of the old in the total population (see also Meier & Werding 2010).

Empirical analyses

Our empirical analyses concentrate on the main economies in terms of GDP and population worldwide. We include 50 economies, of which 21 are developing and 29 are developed, where the first are defined as countries with an average GDP per capita of less than €12,000 in 2010.[5] According to our calculations based on UN projections, the population in 2050 for these 50 countries will be 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 world's population of 6.9 billion. Figures 2 to 7 illustrate basic statistics for the group of developing and developed economies, where the line represents the median, and the area represents the range between the lowest and the highest value across the countries in each group per year. We treat each country as a separate case (*sui generis*) and the (un-weighted) median thus informs us about the position of the median country in each group.

Figure 2 shows that the median population share of the working age population (*WAP*) in developing economies has been increasing sharply, from 54% in 1970 to more than 65% in 2010. For the decades to come, the

Figure 2: Working age population as a percentage of the total population, 100 * (*WAP*/*POP*)



Source: Own calculations based on United Nations Population Information Network (2011)

[5] Developing countries included are Argentina, Bangladesh, Brazil, Bulgaria, China, the Democratic Republic of Congo, Egypt, Ethiopia, India, Indonesia, Kenya, Mexico, Nigeria, Pakistan, Philippines, Romania, Russia, South Africa, Tanzania, Turkey and Uganda. Developed countries included are Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Great Britain, Greece, Hungary, Iceland, Ireland, Italy, Japan, South Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, Saudi Arabia, Slovakia, Spain, Sweden, Switzerland and the United States of America.

expectation is that the *WAP* gradually falls as fertility rates slightly drop and as the population is ageing. In the median developed economy the decline of the *WAP* had already begun in 2000 and continues to fall up to 2100.

Figures 3a–3c show the young and old age dependency rates for the period 1950–2100. For both the developing and the developed economies, the median value of the young age dependency rate declines sharply (Figure 3a), while for the old age dependency rate it rises strongly (Figure 3b). The developed economies already reach an old age dependency rate of 45% in 2050. This is relevant for our study on fiscal sustainability as old people are more fiscally costly than are young people, in terms of state pensions and healthcare. While the developed economies age rapidly from 5.9 working age persons per old person in 1970 to only 2.4 in 2050, the developing economies move from 15.3 in 1970 to 4.6 in 2050. Ageing thus also takes place in the latter group, but it starts from a different level. The turn in the median of the total (young and old age) dependency rate has already taken place in 2000 in the developed economies, while for the developing economies it will not happen before 2040 (Figure 3c). The graph further shows that, while in the past the combined dependency rate was much higher in the developing countries, for the future it is the other way around (for the median developed country, it is expected to increase from 48.7 in 2000 to 73.4 in 2050).

To summarise, even under the assumption that relative costs on pensions, healthcare, family and education will remain constant in time, the fiscal burden increases due to the growing numbers of old and young relative to those of working age. The available space in the labour market thus becomes more important, as apart from rises in productivity only this space can be utilised to alleviate the pressure.

As Figure 4 shows, the median value for labour market space in the developing economies has hovered around 30% in the period 1990–2008. We have to recall here that due to lack of data we assumed that each working person in a developing economy has a full-time job, while we took information about average working hours per worker into account for the developed economies. In developed economies, part-time work, temporary leave (maternity, parental), longer educational careers and welfare programmes have contributed to a considerable share of the workforce not doing paid work. Labour market space in developed economies is on average hovering around 40% in the period 1970–2010 and the

Figure 3a: Young age dependency rates, 100 * (*YAP/WAP*)

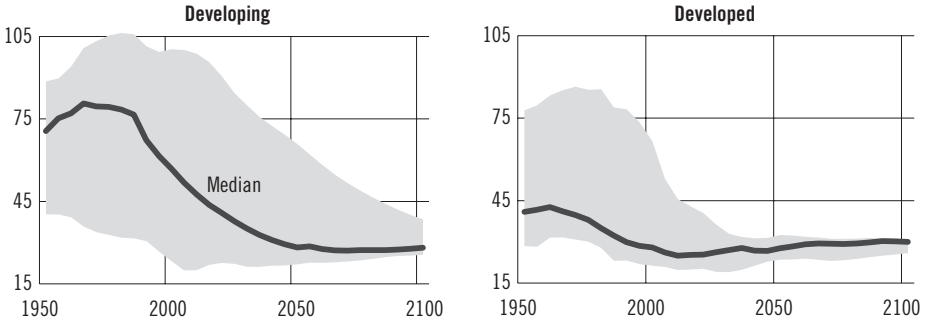


Figure 3b: Old age dependency rates, 100 * (*OAP/WAP*)

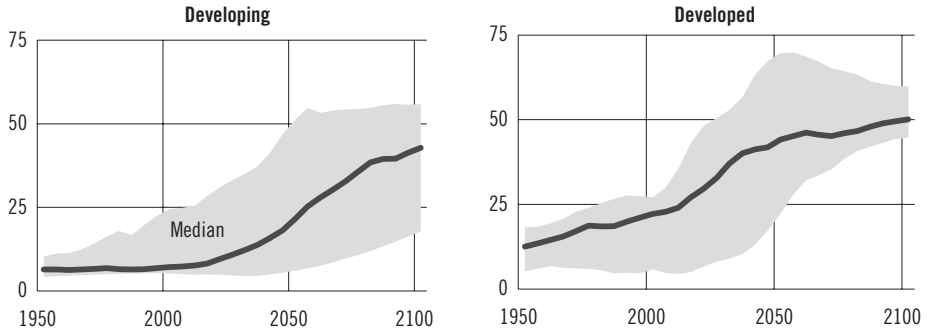
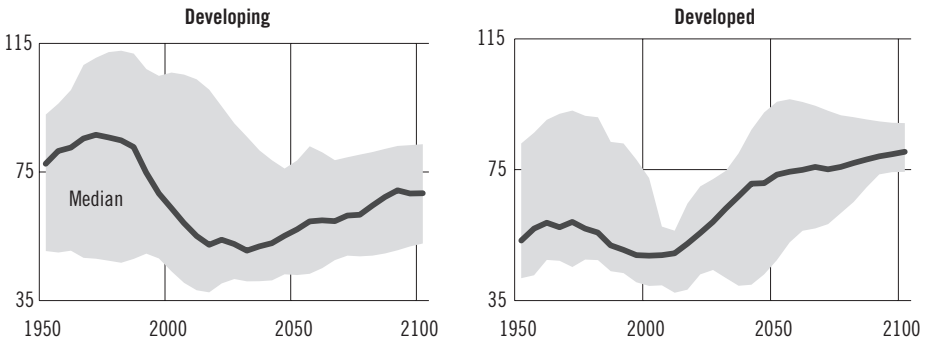
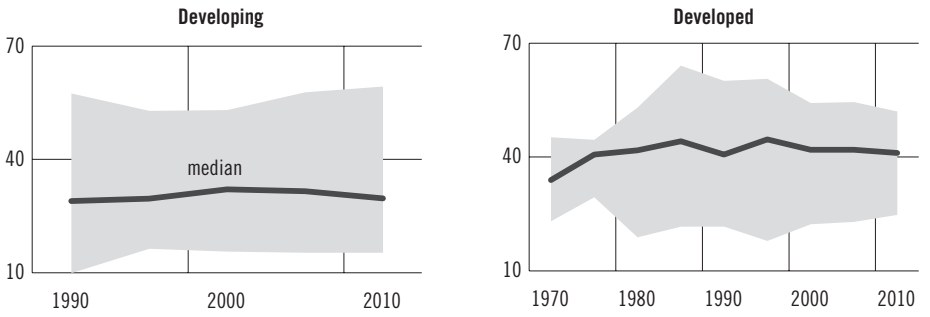


Figure 3c: Young and old age dependency rates, 100 * (*YAP + OAP/WAP*)



Source: Own calculations based on United Nations Population Information Network (2011)

Figure 4: Labour market space, 100 * space



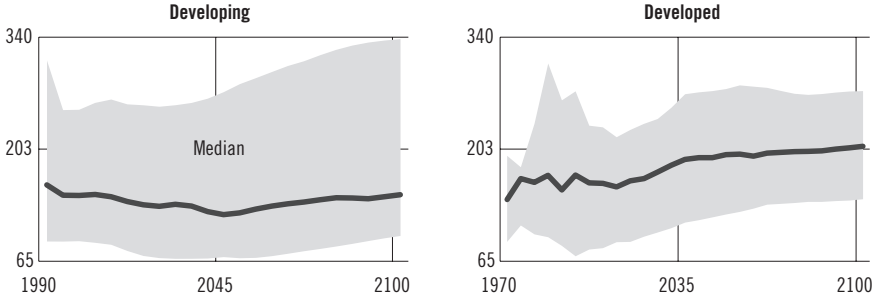
Source: Authors' calculations according to equation (3)

median value is rather constant, although there is considerable variation across countries.

Figure 5 shows the ratio of inactive to active persons up to 2100, where we keep the labour market space constant after 2010. These ratios are more than twice as high as the young and old age dependency rates, which justifies the inclusion of space in the analysis. For the median in the developed countries, after 2035 against every full-time worker there are two persons inactive.

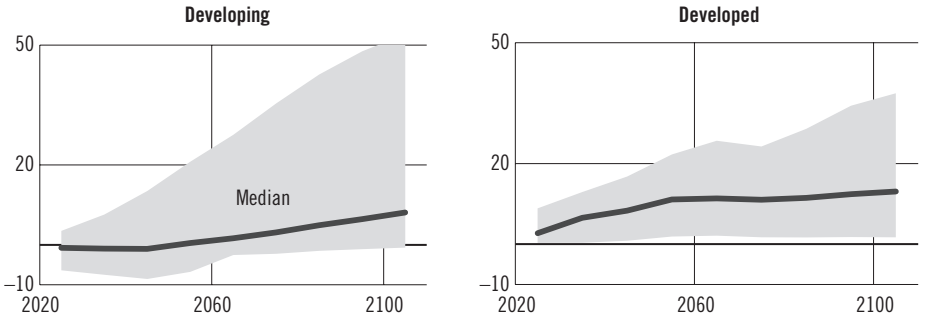
Now that we have shown pressure and space, we arrive at the focal point of our analysis, which is measuring pressure-to-space (Figure 6). Due to lack of information on fiscal spending for most of the developing

Figure 5: Inactive-to-active ratio, 100 * [(*YAP* + *OAP* + *s* * *WAP*) / ((1 – space) * *WAP*)]



Note: The space from 2010 onwards is kept constant.

Figure 6: Pressure-to-space of the old and the young (in percentage points of GDP related to the space in 2008)



Source: Authors' calculations based on UN POPIN and the OECD
Note: Equation (5) for 2020 in comparison with 2008, denoted as 2020–08, as also for 2030, 2040 and 2050 in comparison with 2008.

economies, we were forced to make some bold assumptions. We assumed the fiscal spending to GDP per capita to be equal to the lowest level among the set of developing countries for which we have reliable information, which is OECD-member Mexico (see the section entitled 'Cross-section and panel causality tests on pressure and space' for sensitivity analyses on this assumption). Since our focus is on the *change* in pressure, we measure deviations from the base level in 2008 for each decade starting in 2020 (space is in all cases measured in 2008, our latest realistic figures, as this is the year just before the global recession year).

Figure 6 pictures the change in pressure-to-space over time. For the developing countries, the median value becomes positive only after 2050. There are, however, developing countries in which the fiscal pressure rises 40% points in this period, in comparison to the space, as the range shows (Turkey). The picture is even more gloomy for the developed economies. The change in pressure-to-space is positive over the full range. Since we assumed space to be constant after 2008, this implies rising fiscal costs over the decades to come in comparison with 2008, *ceteris paribus*.

Figure 7 disaggregates the results for 2020–08 as shown in Figure 6, and presents the set of all countries with pressure on the horizontal axis and space on the vertical axis. Interestingly, the developed countries that belong to the same welfare regime type, cluster together (see Esping-Andersen (1990) and Van der Veen and Groot (2006) for a classification of countries). Most interesting for our analyses are the

Figure 7: Demographic pressure of the young and old versus labour market space (pressure in %-points of GDP and space in %)

Source: Authors' calculations

Table 1: Rankings of the changes in pressure-to-space of the young and the old

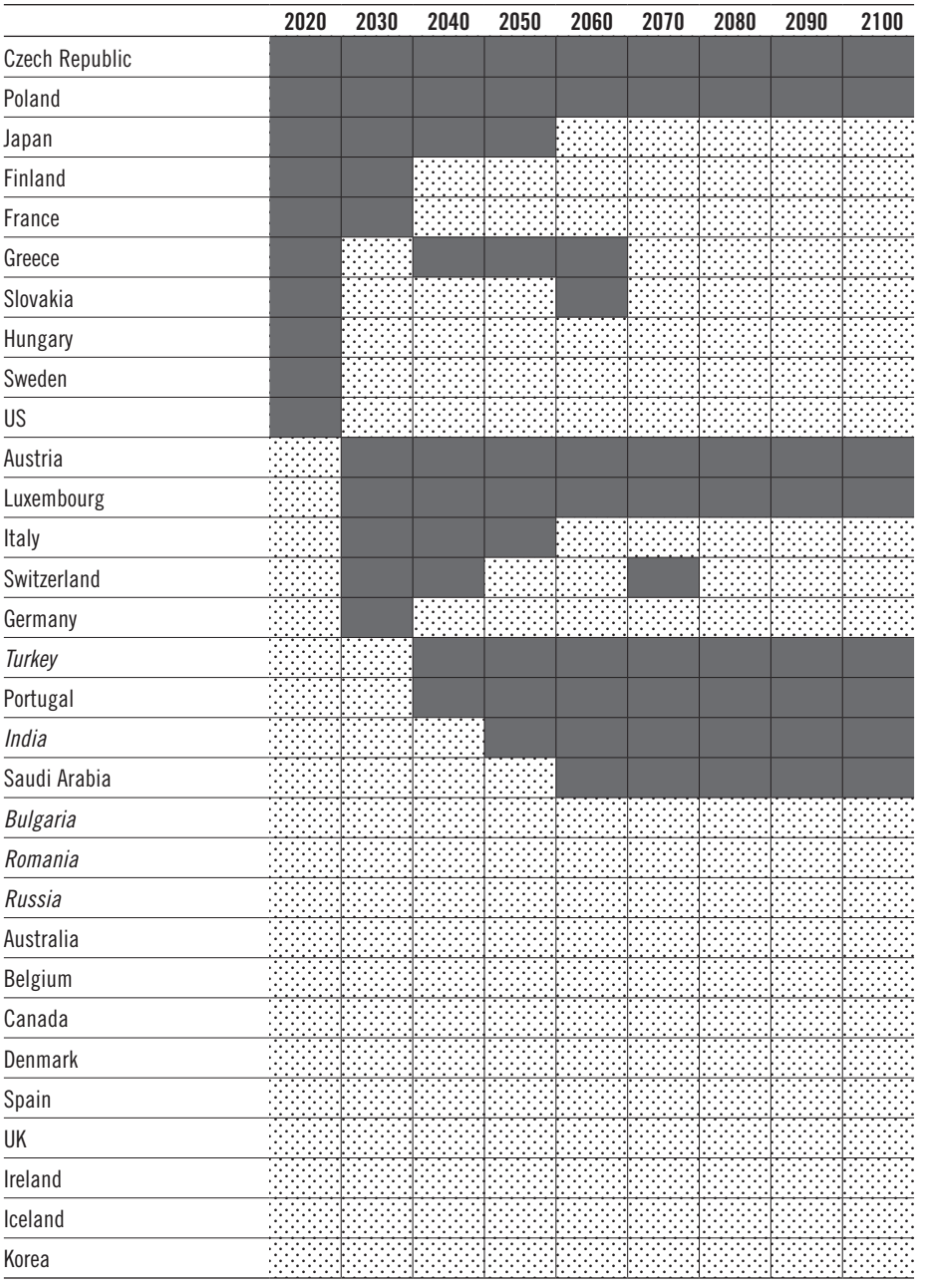


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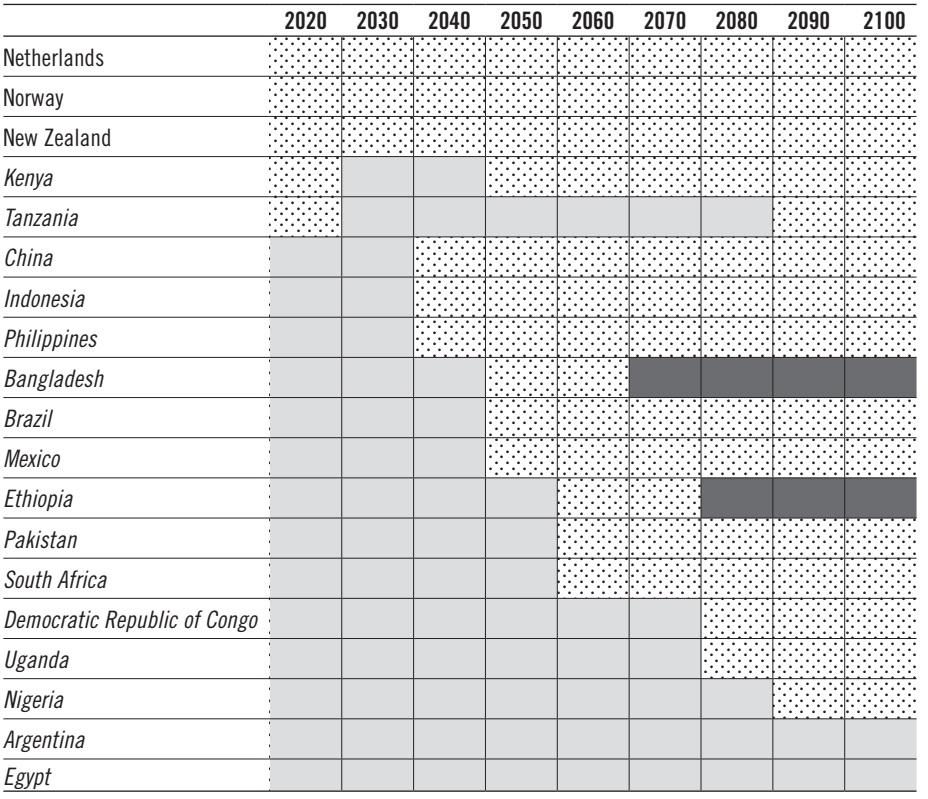
Table 1: Rankings of the changes in pressure-to-space of the young and the old (continued)



Note: Authors' calculations according to equation (5). No healthcare costs are included. Developing economies are in *italic*. Dark tint indicates that the country ranks in the top 10 of the year. Light tint indicates that the fiscal pressure decreases in comparison with 2008. Dotted pattern is the case in between.

countries at the right side. Here you find the countries with the highest change in pressure, such as Japan, the Czech Republic and Poland, but varying in the amount of their space (see also Jarret (2011) on Poland).

From 2008 to 2020, Poland faces an increase in fiscal pressure of almost 4%. In contrast, the demographic dynamics in all developing economies, except India, are expected to lead to no extra, or even to decreasing, fiscal costs (see e.g. Mason *et al.* (2006) on Asia). The wide variety in fiscal pressure, from –1.5% to 4.0%, together with the huge variety in labour space, ranging from 15 to 60%, underlines the diversity of the economies in fiscal and labour market aspects. This scatter plot suggests a positive correlation.

If this relation is indeed significant, it is good news as economies facing increasing pressure currently have more labour market space as well, and the latter can then be used to alleviate rising fiscal costs per capita (see also the next section).

In order to see the evolution over time, Table 1 shows the *change in the pressure-to-space indicator* for each decade from 2020 to 2100. Note that since we assumed both space and relative expenditures to young and old constant due to the lack of further information, the change in pressure-to-space is driven entirely by demographic changes. We categorised the rate of change in the indicator into high (dark tint), medium (dotted), and no or low change (light tint). For instance, the Czech Republic ranks highest as its fiscal expenditures are expected to grow strongly in comparison with 2008 and its labour market space is relatively low. Japan scores red until 2050, but afterwards the change in pressure-to-space compared to the base year is in the medium range (see also Horioka 2010). Turkey, Portugal, India and Saudi Arabia move in the opposite direction. Further down the table, some changes are even more substantial. For instance, there is Bangladesh, which moves from a low-change situation until 2040 into a high-change situation in 2070. Egypt is one of the countries with a low pressure-to-space for this whole period (see also e.g. Peeters 2011).

In the countries where pressure is increasing in the near future, policy-makers might feel a sense of urgency to adapt either government spending or labour market policies to accommodate additional costs. In the section entitled 'Cross-section and panel causality tests on pressure and space', we statistically test whether the change in pressure in the near future is somehow related to the level of labour market space now. As stated, Figure 7 suggests a positive correlation between change in pressure and space.

Cross-section and panel causality tests on pressure and space

So far we have focused mainly on the median country among the set of developing and developed countries. However, we also saw that there is considerable variation among countries. Now we want to make use of this variation to see if there is any relationship between labour market space in 2008 and the change in pressure from 2010 to 2020 (see Figure 7).

An econometric test was carried out and is discussed in the Appendix. The results of this static analysis indicate that, in our sample of 50 countries, the more that pressure rises between 2010 and 2020, the higher the level of space will be. This is good news. Pressurised economies can use this greater amount of space to adjust their labour markets in order to keep the fiscal costs under control.

However, one may wonder whether or not countries are forward looking enough in their policies, and if present and past measures have been taken in view of demographic changes anticipated in the near future. As a short-term solution, highly pressurised countries might increase labour market participation by stimulating more people to work full-time instead of part-time, inserting more of the unemployed in the working labour force or by discouraging early retirement. In all these situations, the labour market space narrows. The mounting fiscal pressure exerted by the dependent population in the near future is then *causing* space to be lower.

To test for this dynamic causality, running from pressure to space, we performed an econometric panel analysis, as discussed in the Appendix. The results suggested that labour market space does not change in anticipation of future (or past) increases in pressure. The outcome that countries facing increasing pressure tend to have more space of the static analysis still holds, but from a dynamic perspective it cannot be concluded that countries expecting an increase in pressure already anticipated this by reducing their space. Note that both outcomes are still consistent with each other.

Scenario analyses

In our baseline scenario, the median old age pressure is 1.6% of GDP in 2020 in the developing countries and 7.8% in the developed economies (Table 2). The range within each group in 2020 is broad (see Figure 3b), varying from 0.6% of GDP to 8.2% of GDP for the developing, and from 2.1 to 15.7% for the developed economies. Of course, our projections are surrounded by great uncertainty, if only because policy measures will make the actual outcomes deviate from baseline projections. We will focus on two such policies: public healthcare policy and adjustment of the official retirement age. Public health costs are highly relevant as in ageing

Table 2: Scenario analyses

	Developing	Developed
Baseline old age pressure – in % of GDP		
2020	1.6 (0.6; 8.2)	7.8 (2.1; 15.7)
2050	3.0 (1.2; 20.1)	11.9 (3.7; 22.6)
Including health costs – old age pressure in deviation from the baseline, in % points		
2020	2.5 (0.0; 5.2)	6.5 (4.0; 7.2)
2050	4.6 (0.0; 10.8)	8.3 (9.0; 8.5)
Higher pension costs for the developing economies – old age pressure in deviation from the baseline, % points		
2020	5.5 (5.5; 0.7)	
2050	11.5 (7.1; 1.2)	
Working age population increased by 5 years – space in deviation from the baseline, % points		
2008	3.4	4.2
Working age population increased by 5 years – old age pressure in deviation from the baseline,% points		
2020	–0.6 (–0.2; –3.4)	–2.1 (–1.0; –3.9)
2050	–1.1 (–0.4; –6.4)	–2.4 (–0.9; –4.2)

Source: Authors' calculations
Note: Medians of the country groups, minimum and maximum are given in brackets.

societies the demand for healthcare is expected naturally to rise. Based on anecdotal evidence from developed economies, we assume that the old aged are responsible for a share of 80% of national health costs. As Table 2 shows, including healthcare costs means that the median old age costs almost double in value. In comparison with the baseline, they increase by 2.5% for the developing and by 6.5% points of GDP in 2020 for the developed economies.

In view of the retiring 'baby boomers' and the rising longevity of people in general, many countries have already raised their official retirement age, which broadens the working age population and reduces the number of people dependent on a pension income (see Brooks 2000; ILO 2010; Kent *et al.* 2006). Information about public pension costs for

developing economies is scarce, so we relied in our baseline scenario on the OECD statistics for Mexico. We equated the public pension cost per old age relative to GDP per capita for developing economies with no information on pensions to the Mexican level, which spent 1.4% of GDP on pensions in 2009. On the one hand, some economies classified as 'developing' will face lower public costs because their elderly, in the absence of public pensions, are taken care of by their relatives. On the other hand, other countries may incur higher costs, especially if future economic growth is used to provide income protection for the elderly. For the scenario analysis, we picked Turkey, the only other OECD member among the developing countries, which spent 6.1% of GDP in 2008, and take this as our measure for all developing economies. The old age pressure increases on average with 5.5% points in 2020 and 11.5% in 2050, in comparison with the baseline (Table 2). While only Turkey and India figure high in the pressure-to-space ranking (Table 1), higher pension costs for developing economies to this extent will lift more developing economies higher up in our pressure-to-space ranking, surpassing some developed economies. This scenario shows that, if public pensions become more prevalent in developing economies, the associated costs can be significant.

Raising the retirement age has two direct effects. First, it broadens the working age population. Second, less money is paid out in pensions. To show the impact, we simulate that the working age population is broadened from people in the range of 15–65 years to those in the range of 15–70 years. Working five years more implies receiving a state pension five years later. The median labour market space in the developing economies increases in this case by 3.4% of the working population (we assume all in between 65 and 70 years of age are not working), while the median old age pressure decreases 0.6 percentage points in 2020 and 1.1 in 2050, in deviation from the baseline (Table 2). As the developed economies age faster, their working age population increases in 4.2% full-time equivalents. In this scenario, fiscal pressure is alleviated by more than 2% points of GDP in comparison with the baseline. This is no small amount of money, since the pressure from ageing decreases by 27% (2.1/7.8), while the median space increases by 10% (4.2/41). Note that here we even did not take into account other effects that raising the retirement age will have, i.e. increasing the number of workers and thus broadening the tax base.

Summary, policy conclusions and future research

As this study shows, the population share of those of working age in the economies under investigation will decrease for decades to come (Figure 2), while dependency rates will rise (Figure 3). We used an indicator, called *pressure-to-space,* to rank the fiscal pressure induced by demographic changes in relation to the labour market space. According to this measure, the pressure is mounting most in the developed economies (especially Poland, the Czech Republic and Greece), while the majority of the developing economies rank at the bottom of the list. However, in some developing economies (notably Turkey and India) the pressure is mounting quickly. Moreover, we show that when old age costs per person are pitched at the level of Turkey, developing economies will even surpass some developed economies in the ranking list.

Methodologically the *pressure-to-space* indicator is tailored to identify how countries perform in comparison with their peers. From a macroeconomic policy point of view, the change in this indicator over the course of time is more relevant. Our panel data analyses show a large explanatory power of 90% of the labour market space for the set of 50 countries during 2000–20 with the inclusion of fixed country and time effects. This implies that idiosyncratic country and time effects explain the labour market space well. Moreover, in the cross-country sample the relationship between the change in pressure during 2010 and 2020 and the labour market space in 2008 is positive and significant. Countries facing increasing pressure have thus the option to use the available space in the labour market. One such instrument is the official retirement age. Increasing the retirement age from 65 to 70 reduces old age pressure by almost 30% in the developed economies, while labour market space at the same time increases by 10%.

We found no evidence that countries have already started reducing their labour market space in anticipation of the rising fiscal pressure in the near future. Our econometric analyses thus show no significant causality running from the projected rise in fiscal pressure of the old or of the young to the current labour market space, neither for the developing countries nor for the group of developed economies. This implies that the projected

demographic change has not (yet) triggered labour market reforms aimed at higher labour market participation.

Future research should also include migration, accumulated public debts and the net international investment position. Alongside reducing space, the immigration of young workers, a low public debt and a high net international investment position might help to limit the rise in the fiscal burden in the transition to ageing economies.

Appendix

Running a univariate ordinary least squares (OLS) regression, splitting the pressure exerted by the young and the old, gives

$$\underset{}{space_{i,2008}} = \underset{}{0.33} + \underset{(15.5)}{0.07} * \Delta_{2020-10} ypres_i + \underset{(2.59)}{0.05} * \Delta_{2020-10} opres_i \quad \underset{(3.44)}{}$$

with the countries denoted by subscript $i = 1,2 \ldots 50$ and an adjusted goodness-of-fit $R^2_{adj} = 0.32$. According to the t-values shown in brackets, both the change in pressure of the young and the pressure of the old is highly significant and positively correlated with the level of labour market space. The reaction coefficient of the pressure of the young is 0.07 and of the old 0.05. This implies that a country with a 1% point higher change in pressure of the young as a percentage of GDP in comparison with another country has a larger space of 7%. A country with a 1% point higher change in pressure of the old has a 5% larger space than its peers.

To test for dynamic causality, running from pressure to space, we performed an econometric panel analysis. This accounts for the cross-section of 50 countries followed over a number of years. The time series dimension that we use for the space for each country covers 2000–10 as this is the period for which we have data points for each country. Only each fifth year is included due to the availability of the UN data on demographic developments. Because we take first differences of the future values in the pressure variable, it implies that there are three data points in time: 2000, 2005 and 2010 (2010–00, 2015–05 and 2020–10 for

the pressure). The sample is thus balanced as each variable is observed at each point in time.

We run an OLS-regression of the labour market space on the change in young and old age fiscal pressure. The latter is observed at $t + 10$ in deviation from t, which we denote alike in the subscripts of the explanatory variables. We tested extensively whether random or fixed effects are significant. It turns out that the fixed effects deliver *adjusted* R^2s of more than 90%, while the random effects get us only to 30%.

Table 3 reports the estimated results for the full sample, for the group of developing economies and for the group of developed economies. It shows that neither the change in young nor in old age pressure affects the current level of space for the full sample of 50 countries. Splitting the sample into developing and developed economies does not alter the results much. We also experimented with five-year differences, with past changes in pressure and the levels of pressure, but none of these gave us significant parameter estimates for the pressure variables. We thus conclude that labour market space does not change in anticipation of future (or past) increases in pressure. The outcome that countries facing increasing pressure tend to have more space of the static analysis

Table 3: Panel regression results for the causality from pressure to space

	All countries	Developing	Developed
$ypres_{i,t+10} - ypres_{i,t}$	0.001 (0.20)	–0.003 (–0.25)	0.007 (1.21)
$opres_{i,t+10} - opres_{i,t}$	0.004 (0.54)	0.05 (1.62)	0.001 (0.09)
Constant	0.37** (53.4)	0.31** (28.5)	0.40** (51.8)
Adjusted R^2	0.96	0.94	0.96
Fixed country dummies	Significant	Significant	Significant
Fixed time dummies	Insignificant	Insignificant	Significant
Number of countries	50	21	29
Number of observations	150	63	87
Sample	2000–2010	2000–2010	2000–2010

Source: Authors' calculations
Note: The dependent variable is $space_{i,t}$. The t-values denoted in brackets. One star indicates that the included explanatory variable is significant at the 5% level.

still holds, but from a dynamic perspective it cannot be concluded that countries expecting an increase in pressure already anticipated by reducing their space. Note that both outcomes are not inconsistent with each other. After all, in case the current space was reduced in reaction to rising fiscal costs in the future, the relationship in the static test was not significantly positive.[6]

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[6] This follows from the *pressure-to-space* indicator as the denominator falls in case of a reduction in space. High levels of the *pressure-to-space* indicator could therefore also indicate that countries already decreased their space in response to the pressure. But our causality tests here reject this thesis.

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