Drew University College of Liberal Arts

Europe's Population Decline:

Implications for its Global Power in the Decades to Come

A Thesis in International Relations

By

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Abstract

This paper examines the novel demographic developments of an aging population that is also in decline and European power changes. With population often being named as a factor that in some way relates to state power, this paper analyzes the connection of population aging and decline and how the effects will impact Europe's international power position. Previous research fails to adequately show the relation between demographic characteristics and state power that is also tailored to specific states or regions. This research allows for a finer grip on the effects of population changes on the features of state power, which grant better policy responses and security forecasts. Following a theoretical and historical background in demographic change, demographic data of Europe and the world, a discussion on the concept of state power, and an analysis of Europe's military, economic and technological strength related to country demographics. The paper argues that Europe's international power will be negatively impacted by population aging and decline. Furthermore, it will be shown that the impact of these demographic characteristics on European power are channeled through reductions in total potential military manpower, military spending pressures, tensions in economic growth, increases in societal burdens and costs, changes in saving and investment patterns, and increasing challenging conditions for technological advancement.

Keywords: European power, population aging, population decline, military power, economic power, technological superiority.

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Introduction

Europe is currently entering a new phase of population change, a population that is not only aging but also declining. Low fertility rates, small inward migration flows, and stable death rates are all contributing to the demographic change in Europe. This development has been known for some time but it has lacked some in-depth research on how this population change will impact Europe specifically. Although Europe isn't the only region that is facing a declining population, since this trend is globally inevitable, it is the timeline that is different for every state and region. Here, it is Europe along with some Eastern Asian states, including Japan and China, who are going to experience the reduction firsthand. Hence, these regions will be confronted with the effects of population aging and decline that are on a scale unseen before in history. Unsurprisingly, this novelty brings up certain insecurities about the consequences of it. Therefore, to start mapping out these still unknown effects, this paper will be delving into one specific question regarding the effects of population aging and decline, how will it change Europe's international power position?

Europe is a region with an already much older population compared to the other global regions and it has seen much lower rates of population growth over the past decades. This is not only contributing to the degree of aging of the European population but also to the expected decline in total population size that Europe is facing over the next 15 years. However, this decline in population isn't only an absolute population decline, Europe will also be declining in relative size compared to the other regions as Europe's global population weight is going to be reduced significantly. For that reason, with the absolute and relative population decline and so the reduction of European relevance in population size globally, a logical next question is how it impacts their future global power position.

Historically population size has been deemed important by state leaders because it is seen as a core factor for military power which was then and still is regarded as an influential

criterion for great power status. Population compositions are also claimed to be essential to understanding power shifts in world politics as demographic differences and changes will cause national power alterations (Kugler and Swaminathan, 2006). Consequently, arguments emerge that population aging and decline "is bound to have economic and political ramifications for developed industrial states" (Leuprecht, 2015, 2), or that population decline will put a drag on relative economic and military power (Eberstadt, 2019, 155).

However, these arguments above are often made without adequate or complete evidence and logic that is situation tailored. Since power gives states the ability to command or exert influence over the actions of others to achieve their own interests, it is deemed crucial for states. Yet, measuring power is complicated and it also lacks consensus in the academic world. Thus, the relation of population dynamics to power variability is often indistinct. This research seeks to examine and bring to light the connections between demographic characteristics and power and exemplify how that will pertain specifically to European power. This information can provide a better understanding of the expected effects of population changes on elements of state power which could also lead to early and more accurate policy responses to manage the negative impacts. On top of that, it also can help to create important future security projections which shouldn't be overlooked since demographic change is almost always a slow-moving change that is quite powerful (Libicki, Shatz, and Taylor, 2011, xiii).

This paper will conclude with the argument that with all elements considered, including military manpower, military spending, economic might, and technological advancement, Europe's position of power in the international system will be negatively affected if the demographic changes aren't dealt with effectively. Europe's military manpower will see absolute and relative supply reductions and while their military spending

is relatively high on a global scale, their military budget will also be faced with downward pressures, this time due to the economic effects of these population changes.

Whereas, Europe's economic power will be attacked from multiple angles by the demographic shifts that are happening. Europe's GDP growth can't expand anymore by simply increasing their workforce, now the productivity growth element will be the most important factor to ensure economic growth. However, besides the fact that productivity growth has already been declining in advanced economies, it is also expected to be negatively impacted by these demographic changes. Therefore, the expected economic growth for Europe is set quite low and will limit potential growth in overall societal quality of life. While economic growth doesn't have to be negative in absolute numbers, it seems that other regions, especially Asia and Africa, aren't going to be faced with growth rates that low, these regions have demographics that are still much more favorable. But in addition, these regions also have more low-hanging fruit for productivity growth. Thus, the economic weight and the importance of Europe are most likely to decrease and population changes play a role in that process.

Furthermore, Europe will also be faced with a rising dependency ratio that is much higher than the other regions will be dealing with in the coming years. Fiscal pressures in expenditures on increased elderly care will have to be dealt with while there is already pressure on economic growth. On top of that, there is an increasing need for investments in R&D to keep up with innovation and technological advancement since older populations are less innovative and thus the aging population slows innovation down. This will not only be important for Europe to increase their productivity growth, but also for their general position in the global economy and military advancement. At last, the expected dissaving in society will also pressure domestic investment and will create an additional obstacle for Europe.

This paper does recognize that changes in European power will also automatically entail positive shifts in other global power shares. This questions why a potential decline in European power matters, or in other words, what makes Europe's power position important? While this question can be its own research essay, here there are two general arguments put forward. First, it is principally presumed that the power proportion in the international system matters to Europeans themselves, as more power allows them to better defend their interests. However, others can deem European power important because they are seen as an essential protector and promoter of the international liberal rule-based order.

To come to the argument that the demographic changes Europe is faced with will negatively affect their international power the paper will be divided into multiple sections. First, it will provide theoretical and historical background around demographic changes to provide the context around the current developments. This is followed by the examination of the data showing the current and expected demographic shifts. This section will demonstrate that the European population data is central in the discussion, while also incorporating the global and regional demographics that are changing. Afterward, the discussion moves on to the concept of power. Two questions are central here: what is power and why is it important. The conversation around power structures provides an in-depth analysis of how Europe can be impacted by separate power components, where the main focus is on military, economic, and technological strength.

Unit of Analysis

Before looking at the theoretical and historical background to demographic changes, it is essential to explain the unit of analysis of the paper: Europe. When this paper is talking about Europe it is referring to all European states generally considered to be part of the European continent except for Russia, Ukraine, and Belarus. The list of states considered to be part of Europe isn't only based on their geographical position, but also on their level of cooperation, the similarities in government structures, their territorial control, and/or their ethics and values. Therefore, even with all European states experiencing these demographic changes, Russia, Ukraine, and Belarus are excluded. This list also excludes Turkey from being seen as a part of Europe. Even though Turkey has its connections with NATO and has a running bid to join the EU, that bid is stalled and Turkey is currently on a path that is diverging from Europe's general collective identity and values.

This paper also hasn't limited Europe to the European Union. If this paper was to look at just the European Union it would exclude important states that add to Europe's power and thus are part of Europe's power outlook. In addition, the level of cooperation, connectedness, and integration between all these European states is extremely high which has been unprecedented for sovereign states. Notably, this also isn't limited to just states within the European Union. While recognizing that the European Union is the reason why all European states have extraordinary levels of cooperation and allowed Europe to increase its power collectively, these effects haven't stayed strictly within the Union borders.

Lastly, the unit of analysis isn't limited to the European Union because the states that aren't officially full members of the EU are either in the process to join the EU or have other standing agreements with the EU. This again illustrates how the effects created by the EU spillover beyond those borders. This makes it more important to have a broader unit of analysis since the European Union won't be set in stone this coming century.

Moreover, this level of integration and cooperation is also not just limited to economic measures. In terms of military cooperation, there isn't only the increasing military integration within the European Union but using NATO membership provides an additional layer to European military cooperation. While NATO isn't an exclusive European membership organization, as it has three outside of Europe members, it stays a predominantly European military alliance where it assures the collective protection of the states that are part of it. This

provides Europe not only with a collective security mechanism that allows for greater interconnection among European states themselves but also shows unity to the outside world which with recent events has been reaffirmed.

Consequently, European states show economic, social, and military connection and integration between sovereign states on a level by and large unseen anywhere else in the world. This allows the paper to predominantly look at Europe from a one-entity perspective instead of just a geographical region that possesses many small states. In addition, the unit of analysis is a broader Europe than just the European Union (see appendix table A1 for the full list).

Understanding Demographic Change

Important numbers to population sizes

As will be shown below, in the demographic transition model there is only a focus on birth and mortality rates and how those impact population sizes. However, the overall population size is affected by birth rates, mortality rates, and migration flows. Historically, migration flows were small enough to not severely impact the change in total population, yet, nowadays it is growing in importance (UN a, 2019). This is especially the case for the Western World because they are often receiver states of migration. While migration flows are also impactful for the sender countries, the overall impact for them arguably tends to be lower due to higher fertility rates in these states and because outward migration is often spread out between more states than the amount of receiving states.

Therefore, since population sizes are also impacted by migration flows it can be argued that Europe is only facing an absolute population decline because it has strict migration policies that are in place to limit the migration inflow from outside of Europe. Migration trends are a factor that could reduce the population aging and decline in receiving states because migrants are often relatively young (Bloom and Luca, 2016). Nonetheless,

while there is variation between countries, on average Europe's public opinion towards immigration from outside Europe is rather negative (Goldstone, 2008) and therefore policies that could support immigration towards Europe aren't actively created. In comparison, the migration influx into the United States is a major reason why they aren't experiencing this new trend Europe is facing. Making the US an outlier in the Western world as their annual rate of population change is still positive and will stay positive during this century (UN b, 2019). Hence, you could argue that Europe is facing a self-imposed population reduction as many people are more than willing to relocate to Europe.

Though migration flows are also the most unpredictable compared to mortality and birth rates, one could consider the migration crisis in Europe in 2015 for example. While mortality rates are also more unpredictable than expected as the global COVID-19 pandemic has shown, deadly natural disasters and pandemics are still much rarer than unexpected big migration influxes or outfluxes. With that being said, this paper holds the assumption that Europe will keep its tight migration policies in place and thus continues to limit the role migration will have on their demographic changes.

Lastly, the demographic transition model tends to only focus on absolute changes in country size but that isn't the only thing that matters. The relative size of age groups within society is also a statistic that is important because it can reveal the demographic trends in the future of a country. This is why "population developments are at least partially an exception to the inherent unpredictability of social and political life" (Vanhuysse and Goerres, 2021, 4).

The Demographic Transition

The demographic transition is a well-known phenomenon and theory that describes the decline in mortality rates and the following decline in birth rates in society. Currently, every state either has already completed the transition or is still experiencing it, making it a global trend. The demographic transition is also seen as a shift in the economic development and

technological advancement of a state. This explains why it is mostly the developing states that are currently still in the demographic transition as they started the process of declining mortality and birth rates much later than most developed states (Bloom and Luca, 2016).

The demographic transition has multiple stages, where the first stage can be marked as a strong decline in mortality while fertility within the state remains high. This allows for more people to live and causes an overall population growth. The mortality decline during this stage is mostly due to a decline in infant mortality, therefore, the population growth is producing a population boom centered in the youngest age groups (Goldstone, 2012) (Bloom and Luca, 2016). The second stage of the demographic transition is put in motion by effects the first stage generates: an upward pressure in family size and a rise in urbanization. Those effects will help lead to a fertility decline in the second part of the demographic transition (Dyson, 2010). This fertility decline causes a lowering rate of population growth but the population will still continue growing until the decline in fertility rate has caught up with the decline in mortality rates. However, as the rate of population growth goes down due to declining fertility, the working-age population will start to grow at a faster pace than the overall population and therefore lowering the dependency ratio in society (Bloom and Luca, 2016).

The last and third stage of the demographic transition is the period where the population moves away from being a predominantly young population and starts to grow older. Mortality and fertility rates have reached a lower equilibrium than pre-transition demographics and caused the population to stop growing and therefore stabilizing it. Society starts maturing as the influx of youth declines and the increased longevity of life becomes visible.

At the end of the demographic transition, population growth is around zero, fertility and mortality rates are stable and low, and the overall population size is bigger than the pretransition size. This whole process in the Western world generally took around a century to complete but not every state started this transition at the same time and therefore not every state has completed it. It is projected that it is fully completed in every country by 2100 (Bloom and Luca, 2016). Notably, while the demographic transition in the developing countries started almost a century later than in most developed states, they are completing it at a much faster pace (Bloom and Luca, 2016). To put this in perspective, it took Great Britain 130 years to get fertility down from 7 to 2 children. This same process only took South Korea 20 years and Iran 22 years (Goldstone, 2012, p. 20).

The reason why not every state starts and completes the demographic transition at the same time is because the transition model has some starting and end conditions. One key factor driving the transition model is economic change, where the industrialization of an economy generally sets the demographic transition in motion. The start of the demographic transition was in Western Europe and had everything to with the economic changes that were happening in society. For Western Europe it was the Industrial Revolution that was the main event that created the byproducts needed for the demographic transition, for example, improvements in living standards, higher caloric intake, better health access and understanding, better sanitation infrastructure, and many more (Goldstone, 2012)(Fogel, 1997; Preston, 1975; Cutler et al, 2006, as cited in Bloom and Luca, 2016, p. 15).

The economy at the beginning of the demographic transition is starting to industrialize and therefore the economy is still very simple and mainly agriculture-focused. At the end of the transition, the economy is seen as generally industrialized and not agriculture dominant. However, it must be said that the demographic transition can proceed differently for every state as the model has generalized the Western experience.

Population aging beyond the demographic transition

In the early 20th century, there was a concern that the global population was spiraling out of control but this old image became obsolete in the 1970s as the last stage of the demographic transition became visible (Libicki, Shatz, and Taylor. 2011, p. 44). In the demographic transition model, it is the last stage where the population starts to age and population growth dials down. Whereas at the beginning of the transition the bulk of the population was in the lower age group segments of society as infant mortality was one of the first to decline. Eventually, the decline in fertility and the increased longevity of one's lifespan moves the bulk of the population toward the older age groups. This shift to a higher average population age also brings about a dependency ratio that isn't solely focused on children. The 65+ section has also gained volume which allows for an increasing total dependency ratio. This aging in society is expected within the demographic transition model.

However, Europe is even past this last stage of the demographic transition where normally this stage stabilizes its population size. Europe and many other states have a fertility rate that kept moving further down while the demographic transition model expected that fertility would stabilize at the natural replacement rate of 2.1 (Jackson and Howe, 2008, p. 37). This lower than replacement fertility rate isn't only increasing the level of aging in society, they are also about to enter a new transition of a declining population and that is something unpredicted by the demographic transition. Europe together with certain other states are the first to experience this move past the traditional demographic transition model and to a more extreme level of aging and eventually population decline because they were the first states to complete it. This will eventually turn into a global phenomenon as fertility declines and the rise in the median population age is already visible in the forecasted demographic data on the global level. It is the absolute population decline, as shown in the next section, that doesn't apply to the general world population (table 1, page 6).

Current Population Data and Expected Trends

This section will present the current population data and the trends to be expected in the future supported by tables and graphs. The focus here will be on Europe but to put Europe's development in perspective, the overall world population data and the other global regions will also be analyzed. The states to be considered to be part of Europe in this paper is a political-based list as mentioned under the unit of analysis section (see appendix A1). Therefore, as explained earlier, Europe excludes the following states that are often considered to be part of Europe geographically: Russia, Ukraine, Belarus, and Turkey.

The data from all population statistics presented comes from the United Nations Population Prospects database, the 2019 update, and presents the medium-variant population projection. However, taking note of the UN grouping of European states, which includes Russia, Ukraine, and Belarus, and excludes Cyprus, this paper has adjusted some of the UN data accordingly. Consequently, the grouping of Europe is done differently in this paper than the standard UN region groupings. This led to the complete exclusion of Russia, Ukraine, and Belarus in analyses unless specifically stated. Additionally, it has left out Cyprus from the European analysis, instead, Cyprus is presented under the Western Asia regional group. Due to Cyprus's relatively small population size and thus low relevance in the data, this is considered acceptable for this research.

The world's demographic data

Before diving into European population statistics, the paper will provide general population data for the world's population as this will put regional data in more context. The total world population was 7.79 billion people in 2020 and is expected to climb up to 9.74 billion in 2050 and 10.88 billion in 2100, as you can see in table 1 (UN c, 2019). The table also shows that even though the world population is still growing the average global growth rate is slowing down significantly, but the growth rates still vary greatly between regions

(UN a, 2019). Nevertheless, the overall slowdown in growth isn't a surprise considering the decline in fertility rate over the years which is reaching below replacement level in 2075.

Additionally, the data in table 1 also shows how the median age is also going up together with the percentage of the population aged above 65+. Notably, the population aged above 65+ is the fastest-growing age group (UN a, 2019). This population information taken together with graph 1, which presents the age pyramids of the total world population in 2020 and 2100, shows that the total world population is moving from a relatively young population to a more mature one. In other words, showing the completion of the demographic transition from the global perspective. Although the total world population isn't yet declining in absolute size at the end of the century, all the data points to that inevitable path after this century.

	Years					
	1950	2000	2020	2050	2075	2100
Total Population (billion)	2.54	6.14	7.79	9.74	10.58	10.88
Population Change (% of pervious column)	-	141.7%	26.9%	25.0%	8.6%	2.8%
Absolute Population change (of pervious column)	-	3.60	1.65	1.95	0.84	0.30
Median age (years)	23.6	26.3	30.9	36.2	39.2	41.9
Total fertility (live births per women)	5.1	2.7	2.4	2.2	2.0	1.9*
Percentage of population aged 25-64	42.4	45.3	49.7	49.2	48.6	48
Percentage of population aged 65+	5.1	6.9	9.3	15.9	19.5	22.6
Total dependency ratio** (per 100)	135.8	120.6	101.2	103.2	105.8	108.5

Table 1: World population data

Source: UN Population Prospects, 2019, medium projection.

* Data of year 2099

**the total dependency ratio of the population aged 0-24 and that aged 65+ to the population aged 25-64. They are presented as number of dependants per 100 of working age (25-64).



Graph 1: The world population pyramids: 2020, 2100

Source: UN, World Population Prospects 2019, volume II: Demographic profiles

Europe's population trends

As mentioned, Europe is one of the first to experience these new population developments that will eventually be a global phenomenon. However, Europe's situation still stands out from the rest of the world. These changes in population size and age distributions are historically unseen and Europe is one of the first regions to face these unpredictable changes throughout society. Additionally, Europe is going to deal with a population decline in not only absolute numbers but also in relative numbers. Lastly, Europe also stands out from other states and regions because it doesn't have the bulk of its population located in the childbearing ages as you can see in graph 2. Europe already has a relatively old population due to its earlier start with the demographic transition.

Two-thirds of the expected population growth globally through 2050 will be driven by current age structures (UN d, 2019, p. 8). Again, going back to graph 2, this trend won't apply to Europe as their demographic momentum is long gone, its age pyramid isn't even a true pyramid anymore. In other words, by only looking at the age distribution Europe's contribution to population growth based on age structures will be limited as the upcoming childbearing age groups will be significantly smaller. Northern America and Eastern Asia have just like Europe lost their demographic momentum, but they still have a higher share of their population aged 34 and under compared to Europe.

In comparison, graphs 3 and 4 containing the age pyramids for Northern Africa and Western Asia, and Southern Asia show how even the other regions that are considered to be aging and have low fertility rates still have a demographic momentum that results in them still growing in absolute population size. This is because their populations are still centered around the younger age cohorts and therefore are about to reach or will reach the reproductive age over the next few decades (UN d, 2019). The regions South-Eastern Asia, Central Asia, Latin America, Oceania, and Sub-Saharan Africa are also all regions where the population pyramid is similarly shaped like the examples shown below in graphs 3 and 4. Therefore, they are also all still expected to grow in absolute size for a solid more years.



Graph 2: Europe's* population pyramid, 2020

Source: UN, World Population Prospects 2019, volume II: Demographic profiles

*This population pyramid includes Russia, Ukraine, and Belarus. Since their demographic trends are parallel to the political grouping of Europe this graph is still usable to show the form of the pyramid.

Graph 3: Northern Africa and Western Asia population pyramid, 2020





Source: UN, World Population Prospects 2019, volume II: Demographic profiles

This difference in age distribution among Europe's population compared to other regions is important to notice because this still allows for divergence in population sizes to form. Even if states have the same birth rate and population total, a population with the majority in the younger age categories will have more women in child-bearing ages. Therefore, they will have an absolute higher number of births than a population where the majority is located in the older age groups. This difference in population size growth is also not always settled within one generation. A demographic momentum tends to reduce with each generation but how strongly depends on the fertility rate. Thus, in addition to simply looking at fertility and mortality rates, understanding the relative size of the age cohorts is also important when looking at population data as that will show why Europe holds a different position than many others do.

Moving on to Europe's total population size over the years, table 2 shows certain population statistics about Europe. The first thing to note is the population total, population percentage change, and absolute population change as they all show Europe's population reduction. As the table shows, Europe's total population is currently around its peak with 548.5 million in 2020. The corresponding years after that show a downward trend in their

total population size. Zooming out to the two outer years 1950 and 2100, it shows Europe's total population only grew by a slim 17.5% (table 3). This number evidently stands out as only Eastern Asia and the populations of Russia, Ukraine and Belarus together are also expected to have a growth below total population replacement in that same time span. Additionally, looking at the years 2020-2100 in table 3 shows that Europe's population from 2020 to the end of the century is expected to decline by around 14%. Meaning that Europe's population growth between 1950 and 2100 is mainly located before 2020.

The expected coming decline in Europe's population size isn't surprising when looking at their fertility rate (live births per woman). While Europe in 1950 had a fertility rate that still stood above the 2.1 replacement level, it reached its lowest rate of 1.46 in 2000. Now looking back at the world data, it showed that the global fertility rate won't reach below 2.1 until around the year 2075. While for Europe the fertility rate did go up in 2020 and is expected to continue to go up to 1.75 in 2099, it is still below the 2.1 replacement rate during the whole century. Therefore, the population of Europe will continue to decline even with the small rise in its fertility rate.

Furthermore, the data presented in table 2 also presents how the median age in Europe is going up together with the percentage of the population aged 65 and above. This all shows a population that is getting older. On top of that, the percentage of the population aged between 25 and 64, also seen as the total potential workforce, is already in a slow decline as it peaked in around 2000 at 53.9% and is expected to decline to 45% in 2100. So, not only is Europe clearly aging but their total potential workforce is also shrinking as a percentage of the total population. Therefore, as anticipated, table 2 also shows that the total dependency ratio is showing a strong rise over the course of the century.

Table 2: European population data

	Years					
	1950	2000	2020	2050	2075	2100
Total Population (millions)	401.5	520.4	548.5	530.8	493	471.6
Population Change (% of pervious column)	-	29.6%	5.4%	-3.2%	-7.1%	-4.3%
Absolute Population change (of pervious column)	-	118.9	28.1	-17.7	-37.8	-21.4
Median age (years)	31.1	37.9	43.5	48.5	49	49.4
Total fertility (live births per women)	2.6	1.46	1.58	1.69	1.73	1.75*
Percentage of population aged 25-64	49.7	53.9	53.7	46.6	45.3	45.0
Percentage of population aged 65+	8.8	15.5	20.3	29.7	30.9	31.3
Total dependency ratio** (per 100)	102	85.8	86.5	114.7	121.1	126.1

Data source: UN Population Prospects, 2019, medium projection.

* Data of year 2099

**the total dependency ratio of the population aged 0-24 and that aged 65+ to the population aged 25-64. They are presented as number of dependants per 100 of working age (25-64).

Table 3: Percent and absolute change in total population, all regions Years

	1950-2020		1950	-2100	2020-2100		
In million	% change	Absolute change	% change	Absolute change	% change	Absolute change	
World*	212.0%	5.3	336.0%	8.4	39.7%	3.1	
Europe	36.6%	147	17.5%	70.1	-14.0%	-76.9	
Northern America	113.7%	196.3	184.4%	318.3	33.1%	122	
Oceania	228.5%	29.7	476.2%	61.9	75.4%	32.2	
Northern Africa and Western Asia	424.9%	425.7	826.0%	827.6	76.4%	401.9	
Central Asia	324.6%	56.8	556.6%	97.4	54.6%	40.6	
Southern Asia	293.4%	1447.1	349.1%	1721.9	14.2%	274.8	
Eastern Asia	147.7%	1000.6	80.5%	545.1	-27.1%	-455.5	
South-Eastern Asia	305.0%	503.5	350.8%	579.1	11.3%	75.6	
Latin America and the Caribbean	287.4%	485.2	302.8%	511.2	4.0%	26	
Sub-Saharan Africa	511.4%	915.4	2009.1%	3596.3	245.0%	2680.9	
Russia, Ukraine, Belarus	34.7%	51.3	6.9%	10.2	-20.6%	-41.1	

Data source: UN Population Prospects, 2019, medium projection.

* Numbers are presented in billion

Nevertheless, be mindful that the absolute decline in population is simultaneously

happening on top of the percentage-share decrease of the potential workforce in Europe. The total extent of the workforce decline in absolute size is therefore not completely shown by the numbers in table 2. For that reason, the European population size divided into three broad age groups is presented in graph 5. This graph presents the age groups 0-24, 25-64, and 65+ and

their change in absolute size over the past and coming years. It shows that the total potential workforce (age 25-64) besides its decline in population share also loses numbers in absolute terms starting from 2020. The same trend is visible for people aged 24 and below as that age group has been declining since 1950. Yet, the age group of 65 and above shows the opposite development, with a clear rise in absolute size until 2075.



Graph 5: European Population by Age Groups

Europe's demographic trends in context to other regions

However, Europe's population data is somewhat meaningless without putting them in better context to the other regions in the world. Therefore, starting with graph 6, the graph presents the population growth in index numbers for all the regions and takes the year 1950 as the base year for all regions. Additionally, the graph has emphasized the peak population sizes for each region with a dot. Yet, notice that the Sub-Saharan Africa region isn't presented in this graph. They are an outlier with their expected population growth during the upcoming years and thus they deform the graph too heavily. The full data on each region's absolute population size by year is presented in the appendix table A2 and includes Sub-Saharan Africa.

Source: UN Population Prospects, 2019, medium projection.



Graph 6: Population changes by region between 1950-2100

Data source: UN Population Prospects, 2019, medium projection.

Although graph 6 doesn't show the absolute differences in population sizes between the regions since the graph shows index numbers, the graph still allows for two important observations. First, it shows how there are significant differences in the relative population growth rates between the regions over the years, especially after 2000. Northern Africa, Western Asia, Central Asia, and Oceania are all regions that are to experience serious increases in their own relative populations and their growth rate only starts to slow at the end of the century. In comparison, while Northern America also keeps growing till the year 2100 in population size, they show a much lower growth rate over the same period.

Second, the graph shows there is a noteworthy variation in when each region reaches its peak population size. Seven out of the eleven regions, including Sub-Saharan Africa, are reaching their peak population size between the years 2075 and 2100. Meanwhile, Russia, Ukraine, and Belarus together have already hit their population peak near the year 2000, Europe will reach that around the year 2020 and Eastern Asia will hit it around the year 2030. Therefore, this affirms that for the moment absolute population decline is still a phenomenon

to select regions, including Europe. Although, it is worth noting that Eastern Asia's population peak is in all likelihood artificially early due to China's one-child policy they had in place for almost 40 years and only recently has been removed.

Furthermore, while Eastern Asia is peaking closely after Europe, Eastern Asia still has a greater percent population growth between 1950-and 2100. Eastern Asia is expected to have grown 80.5% in population size in 2100 with 1950 as the base year (table 3). Whereas, Europe during the same timeframe will see a population increase of only 17.5%. Additionally, take note of the already staggering absolute population size difference between Europe and Eastern Asia, which is around 1.1 billion today. Nor will this disparity in absolute population sizes be significantly reduced at the end of the century since it is still expected to be around 750 million people in 2100.

The data shown in graph 6 does have its limitations to what information can be presented. Due to the graph showing index numbers, it can only show when each region is expected to decline in terms of population numbers and the growth rate of each region individually. The graph doesn't show the relative difference between each region's population proportion. Just as table 3 already reveals, the percentage growth might be high for certain regions, however, it doesn't have to equal a big outright population size, and taking into consideration Oceania in table 3 confirms this. Oceania between 1950 and 2020 had over a 200% population increase, yet, this was 'only' equal to an increase of a little below 30 million people. Hence, it is important to also look at the relative population size differences between the regions besides just looking at the variations in population growth rates. This is also especially essential when considering that all regions have different growth rates and so allowing for shifts to happen in regional population weight.

Therefore, in graph 7 the population share of each region is shown for the years 1950, 2020, and 2100 as this allows for a region size comparison. Graph 7 shows how Europe held a

15.8% share of the total global population in 1950, this dropped to 7% in 2020, and eventually even moves down to a 4.3% portion of the global population in 2100. This accordingly results in an expected population-share decline of 11.5 pp between 1950 and 2100 (table 4). The majority of this decline is between 1950 and 2020 which signifies how Europe is already met with critical global population modifications that will still continue to shift. Whereas Europe was ranked as the third-largest region in 1950, they have dropped to the 6th rank in 2020, but ultimately they will move down to the 8th rank out of 11 at the end of the century. This indicates that Europe is not only faced with a reduction in population size in absolute numbers, but they are also already facing a decline in their relative size and significance when comparing them to the other regions.

Looking at the other regions and their changes in relative size generally shows a less striking image, here the exceptions are Eastern Asia and Sub-Saharan Africa. While most regions stay below a range of change of 5 pp as seen in table 4 and so encounter limited relative shifts. Eastern Asia is expected to be declining 10.3 pp in their population share between 2020-2100 and Sub-Saharan Africa will be gaining a 20.7 pp share during this period. Thus, as Sub-Saharan Africa is gaining global population weight and is expected to house almost 35% of the total population in 2100, Eastern Asia, like Europe, is faced with a decline in population share. However, Eastern Asia in 2100 is still forecasted to hold 11.2% of the world population, moving them only from the 2nd rank in 2020 to the 3rd rank in 2100. Therefore, even with Eastern Asia's relative decline globally, this decline is more limited compared to Europe's reduction when considering their more substantial falling ranking.



Graph 7: Regional population share out of total global population (in %)

Data source: UN Population Prospects, 2019, medium projection.

	Years				
	1950-2020	2020-2100	1950-2100		
Europe	-8.8%	-2.7%	-11.5%		
Northern America	-2.1%	-0.2%	-2.3%		
Oceania	0.0%	0.1%	0.2%		
Northern Africa and Western Asia	2.8%	1.8%	4.6%		
Central Asia	0.3%	0.1%	0.4%		
Southern Asia	5.4%	-4.5%	0.9%		
Eastern Asia	-5.2%	-10.3%	-15.5%		
South-Eastern Asia	2.1%	-1.7%	0.3%		
Latin America and the Caribbean	1.7%	-2.1%	-0.4%		
Sub-Saharan Africa	7.0%	20.7%	27.7%		
Russia, Ukraine, Belarus	-3.3%	-1.1%	-4.4%		

Table 4: Change in regional population-share (in percent-point)

Data source: UN Population Prospects, 2019, medium projection.

Moreover, one demographic change that is identical to all regions is population aging. Over the years the median age is rising in all regions as illustrated in graph 8. This population aging trend is also supported by the data on the population percentage aged 65 and up as the share of this age cohort is significantly rising in all regions (see appendix table A3). Graph 8 shows that only Sub-Saharan Africa is more distinctively behind the other regions regarding median age, while Europe is holding a position at the top together with Eastern Asia and Latin America. Europe, Eastern Asia, and Latin America are also outliers with their population share aged 65 and up as they are the only ones with a share above 30% near the end of the century. Interestingly, graph 8 does also show how Northern America is still notably younger than Europe based on their median age.



Data source: UN Population Prospects, 2019, medium projection.

Lastly, although all regions are experiencing aging populations, absolute population decline is still something that is not common among most regions. This is already shown in graph 6 but it is also reaffirmed when taking into account fertility rates (appendix table A4). In 2020 it is only a select number of regions that have a fertility rate below the replacement level of 2.1. Where it is only Europe, Northern America, and Eastern Asia that have replacement levels below the 2 in during this time. Yet, considering Northern America's extremely high net migration rates, their population is still anticipated to grow over the whole course of the century. Even so, just as graph 6 shows population growth rates are slowing down for all regions at the end of the century. That is due to the expected fertility rate below or at the replacement level of 2.1 for all regions in 2100 which will also further contribute to population aging.

The Concept of International Power

The relative and absolute decline of Europe's population, in addition to them already being a relatively older society now and in the future, brings up questions surrounding Europe's position of power on the international stage in response to these demographic changes. Population size on its own has never been the sole determining factor on why certain states hold specific (political) positions in the global order (McNicoll, 1999) or on why states are considered powerful (Eberstadt, 2004). Nonetheless, population size certainly does play a role since it is a potential resource pool for a nation (Kugler and Swaminathan, 2006). In addition, especially now with major predicted changes in the regional shares of population proportions, this could upset structures in the current power balance (McNicoll, 1999). Or as Eberstadt (2004) writes, demographic factors can "alter the complex strategic balance between, and within, countries" (p.1).

To this degree, the population variable is said to have an indirect role in the status of regions and states. Population size itself doesn't create the international order of states, however, population size and its characteristics do impact the level of the potential power a region or state can acquire on the international stage. Therefore, there is a gap to be filled in the literature on how the impact of demographic changes in Europe will affect their international power standing. To answer these questions related to the concept of European power and how it will be impacted, there first needs to be an understanding of what power is, how it can be measured, and why it is important. Afterward, the research will analyze how population demographics play a role in each distinct power component.

What is power?

The question of what power is, is highly debated in the international relations community and has led to a great deal of variation on how the concept of power is conceptualized (Schmidt, 2005) (Baldwin, 2016). This paper will follow a general and broad

definition of power with a focus on the importance of hard power on the global stage, meaning military and economic power. Recognizing the significant role of power for states and the hard power emphasis leads to a more realist outlook in this paper since for realists "power is the currency of international politics" (Mearsheimer, 2001, 12) and the realist school has also been the most dominant one in the study of power (Schmidt, 2005). However, this paper doesn't limit itself to the realist framework as cultural and regime type differences can't be ignored to understand Europe as a bloc and their relationships with other states that hold similar values and beliefs versus states that don't have these overlaps.

Power in international relations theory could be defined in terms of "the economic and military capabilities of states or as the ability to command or influence the actions of others – whether directly or by setting the rules of the game" (Rothgeb, 1993, as cited in McNicoll, 199, 415). Another way of describing power is having the ability to coerce the behavior of other states in your favor or to exercise influence over other actors in the international system (Schmidt, 2005, 527). Or as Beckley (2018) writes "power is typically defined as the ability of a country to shape world politics in line with its interests" (p. 8). All these definitions while being slightly different are at the core conveying a similar meaning. On top of that, these definitions show that power often isn't strictly defined as measured attributes like for example military and territory size, which is how Waltz (1979) sees it. Instead, power is repeatedly defined by a more abstract understanding of state capabilities to achieve its interests.

However, since power is explained in abstract and not directly measurable features it complicates the assessment of state power. Therefore, to measure Europe's power the paper will conceptualize power with measurable attributes since measuring the actual outcomes of state actions along the lines of their interests is unattainable (Beckley, 2018). Nevertheless, the paper recognizes that not all state power is able to be measured, nor is there a straightforward relationship between the quantifiable variables. The uncertainty around power measurements also brings up a point made by predominantly neoclassical realists which is the assumption that foreign policy officers can't completely grasp the exact power held by other states since foreign states are so-called 'black boxes'. Instead, the perception of the state's power is used in foreign policy decisions, and therefore the actual power a state holds can very well differ significantly from what the outside calculated it to be (Schmidt, 2005, 544-546). Although, it is unlikely to have big disparities between the perceived and actual state power.

How will power be measured?

There are many complications with how power can be measured that aren't just due to the abstract defined power concept. For starters, while military and economic strength are in one perspective independent measures of power, they have a more complex relationship than just a sum-up. For example, economic size and strength can directly impact the total potential of military spending (Libicki, Shatz and Taylor, 2011, 90). On top of that, neither military nor economic power is more important than the other. As Waltz writes "states are not placed in the top rank because they excel in one way or another" (p.131), nor can today's international order be explained with just one measurement. It is possible to compare states and rank them on static single factors but it is the complex interactions between certain elements of a state that determines its position in the international order (Lake, 2018, 7).

This all has led to a still unclear link between resources and power and has brought up critiques. As Finnemore and Goldstein (2013) write "even when resources create power – in the form of troops, guns, and money – that power does not always translate into policy success" (3). This is reaffirmed by Schmidt (2005), power measured by the possession of certain resources doesn't include the ability of a state to convert these resources into actual influence (529). Besides, power alone isn't enough since grit, luck, and wisdom matter as well (Beckley, 2018, 13) and the Vietnam War presents a real-world example of this. The

United States was evidently the supreme state in the conflict, yet, they were still not able to translate their power into success. Therefore, it is important to recognize that there could be and are many additional small characteristics that states possess which will impact their actual and potential power, although these are not always clearly visible.

Furthermore, not all goals can be achieved by all kinds of power, therefore power measured as one lump isn't always the best way either to identify a state's strength (Schmidt, 2005, 530). This critique and the critiques mentioned above of power and its measurement are well-grounded and show the limitations of assessing state power when not solely looking at the actual outcomes of state actions. But as Beckley (2018) points out, waiting for an event to happen in order to measure power is impractical and undesirable and, therefore, a way to measure power remains important for security planning even if the measures contain flaws. Hence, for the analysis of how demographic changes will impact European power internationally the following components are used to quantify power in this research:

- Military power
 - Military Personnel
 - Military Spending
- Economic Power
 - Total GDP
 - GDP per Capita
 - Societal burdens and costs
 - Economic linkages, dependencies, and control
 - Saving and investment rates
- Technology
 - $_{\circ}$ Innovation

Realists tend to look just at military strength when talking about power (Schmidt, 2005) but as Baldwin (2016) points out, the importance of just military force has been overstated in the IR discourse, which led to the underestimated significance of economic statecraft. There are more ways besides military threats or actions to exercise influence on

other states as there are other (coercive) threat possibilities, nor are military threats "necessarily the most credible threat or the one most likely to be used" (Baldwin, 2016, p.184-185). So, this lack of economic power inclusion ironically has also led to a reduced understanding of military potential at the same time (Baldwin, 2016).

Therefore, here both military and economic power are at the core of hard power consideration (Wilson, 2008) (Beckley, 2018). The emphasis on military and economic power is standard in the overall power discourse outside the strict borders of realist thinking. As Beckley (2018) writes "the logic of this approach is simple and sound: countries with more wealth and more military assets at their disposal tend to get their way more often than countries with fewer of these resources" (8). With regard to technology supremacy, it is a relatively understated component in state power considerations, nor is it just a military power element. Simply observe the opening sentence of Sahin and Barker (2021) "technological leadership has become a central dimension of geopolitical power" (p. 5) as it highlights its use for both economic and military competition.

However, there are other smaller and more abstract measures of power that aren't looked at in this research, a more extensive list isn't in the scope of this paper. This paper is predominantly focused on power components that will be affected by demographic changes. Additionally, when looking at state power this paper doesn't occupy the question of how power is utilized to obtain desired ends. Rather, the paper is focused on what power is and how it can and will most likely be impacted by demographic changes. An assumption that the paper does hold is that a change in power will impact the position of a state or region in the international order and its ability to exert influence and achieve its interests.

Why is power important?

The question of why power is important to states has everything to do with how realists and states see the structure of the international system, which causes the balance of

power to be the motor of world politics (Beckley, 2018). The international order, of which all sovereign states are part, is a world of anarchy because there isn't one central overarching authority on the global level. This lack of universal authority has fundamentally shaped the workings of world politics as this structure makes states care about the balance of power relative to each other and forces states to pursue power (Mearsheimer, 2007, p. 71, 72). The structure of the system has led to a lack of guarantee for arguably the most valued principle in the international community, territorial sovereignty. In other words, the survival of the state isn't assured. Therefore, it creates the need for states to build up the means to protect themselves against the possible event of an outside attack and so the theory argues that states strive to gain power. Along with the neoclassical realist theory, power itself is not the means to an end, instead, it should be viewed as a state trying to control and shape the environment around them (Schmidt, 2005, p. 546).

However, it cannot be denied that the working of the international system is more refined than just total anarchy and a complete lack of order among states. Just as Lake (2018) points out, it is a misconception to see all relations between states as anarchic because while anarchy creates a state's drive for power, it also creates the power to form some sort of order and structure between states. Nonetheless, realism is given great importance for the understanding of why state power is so imperative because according to Schmidt (2005) we can be fairly certain that practitioners of international politics "understand and often act on the basis of the realist conception of power" (p. 549). Consequently, the concept of anarchy is and stays central, ensuring states can ever be certain about the intentions of other states (Mearsheimer, 2001).

Furthermore, the desire for power by states in this paper isn't seen as either powermaximizing or security-maximizing but rather as influence maximizing. This understanding of the relationship between states and power is more in line with the definitions of power stated earlier. As power provides the ability to exert influence, it therefore can help states to achieve their interests. Another way to look at it is from the maximization of self-interest, which is at the core of state behavior and individuals alike and makes power important, where protecting its territorial sovereignty is a part of this self-interest. Where there is disagreement among realists about whether all states are motivated by the same interests, the assumption in this paper is in line with the neorealist view, since states have different domestic structures they will be motivated by different interests (Schmidt, 2005, 545-546).

Military Power

A comprehensive explanation of what military power is and one that explains its importance is written by Beckley (2018). He writes that "military resources (e.g. troops and weapons) ... enable a country to destroy enemies; attract allies; and extract concessions and kickbacks from weaker countries by issuing threats of violence and offers protections." (p. 11). However, it is without a doubt that states are faced with a world order where "the ease of legitimating the use of military force declined" (Baldwin, 2016, 185) as strong international norms have emerged. Even so, this decline in the legitimization of military force doesn't remove the need for defense capabilities. Just as the Realism theory above argues, states can never be certain about the intentions of other states and the Russian invasion of Ukraine in early 2022 is a recent example of that.

Having said that, within the notion of military power there are two core parts where military strength can be pulled from, military personnel and military spending. While (military) alliances can also be significant for states and their military power, only NATO and the Common Defense and Security Policy in the EU have put military assistance as a legal requirement in their alliance agreements. Hence, with the EU being part of both and with the alliances not being directly affected by demographic change, it removes the need to actively take into account (military) alliances in this paper.

So again, the two military power components, personnel and spending, will be addressed in this section to assess their connection with demographic factors. This is followed by an examination of the relevance of the European demographic changes to these components. This analysis subsequently supports the argument that military personnel and military expenditures both can be impacted by demographic changes from multiple angles, where population aging and decline will provide negative effects if other states aren't dealing with the same demographic challenges. This for Europe will then lead to predominately downward pressures on their total potential military manpower size and their military government funding.

Europe as a military unit

Before moving on to the discussion on military personnel, military power isn't generally measured from a regional level. Instead, military might is normally looked at through a state-level lens because of the central importance of territorial sovereignty and thus the security of the state. As realist theory points out, states should not let their security depend on the army of another state because self-interest is always at play and national interests will always be put first over collective interest when possible. In other words, it is the job of the states themselves to provide the security that is deemed necessary for state survival because you can't build on other nations for protection as invasion is always deemed possible (Schmidt, 2005).

This placed importance on an independent military capacity for states is why in Europe there is a disparity between their economic integration and their military integration. While due to the existence of the European Union and the European Internal Market many invisible state borders were removed and led to extremely high levels of economic cooperation and integration. European states aren't ready to eliminate the boundaries keeping in place their primacy over their national security. However, besides the political difficulty of

one European military, it is also logistically complicated due to the construct of the state that is at the center of international law and politics. Consequently, the concept of defense is still a state issue in the European Union and beyond and so lacks the same cooperation in the military arena as it does in economic terms.

Nevertheless, this doesn't mean there isn't any military cooperation in Europe. Although a complete analysis of Europe's defense integration can be a completely separate research paper, here are some core developments. The treaty of Lisbon came into effect in 2009 and is an important example of EU defense integration (Basov, 2019). It created the Common Defense and Security Policy (CSDP) and made any CSDP member country obliged to provide "aid and assistance by all the means in their power" if another member state is attacked on their territory (EU, 2008)(Article 42(2)). This gives Europe a collective security agreement, and thus, the security of one state is also important to the other European states. Another example of increased cooperation is the European Defense Fund (EDF) that aims for aims to strengthen the single market for defense in Europe (European Parliament, 2018).

In addition, especially since Donald Trump publicly questioned NATO and the lack of need for it for the US, there has been increased attention, talk, and cooperation to further EU defense integration. Just recently in 2021 EU president, von der Leyen called in the State of the Union Address for a European Defense Union (European Commission b, 2021). In addition, there is expanded cooperation in security and defense between the Heads of States in the EU (Hoijtink and Muehlenhoff, 2020). But if the actual creation of one European army is the ultimate end as endorsed by Angela Merkel and Emmanuel Macron (De La Baume and Herszenhorn, 2018). Or instead, a highly integrated union of each state's defense industries is going to be the end result will stay unknown for the time being. The fact remains that Europe has a collective security mechanism in place that helps pull military power together and increases military influence (Coleman and Rowthorn, 2011, 231). On top of that, according
to Norheim-Martinsen (2012), "the EU has proved itself a far more potent security and defense policy-maker than having 27 veto-wielding Member States might suggest ..., the EU has, in several ways, been able to lead a proactive and efficient foreign and security policy, without losing the legitimacy of the consensus mechanism" (p.172).

Furthermore, besides the European defense integration talked about above, almost all European states, that aren't neutral countries, are part of NATO. NATO, which was created to provide security on the European continent during the Cold War, still is a political and military alliance centered around the security in Europe. Moreover, NATO is also a collective defense organization with the extra protection of three outside states, Canada, Turkey, and most importantly, the United States. NATO, which started to fall to the background in its importance during the past years as Europe was a stable and peaceful continent, has recently been deemed extremely vital again by its member states with the invasion of Russia in Ukraine. This again puts Europe in a more collective defense frame rather than simply being separate sovereign states where the security of one state is the safety of all states. Therefore, there arguably is room to view Europe with a collective lens for their military power.

Military Personnel

As power is measured compared to the relative strength of other states (Schelling, 2008), it allows for a more straightforward comparison with population changes in the world. Therefore, making it evident that a decline in population both relative and absolute will impact the total potential military size and strength compared to others who aren't faced with these developments. This is why population is repeatedly stated as a factor impacting military power (Waltz, 1979; McNicoll, 1999; Mearsheimer, 2001; Schmidt, 2005; Jackson and Howe, 2008; Coleman and Rowthorn, 2011: Libicki, Shatz and Taylor, 2011; Sciubba, 2012; Beckley, 2018).

By having a smaller population you have a lower bound limit on military manpower than other states with larger populations. Additionally, as Howe and Jackson (2012) show, historically size has always been an advantage as you can mobilize more manpower and therefore capture and occupy bigger territories. However, besides relative and absolute total population size, it is also important to look at the population age distribution. If a state or region has a significantly bigger share of their population above the age of 65 and up compared to the working-age population share (25-64), it will negatively impact their manpower ability as well (Libicki, Shatz and Taylor, 2011). Here it is also worth mentioning that certain societies have skewed male-female population ratios. Some states have a notable amount of what is called 'missing women' since male children are preferred in certain societies, leading to a bigger population share of the total male population. This skewed malefemale ratio can give states a bigger than expected military manpower potential since the military field is still highly male-dominated in the majority of the world.

Furthermore, not denying that numbers matter for military power and having more people is generally more desired, it also matters what the type of military operation is at play because not every military operation requires a large manpower base (Libicki, Shatz and Taylor, 2011). Holding territory and a full-fledged invasion requires a significant manpower size but the ability to hurt can be achieved in various less manpower-intensive ways. Building on that, size is no guarantee of victory and the balance has been shifting away from manpower towards money, software, technology, and skill instead (Libicki, Shatz and Taylor, 2011). Even so, it isn't possible to substitute manpower completely by all these factors.

Along with the points named above showing a more direct and clear potential effect of how population impacts military power, there are more indirect relationships between demographic characteristics and military power that can yield an impact. One of these indirect impacts of population relates to what Libicki, Shatz and Taylor (2011) call 'qualifying

parameters'. They identify four qualifying parameters that need to be considered on top of just population size to indicate how big the total potential military manpower can be. These are, (1) recruitment policies; (2) health; (3) education and training; and (4) "the willingness to serve" (p. 92). How states pass these four qualifying variables on top of population size can allow for significant potential variations to shape between states and their military personnel strength, even if population sizes are similar.

While the importance of education and health has also been brought up by others (Eberstadt and Groth, 2007) (Sciubba, 2014), the entry into the information age provides an additional emphasis on these components. Now it is not only the number of fighters that is relevant or even the quality of the equipment that became relevant after the industrial revolution and already had reduced the relevance of manpower a little (McNicoll, 1999). The quality of information, sophisticated software, and communication systems are all also becoming increasingly vital for the strength of militaries and as well lower the need for manpower sizes (Libicki, Shatz and Taylor, 2011). A military with personnel that is highly skilled and has superior technology will need fewer resources to accomplish the same as a military that is lower-skilled and has less advanced or outdated technology (Beckley, 2018, 14).

However, this change within the military sphere has led to an increased need for technical experts. Here one could argue that the greater the population size, the greater the pool of potential technical experts. However, this line of argument is to a large extent incorrect, the level of technical expertise in society is extremely dependent on the educational opportunities and general education level in society (Libicki, Shatz and Taylor, 2011).

The impact on military personnel

As shown, Europe will be declining in both its absolute and relative population size during this century. Besides Europe, it is only Eastern Asia and Russia, Ukraine, and Belarus

that are also faced with an absolute population size decline. Whereas, with regards to the global population share shifts, Europe is faced with a remarkable loss in their global population share compared to the other regions. On top of that, the geographically closely located North Africa and Western Asia regions will surpass Europe in population size within the next 10 years and thus will also eventually hold a larger global population share. This will put Europe's military personnel at a disadvantage since they not only will have an absolute lower manpower potential, but in relative terms their military manpower capability is also losing significant ground.

However, no other region has an as integrated military and defense as Europe does, or has a collective security alliance with the regional sovereign states. Therefore, it might be more logical to frame Europe in a competitive picture with individual states as there aren't any other regional blocs to account for with respect to military power. Within this frame, Europe in 2020 is the third-largest in population size, after China and India. This ranking will stay the same until around the year 2075 as then Nigeria will pass Europe (appendix table A5). This thus shows a more positive image for Europe as only two other states that are geographically distant are bigger in absolute population size for most of the century. In this assessment, Europe's military manpower potential isn't concerningly affected from a relative perspective since Europe is still one of the biggest in size, especially in its own immediate region.

Even so, besides the total population size differences, the age distribution of a population also needs to be considered. While all regions and states are aging, and thus, increasing their population share of the people aged 65 and up, it is important to notice how there is still great variety between states and regions in this 65+ share. Earlier graph 8 already showed how Europe's median age in 2020 is much higher than most other regions, signaling a relatively older society. Additionally, Europe is currently the only region where around 20%

of its population is aged 65 or up. East Asia for example only has around 13% of its population aged 65 or above and that is still considered high compared to the other regions (appendix table A3). Anyhow, over the course of the century the difference in age distribution will be evening out.

Comparing Europe again as a region to other individual states shows how Europe is significantly disadvantaged by its high population share aged 65+. Only Europe will until around the year 2075 hold a relatively large share of their population above 65+ (appendix table A6). Therefore, in graph 9 the data is presented on a selection of states and their absolute population size aged between the ages 20 and 64 as it allows a better analysis of the actual manpower that can be used for military combat. The graph shows how Europe is declining in total military personnel size potential in absolute numbers starting from 2020. But they are also declining in relative size to other states like Nigeria, the US, Pakistan, and Indonesia since they are seeing a growth in these population numbers. This shifts the earlier sketched picture of Europe's favorable military manpower position down a notch. Many other states aren't declining until later in the century and they also aren't as old yet as the European



Graph 9: Population size aged 20-64, select states 1950-2100

Data source: UN Population Prospects, 2019, medium

population is. So, the effects of Europe's aging and population decline will be negative in relative terms as their potential military manpower size will decline compared to other states.

Moving on to variables of health and education in connection with Europe, it shows a positive picture. Europe has a demographic advantage in terms of health, as all regions are not aging as healthy at old age as the older generation in Europe is (Eberstadt and Groth, 2007; Eberstadt, 2019). Life expectancy at birth is one indicator that shows the general health of the population and it shows that during the whole course of the century Europe will have the highest life expectancy at birth compared to all other regions (appendix table A7).

Additionally, Europe is also a frontrunner in terms of education and training (Steinberg, 2007; Eberstadt, 2019). In the education index¹ by the UNDP in 2019, the top 30 holds 19 European states (UNDP, 2019). The Human Capital Index (HCI) by the World Bank, which measures which countries are the best in mobilizing the economic and professional potential of their citizens, holds 21 European states in the top 30 in 2020. Lastly, in the Human Development Index² (HDI) by the UNDP Europe again holds a dominant position at the top, with 21 states included in the top 30 in 2020 (UNDP, 2020). Thus, this data on education and health show how Europe is at top of these measures and will potentially help mitigate Europe's relative decline in potential manpower to other lesser developed states.

In comparison, Russia, a state that is also facing a population decline in absolute and relative numbers, has its military manpower potential questioned since Russia has a poor performance in higher education rates and technical training (Eberstadt, 2011). Furthermore, the other states that fill up the remaining spots in these top 30s are all other developed states. In the case of the US, they were placed in the 16th place in the education index in 2019, for the HCI they didn't even make the top 30, and in the HDI they were ranked 17th in 2019.

¹ The education index is an average of mean years of schooling (of adults) and expected year of schooling (of children).

² The HDI measures achievements in key dimensions of human development: a long and healthy life, being knowledgeable, and a decent standard of living.

Whereas, China in the education index is ranked 113th, in the HCI they are ranked 45, and in the HDI they are ranked 85. Lastly, India in the education index is placed 144th, is ranked 116th in the HCI, and in the HDI they are ranked 131. This shows how Europe also compared to other powerful states like the US, China, and India outperforms them and therefore shows a skilled population that positively impacts the quality of the military manpower in Europe.

Military Spending

Military manpower doesn't show the whole picture in order to grasp the full potential military might of a state. It will always be central to invest in your military capabilities and that requires the spending of money. When comparing military expenditures between states you can look at the absolute level of the money being spent or you can look at the expenditures as their share of GDP. Both statistics can show relevant information, especially over time, including the economic strength, wealth, and determination of the state.

With a bigger and stronger economy, a nation technically speaking can devote more money to military expenditures (Beckley, 2018) and thus increases the military power potential of a state (Barslund and Gros, 2016). However, as will be described in more detail in the next section, population change can impact a state's economic size and strength from multiple angles. In terms of military power, this economic impact leads to two effects on the ability to protect military power. First, a severely aging society moves the dependency ratio up and therefore increases the fiscal burden of government expenditures on elderly care. This might lead to a downward pressure on other segments of government spending, including military spending since the increase in elderly care costs need to be financed from somewhere (Jackson and Howe, 2008; Goldstone, 2008; 2010; Libicki, Shatz and Taylor, 2011; Leuprecht, 2015).

Secondly, the impact of a decreasing workforce size, which can be due to both the aging of society and the absolute decline in population, can negatively impact future

economic growth. This in return can limit potential military spending growth which is important from a relative viewpoint. If other states don't face these economic reductions in growth, it could lead to growing military spending gaps between states.

The impact on military spending

Military spending as said will be mostly affected by the government budgets available that will be pressured by an increasing dependency ratio in society that will expand elderly care expenditures. In addition, the government budget availability on military spending can also be impacted by the negative effects of absolute population decline on economic growth. Currently, Europe's collective military budget is quite high compared to other states. In the top 5 of total military spending, Europe has the second largest total military expenditure, as shown in graph 10. The United States, which holds the first position, is somewhat of an outlier since they spend significantly more. Compared to Europe the US spends 40% more on its military and this difference in spending isn't because of the bigger size of the US economy but because the US spends a higher share of its GDP on military funding. Lastly, graph 10 also shows how the level of military expenditure of most of the states has been quite constant over the past 15 years. Only China is showing a steady rise in its absolute military spending level. However, China's increase in military spending doesn't also equal a rise in their military spending as a share of their GDP since that has stayed very stable over the past 15 years. Instead, the growth in military expenditure is the result of China's growth in total GDP itself.

China's rise in military expenditure over the past years has moved them up to a position that is close to Europe's level of spending in 2020. Therefore if Europe were to be faced with military budget cuts due to government budgetary pressures it will most likely result in China surpassing Europe in the near future in terms of military expenditure. And unfortunately as will be shown later on, Europe will be faced with a high increase in the

dependency ratio since their workforce is shrinking and their population above the age of 65 is growing, thus resulting in expected increases in elderly care expenditures. Additionally, Europe will be faced with a modest expected economic growth, especially compared to the anticipated growth in the developing world. Accordingly, this could mean that other states besides China could be growing closer to Europe in terms of spending.



Graph 10: Military Expenditure (in billions) 2005-2020

SIPRI Military Expenditure Database, 2021

Economic Power

While economic size and strength influence military power, economic power on its own is a forceful way to pursue goals. As earlier, the need for military power can never fully cease to exist based on the structure of the international system, however, the world has stronger international norms that have reduced the ease to legitimize the use of force. On top of that, the threat of force isn't as credible anymore as it used to be, partly due to the fact that the cost of war has increased significantly as it is easier to destroy and there is more to destroy (Baldwin, 2016, p. 186). This all has lowered the extreme emphasis International Relations theory had on the importance of a state's military capacity and increased the importance of economic power.

Meanwhile, the world economy has seen dramatic changes with the process of globalization and has allowed certain states to gain great political influence as they expanded their economic power. Whereas, these states with just their military strength could otherwise never have expanded to the same level of authority on the international stage. But now wealth enables countries to buy influence through aid, loans, investments, production, trade, consumption, and bribes (Beckley, 2018, 11). It also allows states to coerce with the threat and execution of imposing economic costs on other states, for example, through economic sanctions.

Unsurprisingly, there are several diverse elements composing economic power of which some aren't covered in this research. This section will explain how certain economic power elements each play a role in the economic strength of a state and how demographics can influence it. It will be demonstrated that especially total GDP, societal burdens and costs, and the saving and investment rates have the most direct links with demographic changes. Nevertheless, a state's GDP per capita and its economic linkages, dependencies, and control are still indirectly affected by the changes in the other economic power parts.

Total GDP

The most straightforward understanding of economic power is to look at the size of the economy. By having a big economy, it generally means you also have more money at your disposal and the total Gross Domestic Product (GDP) is a way to measure economic size. With the general assumption that a bigger GDP reflects more wealth and wealth is power. The GDP reflects the total economic production of the goods and services produced within a state and thereby generally shows the size of the economy, not including the informal economy. Additionally, by comparing GDP levels over time you can look at the GDP growth rates, and these growth rates are also used as an indicator of the general health of the economy (Callen, 2020).

However, this doesn't suggest that GDP is the only measure to understand economic power. The total GDP doesn't completely account for the efficiency and productivity of a state because by simply having a bigger population you can produce more and thus have a bigger GDP (Beckley, 2018). Additionally, a GDP doesn't account for the costs in society. This shows that the total GDP isn't a perfect measurement as it doesn't tell the whole story. Nonetheless, it does give a strong assessment of a state's economic size and how population changes impact the potential size of a state's GDP.

The role of demographic change on the total GDP level is quite evident and it also holds an important role in state power. As said by Jackson and Howe (2008) "no one disputes that population size and economic size together are a powerful double engine of national power" (p.71). Having a larger population, or more precisely a larger workforce, provides the state with the production means to produce more if workers' productivity is equal globally (Coleman and Rowthorn, 2011). Therefore, a declining population and an aging one will lead to a downward pressure on the state's potential workforce size and so reducing the total potential GDP output and thus economic growth if efficiency is constant (Bloom, Canning and Fink, 2010; Libicki, Shatz and Taylor, 2011; Harper, 2014, 588).

For a declining population and workforce to keep growing in total GDP output, the workers' efficiency rate and total productivity will have to go up. However, since workers' productivity is far from equal in the global economy, there isn't a linear relationship between population size and economic size. Yet, as will be touched upon later, the potential efficiency growth rate of states is skewed in the favor of developing nations in the coming years (Barslund and Gros, 2016).

Lastly, a declining population will also impact total GDP and economic growth due to declining aggregate demand in society (Tyers and Shi, 2007). A state with a population

declining in absolute terms will be a shrinking market as the number of consumers will go down (Eberstadt, 2010; Coleman and Rowthorn, 2011, 226).

GDP per Capita

GDP per capita is an additional supporting economic measurement of power as it provides an additional layer to the understanding of a state's level of wealth. As said, total GDP doesn't show us the workers' productivity and doesn't account for total population size differences, which leads to a lack of understanding of the overall standard of living and wellbeing in a country. The population size influence that is present in GDP is taken out in the GDP per capita variable as the GDP is divided by population size and therefore it provides a ranking of states that are wealthy beyond a big population. Furthermore, while GDP per capita still doesn't capture specific well-being measures, it does show a general indication of it (Callen, 2020). In addition, GDP per capita gives us additional information about states as it will generally tell us if a country is efficient and is highly productive (Beckley, 2018) which in return gives a picture of the state's population education and skill level.

Societal burdens and costs

However, as indirectly indicated the GDP isn't the only measure that needs to be considered when looking at a state's wealth. Just as Beckley (2018) writes, a state's costs and societal burdens are also important to take into account. A state with large cost burdens, like welfare costs or low production efficiency, will drain a country's wealth and thus, lowers the potential resources that can be devoted elsewhere, like buying influence in another country. In regards to population aging, states are "economically disadvantaged because of the anticipated future growth in elderly dependents and the accompanying reduction in the proportion of workers" (Sciubba, 2012, 70). In other words, with an increase in the share of people aged 65 and up in society, the declined working-age population will have a higher fiscal burden as they have to provide for more (Vanhuysse and Goerres, 2021). Where this

increasing dependency ratio will only be worsened by the continuous increase in life expectancies (Libicki, Shatz, and Taylor, 2011).

In regards to the increasing dependency ratio, it is the pensions and health care costs that will be the main factors driving up the burden on the workforce and the government alike. However, it are mostly the developed states that have expensive pension welfare systems in place, and therefore these predicted increased costs will have the potential to strongly impact state budgets and the economy as a whole in only a specific number of countries (Naumann and Hess, 2021, p. 357). On top of this, is the issue of having fewer workers providing for the pension system and governments losing tax revenue from the declining labor force while more retirees are drawing from it for increasing lengths of time (Libicki, Shatz and Taylor, 2011; Coleman and Rowthorn, 2011; Harper, 2014, 589; Naumann and Hess, 2021). It together will create strong financial pressures which will most likely lead to budgetary challenges that could threaten the financial sustainability of the welfare system in its current form (Naumann and Hess, 2021). While also potentially producing budget pressures in other functions of government, like military expenditure, education, etc. (Libicki, Shatz and Taylor, 2011) (Jackson and Howe, 2008).

Economic linkages, dependencies, and control

Furthermore, economic power isn't just about a state's production output size or costs, economic power can also be understood by national governments forming rules "governing access to factors of production, credit, and markets, and other fundamental questions affecting economic enterprise and economic transactions" (Strange, 1975, 223). In other words, having economic power provides some level of rule setting regarding market access and the potential of withholding economic advantages, while these states themselves have a reduced vulnerability to external disruptions and a big market size (Drezner, 2007).

Globalization has led to unprecedented levels of economic dependency and connections between states, which has also led to strong increases in general global wealth with beneficial outcomes on both sides of the transaction. Consequently, globalization was quickly hailed as the best outcome for all states, but at the same time it brought around new risks for states. As the world currently has unprecedented levels of economic interdependence, it is this interdependence that can be weaponized creating influence and coercive power for certain states and adding to their total economic power (Farrell and Newman, 2019). Power and vulnerability are labeled as the consequences of aggregate market size and bilateral interdependencies as it is these bilateral interdependencies that are asymmetric networks and therefore allow for weaponized interdependence (Farrell and Newman, 2019, 43, 45). One way of weaponizing these economic linkages and dependencies is by implementing economic sanctions.

By imposing sanctions you inherently alter and reduce the economic relations between two countries and that affects both the targeted country and also to a lesser extent the imposing country (Ahn, 2019, p. 127). Therefore, the sending country of the sanctions needs to be able to carry the economic costs they are about to impose on themselves by implementing sanctions on a state with economic ties to you. Additionally, the impact of sanctions is channeled through the target's dependence in economic terms on the state that is imposing the sanctions. Therefore, if the state that is introducing the sanctions is more reliant on the targeted economy then economic harm will most likely rebound (Ahn, 2019, p. 128). This all explains why it is often big and economically powerful states with hard currencies that impose sanctions as they often have the upper hand in the economic relationship

Adding to this, states that have political authority over central nodes in the international economic network, through which money, goods, and information travels, have an additional special ability to impose costs on other states (Farrell and Newman, 2019, 45).

Examples of these central nodes can be important individual banks or loans in financial networks (Han, Witthaut, Timme, and Schröder, 2019), individual companies that have global product domination (a monopoly) that provide an essential service or role in society, or the control of particular currencies. In addition, according to Farrell and Newman (2019), most of the central nodes are not randomly distributed globally, instead, they are concentrated in advanced industrial economies (p. 53) since these economies were able to dominate relevant innovation.

Moreover, it is also argued that international institutions designed to generate market efficiencies and reduce transaction costs can be used for coercive ends since these intuitions also play central nodes in the global economy. As Farrell and Newman (2019) put it "focal points of cooperation have become sites of control" (p. 47). This view is reaffirmed by Peet (2007) since economic policies produced by international governance institutions are made in the interests of dominant economic powers.

The relation of demographic change to economic linkages, dependencies, and control has to do with the effect of population size decline on economic growth, domestic demand (market size), and the global trust in the stability of the economy. By having a large economy, and thus more wealth, you can bear economic costs to impose sanctions for example. By having a large domestic market size, you have a desired market to which other states and foreign companies want access to, giving you more control and room to create important nodes in the global economy. Lastly, having an economy that is considered stable makes it safe and preferred over more uncertain and risky economies, therefore states will have no desire to shift economic ties.

Saving and investment rates

Trust in the future prospects of another state's economy is important, however, demographic changes can create uncertainty and undesirable future prospects that in return

impacts the rate of investment. For investors, it is important that there is confidence in growth as a growing market that can sustain demand levels is obviously preferred over a shrinking market. Contracting markets, where the total population size is going down together with the potential workforce, can squeeze profitability, for example, due to diminishing economies of scale and by having a smaller domestic consumption market size (Coleman and Rowthorn, 2011, 226). Thus, this prospect lowers incentives for investments. On top of this, due to the strain on GDP growth in societies with declining populations, it allows for only small margins that can be invested for the future (Goldstone, 2008; Leuprecht, 2015).

However, the importance of investments for states is only starting to grow further in the coming years. Investments in technology and general innovation will be extremely important for gains in overall productivity as is needed for continued economic growth (Barslund and Gros, 2016). Without R&D investments it won't provide the needed innovation that creates the technology that is needed to stay globally competitive (EIB, 2019). Additionally, investments in education and human capital are also extremely important as both have strong positive impacts on the performance of the economy.

Furthermore, population aging and decline will also lead to lower saving rates as there is dissaving among the older generation (Tyers and Shi, 2007; Jackson and Howe, 2008; Bloom, Canning, Fink, 2010). It is expected that the emerging economies will have an increasing share of the global savings (Tyers and Shi, 2007; Gros and Alcidi, 2013). So, this will mainly put pressure on aging states in the developed world.

The Impact on Economic Power

Europe is often labeled as an economic giant in the world economy, however, it is already said that Europe will be faced with a reduction in "economic clout" in the coming years (Barslund and Gros, 2016, 9). What the role of population change plays in this diminishing weight of the European economy in the global economy isn't completely certain and set in stone. But there seems to be a consensus that population aging and decline will and already are producing negative pressure on multiple economic variables, especially when taking Japan as an example case.

This section will first put Europe in an economic context to the rest of the world by looking at their total GDP, GDP per Capita, and trade position. Then the analysis will move on to how Europe's demographic trends are and will impact them and how that relates back to the economic power components touched on above. This builds to the argument that Europe's more intense population aging and earlier population decline are creating damaging conditions for Europe's economic power. Consequently, it are the economic growth restraints, increase in cost burdens, and investment pressures that will play a major part in this power decline.

Putting Europe in Economic Context

Starting by looking at Europe's total GDP size, which reflects their economic size, Europe is ranked high up. In graph 11 you can see the total GDP sizes for states with the biggest total GDP in 2020. The graph includes the GDP levels for all European States together, for just the European Union, and the European states not in the EU, in addition, the graph doesn't show the individual states that are in the EU. This graph illustrates how both the European Union and all the European states together are the second-largest economy in the world, after the United States. However, China is expected to pass the European Union in GDP size by 2030 (de Castro, 2022). Even so, as the graph shows, the gap between the 3 largest economies is quite large and thus Europe is expected to stay in the top 3 for a significant remainder of years.





Source: World Bank, World Development Indicators, 2020 *Includes the UK and Switzerland

Furthermore, the size of the European economy also reflects how its weight in economic terms is much larger than in population terms. In 2020 the economic weight of all European states is 23% of the total global economy (graph 12) while in that same year their population weight was only 7%. This shows how the European economy isn't simply based on population size because otherwise they would have had a much smaller share of the total global economy.



Graph 12: GDP share by region, 2019



However, Europe's weight in the global economy has been declining (see Appendix table A8). This however isn't surprising considering the different rates of GDP growth rates each region had on average during the past 25 years. Graph 13 shows the GDP growth rate in percentage for each major region including the world average from 1995 to 2019. It is evident that Europe's GPD growth rate has been below the global average during the complete timespan of the data presented in the graph. In stark contrast to Europe are the regions Asia and Africa, they have shown GDP growth rates that are notably above the global average. Whereas, Asia in particular has a high GDP growth rate and never dropped below the global average between 1995 and 2019. This explains why Europe is losing weight in the world economy with their GDP share, and other regions like Asia are gaining economic weight in terms of their GDP.

When looking at Europe in terms of GDP per capita their position isn't as high as their total GDP size. Graph 14 shows the same states presented in graph 11, but graph 14 includes the world average and excludes non-EU European states. In addition, note that while graph 11 presented the countries with the highest GDPs on the global scale, graph 14 doesn't present the states based on the highest GDP per capita. Having said that, Europe is still ranked high in





terms of its GDP per capita compared to the world average and especially to China. However, compared to other developed states like the US, Australia, Canada, and Japan, Europe is on the lower side in terms of GDP per capita. Therefore, this shows how Europe isn't as productive and efficient as some other highly developed economies. Within Europe there is also a disparity between states and their level of GDP per capita, most along the lines of Western Europe vs. Eastern Europe.



Graph 14: GDP per Capita 2019

Source: United Nations AMA database 2021

Lastly, by putting Europe in the context of international trade, their dominance and integration in the global market truly becomes apparent. Looking at just the European Union (EU-27) in 2018 accounted for more than a quarter of the world trade in goods (Standell and Wolff, 2020). For that quarter, 12% was exported by the EU to non-EU countries, also called extra-EU trade. The other 16.8% was intra-EU trade, goods exported between EU members. In terms of goods imported, the total of the EU was again more than a quarter of the total global import market of goods with similar divisions between extra and intra-EU trade. In comparison, China is the second-largest exporter of goods with 11.5% of the global total, and the US the third largest with 8% of the global exports in goods. In terms of imports, the US is the second-largest importer (12.5%) and China the third largest (9.9%) in 2018 (Standell and Wolff, 2020).

When looking at the EU's export and import of services their global share is around one-third of the global market in services in 2018, while also keeping a trade surplus of their overall trade balance during the past 10 years (Eurostat, 2021). Unsurprisingly, the US comes in second for both imports (9%) and export (12.1%) of services, but the third largest exporter of services is the UK with 6% of the global total. China is still the third largest importer of services (8.3%). Both in terms of goods and services exports and imports, the other states with relatively sizable shares, between the 0.5-4%, of the global trade are the other states with the highest GDP levels included in graph 11 (Standell and Wolff, 2020).

The significance of trade for the EU is also highlighted when looking at their total imports and exports in percentage share of their GDP. In 2018 the EU's import of goods and services as a percentage of its GDP was 45.3%, and for exports it was 49.2%, both including extra and intra-EU trade (Eurostat a,b, 2022). These numbers stand out because they typically tend to be low for states with large populations with big economies. So in comparison, the US

in 2018 only had a 12.3% of export in goods and services as a percentage of its GDP and China's total export was a 19.1% share of its GDP (World Bank a,b, 2022). This is showing a stark difference in the importance of international trade between the three with the largest GDPs.

The effects on the economy

While the focus of this paper is on Europe and their demographic change, Japan is dealing with the same demographic struggles but Japan is facing it earlier than Europe. Therefore, Japan is already showing some effects of a declining labor force and an aging society. Westeluis and Lui (2016) found based on Japan's data that the aging of the working-age population had a significant negative impact on the total factor productivity, in addition, they found that it brings deflationary pressures. Moreover, Japan's declining and aging population is estimated to also negatively affect GDP levels in the future. Colacelli and Corugedo (2018) state that without structural reforms Japan's real GDP is expected to decline by 25% in the next 40 years where the decline in labor inputs is named the direct effect.

Another IMF study by Han (2019) finds that demographic change has a negative impact on Japan's natural interest rate due to the reducing labor force and slowing productivity growth. Japan has also shown the financial challenges of a growing elderly population and a smaller labor force pool to tax for the finance of the social security system since their country's public debt share of their GDP is the highest in the world (Hong and Schneider, 2020, 22). Thus, the influence of aging and population decline is visible in their economic and financial performance (Hong and Schneider, 2020).

In the IMF world economic outlook 2018 with a special issue on the challenges to steady growth, it said how Japan's medium-term economic growth prospects are impeded by their unfavorable demographics and a trend decline in their labor force (p. 39). However, this report doesn't only label this as an issue for Japan. This report writes that in advanced

economies the growth trend had been downward since the mid-2000s. They continue by saying that this long-term decline is in part due to aging workforces and slower productivity growth, which will also hold back gains in medium-term potential output (IMF, 2018, xiii, xvii). Another report written by Hawksworth and Chan (2015) on the economic growth expectations of the world up until the year 2050 also mentioned that after 2020 there is an expected global growth slowdown, where the working population growth slowdown in many large economies is named as one of the factors influencing this reduced growth (p. 1). The European Commission (2021) has also named how the decline in labor input will make a negative contribution to potential growth in the EU and named how GDP growth will almost entirely be driven by productivity increases (p.40).

However, these findings aren't new, Gros and Alcidi (2013) wrote that the long-term growth outlook for the EU is heavily shaped by demographic developments. Where demographic decline will be compounded by lower labor productivity growth and produces a dim potential growth in Europe (Gros and Alcidi, 2013, p. 3). In an even earlier IMF report Callen and Spatafora (2004) found that GDP per capita growth is positively correlated with changes in the relative size of the working-age population, and negatively correlated with changes in the share of the elderly population (p. 143).

With the downward pressure on economic growth by population aging and declining simultaneously, low productivity growth, in other words, low increases in production efficiency is also mentioned multiple times by others to negatively affect the economic growth expectations. Maestas, Mullen, and Powell (2016) estimated that reductions in GDP are by one-third from slower labor force growth and two-thirds from slower growth in labor productivity of workers across the age distribution. Productivity growth is a key indicator of long-term economic growth and is important to helping increase living standards and purchasing power of consumers (Remes, et al., 2018), however, the trend over the past years

has shown a decline in labor productivity, especially after the financial crisis in 2007-08 (Adler et al., 2017; Erber, Fritsche, and Harms, 2017; Remes, et al., 2018). One explanatory element mentioned for this is that the overall process of innovation seemed to have slowed, especially in highly industrialized countries including Europe (Adler et al., 2017; Erber, Fritsche, and Harms, 2017).

In addition, low productivity growth is also impacted by aging workforces since they are linked to lower productivity growth (Adler et al., 2017; Dieppe, 2021). In a study by Aiyar, Ebeke, and Shao (2016) they specifically look at Europe and find that workforce aging will most likely be a noteworthy drag on European productivity growth for the next few decades for both labor and total factor productivity (TFP). They estimate that if workforce aging wasn't present in Europe, the TFP growth through 2035 would be around one-quarter higher than the one that includes Europe's aging (p.14).

However, as mentioned earlier in the paper, since population growth can't foster GDP growth when the population and workforce are declining, the rise in productivity growth to ensure economic growth becomes even more important. This importance of productivity growth as a driver for overall economic growth and thus the overall size of the economy has been reaffirmed by Remes et al. (2018), especially considering that in the past 50 years a third of the average annual GDP growth was due to increases in the working-age population (Remes et al. (2018); Dieppe (2021). Remes et al. (2018) also write how advanced economies may be trapped in a vicious cycle of economic underperformance due to slowing productivity growth together with population aging (p. 23). On top of that, Adler et al. (2017) mentioned how Europe in particular is facing a drag on productivity growth as the effects of the financial crisis were harsher there.

The low productivity growth trend that has been long underway in the advanced economies isn't reflected in emerging markets and developing economies. For the emerging

markets and developing economies the labor productivity growth has kept growing over that same timespan until the global financial crisis in 2007-08 (Dieppe, 2021, 53). Even so, these economies are still facing higher rates of productivity growth than the advanced economies, which most likely can be explained by their still more favorable demographic trends and by investments in human capital, which still has more 'low hanging fruit' (Barslund and Gros, 2016; Dieppe, 2021). Nevertheless, the contribution of human capital to labor productivity growth has been declining over the years, although more strongly for the developed economies (Adler et al., 2017).

Furthermore, besides the effect of unfavorable demographics on economic growth, changes in demand are also most likely to present themselves. Declining consumption is mostly due to low productivity growth and lack of workforce growth, there isn't a demand momentum anymore (Remes, et al., 2018). This declining demand could also put a drag on investments which in return could further lower productivity growth (Remes, et al., 2018).

The effects on societal burdens and costs

While the whole world is getting older, not every region is as old and has the same share of its population aged 65 or up. Europe is an outlier here, not only does Europe have the highest median age during most of the century, but it also has a high share of its population aged 65 or up compared to other regions and it also has a much higher old-age dependency ratio than the other regions have (appendix table A9). This brings up questions about how Europe's wealth and thus in part their economic power will be affected by the rising cost of old-age retirement and other elderly spending like healthcare.

With the rising old-age dependency ratio it isn't a surprise that in the baseline scenario the total cost of aging, including pensions, health care, and long-term care expenditures are expected to increase (EC, 2021). A more specific measurement besides the old-age dependency ratio is the economic old-age dependency ratio (inactive elderly vs. employed

population) which is an important indicator to help assess the impact of aging on budgetary expenditure. Yet, this ratio is also expected to rise significantly in the EU (EC, 2021). According to the European Commission (2021), the increase in age-related expenditure is mostly driven up by long-term care and health care spending, which together are projected to raise spending as a share of the GDP by 2 pp. up to 2070 (p. 8). However, another report by Gaub (2019) put the projected increase in European spending on age-related issues at 2 percent by 2030. To put in perspective, the EU's average social protection spending is 28% of GDP in 2016 (Spasova and Ward, 2019).

Notwithstanding the great variety of pension systems in Europe, all systems are said to face growing challenges to ensure adequate funding for sufficient benefits (SPC and EC, 2021). In 2018 old-age benefit expenditure in the EU was about 10.8% of the GDP in the EU, which is around 40% of the total spending on social protection. However, the pension expenditure is expected to increase to 12.7% of GDP in 2045 while prior to 2019 many EU states already faced rising pension costs (EC, 2021). On average, in the EU the old-age benefit programs are predominantly funded through social contributions, like employers' and employees' contributions, as that accounted for 65% in 2018. Still, government revenue from taxation accounts for a solid 25% (SPC and EC, 2021, 123, 130). In addition, there is a shift happening where the social contribution to the funding of social protections is declining in share, while the share of general government spending is increasing (Spasova and Ward, 2019).

Lastly, Spasova and Ward (2019) write how expenditures on old-age benefits have been kept in check due to policy reforms in many states. These policies have been mainly focused on increasing the retirement age and closing up early retirement possibilities (p.13). Nevertheless, demographic changes are still named a core challenge to social protection financing as these reforms are not enough to fight all the coming challenges (Spasova and Ward, 2019).

The effects on saving and investment

It is said that the aggregate saving level in advanced economies will decline as governments are expected to spend more on social protections while also having an aging population that is saving less (Amaglobeli, Dabla-Noris, and Gasper, 2020). The level of saving based on age is built on the assumption that the elderly generation will spend the savings they have acquired during the duration of their working life in their retirement phase (Aiyar, Ebeke, and Shao, 2016). Therefore, the expectation is that the level of savings will remain much higher in emerging and developing states (Gros and Alcidi, 2013, 22; Amaglobeli, Dabla-Noris, and Gasper, 2020).

However, this expected decline in saving rates in societies where the population aging is more severe might produce problems for the level of investment. National saving is the main source of finance for domestic investments, even in a world with great capital mobility (Amaglobeli, et al., 2019). In addition, demographic changes can lower investment incentives since an older population produces less pressure on for example residential and infrastructure investments (Remes, et al., 2018, 17).

The Assessment of the Overall Economic Impact

Population aging and decline in Europe will impact the level of economic growth negatively. This isn't surprising considering that in the past 50 years the annual GDP growth was related to increases in labor force sizes, which is now expected to decline in Europe. In addition, the level of overall productivity is also expected to continue to slow down, which is also partly impacted by these demographic changes. This would mean that Europe's level of GDP growth is expected to stay low. While at the same time many other states with emerging and developing economies like in Asia and Africa aren't faced with these same levels of

negative impacts on productivity growth as they still have more favorable demographic trends and still have big advances to acquire in human capital. Therefore, there at least is an anticipated relative decline of the European economy on the global stage where population impacts Europe's growth negatively.

Europe is also confronted with increasing societal burdens and costs due to its aging society and declining workforce as a tax base. This will pressure Europe's level of wealth as there will be much more need to finance domestic problems. Furthermore, the level of aging in Europe is also expected to decrease the levels of domestic savings and therefore most likely also the level of domestic investment. On top of this, the level of consumer demand due to declining populations might also produce negative impacts, in particular on investments in society. Yet, investments are extremely important for increases in economic productivity growth.

Another concerning outlook is that one of the explanations for the reduction in productivity growth is related to the slowed processes of innovation. As described in more detail in the following section, this is also something that Europe isn't expected to excel in the coming years since they are a significantly older population, their investment level as part of the GDP is low, and their competitive position in technology development is already at stake. In addition, now with minimal GDP growth due to Europe's demographic changes, the increased need for R&D investments might not be possible without also increasing Europe's public debt share of their GDP. Europe is already faced with increasing expenditures on oldage benefits and other social protection spending, thus, the additional money needed for innovation investments will be harder to find.

This all together shows multiple angles on how population aging and decline can and most likely will impact Europe negatively in multiple economic measures. This in turn can affect Europe's market power and control over key central nodes in the global economy as that requires a strong and large economy. Trade is extremely important for Europe's ability to effectively influence and coerce with economic measures and so Europe's dominance in international trade is central to Europe's market power (de Castro, 2021). While strong direct effects of Europe's population dynamics haven't been mentioned, the potential decline in the consumer market and overall low economic growth will not produce favorable conditions for upkeeping growth in international trade. On top of that, low economic growth could reduce the ability of Europe to bear costs with enforcement through economic means. In addition, if the outlook on economic conditions in Europe remains low and the trust in the European economy will decline, it could impact the desire for the Euro as the second largest international reserve currency.

Technology

Technological leadership plays a key role in protecting "geopolitical, economic, and military competitiveness" (Sahin and Barker, 2021, 6). Having superior technology gives states great leverage as it allows for an edge in economic and military competition, but it also can provide states with the freedom of not being dependent on foreign technologies. In economic terms, technical discoveries and innovation can lead to productivity growth or increased efficiency and allows businesses to stay competitive in the global economy. For military power, technological discoveries have extensive consequences for "military hardware, training, and tactics and thus for national defense strategy" (Jackson and Howe, 2008, 26). Thus, technology supremacy can shift power balances and lower the need for big manpower sizes.

Innovation

To obtain technological leadership there needs to be a certain level of innovation. However, as stated earlier, the level of investments is going to be under pressure, but it is also the younger people that tend to be more innovative, dynamic, and entrepreneurial while the

older generation becomes more conservative (Jackson and Howe, 2008). Path-breaking innovations are predominately from people below the age of 45 and so states with fewer young people in the workforce could lose their edge in innovation (Goldstone, 2008, p. 6-7). Therefore, this shows a pessimistic view of the future levels of innovation for states with disproportionate aging and declining populations, while it is the innovation that is needed to stay competitive as a powerful state.

However, Sciubba (2012) doesn't view the relationship between youth and innovation not as straightforward. She presents the argument that population aging in itself can be a factor that drives innovation because there are many changes that need to be responded to. Additionally, she argues that many developed states have a better climate that supports innovation in terms of general encouragement for advancement, education, and legal protections for innovation and this lacks in developing states.

Europe's older population vs. technology and innovation

While the older generation tends to be less innovative, innovation is vital to help fight the low productivity growth trends. In a study by Aksoy et al. (2019) they have shown that aging will lead to lower applications for patents and therefore consequently negatively impacts the contribution of innovation to growth (Sahin and Barker, 2021, 2). In meantime, Europe is argued to lag behind in the global tech race and is expected to face an uphill battle to remain competitive (Sahin and Barker, 2021). Europe lacks first-mover advantages and dominant home-grown tech players. Additionally, it said that Europe risks a global loss in competitiveness due to its low levels of public and private investment in research and development in tech (Aktoudianakis, 2020, 15)(EIB, 2019). This low investment in R&D will most likely have negative impacts on the EU's innovation and long-term growth, while at the same time China is strongly scaling up their investments in R&D (Aktoudianakis, 2020 16).

Lastly, Europe has also failed to leverage the dual-use of technologies in their militaries and economy, while the US and China are already actively doing this (Sahin and Barker, 2021).

On top of that, Europe is going to face pressures on economic and productivity growth which could negatively impact the investment capability of Europe at a time where it is needed. And that is just what the European Investment Bank (EIB) is projecting, the level of investments is expected to join the economic slowdown in the coming years (2019). The EIB also pointed to the EU risking a loss of global competitiveness with its slow innovation, adoption of digital technologies, and productivity growth, while the world is facing rapid technological change (2019). They have recommended that government expenditure should increase in order to adjust Europe's shortcomings in innovation and technological advancements. On top of that, productivity-boosting opportunities according to Remes et al. (2018) lie mainly in digital opportunities.

In terms of military technology and innovation, Europe at the same time holds a relatively large amount of arms-producing and military service companies. Based on SIPRI 2020 data, 26 companies in the top 100 were European- based. Where another 45 companies are based in the US, 2 in other NATO members, and 15 companies are based in other democracies (SIPRI, 2020). This shows, that not only does Europe itself has a significant share in the top 100, but close allies like the US also fill up a major part of the other remaining spots. In other words, there aren't any major concerning states that hold dominance in the data.

Similar data is the SIPRI data on the major arms exporters globally. Here Europe again shows a good and sizable position on the global stage, 5 European states – France, Germany, the UK, Spain, and Italy – are in the top 10 global exporters. On top of that, Europe accounted for a little more than 26% of the global trade in 2016-20 (Wezeman, Kuimova, and Wezeman, 2021). To put these numbers in perspective, the US holds a 37% share, Russia

20%, China 5.2%, and India only a 0.2% share of global arms exports (Wezeman, Kuimova, and Wezeman, 2021). This data on arms exports together with the relatively large amount of arms-producing and military service companies show a good technological military capability for Europe in the form of equipment, where the quality of information, sophisticated software, and communication systems are some part of it. Therefore, again even with Europe's decline in relative and absolute size, these manpower deficits might be mitigated by their dominant position in the arms market. However, if Europe will keep this position with the relatively large amount of arms-producing and military service companies and arms exports is remain to be seen, since the innovation prospects of Europe are much more negative than they are for the US and China.

Conclusion

The world population is aging as the average age and percentage of the population above the age of 65 is on the rise everywhere. In addition, at the end of this century the total world population will reach its peak. However, not all regions are facing these same demographic changes at the same time. Europe already has a much older population compared to the other regions and states. On top of that, Europe is expected to decline in total population size over the next 15 years. This decline in Europe's population over the course of the century isn't only an absolute decline in population, it is also declining in relative size. Compared to the other regions, Europe's global population weight is going to be reduced significantly in the coming 80 years. Meanwhile, almost all other regions still have demographic momentums and will remain growing in population size even with today's lower fertility rates.

These shifts in the demographics of Europe and the world will lead to changes in the international division of power. In the case of Europe, Europe is going to see its international power diminishing as a result of this and therefore losing some of its ability to exert influence

or command the actions of others. As Europe will be reducing in population size and moving to a larger share of its population aged above 65, and thus facing reductions in its potential workforce size, it will lead to a lower total military manpower capacity. Its military personnel size will be reduced in both absolute and relative terms and that will impact the viability of certain military operations. In comparison, other states are seeing an increase in their population share between the age of 20 and 64, so they aren't restrained by declining military personnel. But, Europe's health, education, and available technological quality will probably mitigate some of the negative effects of the decline in manpower.

On top of this, Europe will be witnessing a growing downward pressure on economic growth, a rise in societal costs, and shifts in saving and investments rates, which are all damaging its economic strength and economic control in the global economy. With Europe's decline in population size, its GDP can't grow any more from workforce increases, now productivity growth will be the central element to sustaining economic growth. Yet, productivity growth itself is also negatively affected by the demographic changes in Europe since older workforces are less productive. Productivity growth is also put under increased pressure due to the reduced level of innovation by older societies. Additionally, Europe has a growing old-age dependency ratio that not only is much higher than the rest of the world, but it will also bring up healthcare and social protection costs and reduce its level of wealth. This increase in cost and restrain on economic growth will also negatively affect the level of military expenditures since government expenditures might need to be relocated away from military spending. Lastly, Europe will start to see de-saving which will lead to less available investment budgets, but on top of that, it will see declining incentives for domestic investments.

Furthermore, with Europe's beyond proportional aging society it will most likely lead to reduced levels of innovation and technological advances. Older generations are less

innovative, yet, innovation and superior technology are essential to geopolitical, economic, and military competitiveness. In addition, innovation requires investments in R&D and so it needs government funding. But Europe will already be faced with rising costs due to the rise in its elderly population, so the needed increase in R&D investments might be unattainable for Europe without debt expansion. As of now Europe still has a sizable amount of armsproducing firms and arms exports which add to their military power position. However, if the rate of innovation will slow it could jeopardize this position.

So, from both the military and economic side European power is going to be challenged due to its own and the world's demographic changes. With this decline in power, Europe will be seeing alterations that could influence their market control and overall influence in the global political sphere which will lower Europe's capability to successfully pursue its interests. Nonetheless, with this research exposing where demographic changes can impact power components and looking at Europe's situation in particular, it can help form better and early policy responses to help mitigate the effects of population aging and decline.

Here as this research has shown, it will be critical for Europe to keep innovation up to produce higher productivity growth, while also putting an effective policy in place to deal with the increased financial elderly care burden. These two main focus points can also help create positive spillover effects on military expenditure, technological dominance, and general economic trust. Addressing this will be important for Europeans so that they won't lose influence on the global stage and allows them to effectively defend their interests. But mitigating Europe's power decline could also be deemed important for the protection of the international liberal order.

That being said, there are many additional questions that need to be answered regarding the effects of Europe's population aging and decline and power shifts. For example, how will different demographic structures influence the makeup of the domestic economy? Will the type of imported and exported goods and services change, and could that increase or decrease the dependency on certain states? Nevertheless, in addition to these questions, there are many other areas to explore where shifts in demographics will be affecting Europe. For example, think about potential domestic political instability.

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Appendix

	States (incl. sovereign entities)	In the European Union?	Part of NATO?
1.	Albania	No – but in accession talks with the EU	Yes
2.	Andorra*	No – but is in customs union with the EU and negotiating an agreement for participation in the EU internal market	-
3.	Austria	Yes	No**
4.	Belgium	Yes	Yes
5.	Bosnia and Herzegovina	No – but applied and has potential candidate status	No, but is invited for Membership Action Plan
6.	Bulgaria	Yes	Yes
7.	Channel Islands*	No – the TCA applies to them for a limited amount	-
8.	Croatia	Yes	Yes
9.	Cyprus ¹	Yes	No**
10.	Czechia	Yes	Yes
11.	Denmark	Yes	Yes
12.	Estonia	Yes	Yes
13.	Faroe Islands*	No	-
14.	Finland	Yes	No**
15.	France	Yes	Yes
16.	Germany	Yes	Yes
17.	Gibraltar*	No - left due Brexit	-
18.	Greece	Yes	Yes
19.	Holy See*	No – can never be part of the EU due to its monarchy-state structure but has open borders with the EU	No**
20.	Hungary	Yes	Yes
21.	Iceland*	No – but part of the EEA Agreement, EFTA, and Schengen	Yes
22.	Ireland	Yes	No**
23.	Isle of Man*	No	-
24.	Italy	Yes	Yes
25.	Latvia	Yes	Yes
26.	Liechtenstein*	No – but part of the EEA Agreement, EFTA, and Schengen	_**
27.	Lithuania	Yes	Yes
28.	Luxembourg	Yes	Yes
29.	Malta	Yes	No**
30.	Monaco*	No – but de facto part of Schengen and negotiating participation in the EU internal market	-

Table A1 – List of states in Europe, status of membership EU and NATO

31.	Montenegro	No – but it is currently a candidate country	Yes
32.	Netherlands	Yes	Yes
33.	North Macedonia	No – but it is currently a candidate country	Yes
34.	Norway	No – but part of the EEA Agreement, EFTA and Schengen	Yes
35.	Poland	Yes	Yes
36.	Portugal	Yes	Yes
37.	Republic of Moldova	No – but has applied for EU membership	No**
38.	Romania	Yes	Yes
39.	San Marino*	No – but is negotiating participation in the EU internal market and is in EU customs union	-
40.	Serbia	No – but it is currently a candidate country	No**
41.	Slovakia	Yes	Yes
42.	Slovenia	Yes	Yes
43.	Spain	Yes	Yes
44.	Sweden	Yes	No**
45.	Switzerland	No – but is part of EFTA and Schengen	No**
46.	United Kingdom	No – left in 2020 but has official relationship agreements including the TCA.	Yes

* states with less than 0.5 million people ** states with (desired) neutrality

- states have no regular military force and/or aren't responsible for their own defense.

1 Cyprus in not considered in Europe geographically by the UN data.

				Year			
	1950	2000	2020	2030	2050	2075	2100
Europe	401.5	520.4	<u>548.5</u>	547.8	530.8	493	471.6
Northern America	172.6	312.4	368.9	390.6	425.2	461.3	<u>490.9</u>
Oceania	13.0	31.4	42.7	47.9	57.4	67.3	<u>74.9</u>
Northern Africa and Western Asia	100.2	355.9	525.9	608.9	754.0	874.5	<u>927.8</u>
Central Asia	17.5	55.3	74.3	83.8	100.3	111.5	<u>114.9</u>
Southern Asia	493.3	1,456.6	1,940.4	2,143.1	2,396.2	<u>2,414.4</u>	2,215.2
Eastern Asia	677.5	1,519.8	1,678.1	<u>1,699.4</u>	1,617.3	1,402.5	1,222.6
South-Eastern Asia	165.1	525.0	668.6	727.3	794.0	<u>794.0</u>	744.2
Latin America and the Caribbean	168.8	521.8	654.0	706.3	<u>762.4</u>	749.9	680.0
Sub-Saharan Africa	179.0	639.7	1,094.4	1,399.9	2117.7	3,044.6	<u>3,775.3</u>
Russia, Ukraine, Belarus	147.8	<u>205.1</u>	199.1	193.5	179.7	164.3	158.0

Table A2 – Total population size (in millions) by region

Data source: UN Population Prospects, 2019, medium projection. *Underlined data is the regions peak of population size

Table A3 – Percentage of population aged 65 and up, all regions

	Years						
	1950	2000	2020	2030	2050	2075	2100
Europe	8.8	15.5	20.3	24.1	29.7	30.9	31.3
Northern America	8.2	12.4	16.8	20.5	22.6	26.5	27.9
Oceania	7.3	9.8	12.8	15.2	17.9	20.7	24.0
Northern Africa and Western Asia	3.8	4.8	5.8	7.6	12.7	17.2	22.5
Central Asia	6.2	5.2	5.4	8.0	11.6	15.7	21.7
Southern Asia	3.5	4.3	6.2	8.0	13.2	20.9	25.9
Eastern Asia	4.4	7.7	13.4	18.2	27.2	30.8	32.3
South-Eastern Asia	3.8	4.9	7.1	10.3	16.7	22.5	27.3
Latin America and the Caribbean	3.5	5.7	9.0	12.0	19.0	27.0	31.3
Sub-Saharan Africa	3.2	3.0	3.0	3.3	4.8	8.3	13.1

		Years	
	1950	2020	2100
Europe	2.6	1.6	1.8
Northern America	3.1	1.8	1.8
Oceania	3.7	2.3	1.8
Northern Africa and Western Asia	6.6	2.9	1.9
Central Asia	4.6	2.7	1.8
Southern Asia	6.0	2.3	1.7
Eastern Asia	6.1	1.7	1.8
South-Eastern Asia	5.8	2.2	1.8
Latin America and the Caribbean	5.8	2.0	1.7
Sub-Saharan Africa	6.5	4.6	2.1

$\label{eq:constraint} \textbf{Table A4} - Fertility \ rate \ (live \ births \ per \ woman) \ by \ region$

Data source: UN Population Prospects, 2019, medium projection.

Years 1950 2000 2020 2050 2075 2100 Europe 401.5 520.4 548.5 530.8 493 471.6 China 554.4 1,290.6 1,439.3 1,402.4 1,221.6 1,065 India 376.3 1,056.6 1,380 1,639.2 1,607.3 1,447 United States 158.8 281.7 331 379.4 410 433.9 75 Japan 82.8 127.5 126.5 105.8 86.9 Indonesia 69.5 211.5 273.5 330.9 336.3 320.8 Brazil 229 180.7 54 174.8 212.6 210.4 Nigeria 37.9 122.3 206.1 401.3 586.2 732.9 Pakistan 37.5 142.3 220.9 338 394.3 403.1 Mexico 27.9 98.9 128.9 155.2 155 141.5 Turkey 21.4 63.2 84.3 97.1 95.4 86.2 Egypt 20.5 68.8 102.3 160 200.2 224.7 Iran 17.1 65.6 84 103.1 103 98.6

Table A5 – Total population size, select countries 1950-2100

	Years					
	2020	2050	2075	2100		
Europe	20.3	29.7	30.9	31.3		
China	12.0	26.1	30.1	31.9		
India	6.6	13.8	22.0	26.7		
United States	16.6	22.4	26.3	27.8		
Japan	28.4	37.7	37.8	37.3		
Indonesia	6.3	15.9	21.3	26.9		
Brazil	9.6	22.7	31.3	34.1		
Nigeria	2.7	4.0	6.3	10.1		
Pakistan	4.3	7.9	13.2	18.9		
Mexico	7.6	17.0	25.6	31.0		
Turkey	9.0	20.9	28.6	33.5		
Egypt	5.3	9.4	13.2	20.0		
Iran	6.6	20.2	24.4	29.3		

Table A6 – Population share aged 65 and up (%), select countries, 1950-2100

Data source: UN Population Prospects, 2019, medium projection.

Table A7 – Life expectancy at birth, all regions

	Years					
	1950	2000	2020	2050	2075	2099
Europe	64.9	77.0	81.3	85.4	88.3	90.9
Northern America	68.2	77.0	79.3	83.8	86.6	89.1
Oceania	57.7	74.3	78.9	82.2	84.4	86.8
Northern Africa and Western Asia	41.2	68.7	74.02	78.5	81.2	83.8
Central Asia	53.4	64.6	72.1	75.7	78.9	82.1
Southern Asia	36.1	63	70.0	75.1	78.5	81.7
Eastern Asia	44.3	72.5	78.2	82.5	85.7	88.2
South-Eastern Asia	44.2	67.3	72.9	77.4	80.7	83.8
Latin America and the Caribbean	50.2	71.5	75.7	80.9	84.3	87.0
Sub-Saharan Africa	35.6	49.9	61.7	68.7	72.4	75.5

			Years		
	1995	2005	2010	2015	2019
Northern Africa and Western Asia	2.8%	4.0%	4.8%	4.9%	4.6%
Sub-Saharan Africa	1.2%	1.6%	2.0%	2.1%	2.0%
Northern America	26.5%	29.9%	25.1%	26.4%	26.5%
Latin America & the Caribbean	6.3%	6.0%	8.1%	7.3%	6.2%
Central Asia	0.1%	0.2%	0.3%	0.4%	0.3%
Eastern Asia	23.1%	18.0%	20.6%	23.8%	25.3%
South-eastern Asia	2.3%	2.0%	3.0%	3.3%	3.6%
Southern Asia	2.0%	2.7%	3.8%	4.2%	4.8%
Oceania	1.5%	1.9%	2.2%	2.0%	1.9%
Europe	32.7%	32.0%	27.4%	23.6%	22.6%
Russia, Ukraine, and Belarus	1.5%	1.9%	2.6%	2.0%	2.2%

Table A8 – GDP share by region, 1995-2019

Source: United Nations AMA database 2021

Table A9 – Old age dependency ratio by regions 2020-2100

	Years					
	2020	2050	2075	2100		
Africa	9.5	13.1	18.9	27.9		
Asia	17	35	47.9	58.3		
Latin America and the Caribbean	17.7	36.7	56.5	69.6		
Oceania	25.9	36.9	42.9	50.8		
Northern America	32.2	45.7	56.5	60.8		
Europe	37.9	64.0	68.5	72.4		