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Health Professionals Wanted:

Chain Mobility across European Countries

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Abstract

This study analyses recent trends in the mobility of health professionals in Europe. It first identifies the drivers of this mobility, then analysis its main push-and-pull factors, and finally shows how different European countries are affected by these recent movements of health professionals. Our analysis focuses specifically on the patterns of mobility among medical doctors and nurses between 2010 and 2017. A number of indicators have been collected that provide a comprehensive picture of how the pattern of supply and demand for health professionals has changed over the past decade, illustrating the role that the mobility of health professionals across European countries plays in these developments. We find that a number of European countries have benefited from the mobility of health professionals, but this has accentuated imbalances in a number of other countries. Furthermore, a gravity model is used to identify the push-and-pull factors of mobility in a sample of 32 European countries over 2000-2017. Wage differentials in the health sector across the European countries certainly make some of the countries more successful at attracting health professionals than other countries that are failing to retain them. Consequently, the latter group of countries are facing huge challenges to provide health assistance to their own rapidly ageing populations.

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1. General background

Employment in the health sector has experienced its strongest growth over the past two decades. Between 2000 and 2017 it has been rising by 42%, compared with a 15% rise in overall employment ((OECD, 2019).[1] On average, the health sector absorbs about 10% of the workforce. In Nordic countries such as Norway, Sweden, Denmark and Finland the share of people who are employed in the health sector is particularly high at between 16% and 21%. In contrast, in some of the Central and East European EU members (EU-CEE) - e.g. Lithuania and Hungary, but also Slovenia – this share hovers between 6% and 7%, which has hardly changed over the past decade.

In most countries the next decade is likely to be characterised by increasing job opportunities in the health sector. The retirement of baby boomers, the rise in life expectancy and the ageing of the population are generating a greater need for health professionals. Further, because a large share of health professionals is going to retire, demand for new health professionals will expand (CEDEFOP, 2019), although technological solutions which assist medical staff in their work are gaining ground. It is true that vital developments in this sector are already happening, and there are great expectations that in the future technology will complement and facilitate the work of health professionals (OECD, 2019; Britnell, 2019). However, the risk of automation and substitutability of health professionals with robots or machines, at only 5%, is one of the lowest (Pouliakas, 2017).

Despite rising employment among health professionals, shortages are already becoming evident in a number of countries. In general terms, demand for health professionals is met through the supply of health professionals from the existing workforce in the health sector, graduates who have qualified in health and welfare disciplines, health professionals who are foreign-born, and more recently also through automated technology that is assisting or replacing – to a lesser extent – humans in healthcare. Nevertheless, imbalances in the supply and demand of health professionals are prevailing among the European countries.

These supply-and-demand imbalances in the supply of health workers that are arising in many countries have generated a continuous battle to attract health professionals. This battle is going to become stronger. It has already intensified over the past two decades, and a number of wealthier European countries have been benefiting at the expense of poorer ones (Glinos, 2015; Mara, 2019).

These developments have had repercussions for the mobility of health professionals, which has become a blessing for some EU countries but has had the opposite effect in the EU-CEE. Although the EU15 countries have also seen a high degree of outward mobility of doctors –mainly to EFTA countries, the US and Canada –- a large number of doctors who left have been replaced with doctors from the EU-CEE and other third countries. EFTA countries have benefited a lot by receiving doctors from the EU15, while hardly sending any abroad themselves. In contrast, EU-CEE countries have gone through an

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[1]   OECD (2019). *Health at a glance*, Chapter 8, Figure 8.2. "Employment growth by sector, OECD average, 2000-2017". The OECD average includes 30 members of the OECD (excluding Chile, Iceland, Korea, New Zealand, Switzerland and Turkey).

intensive outflow of medical doctors, who have hardly been replaced by doctors from other countries (Mara, 2019).

Thus, this medical brain drain has been striking, especially for EU-CEE countries and the Western Balkans (WB). The free movement of workers within the EU has had an important impact on mobility patterns, especially for this occupational group (Glinos, 2015). The phenomenon is very complex, and its drivers are related to economic and institutional factors, but it is also driven by linguistic, cultural and geographical proximity (Adovor et al., 2019). In addition, imbalances in the supply and demand of health professionals have generated a great divide between rural and urban areas (OECD, 2019).[2]

Accordingly, the purpose of this study is to shed light on recent shifts in the demand and supply of health professionals and the challenges ahead for European countries. More specifically, we aim to investigate the drivers of mobility of health professionals in Europe and thus identify the main push-and-pull factors.

We have structured our research into three stages. *First,* we have collected a number of stylised facts which provide a broad overview of how the pattern of demand and supply for health professionals has been shifting over the past decade. We will focus specifically on how demographic changes will drive the demand for healthcare – e.g. the change in life expectancy and the share of the population aged 65+. We will also provide a number of indicators about the domestic health workforce – their density relative to the population and changes over time – and the contribution of foreign-trained health professionals, as well as gaps in terms of earnings among health professionals across countries. *Second,* using bilateral data about health workforce migration – including doctors and nurses – we analyse migration patterns of health professionals, identify the main sending and receiving countries of health professionals and how certain countries have become more attractive over time, whereas some others have been losing health professionals. *Third,* using a gravity model, we identify important push-and-pull factors of mobility.

The study is organised as follows. In the second section we provide stylised facts about health professionals' dynamics, demand drivers, and mobility patterns between the EU countries. In the third section we analyse the special case of the mobility of health professionals from Austria and the Western Balkan countries (Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, Serbia and Kosovo). In the fourth section we present the gravity analysis, the estimation results and the main findings, and in the last section we summarise our conclusions.

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[2]   For example, for countries such as the Czech Republic and Hungary but also Latvia, the density of medical doctors in urban areas is two to more than two times higher than in rural areas, while in other countries, e.g. Norway, Finland, Sweden and Switzerland, such gaps are less pronounced. Source: OECD Regional Statistics Database 2019.

2. Health workforce and international mobility

2.1. THE SUPPLY OF HEALTH PROFESSIONALS

The density of the health workforce has improved across all European countries.3 The data over the past decade suggest that the number of health professionals in relation to the population has increased. Whereas in 2010 the number of health professionals stood at 337 per 100,000 inhabitants for medical doctors and at 793 per 100,000 for nurses and midwives, by 2017 these ratios had risen to 369 and 843, respectively (see Figure 1 below).

However, substantial differences concerning the density of the health workforce across the European countries are visible. A first group of countries – e.g. Norway, Sweden, Switzerland, Germany, Denmark and Iceland, but also the Czech Republic – show ratios of health professionals to the population above or close to the EU28 average for both medical doctors and nurses and midwives. Most of the countries in this group have experienced an increase in the density of health professionals, with the exception of the Czech Republic, Sweden and Iceland in the case of nurses (Figures 1 and 2 below). A second group of countries – including e.g. Austria, Portugal, Italy, Spain and Greece as well as Bulgaria and Lithuania – are also characterised by a medical doctors' density above the EU28 average; however, the same does not apply to nurses. In most of these countries the density of medical doctors has improved, while the density of nurses has deteriorated – mainly in Slovakia, but particularly in Greece, which is the European country with the lowest density of nurses.

Figure 1 / Health professionals: medical doctors per 100,000 inhabitants, 2010 and 2017
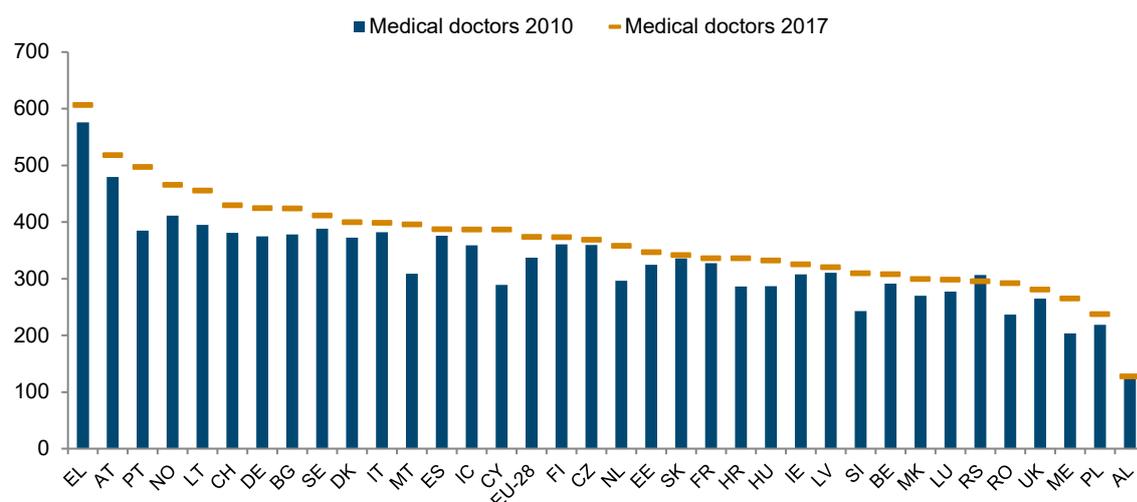
Source: Eurostat.

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3   Expect for Serbia.

Figure 2 / Health professionals: nurses per 100,000 inhabitants, 2010 and 2017
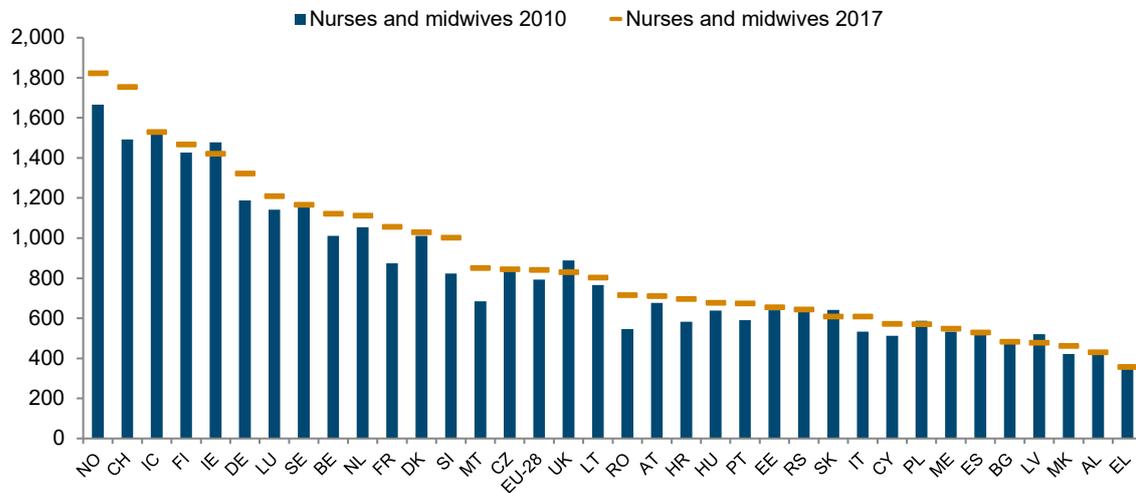
Source: Eurostat.

Figure 3 / Health graduates, medical doctors per 100.000 inhabitants, 2010 and 2017
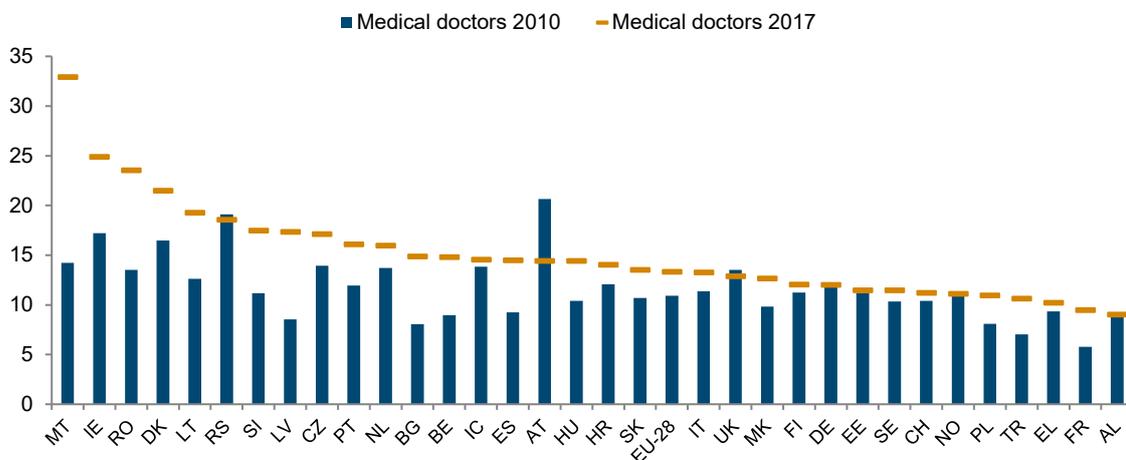
Source: Eurostat.

A third group of countries, which includes the UK, Ireland, the Netherlands, Slovenia, France, Belgium and Luxemburg, appears to have a lower density of medical doctors than the EU28 average, although this has increased over the past decade. The density of nurses per 100,000 of the population is above the EU28 average, but this ratio has been deteriorating, particularly in Ireland and the UK (see Figures 1 and 2).

A fourth cluster of countries – mostly comprising EU-CEE and Western Balkan countries – is characterised by a lower density of both nurses and medical doctors than the EU28 average. Within this group the density of medical doctors has improved over the past decade, except for Serbia, but for nurses the density has deteriorated, especially in Poland, Latvia and Slovakia.

Diverging patterns also emerge concerning the pool of health professional graduates destined to enter the health workforce. In 2017 the ratio of health professional graduates per 100,000 of the population in the EU28 rose to 13 for medical doctors and to 38 for nurses, compared with a ratio of 11 and 37, respectively, in 2010.

It is important to note that the grouping of countries with respect to health professional graduates differs strongly from the country grouping by health workforce density as discussed above (Figures 1 and 2). In particular, a number of countries such as Denmark, Portugal and Netherlands, but also other countries such as Romania, Slovakia, Croatia, Slovenia and Serbia, have a density of graduate medical doctors and also of nurses above the EU28 average.

It is not only the positioning of countries that differs, but the ratios have also changed strongly over the past decade. The density of graduate medical doctors has declined, particularly in Austria and to a lesser extent also in the UK and Serbia, whereas the density of health graduates has almost doubled, especially in Bulgaria and Latvia. Other countries, such as Romania, Lithuania and Slovenia, have also recorded a quite substantial expansion in the number of medical graduates. The trend for graduate nurses is different: their density shrank particularly strongly in Croatia, Slovenia and Slovakia, but rose particularly strongly in Romania, Switzerland and Norway.
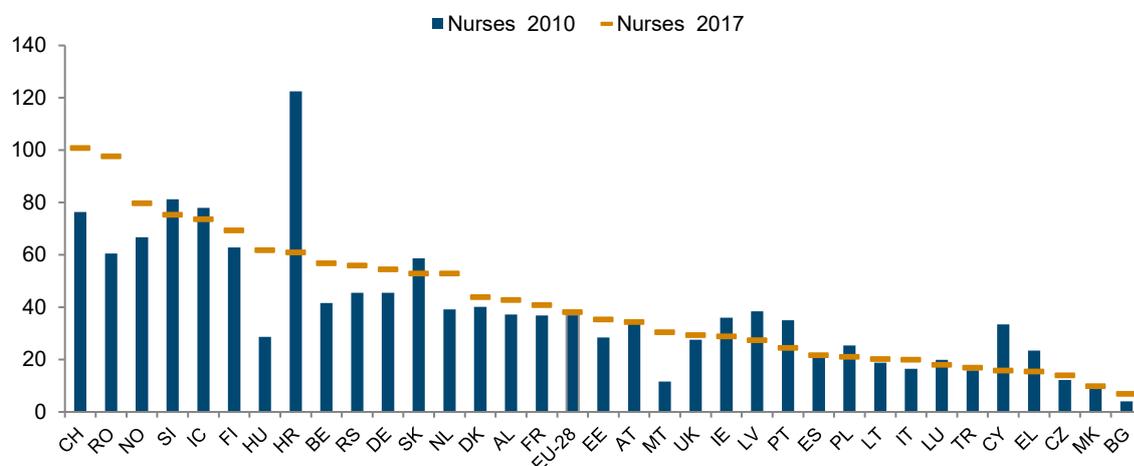
Figure 4 / Health graduates, nurses per 100.000 inhabitants, 2010 and 2017

Source: Eurostat.

For a number of countries in the EU-CEE the rise in the number of health professional graduates has therefore been disproportionate to the increase in the health workforce. This pattern indicates that countries such as Romania, but also Croatia, Slovenia and Slovakia, have a lower density of health professionals than the EU28 average, despite a higher density of health graduates. Moreover, the strong rise in the density of health graduates is only partly reflected in an expanding health workforce in these countries.

Another group of countries, such as Austria, the UK, Ireland, Latvia and the Czech Republic, shows a density of graduate medical doctors above the EU28 average, but this is in combination with a lower density of graduate nurses compared with the EU28 average (see Figure 3 and 4). Especially in Austria,

health graduates' density dropped for both categories of health professionals. For the remaining countries the ratio of graduate nurses remained stable. The worst-placed countries – those in which the ratio of both medical doctors and nurses stands below the EU average – are not only some of the Western Balkan and EU-CEE countries – Albania and Macedonia, and Hungary, Poland, Bulgaria and Estonia – but also wealthier EU economies, such as Luxemburg, Sweden, but also Spain and Greece. Some of these countries have experienced important shifts over the period 2010-2017. For example, the ratio of graduate nurses in Albania has exceeded the EU average. In the case of Bulgaria the ratio of graduate medical doctors has improved and risen above the EU average, while Hungary has joined the group of countries in which both categories of health graduates are exceeding the EU average.

2.2. THE DEMAND FOR HEALTH PROFESSIONALS

Ageing populations and their rising longevity pose different challenges across EU countries. Challenges looming ahead exert pressure not only in financial terms, through rising expenditures, but also as a result of the increasing demand for health professionals. Huge differences exist among the EU countries with respect to health expenditures in per capita terms. A number of wealthier European countries such as Switzerland and Norway, but also Germany, Sweden and Austria, spend up to three times more per capita on health than a number of EU-CEE countries, such as Latvia, Poland and Hungary (OECD, 2019). Health expenditures have been rising especially in wealthier countries as well as in those countries where the ageing of the population has been more pronounced (OECD, 2019). As such, imbalances are likely to emerge among the EU countries not only with regard to health provision, but also as far as the attraction and retention of their health workforce is concerned.

Rising longevity and population ageing are putting a strain on healthcare provision. Recent demographic changes suggest that a number of European countries are experiencing a rise in the life expectancy of their populations. In particular, in 2018 life expectancy above the age of 65 exceeded on average 17 years for men and 21 years for women (Figure 5). Over the past two decades life expectancy above 65 has grown by more than two years, and over the next decade – until 2030 – a gain of 1.5 years is expected for both men and women (Figure 6).

Figure 5 / Life expectancy above 65 years in EU and EFTA countries, 2018, number of years
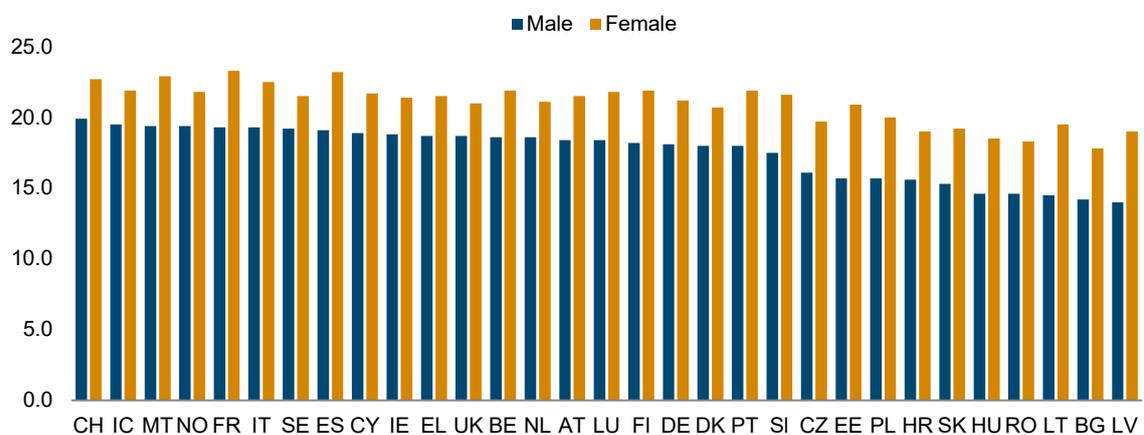
Source: Eurostat.

Figure 6 / Gains in life expectancy above 65 years by 2030, number of years
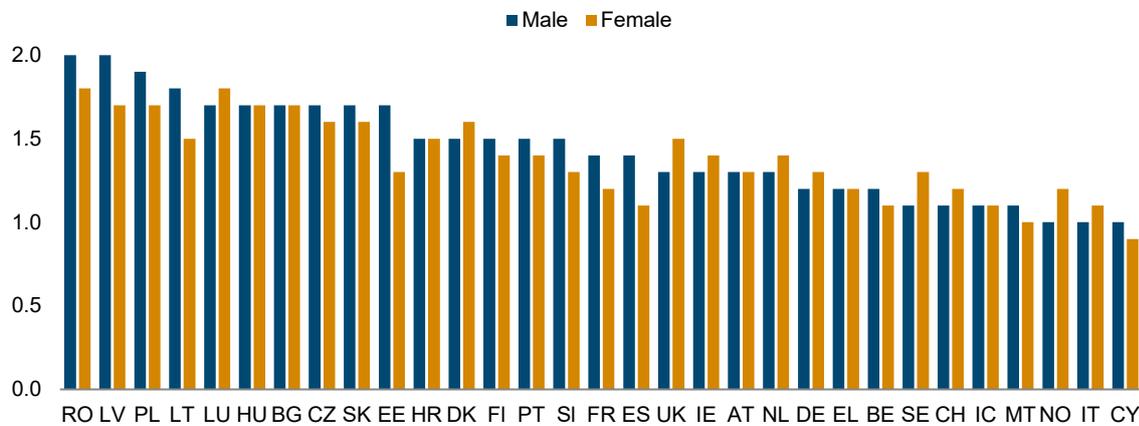
Source: Eurostat.

Life expectancy and the gains in life expectancy differ between men and women in the EU countries. The highest life expectancy above the age of 65 is found in Switzerland, Norway, France, Italy and Sweden. In contrast, in a number of EU-CEE countries – e.g. Latvia, Bulgaria, Lithuania and Romania – gains in life expectancy above the age of 65 have been smaller, and gender gaps in life expectancy are wider. However, projections for the next decade (2020-2030) suggest that the gap in life expectancy between the EU-CEE countries and the EU15 will continue to narrow, since gains in life expectancy for both men and women are expected to be higher for the EU-CEE countries than for the EU15 bloc (see Figure 6). Such dynamics suggest that the EU-CEE, EFTA and the EU15 will all be facing rising demand for healthcare – especially for care-based related services – owing to the rising longevity of their populations.

Figure 7 / Population above 65 years by country groups, current and projected trend, in % of total population
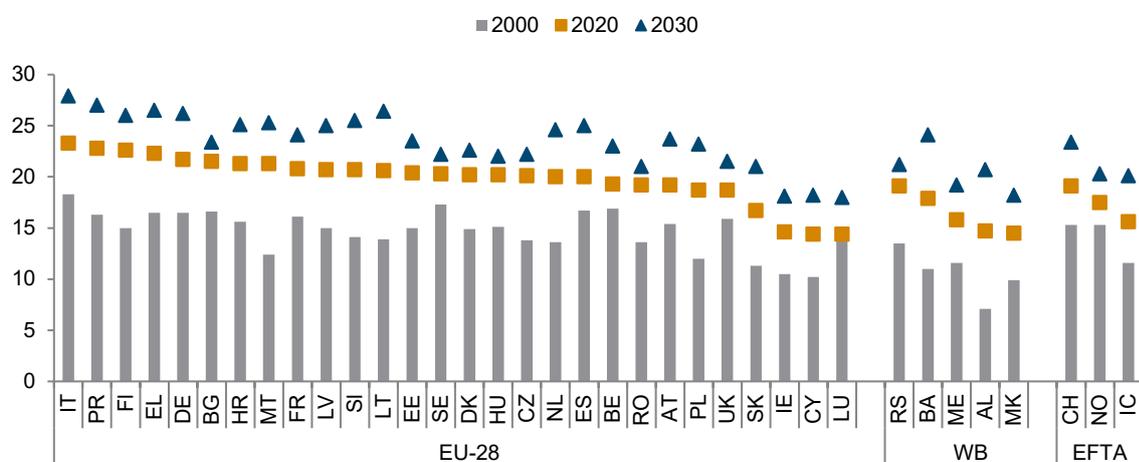
Source: UN Population statistics.

The ageing of the population is a phenomenon that is particularly pronounced in a vast majority of EU countries compared with the rest of the world (with the exception of Japan). For a number of countries in Europe one out of five persons in the population is above the age of 65 – e.g. in Italy, Portugal and France, but also in Bulgaria and Croatia (Figure 7). By 2030 this ratio is expected to have risen further, to about one out of four in the population. Also, Western Balkan countries are already showing clear signs of rapid ageing, especially Bosnia and Herzegovina and Serbia (see Figure 7). Hence, this phenomenon will continue to affect a number of European countries.

2.3. EMERGING IMBALANCES FOR HEALTH PROFESSIONALS

Shortages of health professionals are looming among European countries, given the rising demand despite the growing supply in this category of workers (Table 1). One-half of the EU28 countries report shortages of medical doctors, and this group comprises especially northern EU countries such as the Nordic countries, the UK, Ireland, Belgium, Germany and the Netherlands. Among the EU-CEE countries medical doctor are in short supply, especially in the Baltics, Slovakia, Slovenia, Croatia and Bulgaria. As concerns nurses, one-third of the EU28 members are affected by the lack of staff, and again Nordic countries, but also Bulgaria, Latvia and Slovakia, seem to be affected. For other categories of health professionals the shortages are especially pronounced among northern European countries. In Belgium, Ireland, the Netherlands, Finland and the UK the scarcity of health professionals is particularly pronounced, and this applies to all three categories. Countries pursue different strategies and policies to satisfy their current and future demand for health workers. As shown above, in most of the EU-CEE countries the number of medical doctors (relative to the population) is above the EU28 average, but their health workforce remains below the EU28 average. The reason is that quite a large number of health professionals in the EU-CEE are moving to one of the EU15 or EFTA countries, which are filling their vacancies by attracting health professionals from the EU-CEE, the Western Balkans and other third countries.

Table 1 / Occupational shortages of medical doctors, nurses and other health professionals in selected EU countries

	BE	DK	DE	IE	FR	NL	FI	UK	EE	BG	HR	LV	LT	SI	SK
Medical doctors	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Nursing and midwifery professionals	■	■		■		■	■	■	■	■		■			■
Other health professionals	■			■	■	■	■	■						■	

Note: Shaded cells indicate shortages.
Source: Own elaboration from European Commission (2017, page 17).

Apart from being demand-driven, shortages in the health workforce are also supply-driven. Quite a large share of health professionals in the EU and EFTA countries is approaching retirement age. In most countries the share of health professionals above the age 55 has been rising, especially in Italy, Spain, Luxemburg, Latvia and Austria, while it has declined only in a few countries, such as the Netherlands, Norway and Sweden, as shown in Figure 8. On average, one out of three health professionals in the EU is above the age of 55. For a number of EU countries this ratio is even higher. Especially in Italy, more than half of all health professionals fall into the age group above 55. In France, Germany and Belgium, but also in Latvia, Estonia or Hungary the share of health professionals above the age of 55 ranges between 44% and 48%. The UK is the only EU country that has a relatively younger health workforce –

only one out of ten health professionals is above the age of 55. Despite the rising needs the vast majority of job opportunities for health professionals until 2030 will therefore be driven by replacement rather than expansion demand (see Figure 9).

Figure 8 / Share of physicians age 55+ in selected EU and EFTA countries, % of total physicians
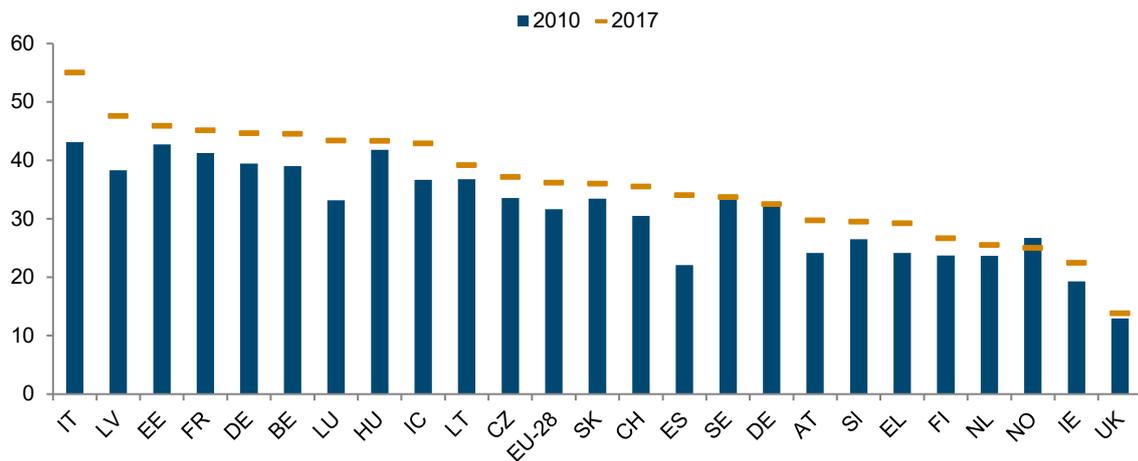
Source: OECD.

Figure 9 / Job opportunities for health professionals in selected EU and EFTA countries, 2018-2030, in thousands
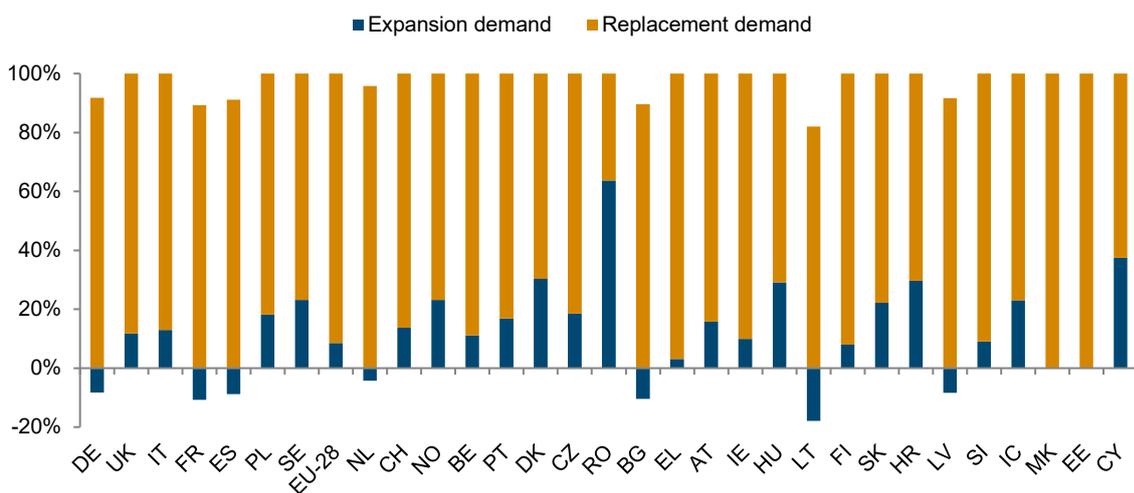
Note: Job opportunities represent the sum of net employment change and replacement demand. The concept of replacement demand is based on the fact that some jobs become available due to people leaving work places for different reasons (retirement, migration etc.) These vacant positions need to be filled. In practice the replacement needs are much higher than the net change of employment (expansion demand). As the distribution of those leaving the labour forces is difficult to estimate on a yearly basis, the replacement needs for the period 2018 – 2030 are provided.
Source: own elaboration using CEDEFOP Forecast Database.

Demand expansion is expected to be the main driver of job opportunities in the health sector, particularly in Romania, but in some countries, such as Germany, France, Spain, the Netherlands, Bulgaria, Latvia and Lithuania, job opportunities for health professionals are expected to decline. Instead the vast majority of job opportunities for health professionals between 2018 and 2030 will be driven by replacement demand, because the challenge of health professionals' retirement is imminent and intensified by their mobility. This is particularly strongly felt in those countries which are already facing an ageing health workforce, such as Italy, Spain and Germany (see Figures 8 and 9).

2.4. HEALTH PROFESSIONALS' MOBILITY

2.4.1. Mobility of health professionals in Europe

A number of countries in Europe are tackling their shortages of health professionals by employing health staff that has been trained in another country. With EU enlargement the intra-EU mobility of health professionals has intensified, but the number of health professionals originating from third countries is also rising continuously. The international mobility of health professionals has been advantageous for a number of net-receiving EU countries. However, for the other countries – which are net senders – it has been detrimental and has accentuated further shortages of health professionals.

Among health professionals in Europe one out of ten is foreign-born, with substantial differences noticeable in individual countries. In Ireland almost half of the medical doctors are foreign-born, as shown in Figure 10. In Sweden and Switzerland one out of three doctors originates from abroad, whereas in other countries, such as Germany, Denmark and France, the share of foreign-born medical doctors is close to the EU average. Austria as well as Italy are notable among the group of countries for their low share of foreign medical doctors, which is below to EU average – e.g. close to 5% in Austria and 1% in Italy. Also, a number of EU-CEE countries – Poland, Lithuania, Romania, Croatia and Estonia – fall into the group of countries where the share of medical doctors from abroad is lower than the EU average, with shares not exceeding 2%.

Figure 10 / Share of foreign-trained doctors in selected EU and EFTA countries, in %
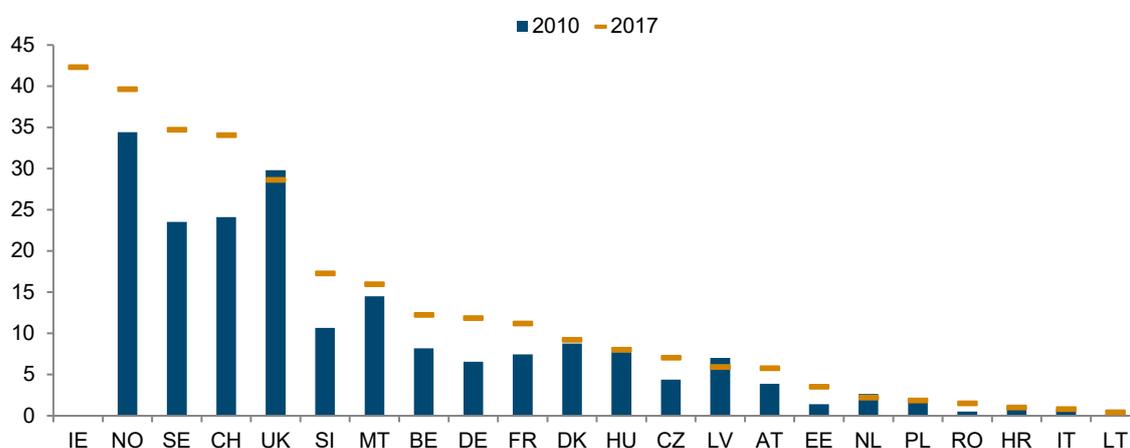
Source: Eurostat.

Figure 11 / Share of foreign-trained nurses in selected EU and EFTA countries, in %
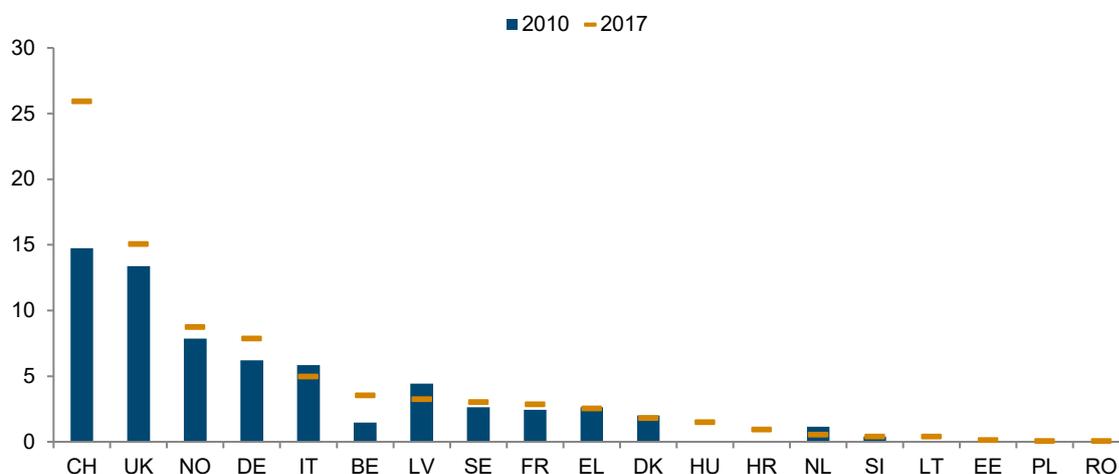
Source: Eurostat.

Similarly, concerning the employment of foreign nurses, there are huge differences across European countries. Again, in wealthier countries such as Switzerland and the UK the share of foreign nurses is 25% and 15%, respectively, which has been growing significantly over the past decade. In other countries – e.g. Italy, Greece, Denmark and Netherlands – the share of foreign nurses accounts for less than 10% and has been declining over the past decade. As for the EU-CEE countries, foreign nurses complement the domestic workforce only marginally, with a share of less than 1%. Therefore, there is a strong polarisation between a small group of countries where foreign nurses are indispensable and those countries where healthcare is mostly provided by domestic nurses.

The UK is the country which has received the largest number of health professionals from abroad, with a net inflow of medical doctors of 45,000 between 2010 and 2017. While the UK has been receiving more than 53,000 medical doctors, it has also been sending more than 8,000 abroad (see Figure 12). Similar patterns and levels are also observed regarding the mobility of international nurses in the UK (see Figure 13). Between 2010 and 2017 the UK received more than 49,000 nurses from abroad, compared with a modest outflow close to 4,000 nurses.

Other countries which have attracted thousands of medical doctors and nurses but have sent hardly any of them abroad are Switzerland and Norway. For these two countries net migration of health professionals – both medical doctors and nurses – has ranged between 10,000 and 20,000.

Other countries, such as Germany for example, experience a high exchange of medical doctors. The number of German medical doctors who leave is quite high, but this is offset by a similar number of foreign-trained doctors – close to 15,000 – who have moved to Germany. Still, the net effect is negative, suggesting that Germany is a country that is losing medical doctors. In contrast, the number of foreign nurses who move to Germany is twice as high as the number of those who leave. Austria is another country where the outflow of medical doctors is exceeding the inflow, whereas for nurses the net flow is positive. Other countries, such as Italy and the Netherlands, are losing both medical doctors and nurses. Among EU-CEE countries the net flow of medical doctors and nurses is predominantly negative.

Especially Romania and Poland, but also Hungary, stand out among the EU-CEE countries for the largest outflow of medical doctors and nurses.

Figure 12 / Medical doctors' inflow and outflow at country level, 2010-2018 cumulative
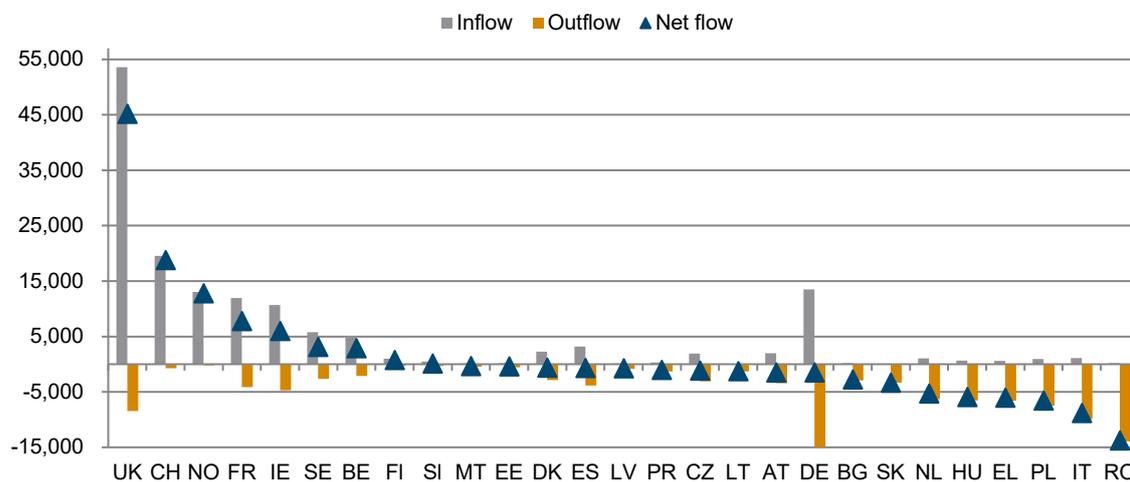
Source: Eurostat, OECD.[4]

Figure 13 / Nurses inflow and outflow at country level, 2010-2018 accumulative
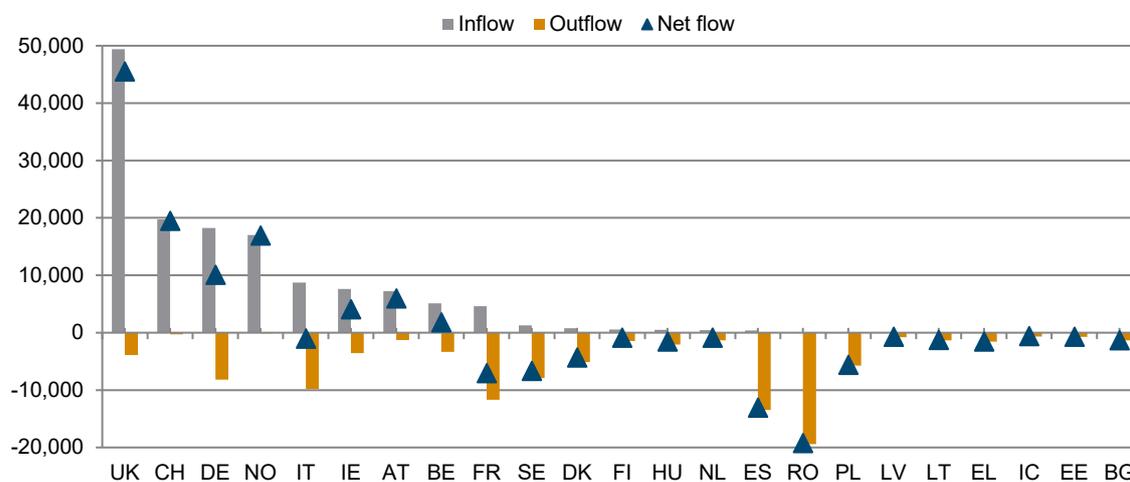
Source: Eurostat, OECD.[5]

Overall, the main receiving countries which are emerging as winners in this battle for health professionals – both for medical doctors and nurses – appear to by the UK, Ireland, Switzerland, Norway and Belgium. Another group of countries which are still successful in attracting medical doctors but are losing nurses include France and Sweden. Austria and Germany are more successful in attracting nurses from abroad but are failing to retain medical doctors.

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[4]   Medical doctors' inflow data are from Eurostat; outflow data are from OECD.

[5]   Ibid.

2.4.2. Bilateral patterns of mobility

Countries such as the UK have benefited from the mobility of health professionals within the EU as well as third countries.[6] According to the OECD, more than half of medical doctors in the UK originate from countries outside of the EU, especially Pakistan and India; 27% came from the EU15 – largely from Italy, Greece Ireland, Spain and Germany – with another 16% originating from the EU-CEE – especially from Romania, Poland, Hungary and the Czech Republic. Between 2014 and 2017 the UK received quite a large number of nurses from Italy, Spain and Romania, but recently these numbers have declined. Instead more nurses have arrived from the Philippines – nearly half of all foreign-trained nurses who moved to the UK in 2018 originated from the Philippines.

Norway and Switzerland rely heavily on medical doctors from the EU15. These two countries have benefited from a large inflow of foreign-trained doctors while having sent only few doctors abroad. The inflow of medical doctors from abroad has been much higher than the number of local graduates, and as a result these two countries have the highest shares (apart from Ireland) of foreign-trained doctors, at close to 40% in Norway and 35% in Switzerland (see Mara, 2019). Particularly Switzerland, which offers much higher wages relative to the EU countries, has been a magnet for doctors as well as nurses from Germany, but also from Italy, France and Austria, while Norway has been attractive for health professionals especially from Sweden, Denmark and Spain, but also from Poland, Lithuania and Hungary (see Mara, 2019; and OECD, 2019).

Germany is an attractive country for health professionals from the EU-CEE, especially for doctors from Romania, Hungary, Bulgaria, Poland and the Czech Republic. Medical doctors from this group of countries moving to Germany accounted for close to 60% of the total inflow of foreign-trained doctors to Germany between 2010 and 2018. The move of doctors from Austria to Germany has also been important at close to 1,500 (or 12% of total inflow of foreign-trained doctors into Germany) and exceeded the number of German doctors who moved to Austria. As concerns nurses, apart from the EU-CEE countries, recently a large number of them have been coming from Croatia or Western Balkan countries, especially Bosnia and Herzegovina, Serbia and Albania.

Germany is another EU country which is recording losses of medical doctors, despite receiving many health professionals from abroad. The inflow of doctors from abroad has to a large extent compensated for 90% of Germany's outward mobility. As far as nurses are concerned, the inflow has been higher than the outflow. Between 2010 and 2018 more than 14,000 German doctors and 10,000 nurses preferred to leave the country, mainly moving to Switzerland,[7] but also to Austria or countries outside the EU. Such outward mobility of German health professionals has been driven by a high demand in these countries as well as the relatively high wages offered to health professionals in countries such as Switzerland, Austria or Luxembourg.

In Austria the inflow of foreign-trained doctors has compensated for 60% of outward mobility, but in the case of nurses the inflow is outpacing the outflow. The main destinations for Austrian doctors have been Germany, Switzerland and the UK. In contrast, Austria has been attracting mainly German doctors, who accounted for 57% of the inflow of foreign-trained doctors to Austria between 2010 and 2018; doctors

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6   Main data source: OECD Health Workforce Migration Database.

7   Respectively close to 10,000 and 7,000 medical doctors and nurses moved from Germany to Switzerland between 2010 and 2018. Source: OECD Health Workforce Migration.

from the EU-CEE – e.g. Hungary, Slovakia, the Czech Republic, Romania and Bulgaria – contributed another 34%.

The chain mobility[8] of health professional has been particularly penalising for the EU-CEE countries. Across these countries Romania stands out as having the highest level of outward mobility for both medical doctors and nurses (see Figures 12 and 13). For a number of other EU-CEE countries, such as Poland, Hungary, Bulgaria and Slovakia, the net effect of doctors´ migration has been negative as well. The inward mobility into these countries has been negligible and completely failed to offset the outward mobility. The Czech Republic has attracted mainly doctors from Slovakia and Ukraine, Hungary has attracted health professionals from Romania, Romania has received professionals from Moldova, and in the Baltics these health professions came mostly from Russia. Besides, the density of health professionals in the EU-CEE countries tends to be rather low, much lower than the EU average, and has deteriorated in some countries between 2010 and 2017.

2.4.3.   Health professionals' wage differential: a driver of mobility

Health professionals' wage differential is a pull factor for overseas and east-west migration for this category of workers. It is worth noting that the remuneration for health professionals in the UK has deteriorated over the past decade and is now below to EU15 average (see Figure 14).[9] This might have been one of the push factors that prompted close to 4% of medical doctors to leave the UK and move to New Zealand, the US and Canada. However, considering that the remuneration in this sector[10] is higher than in some of the EU15 countries, for example such southern EU countries as Italy, Greece or Portugal, let alone in the EU-CEE and developing countries, the UK has managed to attract a large number of foreign-trained doctors from these regions. Despite this the UK continues to be confronted with shortages of medical doctors (European Commission, 2017), and the density of health professionals is below the EU average.

Norway and Switzerland rely heavily on medical doctors from the EU15 thanks to the higher remuneration they offer to health professionals. This factor may be one of the main determinants why these two countries have benefited from receiving foreign-trained doctors while having sent only few doctors abroad. Particularly Switzerland,[11] which offers much higher wages than the EU countries – two times higher than EU15 average – has been a magnet for doctors as well as nurses from Germany, but also from Italy, France and Austria, while Norway has been attractive for health professionals especially from Sweden, Denmark and Spain, but also from Poland, Lithuania and Hungary (see Mara, 2019; and OECD, 2019). The wage differential in the health sector between the EU-CEE countries and Germany is significant, and as such is an important pull factor of mobility for health professionals from the EU-CEE. Similar patterns and wage gaps apply to nurses. A large outflow of nurses from the EU-CEE, but also

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8   By chain mobility we mean the outward mobility of health professionals from a given country – native or foreign doctors who leave – and their partial replacement with other foreign-trained doctors. One example of chain mobility might be the outward mobility of health professionals from Germany moving to Switzerland, the UK and the US, for example, or the inward mobility of foreign-trained health professionals from Austria, Romania or other EU countries to Germany – a mobility which offsets the departure of native health professionals with new entries of foreign-trained health professionals.

9   See also Mara (2019).

10   Ibid.

11   See Mara (2019) and OECD (2019).

from the Western Balkan countries – especially Bosnia and Herzegovina, Serbia and Albania – towards the EU-15 has emerged over the past decade.

Figure 14a / Remuneration of employees in the health sector, ratio to EU-15 (simple average), 2018 or latest year available
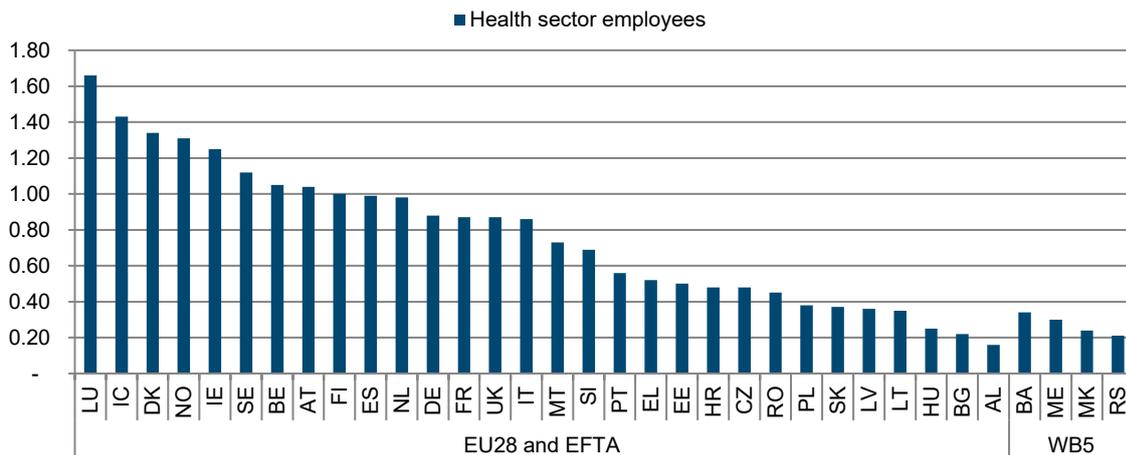
Note: Remuneration of health sector employees refers to average monthly wages per employee in NACE Q Human health and social work activities (used as a proxy) provided in PPS mn. Data for EU-CEE and WB countries are based on administrative data, the remaining countries (EU15 and EFTA) on National Accounts data.
Source: wiiw Annual Database and Eurostat for Health professionals, own calculations.

Figure 14b / Remuneration of hospital nurses and health specialists, ratio to EU-15 (simple average), 2018 or latest year available
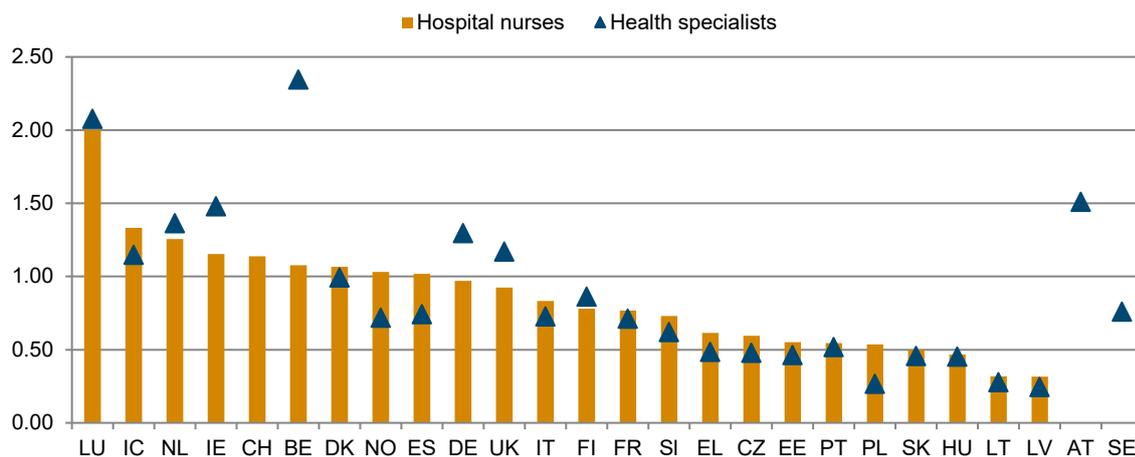
Note: The remuneration for hospital nurses and health specialists is defined as the average gross annual income provided in PPS mn. For countries such as AT and BE information about remuneration of self-employed specialists has been used. Salaried hospital nurses: Certified/registered nurses actively practicing in public and private hospitals and who receive most of their income via a salary, including fully-qualified nurses (with post-secondary education in nursing) and associate/practical/vocational nurses with a lower level of nursing skills but also usually registered, (OECD Health Statistics 2019). Health specialists: fully-qualified physicians who have specialised and work primarily in areas other than general practice. Physicians in training should normally be excluded, (OECD Health Statistics 2019).
Source: OECD for hospital nurses and health specialists, own calculations.

3. Health professionals' mobility between Austria and the Western Balkan countries

Austria has one of the highest stocks of medical doctors in per-capita terms among the European countries. Over time the number of medical graduates in Austria in per-capita terms has dropped significantly, and the inward and outward mobility of health professionals trained at home and abroad has intensified. In contrast, the Western Balkan countries have the lowest density of health professionals relative to their populations. The number of health graduates in per-capita terms is one of the lowest. Demographic trends indicate that population ageing is also expanding among the Western Balkan countries. Despite this shortage of supply of health professionals and the rising demand for health and long-term care, the Western Balkan countries are experiencing an exodus of health professionals. Therefore, we analyse below in more detail the case of Austria and the Western Balkan countries.

3.1. THE AUSTRIAN CASE

Austria is the European country with the largest number of doctors in per-capita terms after Greece, with 518 medical doctors per 100,000 inhabitants, compared with the EU28 average of 374 per 100,000. This high level of medical doctors compared with other EU28 and EFTA countries has to be attributed mainly to the high number of graduate medical doctors who annually join the workforce of health professionals in Austria. However, while in 2010 the number of medical graduates was more than two times higher than in the EU28 at 22 per 100,000 inhabitants, over the past decade this ratio has shrunk drastically by one-third to just 14 medical graduates per 100,000 inhabitants – close to the EU28 average. Furthermore, this drop in the number of medical graduates has been accompanied by an outflow of medical doctors to other destinations in Europe, especially to Germany, Switzerland and the UK, but also further afield to the US, for example.

According to the OECD, between 2010 and 2017 more than 3,400 Austrian medical doctors left the country. Meanwhile, the number of medical doctors from other countries who moved to Austria over the same period stood below 2,000. Consequently, inward mobility of foreign-trained medical doctors has only partly compensated for the outward mobility of Austrian medical doctors, and these have mainly been doctors originating from Germany, but also from Central and East European countries such as Hungary, the Czech Republic, Slovakia, Romania and Croatia.

Between 2012 and 2017 Austria has been losing its doctors, whose outflow to Germany and Switzerland has exceeded the inward mobility of the medical doctors originating from these two countries to Austria. With respect to Switzerland, the negative net flow has been shrinking over the period 2012-2017. With respect to Germany, in contrast, the turnover remains still high, but the net flow has turned positive, with the number of German doctors moving to Austria slightly exceeding the number of Austrian doctors moving to Germany.

Figure 15 / Medical doctors´ mobility, Austria, Germany and Switzerland
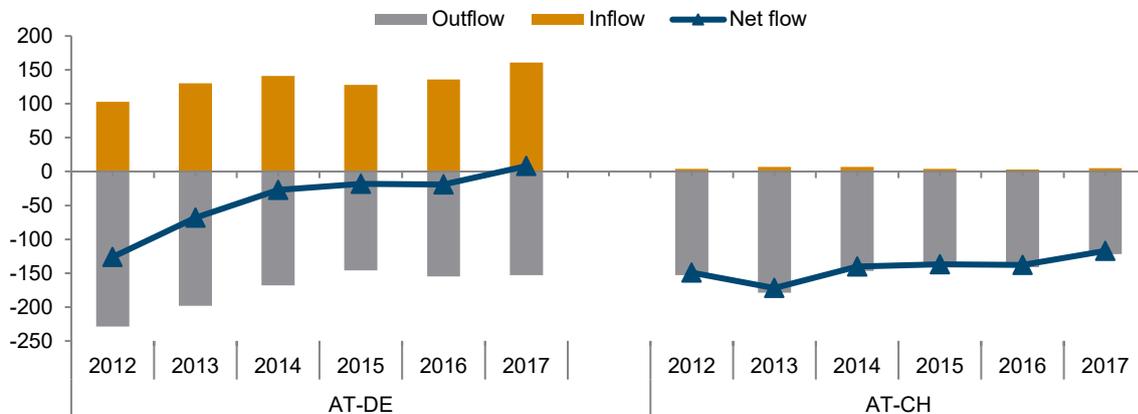
Source: Own elaboration using Health Workforce Migration OECD Dataset.

Figure 16 / Foreign medical doctors (as of 2018) and foreign nurses (as of 2019) in Austria by country of origin
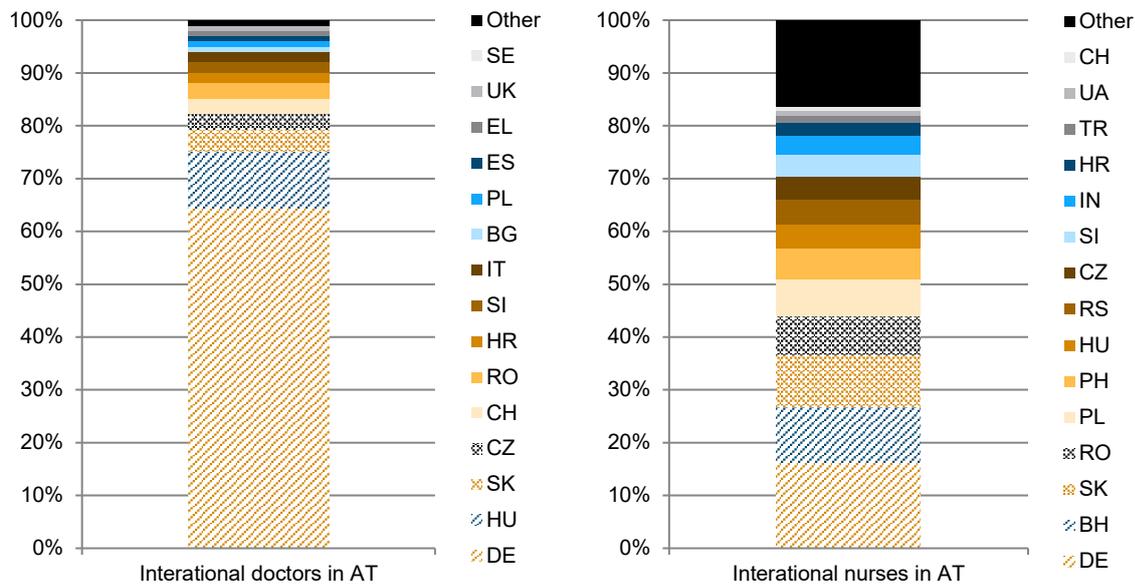
Source: Own elaboration using Health Workforce Migration OECD Dataset.

With respect to nurses, the staff available in per-capita terms is below the EU28 average and has changed only slightly between 2010 and 2017, standing at 711 nurses per 100,000 inhabitants as of 2017. The number of graduate nurses per capita is also below the EU28 average and has remained unchanged over the same period. Consequently, Austria relies much more on nurses originating from other countries, who accounted for a share of 18% as of 2019,[12] than on medical doctors, with a share at 6% as of 2018. For nurses, the sample of sending countries seems to be quite heterogeneous. Close to 16% originate from Germany, 11% from Bosnia and Herzegovina, 10% from Slovakia, 7% from

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[12] Source: Own elaboration of Gesundheitsberuferegister 2019, special extraction.

Romania, another 7% from Poland, 6% from Philippines, 5% each from Serbia, Slovenia and the Czech Republic, and the rest from other countries. Between 2010 and 2017 the inward mobility of nurses in Austria increased significantly, with a net flow of foreign-trained nurses in Austria being close to 6,000.

In the near future the demand for health professionals in Austria is expect to surge rapidly. Close to 30% of doctors in Austria are aged 55 and above. Therefore, an important part of demand will be driven by the replacement of doctors who will go into retirement, but new job opportunities are also expected to emerge. According to CEDEFOP,[13] there were more than 13,600 job vacancies for health professionals in Austria at the end of 2019. Rising life expectancy at age 65 (by close to 20 years) and the relatively high share of the population aged 65 and above, which already stands at 19% and is expected to expand further by 4 percentage points until 2030, suggest that the demand for long term-care, and in particular for qualified nurses who provide assistance with daily living activities, will increase further. Given the relatively low level of available nurses in per-capita terms and the stagnant level of graduate nurses generated by the education system, it is highly probable that Austria will continue to count on nurses arriving from abroad to respond to the expansion of demand for long-term care.

3.2. THE WESTERN BALKAN COUNTRIES' CASE

Between 2010 and 2017 more than 432,000 citizens from the Western Balkans (WB) emigrated to the EU – an outflow which corresponds to 3% of the total population in the region.[14] This high outward mobility has also been a characteristic of the health profession. The region is showing evident signs of ageing and shrinking and is already suffering from a low density of health professionals (see also Table 2 below and Figure 1-2 in the main text, section 1). The outward mobility of health professionals from the WB has intensified, especially over the past decade. This is mainly demand-driven – especially from Germany – but also supply-driven, taking into account the huge gap in terms of earnings between the WB and the EU (see Figure 14 above). In 2018 average monthly wages per employee in human, health and social work activities in the WB countries were two to three times lower than in the EU28 countries. While in 2018 an employee in the health sector in Albania earned close to EUR 900[15] (PPS per month), in Germany this was close to EUR 2,400 (PPS per month). Also, in Serbia monthly wages in the health sector were two times lower than in Germany. In Bosnia and Herzegovina wages in the health sector have been rising particularly rapidly by at least 17% over the past ten years. In 2018 an employee in the health sector could earn EUR 1,860 (PPS per month). Nevertheless, the gap in terms of earnings in the health sector between the WB and the European countries remains large enough to generate high outward migration rates among health professionals.

Emigration of health professionals from the WB region is reflected in a lower number of medical doctors as well as nurses, but also a lower density of health professionals. This is particularly true in Albania (see Table 2 for further details). For other countries, e.g. Serbia, Bosnia and Herzegovina and Montenegro, the number and density of health professionals has improved, whereas in North Macedonia

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[13]   https://www.cedefop.europa.eu/en/data-visualisations/skills-online-vacancies/regions-and-occupations

[14]   Source: Eurostat: Immigration by age group, sex and citizenship [migr_imm1ctz]. For a number of countries the information about immigration flows has not been provided. Therefore, the figures provided are underestimating the actual level of immigration from WB to the EU.

[15]   wiiw Annual Database and Eurostat for average monthly wages per employee, in human health and social work activities are provided in current prices, million purchasing power standards (PPS). For each of the three indicators the ratio to the EU15 average has been calculated for every individual country.

the number of nurses and their density relative to the population have deteriorated. Moreover, the medical brain drain[16] has more than doubled in Albania – its ratio of health professionals abroad accounted for 18% of the total health workforce in 2017, compared with 7% recorded in 2010. In North Macedonia this ratio has increased to 22%. Also, in Serbia and Bosnia and Herzegovina the loss of health professionals almost doubled between 2010 and 2017, reaching 14% and 8%, respectively, in 2017. Germany, but also the US, the UK and Canada, are the preferred destination countries for Albanian health professionals. For other countries of the WB (apart from Germany, Switzerland, Sweden and Norway) a lot of mobility has also occurred within the region or to neighbouring countries – e.g. North Macedonians and Bosnians moving to Serbia and Slovenia. In 2017, of the 4,600 foreign-trained nurses who moved to Germany close to 32% originated from one of the WB countries (Albania, Bosnia and Herzegovina, Serbia and North Macedonia). Dekra Academy, a private German company, has been operating in Albania since 2015. It offers professional training for nurses as well language courses in German in different cities in Albania. After completing their training the nurses obtain a licence to exercise their profession in Germany. A job offer with a net salary of EUR 1,500 is guaranteed if the B2 level in German language has been attained.

The Skilled Immigration Act,[17] which was approved by the German Bundestag and entered into force in March 2020, aims to facilitate the labour market entry and employment of highly qualified professionals originating from countries outside the EU. In July 2019 Germany also signed an agreement with the government of Kosovo offering assistance with the training and qualification of nurses. Recently, the outward mobility of health professionals from Kosovo to Germany has been rising, but no official statistics are available. Such policy changes will certainly affect emigrants from the WB who move to Germany. Moreover, the effects on the region might be negative, since the potential to out-migrate is high.

Circular migration of health professionals or short-term exchange programmes between countries might be a much more effective approach. Already the region has produced high rates of outward mobility, including of health professionals. Therefore, a further intensification of outward mobility for this category of workers might be devastating for the region. Circular migration of health professionals or short-term exchange programmes between countries might be a much more effective approach rather than training programmes that facilitate the outward mobility of the health workforce. The region is already affected by the low density of health professionals. Taking away further health professionals might be detrimental for the population in the region, which is faced with shortages and poor healthcare assistance. And as far as the retention of the health workforce is concerned, this approach is not aligned with the WHO's Sustainable Development Goal outlined in its 2030 Agenda – Goal 3, target 3.c – which requires to "substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries". In addition, the WHO Global Code of Practice on the International Recruitment of Health Personnel, adopted in 2010, deems that recruitment from health systems affected by shortages of health professionals should be avoided (Glinos, 2015).

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[16]   Medical brain drain (ratio of doctors abroad over the total number of doctors at home and abroad).

[17]   https://www.make-it-in-germany.com/en/visa/kinds-of-visa/work/skilled-immigration-act/

Table 2 / Medical brain drain from the Western Balkan countries

.	Medical doctors density (per 10 000 population)			Nursing and midwifery personnel (per 10 000 population)		
	2010	2017	Time period, latest year available	2010	2017	Time period, latest year available
Albania	12,379	11,998	2010-2016	45,681	35,998	2013-2016
Bosnia and Herzegovina	17,907	20,003	2010-2013	57,924	62,998	2010-2014
Serbia	24,714	31,251	2010-2016	53,224	61,203	2010-2016
Republic of North Macedonia	26,759	28,736	2010-2015	47,805	37,917	2010-2015
Montenegro	20,311	23,337	2010-2015	56,736	57,179	2010-2015

	Medical doctors (number)			Nursing and midwifery personnel (number)		
Albania	3,640	3,511	2010-2016	13,334	10,534	2013-2016
Bosnia and Herzegovina	6,665	7,211	2010-2013	21,560	22,465	2010-2014
Serbia	22,316	27,563	2010-2016	3,542	3,592	2010-2016
Republic of North Macedonia	5,541	5,975	2010-2015	9,899	7,884	2010-2015
Montenegro	1,268	1,466	2010-2015	48,060	53,982	2010-2015

Source: WHO.

.	Medical brain drain (ratio of doctors abroad over the total number of doctors at home and abroad)			Percentage of graduates from tertiary education graduating from Health and Welfare programmes, both sexes (%)		
	2010	2017	Time period, latest year available	2013	2018	Time period, latest year available
Albania	7%	18%	2010-2017	14,68 %	14,05 %	2015-2018
Bosnia and Herzegovina	8%	14%	2010-2017	13,29 %	11,94 %	2015-2018
Serbia	4%	8%	2010-2017	9,58 %	9,73%	2015-2018
Republic of North Macedonia	17%	22%	2010-2017	8,44 %	10,22 %	2013-2015
Montenegro	0%	3%	2010-2018	-	-	

Source: own calculation.   Source: UNESCO STATS.

	Stock of doctors abroad to selected OECD countries	Time period, latest year available	Top five main destination
Albania	257	772	2010-2017	Germany (10 times higher than in 2010), USA, UK, Canada, Greece
Bosnia and Herzegovina	559	1,129	2010-2017	Germany, Serbia, Slovenia, Switzerland, Norway
Serbia	853	2,486	2010-2017	Germany, Slovenia, Sweden, Norway, Sweden, UK
Republic of North Macedonia	1,150	1,726	2010-2017	USA, Germany, Serbia, Slovenia, France
Montenegro	2	46	2010-2018	

Source: Own elaboration using OECD, UNESCO, WHO and national statistics.

4. Drivers of mobility of health professionals: a gravity approach analysis

4.1. THE GRAVITY MODEL OF MEDICAL DOCTORS' MOBILITY

For the analysis of bilateral movements of health professional workers a gravity model is applied. The latter approach has often been used to analyse the mobility of the overall population in a number of studies (e.g. Landesmann et al, 2015; Mara and Vidovic, 2015). The rationale of a gravity framework is that an individual chooses to move abroad or not depending on his/ her expectations about employment opportunities or the level of earnings in his/ her country of origin in comparison with other countries. Apart from economic determinants, other factors which might facilitate mobility can be taken into account, such as geographical proximity or cultural and language affinities.

In the context of health professionals, by applying the gravity model we aim to capture push-and-pull factors of mobility for this particular group of workers. Expectations about employment opportunities or absorption capacity to retain or attract health professionals are recognised as important pull factors for the mobility of this group of workers. Higher levels of earnings in this sector in a potential host country and relatively high wage differentials between sending and host countries are expected to have a positive impact on attracting health professionals in the potential host countries. Further, demand for health professionals is expected to be driven by the needs of the population for health services. As outlined above, an ageing population certainly has a greater need for healthcare. Therefore, the demographic structure of the population and their differences across countries are expected to be important drivers of demand for health professionals. Countries where the demand for health professionals is high and available financial resources are more abundant – e.g. for employing or offering a higher level of compensation to health professionals – tend to be more successful at retaining domestically trained doctors as well as attracting foreign-trained health professionals than countries which have financial constraints or offer lower wages in this sector.

Apart from the demand side, the supply side also matters. The supply of health professionals, i.e. the existing workforce of health professionals, depends on the contingent of students and health graduates who join the labour market of health professionals, on the inward and outward mobility of health professionals, and on the retirement rate of this group of workers. Therefore, to define the mobility of health professionals, we estimate a gravity model which takes these aspects of the demand-and-supply side of health professionals into account, including monetary and non-monetary determinants of mobility. For data reasons we focus on the specific case of medical doctors' and nurses' mobility. The data allow us to consider the mobility of health professionals across 32 countries, including the EU27 member states and the UK, the EFTA countries (Norway, Switzerland and Iceland), and Albania.

The gravity function is specified in the following form:

eq. (1)

$$SFD_{fit} = \beta_1 * \ln(w_{ft}) + \beta_2 * \ln(w_{it}) + \beta_3 * \ln(SD_{ft}) + \beta_4 * \ln(SD_{it})$$

$$+\beta_5 * \ln(GD_{ft}) + \beta_6 * \ln(GD_{it}) +$$

$$+$$

$$\beta_7 * dist_{if} + \beta_8 * contiguity_{if} + \beta_9 * com\_language_{if} + \beta_{10} * ethnic\_language\_c_{if}$$

$$+$$

$$\beta_{11} * Pop65_{ft} + \beta_{12} * Pop65_{it} + \beta_{13} * SHFD_{ft}$$

$$+$$

$$+\beta_{14} * SHFD_{it} + \varepsilon_{fit}$$

Whereby the main determinants are:

› SFD_{fit} refers to the stock of foreign doctors/nurses residing in destination country (f) and originating from country (i);

› wage rates in the health sector in the destination and origin country, w_{ft} and w_{it} respectively; as data on doctors' level of earnings are not available, we use health sector level of earnings as a proxy[18];

› SD_{ft} and SD_{it} represent the available number of doctors/nurses in the destination and the country of origin;

› GD_{ft} and GD_{it} represent the stock of graduate doctors/nurses in the respective foreign country and the country of origin;

› $pop65_{ft}$ and $pop65_{it}$ stand respectively for the population above the age of 65;

› $SHFD_{ft}$ and $SHFD_{it}$ represent the share of foreign doctors/nurses in the respective foreign and the origin country and might be a proxy about the capacities to absorb health professionals from abroad.

› Further gravity model determinants, which are country-specific and constant over time, are represented by:

    – $dist_{if}$, the geographical distance between the sending and host country;

    – $contiguity_{if}$, the border commonality;

    – $com\_language_{if}$ refers to sharing the same official language;

    – $ethnic\_language\_c_{if}$ when at least 9% of the populations of sending and host countries share the same language.

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[18]   Health professionals' remuneration, defined as average monthly wages per employee, in human health and social work activities, are provided in current prices, million PPS.

4.2. DATA AND DESCRIPTIVE STATISTICS

Several data sources have been used to empirically estimate the gravity model for the mobility of health professionals. Statistics for the bilateral mobility of health professionals were obtained from the OECD's Health Workforce Migration database for two categories of health professionals – medical doctors and nurses.[19] Data concerning the bilateral stock of medical doctors and nurses by country of origin in the OECD are available for the period 2000-2018. For our analysis we used a selected number of OECD countries. Our sample is composed of 32 destination countries – including the EU27 countries and the UK, the EFTA countries and Albania. The same group of countries has been selected as the main sending countries. Our investigation covers the period 2000-2017. The descriptive statistics of the main indicators are presented in Table A1 in the Annex. Other indicators, such as the stock of health professionals – the stock of graduates, the share of foreign-trained health professionals (both medical doctors and nurses) and the share of the population above the age of 65 – were obtained from Eurostat for the same countries and for the same time period. Data on the remuneration of health professionals were obtained from the wiiw database, which uses national accounts data to calculate monthly wages in the health sector, in euros (EUR) and purchasing power parity (PPP). The gravity variables,[20] such as distance, common ethnic language and contiguity/ common border, were obtained from the CEPII. Table A1 in the Annex presents some basic descriptive statistics on the main variables used for the gravity model estimation.

4.3. ESTIMATION RESULTS OF GRAVITY MODEL

In our empirical analysis we aim to establish the main determinants of health professionals' mobility with a focus on two specific groups – medical doctors and nurses. When estimating gravity models with a large set of countries, one shortcoming which is often encountered is the likely large number of zeros or missing information for a number of indicators, either being flow or stock data. Moreover, the log transformation of zero values among the observations enlarges further the sample of missing information. Therefore, in our approach we implement different estimation specifications to tackle such drawbacks and reduce the biasedness in our estimates. Besides, it emerges from the stylised facts that the mobility and the exchange of health professionals have involved one group of countries more than others (e.g. Germany-Austria, France-Belgium, Germany-Switzerland, Romania-Germany etc.). This might also be another source of biasedness in our regressions – specific pair countries might drive the estimation results. Accordingly, we started by estimating empirically the gravity model for both doctors and nurses by running standard OLS regressions. The next step consisted of using the Poisson pseudo maximum likelihood (PPML) estimator on our gravity model to account for the large number of zeros and cross-check the validity of our estimates.[21] As emphasised above, a set of country pairs might also drive the results. Therefore, in addition we applied panel FGLS and PPML estimates by including specific pair-country dummies to account for the biasedness that some country pairs might generate in our model estimation. The FGLS estimates are presented in Table 3 below, while OLS and PPML estimates are presented in Table A3 and A4 in the Annex. Table 3 presents the FGLS estimation results of the main

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[19]   https://stats.oecd.org/Index.aspx?DataSetCode=HEALTH_WFMI

[20]   These variables are commonly used in gravity models and we have downloaded them from:
        http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8

[21]   The PPML approach is commonly used for trade gravity models estimation and was initially recommended by Santos Silva and Tenreyro (2010).

determinants both of the stock of foreign-trained doctors (column 1) and nurses (column 2) and how the demand-and-supply factors affect it.[22]

Table 3 / Gravity estimation results

	FGLS Estimates (dependent variable: log of stock of foreign doctors)		FGLS Estimates (dependent variable: log of stock of foreign Nurses)
Ln_SDit (doctors)	0.0250	Ln_SDit (nurses)	0.521***
	(0.0258)		(0.0208)
Ln_SDft (doctors)	0.722***	Ln_SDft (nurses)	0.652***
	(0.0252)		(0.0444)
Ln_SHFDit (doctors)	-0.141***	Ln_SHFDit (nurses)	-0.175***
	(0.00737)		(0.0171)
Ln_SHFDft (doctors)	1.125***	Ln_SHFDft (nurses)	1.072***
	(0.0109)		(0.0225)
Ln_GDit (doctors)	0.460***	Ln_GDit (nurses)	0.107***
	(0.0247)		(0.0161)
Ln_GDft(doctors)	-0.151***	Ln_GDft (nurses)	-0.189***
	(0.0262)		(0.0487)
Ln_pop65it	0.653***	Ln_pop65it	-0.383**
	(0.0776)		(0.130)
Ln_pop65ft	2.422***	Ln_pop65ft	-0.0897
	(0.0864)		(0.129)
Ln_Wit	-0.723***	Ln_Wit	-0.728***
	(0.0206)		(0.0296)
Ln_Wft	0.762***	Ln_Wft	1.006***
	(0.0364)		(0.0513)
Contiguity	0.958***	Contiguity	0.887***
	(0.0348)		(0.0528)
Common ethnic language	0.702***	Common ethnic language	0.141*
	(0.0351)		(0.0668)
Log_Distance	-0.303***	Log_Distance	-0.570***
	(0.0181)		(0.0285)
_cons	-16.80***	_cons	-7.960***
	(0.447)		(0.661)
Time dummies	Yes		Yes
Specific country pair dummies	Yes		Yes
N	2670	*N*	1215
RMSPE	0.241		0.074

Standard errors in parentheses.
+ p < 0.10, * p < 0.05, ** p < 0.01, *** p < 0.001.

Estimation results show a positive significant sign with respect to the supply of doctors in the receiving country (SD_{ft}), suggesting the existence of a positive relationship between the existing stock of available doctors and the stock of doctors from abroad. The same relationship is also confirmed for nurses. One explanation might be that countries which are already characterised by a large stock of medical doctors

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[22]   The comparison of estimation results attained through OLS, PPML and FGLS shows them to be consistent. However, instability emerges as concerns the stock of health professionals. In terms of Root Mean Squared Percentage Error (RMSPE) and the significance of estimated coefficients, the panel fixed effect GLS estimator performed better than other regressions. Therefore, for the interpretation of the coefficients we will refer to these estimates.

as well as nurses offer more employment opportunities or have higher absorption capacities to attract doctors and nurses from abroad. From the perspective of a sending country, the estimates turn out not to be consistent for medical doctors. However, with respect to nurses they are consistent and show to have a positive sign. A positive relationship between the existing stocks of available nurses at home and abroad suggests that a high supply of nurses at home might be associated with a higher supply of nurses being sent abroad. Therefore, a positive coefficient of 0.5 suggests that a rise in the stock of nurses in the sending country by 10% might be associated with a higher stock of nurses from that country at 5%.

With regard to the estimation results about the stock of graduate medical doctor and nurses, we find respectively a negative and a significant coefficient as concerns the receiving country (GD_{ft}). Thus, from the perspective of a receiving country, there exists a negative relationship between the stock of graduate medical doctors who enter the labour market and the stock of foreign-trained doctors abroad. This means that countries which have a large stock of graduates joining the health workforce might be less dependent on medical doctors from abroad. An interpretation of the respective coefficient suggests that a rise of 10% in the stock of graduate doctors/ nurses might be associated with a drop in the stock of doctors and nurses from abroad by 1.5% and 1.9%, respectively, for foreign-trained doctors and nurses.

From the perspective of a sending country there exists a positive relationship between the stock of graduate medical doctor and the stock of doctors from that country working abroad (GD_{it}). This result suggests that countries with a large number of graduate medical doctors tend to send more doctors abroad. The same results also apply to nurses. Accordingly, a positive coefficient for doctor graduates at 0.46 and for nurses at 0.11 suggests that a 10% rise in the stock of health professional graduates at home might generate an increase in the stock of doctors and nurses abroad of 4.6% and 1.1%, respectively. To summarise, a higher stock of graduate medical doctors and nurses is associated with a lower dependence on medical doctors and nurses from abroad as well as a higher supply of them in foreign countries.

We also find that the coefficient estimates with regard to the share of foreign-trained doctors and nurses have respectively a positive significant coefficient for the receiving country ($SHFD_{ft}$). Those countries which already have a high share of foreign-trained doctors or nurses tend to attract more foreign-trained doctors, confirming the strong network effect on the mobility of health professionals – as indicated by positive and larger than one coefficient estimates, both as concerns the share of foreign-trained doctors and nurses.

From the perspective of a sending country, there exists a negative relationship between the share of foreign-trained doctors/ nurses and the stock of doctors from that country being abroad ($SHFD_{it}$), which suggests that countries which rely heavily on foreign-trained doctors tend to send fewer medical doctors abroad.

With respect to the demand-side aspects, we find less consistent estimation results. For example, as concerns doctors, from the destination country perspective we find a positive relationship between the population share above the age of 65 and the stock of foreign-trained doctors. The positive and large size of the coefficient points out those countries with a higher share of the population above the age of 65 that might be exposed to a higher demand for healthcare workers. As such they might attract a higher number of foreign-trained doctors to meet their higher demand for healthcare. Therefore a higher share

of elderly people certainly might be associated with a higher dependence on medical doctors from abroad. From the perspective of the country of origin, we also find that a higher share of the population aged 65+ might be associated with a higher stock of medical doctors from that country being abroad. Such results might hint at some constraints as concerns absorption capacities, but also with respect to ageing and long-term care services, e.g., how large might be the number of recipients who get assistance from the system, or how is the long-term care funded. As concerns nurses, we find that a higher share of the population aged 65+ might be associated with a lower stock of nurses from that country being abroad, pointing out that the ageing of the population and a higher demand for nurses in the home country deters the outward mobility of nurses.

Regarding the estimation results about the remuneration of health professionals and how it affects their mobility, we find respectively a strong positive and significant coefficient concerning the receiving country (W_{ft}). The pull effect is particularly high for nurses, with a coefficient greater than one. A relatively higher level of earnings in the receiving country attracts more medical doctors and nurses from abroad. At the same higher wages in the domestic market might deter the outward mobility of medical doctors and nurses, as shown by the negative sign of the variable W_{it}. Therefore, countries which tend to have a higher remuneration of health professionals tend to attract more health professionals from abroad. But from the perspective of the sending countries it is also true that higher wages at home might be accompanied with a lower number of medical doctors and nurses moving abroad. Therefore, remuneration in the health sector might be a strong pull factor to emigrate but also to deter outward migration among health sector workers. In terms of the size of coefficients, an increase in the remuneration at home of 10% might deter the stock abroad of both doctors and nurses by 7%.

In line with expectations, our findings suggest further that for countries which share a common border and are geographically not distant the mobility of health professionals might be higher. Distance has a negative and higher effect, especially on the mobility of nurses. Other indicators which capture cultural or linguistic affinity – such as sharing the same ethnic language – are positively associated with the mobility of doctors, and the effect appears to be stronger than for nurses.

5. Main findings and conclusions

In this study we analyse the patterns of mobility of health professionals across the European countries with a specific focus on medical doctors and nurses. We present a number of stylised facts to sketch the demand and supply of health professionals and the role that the mobility of health professionals has played to satisfy the demand for these professionals across the European countries. The descriptive analysis indicates that among the EU countries there are diverging patterns as far as both the demand and the supply of health professionals are concerned. A number of countries have managed to satisfy their demand by recruiting foreign-trained health professionals. The battle for health professionals among the EU countries has produced winners and losers. This implies that for a group of countries – especially those from the EU-CEE, which are mainly net sending countries of health professionals – severe drawbacks from the mobility of health professionals prevail.

The descriptive statistics also show an interesting existing "paradox", namely that a high density of health graduates goes hand in hand with a low density of the health workforce. This pattern can to a large extent be explained by the cross-border mobility of health professional in Europe. The group of countries which shows the lowest density of health professionals consists of the Western Balkan countries and a number of CEE countries. Especially Slovakia, Hungary, Croatia and Romania have a higher density of graduates – both among doctors and nurses – than the EU average, but their health workforce availability is below the EU average.

To shed light on the drivers of mobility, we estimated a gravity model for health professionals' mobility, separately for doctors and nurses and covering 32 European countries over the period 2000-2017. The empirical estimation of the gravity model suggests that better earnings prospects and higher wage gaps among health professional across the European countries are certainly an important driver of the mobility of health professionals, especially nurses. Geographical proximity and contiguity, but also language affinity, are relevant for explaining the mobility of health professionals.

On the supply side, from the perspective of destination country, a higher number of graduate health professionals might be accompanied by a lower dependence on health professionals from abroad. In contrast, from the perspective of the sending country it might be associated with a higher supply of health professionals being sent abroad.

One the demand side, the results confirm that here the mobility of health professionals does play a role. In particular, the age structure of the population, and consequently the demand for long-term care, is driving the mobility especially of doctors from the perspective of both the sending and the destination country. Furthermore, from the perspective of the sending countries the mobility of nurses might be deterred due to higher demand for long-term care.

Foreign-trained doctors and nurses by and large tend to complement the demand for health professionals and the network effects matter and are an important determinant of mobility among both doctors and nurses.

Rising life expectancy and the ageing of the population, but also the retirement of baby boomers and of the doctors who belong to this generation, are putting further strains on the demand for health professionals, which is expected to change dramatically. The EU health system has to deal with the challenge of replacing a large contingent of health professionals who will soon retire, while at the same time responding to the higher demand for health professionals that will affect all European countries. This state of affairs is particularly challenging for the EU-CEE and the Western Balkan countries, which are faced with a rising demand combined with a declining supply of health professionals. Moreover, these countries have been less successful at retaining and attracting health professionals trained abroad, given the high earnings gap between the health professionals in these countries and the EU15. New policy measures will have to be introduced with the aim of increasing the number of health graduates at home, even though this might be counterintuitive for these countries in view of the high rate of medical brain drain. This will have to be combined with rising wages for this category of health professionals in order to deter these health professionals from leaving home while at the same time attracting others from abroad.

The Covid-19 emergency has confirmed that all EU countries have weaknesses in their health system, and one of them is the inadequate supply of health professionals. Therefore, new policy instruments should be introduced with the aim of expanding the supply of health professionals as well as fostering the mobility of health professionals across the European countries. This would avoid making winners of some countries at the expense of others. Therefore, coordination at the EU level in this direction is deemed that mobility of health professionals is beneficial both for receiving and sending countries.

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Annex

Table A1 / Descriptive statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Stock of Doctors	3660	74914	89640	976	351195
Doctors´ Graduates	3986	2948	3303	85	10069
Share population 65+	4035	17	2	8	22
Stock of foreign trained doctors	4036	203	495	1	6844
Share of foreign trained doctors	3905	14	12	0,15	42
Stock of Nurses	2016	176097	147694	7428	1069000
Nurses´ Graduates	2571	9364	8009	378	46317
Stock of foreign trained nurses	2878	296	1227	1	16000
Share of foreign trained nurses	2878	4	4	0,01	26
Remuneration of health professionals, monthly, EUR pps.	3858	2020	561	597	3809
Distance	4036	7	1	4	8
Contiguity	4036	0	0	0	1
Common ethnic language	4036	0,079	0	0	1

Table A2 / OLS estimates

	(OLS) (dependent variable: log of stock of foreign doctors		(OLS) (dependent variable: log of stock of foreign Nurses)
Ln_SDit (doctors)	-0.0494	Ln_SDit (nurses)	0.360***
	(0.0768)		(0.0652)
Ln_SDft (doctors)	1.001***	Ln_SDft (nurses)	0.492***
	(0.0809)		(0.130)
Ln_SHFDit (doctors)	-0.198***	Ln_SHFDit (nurses)	-0.263***
	(0.0214)		(0.0495)
Ln_SHFDft (doctors)	1.235***	Ln_SHFDft (nurses)	1.326***
	(0.0349)		(0.0589)
Ln_GDit (doctors)	0.643***	Ln_GDit (nurses)	0.363***
	(0.0772)		(0.0600)
Ln_GDft(doctors)	-0.370***	Ln_GDft (nurses)	0.0678
	(0.0798)		(0.145)
Ln_pop65it	0.0391	Ln_pop65it	-0.620+
	(0.203)		(0.325)
Ln_pop65ft	2.394***	Ln_pop65ft	0.617+
	(0.250)		(0.353)
Ln_Wit	-1.070***	Ln_Wit	-1.057***
	(0.0595)		(0.0902)
Ln_Wft	0.618***	Ln_Wft	1.116***
	(0.0862)		(0.166)
Contiguity	0.900***	Contiguity	0.608***
	(0.0848)		(0.143)
Common ethnic language	1.272***	Common ethnic language	0.238
	(0.0971)		(0.157)
Log_Distance	-0.419***	Log_Distance	-0.803***
	(0.0568)		(0.0817)
_cons	-12.28***	_cons	-7.055***
	(1.061)		(1.846)
N	2670	N	1215
R^2	0.637	R^2	0.613
RMSPE	0.263		0.099
F	358.8		146.2

Standard errors in parentheses.
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table A3 / PPML estimates

	(PPML) (dependent variable: log of Stock of foreign doctors)		(PPML) (dependent variable stock of foreign Nurses)
Ln_SDit (doctors)	0.00466	Ln_SDit (nurses)	0.0157
	(0.00958)		(0.0135)
Ln_SDft (doctors)	-0.0656***	Ln_SDft (nurses)	-0.0713***
	(0.0142)		(0.00932)
Ln_SHFDit (doctors)	-0.104***	Ln_SHFDit (nurses)	-0.140*
	(0.0296)		(0.0601)
Ln_SHFDft (doctors)	1.011***	Ln_SHFDft (nurses)	1.062***
	(0.0348)		(0.0641)
Ln_GDit (doctors)	0.151***	Ln_GDit (nurses)	0.271***
	(0.0233)		(0.0478)
Ln_GDft(doctors)	0.306***	Ln_GDft (nurses)	0.268***
	(0.0352)		(0.0462)
Ln_pop65it	0.185	Ln_pop65it	-0.355
	(0.272)		(0.517)
Ln_pop65ft	2.539***	Ln_pop65ft	1.804***
	(0.310)		(0.541)
Ln_Wit	-0.418***	Ln_Wit	-0.0468
	(0.0863)		(0.160)
Ln_Wft	0.478***	Ln_Wft	0.554***
	(0.107)		(0.155)
Contiguity	0.884***	Contiguity	0.736***
	(0.118)		(0.199)
Common ethnic language	0.323*	Common ethnic language	-0.0294
	(0.149)		(0.371)
Log_Distance	-0.110	Log_Distance	-0.0217
	(0.0744)		(0.105)
_cons	-12.32***	_cons	-13.61***
	(1.284)		(2.127)
Specific country pair dummies	Yes		Yes
N	16220	*N*	13142
R^2	0.598	R^2	0.423
RMSPE	0.253		0.204

Standard errors in parentheses.
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

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