

PART II

Chapter 8

Population Structure, Employment and Productivity

The composition of the working-age population can influence aggregate employment and average productivity because both employment rates and productivity levels vary across population groups. This chapter assesses the quantitative importance of the working-age population broken down by age, gender and education in explaining differences in employment and productivity levels across countries. Differences in population structure are found to contribute importantly to variations in both labour utilisation and productivity performances. Combining these mechanical effects, differences in the composition of the working-age population account for around a third of the gap in GDP per capita for Europe (EU15) relative to the United States, mainly due to differences in educational attainment.

Introduction

The young, the old, women and the lower-educated often have a weaker attachment to the labour market than prime-age and higher-educated males; when in work, the young and lower-educated also have lower productivity. As a result, the composition of the population and the labour force can influence the aggregate labour market and productivity outcomes: countries where a large share of the working-age population is young or has low educational attainment can be expected to have lower aggregate employment rates and be less productive than countries where the shares of the prime-age population and the higher-educated are high. At the same time, countries with high employment rates may employ low-productivity workers more intensively, thus depressing average productivity levels. Conversely, low employment rates may be associated with low-productivity individuals not participating in the labour market, thereby raising average productivity as measured with output per hour worked.

This chapter assesses the quantitative importance of differences in the composition of the working-age population for cross-country variations in aggregate labour utilisation and productivity levels, and thus GDP per capita.¹ To this end, the chapter breaks down the working-age population of each OECD country into 30 groups (defined by age, gender and education), and calculates the mechanical impact on aggregate employment and average productivity if each country had the same group-specific population structure as in the United States. This procedure allows a decomposition of employment and productivity gaps between countries into differences due to the composition of the population and to effective performance.² In addition, and for given population structures, the chapter calculates the effect on average productivity of assuming group-specific employment rates to equal those of the United States.

The main findings of the analysis are as follows:

- Differences in the structure of the working-age population, especially as regards educational attainment, account for around a third of the employment rate gap, or about 2 percentage points, between Europe (EU15) and the United States, with significant heterogeneity within Europe between low and high-employment countries. In Korea, Japan and Norway, the population structure is more favourable to employment than in the United States.
- Aligning each country's working-age population structure with that of the United States would reduce the gap in output per hour worked *vis-à-vis* the United States, by around 4½ percentage points on average across OECD countries and by as much as 5 percentage points for Europe (EU15). Turkey, Mexico, Portugal, Italy, the Czech Republic, the Slovak Republic and Greece would record productivity gains in excess of 10%. Again, differences in educational attainment across countries account for most of these effects.
- Combining these mechanical effects on employment and productivity, the difference in the composition of the working-age population accounts, on average, for 6 percentage points of the GDP per capita gap *vis-à-vis* the United States, and for 7 percentage points

for Europe (EU15). This should be seen in the context of overall gaps in GDP per capita of about 40 and 25 percentage points, respectively. For central European countries, Turkey and Mexico, where gaps exceed 50 percentage points, they would narrow by around 10 percentage points.

- Over and above the effect of population structure, most low-employment countries tend to have a relatively small share of low-productivity workers in the workforce. Hence, the current employment-rate structure in these countries artificially boosts measured productivity compared with the United States. In Europe (EU15), average labour productivity is raised through this labour composition effect by about 1½ per cent.
- The diagnosis underlying the selection of policy priorities in *Going for Growth* is not seriously affected by the above adjustments. This is because the adjustments do not have major effects in shifting countries' areas of good and bad performance as they contribute to GDP per capita.

Population structures across OECD countries

Population structures differ across countries both as regards the proportion of people of working age (15-to-64) in the total population, and as regards the composition of the working-age population (Figure 8.1).³ Thus, the share of the working-age population in total population ranges from 63% in Mexico and the United Kingdom to more than 70% in Korea, the Czech Republic and the Slovak Republic.⁴ As concerns the working-age population, its structure differs markedly across countries, except in the gender dimension:⁵

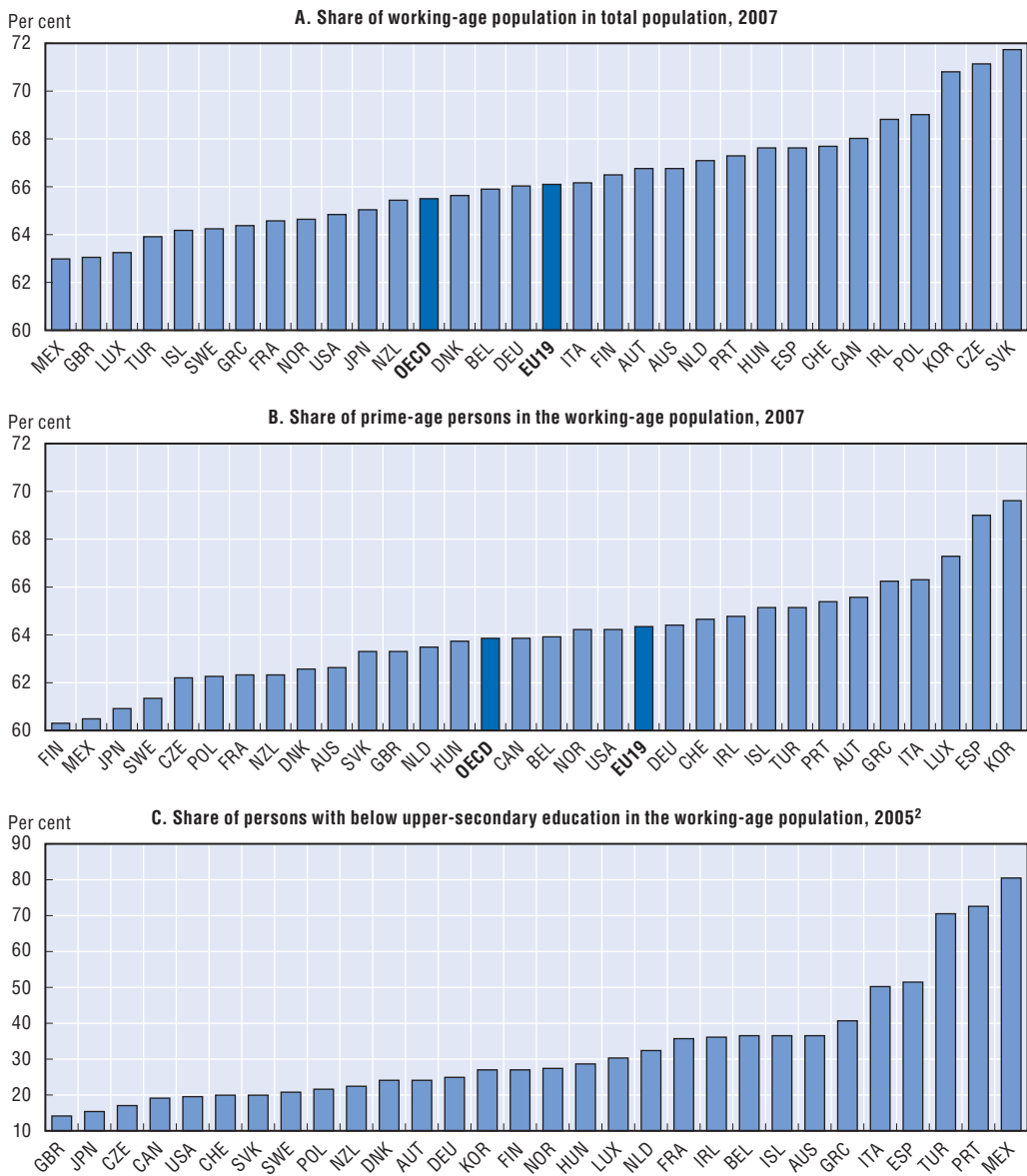
- Differences are important along the age structure, with the prime-age population (25-to-54) representing 60 to 70% of the working-age population depending on the country; the share is comparatively low in Finland, Mexico, Japan and Sweden and relatively high in Korea, Spain and Luxembourg.
- The largest variations are along the education dimension. The share of working-age persons with below upper-secondary education varies from some 15% for the United Kingdom and Japan to 40% or (considerably) above for Mexico, Turkey and the southern European countries.⁶

Working-age population structure and employment performance

Differences in employment rates across population groups are consistently observed in OECD countries.⁷ This might to some extent reflect institutional factors and disincentives embedded in government policies, but their consistent pattern across OECD countries suggests that some groups may have an inherent disadvantage to being employed. Therefore, population structure could be an important determinant of aggregate employment outcome.

Specifically, the employment rates for the lower-educated, the old and female workers are notably below the average in almost all OECD countries (Figure 8.2; this is true also for the young, not represented in the figure). Moreover, countries like Canada, the United Kingdom and the United States that have a good overall employment record have an employment rate for the low-educated group that is below or very close to the OECD average (56%). They have, however, a small share of individuals with below upper-secondary education (see Figure 8.1, Panel C).

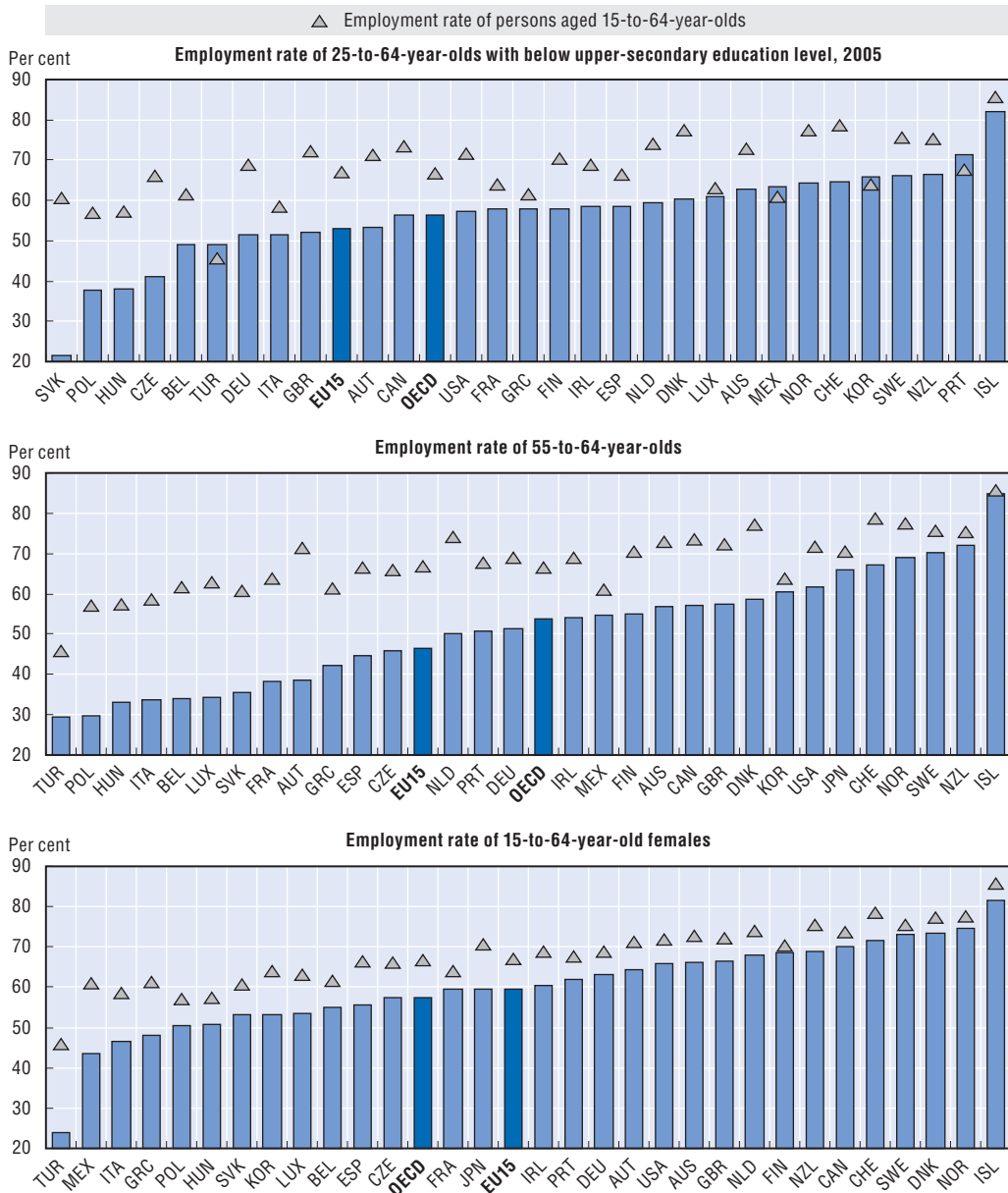
Figure 8.1. Differences in population structure across OECD countries¹




1. The working-age population refers to the population aged 15 to 64, the prime-age population refers to the population aged 25 to 54.
2. For Poland and the United Kingdom, this share might be significantly under-estimated as it excludes the “ISCED 3C Short” programme that is at the limit of the lower/upper-secondary level. “ISCED 3C Short” represents 34% of the working-age population in Poland, 19% for the United Kingdom in 2005; Iceland comes third with only 7%.

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The difference in countries’ total employment rates *vis-à-vis* that of the United States, can be broken down into a component due to differences in working-age population structure and another component reflecting the employment performance within groups.⁸ The former (“structural”) component measures the difference between a country’s total employment rate and the one that would obtain if this country had the US population structure while keeping its own group-specific employment rates.⁹ Conversely, the latter (“effective performance”) component measures group-specific employment-rate

Figure 8.2. **Group-specific employment rates vs aggregate employment rate, 2007**

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differences vis-à-vis the United States, weighted by the share of each group in the total US working-age population.

For EU15 countries on average, about a third of the difference in aggregate employment rates vis-à-vis the United States comes from the structural component (Table 8.1).¹⁰ This means that if these countries had the US working-age population structure while maintaining their own group-specific employment rates, a third of the total employment gap vis-à-vis the United States would disappear. The structural component is particularly large in Mexico, southern and central European countries, France and Ireland. The implication is that, given their population structures, these countries would have to perform better in terms of group-specific employment rates than the United States to

Table 8.1. **Population structure and employment performance, 2004**

Country ¹	Aggregate employment rate ²	Employment rate gap vs. the United States (<i>percentage points</i>)		
		Total	Population structure component	Effective performance component
Turkey	46.1	-25.1	-1.3	-23.8
Poland	51.9	-19.4	-5.2	-14.2
Hungary	56.8	-14.5	-5.6	-8.8
Slovak Republic	57.0	-14.2	-3.3	-10.9
Italy	57.4	-13.8	-6.5	-7.3
Greece	59.6	-11.6	-2.0	-9.6
Mexico	59.9	-11.4	-8.1	-3.3
Belgium	60.4	-10.8	-2.9	-7.9
Spain	62.0	-9.2	-3.2	-6.0
France	62.4	-8.9	-3.3	-5.6
Luxembourg	62.5	-8.8	1.4	-10.1
Korea	63.6	-7.6	4.1	-11.8
Czech Republic	64.2	-7.0	-2.3	-4.7
Germany	65.0	-6.2	-0.8	-5.4
Ireland	65.5	-5.7	-3.3	-2.4
Finland	67.2	-4.0	-1.3	-2.7
Austria	67.8	-3.5	-2.1	-1.3
Portugal	67.8	-3.4	-3.1	-0.3
Japan ³	68.4	-2.9	2.3	-5.2
Australia	70.3	-0.9	-2.6	1.7
United States	71.2	0.0	0.0	0.0
Netherlands	71.2	0.0	-2.5	2.5
Canada	72.5	1.3	0.7	0.6
United Kingdom	72.7	1.4	1.8	-0.3
Sweden	73.5	2.2	0.0	2.2
New Zealand	73.5	2.3	-0.9	3.2
Norway	75.6	4.4	2.1	2.3
Denmark	76.0	4.8	-1.1	5.9
Switzerland	77.4	6.2	-0.4	6.5
Iceland	82.9	11.7	-0.6	12.2
<i>European Union (EU15)</i>	<i>64.8</i>	<i>-6.4</i>	<i>-2.2</i>	<i>-4.2</i>
<i>OECD</i>	<i>65.1</i>	<i>-6.1</i>	<i>-1.3</i>	<i>-4.8</i>

1. Data for EU15 and OECD are weighted average based on population aged 15 to 64.

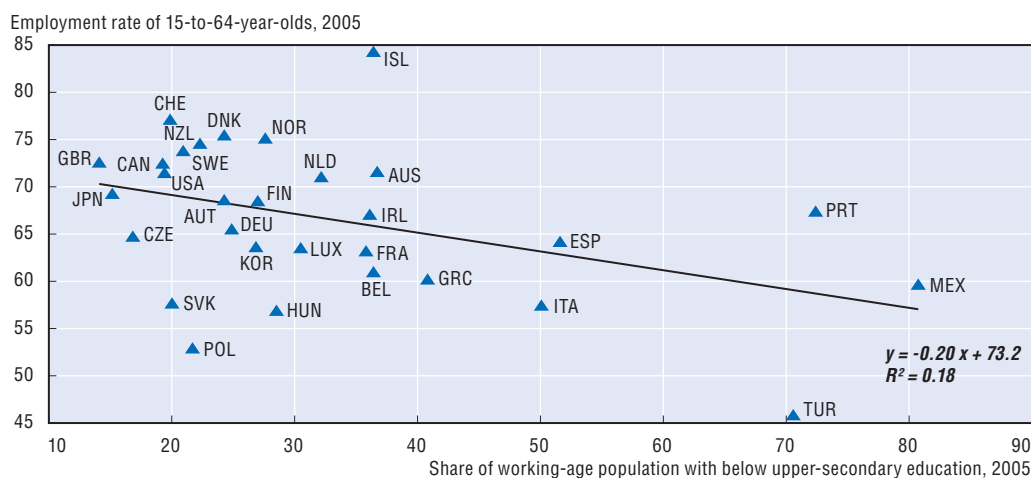
2. Employed persons as a percentage of the working-age population (15-to-64-year-olds).

3. 2003.

reach a similar aggregate employment rate. By contrast, the population structure in Korea, Japan, Norway and the United Kingdom seems more favourable to employment than that of the United States.

The link between population structure and the total employment rate appears clearly in the educational dimension. The share of the working age population not having an upper-secondary education is significantly and negatively correlated with the total employment rate across countries (Figure 8.3). Based on this very simple relation, a 10 percentage points lower share in the population having at most a lower-secondary education qualification would on average be associated with an increase in the total employment rate of 2 percentage points. This would imply that education affects GDP per capita beyond its effect on aggregate labour productivity.

Figure 8.3. **The share of population with below upper-secondary education is negatively correlated with the total employment rate**



Note: The regression coefficient is -0.20 with a standard error of 0.08 (P-value 0.02). When the countries recording a GDP per capita lower than half of the US level (Hungary, Mexico, Poland, the Slovak Republic and Turkey) are excluded, the coefficient is -0.17 (S.E. 0.09 , P-value 0.07). When Portugal and Iceland are further excluded, the coefficient is -0.34 (S.E. 0.09 , P-value < 0.01).

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Working-age population structure and productivity

Population structure can affect average labour productivity in different ways, beyond the well-recognised role of more widespread education in boosting individuals' long-term productivity levels. Indeed, an expanding literature has stressed the importance of demographics for productivity developments (*e.g.* Feyrer, 2008; Werding, 2008). Age structure can, in principle, have a large impact on productivity as individuals' productivity may systematically differ over the active period of life because of experience, depreciation of knowledge and age-related trends in physical and mental capabilities, though the net effect of these factors is open to debate.

In an attempt to give an order of magnitude of such productivity differences across population groups, Table 8.2 reports data on relative wages across age and education groups for a selected number of countries.¹¹ Based on this imperfect proxy for relative productivity, young workers with below upper-secondary education appear to be only about half as productive as the average worker, whereas the most productive groups (individuals older than 45 with tertiary education) are about 50% more productive. However, seniority wage profiles reflect other factors than productivity – such as attempts by enterprises to retain workers – and these measures should therefore be seen as indicative only.

Assuming that relative wages reflect productivity differences across groups within each country, aligning population shares for all groups in OECD countries on those in the United States would increase average productivity levels in almost all countries.¹² Based on this mechanical effect, differences in the composition of the working-age population compared with the United States penalise Europe (EU15) in terms of output per hour worked by 6%, while the effect for central European countries is about 10% and for Turkey and Mexico more than 20% in lost productivity (Figure 8.4, Panel A). It needs to be stressed that the structure of the working-age population in these calculations is not just

Table 8.2. Productivity levels by age groups and education levels
 Proxied by wages; average wage for workers aged 45-54 with upper-secondary education = 100

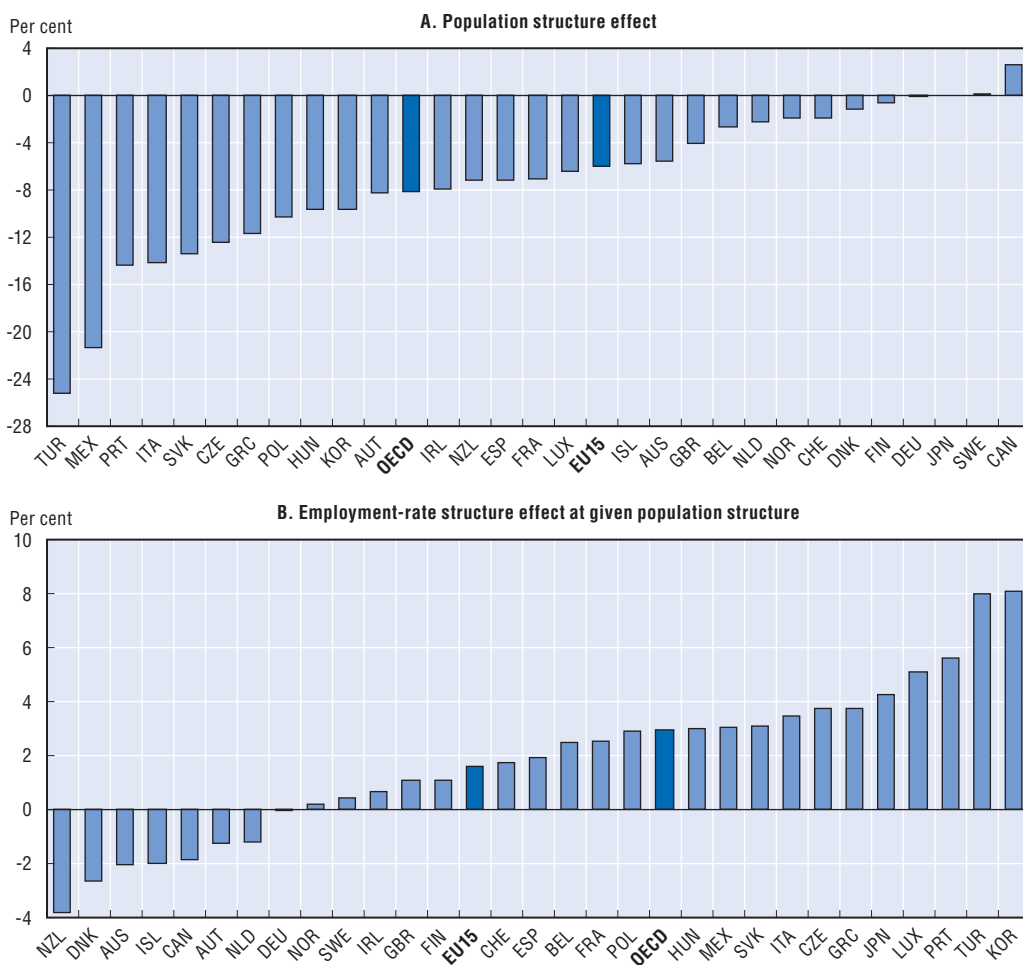
Wage measure: total wages/total hours worked ¹					
Age groups	15-24	25-34	35-44	45-54	55-64
Primary and lower-secondary education					
France	42	55	64	69	71
Germany	36	84	94	90	86
Italy	52	65	72	73	72
Spain	49	57	63	69	70
Sweden	51	85	93	92	92
United Kingdom	76	87	89	85	82
United States	45	69	78	82	83
Upper-secondary education					
France	30	58	82	100	119
Germany	63	90	98	100	97
Italy	56	72	88	100	107
Spain	53	62	80	100	98
Sweden	70	88	95	100	109
United Kingdom	71	88	99	100	91
United States	51	79	95	100	102
Tertiary education					
France	43	75	110	117	155
Germany	64	107	129	133	136
Italy	77	94	112	155	164
Spain	55	80	109	142	155
Sweden	61	101	130	125	147
United Kingdom	75	105	124	118	112
United States	72	116	151	149	159

1. See Boulhol (2009) for details.


something policy has to contend with: an important driver of the results is past education policies (see below).

Because group-specific employment rates differ across countries, the employment structure (by education, age and gender) influences differences in average productivity across countries beyond the sole effect of population structure.¹³ Indeed, in most countries, measured productivity is artificially boosted due to an employment-rate structure that is relatively more detrimental to low-productivity groups than in the United States: the effect on overall productivity is about 3% on average for the OECD and 1.5% for Europe (EU15) (Figure 8.4, Panel B). This means that aligning the group-specific employment rates with those of the United States at a given population structure would result in a decrease in average productivity of these respective amounts. Even though labour market reforms aiming at integrating these low-productivity individuals raise welfare, they are likely to generate a trade-off between employment and output per hour worked (see Box 8.1).

Figure 8.4. **Mechanical effect of population and employment-rate structure differences vis-à-vis the United States on average hourly productivity, 2004¹**



1. In France, for example, average hourly productivity is mechanically reduced by 7.0% compared with the situation where France had the same population structure as the United States while keeping its group-specific employment rates. Average hourly productivity is mechanically increased by 2.4% compared with the situation where France had the same employment-rate structure as the United States while keeping its group-specific population shares. Data for the EU15 and OECD (minus the United States) are weighted averages.

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Box 8.1. Long-term trade-off between labour utilisation and productivity

Some research suggests that there is a trade-off between employment and average measured productivity, and that, as a result, improved employment performance might have less effect on GDP per capita than might be expected (see *e.g.* Bourlès and Cette, 2005, and OECD, 2007, for a survey). There are a number of reasons for higher employment to be associated with lower average labour productivity. In the short term, the stock of capital is slow to adjust, and increases in employment might therefore have a negative impact on labour productivity as capital per worker declines (Gordon, 1997). In the long term, as capital adjusts, the trade-off may be less stark or even non-existent, and this may not have been satisfactorily taken into account in previous studies (McGuckin and van Ark, 2005). Nonetheless, changes in employment and in average productivity could still be linked through changes in the productivity of individual workers and through shifts in labour composition.

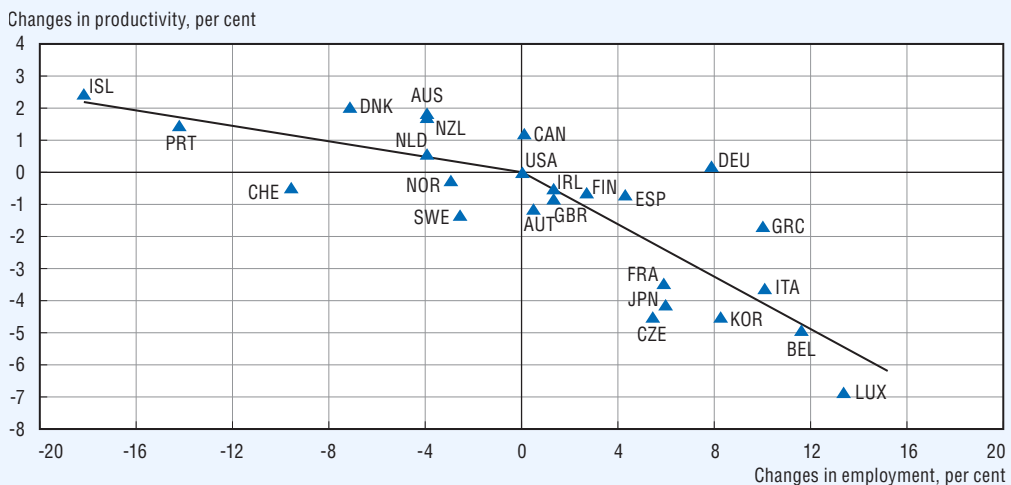
Box 8.1. Long-term trade-off between labour utilisation and productivity (cont.)

While OECD (2007) assesses the impact of labour market reforms on individuals' productivity through mechanisms such as the faster adoption of new technologies, the allocation of labour resources to new high-productivity activities and human capital depreciation following long-term unemployment spells, the focus here is on the effect of changes in labour composition.

If employment increases come from the inclusion of relatively low-productivity workers in the workforce, the average quality of the workforce diminishes, generating a persistent trade-off between employment and average productivity. The magnitude of the trade-off is then directly related to the productivity level of the newly integrated workers relative to that of the average worker. In most countries, employment rates are lower for low-productivity workers, and changes in these employment rates typically generate a trade-off. Conversely, if increases in employment are associated with a higher average education level of the workforce, productivity and employment are positively related.

The figure below summarises the impact on aggregate labour input and productivity, if employment rates in each population group, for each country given their population structure, were to match those in the United States (see Boulhol and Turner, 2009, for further details). Replicating the US employment-rate structure would generate a persistent trade-off between employment and productivity, an increase in labour utilisation of one per cent being associated with a decline in output per hour of $\frac{1}{4}$ per cent on average in OECD countries, based on estimates over 1997-2004. Of course, since the trade-off is only partial, an increase in labour utilisation raises GDP per capita.

Employment and productivity changes when matching US employment rates within each group, 2004¹



1. While the figure represents the cross-section of OECD countries for 2004 only, the elasticities reported in the box are estimated over the period 1997-2004.

Box 8.1. Long-term trade-off between labour utilisation and productivity (cont.)

However, the extent of the trade-off appears to differ across countries. For low-employment countries (on the right of the figure), aligning employment rates with the US ones implies a change in employment structure associated with lower aggregate productivity, with a trade-off sensitivity of about $\frac{1}{3}$ (instead $\frac{1}{4}$ on average across all countries) over 1997-2004, whereas for high-employment countries (on the left of the figure) the changes in employment are more equally distributed and therefore imply only a minimal trade-off. Thus, even for low-employment countries, around two-thirds of the employment gains would be reflected in GDP increases.

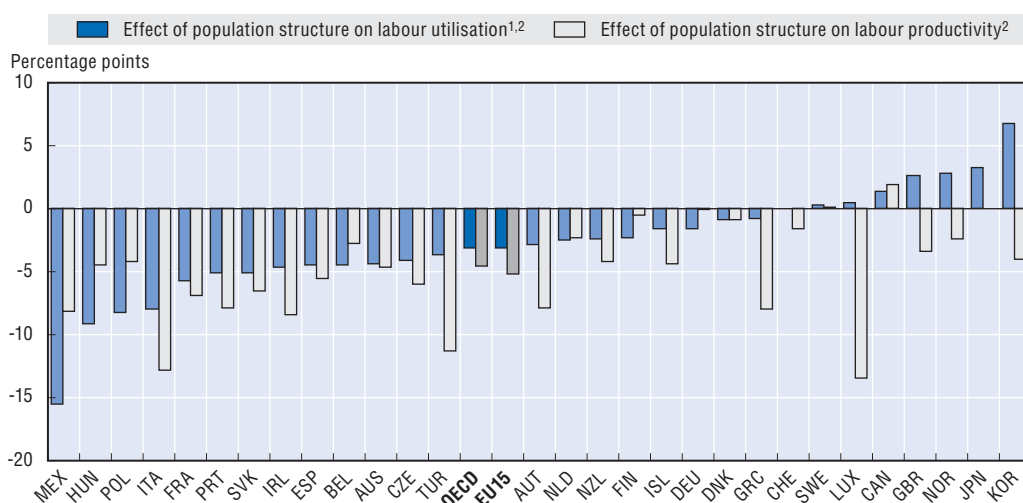
Conclusions and policy implications

This chapter has calculated, for each OECD country, the mechanical effect of a hypothetical shift of the working-age population structure to that of the United States. It is mechanical because group-specific employment rates are assumed to remain at their current level in each country. Figure 8.5 recapitulates the above results, bringing together the effects on labour utilisation and hourly productivity, measured as contributions to the respective gaps vis-à-vis the United States.¹⁴

Based on these mechanical calculations, the structure of the working-age population accounts for 6 percentage points of the GDP per capita gap vis-à-vis the United States for other OECD countries on average, and for 7 percentage points for Europe (Figure 8.6). These effects compare with overall GDP per capita gaps of 40 and 25 percentage points, respectively.¹⁵

Figure 8.5. **Mechanical effect of population structure differences vis-à-vis the United States on labour utilisation and hourly productivity, 2004**

Contribution to the gap vis-à-vis the United States (USA = 100, current PPPs)

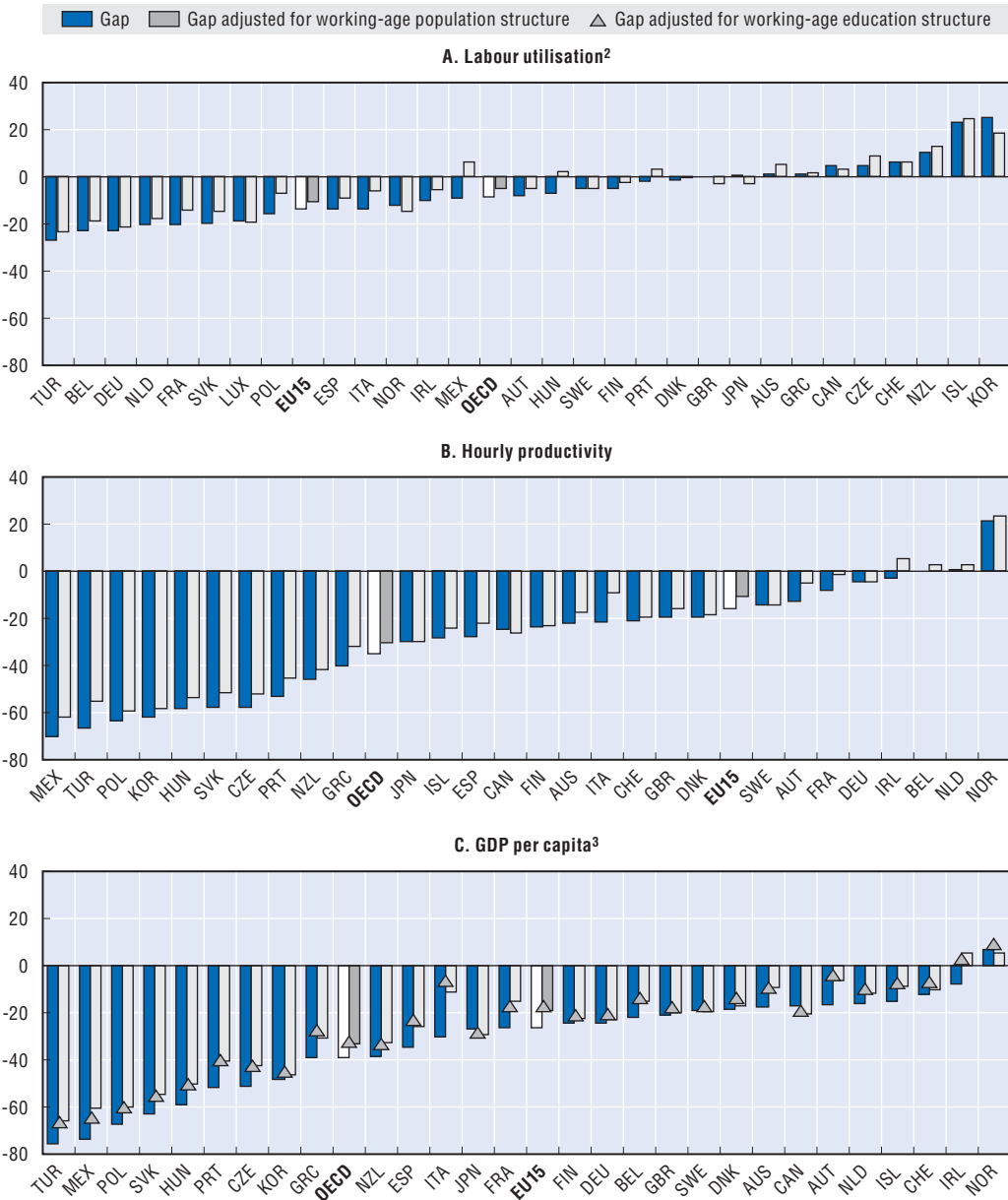


1. Labour utilisation is defined as the total hours worked divided by the working-age population. The effect on labour utilisation includes the impact on aggregate employment plus the compositional effect on aggregate average working hours, holding group-specific average working hours constant.
2. Data for EU15 and OECD (minus the United States) are weighted averages.

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Figure 8.6. **Structure-adjusted labour utilisation, labour productivity and GDP per capita differences, 2004**

Gap vis-à-vis the United States (USA = 100, current PPPs), percentage points¹



1. Data for EU15 and OECD (minus the United States) are weighted averages.
2. Labour utilisation is defined as the total hours worked divided by the working-age population. Adjusted labour utilisation takes into account the effect of the working-age population structure on employment plus the composition effect on aggregate average working hours, holding group-specific average working hours constant.
3. For Belgium as an example, the GDP-per-capita gap is 21.7 percentage points, falling to 14.9 when adjusting for the working-age population structure. Education contributes 13.6 of these 14.9 percentage points.

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The effect of the working-age population structure is dominated by differences in the education composition of the population. In fact, the impact of replicating the US education structure for each country-specific gender-age group suggests that education explains about 85% of the overall working-age population structure effect (Figure 8.6, Panel C).

Although education is primarily thought of as affecting productivity, the effect of differences in population structure on labour utilisation is on average almost as large as that on productivity. The education structure of the working-age population is strongly influenced by education policies over previous decades, and the large population-structure effects reported in this chapter are suggestive of the potential for education reforms to improve future employment and productivity performance.

Even though the computed effects of working-age population structure are large in many cases, they only modestly alter the qualitative assessment of countries' performance in terms of labour utilisation and productivity.¹⁶ The main differences from taking into account the effect of working-age population structure are the following:

- Labour utilisation: the “underlying” performance of Mexico, Hungary, Italy, Poland, France and the Slovak Republic is significantly better than unadjusted measures indicate, whereas the converse is true for Korea, Japan and Norway.
- Labour productivity: adjusting for working-age population structure leads to a higher output per hour worked, especially for Italy, Austria, France and Ireland, and also for Turkey, Portugal and Greece.
- GDP per capita: adjusted measures are higher than unadjusted ones in Italy, Mexico, France, Iceland, Greece and Portugal, and lower in Canada, Japan and Switzerland.

Overall, as differences in the structure of the working-age population tend to affect labour utilisation and productivity in the same direction, the adjustments do not affect the relative weakness in performance between productivity and labour utilisation: countries with a relative weakness on the productivity side are mostly the same on the adjusted and unadjusted basis. As a result, the diagnosis of weaknesses underlying the selection of priorities in Going for Growth is not seriously affected by adjusting for differences in the structure of population across countries.

Notes

1. This chapter is based on analyses reported in Boulhol (2009) and Boulhol and Turner (2009).
2. In doing this, group-specific employment rates are assumed to remain at their current levels in each country. This implies that the complex implications for group-specific labour utilisation performance of such population shifts are ignored. In addition, the results are subject to the chosen population breakdown. If data would have permitted, a finer decomposition could have been implemented, potentially leading to somewhat different findings.
3. The age structure of the population is influenced by life expectancy, which varies widely across countries. Using the same age limit (64) for working age population across countries is therefore an arbitrary assumption.
4. This share (the so-called dependency ratio) is kept constant throughout the analysis reported in this chapter.
5. The working-age population is almost equally split between males and females in almost all countries. Only Iceland and Mexico present an unusual gender distribution for the *working-age* population. This is due to working-age male migration, inward and outward respectively.
6. The analysis reported in this chapter relies heavily on the comparability of education levels across countries using International Standard Classification of Education (ISCED). In some countries (*e.g.* Poland and the United Kingdom), the appropriate classification of some large education programmes is subject to some doubt.
7. Empirical studies have found that educational attainment, gender and age influence labour supply and demand. For example, changes in the age composition of the population are estimated to have increased the natural rate of unemployment (NAIRU) in the United States by 0.7 percentage point

between 1960 and 1979 and reduced it by the same amount between 1979 and 1998 (Katz and Krueger, 1999). Moreover, works at the OECD and European Commission have also investigated the effect of population structure: Burniaux *et al.* (2004) and Carone (2005) conduct a shift-share analysis to make projections about labour force participation, while Mourre (2009) studies the impact of demographics and education on GDP per capita.

8. This standard shift-share analysis is based on the total population being broken down into 30 groups: 5 age classes, 3 education levels and gender. Ideally, other dimensions, such as immigration, should also be taken into account, but this is not possible because of the lack of data.
9. This calculation extends the Perry-weighting procedure to education on top of demographics. Following Perry (1970), this procedure captures the direct effects of demographic changes, assuming that these changes affect labour force shares but not the employment rates of individual groups. As highlighted by Ball and Mankiw (2002), this assumption has been questioned due to possible indirect effects, but with unresolved inferences. For example, Shimer (1999) argues that a younger labour force raises unemployment among the young, whereas Shimer (2001) argues that it reduces unemployment for both young and older workers.
10. This breakdown is likely to be influenced by the stance of policies because group-specific employment rates in different countries are partly a result of country-specific policies. However, if the structural component is computed using the US employment rates rather than the country ones, population structure accounts for half of the employment gap between Europe and the United States (see Bouhhol and Turner, 2009).
11. In the long run, the contribution of labour to output should be closely related to the cost of labour. That is, marginal labour productivity should be closely related to wages. If relative wages between two groups of workers differ too much from the relative productivity of the two groups, firms adjust their employment structure to restore the balance. The fact that relative wages can differ significantly from relative intrinsic productive capacities, as a result of *e.g.* rent-sharing or discrimination, does not imply that they are inconsistent with relative marginal productivity.
12. These estimates are based on the methodology developed by Jorgenson *et al.* (1987) to calculate labour quality growth, which has been extended to simulated states of an economy. The production function is supposed to have constant returns to scale and the labour aggregate is a translog function of labour inputs determined by the hours worked by each group of workers. Because the considered population shifts are sometimes huge, the underlying assumptions behind such estimates are on the edge of what the methodology can support. This exercise is simply meant to provide orders of magnitude and highlight the main mechanisms at work.
13. The employment structure combines the structure of the working-age population and that of the employment rates.
14. Even though group-specific average working hours are assumed to remain at their current level, changes in labour composition alter the aggregate average working-time. Therefore, the effect on labour composition includes this change on top of employment changes.
15. Taking into account also the population outside the traditional working age, the effect of the total population structure is somewhat lower due to an above-average dependency ratio in the United States.
16. One reason is that working-time differences across countries explain a large part of differences in GDP per capita, and that the analysis reported in this chapter has been carried out holding group-specific average working-time constant in each country.

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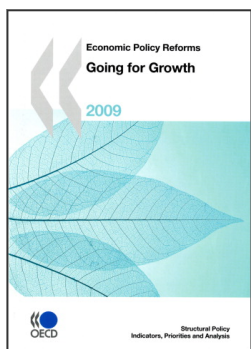
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CAN	Canada	CAD
CHE	Switzerland	CHF
CZE	Czech Republic	CZK
DEU	Germany	EUR
DNK	Denmark	DKK
ESP	Spain	EUR
EU	European Union (the EU15 refers to members prior to the 2004 enlargement)	n.a.
FIN	Finland	EUR
FRA	France	EUR
GBR	United Kingdom	GBP
GRC	Greece	EUR
HUN	Hungary	HUF
IRL	Ireland	EUR
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