WDA Forum

University of St.Gallen

Project Papers 2017

on Demographic Challenges

Megatrend "Global Demographic Change" Tackling Business and Society Challenges in 2030 and Beyond

Master Class Seminar by Dr. med. Hans Groth, MBA
at the University of St. Gallen, Switzerland
Fall 2017

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I. FOREWORD

Demographic change, ageing, retirement age, pension system performance – topics like these are omnipresent nowadays. The World Demographic & Ageing Forum (WDA Forum), a foundation established in St. Gallen in 2003 has for many years been a platform to enable dialogue, research, develop positions and generate understanding across generations and societies, both nationally in Switzerland and internationally.

In recognition of the complex nature of the topics ageing and demography, the WDA Forum is conducting a series of activities to ensure better understanding and the promotion of new viewpoints and innovative ideas. The respective master course offered at the University of St. Gallen is one of these activities. No social science study track can be pursued isolated from the parameters around ageing as they cut across almost all of study objects in one way or another. It is important to promote a scientific evaluation of inherent issues and subsequently the critical evaluation and constructive discussion of facts, proposals and theories. The paradigm shifts to be expected will challenge our world in a way never seen before. Resulting population movements, rising healthcare cost, retirement financing, behavioral impact within cohorts emerging and voicing their expectations will lead to challenging conflicts. Promoting concepts to deal with the issues at hand requires mastering tools, the analytic processing of information and an open but critical mind.

The papers included herein are the result of a Master class taught by Dr. Hans Groth during the 2017 fall semester. They represent an example of the range and the scope dealt with as much as they provide an indication of the approach taken to deal with the subject chosen. Each paper, while not at the same level as a thesis, has to meet formal and scientific standards. All papers were developed in a course held under the supervision of Dr. Hans Groth. The program also includes discussion, debate and presentation by experts in the field. The papers are shedding light on various aspects of demography, such as summarizing status and prospects of regions or countries, a critical evaluation of concepts, characteristics of change and dynamics, all seeking to contribute a constructive perspective, a critical assessment or plain analytical overview.

Such a paper, submitted by a team of students, is assessed by the reviewing professor and challenged by all students embarked in this class.

My gratitude goes to the University of St. Gallen, who understands the relevance of such an important master program; to Regina Regenass from the WDA Forum for coordinating everything behind the scenes and of course Dr. Hans Groth for the cooperation and the exchange that led to this publication.

I am of course particularly grateful that the compilation of this years' papers as a publication was made possible by the support of the Galenica group. The Galenica group has supported

the WDA Forum for some time based on the conviction that the subject of ageing is of utmost importance particularly in healthcare and that the discussion is either not getting proper attention or is not anchored sufficiently on facts but rather often on preconceptions, interests, and existing frameworks. Galenica is proud to participate in the work of the WDA Forum and is also proud to support the endeavors of students in this field. Galenica has high hopes that all this may be a small but important step, helping to develop solutions, prioritize activities, engage in dialogue and fundamentally provide services needed in tomorrow's health-care world.

Enjoy the reading and do get back to the WDA forum if you have comments and insights.

We have just started the first steps of a long journey – a journey of longevity and what it means to our life, our societies and the balance of our social systems.

Dr. iur. Christian Köpe
President WDA Forum
Executive Director, Galenica AG, Berne

II. INTRODUCTION AND RATIONALE

Since 2009 I have had the privilege to teach a master class at the University of St. Gallen entitled "*Megatrend Global Demographic Change: Tackling Business and Society Challenges in 2030 and beyond*."

The concept of this class is based on case studies, discussion rounds and interactive outside-the-box conversations on global population trends in the 21st century and their impact on business & society.

The case studies elaborated each year by the students focus upon four categories:

- Demography and geopolitics across the globe
- Natural resources
- Demography and business & society
- Demographic challenges in Switzerland

But what is my motivation to offer such a lecture with both a changing content and a very interactive style?

The coming decades will expose us to demographic dynamics that history has not equipped us to manage/to cope with. It forces us to focus on the future, a period of time which we are not accustomed to reflect upon. This is why the megatrend of demographic change is so intimidating and makes it all the more crucial to be permanently prepared for innovation and creativity as well as openness for change.

However, this will only be achievable if appropriate education/training and thus knowledge/skills are provided for those who have to lead and manage this challenge.

My response as a member of the 60+ generation is to provide a unique platform for academic thinking and exchange for HSG students who want to broaden the scope of their education in terms of demography and its impact on business, governance and society – both as managers and as responsible members in the communities they are living in.

In this year's autumn semester 19 students from 6 different nations (Netherlands, France, Germany, Croatia, Russia, Switzerland) and from 8 different HSG Programs (SIM, MIA, MBF, MaccFin, MSC, MBI, CEMS, Master Exchange) successfully bid for my class.

In this book, you will find the corresponding papers which were elaborated by these 8 working groups in November 2017. Prior to submission all papers have been presented and vividly discussed in class.

I am convinced that the 2017 papers of my students will be an extremely inspiring source on how our “Planet Earth” might develop. One might also agree that these students have developed a solid understanding about their business and civil society environment in which they are most likely to live in between 2030 and 2050.

On behalf of all 19 students who contributed to the content of this book, I am happy to facilitate further discussions with any potential reader.

Dr. med. Hans Groth, MBA

Chairman of the World Demographic & Ageing Forum (WDA Forum)
Guest Lecturer on “Demography and its interdependencies to wealth, health and social sustainability”, University of St. Gallen

St. Gallen, April 2018

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Country & regional case studies

A. Mauritius – How did this Island State manage its Demographic Transition? What are the lessons learned for other African countries to catch their potential demographic transition?

by Julien Sarkar & Stéphanie Mégret

In this paper, the authors focus on the issue of population growth and on how Mauritius can serve as best-practice to support countries of the African continent to plan their demographic transition in the best way possible. This is executed through an exploration Mauritius' demographic transition as a country (which switched from very high fertility rates to very low ones), through boiling down lessons learned and through issuing six short and snappy key recommendations.

This research is imperative as over-population has serious implications on the future development of our planet. The outcomes of too many people inhabiting a continent can be very severe. A large working-age population means that there will be a large need for labour. With-out adequate policies and planning, this can cause under- or overemployment, which can lead to political instability, elevated crime, and a deterioration of social capital (Urdal, 2006). Some regions such as east Asia, capitalized on export-oriented policies that created an increased demand for workers. Consequently, the country had had more working adults and fewer children per family. This allowed the government to invest more in child education and health care, providing for a healthy workforce which had enough skills and health to integrate the workforce (World Bank, 2017). However, the African continent is going in the other direction, with an ever-increasing population and job-loss threats, crucially resulting in a growing and aging population. As the only African country with negative population growth rates, Mauritius is the exception in Africa and a proof that a reverse of situation is achievable.

In order to find out Mauritius' secret recipe for success, the authors start by introducing the topic and laying out fundamental knowledge about the African continent and the country of Mauritius. They then analyse Mauritius with a PESTEL Analysis. The outcome of this re-search showed that Mauritius had unique strengths thanks to its melting-pot of cultures that resulted from stable political system, good infrastructures, focus on education, diversification of the economy, increased education by political and religious institutions, centuries of migration from all over the world, peaceful cohabitation, technological innovation, very moderate urbanization, environmental efforts and a strong and transparent legal system.

Consequently, these USPs were tied to the previously-depicted negative African demographic trends and the issuance of six key recommendations:

- Democratize and stabilize political systems and infrastructures
- Diversify, open and liberalise the economy
- Educate all, in particular children
- Foster the country's ecosystem and natural resources
- Increase the transparency of the legal system and do not over-regulate
- Invest in innovation

In order to implement the recommendations successfully, governments will have to carefully adapt these recommendations to the specificities of their country and focus on the ones which are most relevant for them. The authors conclude by stating the limitations and possibilities for further research that would enable to increase the impact of their recommendations even more.

TABLE OF ABBREVIATIONS

DDR	Demographic dependency ratio
FSI	Fragile state index
GDP	Gross domestic product
NP	No page number
PESTEL	Political, economic, social, technological, economic & legal
R&D	Research & development
SSA	Sub-Saharan Africa
UK	United Kingdom
UN	United nations
USP	Unique selling proposition
WDA Forum	World demographic & aging forum
WHO	World health organisation

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1. Introduction

Introduction to demographic change

Today, we can safely say that demographic change is one of main topics of the 21st century. It is estimated that by 2030, there will be 8.5 billion people on the earth, increasing today's population of roughly 7.6 billion by 13% (United Nations I, 2015). The rising population, combined with increasing climate change and so on make many worry about future of planet, which will highly depend on how we manage our resources, our environment and fertility (United Nations II, 2015). Despite impressive progress in the fields of healthcare and technology, a too rapid growth among the population can lead to inequality and consequently to hunger and internal conflicts. On certain continents, the extreme population problem is more or less under control. In others however, lack of education and available resources means that governments have troubles juggling between economic growth and demographic repartition. One continent that has exceptionally high fertility rates is Africa. The population of this continent is estimated to explode: going from the current billion people to four billion by 2100 (WDA Forum, 2017). However, there is an exception to this in the Mauritius island nation. Mauritius is, as the U.S. Commercial Service (2014) states, "one of the most competitive, stable, and successful economies in Africa (…) [and is] ranked as an upper-middle country by the World Bank" (p.1). This nation can also boast an extremely balanced age range (see appendix I) and stabile population (see appendix II), allowing it to nurture a stable GDP growth rate and stable social and economic conditions.

Introduction to the research question

The goal of this paper is to discover the success factors of Mauritius and to find out how these could be applied other nations of the African continent. In order to do this, the strengths of Mauritius will first be analysed and discussed. In a second step, the authors will aim to apply these learnings to other African countries, for them to be able to better their own demographic dividend. Consequently, the authors will first quickly sketch out Africa's biggest demographic challenges. Then, the authors will analyse Mauritius qualitatively with a historical depiction of the country, as well as an integrative analysis through the PESTEL framework, which will combine qualitative and quantitative indicators. Subsequently, they will draw conclusions on what made Mauritius a successful nation with regards to demographic transition. Then, derived from this case study, they will provide key recommendations about how African countries can use Mauritius' learning to stabilise their demographic dividend. Last but not least, a conclusion will be drawn and limitations and suggestions for further research will be laid-out.

2. Demographic Fundamentals

The following chapter will deal with the theoretical fundamentals of our research question, to give all readers a common understanding of demographics in Africa and the particularities of Mauritius.

2.1. Current situation and major demographic trends in Africa

Demographic trends in Africa are marked by a rapid growth of population (see appendix V). There are several reasons and implications for this, which will be shortly presented under the form of trends in the following paragraphs.

The most significant trend is without a doubt high birth rates. Fertility rates in Africa are still the higher than anywhere else on the planet. On global average, women bear 2.5 children, whereas in Africa the average number of children lies around five. The fertility rates themselves differ depending on country and many managed to lower fertility in the past years. Still, only nine African countries (either an island or located in North Africa) have a lower fertility than the global average. In general, urban educated women have less children (Canning, Raja, & Yazbeck, 2015). The Sub-Saharan Africa region experiences an extremely slow decline in fertility: Between 2005 and 2010 an average of 5.4 children were born per women, down from 6.5 children in 1950 to 1955 (World Bank, 2015).

In addition to this, child mortality is declining faster than ever before (see appendix) and even longevity increased from 37 years in 1960 to 54.3 years in 2010 in SSA excluding South Africa (World Bank Data Bank, 2017). This combination leads to high youth dependency (Canning, Raja, & Yazbeck, 2015, p. 6). Cincotta (2017) concludes that there are and will be an increasing number of young adults in the population that are seeking for work (workforce growth) and more and more children going to school. Due to these changes, the ratio between working-age (15-65) and dependant population (0-14, 65+) is increasing. This shift in the population structure enables Africa to potentially unlock a demographic dividend. Combined with high levels of unemployment, bad quality of schooling and political instability/backlash these developments have to be addressed. (Cincotta, 2017). The last big trend is urbanization. When in 1990 a third of Africa's population lived in cities, by 2035 it will already be half of the population. Drivers for urbanization are not agricultural productivity or increased industrial output, like it was in developed countries, but the growth of the informal sector (United Nations, 2017).

In short the combination of long-term trends of high fertility, better healthcare, increased longevity, a high ratio of dependent population and unemployment, and to a certain point urbanization are problematic in the whole continent and urgently have to be addressed.

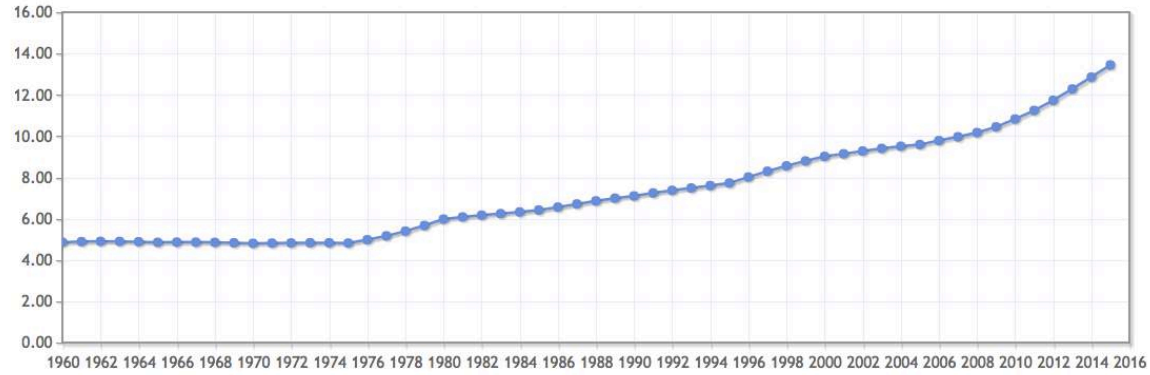
2.2. Historical development and current demographics of Mauritius

Figure 1: Map of Mauritius (Project Cargo, 2017, np)

Mauritius is a nation located in Africa and situated east of Madagascar, in the Indian ocean. Its total territory covers 2040 km^2 of sea and land territory. The nation of Mauritius consists of 4 islands: Mauritius, Rodrigue, Agalega and Saint Brandon amount to a total of 1.3 Mio inhabitants. Mauritius was discovered by Portuguese explorers in 1507, after which it went through Dutch occupation, French occupation in the 18th century, and British occupation in the 19th Century, until the country finally gained independence in 1968. The capital of the country is Port Louis on the Island of Mauritius. According to the last numbers, the country has a birth rate of 0.28% in 2017 (World Population Review, 2017), or, said differently, an average of 1.75 children per woman (CIA, 2017). This is very low given the fact global fertility is in average of 2.5 children per women, with an average of 4.7 in Africa (UN III, 2015; appendix VIV).

Mauritius is a country with a balanced age repartition. Its demographic dependency ratio (DDR), measuring the ratio in between the dependent (which mostly consist of children and

Figure 2: DDR of Mauritius (Index Mundi, 2017, np)



the elderly) and working population was of 41.6 (in other words, 13.1% of the population is dependant of the others) with a youth dependency ratio of 27 in 2015 (Index Mundi, 2017).

This is very low compared to Senegal's score of 87.6 and youth dependency ratio of 82.1 or Niger's score of 113 and youth dependency ratio of 107.5 (CIA II, 2017). In the World Factbook (2017), it is stated that the country: "has transitioned from a country of high fertility and high mortality rates in the 1950s and mid-1960s to one with among the lowest population growth rates in the developing world today" (p.1).

3. PESTEL Analysis of Mauritius' Demographic Transition

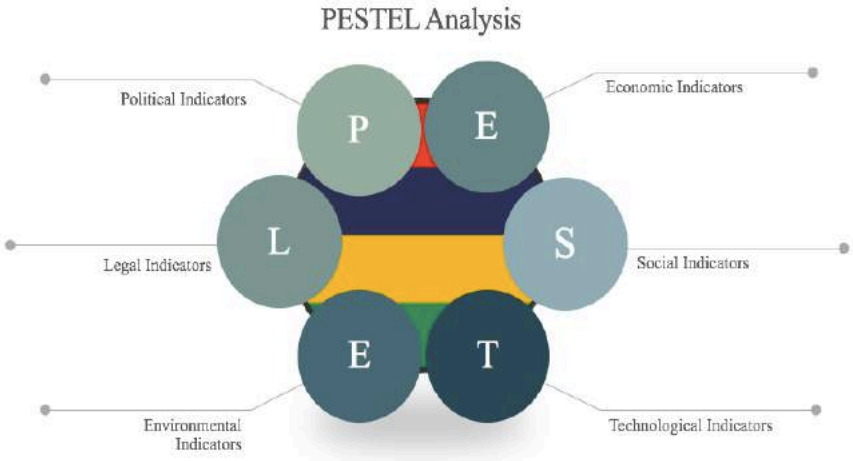


Figure 3: PESTEL Analysis (own representation built on class material)

Due to the complexity and number of factors influencing demographics, a principally qualitative approach has been favoured to tackle our research question. In this paper, the authors will carry out a PESTEL Analysis of Mauritius' demographic transition. This framework has been chosen for the underlying analysis due to its coverage of a wide set of indicators and variables, providing us valuable insights with the key influencers of demographics in each of the analysis categories, and a holistic bond between all factors, enabling us to create a linkage between all components.

3.1. Political

Mauritius is a country with, since its independence from the UK in 1968, a stable political system, which consists of a multi-parliamentary democracy with changing coalitions (World Bank, 2016) and elections for presidency held every 5 years (CIA, 2017). In 2017, it was ranked with a Fragile State Index (FSI) score of 41.7/120, putting it 148th out of 178th states with regards to fragility and ranking it as the most stable country in Africa (Fund for Peace II, 2017). It was also the only African country to be ranked as a "full democracy" by the Economist Intelligence Unit (Heritage, 2017). Economist Ndoli Kalumiya, attributes a lot of Mauritius' success to its well organised governmental institutions (Kalumiya, 2001). What is more,

Mauritius has good public infrastructures and dynamic reforms (US Commercial Service, 2014).

Corruption is low in Mauritius (Heritage I, 2017). The general trust in the state legitimacy is very high (Fund for Peace I, 2017). However, in the past years, the indicator for legitimacy is slightly in decline. A reason for this could be the very long presence of the previous prime minister, Sir Anerood Jugnauth, had been in this position for more than 16 years, and the fact that the current prime minister is no other than his son (CIA, 2017). However, given the fact that they were both appointed by the president, and that the president is elected democratically every five years, this does not seem to have too much of an impact on the legitimacy of the government. There is little external intervention in Mauritius and human rights seem to be respected to a great extent (Fund for Peace, 2017).

3.2. Economic

Economics Nobel Prize James Meade famously predicted Mauritius to be a perfect candidate for failure because of its heavy reliance on cane crops, and strong different ethnic groups (Kalumiya, 2001). However, as stated in the introduction, Mauritius is a model of success and its GDP growth is double the African average. Mauritius' Gini coefficient (which calculates inequality within a country on a scale from 0-1) declined from 0.5 to 0.37 in between 1962 and 1987 (Kalumiya, 2001). The World Factbook states: "since independence in 1968, Mauritius has undergone a remarkable economic transformation from a low-income, agriculturally based economy to a diversified upper middle-income economy (see appendix XI) with growing industrial, financial & tourist sectors" (CIA, np, 2017). The government of Mauritius does not play a too strong role in the economy either and encourages trade (Heritage I, 2017).

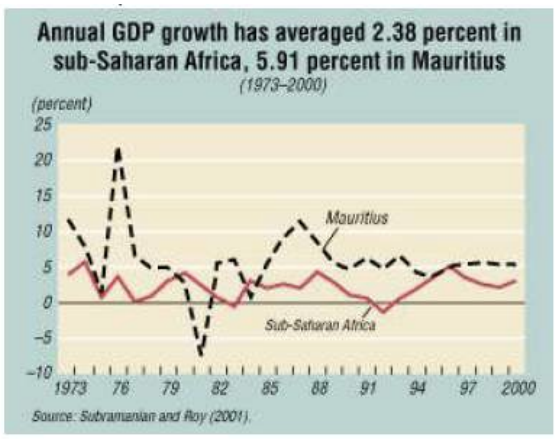


Figure 4: Annual GDP Growth, (Kalumiya, 2001, np)

Being a nation of islands, Mauritius has a riveting import-export strategy and has been a very open country since the 1980s. Kalumiya provides us with two reasons for this. Firstly, the government issued many policies which, although they were interventionist, favoured trade. For instance, all imports were duty-free and so encouraged competitiveness and tax-incentives were provided to firms carrying out exports, and in particular in the sugar, textile and clothing sectors. Secondly favourable politics towards foreign direct investment were established. It is interesting to note, that although Mauritius has a natural and historical strength in sugar cane

production, they have not focused on this area but also hugely invested in textile and other manufacturing products (Kalumiya, 2001). Mauritius also participates proactively in regional and multilateral trade initiatives (Naeem, 2008, p104).

However, the country has known a slight recession in the past few years and the country's balance is in slight deficit (World Bank, 2017). This can be in part attributed to the fact that Mauritius was very successful in the textile industry because it signed the Multi Fibre Agreement in 1973 and the Lomé Convention in 1875, which allowed them to sell textile to the EU under preferential market access, without paying import taxes. This encouraged many foreign investors, in particular from Hong Kong, to invest in this industry. However, there was a reform by the government and WTO which abolished these practices and in consequence many economic advantages (Naeem, 2008, p.94). Nevertheless, the economy is growing positively and the country is on the right tracks (World Bank, 2017). The government of Mauritius expects Brexit to have a negative influence on the country's economic growth (BMI Research, 2017), however, this impact is not huge and not so relevant for the purpose of this paper, and our analysis will limit itself to Mauritius' average economic conditions.

3.3. Social

Mauritius' social conditions are particularly fascinating. The population consisting of Indo-Mauritian, Creoles, Sino-Mauritians, Franco-Mauritians as well as a small part of the population of Chinese and English origin, is highly multi-ethnic and multi-cultural (Mauritius Government, 2017). There is no indigenous population (World Fact Book, 2017). The official language of the Mauritian islands is English, but French and Creole are also largely spoken. Different religions also co-exist peacefully and 52% of the population identify to Hinduism, 28% as Roman Catholics, 16.6% Islam, 2.5% Buddhism and 2% Protestants (Mauritius Government, 2017).

In addition to good social conditions, Mauritius also has good educational and working conditions. In the 60s, Mauritius was a rare bird regarding education, as schooling rates steadily went up (while they were going down in the rest of Africa). This, pushed by both the government and religious institutions, enabled the population to be educated about reproduction and about the limits of resources on the islands. As a result, the fertility rate fell from 6.2 children per women in 1963 to 3.2 in 1972 and 1.4 today, and has been below replacement level since the end of the 90s (World Fact Book, 2017). Illiteracy is also continuously declining (UNESCO, 2017). Labour conditions are satisfactory in Mauritius. There is a large presence of trade unions in the country. Unemployment stagnates at surprising low 7.4% (Mauritius Statistics, 2016). Steady growth has not only reduced income inequalities but

also increased life expectancy, lowered infant mortality and enabled local infrastructures to be modernised (CIA, 2017).

Finally, medical standards are high in Mauritius, allowing 98% of births in between 2007-2012 to be carried out with competent medical staff (Common Wealth Health, 2017). The country is also equipped with private and public clinics and the country has set up a partnership with Asia's largest health care group, the Apollo Hospital Group, and the country's health institute provides regular trainings (Common Wealth Health, 2017). The country also has a clear health plan and leadership system (WHO, 2017)

3.4. Technological

Figure 5: Development of Productivity in Mauritius (Trading Economics,, 2017, np)

Since Mauritius offers one of the best infrastructures in SSA, the per capita electricity consumption ranks as third highest in this region (Africa Progress Panel, 2017). Electric power consumption has tripled since 1990 to 2183kWh per capita in 2016 (World Bank II, 2017). However, the electricity infrastructure still must be improved to reach Western standards: it takes on average 81 days to get access to electricity (Doing Business, 2017, p. 224).

Mobile cellular subscriptions are on a Western standard though, 144.2 per 100 people increased had their own subscription in 2016 (World Bank II, 2017). This doesn't give them access to the internet yet since only 53.2% have been using it in 2016 (World Bank II, 2017). Mobile banking is big even without a broad internet coverage: 52% of all Mauritians use mobile banking, offered by three banks (Ramdhony & Munien, 2013).

Mauritius is the second most innovative country in SSA region and productivity is growing quickly, as can be seen in Figure 4. They have very strong inputs but could improve on outputs (Global Innovation Index, 2017, p. 257). For an example in agricultural research, Mauritius invests 5.89% of its agricultural GDP in R&D, more than any other SSA country, but they still don't export any high-tech products (ASTI, 2017). High technology exports made up 0.0596% of all manufactured exports in 2015 according to World Bank (World Bank II, 2015).

3.5. Environmental

Urbanization has not developed to a megatrend in Mauritius. 42% of total population lives in cities. While in 1990 the urban population was growing by 1.4% it shrunk in 2016 by 0.2% (World Bank II, 2017). Sanitation facilities are widely spread (89% have access) and 99% have access to improved water sources (World Bank II, 2017, p. 56). Access to water in Mauritius is in general good, but drinkable water is depending heavily on rainfall. Big projects like damns are planned, since climate change reduces the rainfall (Rights4Water, 2015).

CO_2 emissions tripled since 1990 to 3.35 metric tons per capita (World Bank II, 2017) but in 2011 Mauritius was ranked with the second-best air quality by the WHO (Le Matinal, 2011). In general, the climate is very tropical, but modified by southeast trade winds. The terrain consists of a small coastal plain rising to discontinuous mountains encircling a central plateau. Natural resources are arable land and fish. Current environment issues are water pollution and the degradation of coral reefs (CIA, The World Factbook 2016-17, 2015, p. 486).

3.6. Legal

In 2017, Mauritius was the highest ranked African country in terms of economic freedom and ranking higher than Norway or Iceland (HeritageI, 2017). Property rights are well protected, but intellectual property laws are relatively week. Judges are independent, the legal system is non-discriminating and transparent. Corruption is not always prosecuted consistently. Albeit, this makes the country's institutions one of the strongest in Africa (Heritage, 2017).

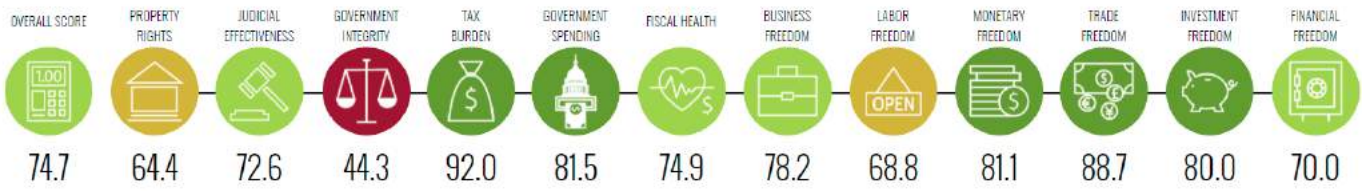


Figure 6: Economic freedom in Mauritius (Heritage II, 2017, np)

In the “Doing Business Report”, Mauritius was ranked 49th, whereas registering property and getting electricity are the lowest scoring points. (Doing Business, 2017). Experts see structural reforms in labour market, such as promotion of youth and female workers, higher education and innovation policies as one of the key issues now (Mission to Mauritius, 2017). Wage gap and participation rate of women are both on the level of 50% (World Bank III, 2017). Female legislators, senior officials and managers are represented at 23%, whereas in Switzerland has only 33% and there are even only 25% female representatives in Italy (World Bank II, 2017).

The regulatory framework has undergone some reforms already and labour market are flexible compared to SSA region (Index of Economic Freedom, 2017). Yet social protection represented by large and active trade unions is similar so Western countries (Subramanian, 2001). State-owned enterprises and welfare benefits reforms are proceeding at a slow rate and consume many resources (Heritage, 2017).

4. Recommended Actions for African Countries

The previous chapter related to the unique strengths of Mauritius. The present one will expose which strengths can be replicated by other African countries. One may argue that Mauritius is geographically isolated from the rest of the continent and thus, under different circumstances than the typical continental Africa ones. However, its total reverse of situation as a state with a very high positive population growth rate similar to average sub-Saharan Africa to a decreasing one (and sometimes even negative) shows that it has a rich collection of lessons-learned that can be put into place in a majority of African countries. It also shows that economic growth, good governance, resources, education, climate change and many more factors are all interlinked.

There are many possible recommendations to give. However, the previous analysis of demographic trends and Mauritius allowed the authors to identify the most relevant and implementable. In order for other African countries to plan out a similarly successful transition to milder growth rates, the following six key and to-the-point recommendations are offered as potential guidance:

1) Democratise and stabilise political systems and infrastructures

Although this recommendation is probably very difficult to implement in many African countries, it is imperative for the states to strive for a functioning governmental system with, if possible strong and honest political leaders. Mauritius’ multi-parliamentary democracy seems to be a good structure. Once these structures have been established, they should be stabilised, as it

has been done in Mauritius. Stabilisation can be attained through the inclusion of all citizens and a true democracy. What is more, governments need to learn how to be more efficient and transparent. This can be obtained through good public infrastructures and stimulation of the economy, as it will be explained in the next recommendation.

2) Diversify, open and liberalise the economy

Mauritius is a true role model in this respect. Although the country was originally specialised in sugar cane production, it diversified its economy to many activities, may it be tourism, fishing, or textile production (see appendix IV). This resulted in the creation of new jobs and an opening to the rest of the world. Mauritius used its history as a colony to create push trade with certain countries and use it to its best advantage. The government also encouraged trade and carried out favourable export politics and encouraged foreign direct investment. Many other African countries could also spur their economies in a similar manner.

In a similar way of thinking to the previous recommendation, the government must work hand in hand with citizens and local businesses to make their country more dynamic. As it is the case in Mauritius, this can be achieved through private-public partnerships, facilitating small businesses, or in other words fostering entrepreneurship, and improving the efficiency of the economy through different channels. As stated in point one, infrastructures should also be invested in for this purpose. What is more, if it is possible, governments should reduce their dependency on foreign aid, which makes their businesses vulnerable to the economies of other countries. One can notice that Mauritius only fully became economically strong once it gained independence.

3) Educate all, in particular children

Education is at the basis of all social progress. Nations should therefore invest in reducing illiteracy and basic procreation knowledge. Secondly, countries should also educate all not only about reproduction, but also about political accountability and inter-cultural respect and understanding. In a similar way, the sole recipients of this education should not only be women, but also but men. Mauritius' state and religious institutions inspiringly worked hand in hand to make citizens aware of all of this and encouraged understanding and education. As Mauritius began education by increasing the rate of primary and secondary school attendance rates, the authors believe that the best way to start education is by improving school system. When a child learns something, he will tell it to his parents and there will be a ripple effect. An educated youth will also enable future generations to live with more tolerance and peace. A better understanding of the world, limits of resources and society will naturally make population

growth pace down. Additionally, studies have shown that, in Africa, women with higher education levels tend to have less children than the ones with little schooling (Pradhan, 2015; appendix X).

4) Invest in technologies and infrastructure

Mauritius is a leader in technologies and mobile investments and illustrates that new technologies can bring precious added value to many countries. Firstly, digital technologies enable people to have better access to news and to education, which allow them to be more informed and think more critically. Secondly, technologies can increase productivity and therefore also increase the competences of a country and economic advantages. Figure 4 clearly shows that productivity in Mauritius has sky-rocketed and this can be correlated to the use of technologies. Finally, it allows a diversification of workforce and provides exposure to small businesses. They can also be very valuable for providing tourism. Finally, technologies are also primordial in healthcare. Although this may sound counter-intuitive, a better health system that allows people to live longer encourages long-term thinking and draws attention to the holistic relationship in between society, education & health.

5) Foster the country's ecosystem and natural resources

Over-exploitation of resources, pollution and over-urbanisation can lead to disastrous and irreversible consequences. It is therefore primordial for countries to increase awareness to environmental problems and notify citizens that it is directly linked to economic wellbeing. Although the conditions are not optimal, Mauritius provides a good example on how access to clean water for instance, can improve lives. This also has a positive impact on many industries, such as agriculture, which can then in turn provide better food supplies. Relating to the previous recommendation, machinery and new technologies can also be used to manage natural resources.

6) Increase the transparency of the legal system and do not overregulate

Proper legal mechanisms are key for a functioning state and primordial in the holistic way of functioning of society, as safety is a basic need of each and every human being. Mauritius' laws are well balanced with regards to property rights but still has margin to improve in the domain of intellectual property. However, it is overall still a fair and well-functioning system (Naeem, 2008). What is more, the country is still ahead of the African continent, which lacks structures and transparency in many countries. Not over-regulating relates to the openness of the economy and the government encouraging local businesses to thrive.

5. Summary

The current chapter will give an overview of the most important statements, show limitations of those and recommend further studies in this research area.

5.1. Conclusion

The research question of this paper was to analyse the success factors of Mauritius and transfer them to the African continent with a focus on sub-Saharan region. The current situation of the African continent is marked by high fertility rates, which didn't change much in the last 60 years. However, longevity increased by nearly 20 years in SSA and mortality rates are lowering steadily. Mauritius on the other hand has transitioned from high fertility and mortality rates to one of the lowest populations growth rates in the developing world.
The PESTEL analysis has shown that Mauritius managed to build a stable political system since gaining its independence from the UK in 1968. Trust in the state legitimacy is very high and human rights are very well respected. On average, Mauritius growth is double the SSA average, it's Gini coefficient has been lowered; all thanks to the very open import-export strategy since the 1980s. Mauritians are also very open in regards of cultures and ethnics. The population consists of many origins and different religions co-exist peacefully. Religious and governmental institutes pushed education over the years and illiteracy rate are continuously declining. The offered infrastructure is one of the best in the SSA region. Mobile cellular subscriptions are on Western standards and Mauritius is the second most innovative country in the region, after South Africa. Unlike in any other Western country, urbanization is not a big thing – in 2016 urban population was even shrinking. However, issues like pollution of water and CO_2 emissions are current topics for the government. The country ranks very high on economic freedom, legal system and in doing business in general.

Based on the PESTEL analysis the authors concluded the most crucial elements for the success of Mauritius and gave recommendations for implementation:

- Democratize and stabilize political systems and infrastructures
- Diversify, open and liberalise the economy (and enable environments and create implementation mechanisms for better economic engagement)
- Educate all, in particular children
- Invest in technologies and infrastructure
- Foster the country's ecosystem and natural resources
- Increase the transparency of the legal system and do not overregulate

5.2. Limitations and outlook on further research

Although the authors have taken particular care in staying as analytical and objective as possible, they have identified a few key research-related limitations that must be taken into account while reading this analysis. The authors tried to include as many factors as possible through the PESTEL framework and carried-out analysis is mostly qualitative way. However, the demographic development is influenced by so many different aspects, that it is not possible to include everything. Prediction of future events, also when based on best practices, is extremely complex. Even Economics Nobel prize winner James Meade couldn't predict the development of Mauritius.
As our recommendations were done for the whole Sub Saharan Africa region, there is a risk of over-generalisation since every country faces different challenges or has made progress differently. Therefore, the authors recommend a deeper analysis where Mauritius is compared to specific countries. That way, specific problems of that countries can be analysed and confronted with Mauritian solutions.

What is more, this shouldn't be limited to African countries as other colonized Latin American countries or South/ South-East Asian countries can be compared too. The authors have identified two key topics that could be interesting to pursue as further research in the topics of Mauritius as a best practice and limitation of population growth in Africa. First of all, the authors believe it would be intriguing to turn all the PESTEL factors into quantitative variables and carry out a quantitative analysis. This would enable the understanding of the biggest gaps in between Mauritius and the rest of the African continent and would allow the countries with the most gaps to focus on the areas with the most important risks first. Second of all, Mauritius is a country which, in contrary to many other African countries, was greatly influenced by India and its culture. It would be interesting to carry out an analysis in between the African continent and India to better understand the influence of different cultures and could make new findings arise.

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7. Appendix

Appendix I: Age Distribution

Table 1.13(a) - Age distribution of the population [1/] as enumerated at the 2000 and 2011 censuses - Republic of Mauritius[2/]

Age group (Years)	2000				2011			
	Male	Female	Both sexes		Male	Female	Both sexes	
			Number	%			Number	%
0	9,574	9,341	**18,915**	1.6	6,151	6,156	**12,307**	1.0
1 - 4	38,066	37,322	**75,388**	6.4	30,551	30,220	**60,771**	4.9
5 - 9	53,037	52,152	**105,189**	8.9	44,947	44,068	**89,015**	7.2
10 - 14	49,428	48,312	**97,740**	8.3	47,302	46,337	**93,639**	7.6
15 - 19	51,671	50,417	**102,088**	8.7	50,715	50,293	**101,008**	8.1
20 - 24	55,108	55,784	**110,892**	9.4	46,871	45,800	**92,671**	7.4
25 - 29	46,749	47,048	**93,797**	8.0	45,589	45,348	**90,937**	7.4
30 - 34	49,964	49,551	**99,515**	8.4	52,182	51,247	**103,429**	8.4
35 - 39	51,621	50,325	**101,946**	8.6	44,241	43,556	**87,797**	7.1
40 - 44	45,798	44,608	**90,406**	7.7	45,150	44,236	**89,386**	7.2
45 - 49	39,133	38,798	**77,931**	6.6	49,800	49,541	**99,341**	8.0
50 - 54	27,790	29,149	**56,939**	4.8	42,996	43,341	**86,337**	7.0
55 - 59	19,228	21,263	**40,491**	3.4	35,713	37,341	**73,054**	5.9
60 - 64	15,301	17,796	**33,097**	2.8	27,143	30,199	**57,342**	4.6
65 - 69	11,758	14,010	**25,768**	2.2	15,846	19,593	**35,439**	2.9
70 - 74	9,491	12,203	**21,694**	1.9	10,986	14,389	**25,375**	2.1
75 - 79	6,047	8,863	**14,910**	1.3	7,349	10,695	**18,044**	1.5
80 - 84	2,584	4,548	**7,132**	0.6	4,176	7,193	**11,369**	0.9
85 +	1,363	3,528	**4,891**	0.4	2,767	6,170	**8,937**	0.7
Age unknown	45	74	**119**	0.0	373	246	**619**	0.1
All ages	**583,756**	**595,092**	**1,178,848**	**100.0**	**610,848**	**625,969**	**1,236,817**	**100.0**

[1] 'de jure' population; not adjusted for underenumeration of young children

[2/] excluding Agalega and St Brandon

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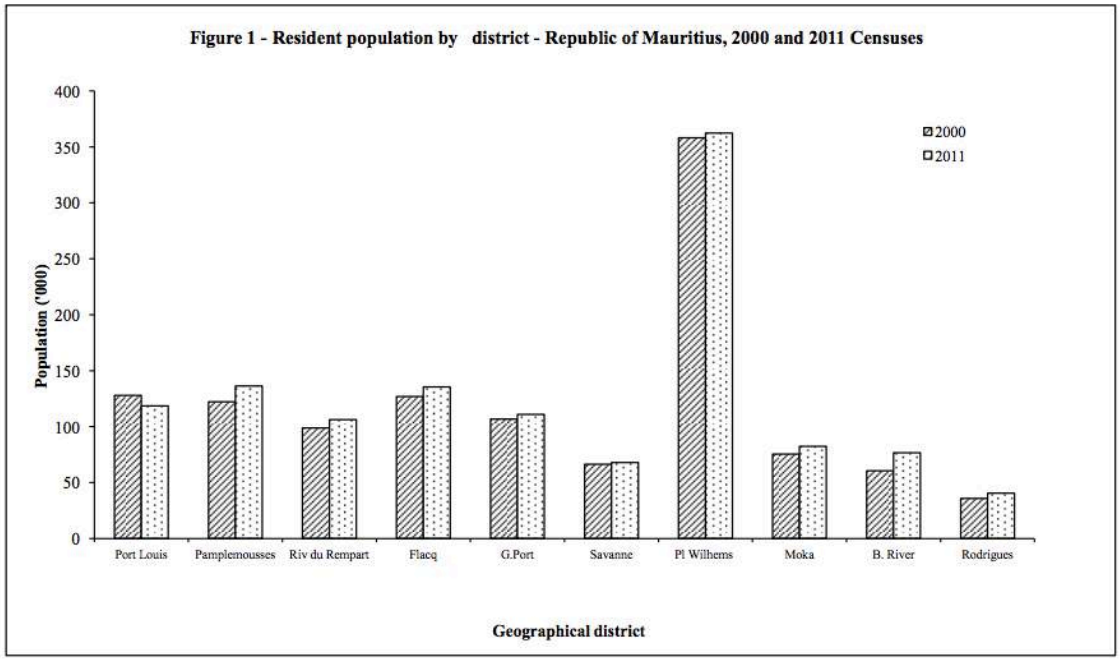
Age Distribution of the Mauritian Population, Statistics Mauritius, 2016, np.

source: http://statsmauritius.govmu.org/English/StatsbySubj/Documents/Digest/Demography/Digest_Demo_Yr16.pdf

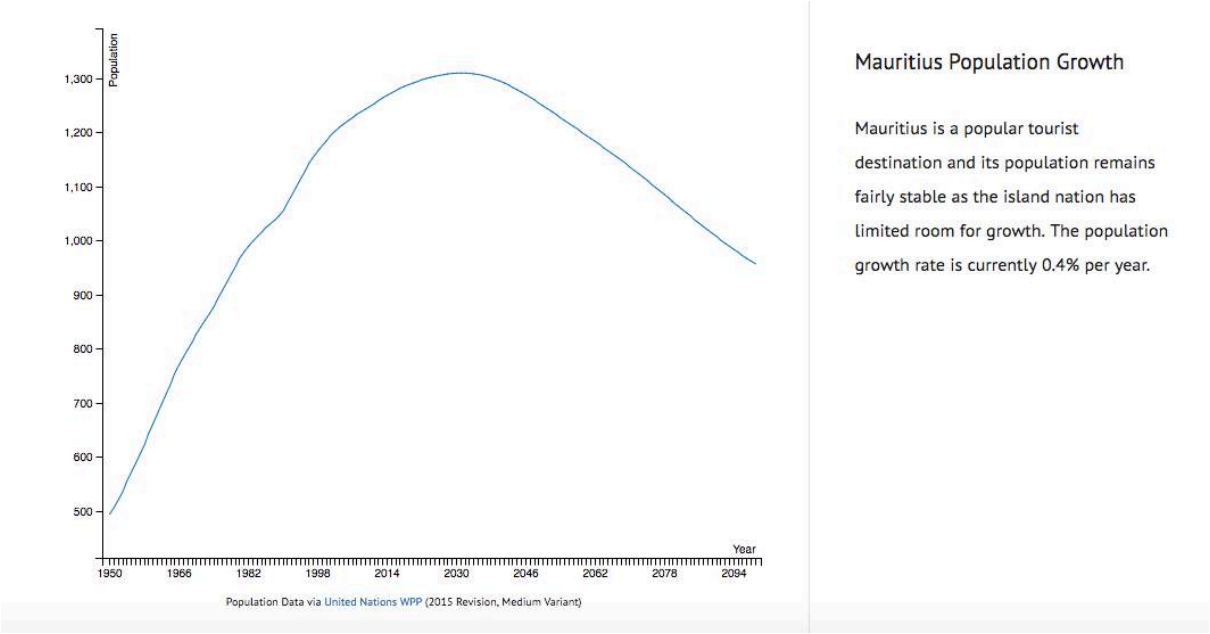
Appendix II: Growth in Cities



Resident by District in Mauritius (Statistics Mauritius, 2016, np)

source: http://statsmauritius.govmu.org/English/StatsbySubj/Documents/Digest/Demography/Digest_Demo_Yr16.pdf

Appendix III: General Population Growth (historical and predicted)



Mauritius Population Growth (United Nations, 2015, np)

Source: http://worldpopulationreview.com/countries/mauritius-population/

Year ▾	Population	% Male	% Female	Density (km²)	Growth Rate
2017	1,281,353	49.32%	50.68%	631	0.28%
2015	1,273,212	49.39%	50.61%	627	0.33%
2010	1,247,951	49.57%	50.43%	615	0.41%
2005	1,222,006	49.56%	50.44%	602	0.47%
2000	1,185,143	49.59%	50.41%	584	0.74%
1995	1,128,676	49.85%	50.15%	556	1.17%
1990	1,055,865	49.87%	50.13%	520	1.18%
1985	1,015,763	49.63%	50.37%	500	0.74%
1980	966,036	49.31%	50.69%	476	1.24%
1975	892,208	49.34%	50.66%	440	1.64%
1970	826,447	50.03%	49.97%	407	1.58%
1965	753,285	50.00%	50.00%	371	2.14%
1960	660,023	49.86%	50.14%	325	2.84%
1955	570,645	49.80%	50.20%	281	2.99%
1950	493,254	49.80%	50.20%	243	2.64%

Mauritius Population Growth (United Nations, 2015, np)

Source: http://worldpopulationreview.com/countries/mauritius-population/

Year ▴	Population	% Male	% Female	Density (km²)	Growth Rate
2020	1,291,361	49.22%	50.78%	636	0.22%
2025	1,303,546	49.06%	50.94%	642	0.13%
2030	1,309,522	48.91%	51.09%	645	0.02%
2035	1,307,027	48.77%	51.23%	644	-0.13%
2040	1,294,882	48.67%	51.33%	638	-0.27%
2045	1,274,435	48.60%	51.40%	628	-0.38%
2050	1,248,976	48.59%	51.41%	615	-0.43%
2055	1,221,766	48.64%	51.36%	602	-0.45%
2060	1,194,226	48.73%	51.27%	588	-0.47%
2065	1,165,991	48.86%	51.14%	574	-0.50%
2070	1,136,106	49.01%	50.99%	560	-0.55%
2075	1,104,295	49.17%	50.83%	544	-0.59%
2080	1,071,270	49.32%	50.68%	528	-0.62%
2085	1,038,421	49.46%	50.54%	512	-0.62%
2090	1,006,771	49.59%	50.41%	496	-0.60%
2095	977,568	49.73%	50.27%	482	-0.56%

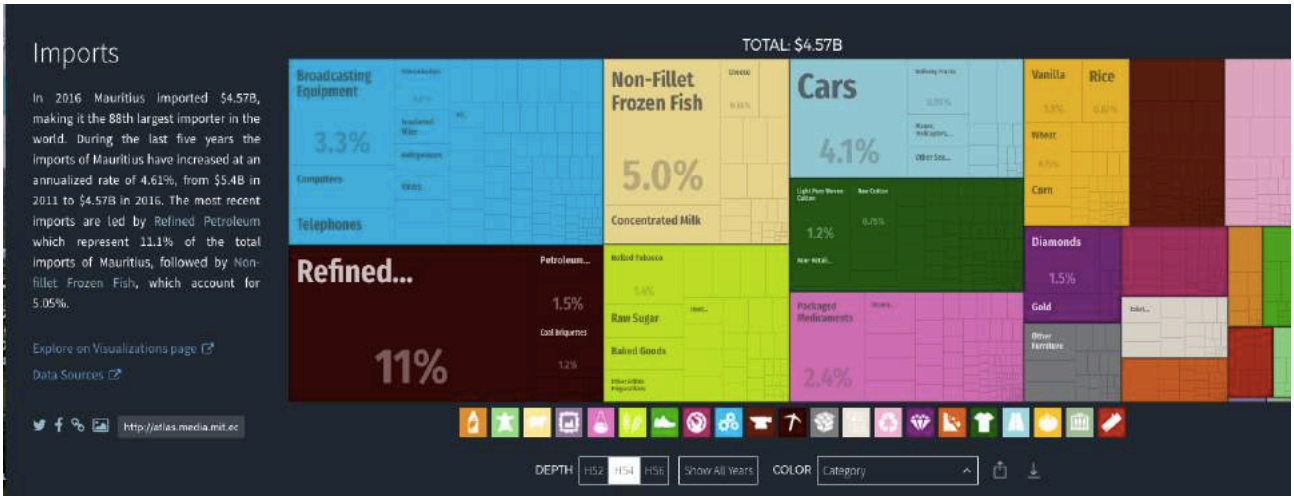
Mauritius Population Growth Projection (United Nations, 2015, np)

Source: http://worldpopulationreview.com/countries/mauritius-population/

Appendix IV: Mauritius Exports & Imports

Mauritius Exports (MIT, 2017, np)

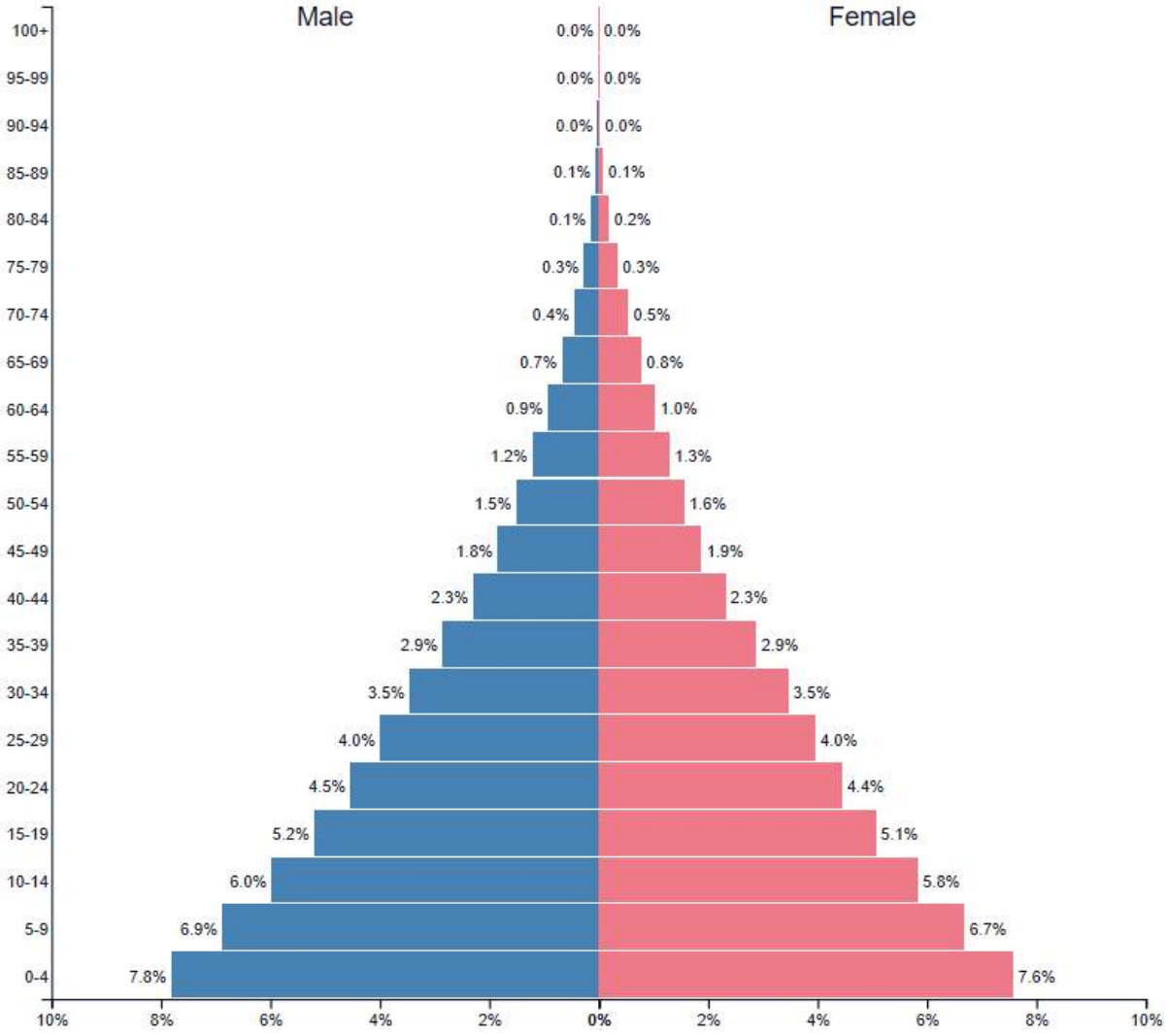
Source: http://atlas.media.mit.edu/en/profile/country/mus/



Mauritius Imports (MIT, 2017, np)

Source: http://atlas.media.mit.edu/en/profile/country/mus/

Appendix V: Population pyramid in Africa



Population pyramid in Africa (Population Pyramid, 2017, np)

Source: https://www.populationpyramid.net/africa/

Appendix VI: African Demographic Transition Model

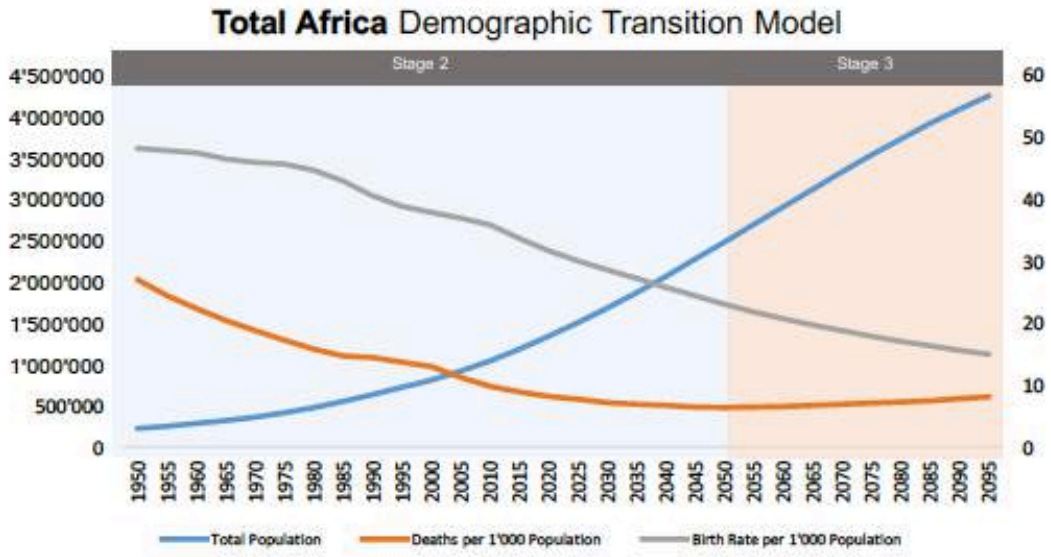
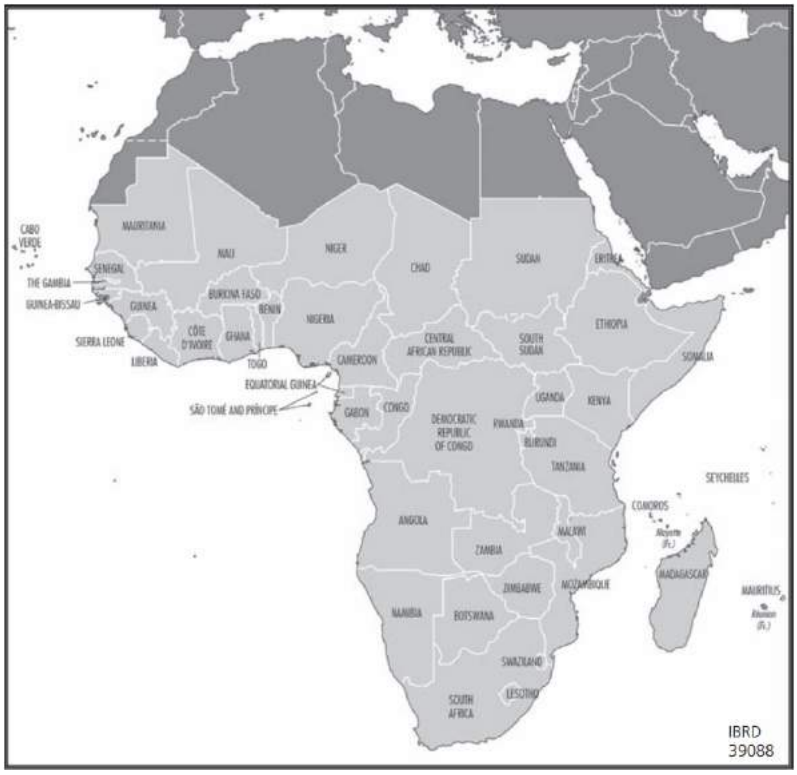


Figure 1: State of Demographic Transition (Source: World Population Prospect 2015, Available: https://esa.un.org/unpd/wpp/)

State of Demographic Transition (World Population Prospect, 2015, np)

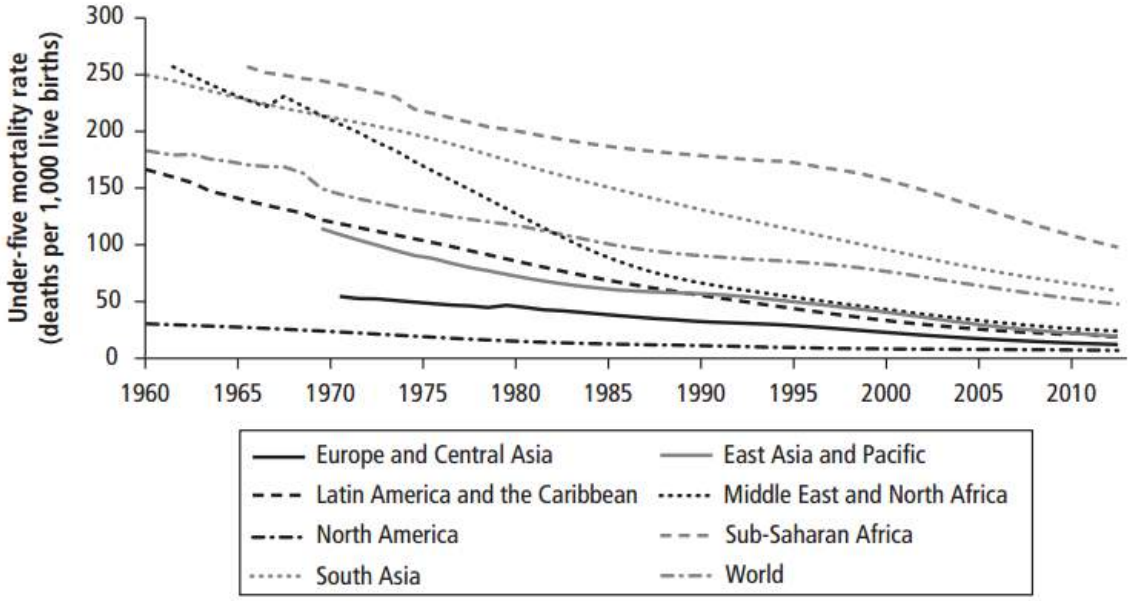
Source: https://esa.un.org/unpd/wpp/

Appendix VII: Sub-Saharan Africa



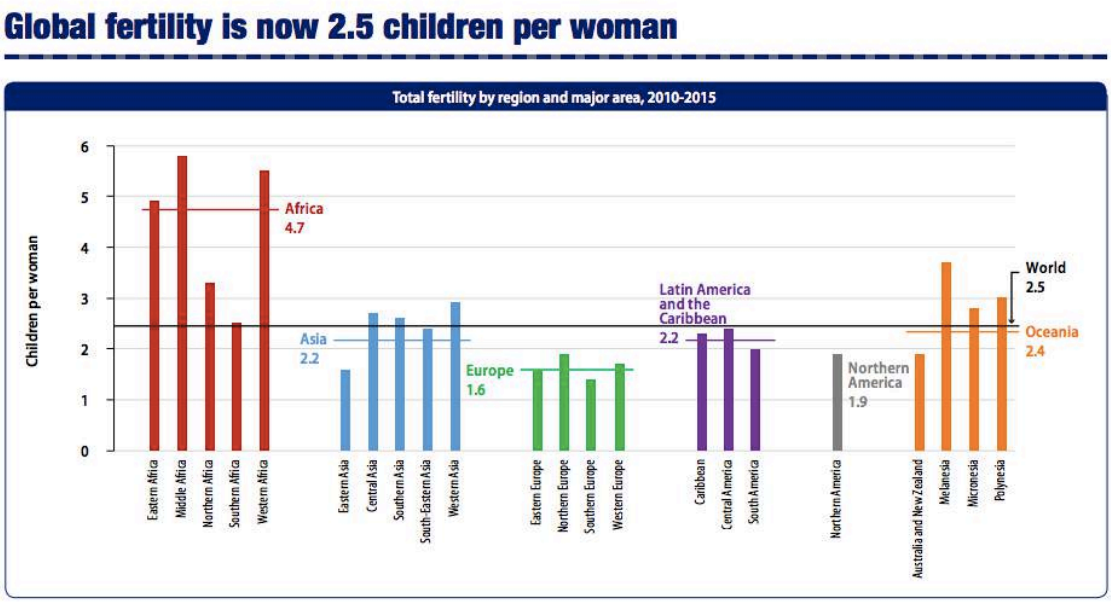
Sub-Saharan Africa (Canning, Raja, & Yazbeck, 2015, p. VI)

Appendix VIII: Under-Five Mortality Rates in the World



World Mortality Rates under five (Canning, Raja, & Yazbeck, 2015, p. 8)

Appendix VIV: Global fertility is now at 2.5 children per woman

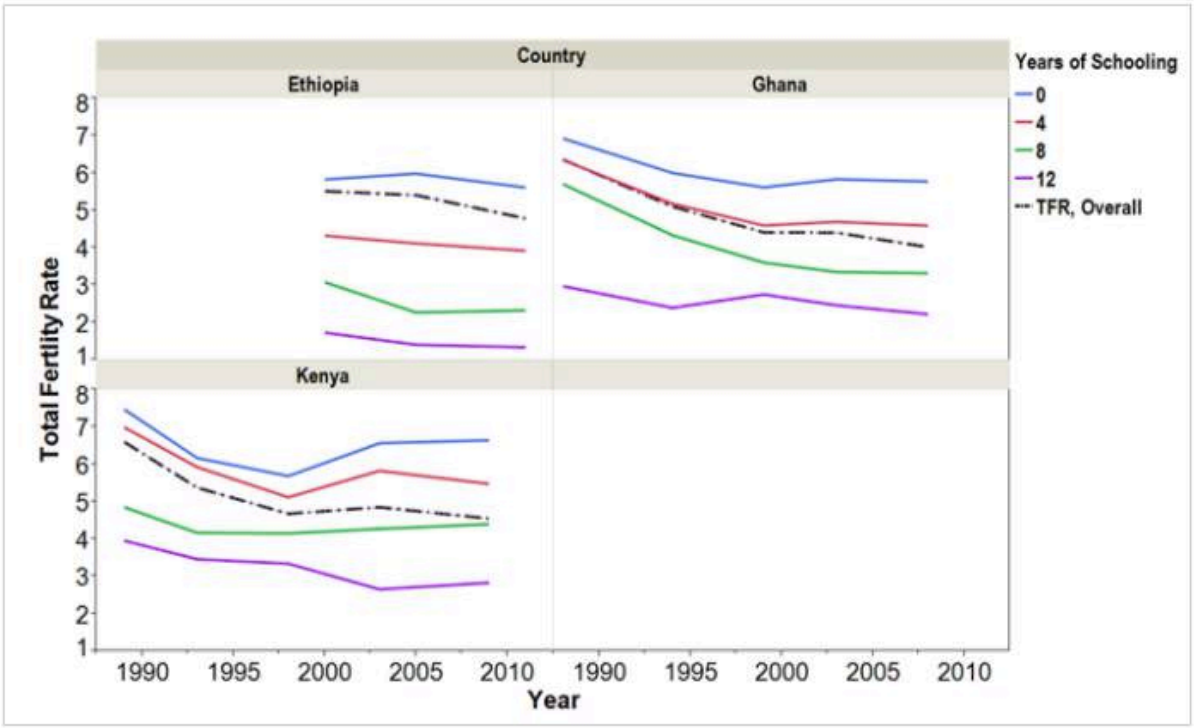


Global fertility is now 2.5 children per women (United Nations, 2015, p.3)

Source: http://www.un.org/en/development/desa/population/publications/pdf/fertility/world-fertility-patterns-2015.pdf

Appendix X: Female Education and Childbearing

Relationship between Female Education and Fertility: Ethiopia, Ghana and Kenya

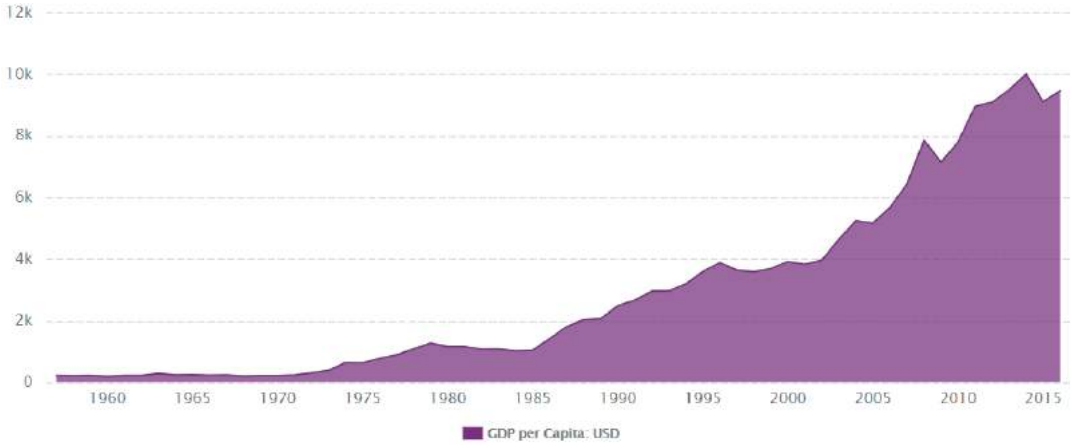


Data from Demographic and Health Surveys in Ethiopia, Ghana and Kenya [1988-2011]

Relationship between Female Education and Fertility (Pradhan, 2015, np)

Source: http://blogs.worldbank.org/health/female-education-and-childbearing-closer-look-data

Appendix XI: GDP per Capita development for Mauritius in USD



Source: https://www.ceicdata.com/en/indicator/mauritius/gdp-per-capita

B. Myanmar: Gain knowledge about its past, present and future demography till 2050

by Ilya Shulman and Yulia Kulmatitskaya

This paper analyses past and present demography of Myanmar as well as provides the demographic forecast for 2050. Further, PESTEL analysis is executed to evaluate Myanmar's potential, which is followed by the demographic projections for the future in order to provide suggestions that ensure the full benefit from Myanmar's demographic window of opportunity. The demographic analysis of Myanmar within this paper has shown that the country is currently at the third stage of demographic transition and has huge potential for development. The population distribution dynamics indicate that the number of the retired people increases rather negligibly, the population below working age is shrinking and the proportion of the labor force is growing, which creates demographic dividend for Myanmar and room for economic development. For Myanmar's utilization of the favorable demographic situation, this paper proposes to increase labor productivity by introducing mechanization in agriculture and raising government expenditures on education. This paper also suggests shifting away from the reliance on the exports of raw materials and focusing on the production of processed or manufactured goods for exports.

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1. Introduction

When it comes to the discussion of the demographic situation of a state, it is always appealing to evaluate a country which is undergoing a significant change or is at the stage of massive development. One of the countries largely matching the above-mentioned criteria is Myanmar.

Myanmar, which is also known to many people as Burma, is located in Southeast part of Asia, and is surrounded by 5 countries, namely, Bangladesh, India, China, Thailand, and Laos. Myanmar's unique geographic and cultural position plays significant role in its development, including demographic dynamics, and represents huge potential for its economic development. When assessing the country's potential, demography is an extremely important factor, largely defining the outlook on the country's future. Analyzing demography is extremely important for governments and societies to prepare for the future challenges and for the constant improvement of the level of life within the country. Demographic analysis helps governments, businesses and society to find a common variable and make effective and need-based decisions when it comes to the country's future.

This paper analyses past and present demography of Myanmar as well as provides the demographic forecast for 2050. Further, PESTEL analysis is executed to evaluate Myanmar's potential, which is followed by the demographic projections for the future in order to provide suggestions that ensure the full benefit from Myanmar's demographic window of opportunity.

2. Analysis of the Present Demography and Demographic Trends

The nationality of people living in Myanmar is known as Burmese. The state of Myanmar reports 135 indigenous ethnic groups, of which Burman (Bamar) comprise 68%, Shan 9%, Karen 7%, Rakhine 4%, Chinese 3%, Indian 2%, Mon 2% (Central Intelligence Agency). The official language of the country is Burmese, however, minority ethnic groups have their own languages. According to 2014 national census, 87.9% of population practice Buddhism, 6.2% - Christianity, 4.3% - Islam, 0.8% – Animism, 0.5% – Hinduism (Central Intelligence Agency).

As of 2017, Myanmar occupies 24th place in the world based on the size of its population (55 mln people). World Population Data projects the size of Myanmar population to be 58.9 mln in 2030 and 62.4 mln in 2050. As of now, the population growth is at the level of 0.9% per annum, which corresponds to 121st place in the ranking, which is defined by the current trends in fertility, longevity and migration (US Census Bureau). It should be noted, that though Myanmar's population has been steadily growing, since 1970s the growth rate has been falling and in 2009 it reversed to accelerating. (World Bank 2017).

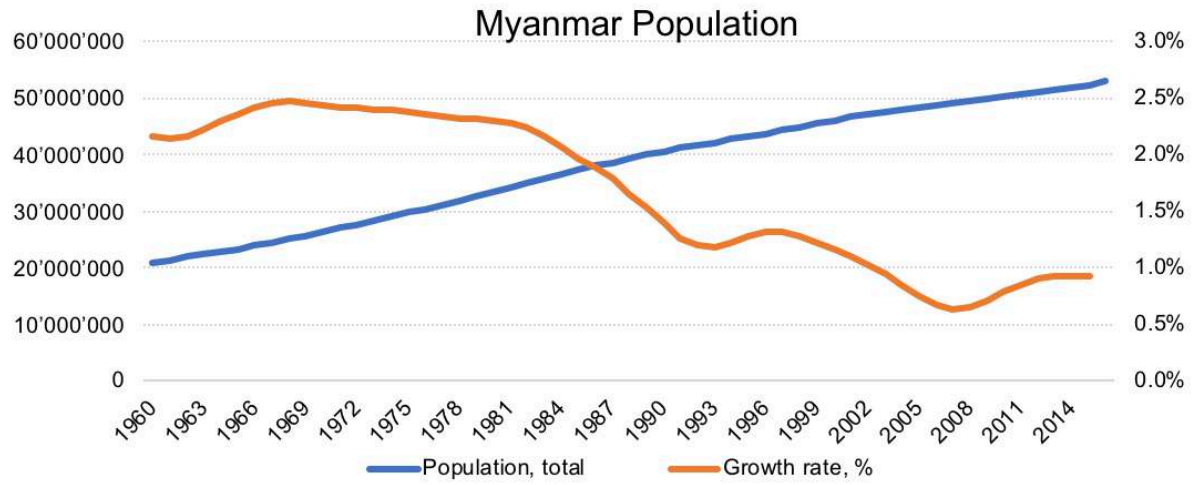

Figure 2. Myanmar Population (World Bank, 2017)

2.1 Fertility, Longevity and Migration as Demographic Trends

Current birth rate is 18 births per 1000 population (97th place in world ranking), whereas mortality rate is 8 deaths per 1000 population (114th place in the world ranking) (World Population Data & Central Intelligence Agency). The average number of children per woman, or in other words, total fertility rate, is 2.3 and of the thousand newborn babies 52 will die (World Population Data).

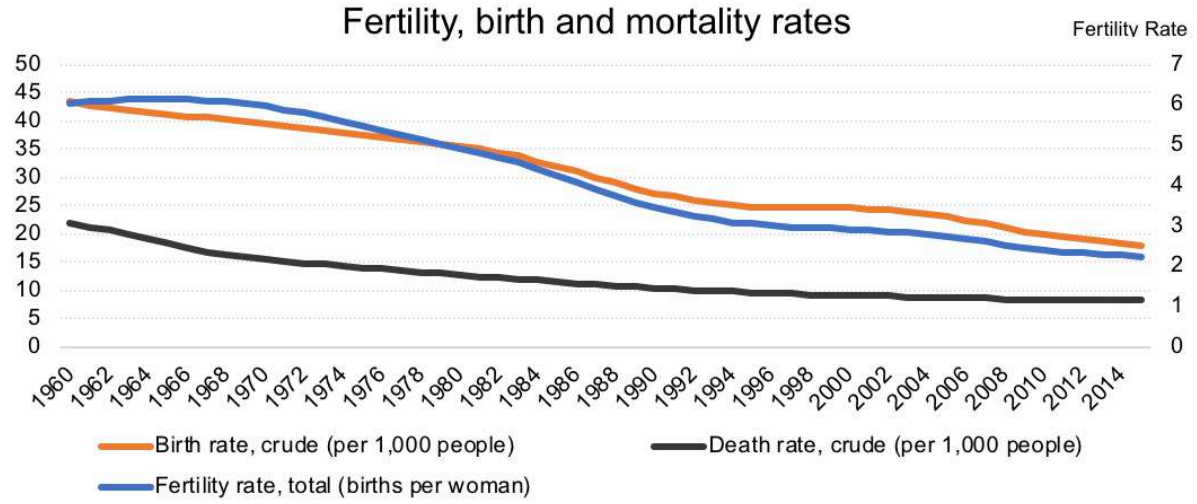

Figure 3. Age Dependency Ratios (World Bank, 2017)

Thus, it can be argued that Myanmar is currently at the stage 3 of the demographic transition, or late transition, when birth rate is declining and the rate of population growth is falling. However, it is not at the final stage 4 yet, as the death rate is still not low and the population growth is still significant (May, J. 2013).

Considering longevity, the anticipated life expectancy at birth is 68.2 years for the whole population, 66.6 years for males and 69.9 years for females as estimated in 2017 (Central Intelligence Agency). The median age of Myanmar population is 28.2 years, which places Myanmar in 128th place in the corresponding ranking (Central Intelligence Agency). Deeper age-gender distribution analysis is presented in the section *2.2 Further Demographic Analysis*.

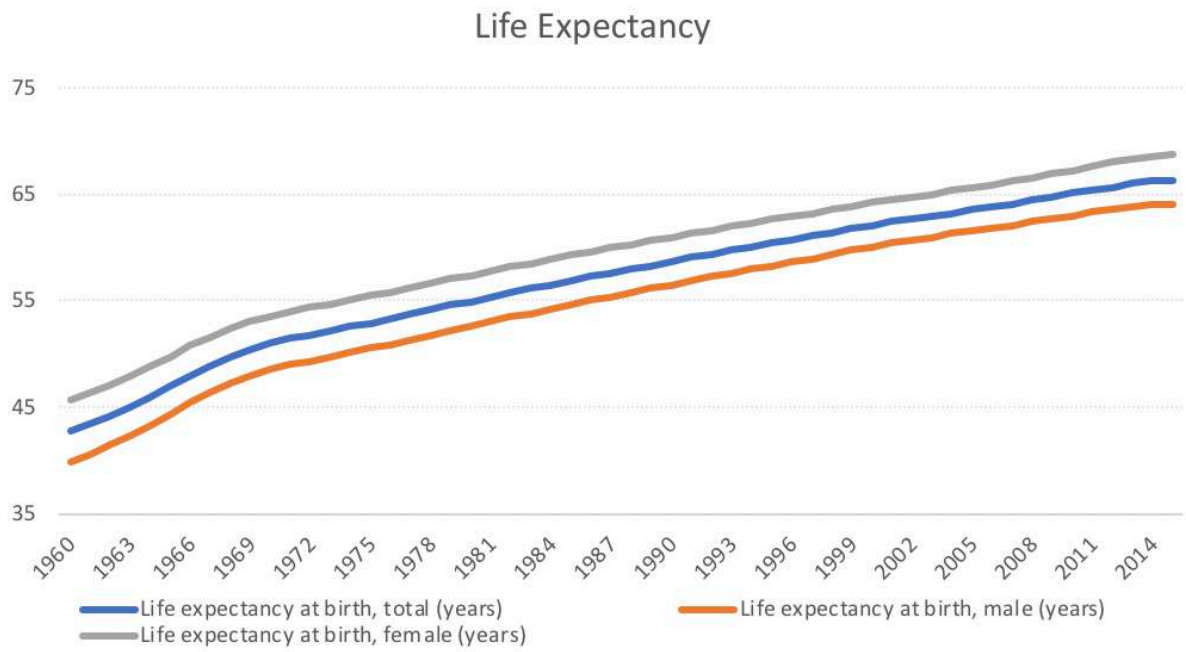

Figure 4. Life expectancy (World Bank, 2017)

The net migration rate (number of immigrants minus number of emigrants) is -1.5 migrants per 1000 population (149th place in the world ranking) (Central Intelligence Agency). Migration is a very important factor, determining Myanmar's population. It borders with Thailand, China, Laos, Bangladesh, India, of which Thailand is a popular destination for the emigrants from Myanmar.

It should be noted that the estimates of Myanmar's population, life expectancy, infant mortality, death rate, growth rate and age distribution are based on the consideration of increased migration and mortality due to HIV/AIDS (Central Intelligence Agency).

2.2 Further Demographic Analysis

The current population density is 80.98 people per square kilometer of land area (World Bank 2016). 35% of the population live in the cities and the number of urban residents as estimated for years 2015-2020 will grow by 2.29% on average every year (estimation valid for 2015-2020) (Central Intelligence Agency).

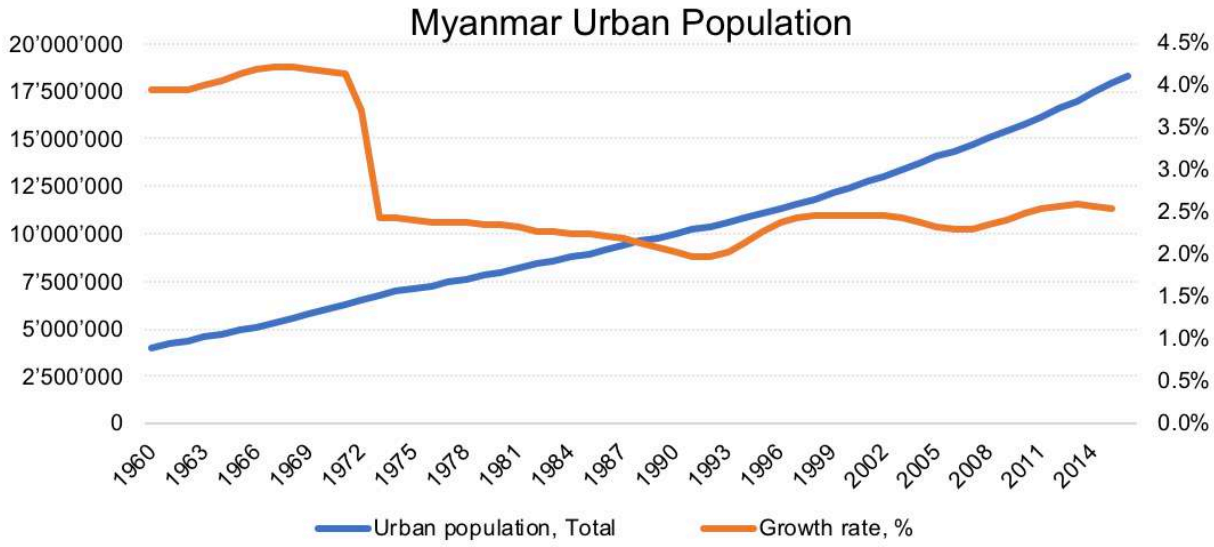

Figure 5. Myanmar Urban Population (World Bank, 2017)

The current and projected age distributions are as follows: 28% of population are below 15 years old and 5% of population are above 65 years old (World Population Data). Current youth of age 15-24 comprises 9.6 million, however in 2050 it is expected to shrink to 8.6 million (World Population Data). The ratio of males to females is between 1.03 and 1.06 up to the age of 24, and after 24 years old it declines below 1 down to 0.89 for the age of 55-64 and 0.77 for the age of >65 (Central Intelligence Agency).

A glance at the current and projected population pyramids shows that currently Myanmar has a large fraction of population, eligible for work force, whereas the aging of population is quite slow and at its early ages, which by 2050 will not represent as an acute issue as in other countries. Myanmar's population pyramid is a narrowing to the top one rather than an expanding one such as that in the other countries at the same income level (OECD Development Pathways 2016). This indicates that Myanmar has a demographic window, which has a huge economic potential and can contribute to Myanmar's economic development.

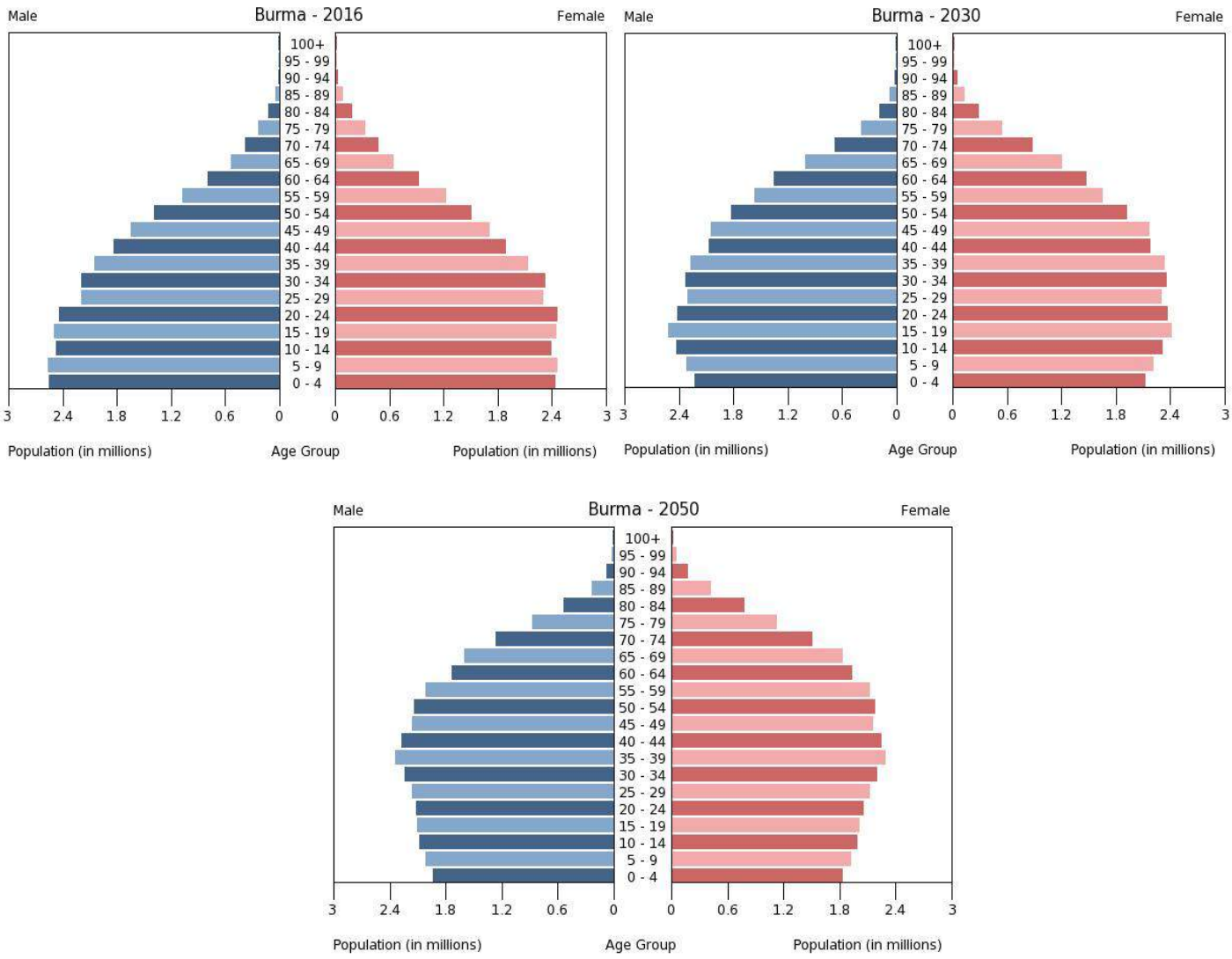

Figure 6. Population Pyramids (Central Intelligence Agency)

As the fertility rate is falling and women represent a slightly higher fraction of the population and the number of females attending secondary and tertiary schools is growing, Myanmar's women could also add to Myanmar's future development by joining the labor force. In the last several decades, the overall labor force has been growing both in absolute terms and as a fraction of the total Myanmar's population. Though the labor force growth has decelerated compared to the 20th century, its growth rate is still higher than the growth rate of population, which creates a window for growing economic and societal welfare.

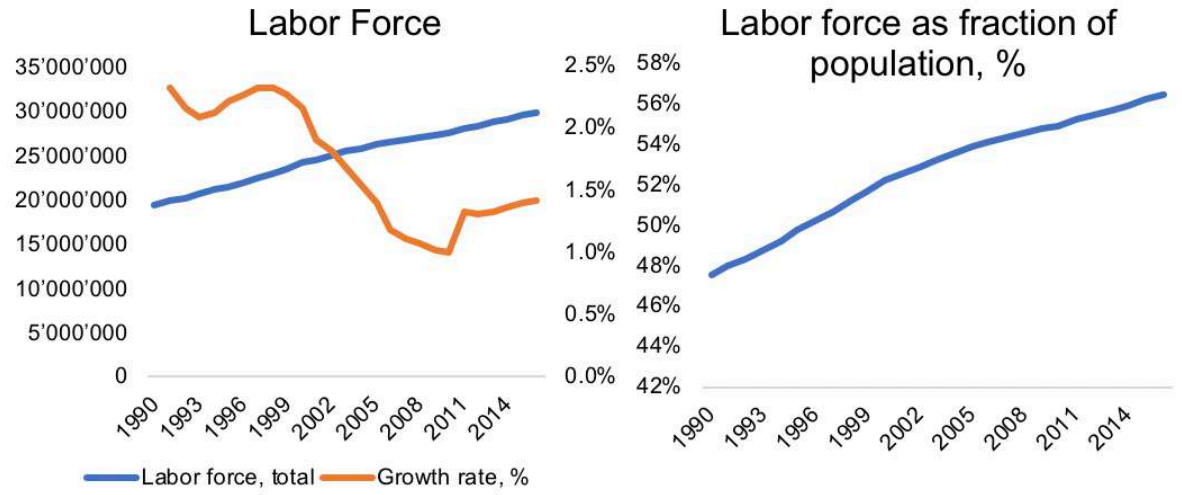

Figure 7. Labor Force & Labor force as fraction of population (World Bank, 2017)

The dependency ratio, which is the ratio of those not participating in labor force to those comprising active labor force, comprises 49.7%, with more granularity: the elderly dependency ratio is 8% and youth dependency ratio is 41.7% (Central Intelligence Agency). The potential support ratio, which is the ratio of the number of people of working age to the number of people older than 65, is at 12.6, according to the estimates made in 2015 (Central Intelligence Agency). As can be seen from the graph below, the dependency ratio has been falling for the last 40 years, mainly driven by the fall of the number of youth not in the labor force.

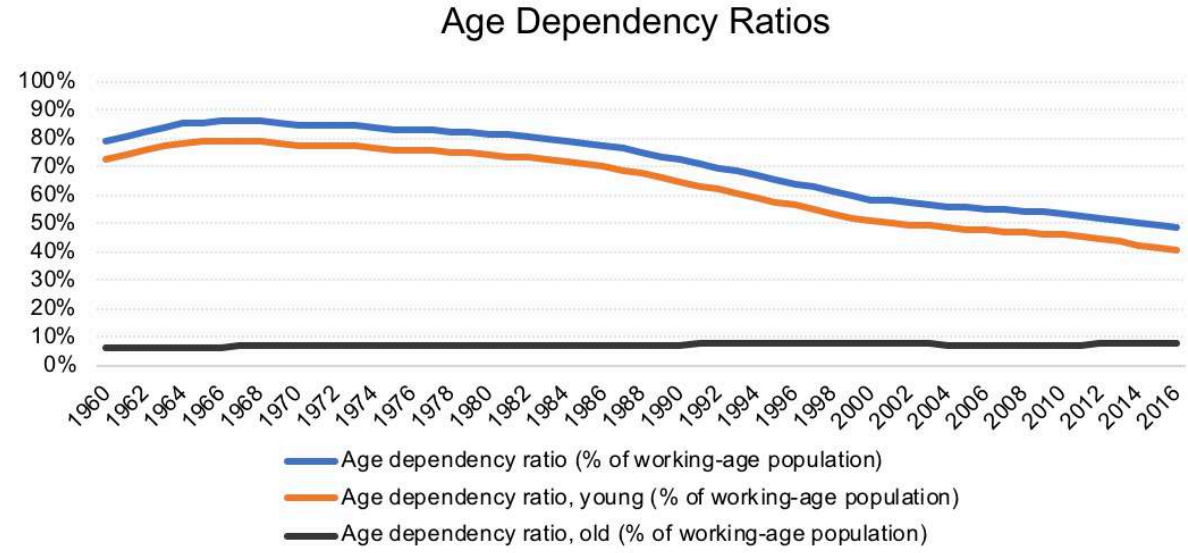

Figure 8. Age Dependency Ratios (World Bank, 2017)

The number of the retired is rather negligibly but gradually increasing, and it could be argued that in terms of old age dependency ratio Myanmar is better positioned than other countries and should use this advantage now to boost its economic development. The factors described

provide a demographic dividend for Myanmar, as Myanmar's economy can benefit from more people as active labor force per the retired or young, women participating in the labor force, and increase in personal savings.

3. PESTEL Analysis

In order to assess the implications of the demographic situation in Myanmar and make reliable forecasts, it is important to thoroughly understand current state of the country and specifically the aspects which determine it. PESTEL analysis can be a perfect complement to the quantitative analysis presented in the paper as PESTEL allows to look at the country from the six key perspectives making sure that none of the relevant details is missed.

3.1 Political Analysis

Myanmar is a parliamentary republic, the capital of which is Rangoon (Yangon), whereas Nay Pyi Taw is the administrative capital (Central Intelligence Agency). Myanmar was the colony of Great Britain between 1885 and 1948, when it gained its independence and created its first Constitution (U.S. Department of State, Diplomacy in Action). However, already in 1962, as a result of the coup, democratic regime was over and Burma existed as a socialist country since then until in 2010 it was pressured to include other political parties in parliamentary elections (U.S. Department of State, Diplomacy in Action).

Before 2011 Myanmar, also known as Burma, was mostly isolated, which is why the information about Myanmar's current demography and state is not the most accurate (Population Reference Bureau). About 3 million Burmese, including refugees, have emigrated since the last national census, in which they are still counted in (Population Reference Bureau). Different ethnic groups fight with each other in some parts of the country, with the most furious confrontation being between the Buddhist groups in Rakhine State and the Muslim Rohingya (Population Reference Bureau).

The Rohingya are legally deprived of Myanmar citizenship due to postulation that they are illegal Bengali immigrants. In 2014 census the Rohingya could not state their actual ethnicity and were forced to identify as Bengalis. Today the world's attention is attracted to the severe discrimination of Rohingya Muslims who are persecuted by Burmese officials and seek refuge in Bangladesh. It has only been close to 70 years since in 1948 Myanmar became independent from Japan and UK, which colonized it. During this time, a huge part of population was destroyed due to religious and ethnic conflicts. Soon after that Burmese population suffered from the civil war, in which the Karens and communists rebelled against the Buddhist majority and regime. The Karen opposition, though largely restrained, persisted for decades despite the 1962 governmental coup, which resulted in the years of military suppression. It is worth

noting that the first elections took place only in 2015, when a cease-fire agreement was signed. However, in 2017 ethnic cleansing broke out again and resulted in 600 thousand Rohingya leaving Myanmar, though national authorities deny the violent actions with respect to Rohingya Muslims. Even after the first free elections, there is not a single Muslim serving the parliament (Time 2017). However, another challenge for Rohingya population of Myanmar is the 1982 Citizenship Law, which defines the citizens of Burma as representatives of ethnicities that had been present in the territory of the country before 1823. This deprived the Rohingya of their citizenship. According to the report of 2009 of U.S. Department of State, the Muslim population of Myanmar is subject to significant underestimation, whereas independent scientific research shows that it must be in the range of 6-10% (U.S. Department of State, Diplomacy in Action).

3.2 Economic Analysis

We will start the discussion of economic situation in Myanmar with GDP. The general measure of GDP of the country in current USD shows that overall country has been improving its' economic position on average by 10% year-on-year during the period of 2010 to 2015 and by 18.9% year-on-year during the ten years from 2005 to 2015 (World Bank 2017). However, this measure may not be so representative without taking into account the growth of the population, so another aspect will be GDP per capita. Myanmar's GDP per capita was increasing on average by 9.1% each year during the period of 2010-2015, whereas taking the longer time span of 2005-2015 yields the figure of 17.9% annual growth of GDP per capita (World Bank 2017). The measure of GDP is crucial when evaluating the current state of any economy, still other aspects play important role too.

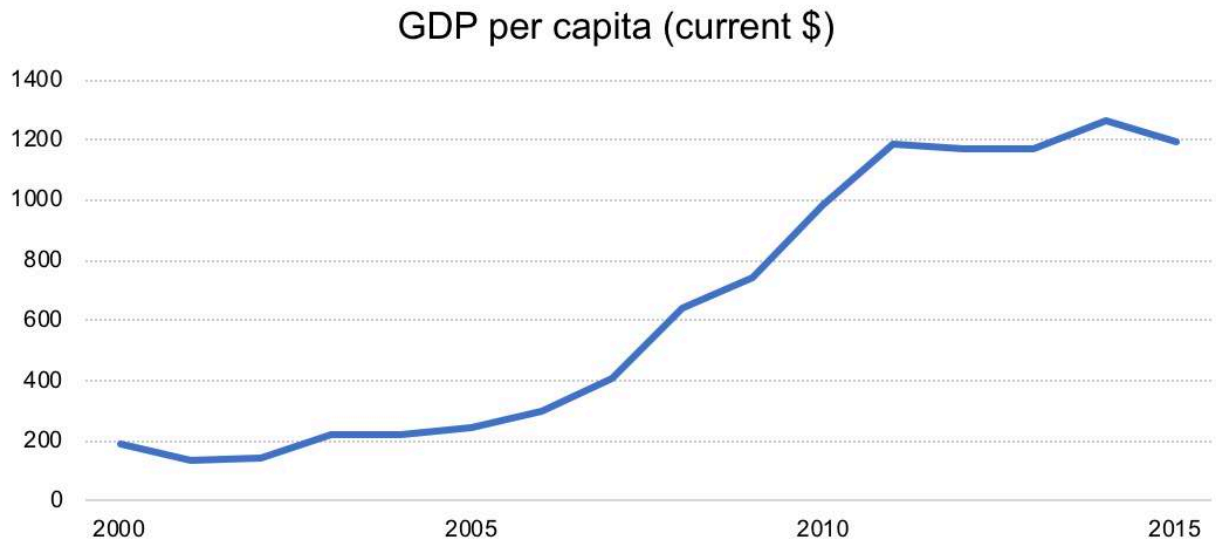

Figure 9. Myanmar's GDP per capita in current $ (World Bank, 2017)

In the current state of the world with increasing role of globalisation and multinational relations, in case a country wants to keep improving its economical position, it is essential to be attractive

for foreign investors. In Myanmar, the foreign direct investments (net inflows) increased on average by 44.9% year-on-year during 2010-2015 to approximately $4Bn in 2015 and by 45.6% in 2005-2015 (World Bank 2017). The increase in the foreign investments is a clear indicator of the increased stability in the country and attractiveness of the country's economy.

Thirdly, it is important to look at the decomposition of GDP, namely, what drives the changes in it. As can be seen from the graph below, there is substantial move from agriculture to industry production, however, the sum of the shares in GDP arising from those two sectors almost doesn't change indicating significant shift towards industrial production in the country.

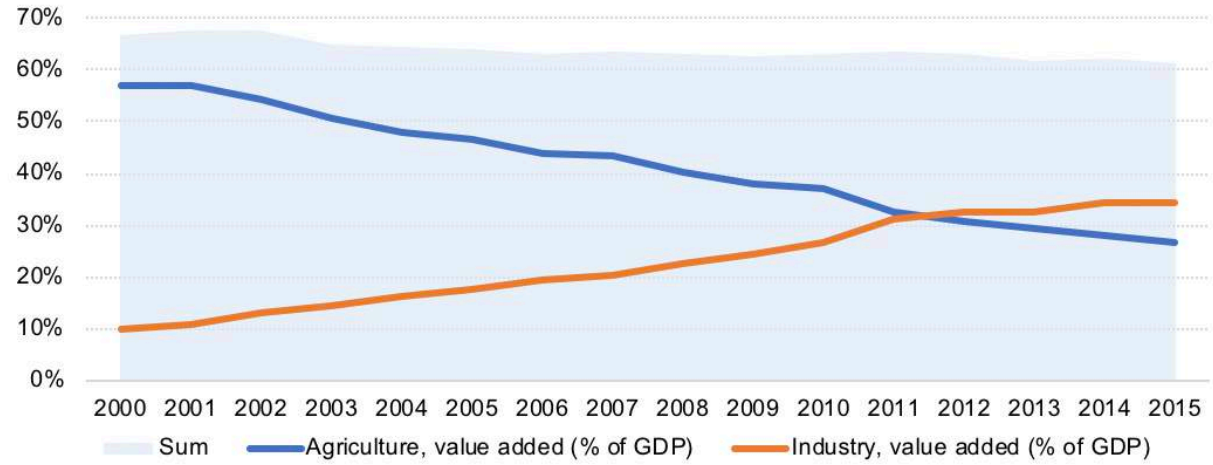

Figure 10. Share of agriculture and industry in GDP (World Bank, 2017)

Fourthly, the country is rich with natural resources. According to International Monetary Fund (IMF) Country report on Myanmar presented in 2015, 70% percent of total country's exports is generated by natural recourses export (mostly gems, jade, oil, and gas), in terms of GDP, those revenues account to approximately 11% of it. Earnings generated via sales of those commodities are the main source of inflow of foreign currencies and main state of governmental income. As the share of GDP arising from these goods' sales is pretty high, country's budget is intensely exposed to the risk of the change in the prices of the goods (which became the case in the recent years). As proposed by IMF, the country may close the arising gap in the budget by increasing the taxes on extraction/export of natural resources as the current tax yield is one of the smallest in the region (Myanmar's tax yield, or Tax Revenues/GDP is almost twice smaller than in Cambodia, and 65% smaller than in Vietnam). On top of Myanmar's land fertility, vast forests, hydro-resources as well as mineral resources mentioned above, Myanmar occupies an advantageous geographic and strategic position between China and India, which is not used to the full benefit of its population yet. (OECD Development Pathways 2016).

Fifthly, country has been significantly improving its position in terms of tourism attractiveness, especially since 2012. In 2011, 816000 tourists visited the country, whereas in 2015 this figure jumped to 4681000 showing a growth of 443% in just 4 years (World Bank 2017). The graph presented below shows the rapid growth of tourism, which started in 2012 and continues until 2015, however, as current political situation in the country can be considered as not stable by many tourists, the growth in the number of arriving tourists may decline in 2017 and upcoming years.

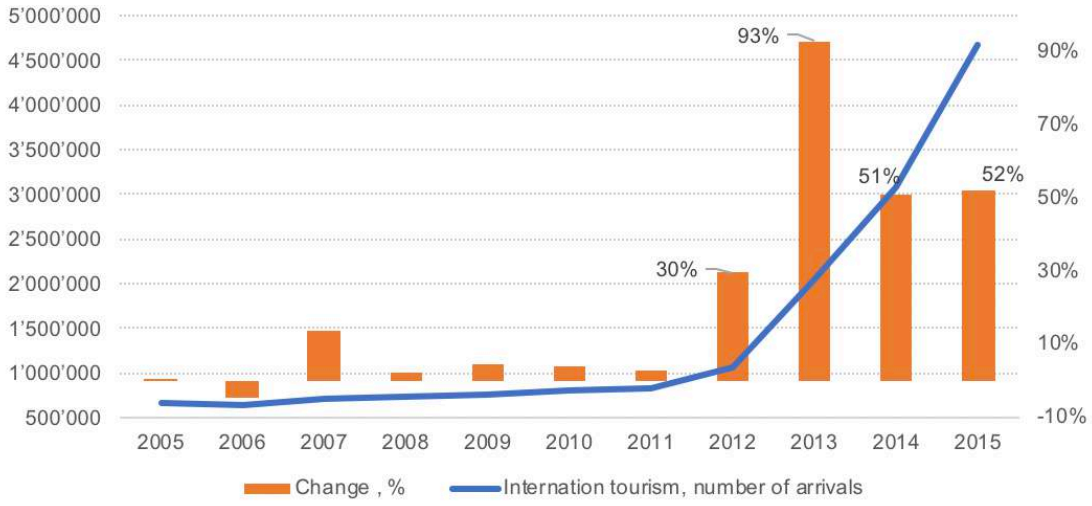

Figure 11. Number of arriving international tourists in Myanmar per year (World Bank, 2017)

In the last 10 years, Myanmar's economy suffered from several periods of macroeconomic turbulence such as banking crisis and price rises leading to almost hyper-inflation, which resulted in the prioritizing of macroeconomic stability by the government (OECD Development Pathways 2016).

Overall, the country is on the way of improving its economic conditions. Combined with the change in political situation, and precisely elections, which allowed the country to move away from the sanctions imposed by EU and US, the situation could most likely improve even further under conditions discussed in section 4 of this paper.

3.3 Societal Analysis

With respect to the social aspect of country analysis, the percentage of population living below the poverty line has been gradually declining from "32.1% in 2004 to 25.6% in 2009 to 19.4% in 2015", whereas average household expenditures were increasing by 1.4% on average per year (World Bank 2017). In terms of health protection, as of 2014, 2.3% of GDP expenditures were directed towards health security and as of 2012, there were 0.57 physicians per 1000 population (Central Intelligence Agency). As of 2017, 0.4% of young males (age 15-24) and 0.3% of young females (age 15-24) have HIV or AIDS (World Population Data). However, the number of physicians per 1000 people and the health expenditures as a percentage of total

government spending have been steadily growing in the past decade. Namely, medical spending as percentage of county's GDP grew from 1.92% in 2010 to 2.28% in 2014 (World Bank 2017).

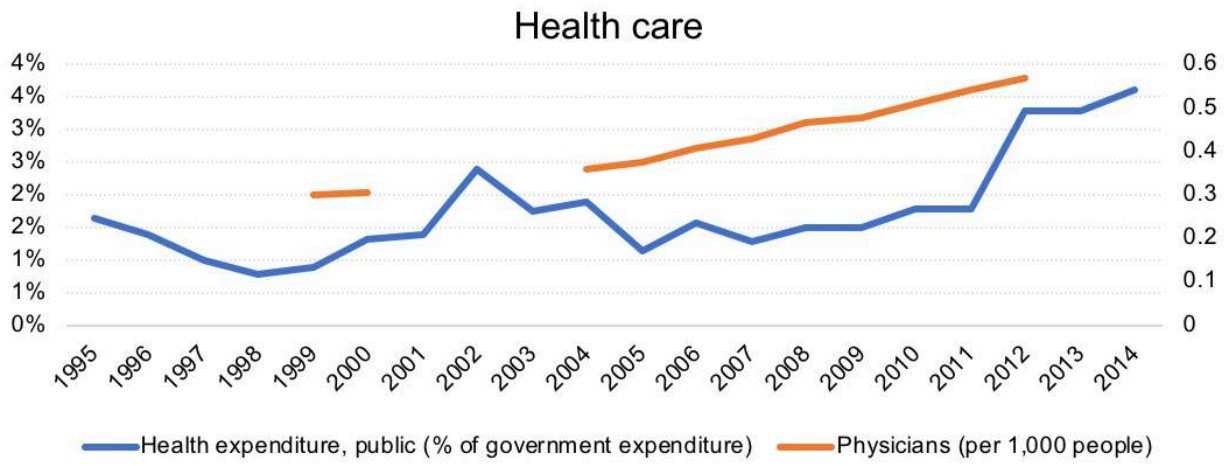

Figure 12. Health Care (World Bank, 2017)

With regards to the governmental expenditures on education and its effect on the society, little data is present to define a trend. However, as of 2017, the population over age 15, who can read and write, comprise 75.6% (Central Intelligence Agency). 51% of males and 52% of females are enrolled for secondary school. 12% of Males and 15% of females are enrolled for tertiary education (Central Intelligence Agency).

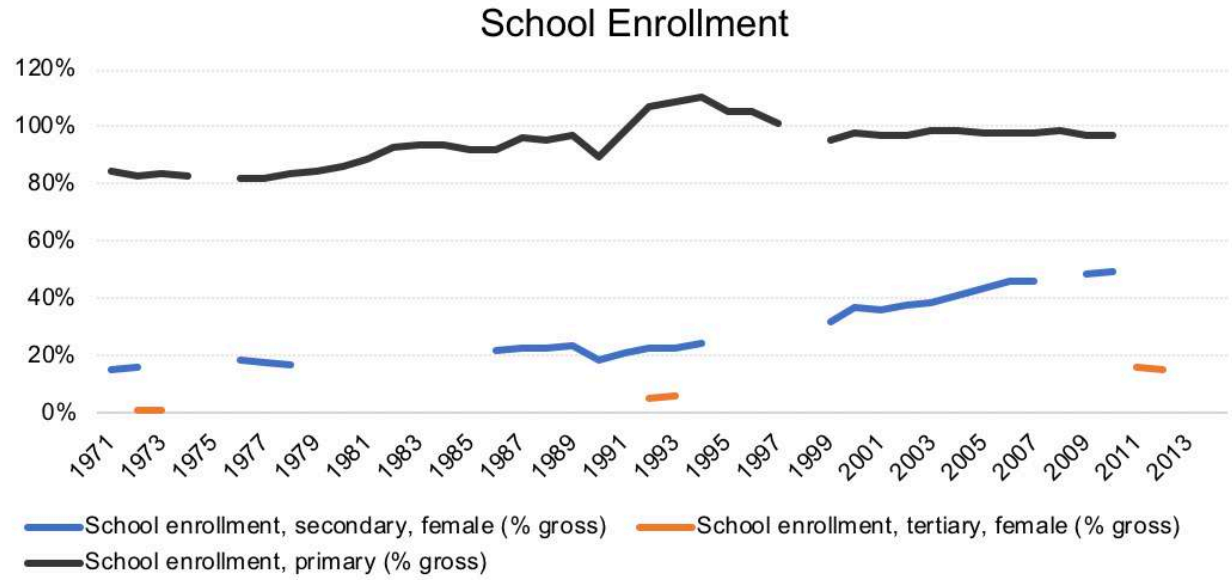

Figure 13. School Enrollment (World Bank, 2017)

("Total enrollment in primary education, regardless of age, expressed as a percentage of the population of official primary education age. GER can exceed 100% due to the inclusion of over-aged and under-aged students because of early or late school entrance and grade repetition.")

Considering living facilities, Percent of population with the access to water varies from 74.4% in the countryside to 92.7% in cities (Central Intelligence Agency). Overall, the percentage of the population with access to electricity has been gradually and slowly growing in the last decade, with the growth taking place in the rural areas and the electricity shortages and break-downs happening in the urban areas.

3.4 Technological Analysis

The number of internet users per 100 people combined with percentage of population who have access to electricity can be used as a reliable proxy of the technological development in the country. Telephone and internet connection in Myanmar are at the very low stage of development, as only 25.1% of population of Myanmar currently have access to the internet (World Bank 2016) and only 2.1% of population actually surfed the internet within the last year (OECD Development Pathways 2016). Though the figure is relatively small compared to other countries, the year-on-year change is large: on average the number of internet users in Myanmar grew by 113% p.a. in the last 5 years, and by 16.5% in 2016 (World Bank 2017). At the same time the number of mobile cellular subscriptions during the last 5 years on average increased by 133.6% and by 18.9% in 2016 (World Bank 2017). To clarify, the number of mobile subscriptions per 100 people has grown from 12.8 in 2013 to 89.3 in 2016 (World Bank 2017).

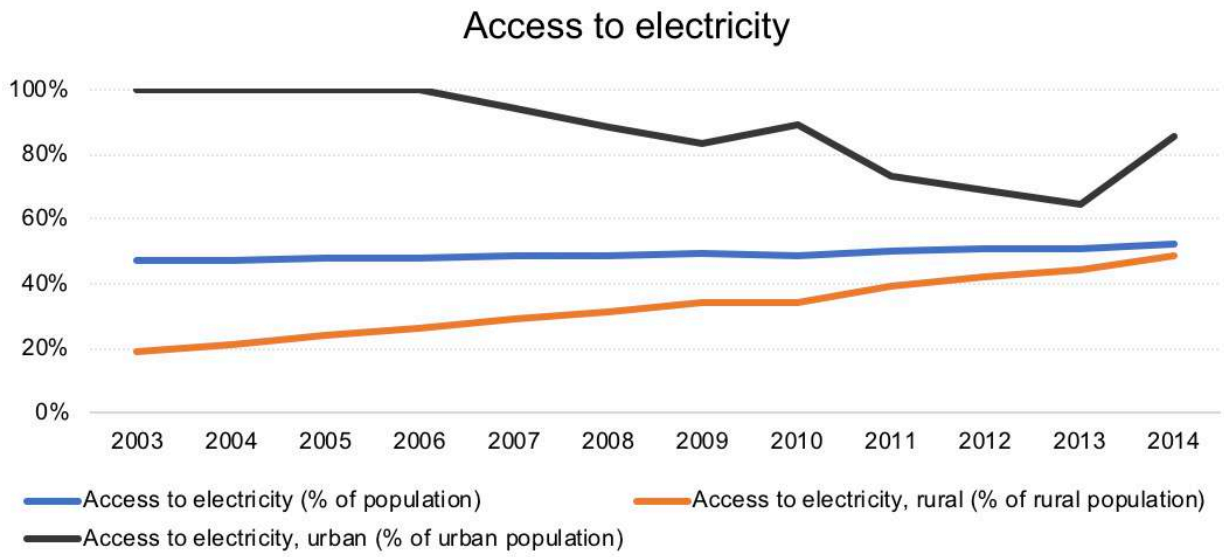

Figure 14. Access to electricity (World Bank, 2017)

In terms of infrastructure, network and transport systems, Myanmar has been lagging behind its geographical peers (OECD Development Pathways 2016). Though since 2013 a lot has been improved, a lot of cities remain not connected by the roads and Myanmar's railroads are still not completed (OECD Development Pathways 2016). Internal electricity supply is also

hindered, as only “28% of the rural population have access to electricity compared to 89% in urban areas” (OECD Development Pathways 2016). Looking at the access to electricity, the percentage of people from urban who have access to electricity steadily declined from 89% in 2010 to 65% in 2013, however in the last years the trend changed and 85.5% had access in 2014, what concerns rural areas, there was a solid growth from 34.3% in 2010 to 49% in 2014. Talking about country in general, 48.8% had access in 2010 and the figure grew to 52% in 2014 (World Bank 2017).

Overall, the prevailing trend is the growth of technological development.

3.5 Environmental Analysis

In order to evaluate the environmental state of Myanmar, we three proxies are used: CO2 emissions, renewable energy, and forest area.

Firstly, as can be seen in the figure 14 below, CO2 emissions in absolute terms have been growing during the last 25 years. However, the absolute measure may not represent the overall picture, so it’s important to use a relative measure, that’s where CO2 emission in terms of kg per $1 of GDP comes from. The figure’s been growing during 1990-2000 and before the mentioned period it had been falling, indicating that the country started to generate economic value using more environmentally-friendly means (either by switching towards “green” operations or improving the way current operations are executed).

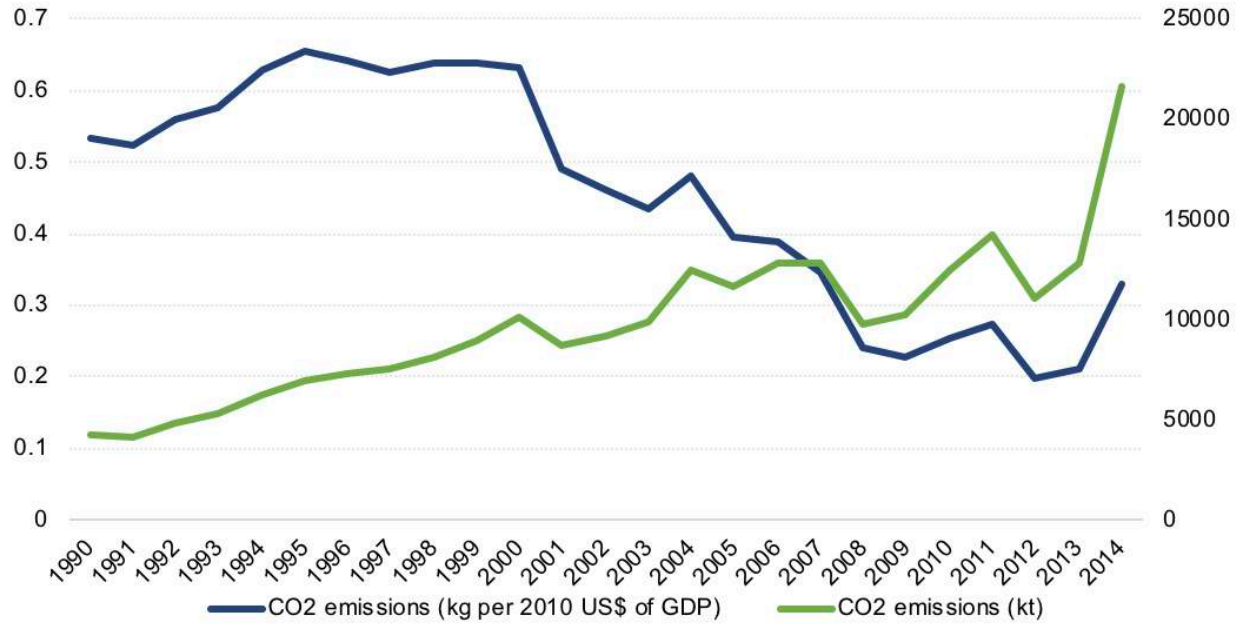

Figure 15. CO2 emission (World Bank Data, 2017)

Secondly, looking at the data for renewable energy, it is quite remarkable that the consumption of renewable energy has always been higher than its’ production, it is especially unexpected to see consumption of renewable energy at the level of 83% of total energy consumption in

1998 when the corresponding production was only 23% of total energy production. The country is managing its energy consumption relatively effectively, though there is a continuous decline of renewable energy usage in the last 5 years.

Thirdly, there is a big concern regarding the forest area which faced a CAGR 1.2% decline in the period of 1990-2014. The issue becomes of especially high importance given the fact that the emission of CO2 has been constantly growing. The country needs to address the issue in the upcoming years in order to avoid possible problems in the future.

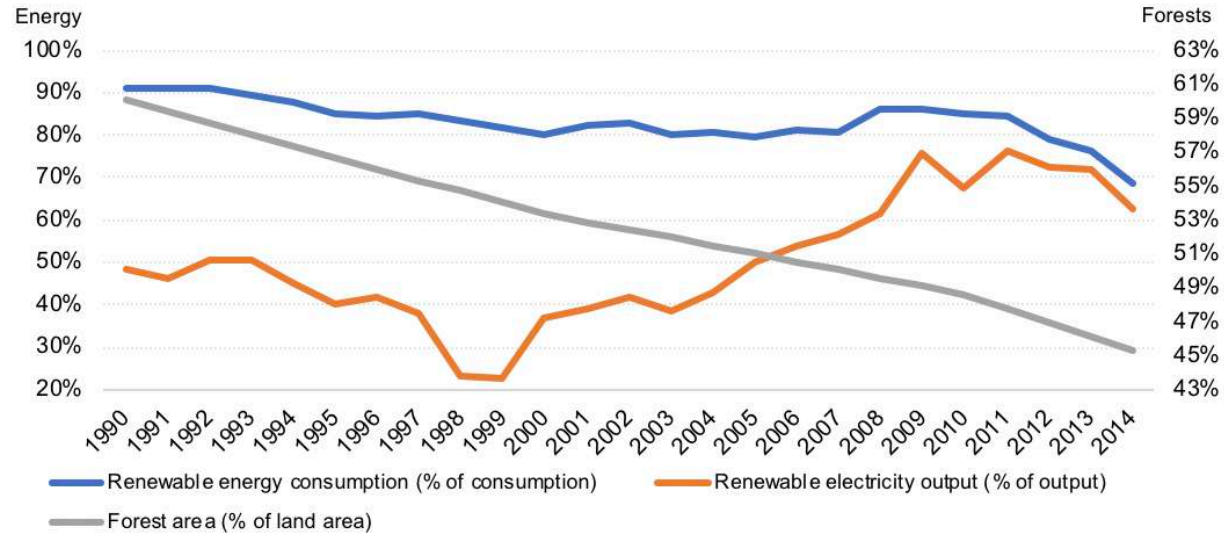

Figure 16. Renewable energy Demand/Supply and Forests area (World Bank, 2017)

To sum up, Myanmar is rich in agricultural and water resources (ranking 14th in the world), which are a great source of hydropower, providing 75% of the electricity generated (OECD Development Pathways, 2016). Myanmar is also rich in exhaustible mineral and energy resources and its forest area comprises about “40% of the total forest area of South-East Asia” (OECD Development Pathways, 2016). However, the country’s government needs to be wise when it comes to regulations related to energy production, manufacturing, and deforestation.

3.6 Legal Analysis

In order to access the legal situation in Myanmar the key metrics proposed by World Bank will be used (the data is provided by World Bank). Those metrics include Control of Corruption, Voice and Accountability, Regulatory Quality, Rule of Law, Political Stability and Absence of Violence/Terrorism, and Government Effectiveness. We cannot say that some of the mentioned metrics are more important than the others, rather it is the overall combination of them which is important. Looking at the graphs presented below which show the global percentile ranking of Myanmar according to various metrics, it becomes obvious that the legal conditions are significantly and rapidly improving in the country. One of the important things to

mention is the huge jump in the Control of Corruption from 0.5 percentile to 13.7 percentile in 2011-2012 (World Bank 2017). Another important aspect is the volatility of Political Stability and Absence of Violence/Terrorism, though in 2016 the value grew to 23rd percentile (World Bank 2017), as a result of the current political situation within the country, the ranking will most likely significantly drop when 2017 figures are released due to the vast forced migration of the Rohingya Muslims.

All in all, the country is on the right track to development, however, the growth of religious intolerance and violence within the country may not only affect the direct migration but may cause further deeper problems in society and hence reduce legal stability in the country.

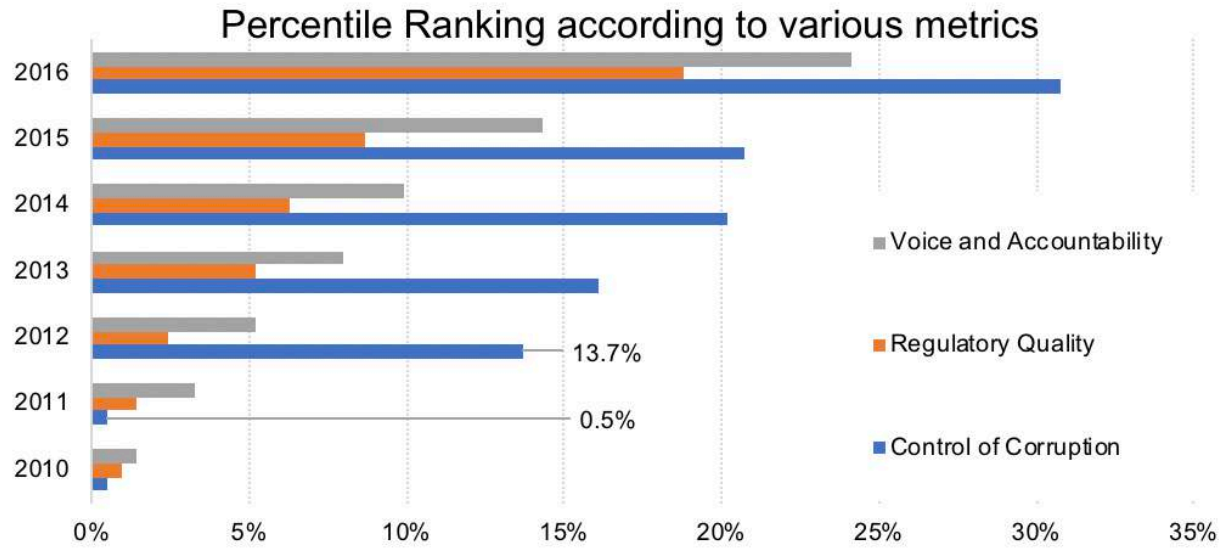

Figure 17. Myanmar's world percentile rankings in various metrics (World Bank, 2017)

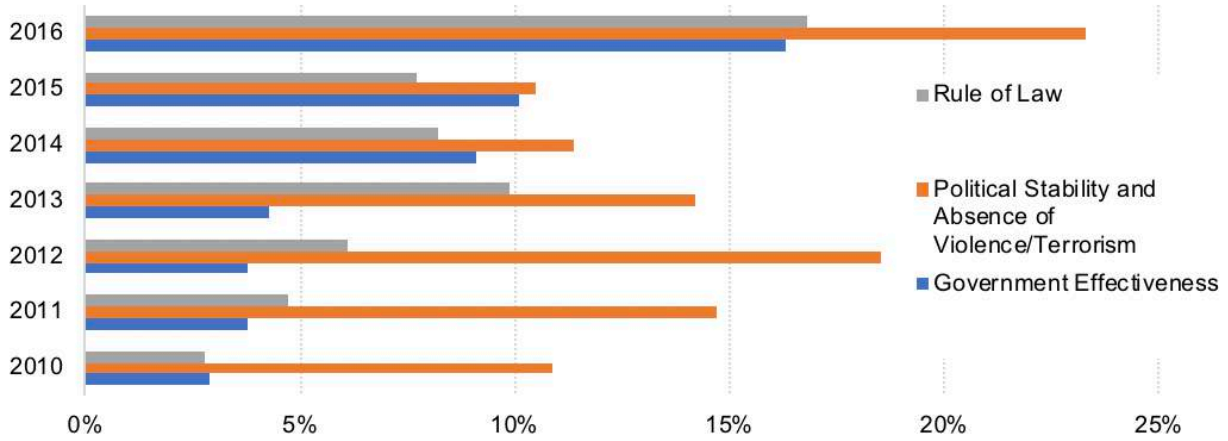

Figure 18. Myanmar's world percentile rankings in various metrics (World Bank, 2017)

4. Country's Future Demographic Snapshot and Suggestions for Future Development

4.1 Demographic Snapshot

Metric	2015	CAGR (based on period 1982-2015)	2050 (scenario 1)	2050 (scenario 2)	2050 (scenario 3)
Population, million	52.4	1.2%	***60.1***	***59.3***	***60***
Population growth, %	0.9%	-	***0.1%***	0.1%	0.1%
Birth rate, per 1000	18	-1.9%	***9***	9	9
Death rate, per 1000	8.1	-1.2%	***5.2***	5.2	5.2
Fertility rate, per woman	2.2	-2.2%	***1***	1	1
Life expectancy, total	66.4	0.5%	***79.9***	79.9	79.9
Dependency ratio, %	49.7%	-1.5%	***29.7%***	29.7%	29.7%
Dependency ratio, old, %	8%	0.2%	***8.65%***	8.65%	8.65%
Dependency ratio, young, %	41.7%	-1.7%	***22.97%***	22.97%	22.97%
Net migration, total	-100232	1.9%	***-190693***	-190693	-190693

Table 1. Demographic snapshot of Myanmar (Authors' calculations)

We have made our own projections for the main demographic metrics of Myanmar in 2050. For forecasting birth rate, death rate, fertility rate, life expectancy, and dependency ratios we used compounded annual growth rate (CAGR) approach. We used the period of 1982-2015 as the estimation window for CAGR. To calculate the future size of Myanmar's population, as well as projected population growth rate, we relied on the forecasts of the birth rate, death rate and total net migration. We received three different figures for the size of Myanmar's population in 2050, the variance of which is caused by the different migration patterns assumed. This paper uses prudent assumptions about the growth of migration and migration patterns due to the current political situation. We forecasted population size and population growth rate using the following formulas:

- $\boldsymbol{CAGR(t_0, t_n)} = \left(\frac{X(t_n)}{X(t_0)}\right)^{\frac{1}{t_n - t_0}} - 1$

- $\boldsymbol{Population_t} = Population_{t-1} + (Birth\ rate\ per\ 1000_t - Death\ rate\ per\ 1000_t) \times Population_{t-1} \div 1000 + Total\ Net\ Migration_t$

- $\boldsymbol{Population\ Growth\ Rate_t} = \frac{Population_t}{Population_{t-1}} - 1$

Scenario 1 for estimating population size in 2050 is based on the assumption that net migration grows with the rate equal to the estimated CAGR.

The ultimate demographic figures for 2017 have not been estimated yet, but this year for Myanmar is characterized by the escalation of the Muslim conflict, as a result of which a crucial number of Rohingya refugees fled from the country. We used the assumption of 600 000 people fleeing the country in 2017 and never coming back as Scenario 2 and incorporated this into the total net migration calculation for 2017, as a result of which the projected population size is the lowest in Scenario 2. We further extended our analysis to account for the fact that when the political and religious turbulence is over, the refugees would return to Myanmar in the following years and this yielded Scenario 3 population size. Both in Scenario 2 and Scenario 3, we assumed total net migration to grow with CAGR each year, apart from the year 2017 and the assumed year of refugee return.

For all three scenarios, our forecast for the population size is lower than that provided by World Population Data of 62.4 mln due to more prudent assumptions about the growth of net migration.

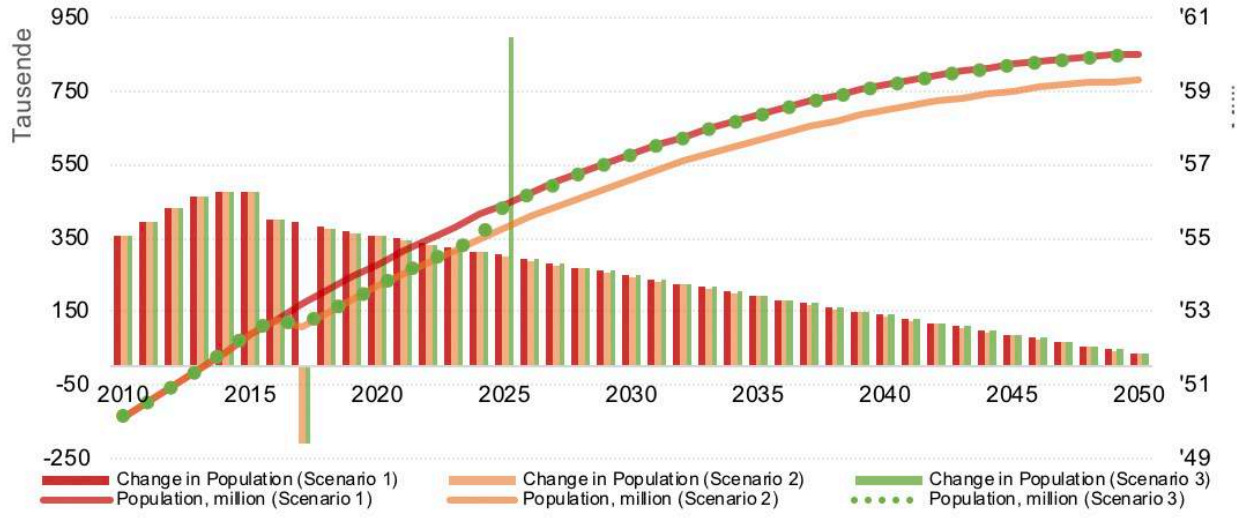

Figure 19. Myanmar population projections. (Author calculation & World Bank 2017)

4.2 Suggestions for Future Development

Following the ideas presented in Kudo et al. 2014, based on Myanmar's current and future demographic state, this paper provides three specific qualitative suggestions which could contribute to Myanmar's sustainable economic development.

Firstly, though the country currently undergoes the transition from agricultural orientation to industrial one, large share of the population works in the agriculture segment. As the labour force and land involved in farming is already high, it is important to use the demographic window as well as falling dependency ratio to the full potential and focus on labour productivity increase. Both labour productivity and 'land' productivity require adjustments, from the labour side we would suggest focus on mechanisation, such as buying new equipment, from the land side it is important to use newly invented fertilisers and adjust the irrigation system. This would require keeping the school enrolment and government expenditure on education growing in order to provide the labour force with the skills necessary for the productive use of new equipment. These measures could significantly enhance productivity and hence increase GDP of the country.

Secondly, as currently the country's exports are heavily dependent on commodities (mainly gas), diversification in this area is of high importance. If we look at the distribution of export revenues of Myanmar and Vietnam in 2014 (latest data available) presented in the Table 2 in Appendix 1, it can be seen that Myanmar's neighbour has a more diversified portfolio of exports and hence depends on some specific stream of revenues to a smaller extent. Another issue with Myanmar's export of gas is that the country has lowest proven reserves out of ASEAN countries whereas Vietnam is in the top of this list, still the latter doesn't rely on the gas exports (See Appendix 1). Myanmar is already moving away from heavy reliance on gas for exports as its' share declined from 52.4% in 2010 to 39.2% in 2014 and it would be beneficial to keep the pace.

However, as world experience shows, most developed countries rely more on the export of processed and manufactured goods whereas Myanmar mainly sells primary goods (i.e. gas, rise, fruits and vegetables). The present and projected population distributions show potential for more human-capital intense production and make moving towards manufactured goods possible. This will allow the country to capture more of the value generation and hence develop new industries, attract new technologies, increase the number of jobs and ultimately increase its' GDP.

5. Summary

5.1 Summary

The demographic analysis of Myanmar has shown that the country is currently at the third stage of demographic transition and should extract the full benefit from the demographic window of opportunity it has. Moreover, the number of the retired people increases rather negligibly, whereas the population below working age is shrinking, which creates demographic dividend for Myanmar and potential for economic development. In this paper, we created a snapshot of Myanmar's population in 2050 and came up with suggestions for extracting the most from the current favorable demographic situation.

5.2 Self-Criticism and Limitations

The demographic analysis presented in the paper is limited by the fact that for a long time Myanmar had been an isolated country and the national census did not take place regularly: before the census of 2014 about 30 years have passed since the previous census. Moreover, the government significantly underestimated the size of the Muslim population as well as the migration rate. This might lead to estimation error in some metrics. We also acknowledge that our forecast scenarios for 2050 do not account for the changes in fertility rate, dependency ratios, birth and death rates, life expectancy, associated with migration and economic, political, legal, societal, environmental and technological factors. This might also result in the forecasting error of the population size and growth.

5.3 Outlook on Further Research

In further research, we would suggest to forecast the demographic picture of Myanmar in 2050 based on the deeper incorporation of the economic, political, societal, governmental, technological and environmental factors and consider their effects on the country's population dynamics.

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Appendices

Appendix 1

Myanmar				Vietnam			
SITC	Description	Value (Mil. US$)	Share	SITC	Description	Value (Mil. US$)	Share
34	Gas, natural and manufactured	4.485,7	39,2%	72	Electrical machinery, apparatus and appliances	36.121,5	24,0%
05	Fruit and vegetables	1.122,4	9,8%	0	Food and live animals	21.422,6	14,3%
66	Non-metallic mineral manufactures, nes	1.083,7	9,5%	84	Clothing	20.289,7	13,5%
84	Clothing	1.015,5	8,9%	85	Footwear	10.317,8	6,9%
02	Crude materials, inedible, except fuels	880,3	7,7%	71	Machinery, other than electric	8.908,3	5,9%
93	Special transact. Not class. According to kind	691,4	6,0%	33	Petroleum and petroleum products	8.338,4	5,6%
042	Rice	621,3	5,4%	03	Fish and fish preparations	7.764,2	5,2%
03	Fish and fish preparations	423,4	3,7%	65	Textile yarn, fabrics, made up articles, etc.	5.180,8	3,4%
24	Wood, lumber and cork	374,9	3,3%	9310	Special transactions	4.889,9	3,3%
044	Maize corn unmilled	355,7	3,1%	82	Furniture	4.748,4	3,2%
	Other	397,6	3,5%		Other	22.225,1	14,8%
	Total	11.451,9	100,0%		Total	150.206,6	100,0%

Table 2. Distribution of export in Myanmar and Vietnam (UN Comtrade Database, 2014)

C. A comparison of Saudi Arabia with Iran: The role of ongoing population dynamics for societal and economic development till 2030

by Dominic Brügger, Andreas Fürst and Laura Zäch

This paper discusses and compares the demographic transition in Saudi Arabia and Iran and how it will shape the economic and social development until 2030. Current trends in fertility, longevity, migration, and their historical background are outlined for both Islamic countries. In conjunction with the findings from the broader macro-environment analysis PES(TE)L, a demographic picture until 2030 is drawn. It can be concluded that Iran has advanced further in its demographic transition as it is already in the fourth stage, while Saudi Arabia is likely to enter it by 2030. Therefore, Iran's demographic window will open earlier. However, Iran's economy and population still suffer from the internationally imposed sanctions and it has limited resources to tackle the high unemployment and poverty rate until 2030 in order to harness its demographic dividend. Saudi Arabia, by contrast, has understood the need of decreasing their dependency on expatriates as prerequisite for their future economic progress. The newly implemented Saudi Vision 2030 targets exactly this issue and aims to strengthen the youth and to diversify their skills. As a result, Saudi Arabia is currently more likely to go through the necessary socio-economic change to benefit from the demographic dividend than Iran.

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LIST OF ABBREVIATIONS

GASTAT	General Authority for Statistics
GDP	Gross Domestic Product
GMDAC	Global Migration Data Analysis Centre
HDI	Human Development Index
MENA	Middle East & North Africa
TFR	Total Fertility Rate
UNDP	United Nations Development Program
UNPD	United Nations Population Department

1. Introduction

It is a common believe that “Muslim societies are especially resistant to embarking upon the path of demographic and familial change” (Eberstadt & Shah, 2012, p. 11). However, rapidly declining fertility rates, high population growth, and the explosion of the youth population are only a few phenomena that can be observed in Muslim countries which contradict this point of view. Demographic change and unprecedented population dynamics are megatrends that affect and challenge all countries, institutions, and individuals alike nowadays. So are the Islamic Republic of Iran (“Iran”) and the Kingdom of Saudi Arabia amid this global phenomenon. Even though these two countries share some characteristics, such as the Islamic religion or the dependency on oil, the two states are currently in distinct stages of their demographic transition. Due to the low dependency rate, Iran is in the best position to harness its demographic dividend. Yet, is the economy able to reap the benefits or will it falter under its demographic challenges? And will Saudi Arabia manage to lower its dependency on expatriates to harness the benefits from the demographic window that is possibly opening by 2030? A positive outcome of these questions largely depends on how the many challenges are tackled. Hence, it is contingent on the political and socio-economic environment in the next decades.

The purpose of this paper is to single out and analyse the key drivers of demographic change in each respective country in light of their past and current individual trends. It further aims to discuss projections about the future demographics by 2030. Moreover, it will be discussed how the changes in the population structures will impact the social and economic development of Saudi Arabia and Iran in the coming years.

To put the outlined socio-economic challenges ahead into perspective, the first section provides an overview about the current demographics and trends as well as its possible historical origins, whenever applicable. Subsequently, the PESTEL framework is integrated to carve out demographic trends from the macro-environment. Based on the five-stage population transition model, a demographic, social, and economic outlook up to 2030 is provided to gain further understanding about the importance of ongoing population dynamics. Following, a comparison of Iran and Saudi Arabia is conducted to find out how those two countries line up to each other. In the concluding section, last remarks, in conjunction with the limitations this paper is constrained by, and recommendations for future research are made.

2. Current Demographics and Trends

In the following paragraphs, Saudi Arabia’s and Iran’s current fertility, longevity, and migration dynamics are going to be discussed in conjunction with its origins.

2.1 Saudi Arabia

2.1.1 Fertility

Despite having experienced a lower percentage decline in total fertility over the last few decades than other MENA countries, Saudi Arabia has seen a substantial decline in absolute fertility of 4.29 (or 37%) between 1985-2015. Yet, current levels are still well above the World's average (Britannica 2017b; UNPD, 2017). The use of contraception, higher income per capita, higher (especially female) literacy rates, and parental attidutes and desires are considered as possible explainations among others (Eberstadt & Shah, 2012, p. 26; Pritchett, 1994). Khraif (2001) provides a different view. He suggests that age at marriage and a woman's education are the most important determinants of fertility behaviour. With time and development in socio-economic sectors, marriages at a very young age, once common in Saudi Ariaba, decreased substantially which has been highly correlated with declining fertility in that age group. In general, nuptiality age is likely still a strong indicator to predict total fertility in the Kingdom (Salam, 2013). This is in line with UNPD's data on age specific fertility rates which show a steep decline in births per 1000 woman in the age groups 15-19 and 20-24 starting approximately in 1980-1985 up to today and much less so for the age groups in the age brackets above[1]. Going forward, low-to-high variant estimates predict future fertility levels between 1.64-2.64 by 2025-2030 which indicates a signifcant downwards shift in the total fertility rate (TFR) for Saudi Arabia and convergence to the observed fertility patterns in the entire Muslim World (Eberstadt & Shah, 2012, p. 11-27; UNPD, 2017).

2.1.2 Longevity

Starting with data post-Gulf War I 1991, Saudi Arabia improved on infant mortality, child mortality, and crude death rate substantially. In combination with its formerly staggeringly high TFR and the decline in TFR up to today, the Kingdom's life expectancy has risen tremendously from 42 to 74 years in just half a century. Although, the rate of change is slowing down since the 2000's (UNPD, 2017). Subsequently, Saudi's population growth rate has increased rapidly and a "youth bulge" emerged in the Kingdom (Goetz, 2003; Kronfol, 2011, p. 8). However, the further progress is in peril, due to the challenges that arising from those demographic deveolopments simoulanteously. The UNDP (2016) has reported that Saudi's Human Development Index (HDI) has increased vastly to a point where the Kingdom lies just below the very high human development group and well above the average of the Arab countries. Although, the slopes of the individual components in the HDI have declined substantially.

[1] 2010-2015 data; The age brackets are as follows: 25-29; 30-24, and so forth.

Additionally, Saudi's inequality adjusted HDI is not applicable due to lack of data which speaks for itself.

2.1.3 Migration

According to UNPD (2017), Saudi Arabia accounts for one of today's highest net migration rates in the world (95% percentile, 2010-2015 estimates). Saudi Arabia is among the 10 counties in which about 51% of total international migrants are spread. Subsequently more than 10 million immigrants account for approximately 30% of the Saudi population (GMDAC, 2015, p.8). The key driver for immigration, which is also consistently stated in various academic literature, is that Saudi Arabia has been suffering from a severe lack of skilled workforce for decades and which has been compensated by a stream of mostly young, foreign labourers (Goetz, 2003, p.24-25; Jessup, 2010). A substantial portion of these expatriates are from India (3 million), Pakistan (2.5 million), and Egypt (2.2 million) (Al Arabiya, 2017). Al-Mutawa' (2017) mentions that many foreigners are employed in the medical sector, apart from the from oil and development sector. On a national level, Saudi Arabia has also experienced large movements in migration due to rapid, uncontrolled urbanization. For example, Riyadh's population has been expanding at a staggering rate of 8.1% p.a. (Abubakar & Aina, 2016, p. 42-63; UNPD, 2017). Various external shocks, such as shifts in recruitment policies towards foreign labourers over Saudis in the late 1980's and the effects of the economic downturn during the post-Gulf War I, have skewed the picture temporarily (De Bel-Air, 2014). However, while not accelerating anymore, the trend is likely to continue. Recent articles (Alhamad, 2014; Cronin 2017) and medium variant forecasts of UNPD (2017) underline the ongoing issues with labour-motivated, young immigrants and continuous, possibly unsustainable, urbanization in Saudi Arabia.

2.2 Iran

2.2.1 Fertility

Five out of the ten greatest fertility declines ever recorded in a 20-year period took place in the greater Middle East. Among those five countries is Iran with an absolute decline in fertility of 4.57 (or 70%) between 1985-2005 (Eberstadt & Shah, 2012, p. 16). The UNPD (2017) reported a drop in TFR from 6.53 to 1.75 between 1980-2015[2]. The notional replacement level of 2.10 (TFR) and perceived threshold to sustain a country's population was clearly breached for the first time in Iran's recording history (Eberstadt & Shah, 2012, p. 19). Abbasi-Shavazi, McDonald,

[2] The first value is averaged from 1980-1985, the second one is averaged from 2010-2015.

& Hosseini-Chavoshi (2009, p. 1) state in a more emphasized manner that Iran's experienced fall in total fertility has been the fasted and largest ever recorded[3].

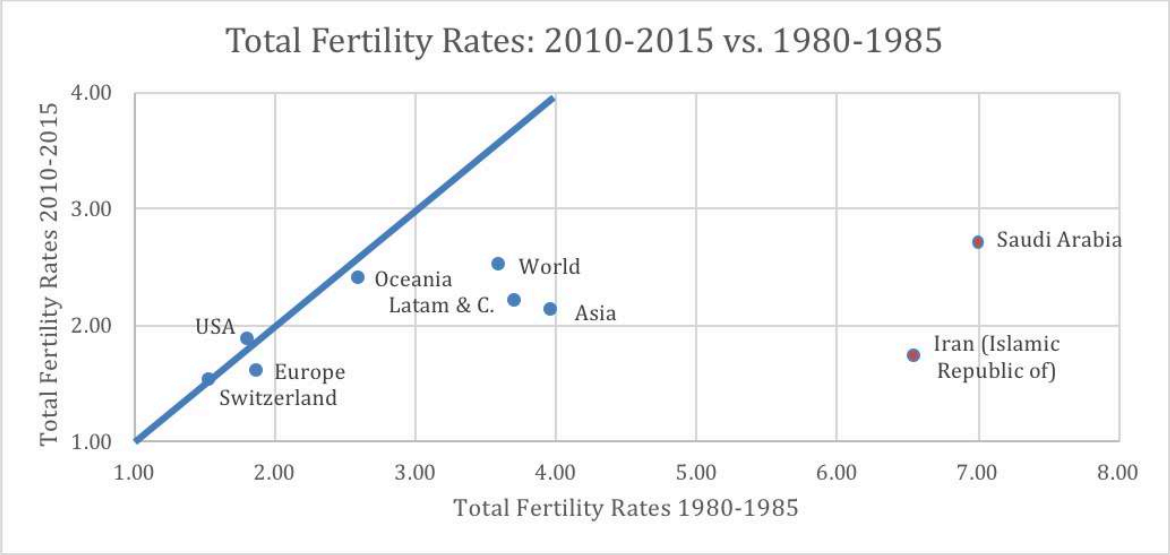

FIGURE 1: TOTAL FERTILITY RATES 2010-2015 AGAINST 1980-1985 BASED ON UNPD (2017) DATA.

Tradition and social practices, such as early marriage and childbearing, are suggested to have created the high but stable levels of fertility in Iran before the 1970s. The subsequent steep decline in fertility rates may have come in two phases according to Worldbank (2010, p. VIII). In the first phase, mainly related to the government's family planning services program installed in the 1960's and rising average age of marriage during the 1970's especially in urban areas, fertilty rates began to decline slightly. However, the discontinuation of the family planing programs after the Islamic Revolution in 1979 and the waged war against Iraq starting in 1980 effectively led to a temporary reversal that lasted almost for a decade. But from the late 1980's on to today, TRF continued dwindling down as the governement reinforced the family planning policies in order to stop the population growth (Disch, 2015, p. 14-15). Additionnal reasons for the drop in fertility were improved primary health care and access to education (Worldbank, 2010, p. 9).

However, as Iran's population is heteregenous and has unique settlement patterns, education and health care did not evolve to the same extent in all parts of the country. That said, is it not surprising that fertility rates differ across regions (see Chapter 2.2.3) and provincial fertility rates have been higher than in urbanized areas throughout Iran's history. Yet, trends in fertility by province and urbanization resemble those at national level (Abbasi-Shavazi, McDonald, & Hosseini-Chavoshi, 2009, p. 43-65).

[3] The sample period is 1976-2006.

Pritchett (1994) argues that the single best predictor for actual fertility levels is desired fertility level[4] at least for less developed regions. In Iran's case, this might have its merits. Various recent fertility surveys[5] in Iran have shown that the majority of women only desire two children which is in line with current estimates. Thus, they might be reliable indicators to estimate future fertility levels which we assume for the purposes of this paper to be true (Abbasi-Shavazi, McDonald, & Hosseini-Chavoshi, 2009, p. 186-188).

2.2.2 Longevity

Starting with post-revolution and post-war Iran to reduce possible bias, Iran experienced a phenomenal decline in infant mortality, child mortality, and crude death rate according to UNPD's estimates among other (UNPD, 2017). As main reason, development across nearly all dimensions and improvements in the health-care system are often mentioned as reasonable determinants for these changes (Delavari et al., 2016; Hosseini-Chavoshi & Abbasi-Shavazi, 2012, p. 104-105). Subsequently, life expectancy at birth has risen to 75 years, yet Iran has still lower longevity values than the average values in the developed world (UNPD, 2017). Nonetheless, the Islamic Republic of Iran has made significant progress along all those factors, not at last due to the governments proactive approach to primary health care, and is on track to meet its child-related Millennium Development Goals (Worldbank, 2010, p 1). The upward-trend in Iran's HDI further strengthens the argument of continuing improvements (UNDP, 2016). If external shocks such as the rather recent economic sanctions against Iran don't interfere drastically with Iran's continuing development efforts, medium variant estimates from reliable sources such as the UNPD may be sound estimates for Iran's future development in respect of longevity and mortality indicators (UNPD, 2017). In conjunction with the changes in fertility outlined in Chapter 2.2.1, the expansion in education and health care has led to a population with a young age structure and low dependency rates (a so called "Demographic Window") (United Nations, 2004; Hosseini-Chavoshi & Abbasi-Shavazi, 2012, p. 97).

[4] That factor is drawn from DHS surveys, expressed by women of childbearing age.
[5] 2000 Iran Demographic and Health Survey (IDHS), 2002 Iran Fertility Transition Survey (IFTS), and 2005 Iran Low Fertility Survey

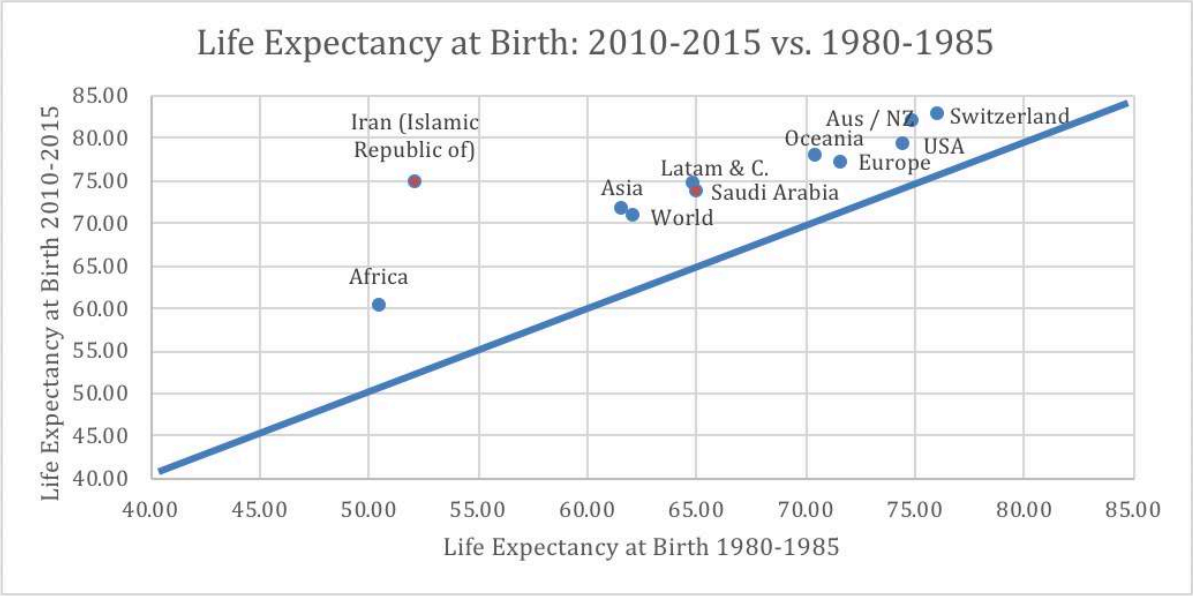

FIGURE 2: LIFE EXPECTANCY AT BIRTH 2010-2015 AGAINST 1980-1985 BASED ON UNPD (2017) DATA.

2.2.3 Migration

Iran has a highly heterogeneous landscape with respect to its topography and water supply that determine the region's fit for human habitation. For reference, the province of Tehran, comprising the metropole Tehran, has a population density of more than 600/km^2 while the Yazd has less than 10/km^2. Iran has seen significant movements in both internal and international migration (Hosseini-Chavoshi & Abbasi-Shavazi, 2012, p. 105). Internally, likely starting in the 1960's, Iran has experienced an accelerated process of urbanization to up to more than 70% by 2015 and growing further (Britannica 2017a; UNPD, 2017). The international migration pattern of Iran has potentially been driven by two major forces. Amid the Iranian Revolution in 1979, Iran experienced large outflows of educated, secularized population to Western countries of which a large part opted to remain there for good (Hakimzadeh, 2006). On the other hand, Iran is a country of origin, transit and destination for migrants due to its geopolitics, demographics and economic opportunities. Thus, major distress in neighbour-countries in the last few decades led to a large influx of refugees from Afghanistan and Iraq, among other, leading to Iran hosting a staggering number of approximately one million refugees by the end of 2015 (Britannica, 2017a; GMDAC, 2015).

3. PES(TE)L Analysis

In order to draw a demographic picture of Saudi Arabia and Iran until 2030, the major factors that influence society must be determined. The PESTEL analysis provides a valuable tool to evaluate which demographic trends could become relevant due to the broader macroeconomic environment. In this paper, the political, economic, social, and legal environment are

considered as the main drivers of demographic change. Due to the limited impact and scope of this paper, technological and environmental analyses are left out.

3.1 Political Analysis

3.1.1. Saudi Arabia

Saudi Arabia follows a regime of absolute monarchy in which the Al Saud dynasty holds the political power since the establishment of Saudi Arabia in 1932 (BBC, 2017). The current King Salman bin Abdulaziz al-Saud is the head of state and government. As no separation of power exists, he combines legislative, executive and judicative functions (U.S. Department of State, 2017). The political power is maintained by a strict interpretation of Wahhabism, a puritanical form of the Sunni Islam, which strives for a return to the society of first generation Muslims (Aarts & Roelants, 2015, p. xii). The Saudi political system can be regarded as stable and continuous without any major shifts in politics mostly because political parties and opposition are not allowed (Marketline, 2017, p. 15). Subsequently, Saudi Arabia belongs to the lowest percentile in the index of voice and accountability[6] (World Bank, 2017). The lack of basic democratic rights is considered as one of the main reasons that deters Saudi Arabia's transition into a modern society (Marketline, 2017, p. 16).

3.1.2 Iran

A major shift in the Iranian political system took place in 1979 when the Islamic Republic replaced the former royal dynasty of the Shah family. The revolution, led by the cleric Ayatollah Ruhollah Khomeini, promised a revitalization of traditional Shiite Islamic values, as the former regime was accused of a westernisation (Disch, 2015, p.11). Since then, the political power is in the hands of a cleric elite which ensures the state's compliance with the Shiite religions laws (Crane, Lal & Martini, 2008, p. 9). The supreme leader is the highest authority in the state and has "the power to determine the general policies of the system of the Islamic Republic of Iran" (Crane, Lal & Martini, 2008, p. 10). Furthermore, he is chief of the armed forces and head of the judiciary and media. Similarly to Saudi Arabia, the lack of separation of power poses the danger of unlawful activities against the interest of the majority of the population and encourages corruption. Citizens are only allowed to elect the president and other members of the government. However, the religious leadership controls all political candidates to ensure their loyalty with the regime. Due to this fact, Iran only achieves a marginally higher index in terms of voice and accountability than Saudi Arabia (World Bank, 2017).

[6] The index measures the extent of which a population can elect the government and has freedom of expression

Even though the political systems of Saudi Arabia and Iran seem to be comparable, the relationship of the two countries is characterized by ongoing political tension. The starting point marked the Iranian revolution which was exclaimed as “a revolution for the whole Islamic world”. Saudi Arabia, whose state religion is the Sunni Islam, felt that its legitimacy and its religious and economic dominance in the Middle East was threatened by the triumphing Shiites (Fisher, 2016). When the Iranian clerics slowly started to spread their influence in the Middle East, Saudi Arabia reacted by intensifying its own ideology. The tensions between the two countries worsened especially during the Iran-Iraq war, but also during more recent conflicts such as the Syria war (Poole, 2016). The peak of the conflict was reached when Iran boycotted the Hajj pilgrim in 2016 and the Saudi government executed a Shia cleric. Eventually, after protests at the Saudi embassy in Tehran, the diplomatic ties between the two countries have been broken (Poole, 2016).

3.2. Economic Analysis

3.2.1. Saudi Arabia

The economy of Saudi Arabia is strongly dependent on its oil business which is by 95% governmentally controlled (Saudi Aramco, n.d.). According to OPEC (2017), Saudi Arabia was the biggest oil exporter worldwide in the year 2016. Last year’s exports including also other goods beside petroleum and petroleum products were in total 182 billion USD. Consequently, the oil business is the main driver for Saudi Arabia’s GDP and accounts for 55% (CIA, 2016). Another 40% has its origin in the private sector. Today, the economy of Saudi Arabia employs a large number of foreign workers who are mostly highly educated (Arab News, 2013). Attractive incentive programmes and high wages lured such professionals to the Kingdom, where they work in positions that could not be occupied by Saudis. Overall, Saudi Arabia is the world’s number 20 when looking at the size of GDP (Knoema, 2017a). Over the last couple of years, growth rates of the GDP varied and dropped significantly between 2015 and 2016 (FocusEconomics, 2017a). In the GDP per capita ranking, Saudi Arabia is 39th in the world, nearly 20 places behind its overall GDP rank (Knoema, 2017b).

Compared to the exports, the import of Saudi Arabia strike out as rather low. Between 2012 and 2014, imports were always less than 50% of exports (FocusEconomics, 2017a). However, the ratio last year was only 1:1.5 mainly due to the agreed oil production cuts (Vaughan, 2017). The most common imported goods in Saudi Arabia are machinery and equipment, foodstuff, chemicals, motor vehicles and textiles (CIA, n.d.). Exchange rates for the local currency are fixed at 3.75 Riyals per USD, a monetary policy to stay even with the USD (Raghu, 2016). In the past years, these measures lead to annual inflation rates between two and three percent (FocusEconomics, 2017a).

To deal with such existing economic challenges and the strong dependency on oil, the crown prince Mohammad bin Salman bin Abdulaziz Al-Saud recently introduced the Saudi Vision 2030, an extensive blueprint for the future of the country. The most important goal is the diversification of the economy (Saudi Vision 2030, 2017). Plans are to maximize the investment capabilities, launch promising sectors like manufacturing, tourism and leisure as well as energy and to privatize government services. These measures should lead to a stronger private sector, lower dependency on oil, a decrease in the unemployment rate and an increase in GDP (Saudi Vision 2030, 2017). The vision is very ambitious and Saudi Arabia has yet to prove if it is capable of such a change. However, the latest economic activities documented by the World Bank seem to be a step into the right direction (World Bank, 2017c).

3.2.2. Iran

The economy of Iran is dominated by oil and gas production (CIA, 2017). It is currently in a transitional phase from a centrally planned to a market economy (Jbili, Kramarenko & Bailén, 2007, p. xiii). In 2012, 80% of its exports were petroleum and related chemical products (CIA, 2012). GDP in 2016 was 393 billion USD, around 55% were from the oil and gas business, 35% from industry and 10% from agriculture (CIA, 2016). Overall Iran was number 27 in the global GDP ranking (Knoema, 2017a). The economic growth has drastically slowed down over the last couple of years because of international sanctions imposed on Iran for its nuclear program (Laub, 2015). Today, most of the sanctions were abolished and Iran's economy is picking up pace again. Last year's growth average was 7.4% (World Bank, 2017a). This development is of great importance because of Iran's current low GDP per capita. Iran ranks 97th in the GDP per capita ranking with current prices. This is 70 places lower than in the overall GDP ranking (Knoema, 2017b).

Total exports in 2016 were 87.5 billion USD compared to imports of 62 billion USD (CIA, 2017). The biggest group of imported products were industrial intermediate goods and raw materials followed by capital goods, foodstuff, and other consumer goods (CIA, n.d.). Unlike Saudi Arabia, Iran did not fix its exchange rate to the US Dollar. In combination with the international sanctions, this lead to strong inflation and rising exchange rates over the last five years (FocusEconomics, 2017a). According to the World Bank, the situation is likely to improve now after the abolishment of most of the international sanctions (2017b).

In its current outlook, the World Bank predicts modest growth for Iran in the coming years. The very high unemployment is likely to stay on its level since there are no major efforts visible that deal with this problem currently. Furthermore, the non-oil sector remains static compared to the growing oil sector. Foreign investment flows often do not materialize and therefore prevent new investors from investing in Iran. Additionally, there are a lot of uncertainties regarding the implementation of the Joint Comprehensive Plan of Action that is going to hinder the

development of the economy of Iran in the future (2017b). All the just mentioned problems also block the current five-year development plan of Iran's government from fostering positive change effectively (World Bank, 2017b). This plan aims among other things at developing a resilient economy with the help of reforms of state-owned enterprises, the financial and banking sector as well as the smart distribution and allocation of oil revenues within the government (World Bank, 2017b).

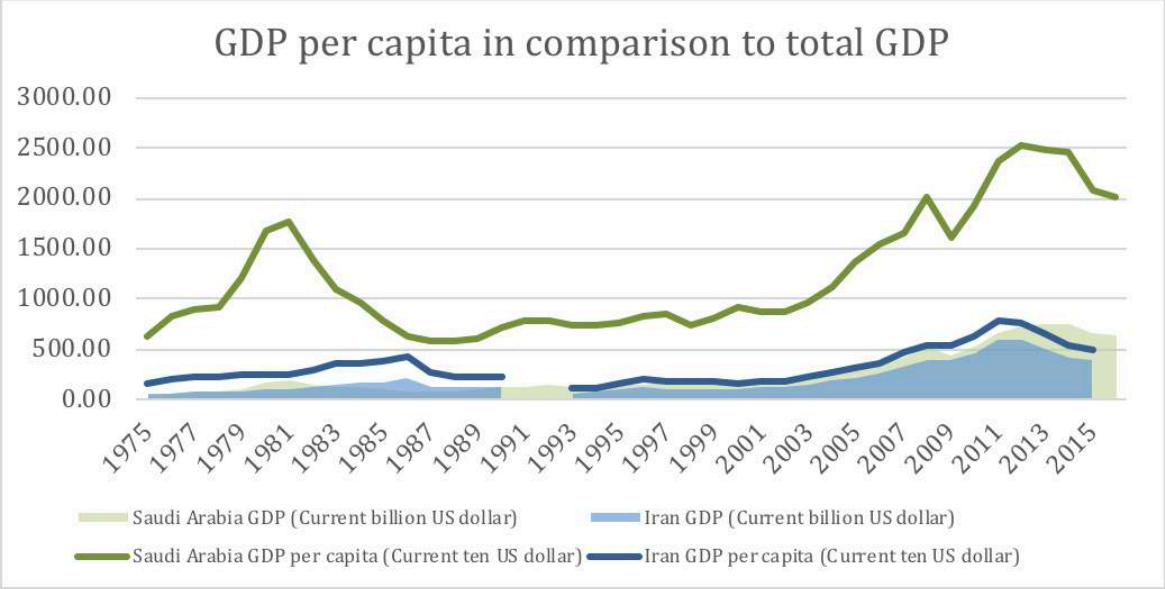

FIGURE 3: GDP PER CAPITA AND TOTAL GDP OF SAUDI ARABIA AND IRAN BETWEEN 1975-2015 BASED ON THE WORLD BANK (2017A) DATA.

3.3. Societal Analysis

3.3.1 Saudi Arabia

Due to the economic boom in the 1970s, Saudi Arabia's population is largely urbanized with more that 80% of the population living in urban areas in 2014 (UNPD, 2014). Additionally, Saudi Arabia has the lowest poverty rates in the Arab world as the government has extensive social service programs in place that grant social welfare to Saudi citizens. Although, according to Sullivan (2013), the welfare program fails to keep pace with the growing population. Reliable assumptions are hard to make considering the government is not disclosing the actual numbers of people living in poverty.

In terms of education, the total literacy rate of adults was at 94.3% in 2013 with the female literacy rate slightly below (UNESCO, 2013). Due to the higher access to education, this number is strongly increasing with youth literacy rates at 99% which indicates a qualified young workforce. However, as discussed in chapter 2, the youth unemployment rate in Saudi Arabia with more than 30% of the total labour force aged between 15 and 24 years is much higher than in its neighbouring countries (World Bank, 2017c). A study of the Boston Consulting Group

revealed that the education level of graduates is too low compared to countries with similar income levels. Additionally, the youth lacks the necessary skills for working in the private sector (Glum, 2015).

3.3.2 Iran

Between 2009 and 2013, Iran experienced a massive decrease in its poverty rate from 13.1% to 8.1% due to its cash transfer program which acted as a substitute for eliminated subsidies (World Bank, 2017a). However, following the long national and international conflicts and the international sanctions against Iran, the quality of social development worsened drastically since 2014 (Suansing, 2017). It is expected that more than half of the population is currently living below the poverty line. The social situation, which is referred to as a "free-fall into poverty", is accompanied by increasing unemployment rates. While total unemployment rate achieved a three-years high in 2016 at 12.7%, the youth unemployment rate even crossed the 30% benchmark (NCRI, 2016). The situation is especially severe for women between 15 and 24 years which suffer from an unemployment rate of 50.6% despite literacy rates of 98%. The discrimination of female workforce is further encouraged by the government that wants to induce higher fertility rates (Frazier, 2014). The social situation in Iran is not expected to improve if the regime continues to set military spending as its first priority instead of infrastructure and social welfare (Suansing, 2017).

3.4 Legal Analysis

3.4.1 Saudi Arabia

Saudi Arabia follows strictly the Islamic Sharia law and regards the Koran as principal source of legal advice (Ansary, 2015). The Sharia guides all aspect of Muslim life and prescribes specific punishments for crimes (Johnson & Sergie, 2014). As Saudi Arabia employs one of the strictest interpretations of Sharia law, punishments such as flogging, stoning, or even executions are still enforced. Additionally, Saudi Arabia has a system of male guardianship for women, meaning that male relatives have control over almost all aspects of women's life (McKernan, 2017). In recent years, Saudi Arabian people have increasingly asked for expanded civil rights. The King is responding to these demands by slow and incremental moves towards modernization, e.g. by the recent legalization of women driving (McKernan, 2017).

3.4.2 Iran

The Iranian law system is officially set up as a civil law system. Yet, many aspects of Sharia law are still retained (Zare, 2013). The Parliament and the Guardian Council split the legislative power. The function of the latter is to ensure that all drafts passed by the parliament are

compliant with Sharia law. As a result, censorship, restriction of civil rights, as well as violent enforcements of the laws are still widespread (Disch, 2015, p. 13). Like in Saudi Arabia, Iranian women face discrimination in political, social and economic life, imposed by law or custom. But in many aspects of everyday life, Iranian women are less restricted than Saudi women. For instance, they were allowed to vote decades earlier than Saudi women, enjoy more educational freedom, and less strict dress restrictions (Zakaria, 2011).

4. Demographic Outlook until 2030

Once the current demographic trends for both Saudi Arabia and Iran and the broader macroeconomic environment have been evaluated, this chapter focuses on the ongoing population dynamics to analyse further development scenarios of these two countries until 2030.

In order to classify the demographic change, the five-stage population transition model will be applied (Groth, 2017, p. 18).

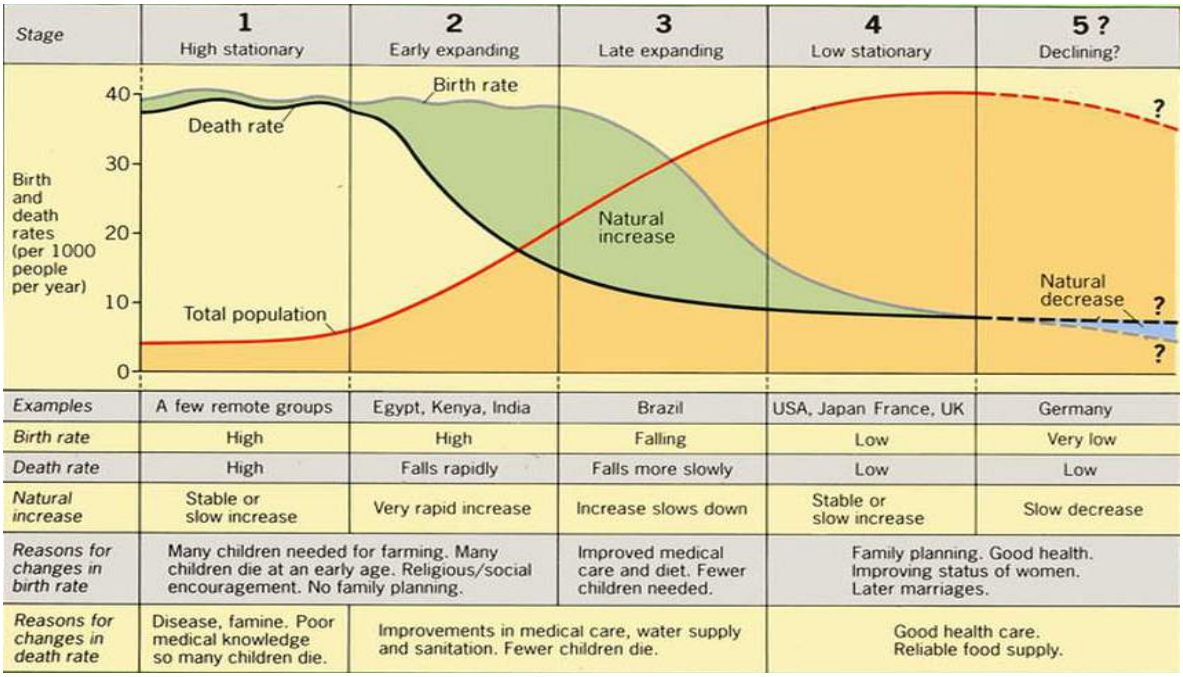

FIGURE 4: THE FIVE STAGES OF POPULATION DYNAMCIS (GROTH, 2017, P. 18).

The population dynamics describe how the population structure of a country changes over time. In phase 2, a state with former high death and birth rates experiences a decrease in mortality leading to a fast increase of total population. As the decrease in fertility only happens one or two generations later (which is marked as phase 3), a so called “boom generation” appears, a population with more young citizens than in previous generations. (Disch, 2015, p. 21- 22). When the children of the boom generation reach the working-age, a country’s workforce grows larger than ever before which has the potential to boost per capita income (Gates Institute, n.d.). The potential economic growth induced by the changing age structure is referred to as

“demographic dividend”. However, to harness the benefits, it is necessary to have appropriate policies in place to support productive employment. According to Jones (2012, p. 31), there is nothing more harmful to an economy’s potential growth or political stability than unemployed young people as it contributes to a disillusion of the youth. As soon as a state enters the fourth stage, fertility rates start approaching mortality rates and the population growth slows down. Consequently, the demographic dividend disappears after some time due to the increasing aging of the population.

4.1. Saudi Arabia

Saudi Arabia experienced the first major shift in its demographics at the beginning of the 1980s when fertility rates began to decline. Simultaneously, the mortality rate and especially the child mortality rate decreased significantly. Hence, life expectancy at birth has risen due to the improved access to quality health services (Mujahid, 2012, p. 184). When the lack of specialized workers and subsequently the dependency on expatriates grew, total population more than quintupled between 1970 and 2010 (UNPD, 2017). Due to decreasing fertility rates and high population growth, Saudi Arabia managed to step up from phase 2 to phase 3 in the population transition model.

Nonetheless, the currently high population growth rate will decline from 2.05% to 1.15% in 2030. Moreover, it is estimated that the population will grow to roughly 40 million by 2030 depending on migration (Worldometers, 2017a). Correspondingly, the TFR is continuing to drop due to the expansion of female education and employment. Thus, it is expected to lie slightly above the replacement level of 2.1 in 2030. Following, the portion of children (under 15 years) is expected to further decline, after it has already decreased from 45% in 1970 to 28% in 2015 (Mujahid, 2012, p. 186). At the same time, the population in the age group between 15 – 29 years will further increase sharply, a development that started in 1995. This is also caused by the large inflow of expatriates who are mostly of working age. It is expected that the number of youth will further grow by more than 20% until 2030 but at a decreasing rate (United nations, 2015). This phenomenon is commonly referred to as “youth bulge” (Kronfol, 2012, p. 249). By 2030, the expected median age of the Saudi population will rise to 34.7 years which indicates that Saudi Arabia will also be confronted with an aging population (Worldometers, 2017a). Due to higher life expectancy, the portion of the population older than 60 years will be more than 10% of total population in 2030. Hereafter, it will increase sharply in the following years (Abussaq, 2015, p. 6).

The change in demographics confronts Saudi Arabia with two problems. Firstly, it will have a growing young and unemployed workforce available while still being largely dependent on foreign workforces. This issue has its roots in the common believe that many jobs are only for expatriates. To stop the ongoing unemployment and to take advantage of the growing young

workforce, Saudi Arabia needs to raise the awareness of the importance of jobs in the private industry and teach their youth the necessary skills (Mujahid, 2012, p. 192). With the Saudi Vision 2030, the government plans exactly to do so and names the skills and competences of Saudi Arabia's children as the one of the most important future assets of the country (Saudi Vision 2030, 2017). Furthermore, the vision targets to reduce the unemployment and emphasises the importance of the private sector. Hence, the government is aware of the potential looming threat of youth unemployment and is currently at the beginning of combating the roots of the issue. Secondly, Saudi Arabia also needs to change its perception about aging and prepare early enough for the awaiting demographic challenge after 2030. Measures, such as a restructured health system, guaranteeing income security or living arrangements, have not been taken so far. Yet, they are crucial in light of the unavoidable shift in demographics (Mujahid, 2012, p. 190-191).

4.2. Iran

Iran's transition from to first to the second phase began in the 1950's as mortality rates started to decline while fertility rates remained at elevated level. Subsequently, the population almost doubled between 1970 and 1990 (Disch, 2015, p. 33). This development continued until Iran's family planning program was introduced in 1989. This also marks the country's transition into the third phase, as TFR declined sharply afterwards and stable mortality rates were achieved. Next, the Iranian population was still growing, but at a decreasing rate. Hence, the age structure shifted from a young-aged (46% were under 15 years in 1966) towards a middle-aged population by the beginning of the millennium (Hosseini-Chavoshi & Abbasi-Shavazi, 2012, p. 101). Since then, Iran can be considered in the transformation to phase 4 which is characterized by low mortality and fertility rates and moderate growth of the total population (Groth, 2017, p. 18).

The current population of around 81 Million in 2017 is expected to grow further to roughly 90 million by 2030 due to the high number of women in their reproductive age (UNPD, 2017). This development implies a growth rate that will decrease from 1% to around 0.5% by 2030 (Worldometers, 2017b). Additionally, the TFR is expected to further decrease to 1.5 by 2030. This development is evoked by the urbanized lifestyles, changing family attitudes, and increased, especially female, education levels. Subsequently, this triggers an increase in the opportunity costs of childbearing (Hosseini-Chavoshi & Abbasi-Shavazi, 2012, p. 102).

The median age, currently at 30.1 years, is expected to increase to 38.4 years by 2030. An aged population is awaited in the next 25 years (Worldometers, 2017b). The fertility transition in the last decades rapidly increased Iran's active population and decreased the dependency ratio (Hosseini-Chavoshi & Abbasi-Shavazi, 2012, p. 112). As a result, Iran is currently amid its demographic window of opportunity which will last until the population starts transforming

in an aging society in the 2040's (Roudi, Azadi & Mesgaran, 2017, p. 4). However, the rapidly growing population also confronts Iran with various challenges such as unemployment, poverty, or undernourishment. To harness the demographic dividend, investments in health, education, as well as social and economic policies are necessary. The extent of which Iran can harness the demographic dividend by 2030 depends mostly on the government's ability to create well-paid jobs for its fast growing, well-educated labour force (Roudi, Azadi & Mesgaran, 2017, p. 23). However, if the unemployment and poverty remain on today's elevated levels, the potential for economic growth will slowly disappear after 2030. This could lead to even higher unemployment or political instability (Hosseini-Chavoshi & Abbasi-Shavazi, 2012, p. 113). Crucial for the development of the unemployment until 2030 is going to be Iran's capability of coping with the Joint Comprehensive Plan of Action and its consequences. The reform plans, that are currently in place, will only work if its banking, trading and investing sectors can soon be reintegrated into the global economy (World Bank, 2017b). Currently, it seems unlikely that Iran has appropriate measures in place to tackle the outlined issues, especially as the outlook in terms of unemployment and economic growth remains unchanged.

4.3. Comparison

The demographics of Saudi Arabia and Iran seem to look very much alike at first glance. Mortality rates have started to decrease almost a century ago in both countries. They are both confronted with decreasing TFR, increasing life expectancy, and hence a growing total population. Additionally, both countries experienced rapid growth in their young population and struggle with the issue of unemployment. However, the reason for the current youth unemployment differs between the countries. While Iran fails to create jobs in the aftermath of an economic downturn and international sanctions, Saudi Arabia relies heavily on expatriates, while the youth is lacking the necessary skills for the private industry (Hosseini-Chavoshi & Abbasi-Shavazi, 2012, p. 113; Mujahid, 2012, p. 185). Besides that, differences in their respective social, economic and historical dimensions lead to two countries that are currently in distinct stages of their demographic transition.

The low dependency, fertility, and mortality rates, as well as the high portion of active population indicate that Iran seems to have moved to the fourth stage providing a demographic window to exploit in favour of economic growth. Saudi Arabia's TFR has also decreased for several decades but will still be above replacement level in 2030. Thus, Saudi Arabia's population growth rate is above the Iranian. This indicates that Saudi Arabia is in the transformation from phase 3 to phase 4 but has not fully managed to transition yet. One can expect that Saudi Arabia will have reached phase 4 by 2030 when their natural increase has further slowed down. By 2030, the Kingdom will be in the best position to harness the demographic dividend as the dependency rate will be at its minimum (Kronfol, 2012, p. 251).

However, to reap the benefits from the demographic dividends, both countries are required to take appropriate socio-political measures. Iran's government needs to put its focus on the creation of jobs and employ as many citizens as quickly as possible, especially its well-educated young population (Roudi, Azadi & Mesgaran, 2017, p. 23). Saudi Arabia, on the other hand, needs to narrow the gap between labour requirements and the supply of qualified native workers (Mujahid, 2012, p. 192).

Currently it seems, as if Saudi Arabia had the better chance of profiting economically from its demographic window by 2030. The main reason is the ambitious Saudi Vision for 2030 which shows that the government is aware of its opportunities and tackles the challenges early enough. If they are successful in implementing the program, there is a high change of an economic boost by 2030, from which the citizens can benefit on a social level as well. Iran on the other side also pursues reform plans, but is strongly limited by its international reintegration. Additionally, Iran's plans do not make the same comprehensive impression as the ones from Saudi Arabia. Iran struggles to improve both living conditions and economic outlooks in the short- and long term.

5. Conclusions

5.1 Summary

This paper examined the current population dynamics that will shape the economic and social development of Saudi Arabia and Iran until 2030. From a superficial view, the two countries seem to be very much alike in terms of their socio-economic development and their demographics. However, the PESTEL analysis has shown that contradicting interpretations of the Islam, different political systems, and economic growth rates not only explain the tensions between the two states, but also help to interpret their distinct demographic status.

While Iran's TFR is already below replacement level and population growth is expected to further slow down by 2030, those indicators will still be comparably higher in Saudi Arabia. Therefore, Iran is already a step further in the demographic transition model and is offered the potential economic benefits from the demographic dividend. To do so, Iran must find a way to improve its current economic and social situation in which a huge portion of the population lives in poverty and unemployment. However, the aftermath of the international sanctions currently deters Iran of successfully implementing reformation programs. Saudi Arabia is currently in the transition of a population with a high percentage of children to a high percentage of young workers. By 2030, Saudi Arabia will also be able to harness the demographic dividend when dependency rates will be at their lowest. By then, the Kingdom must have decreased its dependency on a foreign workforce significantly and improved the quality of education. The already implemented Saudi Vision 2030 acknowledges these issues

and puts in place the necessary social and economic initiatives to prepare Saudi Arabia for the challenges and opportunities ahead. Due to this more comprehensive program, Saudi Arabia's chances to harness the demographic dividend and improve the socio-economic situation by 2030 are likely to be higher than Iran's.

5.2. Limitations

High quality data and a diverse selection of sources and references have been considered for the purposes of this paper. However, the findings rely largely on publicly available data, especially academic literature and information provided by governmental bodies. All those sources have their own limitations. Especially development data is to be interpreted with caution. For instance, survey results rely heavily on census data provided by the governments, given those governments even hold censuses regularly (Melamed, 2014). According to GASTAT (2016) and Iran Data Portal (2017), Saudi Arabia and Iran provide census data available to the public since the 1960's. Yet, considerable bias might still persist. Thus, the authors of this paper implemented data from an arguably more neutral source, the United Nations, whenever at hand. It is assumed that the data provided by this body is the most unbiased source available. Furthermore, estimating future values is always subject to great uncertainty. Considering the large timeframes discussed in this paper, forecast data is prone to large estimation errors. Subsequently, existing forecasts have been used for the most part of this paper. It is believed that they lead to more reliable and comparable results for further research than developing our own projections. Furthermore, the PESTEL analysis provided by authors is structurally subjective. The analysis relies on assumptions and cannot unfold a countries' macro-environment in its entire complexity. Nonetheless, the authors of this paper believe to have added considerable value by applying the PESTEL framework and putting existing socio-economic data into perspective.

5.3. Outlook on Further Research

Due to the limited scope of this paper, several points that are also key drivers for Saudi's and Iran's further development have been left out. For instance, both economies are highly dependent on the export of oil and natural resources. As a result, the economic development and the number of jobs are strongly influenced by the dynamics of supply and demand. An in-depth analysis of the economies' future dependency on oil might give a clearer view of the potential economic developments, or how the issues mentioned above could be tackled.

Moreover, the changing role of females in the societies has mainly been left out. As the empowerment of women, especially in terms of education and participation in the workforce, is increasing, well-educated female workers could provide an immense potential for the

respective economies. The long-term development of female empowerment in Muslim countries is a non-negligible key driver for both the economies and the societies.

Lastly, Saudi Arabia and Iran have already taken measures and initiated programs (such as the Saudi Vision 2030) that prepare the countries for the imminent demographic change. Further research could be conducted on how effective these programs are in taking on the presented challenges. Of special interest would be an analysis and comparison of the two countries preparing for the slow but steady aging process of their respective societies.

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7. Appendix

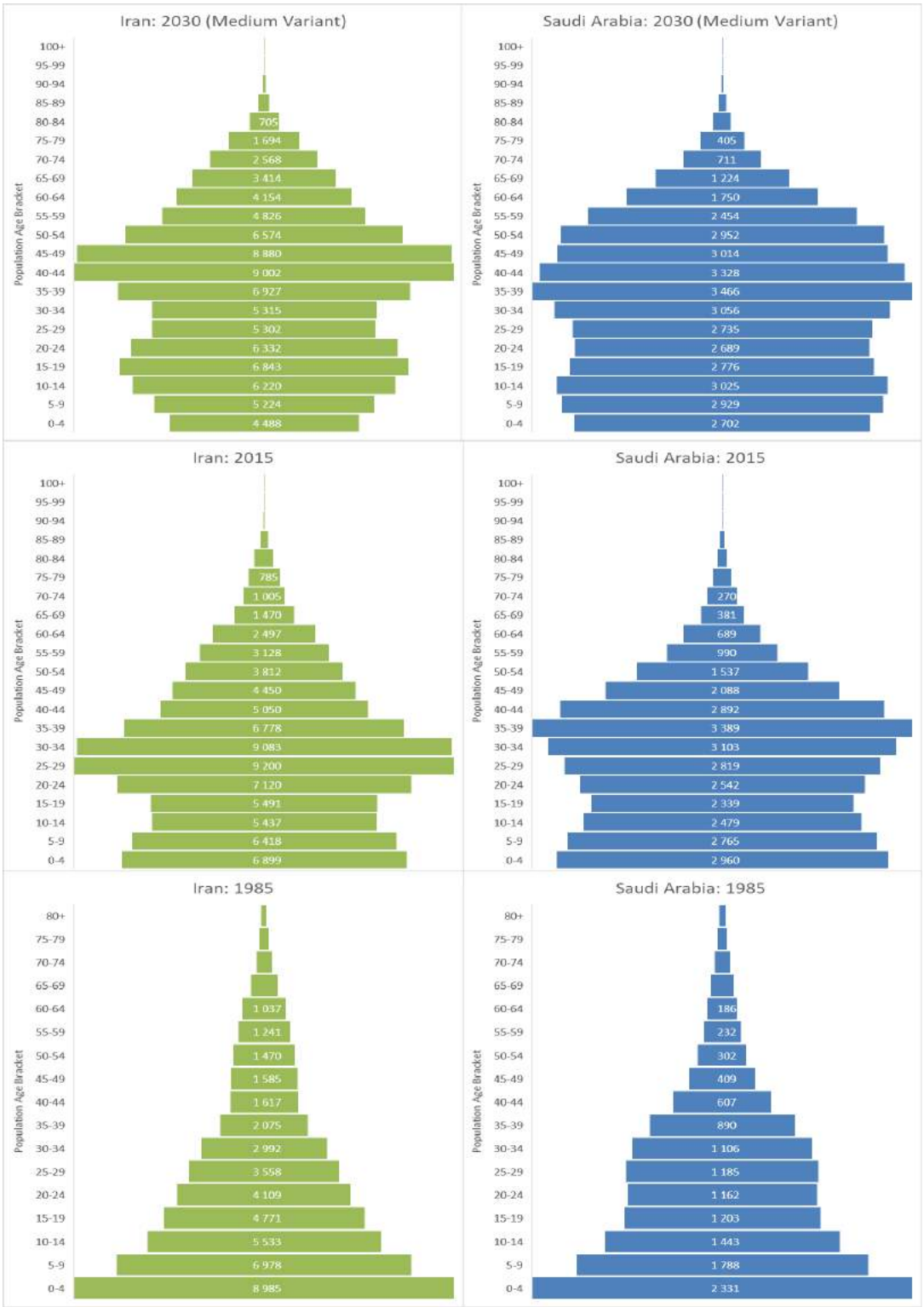

FIGURE A1: POPULATION AGE BRACKETS BASED ON UNPD (2017) DATA.

Demographic Indicators 1950-2030 (5-year average time series)

Indicators	Saudi Arabia						Iran					
Time Series	1950-1955	1980-1985	2010-2015	2025-2030			1950-1955	1980-1985	2010-2015	2025-2030		
Variant				Medium	High	Low				Medium	High	Low
Total Fertility Rate*	7.2	7.0	2.7	2.1	2.6	1.5	6.9	6.5	1.7	1.5	2.0	1.0
Infant Mortality**	201.6	56.2	13.0	7.1	-	-	220.2	71.3	14.8	7.0	-	-
Crude Death Rate***	23.2	7.3	3.5	4.4	4.3	4.5	26.8	13.6	4.7	5.0	4.9	5.2
Life Expectancy ****	41.9	64.9	74.0	76.3	-	-	40.6	52.1	75.1	78.2	-	-
Population by Age												
0-4	2534.4	8984.9	6899.5	4487.8	5987.4	2988.3	537.4	2330.7	2960.3	2701.8	3333.4	2070.2
5-9	1854.9	6978.1	6418.0	5224.4	6593.5	3855.2	416.9	1788.4	2764.9	2929.3	3442.6	2416.1
10-14	1820.7	5532.5	5437.1	6220.0	7181.9	5258.1	357.0	1442.7	2479.2	3025.1	3338.5	2711.7
15-19	1743.8	4770.6	5490.6	6843.3	6843.3	6843.3	309.3	1202.5	2338.6	2776.2	2776.2	2776.2
20-24	1573.2	4108.7	7120.3	6332.0	6332.0	6332.0	265.6	1162.4	2542.4	2688.6	2688.6	2688.6
25-29	1455.6	3558.5	9200.4	5302.0	5302.0	5302.0	225.9	1184.8	2819.4	2734.6	2734.6	2734.6
30-34	1070.0	2991.9	9083.3	5314.6	5314.6	5314.6	193.4	1106.2	3103.4	3056.2	3056.2	3056.2
35-39	905.7	2075.1	6778.0	6926.9	6926.9	6926.9	167.4	890.0	3389.0	3465.8	3465.8	3465.8
40-44	857.0	1617.1	5050.4	9001.8	9001.8	9001.8	146.8	607.4	2892.3	3327.7	3327.7	3327.7
45-49	758.0	1584.6	4449.5	8880.3	8880.3	8880.3	127.6	408.9	2087.9	3013.5	3013.5	3013.5
50-54	618.0	1469.9	3812.5	6574.5	6574.5	6574.5	108.8	301.5	1537.1	2951.6	2951.6	2951.6
55-59	532.0	1240.7	3128.4	4826.3	4826.3	4826.3	90.2	231.6	989.9	2453.6	2453.6	2453.6
60-64	493.0	1037.2	2497.0	4153.9	4153.9	4153.9	70.8	186.3	689.2	1749.6	1749.6	1749.6

D. Managing population dynamics in China, Taiwan and Iran since 1960. What are the differences? What is the societal and economic impact in these countries? What do we know about their future strategies to prosper in the 21st century?

by Charlotte Coste and Baptiste Freymond

The aim of this paper is to analyze and compare population dynamics in China, Taiwan and Iran from 1960 until today. While investigating, we uncovered that their similarities reside in the fact that their fertility rate shrunk within a few decades and was combined on average with a decreasing mortality rate. China's one child policy, added to a change in childbearing behavior resulted in a fertility rate being divided by three within 30 years. Combined with lower mortality rate, due to Mao's investments in health facilities, the population is ageing rapidly and the younger cohorts are too few to support the society. The other main consequence of the policy lies in the idea that having a girl was viewed unfavorably at the time and so it was likely that abortion or infanticide was practiced when the child was a girl. Consequently, nowadays the males' cohorts are undoubtedly bigger compared to the women one's which will result for some of them in an inability to marry. Taiwan is currently facing a similar issue regarding population aging. On the contrary to China, the fertility decrease was mostly due to social behavior changes that inherently triggered a weaker wish to build a family and have children. People tended to postpone their marriage to focus on education and singlehood became a social phenomenon. Taiwan increasing life expectancy was due to a wealthier population and country that provided a better access to facilities and education. Iran on the other side saw its life expectancy decrease as the war was raging with Iraq. War impacted in a different manner all of Iran's population dynamics. Fertility decreased during this period and continued to thanks to the introduction of family planning and modern contraception especially in rural areas. The increasing aging population and low fertility rate pose key challenges for the society and the economy. It is now clear that each of these countries will encounter difficulties in the future when their age pyramids evolve. Government have taken into account the challenges and are working on implementing structures that will: support the elderly, boost childbirth and provide workforce in the years to come. Migration, also, was and still is key in defining these countries' demographics. These last decades, various flows of population as much inward as outward occurred in China, Taiwan and Iran. China for instance, mostly witnessed internal migration and migration inward China after the opening of the country in 1978. Migrants were attracted by economic development and increasing wage level in the 1980s. Taiwan also had to face an economic migration after its great growth in 1960. However, due to strict control of permanent residences in the country and because Taiwan was not welcoming non-educated people prior

to 1990, migration has never been as important as in China. Iran witnessed all types of population flows but reasons were mainly political or religious more than economical. A great issue for Iran is the “brain drain” of the country on one side and a major arrival of refugees during the different wars on the other. Even though Iran is not highly concerned by refugee’s migration nowadays, “brain drain” is still an actual problem. The next decades will be undoubtedly decisive for these countries as they wish to reverse their fertility trend and retain a strong growth. Population dynamics will represent crucial indicators that will define the future of China, Taiwan and Iran.

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Introduction

In order to fully understand the population dynamics in China, Taiwan and Iran, we thought crucial to have an overview of their current situation in 1960.

At this time, China is facing one of the world's largest famine, “three-year natural disaster”, between 1958 and 1961 (Zhao, 2012). This famine was particularly violent due to the lack of management in rural regions and bad weather conditions. This episode is said to be responsible for 30 million excess deaths. This resulted also in a decrease in fertility, from 6.4 children in 1957 to 3.3 in 1961 (Jiang, 2013). The consequences varied from regions and it was not surprising to discover that rural regions were the most affected by the food shortage and the excess mortality, migration thus increased from rural to urban regions.

After Japan’s defeat at the end of the second world war, Taiwan is placed under Chinese control after 50 years of Japanese rule. The Chinese civil war will lead to the installation of the Kuomintang regime in Taiwan until 1987. In the 1960’s Taiwan will encounter prosperity thanks to a fast industrial development, the Taiwan miracle, promoted by an advantageous fiscal regime and a high demand for Taiwanese products.

At the same period, Iran was facing political tension after a coup d’état in 1953 which removed the Prime minister Mosaddeq with the help of the Americans. Iran was now an autocracy ruled by the Shah who decided to conclude agreements with foreign companies over the management of oil facilities. Through to the Bagdad agreement, Iran received financial aids from the United States and thus engaged reforms to modernize the country. This was called the White revolution and add consequences in 1961 on economic, social and administrative sectors.

Now that we had a broad overview of what each country was facing in the 1960s we will go deeper in understanding the population dynamics of each of them. Population dynamics are characterized by fertility, mortality, immigration and migration.

Fertility

China

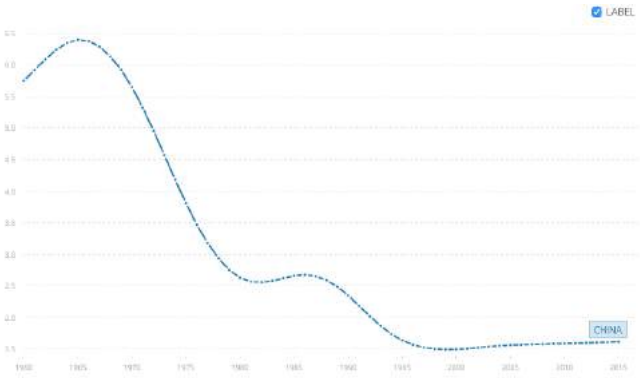
Looking at the fertility rate of those 3 countries, we can easily notice that they are fairly following the same path.

Chinese fertility rate started to decline in the late 1960s and early 1970s and accelerating during the mid 1970s. In 1960 the government realized the need to control births and especially in rural areas according to the Malthus theory they were not enough land to feed everyone (Jiang, 2013). 20 years later the Chinese authorities issued an open letter to all the member of the communist party installing the “one-child policy”. Agreeing to have one child enabled

parents to have better access to commodities and education and provided them with more money. The one-child policy was relaxed in 2013 and abolished in 2015 but the consequences will last in the future and for a long time.

Even though it is commonly admitted that Chinese fertility rate decreased mainly due to the “one-child policy”, reasons are more complex. In fact, we can attribute the early decrease of births number mostly to an economic development of the country, indeed in 1980, the fertility rate was already at 2.2 (Jiang, 2013). The reasons are mainly due to a change in fertility behavior where people deliberately choose not to have more than a certain number of children usually because of a better workforce and education access for the women but also to the higher cost of child rearing. This kind of economic transition usually leads to a higher longevity as a first step and a reduction of births as a following.

It is even projected to fall below 1.4 after 2020, which would categorize China as one of the world's lowest fertility rate. Nevertheless, after 30 years and a reduction of 100 million to 400 million births, depending on estimations, the one-child policy has left its mark on China (Jiang, 2013).



Fertility rate in China from 1960 to 2014

The greatest consequence attributable to the birth policy in China is the unbalanced sex ratio at birth. Indeed, in areas with one or 1.5 children allowed per woman, we counted in 2000 respectively 111.6 and 124.7 men for 100 women. Eastern Asia usually lists more men than women but the difference in term of ratio is by far the highest in China which imply a direct causality of the birth policy. On the other hand, it is said that the policy reduced pressure on education, medical facilities and profession enabling a less crowded environment.

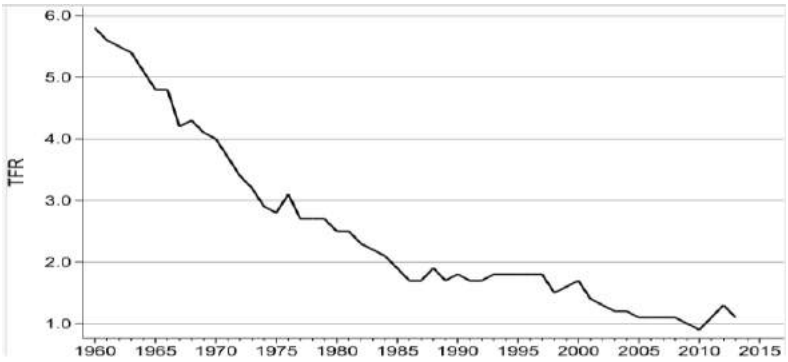
Taiwan

At the end of World War II, Taiwan fell back under the Chinese governance and start to settle as a developed country. A decrease in fertility was observed even though the population was growing at that time due to a massive migration of Chinese people right after the war. The reasons of the fertility drop are common to the Chinese ones, as the Taiwanese government implanted a family planning program in 1965 (Chen, 2012). We can also add that the stigmatization of single women started to disappear and that the stagnant economy of the region encouraged people not to have children. Eastern Asia is particularly touched by the

low fertility phenomenon because of the relatively high cost of raising children but also because of the different mentality present in Western developed countries. In fact, Asian women have a greater willingness to pursue their career instead of being disturbed by children and furthermore Taiwanese tend to marry late. Staying at home in order to raise children is culturally not perceived as normal as in Europe. The average age of mother at first childbearing increased from 23.5 in 1980 to 29.6 in 2010 (Chen, 2012). Meanwhile, the mean age of mothers at childbearing was 30.6 years highlighting an increasingly smaller gap between the mean of the first births and all births.

Aside from the fact that education led to delayed marriages, there is a growing tendency of people staying single in Taiwan. Last year, for Taiwanese in their late twenties, only 30% of women and 15% of men were married (Chen, 2012). These social transformations have shaped Taiwan society and resulted in a large decrease in fertility.

As visible in the chart, the fertility rate decreased continuously until today. Replacement rate level was reached in the mid 1980s. Nowadays, Taiwanese birth rate is one of the lowest in the world.



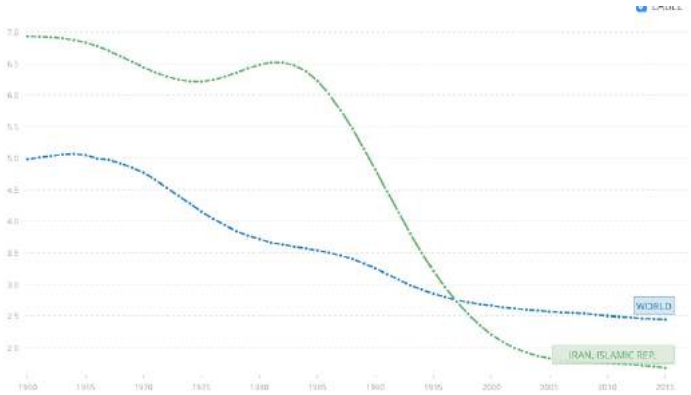
Fertility rate in Taiwan from 1960 to 2015

https://figshare.com/articles/_Total_fertility_rates_in_Taiwan_1960_8211_2014_/1515861

Iran

In 1966, Iranian government tried to implement a family policy in order to decrease the population's growth. At that time, birth control pills began to be sold in Iran. However, variation in fertility was less than expected and fertility went from 7.7 to 7.0 until 1980. Even though the rate declined to 6.0 in the 1970s and increased back over 7.0 right after the Islamic revolution. This can be explained by the raise of contraception pills cost during and after the revolution but also with financial incentives to encourage families to have children. As a result, Iranian population almost doubled from 1968 to 1988. Shortly after realizing that Iran could not sustainably deal with a population growing so fast, the government cut most of social helps for families with children and promoted contraception as never before. Moreover, the government even offered free vasectomy in rural area. At that period, desire for smaller families was rising and this explained why the use of modern contraceptives increased from 27% to 57% between 1989 and 2004 (Roudi, 2017). This led to a sharp decrease in fertility from 6.2 births per woman in 1986 to 2.5 births per woman in 1996.

The replacement level was reached shortly after 2000. After 2006, in order to avoid ageing population, Iran slowly tried to promote births by raising social helps, increasing cost of birth control pills and condoms and starting campaigns to encourage couples to have more children.



Fertility rate in Iran vs World 1960 to 2014

http://www.un.org/esa/population/publications/completingfertility/2Revi

However, it is unlikely that fertility rate will raise much in the future for the same reasons that newly developed country face. Those reasons are better education (marriage at an older age), a new place for the women in the society, strong urbanization and also a change in fertility behavior in general.

Mortality

China

In China between 1963 and 1980 life expectancy rose from 50 to 65.5 (World Bank) (Figure 1). This trend will continue ongoing reach a life expectancy of 76 years old in 2015 for Chinese total population. With an annual rate of one year of life the 63-80 period, Mao era is the most prominent in terms of mortality reduction. What explains this increase in life expectancy?
Firstly, health campaigns were introduced by Mao, “Patriotic Health Campaigns “(Figure 2). This campaigns actively focused on rural areas, their aim was to build sanitary environments for the population: trash removal and latrine construction (Babiarz, 2015). Increasing people's standards of living was essential to combat the different diseases and parasites that were responsible for the deaths in the countryside. Vaccines and disease fighting was another one of Mao’s priority. In the mid 1950s ‘multisectoral’ initiatives for health were put in place to control parasitic diseases. Vaccination campaigns and environment management targeted polio, measles, diphtheria, whooping cough, scarlet fever, and cholera. The success was immediate as for example smallpox was eradicated in three years. All of these campaigns aimed at reducing the impact of these deadly diseases thus resulting in an increase life expectancy especially for the youngest. Childbirth was also concerned by Mao’s improvements as he installed midwives training. Medical care was improved as physician and hospital supply grew. The China’s Rural Cooperative Medical System delivered financing for the rural health system. Education said to also have helped China’s mortality rate at this period. Investments in primary and secondary school resulted in an increased enrolment rate from 20% in 1940 to 97% in 1975 (Babiarz, 2015). A better educated population had two benefits: children were better able to understand and apply health recommendations and education enabled them to find jobs and thus secure a higher expected income leading to better life standards. “Taken together, educational gains during the 1950s and their interactions with public health interventions appear to explain about 80 per cent of infant mortality decline and 75 per cent of under-five mortality decline through the 1960s, and 55-70 per cent of the declines over the entire 1960-80 period” (Babiarz 2015). In the 1980s and 1990s, mortality decline slowed, partly because of the negative impact brought about by some social economic changes at the time. In the last 10 years, China’s mortality reduction sped up again. This change was due to a rapid economic development, and progress made in disease prevention and treatment. China’s life expectancy at birth is now around 75 years (World Bank).

Taiwan

Taiwan also experienced an always increasing life expectancy between 1960 and today, with an increase from 64 years old to 80 years old (Figure 3). Just like China investments in health proved to be particularly successful especially in reducing infant mortality. Indeed, infant mortality decreased from 54 for 1000 in 1960 to 6 in 2005 (McGuire, 2010). Nevertheless, the main driver according to the world bank was the rapid rise of the GDP combined with low income inequality. In the 1970's population rapidly gain access to tap water, health staff and facilities thanks to government actions and larger incomes. A four-year program was also instored expecting medical graduates to practice for a time in underserved regions enabling rural population to receive adequate medical care. This socioeconomic improvement led to exceptional achievement for the period in terms of infant mortality reduction. Actually and in theory, fast economic growth combined with stable income inequality should and in this case resulted in poverty decline. Taiwan was a perfect example of "wealthier is healthier" (McGuire, 2010). National wealth insurance was introduced in 1995 even though at that time infant mortality was already really low. Rapidly expanding incomes, tap water and education also enables people and especially parent to effectively prevent infant death due to bad sanitary arrangements. Overall Taiwan was doing better than continental China as they were one step ahead since they already had most of the facilities installed before 1960. Moving into the 21st century Taiwan is experiencing a steady growth in terms of life expectancy with an average annual growth of 0.25 (IndexMundi). The Kuomintang regime explains the demographical differences between continental China and Taiwan as it enables the island to tackle sanitary and health issue sooner leading to a Taiwanese life expectancy that is higher than a Chinese.

Iran

Focusing on Iran, we are now analyzing an Arab country that was, on the contrary to China and Taiwan, exposed to war. As we analyze life expectancy and mortality rate in Iran we clearly notice a period between 1980 and 1988 where deaths are undoubtedly higher than the normal trend (Figure 4). During this period, life expectancy dropped from 55.89 in 1977 to 53.89 in 1982 (World Bank). This is the result of the Iran-Iraq war that according to the estimations lead to the death of one million Iranians. Iran lost 5% of their male between the age of 15 and 24 leading to smaller youth groups. The war had various consequences on the populations; food shortage and poor health conditions. After 8 years of war, and in an attempt to improve the health system, the Iranian government put in place a medical education system. Health workers called in Iran Behvarz, were trained for 2 years and then appointed as Behvarz to the health house covering up to 1500 people. "The major strength of the administration process was introducing the most appropriate local people to local health authorities by rural councils for being a Behavrz" (Lankarani, 2013). This system was extremely successful in helping rural

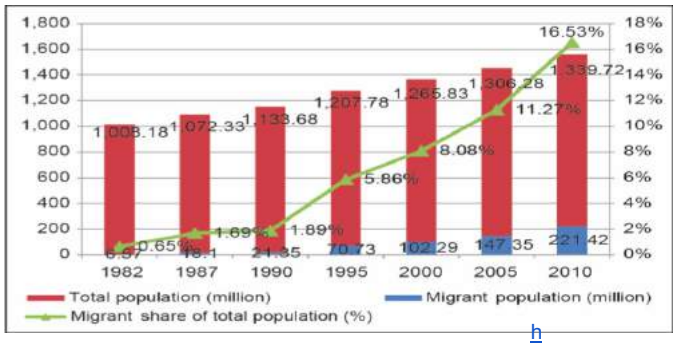
population decrease their mortality rate, indeed, it took only 3 years to increase neonatal vaccine coverage from 33% to over 90% nationwide. Until today, life expectancy in Iran has been increasing every year reaching 75.74 in 2015 (World Bank).

To conclude on our three cases, we have discovered that they all managed a large increase in terms of life expectancy between 1960 and nowadays. Nevertheless, the reasons behind this results are different; China used social policy to improve the life of their citizens, just like Iran after the war and finally, Taiwan managed social and economic development.

Migration

China

After the opening of the country thanks to an economic reform in 1978, China has seen a great number of migrants arriving into the country. As a result, China went from a strongly
low share of migrants in the country before 1978 to around 20% in 2017.



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Firstly, migrants were mostly women moving for social reasons. Then, thanks to job opportunities in the 1990s, male composed the majority of migrants. Migrants also had the tendency to stay for a longer period in China as years passed. This can be explained essentially because of the job opportunities which were always more attractive and in different industries. Consequently, migrants were mostly present in the Eastern coast of China were the main cities are located

Migration within China is also hugely important. As far as humans can remember, internal migration has always existed in China. Because of urbanization, more jobs in other industries than agriculture and poverty, migration has increased even more these last decades. As a result, millions of people moved from rural to urban areas which means from western to coastal regions. Interprovincial migration also occurred in China from poorer to richer ones.

In a census made in 2000, the Chinese government counted more than 40 million inhabitants living in different provinces than the one they are registered in. In order to partially limitate internal migration, Chinese government is trying to promote rural provinces and to help cities to be developed in those regions.

Emigration from China has not officially been important for many years as Chinese government had control on people allowed to leave the country. Most of the people allowed to leave China used to go to Hong Kong as life perspective were better there. Because of restrictions, illegal emigration was highly present in China mostly due to citizens fleeing poverty to a richer country (a great number of them going to the USA).
In 1983, emigration restrictions were modified and people were able to quit the country for business and education purpose.
In recent years, China has observed a new king of emigration. Rich Chinese investors and highly skilled workers are leaving the country to start businesses abroad or following better job opportunities. This is currently leading to a large outflow of capital and emptying China from its resources both human and financial.
Nowadays, even if the Chinese community is one of the biggest present away of its border, the country still has a relatively low emigration rate because China counts more than 1.4 billion inhabitants.

Taiwan

In the early 1960s, a great economic growth led to an important urbanization and internal migration to the cities from the central to coastal regions. After 1980 and an economic boom in the services industry, a massive internal migration to the northern part of the country, and more precisely to Taipei, occurred.
To maintain the economic development of the country in the 1960s, Taiwanese government opened its border to educated migrants. Thanks to an economic system close to the Japanese and American one, Taiwan welcomed mostly migrants from those 2 countries. However, migrations stayed relatively low until the 1990s. After 1990, Taiwan opened its border to all kind of workers (highly skilled or not), which led to a great migration of people coming from different South-eastern Asian countries (mainly from Indonesia and Vietnam). Meanwhile and because of the new role of the women in the Taiwanese society, men faced difficulties in finding spouses. As a result, with the help of Chinese and Taiwanese government, a program has been settled in order facilitate marriage between Taiwanese men and Chinese women.

In 2006, a census counted 383,000 foreign wives or husband married to a native Taiwanese. This number represents more than 1.6 percent of the total population.
(Wikipedia, Demographics of Taiwan)
However, Taiwan always kept a strict control of the number of family coming to Taiwan as permanent residents. This control has limited migration toward Taiwan as a whole for many years.

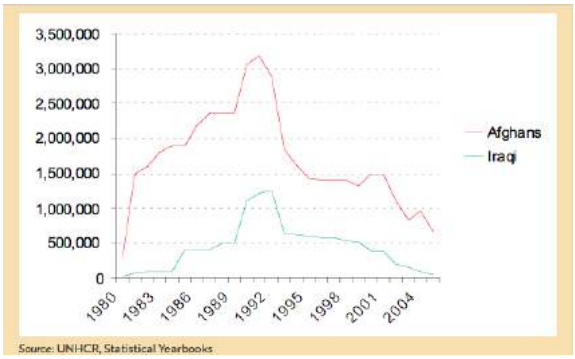
In the 1980s, attracted by an improvement of the socio-economical conditions in their country, a great part of the Chinese community present in Taiwan traveled back to their home country. Even though emigration has usually been low in Taiwan, the 1990s marked the beginning of the emigration of highly skilled and educated people mainly to China, Japan and English speaking country (the USA as the first destination). This sort of emigration has been so important that in a census made 2010, Shanghai counted around 700,000 Taiwanese born people.
(Ji.Ping Lin, 2012)
In recent years, due to rising salary level in China, emigration to the coastal region of China has been even more important.

Iran

Iran has suffered from important emigration since 1950 because of the slow economical relaunch after world war 2. At that time and until the Iranian revolution in 1979, mostly students left the country, seeking better education and job opportunities. USA and England were the principal destinations during this period. As a result, Iranian students formed the biggest foreign student community in the US in the 70s. Meanwhile, a strong economic growth in other Persic countries led around 50,000 Iranian people to migrate to Kuwait and around 40,000 in the UAE. Moreover, Iranian minorities such as Jews chose to leave the country for Israel to avoid persecutions. Before the start of the revolution, Iran counted around 250,000 Iranian born people living abroad.
After the revolution and the Islamisation of the country, a great number of people fled their home country. Reasons were different depending on the age and gender of migrants. Young men mainly wanted to avoid to be enrolled in the army to fight in the war against Iraq. Entire families were also leaving to protect the rights of their daughter's wives as Islamisation of Iran restricted them. Moreover, most educated people such as doctors and professors left the country at the same period.
Since the 1990s, because of an economic crisis, Iran has seen mostly educated people leaving the country looking for better work conditions and perspectives. Iran had and still has one of the highest "brain drain" worldwide, meaning that the rate of people who studied in the country and stayed there afterward is low.
Also, an important number of poor Iranians fled Iran illegally to western European countries or the US asking for refugees status. As a result, in 2004, Iran was in the top-10 countries with the highest number of asylum application. In total, more than 1 million Iranians emigrated since 1950, coming from various social background and level of education.
(Wikipedia, Diaspora irannienne)

In the years following the revolution, not only has Iran suffered from strong emigration but also from migration toward the country. Migrants coming from neighbour states such as Afghanistan and Iraq for the main part. People were usually either fleeing war or moving for religious reasons. The peak of migration was reached in the early 1990s during the Gulf War leading to a refugees population bigger than 4 million which made Iran as the one of the most important refugees host in the world.

Shortly after 2000 and the end of a civil war in Afghanistan, Iran and Afghanistan agreed on a repatriation program. Such program has not been settled for Iraqis, however most of them chose to return to their home country after the end of the conflict with the US.



https://www.migrationpolicy.org/article/iran-vast-diaspora-abroad-and-millions-refugees-home

Regarding internal migration, Iran had one of the strongest urbanization rate these last decades going from 27% in 1950 to 67% urbanization in 2005 (Shirin Hakimzadeh, 2006). This massive movement toward cities can be explained by the different wars which forced people living in rural areas close to conflict zones to move. Also, the lack of investment in rural areas by the government motivated people to find better life conditions in the cities. Iran is currently to implement a "reverse urbanization initiative" by promoting local industries and agriculture.

Societal and economic impacts

In this chapter, we aim to analyze the impacts of the different policy on each country.

China

After 30 years the policy changed the face of China society. As discussed previously the one child policy combined with social behaviour changes firstly led to distortions in sex ratios (Johansson, 1991) (Figure 5). As a consequence, according to the Chinese Academy of Social Sciences, there will be 24 million more men than women of marriageable age by 2020. Population is aging and is now lacking the support of the younger and now smaller cohorts. We can also argue that the fertility behaviour has been modified and thus that it will be complicated for China to effectively change it in the future.

For the economy, this resulted in less workforce but at the same time better professional opportunity for everyone. Education and medical facilities benefited from the population decrease as they were better able to support everyone (Jiang 2013). On the other side this

“lack of population” induced less consumers and thus fewer consummation throughout China. Overall it looks like the policy resulted in more downfalls than opportunities for China. Furthermore, while migration enabled rural population to become wealthier it also created an increasing social and economic gap between rural and urban incomes.

Taiwan

Just like China, Taiwan is facing an ageing population and shrinking younger cohorts due to the decrease in fertility rate (Figure 6). Indeed, as for today the working population is not growing fast enough and not earning enough to support the elderly. It has taken 25 years for Taiwan to jump from an aging population to an aged population, which is faster than most country. Their current situation is critical both in terms of social and economic impact. Just like China, they will lack labour force and eventually the country growth will decrease. On the other side, the society is moving from its traditional family culture to a population that is more and more likely to live single longer (Chen, 2012). This will surely be an issue as Taiwan wishes to improve their fertility rate. Another challenge for Taiwan lies in the fact that people are going back to China because of the higher salary and those people are mostly the most educated.

Iran

As China and Taiwan, the lack of fertility is slowly impacting social and economical aspects of the country. Greater impact will occur in as the future as workforce will shrink meanwhile elderly will have a bigger importance in the society. Moreover, the shortening of the workforce is not only due to an ageing population but also to the infamous Iranian “brain drain” removing a great part of the most educated workforce (and potentially the most financially attractive part of the population for Iran).

Another issue that Iran has to tackle with is the massive urbanization and arrival of refugees in the recent years. Regarding urbanization, flows of people toward cities are usually more important than the expansion of those cities. This means an increasing poverty, poor health conditions and not enough schools to support children’s education. This is also linked to the massive refugees migrations (from Afghanistan for the main part) arriving directly to Teheran or other important Iranian cities. These refugees were either living in slums or in camps directed by NGOs. In both scenarios, it was and still is complicated for the Iranian government to provide enough assistance to this continuous flow of people.

Assumptions about the future

China

The abolition of the one child policy will lead according to the Bank of America to about 9.5 million new births a year. Nevertheless, the labour force is shrinking and will continue to do so as the current 50 years old will soon go into retirement. Actually, it will drop from 911 million in 2015, to 848.9 million in 2020, and to 781.8 million in 2030, according to Deutsche Bank estimates (Figure 7). A population rebound will take a decade and might not even fit in the current fertility behaviour as people tend to privilege small families. Life expectancy will reach 82.67 in 2060 with a fertility rate at 1.747 (World Bank). The challenge for China is to decide how there are going to cope with the aging population and elderly dependence. “China currently spends 3 percent of GDP on overall health spending, including general care and elderly care, and that number is forecast by the OECD to increase to 5.2 percent of GDP by 2030” (OECD). Moreover, China’s spectacular growth is expected to decrease reaching 2.3 percent per year between 2030 and 2060 (OECD). In an effort to manage the coming challenges the government is implementing robotics into its manufacturing sector, raising minimum retirement ages and relocating businesses overseas. Reducing the gap between rural and urban region will surely be one of the next topic in China’s agenda.

Taiwan

Sometimes between 2021 and 2025 Taiwan population will actually start to decrease as the fertility rate has been under replacement level for almost 40 years (Taiwan National Development Council). “The government plans to use subsidies, tax breaks and lengthier parental leave to encourage would-be family makers who have financial concerns” (Mr. Hsueh, Taiwan Government). A campaign to promote childbirth will also be launched remembering Taiwanese of their family traditions. Under these circumstances, it is likely that the insurance and financial services will be improved as the demand will grow. The elderly industry is most likely to explode from 24.6 billion US$ in 2001 to 108.9 billion US$ in 2025. (CEPD, 2006). The migration policy is also expected to change as Taiwan will need to attract both medical workers and skilled employees. Life expectancy is expected to reach 83.79 in 2060 with a fertility rate around 1.5, still under replacement level (IFs). It is now clear that the next decades will be key for Taiwan.

Iran

As planned by the Iranian government, fertility in rural areas will slowly reach urban level. Reasons are mainly urbanization and development of the poorer regions. Also, further improvement in Iranian's family planning will probably encourage even more women to use contraception. Moreover, as women status and their access to work and education are likely to change in the future, their behavior in term of fertility will probably change as well. The only option for Iran to potentially reverse this tendency (or at least not worsen the fertility) would be to adopt a pro-natalist policy. Re-boosting the economy is also an argument to encourage families to have children. Indeed, last years low employment rate and harsh economy have played an important role in the low fertility rate as well.

Iran mortality is also planned to diminish and life expectancy to increase and reach more developed countries level such as the USA. Currently, Iran and American life expectancies were respectively 76 and 79 years in 2015. The combination of low fertility and decreasing mortality will undeniably lead to an ageing population. Ageing population will lead to increasing health and social costs for the elderly and fewer workforce to sustain those costs. Iranian government actually has guidelines that will be adopted in the next decades to tackle this issue. However, no precise actions have been communicated yet.

Regarding migration, Iran will have an effort to make about keeping its highly skilled/educated workers in the country. At the moment, Iran is mostly specialized in the petroleum industries. Iran will have to develop new industries that could even attract experts from other countries. To do so, the Iranian diaspora will play a major role in helping its home country to change its attractiveness worldwide. At the same time, Iran will also have to deal with increasing urban poverty created by a strong and recent urbanization. This continuous flow toward Iranian cities has not by Iranian themselves but mainly by refugees coming from neighbour states

Appendix

Figure 1 : Life expectancy in China between 1960 and 2015 (World Bank)

Figure 2 : Mao's Health Reform (http://factsanddetails.com/china/cat13/sub83/item1652.html)

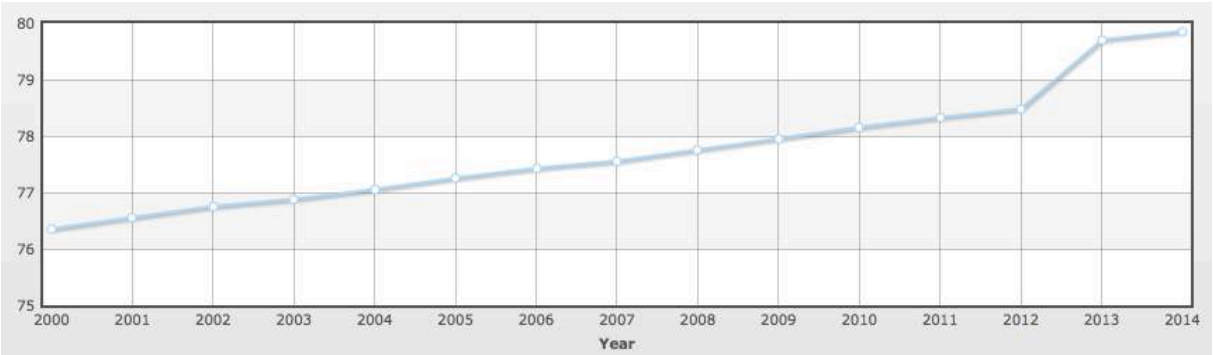


Figure 3 : Life expectancy in Taiwan between 2000 and 2014 (IndexMundi)

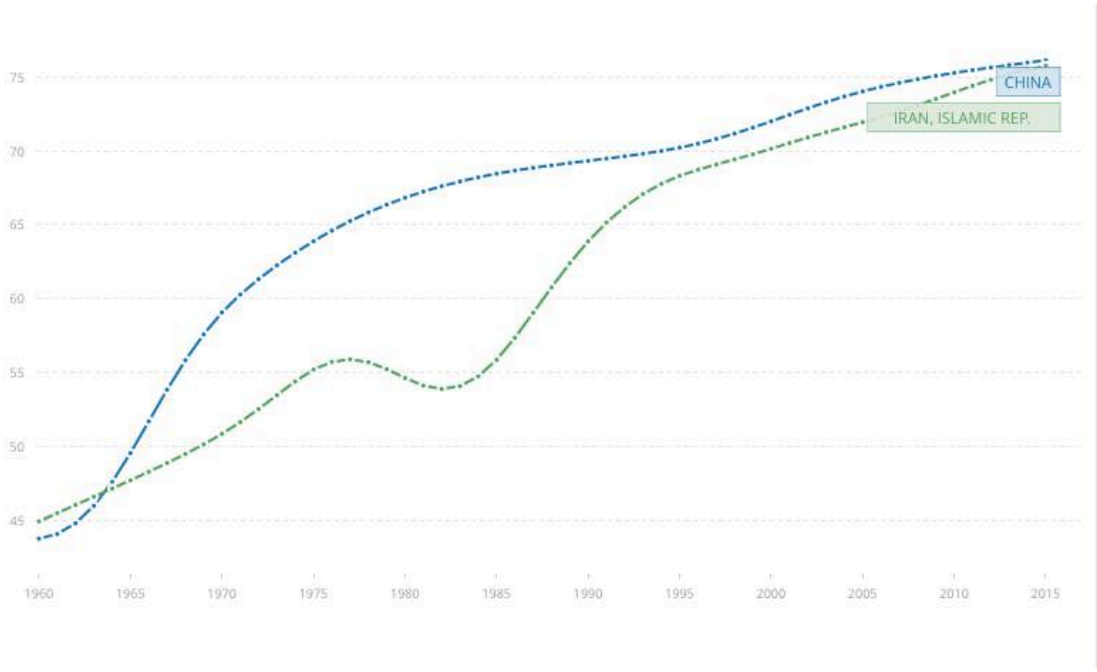


Figure 4 : Life expectancy in Iran versus China between 1960 and 2015 (World Bank)

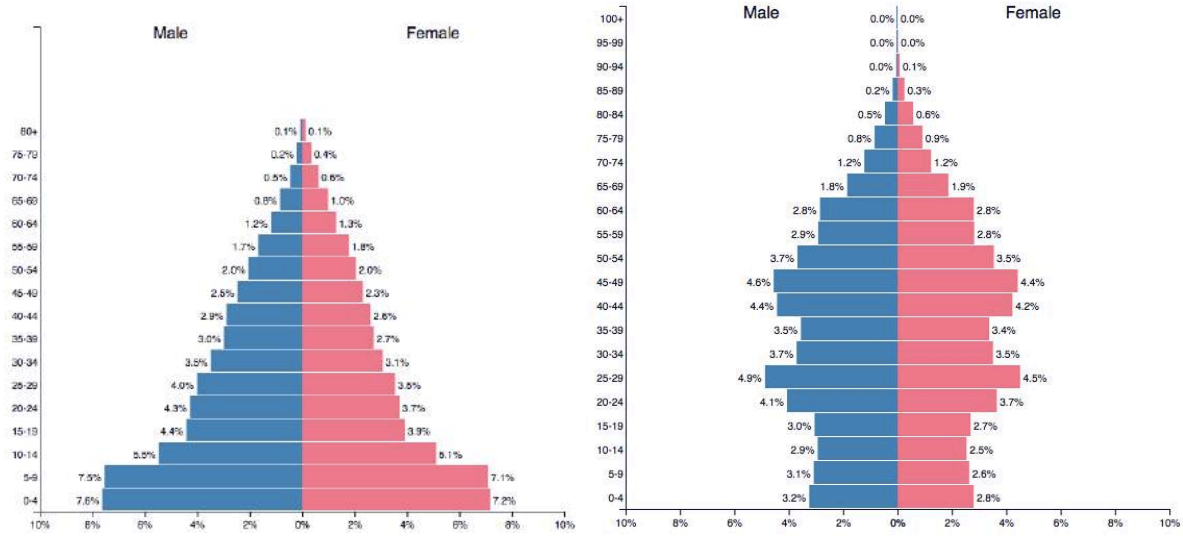


Figure 5 : China's age pyramide and sex ratio in 1960 versus 2015 (https://www.populationpyramid.net)

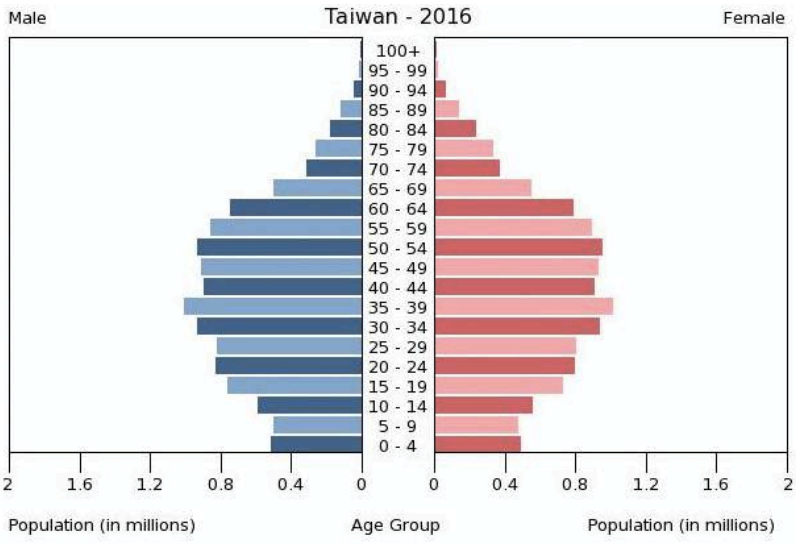


Figure 6 : Taiwan's age pyramide and sex ratio in 2016 (IndexMundi)

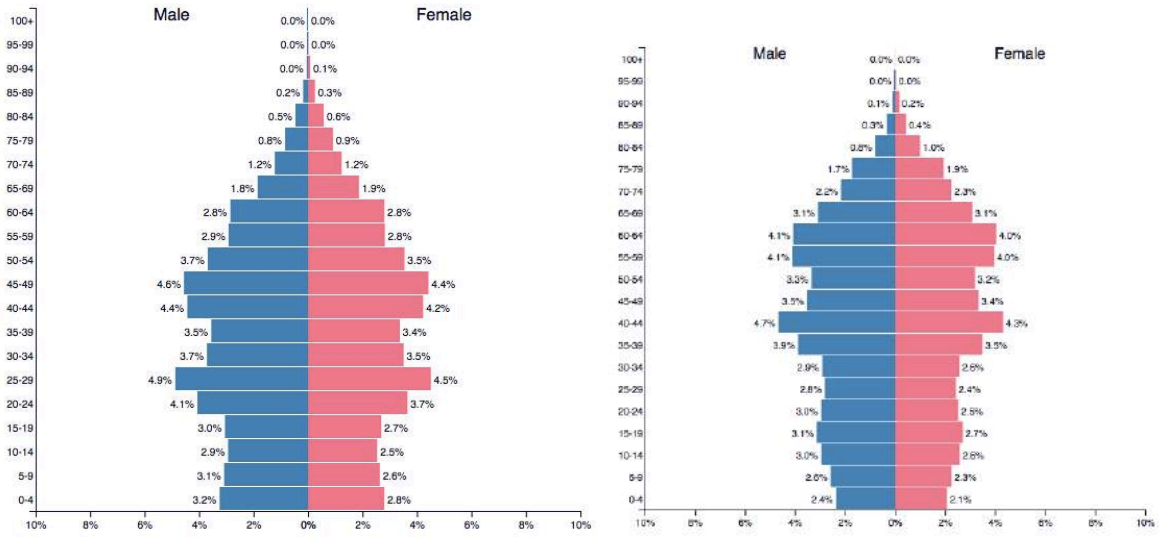


Figure 7 : China's age pyramide and sex ratio in 1915 versus 2030 (https://www.populationpyramid.net)

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Natural Resources

E. Population Growth and access to water. Where is the limit? Why is John Malthus wrong?

by Miro Banovic and Claude-Aline Dubi

Whereas the human population grew only slowly for a long part of its history, growth exploded during the two most recent centuries. In light of this massive growth, many worry whether humanity will be able to feed the world's population in the future, or if a limit will be reached regarding access to food and water. Already more than 200 years ago Thomas Robert Malthus had theorized that populations grow geometrically whilst food production grows linearly. According to his theory, this would inevitably lead to periods of hunger crisis, which would diminish parts of the world population until enough food is available again for everyone, and the cycle starts anew. To find out whether such a limit could be reached, we thoroughly examined past developments in food production and population growth. In this, we found out that although the world population grew faster than ever before in the past two centuries because of rising incomes and improved medical care which impacted fertility rate and mortality rate, this growth was still beat by the increases in food production due to technological advances and increasing investments. As we expect this trend to continue in the future while population growth is expected to slow down as countries enter more mature phases of the demographic transition model, we predict that humanity will likely not reach named limit, contrary to Malthus' projection. Instead, we identify the main problem to be the distribution of food in the world, as most population growth in the 21st century is expected to happen in the most food-insecure developing countries. Further, several factors such as climate change, availability of arable land, technological progress, public as well as private investments, and economic development will influence both food demand and supply. Providing access to food and water is therefore a complex issue and its success is difficult to predict. Nevertheless, failure is not an option, as food and water scarcity would lead to many conflicts, worldwide instability, and hunger crises, which could be detrimental for the development of the human population in general.

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1. Introduction

In 2011, the “the world's seven billionth baby” (Coleman, 2011) was born, while “at the beginning of the 19th century, the number of 1 billion people was exceeded for the first time in history (Van Bavel, 2013).

While these numbers by themselves are astonishing, one also has to keep in mind that this extreme growth had to be sustained by immense developments in every part of human society. For example, through innovations in agriculture humanity was able to increase food production and thus respond to the huge surge in the demand for food, water, and other resources resulting from the population growth.

Until today, it has been possible to meet this constantly growing demand. Indeed, even during the biggest period of growth in terms of population numbers in the history of humankind, food production still stayed ahead and increased even faster. However, the question whether such will be possible in the future remains. As humanity lives on a planet with finite resources, where is the limit? Will the world’s population ever grow so big that we will come close to reaching it? And how can we avert a possibly life-threatening worldwide crisis if such would be the case?

These questions and related aspects will be investigated in this paper. First, past developments of both population growth and food production are explained. This is followed by a quick snapshot of where humanity is standing today. Next, population growth scenarios until 2050 and their implicit challenges related to access to food and water are discussed, along with possible solutions based on our findings from the past. The paper ends with a comparison of Malthus’ famed projections about population growth and access to resources. The current and expected future state of the world will be assessed according to his theory. Finally, the last chapter discusses why Malthus was wrong in the past, what the key takeaways from his mistakes are, and why he will likely also be wrong in the future.

2. Population growth and access to food and water today

As the world’s population has been continuously growing for the past centuries, this had to be sustained by increased food production. In the first section of this chapter, theoretical concepts will be explained and past trends and developments of both population growth and food production will be discussed. Then, the second section presents the current situation and challenges to access food and water.

2.1. Learning from the past

“The modern form of humans evolved about 200,000 years ago” (Howell, 2015). To increase to 7 billion people “the average yearly growth rate over this term should have been around 0.011% annually” (Van Bavel, 2013). Instead, in the centuries before 1800 there had been

"very slow and uneven growth" (Bongaarts, 2009), and "for a very long time the world population did not grow significantly, with periods of growth followed by periods of decline" (United Nations, 1999). Only since the 19th century this switched to seemingly exponential growth as we know it today. Thus, this significant growth has only been part of history for a fraction of humankind's time on earth and had to be supported by increased agricultural production.

2.1.1 Population growth in the past

Looking closer at the phenomenon of population growth on a local level, it becomes clear that there are three drivers to it, fertility rates, mortality rates, and migration. When looking at it on the global level, however, migration becomes irrelevant. Thus, if fertility rates exceed mortality rates the global population grows; if mortality rates exceed fertility rates the opposite is the case.

The world's population had been almost stable from the year 0 until 1000 A.D, as can also be seen in Figure 1. For this time, one can assume that fertility and mortality rates were close to equal and likely both at a high level. This can be argued due to the fact that because of poor medical conditions, mortality – and especially infant and child mortality – is almost certain to have been high. To keep the population size relatively constant fertility rates had to be at a similarly high level. Although there were likely significant variations in this fertility rate over time for several reasons, overall it was much higher than today (c.f. Guinnane, 2011).

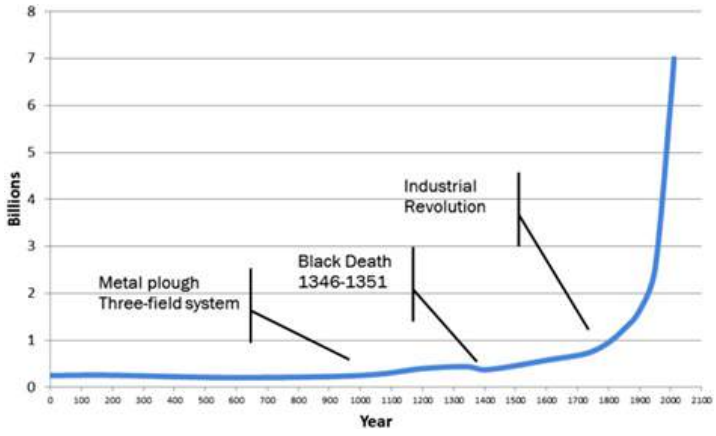

FIGURE 1: HISTORICAL GROWTH OF THE WORLD POPULATION SINCE YEAR 0

Note: from *The world population explosion: causes, backgrounds and -projections for the future*, by Van Bavel J, (2013), retrieved from https://openi.nlm.nih.gov/detailedresult.php?img=PMC3987379_FVVinObGyn-5-281-291-g001&req=4

From the year 1000 A.D., the world's population slowly started to grow. This coincides with the development of the metal plough, as can be seen in Figure 1. Due to this development, incomes and food production sharply increased. It is likely that fertility rates went up, as "the elasticity of fertility with respect to incomes was positive" (Guinnane, 2011). At the same time, this possibly led to lowered mortality rates due to better and more stable food supply.

However, "years of extremely high death rates were quite frequent. Extremely high crisis mortality could be the consequence of epidemic diseases or failed harvests and famine, or a combination of both" (Van Bavel, 2013). An especially impactful example of such is the Black Death pandemic (Figure 1). "A rough estimate is that 25 million people in Europe died from plague during the Black Death" (Black Death, 2017), which lasted from 1347 until 1351.

At the dawn of the Industrial Revolution in the mid 1700s, the world's human population grew […] to 700 million" (Ecology.com, 2011) as depicted in Figure 1. The Industrial revolution started to greatly increase incomes but also lead to improvements in medicine, "resulting in the population explosion that would commence at that point and steamroll into the 20th and 21st centuries" (Ecology.com, 2011). It is likely that the elasticity of fertility rates to income was still positive, and therefore fertility increased. At the same time, due to the improved medical care mortality rates declined, which in combination allowed for massive population growth.

2.1.2 Food production in the past

"Prehistoric societies […] relied on the bounty of nature, before the transition to agriculture began around 12,000 years ago" (Groeneveld, 2016). This means that until then food availability was highly volatile and humans were reliant on their surroundings and had to move around. With the appearance of agriculture, such "traditional hunter-gatherer lifestyles, followed by humans since their evolution, were swept aside in favour of permanent settlements and a reliable food supply" (National Geographic, 2017).

Since then, agricultural output has increased due to the development of new techniques and technologies, and also because "human population and [thus] land use for agriculture increased worldwide" (Stromberg, 2013). Such developments happened globally, albeit for different reasons and in different forms in several parts of the world.

One important milestone to be named is the three-field rotation, which developed in England "between about 1250 and 1350" (Fox, 1986). Through this rotation, farmers were able to grow more productively and efficiently, while at the same time increasing the nutritious value of their plants. The introduction of the three-field rotation coincides with the development of the mouldboard plough, which enabled farmers to plough their land quicker, an advance needed to utilize the increased amount of land necessary for the three-field system. Later on, this further developed to a four-field rotation, as such kept the nutrients in the soil even better.

While the basic principles of the machinery stayed the same throughout the centuries, the mechanization of agriculture as exemplified by the further developed of ploughs was another important factor in increasing food production. Starting from the 1850s, these ploughs were increasingly powered by steam engines (c.f. Selcer, 2006), enabling more effective and efficient ploughing. This was further improved with the invention of petrol engines in the late 19th century, with “the world’s first successful gas tractor with forward and reverse gears” (Macmillan, 2003) being built in 1892.

More recently, the so-called green revolution enabled worldwide technology transfer through widespread research and development initiatives between approximately 1930 and 1970. This revolution was hugely successful in increasing food production around the globe, especially in the developing world (c.f. Hazell, 2009). “The story of English wheat is typical. It took nearly 1000 years wheat yields to increase from 0.5 to 2 tons per hectare (ha), but then wheat yields climbed to over 7 tons per ha during the 20th century” (Hazell, 2009). Through such advancements, “the number of people fed annually by one American farmer steadily increased over the years from 73 people in the 1970s, 129 people in the 1990s, 139 people per farmer in 2000s and 155 in 2010.” (Sullivan, 2014).

2.2 Current situation

Today, the world is producing enough food for all its inhabitants. However, resources are unequally distributed across the globe (“The 2050 challenge to our global food system", 2011) and, therefore, about 10% of the world population suffer from hunger ("The Inequalities of Hunger", 2017). The following section explains theoretical concepts needed to better understand the current situation and outlines the challenges of today’s access to food and water.

Several tools are used to measure hunger and how food is distributed across the globe. The Global Hunger Index (GHI) “measures and tracks hunger at the global, regional and country level” (von Grember et al, 2016, p.7). The GHI is measured based on 3 dimensions: Inequality of food supply, child mortality and child undernutrition. A person is considered undernourished if she eats less than 1800 kcal / day (von Grember et al, 2016, p.7), while the caloric intake of an average adult should amount 2400kcal. Another tool used is the notion of Food Security, which was first defined by the FAO (Food and Agriculture Organisation) in the 1970s. Food security is based on three pillars and their respective stability: Food availability, Food accessibility and Food Utilisation. (FAOa, 2008, p.1).

Although the world’s population has been growing rapidly, the calories available per capita per day have increased steadily in all parts of the world since the 1960s (Figure 2), mainly due to the innovations in agriculture previously mentioned. Figure 2 also indicates that the food supply and its growth vary across continents. For example, the most significant increase in caloric

supply over the past 50 years was in Asia and Africa. Caloric supply for more developed regions such as Europe, and Oceania has been constant since 2000 and the caloric supply for North America has been stable since 2000 (Roser & Ritchie, 2017). The steepest increase comes from the less developed countries and poorer regions in the world, which indicates that inequality in terms of caloric supply is in the world is decreasing (Roser & Ritchie, 2017).

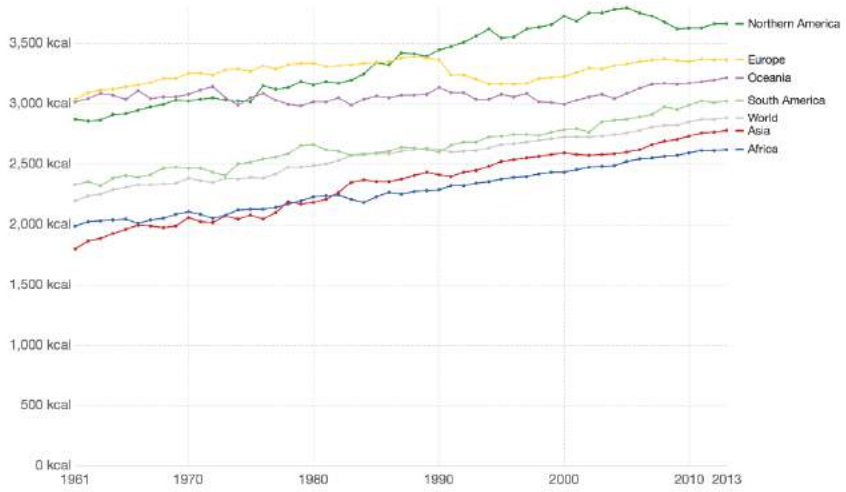

FIGURE 2: FOOD SUPPLY BY REGION IN KILOCALORIES PER PERSON PER DAY, 1961-2013

Note: *Daily caloric supply per capita long-term,* by FAO (2017) retrieved from https://ourworldindata.org/food-per-person/

Still, the Global Hunger Index (GHI) estimates that “52 out of 119 countries have levels of hunger that are serious, alarming or extremely alarming” (von Grember, 2016, p. 16). Although this number has decreased over the past decades, research has shown that global hunger has recently started to increase again (FAO, 2017, p. 2). The access to food and water has especially deteriorated in regions such as sub-Saharan Africa and South-Eastern and Western Asia (FAO, 2017, p. 6).

Thus, access to food and water remains an essential factor for sustainable developments of societies (von Grember, 2016, p.3) Thus, to improve the situation of the currently 800 million people suffering from hunger as well as to anticipate future demand, the UN has set fifteen sustainable goals in 2015 to be achieved by 2030, e.g. end poverty, protect the planet and ensure prosperity for all ("Zero Hunger: Why it matters", 2015, p.1). The objective is to end hunger by making agriculture and food systems sustainable, achieve food security and provide adequate nutrition and health ("Zero Hunger: Why it matters", 2015, p.1).

3. Population growth and access to food and water in the future

While in the past food production could keep up and even outpace population growth, it is uncertain what will happen in the future. In the following chapter, projections will be given with regard to this question. Then, challenges resulting from these projections will be shown, before possible solutions are given.

3.1 Projections

The United Nations has made three different projections for population growth until 2100 as depicted in Figure 3. If the population growth follows the medium variant projection, the population will continue its rise and could reach 9.7 Billion by 2050 and 11.2bn by 2100. The population growth is therefore very likely to continue its unprecedented growth described in Chapter 2, however slowing down gradually. This is because the number of countries with low fertility rate is likely to increase in the future. Indeed, the growth rate of population is expected to decrease from 1.2% in 2010 to 0.4% by 2040-2050 (Alexandratos & Bruinsma, 2012, p.29).

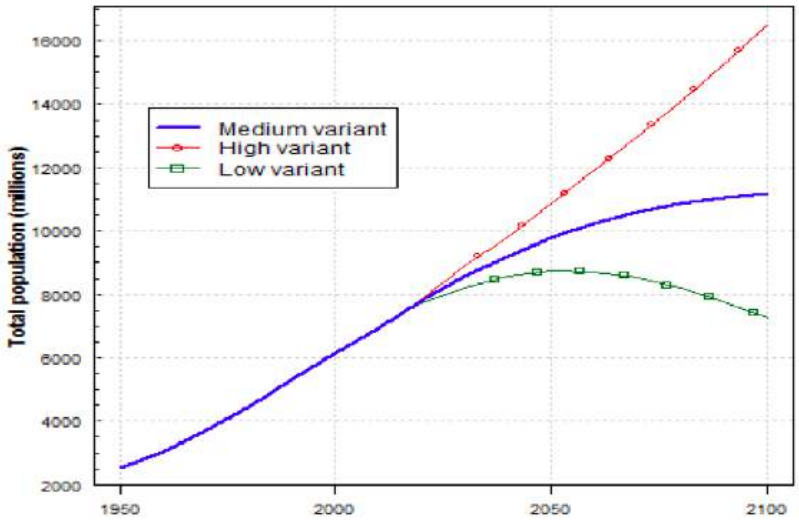

FIGURE 3: TOTAL POPULATION BY VARIANT

Note: *World Population Prospects 2017*, by United Nations DESA Population division, retrieved from https://esa.un.org/unpd/wpp/Graphs/DemographicProfiles/

If the medium variant projection happens to be true, population growth is estimated to peak in 2075 with 9.4 billion and then start its decline and reach 9.2 billion by 2100 (Alexandratos & Bruinsma, p.29).

It's fair to say that the high and medium variant will put pressures on the resources and that the current situation needs to be improved. In order to meet the growing demand, the FAO report recommends increasing the production by 60% (Alexandratos & Bruinsma, p. 95.) If already today approximately 10% of the world population doesn't' have access to food, how will the situation evolve with an additional 2 billion people by 2050? The following section explains the challenges related to this necessary 60% increase in food production. and the overall challenges concerning food security in the future.

3.2 Challenges

As mentioned before, the main problem today when it comes to access to food and water is the inequality in the distribution of resources. Research has shown that it would be possible to produce more than enough food for the population in 2050, but that food security for all will not be achieved: "FAO's 2006 baseline projections show that by 2050 the world's average daily calorie availability could rise to 3130 kcal per person, an 11% increase over its level in 2003. This would by 2050 still leave some 4% of the developing countries' population chronically undernourished" (Alexandratos & Bruinsma, 2012, p. 95.). For several reasons, reducing inequality will remain a huge challenge in the future.

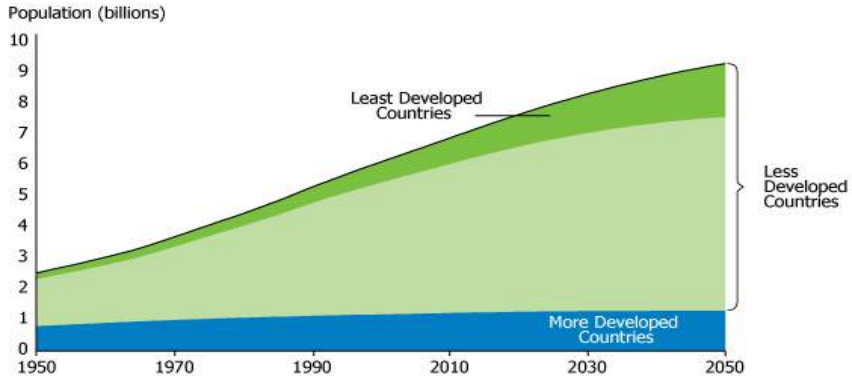

FIGURE 4: POPULATION GROWTH MORE AND LESS DEVELOPED COUNTRIES

Note: *World Population Prospects: The 2010 Revision, medium variant* (2011) retrieved from http://www.prb.org/publications/Datasheets/2012/world-population-data-sheet/fact-sheet-world-population.aspx

As can be seen in Figure 4, the highest population growth will come from less developed regions. These areas, such as Sub-Saharan Africa and South Asia, also have the highest food deficit in the world and are thus most food insecure. These regions are the least equipped to produce sufficient food for such an increase in population.

To increase the global production by 60% by 2050 like FAO recommended, developed countries should increase production by 24% and developing countries by 77% (Alexandratos & Bruinsma, 2012, p. 95.). With the current infrastructures and respective situation in these countries, achieving this growth in production remains a challenge. Further, population growth is not the only factor driving food demand and supply. Other factors such as rise in income or the change in climate will also impact the demand and supply of food and water.

A rise in the per capita income impacts diet. For example, a rise in prosperity will impact the per capita food consumption: "The nine billion people that we expect to be on the planet by 2050 or before may consume more like 12 billion people based on today's food per-capita consumption rates" (Likens). Further, a population with higher incomes will be more likely to eat meat, which in turn needs more water to be produced. It is projected that food demand will increase by 50% by 2050 and more specifically meat demand by 85%.

The decrease of the quality and quantity of arable lands also plays a role. Erosion, deforestation and urbanisation impact the space available for agriculture. Therefore, in the future farmers will have to produce more on a smaller surface (Kwasek, 2012, p.709). In addition to that, climate change will considerably impact the environment in unprecedented ways, which is why this challenge is hard to predict. Nonetheless, it cannot be ignored, as it will have an influence on food demand and supply in one way or another.

Access to water will play a significant role in access to food. Although 71% of the surface of the planet earth is covered in water, less than 4% is actually fresh water (Perlman, 2016). Besides being used for human consumption, this fresh water is also used for agriculture, energy and industry. The Worldbank estimates "that with current population growth and water management practices, the world will face a 40% shortfall between forecast demand and available supply of water by 2030" (Water Overview, 2017). Growing population, rising incomes and expanding cities will increase the demand for water, and ensuring a reliable supply is challenging and uncertain.

As of today, about 70% of the world's fresh water is used for agricultural purposes, and it will not be possible to reach food security without a proper management of the existing water resources (Water Overview, 2017). Climate change will probably reduce the current water supply while we are facing an increasing demand. Similar to food scarcity, water scarcity will increase migration and could trigger civil conflicts, increase disease and mortality (Tran, Koncagul & Connor, 2016, p.1). In addition to that, the projections on economic development are alarming, "some regions could see their growth rates decline by as much as 6% of GDP by 2050 as a result of water-related losses in agriculture, health, income, and property sending them into sustained negative growth" (Tran, Koncagul & Connor, p.1). It is therefore crucial to

undertake changes and implement sustainable solutions to hinder the negative impact of water scarcity.

3.3 Possible solutions

As described above, there are significant challenges ahead. At the same time, there are different possibilities for humanity to change the path it is on and overcome named challenges, which will be explored in the following.

Most importantly, technological progress and innovation are key to improving agricultural practice and increase efficiency in production. Therefore, public and private investment in research and development in this area are essential. Through public investment, on the one hand, independent researchers at universities could focus on the overarching challenge humanity faces, without having to think about profit-driven business needs. Private investment, on the other hand, could have a more direct impact through its business model.

Moreover, it is important to encourage farmers to invest in better technologies by helping them with loans and financial planning. This will have a direct as well as long-term impact on crop production. Through micro-loans the same could be achieved in less developed countries, which would tackle the distribution problem at the same time.

Managing the evolution of prices will also be important. As low-income countries will suffer the most from lack of resources, price stability at affordable levels is essential to guarantee food accessibility to everyone.

Furthermore, adaption from high-income countries, such as a change in diet that reduces meat consumption, would positively impact food security. This could be achieved either through legislation forbidding certain foods and highly inefficient ways of food production, or by promoting more sustainable and efficient foods through subsidies or educational campaigns.

Regarding population growth itself, the further introduction and widespread adoption of contraception will be critical. As described above, most of the future population growth will come from developing countries. There, contraceptive measures are either too expensive for the general population or frowned upon culturally, which is why continued educational campaigns as well as subsidies are crucial.

Taken together, we assume that also in the future demand for food will be met with appropriate supply, as humankind is an innovative, ever-evolving species. Keeping past developments in mind, it is clear that in the face of challenges humanity adapted and found a way to improve its practices, e.g. through the green revolution. Through continued investments, one can almost be sure that the same will also be the case in the future. Combined with the fact that most projections estimate that the world's population will not grow indefinitely but plateau at some point, these points and possibilities lead us to the conclusion that humanity will be able

to produce enough food for everyone in the future. Nevertheless, the challenge will be the allocation of resources to the right regions, as described above, and failure is not an option.

4. Malthus

While we project that a limit with regard to population growth and food and water will not be reached, there have been several theories for the same topic in the past. Probably the most famous one is the Malthusian theory on population growth by Thomas Robert Malthus, which was first published in 1798 through his Essay on the Principle of Population. This book was one of the earliest works on population growth and is still today widely cited by scholars. While Malthus has not been right with his theory until this day for various reasons, we are yet to see how it plays out in the future.

4.1 Malthusian Theory of population growth

Essentially, Malthus' theory can be summarized through the description of the Malthusian catastrophe, which can be seen in Figure 5. A Malthusian catastrophe is the situation "when population grows to such an extent that it can no longer be supported by the agricultural production of a region, country or planet" (Strydom & Struweg, 2016). According to Malthus, this happens as "the human population increases geometrically (exponentially, 1, 2, 4, 8, 16, 32…) [… and] food production could only be increased linearly (1, 2, 3, 4, 5…) and that this would lead to food shortage given the geometrical growth of population" (Seidl & Tisdell, 1999). At this point then a hunger crisis would ensue, leading to a decreasing population until agricultural production is again higher than the demand of the population. Eventually, however, when the population can again be comfortably fed, the population would grow again and the cycle would start anew. The reaching of the Malthusian catastrophe in this cycle was said by Malthus to be inevitable, who stated that "the power of population is so superior to the power of the earth to produce subsistence for man, that premature death must in some shape or other visit the human race" (Malthus, 1798). Looking at the development of population growth since the publishing of Malthus' theory, however, it becomes clear that he has not been correct. There are several reasons for this, which will be explored in the following.

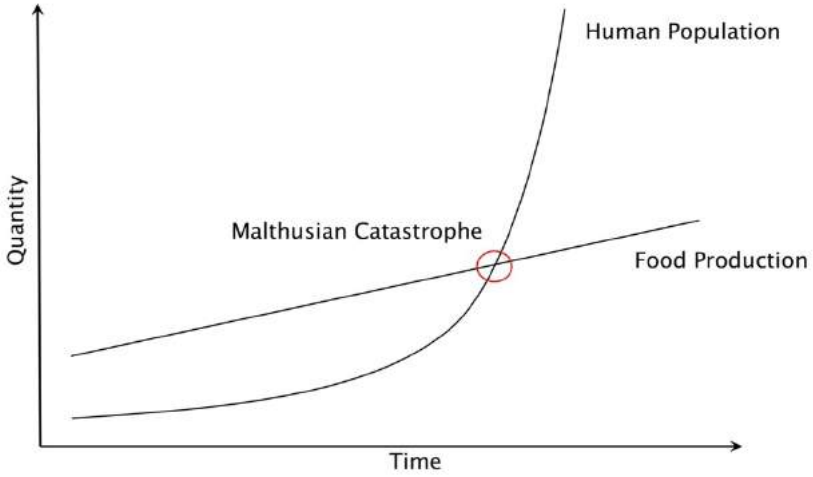

FIGURE 5: BASIC MALTHUSIAN THEORY OF POPULATION GROWTH

Note: *the Maltusian Growth Model*, by GEOG 30, retrieved from https://www.e-education.psu.edu/geog30/node/328

4.2 Why was Malthus wrong?

One main reason why Malthus' projection has been wrong in past centuries is "that the idea of exponential growth was deduced by Malthus from population growth in North America and was not observed elsewhere at his time" (Seidl & Tisdell, 1999). While he generalized this to the world population, a factor that largely attributed to North America's population growth, immigration, was ignored (c.f. Seidl & Tisdell, 1999). This is a clear mistake by Malthus, as on a global level migration does not play a role in population growth, as described above.

Further, Malthus could not anticipate the world-changing consequences of the industrialization. This development had only started to begin during his time, and thus Malthus might not have given it much consideration. It was not possible for him to understand how much the world would profit from this development, and by how much also agricultural output would increase. Therefore, although in the centuries after his projections populations grew faster than ever, food production still outpaced such developments.

Another assumption made by Malthus which turned out to be wrong was that he considered "food to be necessary for the existence of man and to be the sole limiting factor on human population growth" (Seidl & Tisdell, 1999). As described above, for a long time there had been a positive elasticity between fertility and income, which would substantiate Malthus' assumption that with increasing income and thus food, population grows. Nowadays and in the recent past, however, this elasticity is negative or 0, meaning that when a society becomes richer and thus has more food, fertility rates remain the same or go down. It seems that population growth is not restricted only by food availability, but other factors are also at play. "The result is the opposite of what Malthus predicted: the wealthiest nations with the greatest

food security have the lowest fertility rates, whereas the most food-insecure countries have the highest fertility rates." (Shermer, 2016), as analysed above.

More generally, a conclusion that can be drawn from Malthus' wrong projection is that it is never good in demographics to rely on only a single factor for the development of a theory. There are always several different factors at play, and basing one's assumptions on one sole predictor is almost guaranteed to give distorted results.

5. Summary

Having covered the two main aspects in whether humanity will reach a limit regarding food supply and demand in the future, population growth and food production, over a timeframe of several thousand years in the past and some years in the future, this section will summarize the results. Further, we will discuss limitations of our paper and give an outlook on further research needed.

5.1. Will Malthus be wrong in the future? A summary

Contrary to Malthus projection, a limit regarding food supply and demand has not been reached in the past, and will likely not be reached in the future either. In the past, this has been due to rapid technological developments which could not have been foreseen by Malthus, but also due to some false assumptions on his side. Although the population grew faster than ever before since Malthus published his Essay on the Principle of Population, new and improved agricultural practices even outpaced that population growth. Next to the three- and later four-field rotation and selective breeding, which stem from improved scientific knowledge, the biggest influencing factor has been the industrialization. Since the beginning of this remarkable and also unforeseeable (at least in its magnitude) development, output in general and also for food specifically skyrocketed, enabling the sustainment of the ever-growing world population. Next to this, also Malthus' assumption that when a population has more food it inevitably grows, turned out to be wrong. Nowadays, the elasticity of income with fertility rates is 0 or even negative. Most growth in population numbers does not happen in developed countries, as should be the case following Malthus' logic, but instead developing countries with little resources are growing heavily. Despite this, we do not expect humanity to reach a limit when it comes to food supply and demand. Although the world's population will continue to grow, this growth is expected to slow down, while improvements in the production of food are expected to continue similar to the past.

In a broader sense, however, Malthus does have a point. Looking only at food production, humanity might not reach a limit with its increasing demand, but for other resources such as natural oil this might well be the case. At the same time, humans have been known to continuously innovate, which is why also these developments are not likely to constrain

humanity. For this to be the case, however, continuous investments in research and development, both from the public and private sector, are necessary. Further, the challenge of distribution of wealth and food in particular will continue to increase in importance, and thus needs to be tackled as soon as possible.

5.2. Self Criticism / Limitations

This paper is plagued by similar limitations as faced by Malthus more than 200 years ago. Although we can give a coherent picture of the past and present, our future projections can only be based on current knowledge. Unforeseen circumstances, as had been the case with Malthus and the industrial revolution, cannot be accounted for in this paper. Therefore, the projections given above have to be read with caution. Furthermore, there are several scholarly opinions regarding how much and until when the world's population will grow. We, however, could only focus on one such projection in this paper, the medium variant by the UN, although other forecasts could also become true.

5.3. Outlook on Further Research

Research like this should be conducted continuously to always account for new technical or societal developments. In a few years the outlook might well be completely different, be it for the better or the worse. Furthermore, research looking into other possible ways to avoid reaching the much-discussed limit is needed, both from the population growth and the food production improvement perspective.

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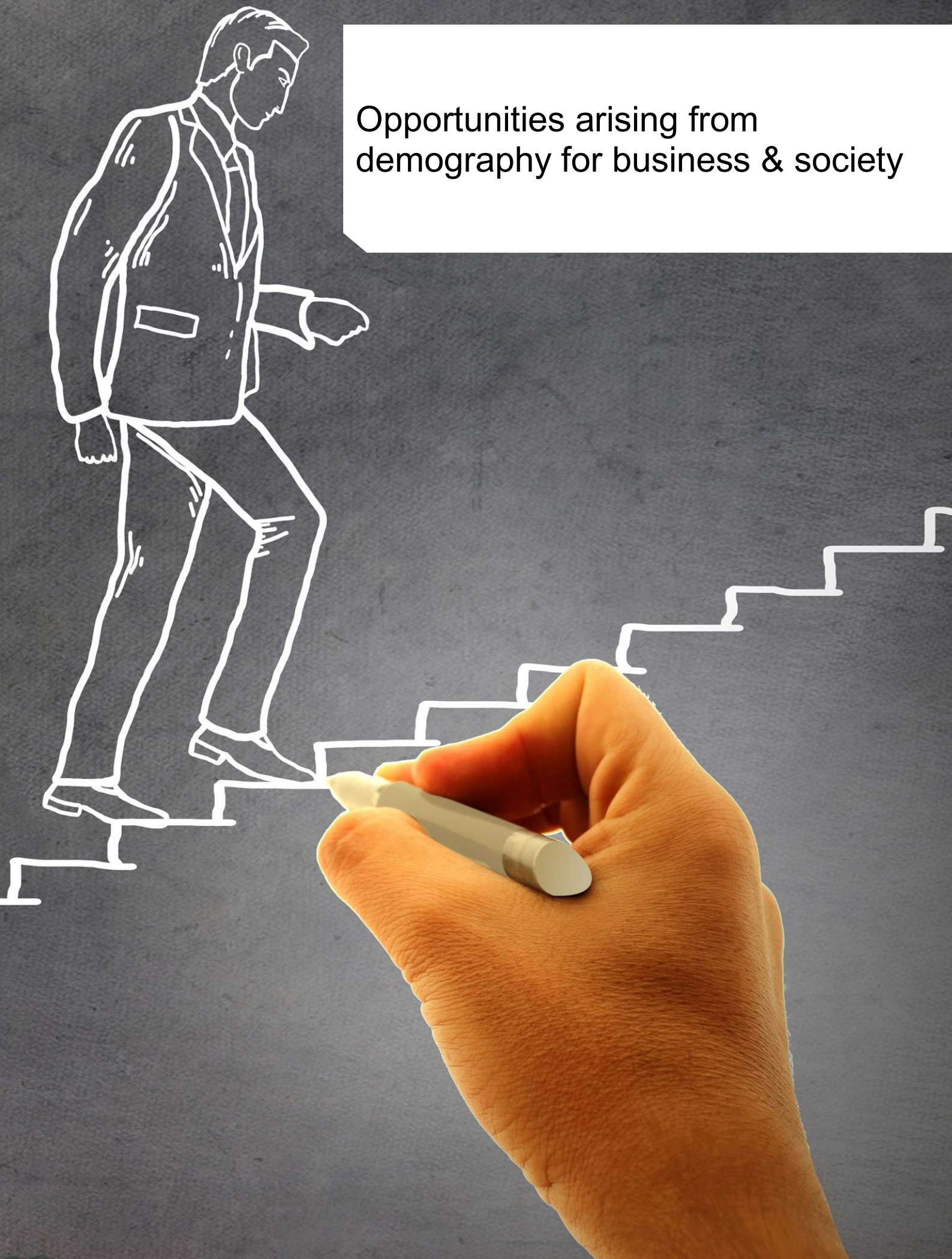
Opportunities arising from demography for business & society



F. Global Demographic Change – Compare the key population dynamics between the 20th and 21st Century. What type of change category will shape the 21st century?

by Jérôme Baume, Gian-Reto Bonadurer & Cédric Lüscher

Demographic change, as one of the five most prominent megatrends, is constantly reshapping the world we live in. This change not only has fundamental impact on today's life, but will also transform the future as we know it. The underlying paper, therefore, seeks to understand the upcoming challenges by discussing the change and underlying drivers of population dynamics in the 20th and 21st century or a unique 200 year time span. A qualitative analysis of three population characteristics leads to the conclusion, that the 20th century was dominated by a population explosion, increased global interaction and the emergence of vast global imbalances in terms of wealth distribution and economic development. In a next step, a forecast for the 21st century yields a shift in global focus to Asia and Africa, where significant increases in wealth, and in the latter case also population, are and will continue to define the century. Lastly, one can also expect a more prominent role of digitization and computing power in the 21st century compared to the 20th century.

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1. Introduction

"As a result of lowered infant mortality, longer lives, and the accelerating conquest of famine there is underway a population explosion so incredibly great that in little more than another generation the population of the world is expected to double."

President Dwight D. Eisenhower on demographic change in 1957. (Cooper, 1991)

As the above quotation of Dwight D. Eisenhower shows, the leaders of our world in the 1950's already anticipated the dramatic demographic changes that have reshaped our world over the past decades. A change that brought with it a doubling of the world population between 1950 and 2000 and was made possible only due to huge improvements in, standards of, and access to healthcare, industrialization, the emergence of computing technologies, and a world economy heavily reliant on cross-border trade. (See chapter 2)

Up until the mid 19th century, population dynamics around the world evolved relatively stable. Had the global population reached roughly 500 to 600 million by 1600, it grew only to roughly 800 to 1'100 million by 1800 (Global Ecology Network, 2017). Growth was limited by high infant mortality and low life expectations due to a general scarcity of food and health care systems (Maddison, 2003, pp. 1-22). Even around 1875 the life expectation in countries like Japan, England or Germany was still below 45 years (Roser, 2017c).

Additionally, the global population lived in silo-like clusters without much direct interaction. Missing means of mass transportation and communication technologies limited more extensive travels. If any large-scale migration patterns occurred, it was mostly because of wars, famines or other disasters (Geo41, 2017). A good example is the emigration of more than two million Irish people to the US due to the potato famine in Ireland in the 1840's (Mokyr, 2017). Comparing these predominately archaic societies up to the 19th century with a modern 21st century society, one starts to wonder what drivers shaped the recent global demographic change. More specifically, it seems crucial to understand what factors and challenges will characterize the 21st century.

The underlying paper takes those thoughts into consideration and further explores the key demographic changes in the 20th and 21st century on a global level. More specifically, chapter 2 first examines the main demographic drivers in the 20th century in three distinct subchapters. By looking at the main population dynamics, interconnectivity and migration flows, as well as wealth distribution the authors extract the main contributors to change. Chapter 3 then replicates this structure for the 21st century and attempts to derive the drivers for demographic change for the remainder of the 21st century. Finally, chapter 4 will combine all findings and conclude with a comparison of the demographic changes and drivers in the 20th and 21st century.

2. The 20th Century

Chapter 2 outlines major drivers of demographic changes during the 20th century. A qualitative and quantitative analysis looks at measures of population dynamics and factors for change. Furthermore, implications of interconnectivity and wealth distribution in the 20th century are explored.

2.1 Population Dynamics

This section examines the population dynamics during the 20th century by first discussing the overall population growth and then assessing the mortality and fertility rates across the globe. Lastly, a glimpse at the aging populations raises awareness for some of the most pressing demographic challenges.

2.1.1 Population Growth

The 20th century was one of the most significant periods with regards to population growth (United Nations, 2000a, p. 1.) Until 1900, global population growth was comparatively slow, reaching 1.65 billion. However, after 1900 it quickly tripled to 6.1 billion in 2000 (Roser & Ortiz-Ospina, 2017c). Looking at these 100 years in more detail, it becomes evident that the rapid growth of the world population started around 1950 at which point there were 2.52 billion inhabitants around the globe. As the above figures uncover, the population would more than double in the next 50 years (United Nations, 2000a, p. 5). What is especially astonishing is the fact that the growth from one to two billion people took 123 years but the growth from five to six billion only took 12 years (United Nations, 2000a, p. 3). This further underlines the impressive speed of population growth during the second half of the 20th century. The last 50 years recorded an extraordinary population growth in absolute terms but also experienced the highest ever population growth rates (United Nations, 2000a, p. 1).

While the trend of population growth can be seen across all continents, the rate at which the continents grew varied significantly. Over the course of the century, Africa grew by 477% and accounted for 12.8% of the global population by 1999 (United Nations, 2000a, p. 6). Asia, the world's most populous region, only grew by 284% from 1900 to 1999 but still made up 60.8% of the global population (United Nations, 2000a, p. 6). With 79% Europe experienced the lowest growth rate during the 20th century and as a consequence lost significant relative share in total world population, which dropped from 24.7% to 12.2% (United Nations, 2000a, p. 6). The strong population growth in the 20th century also raised some major concerns such as the danger of poverty and famines in less developed regions (Van Bavel, 2013, p. 289). It became evident, that better infrastructure, job perspectives, as well as access to water and medical

supplies were required. A necessity that did not become easier with the massive population growth rates witnessed during the 20th century.

But why did population suddenly jump in the 20th century in the first place? The next two sub-chapters will deal with this question and discuss mortality and fertility rates around the globe.

2.1.2 Mortality

One reason for the strong increase in global population is the decline in mortality that occurred in almost all countries, irrespective of initial level and development stage (Ahmad, Lopez, & Inoue, 2000, p. 1175). The population growth that occurred in the first half of the 20th century can mainly be attributed to the decline in mortality rather than high fertility rates for the majority of countries for which data is available. Especially between 1930 and 1950 mortality rates decreased significantly on a global level (United Nations, 1957, p. 4). Countries that experienced high mortality rates at the beginning of the 20th century had the highest decrease in mortality rate (United Nations, 1957, p. 5). However, the decrease in mortality differed, sometimes markedly, across regions. Developed regions such as North America and Europe had already experienced a high decrease by the end of the 19th century, while in developing regions such as Africa and Asia this decrease began only after the end of World War II (Ahmad et al., 2000, p. 1175). As stated in section 2.1.1, the strong increase in the world population began in 1950, which can be partially explained by the reduction in mortality in the less developed countries (United Nations, 2000a, p. 4). Major reasons for the reduction in mortality during the 20th century were medical innovation, public health interventions, economic development, and improvements in waste disposal and water supply (Lee, 2011, p. 3).

During the 20th century, the overall global health advanced however its speed and magnitude varied across different regions around the world. Due to a clear separation of developing and developed countries and the rapid industrialization and wealth generation in developed countries, health improved especially in these developed countries during the late 19th century and first 50 years of the 20th century. These improved health conditions positively impacted the child mortality rate, which can be seen in Appendix A. In North America and most of Europe the child mortality rate was already between 2% to 5% in 1960, while in Africa and Asia it was still between 10% to 40% in 1970. However, in the second half of the 20th century, overall health levels also started to improve in the less developed countries, especially in ones with the highest child mortality rates in 1950. From 1960 to 2000 the annual global number of child deaths[7] declined from 18.08 to 9.78 million. (Roser, 2017a)

With the decline in mortality rates during the 20th century life expectancy increased significantly for all regions. Especially Asia has seen a great increase in life expectancy rising from 42.1 to

[7] Child death refers to deaths that occur between birth and a child's fifth birthday

71.6 years from 1950 to 2015. Africa also experienced a rise in life expectancy during the 20th century, but the rise was tempered due to HIV/AIDS epidemics in the 1990's. Even though Europe and North America already had a 20 - 30 years longer life expectancy than Africa and Asia in 1950 they also experienced an increase during the second half of the 20th century. (United Nations, 2015a, pp. 4- 5)

Just like the overall population growth, the significant decrease in mortality brought about new challenges and transformed the way of living in some regions. An increasing life expectancy (see chapter 2.1.4) and lower mortality rates manifestated an ever-greater burden on health care (Kinsella, Beard, & Suzman, 2013, p. 24) and pension costs, as one can observe in developed countries.

2.1.3 Fertility

Just like the mortality rate, also the fertility rate on a global level declined in the 20th century. At the beginning of the 20th century women in more developed regions such as North America and Europe (except Russia) gave birth to around two to five children, whereas in Asia and Africa women on average had five to eight children (Roser, 2017b). As Appendix B shows, the fertility rate especially declined in the developed regions of Europe and North America during the first half of the 20th century. Interestingly enough, Appendix B shows that the number of children birthed per woman were still increasing in some less developed regions. For example, China's fertility rate first increased from five to six children to six to seven children in the first 50 years of the 20th century. In the second half of the 20th century, the fertility rate then also declined not just in developed countries but also in less developed regions, as can be seen in Appendix B. Overall, it can be observed that the more developed a country became, the lower its fertility rate were.

As a telling indicator of fertility, marriage marks the formation of a family and raises the probablitiy of having children. The younger a woman is at marriage, the longer is her exposure to and potential for pregnancy. In the last decades of the 20th century a clear trend of rising age at marriage occurred. The correlation between fertility rate and marriage age is exceptionally visible in regions such as Asia where marriage age among young women increased and the fertility rate dropped

(see Appendix B). The relationship is also evident in Africa, where the countries that had the fastest fertility declines between 1970 and 2000 also only had less than 10% of married women at age 15 to 19. On the other hand, the reduction of fertility is also highly attributable to the increased usage of contraceptives in developing regions. Developing countries that had reached the highest contraceptive prevalence level in the late 20th century experienced a faster fertility decline, most notably Algeria and Vietnam. (United Nations, 2000b, pp. 137-141)

As one can derive from the above figures, an increased level of and access to knowledge (see chapter 2.2) played a vital role in the decline of fertility rates in the 20th century. Studies have shown that a woman's education is negatively correlated with the number of child births. During the 20th century the educational conditions for women changed for the positive towards an educated female population in many countries around the world, which ultimately led to a reduction in fertility rates. (United Nations, 2000b, pp. 141-142) To summarize, the 20th century advancements in education and contraceptives as well as increase in marriage age caused fertility rates to decline. It finally caused global population growth rates to decline after a peak in 1965 (United Nations, 2000a, p. 4).

2.1.4 Aging Population

As the previous chapters have already shown, the 20th century represents a period of demographic change on a global scale and at an unprecedented rate. The aforementioned decrease in mortality as well as the simultaneous changes in factors affecting fertility profoundly impacted the population's age distribution (Kesternich, Siflinger, Smith, & Winter, 2014, p. 1). On a global level, the population pyramid in 1950 displayed an expansive form, meaning that the global population was made up of a higher percentage of young people than old, giving the pyramid a triangular shape (United Nations, 2017a). As Appendix C illustrates, about 44% of the total global population was under 19 years old, while only 13.5% were over 50 years of age, which is a sign of an overall growing population (United Nations, 2015b). While Western Africa and Asia exhibited comparatively expansive population pyramids in 1950, Western Europe's distribution was more stationary (Appendix D), reflecting a stagnating population growth rate. This supports Europe's demographic transition to decreasing fertility and mortality rates.

In comparison, Appendix E shows the 1950 population pyramid of the United States of America [US]. Similar to Western Europe, the US had, by 1950, also begun its demographic transition, demonstrated by the contraction of the pyramid's shape (US Census Bureau, 2016). The US population pyramid also reflects the beginning of the baby boom, which was set in motion by the end of World War II. The baby boom is a prime example of the common phenomenon of increased fertility rates in post-war settings. The pear shape of the US population pyramid in 1970 with a very wide base (Appendix F) further illustrates this. Compared to the 1970 pyramid of Western Europe, the baby boom had a much more visible effect in the US, although still present in Europe. Appendix G shows the pyramids of different regions by the end of the 20th century. One common theme found across all regions' population distributions is the higher life expectancy. Throughout the 20th century new medical technologies have both lengthened population pyramids as well as widened its upper ends. This trend again echoes the increase in 20th century life expectancies and the challeneges brought about by it. (see chapter 2.1)

2.2. Interconnectivity

After section 2.1 concerned itself with main population dynamics during the 20th century, section 2.2 now discusses three factors related to interconnectivity. Although these factors all differ in their peculiarities, they have all vastly changed the way today's global societies interact with each other.

2.2.1 Migration Flows, Transportation & Trade Integration

As outlined in the introduction, the great migration flows up to the 20th century were mainly caused by wars, economic crises and famines. A fact that remained true well into the 20th century, as the two world wars portrayed (Zolfagharifard, 2016). However, what changed drastically compared to earlier centuries was the directionality with which those migration patterns and population movements were made possible (Geo41, 2017). The innovation and emergence of mechanical means of transportation, for example the first plane in 1903, allowed people to move more freely between countries and continents (History, 2017). What is important to note is that intercontinential migration patterns in the late 19th century and early 20th century were dominated by linear patterns between colonies and their colonising countries, while at the end of the 20th century non-linear migration from anywhere to wealthy "North" countries gained the upperhand. An example would be the migration of Philippinos to the US. A fact that not only symbolizes the correlation to historical miseries, but, interestingly enough, also hints at an overlapse with the temporally shifted access to technology. (United Nations, 2013)

With the availability of mechanical travel and the end of the Great Wars, cross-border trade also began to flourish. As Appendix H shows, a first wave of globalization under the lead of European imperialists found an abrupt halt in 1913. Only after the WWII did international trade integration pick up again. At the end of the 20th century, trade integration stood at 50%, compared to roughly 20% around 1900. Especially important is that trade, and thus interconnectivity, among emerging countries grew significantly. Between 1980 and 2000 it almost tripled in size, underlining that means of transportation had become accessible to lower income countries. (Roser & Ortiz-Ospina, 2017a)

2.2.2 Emmergence of Computers & Access to Knowledge

A true game-changer in the 20th century was the emergence of computers, invented by Alan Turing in the 1940's, and the internet in the 1990's (Espiner & Heath, 2017). Very few innovations have shaped the lives of today's societies with such disruptive power. Computers and the internet firstly enabled large-scale access to and storage of knowledge. Secondly, they significantly reduced the cost to do so. Before computer technology, people were reliant on expensive books and the mechanical printing of such. In that sense, also poorer regions and

economies now gained access to learning platforms and storages of knowledge. As Charles Kenny, a senior fellow at the Centre for Global Development rightly points out, *"This technology wasn't developed as a development tool yet has become one of the greatest vehicles for change"* (Kelly, 2013). Kenny further argues that the younger, digitally native generations seem to make full use of the potential of computing technology and the internet as force of innovation and education (Kelly, 2013). The newly available computing power also coincides with a significant drop in global illiteracy rates. Had the world illiteracy rate been at roughly 75% in 1900, it slowly dropped to 60% in 1950, and then suddenly crashed to 17% in 2000 (see Appendix I). (Roser & Ortiz-Ospina, 2017b). Although the data is controversial, and no clear causality can be identified, one can assume that computers and the internet gave people a significant advantage in knowledge sharing and information processing and ultimately allowed them to reduce illiteracy rates. All in all, one can summarize that computers significantly changed the way people interract.

2.2.3 Urbanization

Although cities have existed for more than 5 milleniums, only 2% of total world population lived in cities around 1800 (United Nations, 2011). In the 19th and 20th centuries, this figure then started to change dramatically, leading to huge interregional differences in the level of urbanization. Regions that share a high level of economic growth usually also display a higher rate of urbanization. Thus, it is not surprising that the first countries that underwent a systematic urbanization trend were in Europe and North America and later in the 20th century rich Asian countries. The reasons why so many people suddenly started to abandon their rural dwellings are plentiful. However, one can usually hold missing job prospects on countryside, better access to medical care, higher life expectancy and higher wages in cities accountable for the shift. If one considers the 19th century industrialization in Europe where cities required factory workers, this seems to make sense (BBC, 2017). Appendix J depicts the aforementioned differences in urbanization from 1950 onwards and allows a glimpse into the future. (United Nations, 2014, p. 8)

2.3 Wealth Distribution – Evolution

Section 2.3 assesses the evolution of the GDP of selected countries as well as the related income distributions within those economies. Before doing so, one should however consider a few theoretical standpoints. Simon Kuznets' (1958) paper on income equality in the US, UK, and Germany suggests that income inequality in all three economies decreased following the start of WWI, while per Capita GDP increased across the board. Kuznets further argues that income inequality is low in agriculture based economies and that this inequality increases as more people move to the industrial sector. Furthermore, author Thomas Picketty (2014) in his book, *Capital in the Twenty-First Century*, builds on Kuznets' argument using more data to

posit that income distribution over the 20th century follows a U-shaped curve, meaning that over the course of the 20th century income inequality started out with high differences in incomes between rich and poor, then dipped during the two World Wars and Great Depression only to rise again in the 80's. Appendix K graphically portrays Picketty's findings in selected economies and clearly illustrates the U-shape Kuznets pointed out (Cassidy, 2014). The onset of the Great Depression put a damper on income inequality, causing levels to bottom out in the 80's. In recent years, the growth of the technology industry, increased trade, and institutions have pushed inequality back up to pre-war levels globally (Baranoff, 2015).

Whereas Picketty's analysis lends itself well to the determination of wealth distribution within a country, GDP measures enable comparisons of wealth between countries, which is equally important in assessing the global demographic impact of wealth. While the global GDP in US Dollars was $1.367 trillion in 1960, this value exploded over the course of the next 40 years, reaching $33.5 trillion in 2000 (The World Bank Group, 2017). Based on the dataset and analyses of Angus Maddison (2001) and subsequently Ivan and Oleg Kitov (2012), an explosion of GDP per capita occurred between 1940 and 1950 in recorded OECD countries (Appendix S). On a global level, Japan experienced the highest GDP growth between 1820 and 1998 with an average annual compound growth rate of 1.93% per capita, almost 0.75% above the global average (Maddison, 2001, p. 28). While, in 1913, Western Europe made up about 33% of the World's total GDP, in 1998 Asia (excluding Japan) lead all regions with 29.5% of total GDP (Maddison, 2001, p. 261).

The global GDP explosion in the latter half of the 20th century from less than 1 trillion US Dollars in 1960 to upwards of 70 trillion US Dollars in 2015 represented a 70-fold increase (Appendix L). In fact, all countries, including developing ones, experienced similar magnitudes of increase in relative terms. In terms of GDP growth, however, the world has experienced a decrease from 5% to 3%. This global metric was primarily driven by a slowdown in North American, Asian, and European growth rates. In comparison, Sub-Saharan Africa's average annual GDP growth rate increased by 0.5% to 4% over the last 50 years (Appendix M). (The World Bank Group, 2017)

The reasons for this rapid global economic expansion are varied. The destruction left behind by World War II spurred investments in the reconstruction of entire cities, especially in Europe and Asia (Kesternich et al., 2014, p. 5). Infrastructure expenditures increased in the US too, for example with President Eisenhower's Federal Highway Act of 1956, which caused price reductions in 32 of 35 industries studied in Nadiri and Mamuneas' (1994) paper titled *The Effects of Public Infrastructure and R&D Capital on the Cost Structure and Performance of US Manufacturing Industries.* The Cold War prompted immense levels of military spending in the US and Russia (Higgs, 1998). Increased international cooperation and trade coupled with reductions in transportation costs (a result of the switch from coal to oil), and improvements in

productivity, especially in agriculture, made more goods and services affordable for more people (Nadiri & Mamuneas, 1994). Increased spendable income further pushed consumption and, therefore, GDP to new heights.

Tying together population dynamics in terms of fertility and mortality and GDP development it is evident that demographic transitions contribute substantially to economic prosperity, as can be seen with East Asia's so-called economic miracle. The improvements with respect to reductions in mortality rates, combined with lower fertility rates positively influence economic strength, for which China is the ideal example. (Bloom & Williamson, 1998)

3. The 21st Century including Forecasts

After discussing the key global demographic changes for the 20th century, this chapter will mirror the structure of the previous chapter and outline the crucial changes and developments in population dynamics, interconnectivity and wealth distribution in the 21st century. More importantly, the forecasts in this chapter will give a hint at which, and how, demographic factors will shape the 21st century.

3.1 Population Dynamics

Section 3.1 entails crucial drivers of population dynamics in the 21st century. First, the overall population growth will be discussed to then elucidate its reasons and other changes in the following subchapters.

3.1.1 Population Growth

Over the last 17 years the population grew from 6.1 to 7.6 billion, adding the last billion within just 12 years (United Nations, 2017b, p. 26). Asia still has the greatest share of global population with 4.5 billion, amounting to 60% of the world population. Africa accounts for 17%, while Europe and North America only have 10% and 6%. According to the United Nations' (2000a, p. 1) report the 21st century will experience a slower population growth rate compared to the previous century and is expected to decrease continuously through the 21st century. Europe and the US are expected to lose share in world population throughout the 21st century (United Nations, 2017b, p. 27). Looking at United Nations forecast in Appendix N it is evident that Africa will experience the greatest population increase during the 21st century. About 40% of the total population will be living in Africa by 2100, while Asia's share of the world population will drop to around 43% as its population starts to decrease from 2050 onwards.

The current global population growth rate is 1.1%, which will lead to a population of 9.8 billion in 2050 and 11.2 billion in 2100 according to United Nations' (2017b, p. 24) forecast. However, experts are in dispute whether the population will endlessly grow or whether there will be an upper limit, a so-called "carrying capacity" as coined by Malthus in 1798. Due to the exponential

population growth, certain factors such as food and water availability, cultivatable land and non-renewable resources might experience an upper threshold (Seidl & Tisdell, 1999, p. 396). Hence, when looking to the future, the notion that population tends to outrun subsitence (Seidl & Tisdell, 1999, p. 397), could potentially lead to an intensivied fight over precious resources. Taking into consideration the effects of technological improvements, however, it is possible that the resource scarcity problem is pushed further into the future or even resolved. Evident at this point is that non-renewable ressources are being extensively consumed at an increasing rate and that the finite water supply could therefore become more valuable in the future (Hinrichsen & Robey, 2000, p. 1). Therefore, unless new technological advancement or a fair redistribution of resources are capable of solving these issues, there might be a cap on global population resulting from local resource scarcity. On the other hand, given the astonishing achievements in the field of technology and medicine so far, one can be quite optimistic. Moreover, under the assumption that Africa and Asia further develop, the population could potentially reach a steady point, driven by population dynamics rather than local scarcity. All in all, the population growth, especially in Africa, will remain a major driver for demographic change also in the 21st century.

3.1.2 Mortality

The global mortality rate continued to decline in the beginning of the 21st century. All three categories – Infant mortality, under-five mortality and adult mortality – decreased (United Nations, 2017b, p. 3). Adult mortality[8] declined significantly due to changes in risk behaviours and medical interventions such as the detection and treatment of cervical cancer (United Nations, 2015a, p. 7). 35% of the adult population now live in countries with adult mortality rate of 10%, whereas in 1950 45% lived in countries with a 45% adult mortality rate (United Nations, 2015a, p. 7). However, there is a noteworthy difference between developed and less developed regions. Africa still has the highest adult mortality rate, while Europe has the lowest (United Nations, 2015a, p. 8).

Looking forward, one can assume that the mortality rate will further decline throughout the 21st century but at a lower rate. The medical advancements and the strong focus of international organisations such as the United Nations or the World Health Organisation in reducing mortality will further positively impact mortatliy rates. An example is the improved, but not perfected treatment of HIV/AIDS. Although the number of HIV infections has decreased since the late 1990s to 2009 by 20%, it still has a crucial impact on health, mortality and life expectancy in many regions around the world (Lee, 2011, p. 3). Overall, the expected decline in mortality is well summarized in a United Nations' (2017b) forecast. It predicts an immense

[8] Adult mortality refers to the probability of dying between the age of 15 and 60 years

mortatliy decline and increase in life expectancy for Asia and Africa over the next 75 years. This undeniably has the potential to alter 21st century family dynamics and population distribution in the developing countries, also creating new challenges regarding infrastructure and health care costs for these countries.

3.1.3 Fertility

Unsurprisingly, the great decrease in fertility that took place in the late 20th century also continued in the early 21st century. It is even likely to continue over the next several decades. Africa still had an overall fertility rate of 4.72 children per woman in 2015 (United Nations, 2017b, p. 15). Asia is slightly above reproduction rate with 2.2 children per woman, while North America and Europa is below with a fertility rate of 1.85 and 1.6, respectively (United Nations, 2017b, p. 28, 37). As mentioned above, Africa will experience the strongest population growth in the 21st century. This is because many countries in Africa such as Nigeria, Botswana and Namibia are in stage two or three of the demographic transition model (see Appendix O) where the mortality rate decreases before, and faster than, the fertility rate, leading to a natural population increase (United Nations, 2017b, p. 571). This increase in population could substantially impair the quality of life for people in developing countries (Shelton, 2014, p. 138). However, it can be assumed that advancements in education, greater contraceptive prevelance and an increase in marriage age will continue to be achieved and, as a consequence, will cause fertility rates to decrease as well. According to the United Nations' (2017b, p. 15) report the fertility rate in Africa will be 2.14 children per women by 2100. In Asia, the fertility rate will decrease over the next 75 years and fall below the reproduction level, causing the population to decline in the second half of the 21th century (United Nations, 2017b, p. 21). Hence, in the long run developing regions could benefit from lower fertility rate as the paper of Joshi and Schultz (2007) indicates. Lower fertility rates can have many positive effects such as enhanced women's health, increase in earnings and household assets, and improved health and schooling for children (Joshi & Schultz, 2007). Therefore, fertility, as a key demographic factor, predicts a significant change especially for Africa and Asia, likely leading to accelerated development, economic improvements and wealth.

3.1.4 Aging Population

According to the United Nations (2015b) the main consequence of decreased fertility and mortality rates is population aging, which refers to the *"process by which older individuals become a proportionally larger share of the total population"* (United Nations, 2015b, p. 9). This global phenomenon has already and will continue to raise questions concerning the ability of the young to pay the pension costs for the increasing number of elderly recipients (The New York Times, 2013). Appendix P, an estimate of the global population pyramid towards the end of the 21st century, portrays a distribution similar to those of the United States and Western

Europe in the 20th century, with a stagnant to contracting dynamic. As more and more developing countries reach the demographic transitional phases four and five, the global age distribution will more closely reflect that. Although some regions, most notably Africa, still maintain an expansive pyramid (Appendix Q), other regions will experience a contraction of natural population growth rates. Overall, the longevity of human life will continue to define the 21st century in terms of retirement and economic development, among other factors. This in turn makes the aging population one of the most important drivers in shaping demographic change in the 21st century.

3.2 Interconnectivity

After the identification of the change drivers related to population dynamics, section 3.2 is again going to look at the most imminent interconnectivity patterns to discuss relevant interconnectivity drivers.

3.2.1 Migration Flows, Transportation & Trade Integration

In 2015, there were 244 million migrants globally, i.e. an increase in absolute numbers of 60% since 1990. Although changing political paradigms, for example the end of the Soviet era, and population increase justify much of that growth, there still remain questions regarding the increase in migration and interactions. (United Nations, 2015c, pp. 1-4) An evident reason for the increase is the spike in global mobility. As section 2.2 showed, mobility accelerated rapidly in the 20th century, allowing people to interact, trade and share ideas more freely. Today, at any point in time, more than 500'000 people are sitting in planes globally (Flightaware, 2017), a number that equalizes a 260% increase in flight passengers since 1990. It is not surprising, that thus global interactions again spiked considerably over the last 15 to 20 years.

As a result, one can forecast the total number of migrants and travelers to increase even further over the course of the 21st century. Moreover, projects like Elon Musk's Hyperloop or Space X will further redefine the modern-day transportation systems (UITP, 2017) and allow more people to access public transportation at a lower cost. Living in such an interconnected world, migration and travel flows will no-longer be bound to surrounding areas. Migrants and travelers will be able to reach virtually any corner around the world within hours. Although this is possible already today the time restriction will be much lower. The expected technological advancements will thus create new social challenges and will require systematic approaches to migration and integration, precisely because of the unprecedented level of mobility. (Compass , 2017, pp. 1-3) It will be interesting to see, how governments react to that challenge. As the Africa-Europe migration showed, the effectiveness of policies instated is not always clearly visible. Migration and subsequent challenges will be of utmost importance in the coming years.

3.2.2 Digitalization, IoT and Smart Computing

While the second part of the 20th century was greatly influenced by the emergence of computers, the technological advancements in the 21st century so far have been driven by digitalization and the further development of the internet. Smartphones, tablets and other connected devices allow people around the world to interact via social media and messenging apps. As already outlined in chapter 2.2, this will especially benefit less developed countries as they receive broad access to knowledge. To put this into perspective, today mobile phones in developing countries make up four out of five connections worldwide. (Kelly, 2013) The demographic digital divide, however, between people who have access to internet and smartphones and people who do not is still quite stricking. Per capita income and internet access, respectively smartphone access, show an 85% correlation. The West and the rich parts of the rest of of the world thus have a significant advantage for the future years. While the United States show over 80% access to internet, African countries are usually still below 50%. (PEW Research Center, 2017) For the future years, one can expect an alignment of poorer and richer countries in terms of access to these basic mobile and internet technologies. However, one should bear in mind that the headstart of digitally connected countries, i.e. rich countries, is quite significant. It will further allow their corporations to profit economically from the rest of the world. An example is the dominance of American IT giants like Facebook, Google, Amazon or Microsoft and their Chinese counterparts like Tencent and Baidu. (Manjoo, 2016)

3.2.3 Urbanization

As section 2.2 showed, discussions about the 21st century urbanization prospects around the world are closely linked to the prospects for future economic development, expected location of global wealth growth, and expected location of global population growth. The industrialization and increased level of wealth in Europe and North America in the early 20th century allowed the first large-scale urbanization movements. Geographically, the next region to be impacted by this urbanization trend was Asia. More precisely, richer countries like Japan, with the world's largest city Tokyo, and lately China, with its rise to an economic superpower, lead the cohorte. This trend in Asia is still not broken and continues to be a driving force of demographic change in the region. As a result, roughly 55% of the world's population lived in urban areas in 2014, while only 600 cities were home to 1.5bn people. According to the UN, these city dwellers are joined by an additional 180'000 people each day. (United Nations, 2014, pp. 5-10) A forecast taking into account the expected medium-term population and wealth growth in Asia (see sections 3.1 & 3.3), expects that the major drivers for urbanization will thus remain Asia until 2030. The world's most populous cities will all be located in China, India or Japan. China alone will be home to more than 23 cities larger than 5 million people. Looking

at the prospects beyond 2030, one can however expect that the focus will shift towards Africa, due to the ongoing population explosion and wealth growth (see chapter 3.1). A piece of evidence for this is the fact that already today, with 4.5% annually, Africa depicts the strongest urbanization rate globally. For instance, Kinshasa in the Democratic Republic of Congo will double its size to 15 million people in 2025. Globally, more than 65% of people are expected to live in cities by 2030. The trend towards urbanization and relocation of population and wealth to cities will thus remain a key driver in the 21st century. (United Nations, 2011)

All in all, the interconnectivity of all areas around the globe will be increasing significantly during the rest of the century. Major forces for change in population dynamics will be the means to interact and connect. Readers should firstly look at less developed countries in Asia and Africa, which will move closer to the rest of the world. Secondly, one should also bear in mind the emmergence of information and communication technogies. The opportunities and potential to share ideas will be humonguous.

3.3 Wealth Distribution - Evolution

Since the 80's income inequality has been on the rise again (Nielson & Alderson, 1997) to such an extent that the period since has been characterized as the Great U-Turn by Bluestone (1990). Lindert and Williamson (1985) defined the sources of income inequality as being threefold: factor productivity rates, labor force growth, and skills deepening. Furthermore, Nielson and Alderson's (1997) review of income inequality based on US county data stipulated that urbanization and an aging population are two of the main factors positively correlated with income inequality that will drive changes in that respect for the decades to come.

Another widely-used metric for measuring income distribution among the residents of a region is the Gini indicator. Specifically, the coefficient reflects the degree of statistical dispersion with respect to income. While this measure is very telling of income distribution within respective regions, its effectiveness as a comparative measure between the 20th and 21st century is limited due to the constrained amount of historical data. A OECD (2014a) report on income inequality and economic growth measured the change in the Gini Coefficient between 1985 and 2011 (or the latest available data) and found a wide-spread increase among OECD countries. In fact, of the 22 countries measured, only the coefficients of Greece and Turkey decreased. According to the OECD data (Appendix R), income inequality in Mexico remained by far the highest. Overall, Scandinavian countries had among the lowest levels of of inequality, as measured by the Gini Coefficient, throughout the 30-year timespan. (OECD, 2014a) On the basis of those factors, one can argue that income inequality in a global perspective will continue to rise in the future as economic growth continues, the population ages, and people continue the move from unskilled to skilled labor. However, these factors do not account for

any potential policy changes that may be introduced as the division between rich and poor becomes increasingly pronounced.

As of 2015, global GDP has once again reached new heights. In absolute terms, GDP has more than doubled since the turn of the century to $75.5 trillion (The World Bank Group, 2017). According to The World Bank, Luxembourg and Switzerland had the highest GDP per capita of all measured countries in 2016. In terms of total GDP, however, the United States, China, and Japan lead with $18.6 trillion, $12 trillion, and $5 trillion, respectively. According to OECD Data's long-term forecast, world GDP is expected to grow to $221 trillion by 2060, with China expected to account for a quarter (OECD, 2014b).

4. Discussion and Key Factors for Change in the 21st Century

To say the least, the 20th and beginning of the 21st centuries can be characterized by its unprecedented rate of evolution in almost all observable aspects related to global demographic dynamics. From the explosion in population and GDP growth to the variety of advancements global interconnectivity, the world we live in is and will continue to change faster than ever before.

In terms of population growth, the slow down expected in the 21st century will follow a century of unseen growth. Geographically, the total growth will shift from being dominated by Asia to a more even split between Asia and Africa, which will make up about 80% of the population by the 22nd century. While mortality rates dropped during the 20th century for developed countries, the rate in Africa is expected to experience the same decrease in the 21st century. Fertility rates were low in developed countries during the 20th century, a result of an increased average marriage age, contraceptives, and better education. In Asia fertility rates are expected to decrease below the repopulation rate, while in Africa rates are still high but expected to decrease towards the latter half of the 21st century. Life expectancy began to increase among developed countries during the 20th century, spearheaded by Europe and the US, followed by Asia and now Africa. On a global scale, the population continually expanded since the 1900's, characterized by a high proportion of young people. Although the world population pyramid will begin to stagnate during the 21st century, life expectancy is expected to continue its growth.

The population boom of the 20th century undoubtedly impacted the accompanying growth in GDP, but the simultaneous growth in GDP per capita is explained by three main factors. Firstly, immense improvements in productivity reduced costs across the board. Secondly, increased international cooperation and trade pushed investments to new heights. Finally, infrastructure expenditures further drove up GDP globally. As the technological innovation rate continues to rise, this trend will also hold true for the future. At the same time, income inequality and,

therefore, wealth distribution has risen in recent decades and will continue to do so due to the continuance of urbanization and aging trends.

Industrialization was the key driver of global urbanization in the US and Europe during the first half of the 20th century. The same trend followed in Asia over the next 50 years and will be visible in Africa over the course of the 21st century. The adoption of mechanical mass transportation for trade and migration in the 20th century furthermore significantly reduced the practical distance between societies. However, this was still restricted to more developed countries. It follows that during the 21st century those technologies will reach even the poorest countries and migration patterns will lose directionality. At the same time, new technologies will allow us to interact in an unprecedented manner. From a technical perspective, the Personal Computer has facilitated cost-efficient access to knowledge on an unimaginable scale. In the future, digitalization will dominate nearly every aspect of daily life, fundamentally reshaping the way in which we interact.

To summarize, digitization, changing geographic focus to Africa & Asia, population growth, an aging population and GDP growth will thus be the main drivers for demographic change in the 21st century.

5. Critical Reflection

The underlying paper discussed the main drivers for demographic change in the 20th and 21st century. At this point, one should recognize that the assumptions made in relation to this research are all based on current information and knowledge accessible to the authors. Quantitative data were sourced from trusted organizations such as the United Nations, UNESCO, or the World Bank Group, and were supplemented with quantitative as well as qualitative data from scholarly articles, reviews, and journals. This paper, however, focused mainly on qualitative factors for analysis, meaning that further research on this subject could include more quantitative aspects to better support conjectures made in this research. Furthermore, this paper largely omits environmental factors relating to demographic dynamics in an aim to narrow the scope of research, avoiding a dilutive effect. That being said, environmental factors could have the capacity to affect demographic trends and thus could be further researched.

Lastly, to circle back to the introductionary quote by Eisenhower, one should be aware of the immense demographic shifts shaping our world. The research showed that major changes are still to come. It will be interesting to see how they shape our everyday lives.

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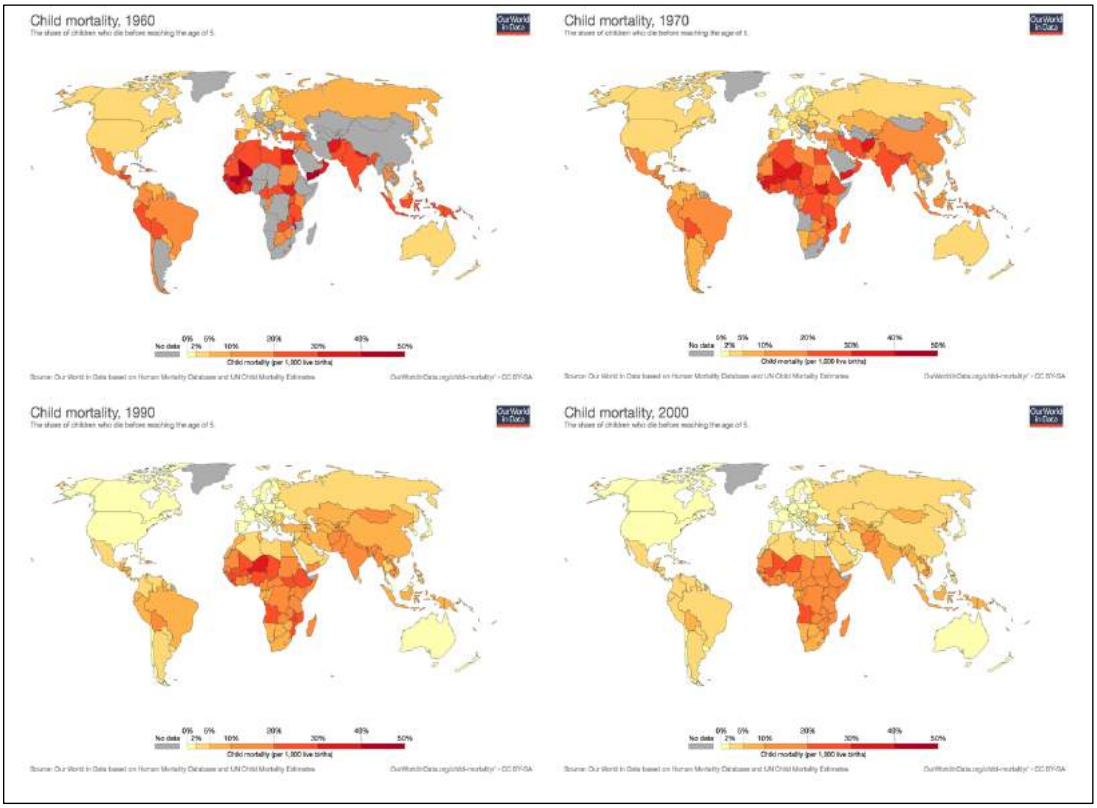
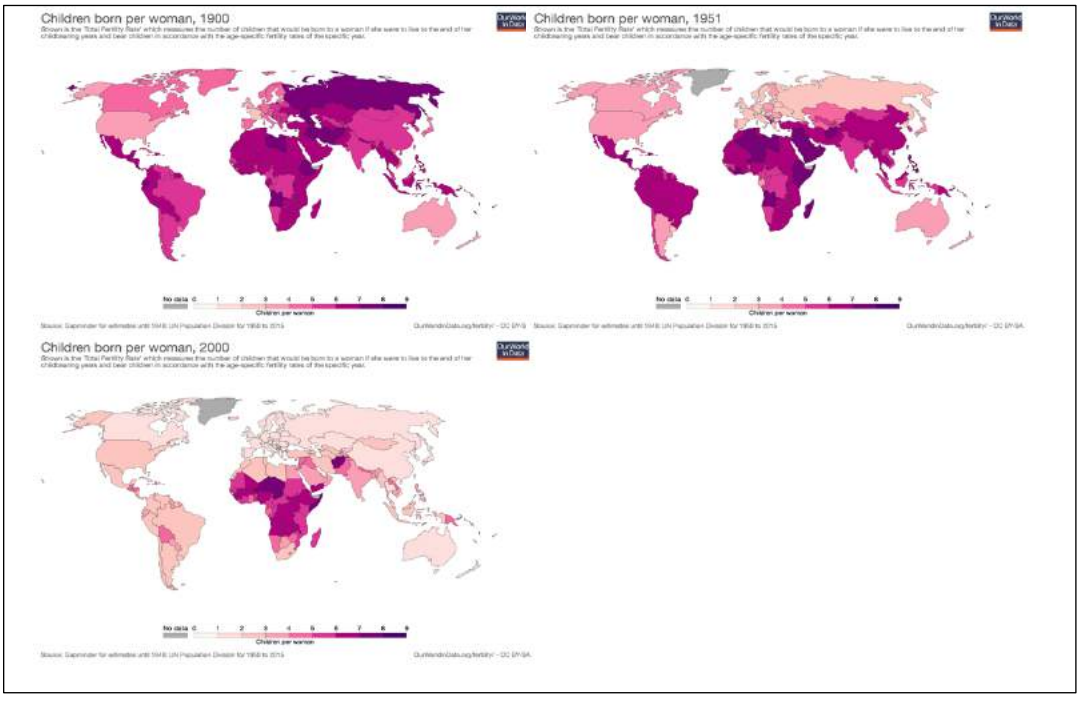
Appendix

A. Evolution of Child Mortality across the World during the 20th Century



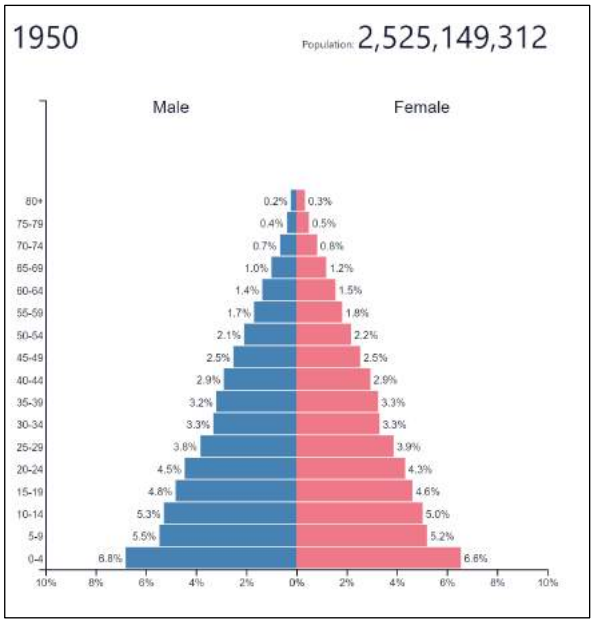
(Roser, 2017a)

B. Evolution of Fertility Rate across the World during the 20th Century



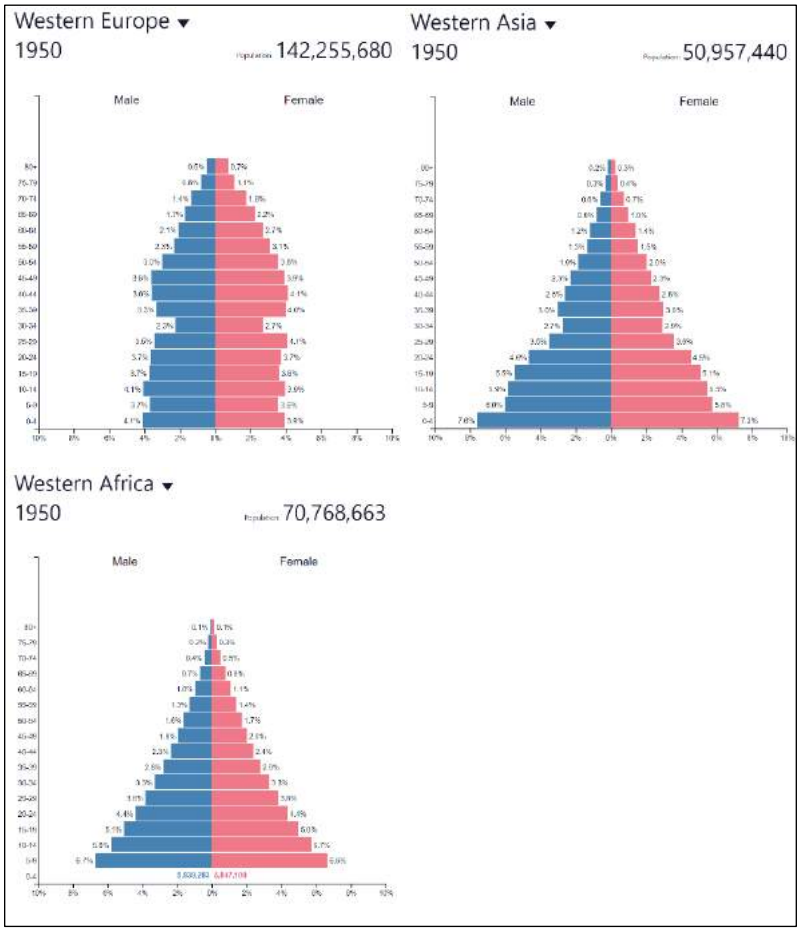
(Roser, 2017b)

C. World Population Pyramid (1950)



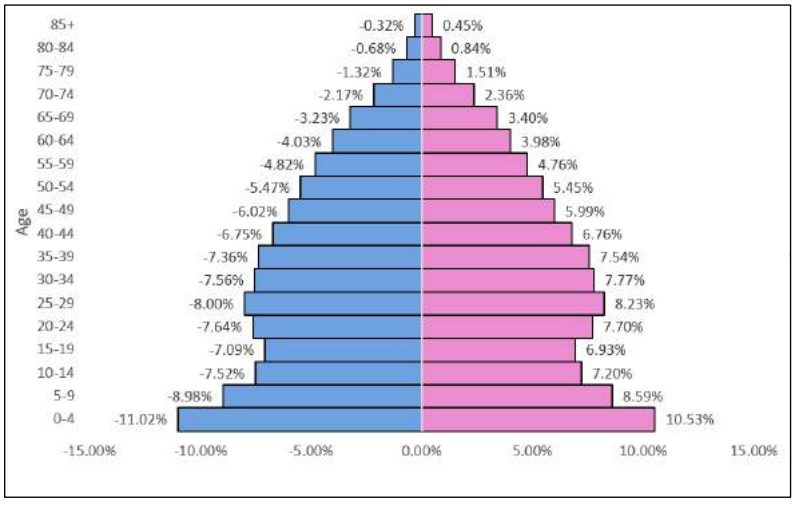
(PopulationPyramid, 2017)

D. Population Pyramids Europe, Asia, and Africa (1950)



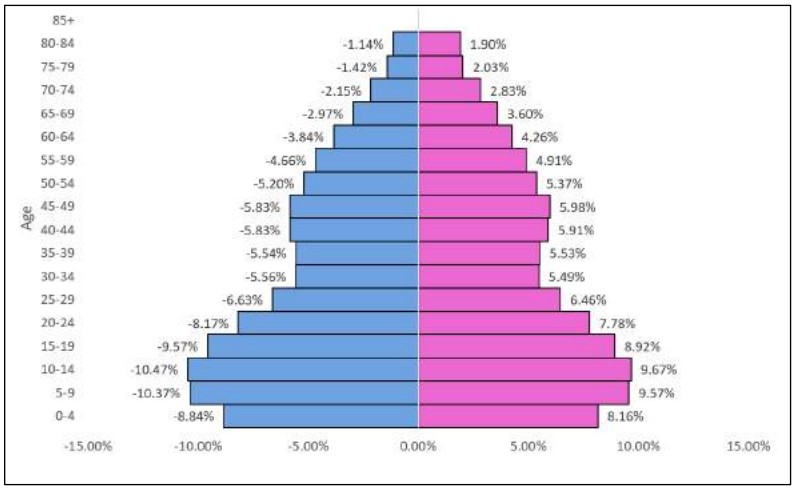
(PopulationPyramid, 2017)

E. Population Pyramid United States (1950)



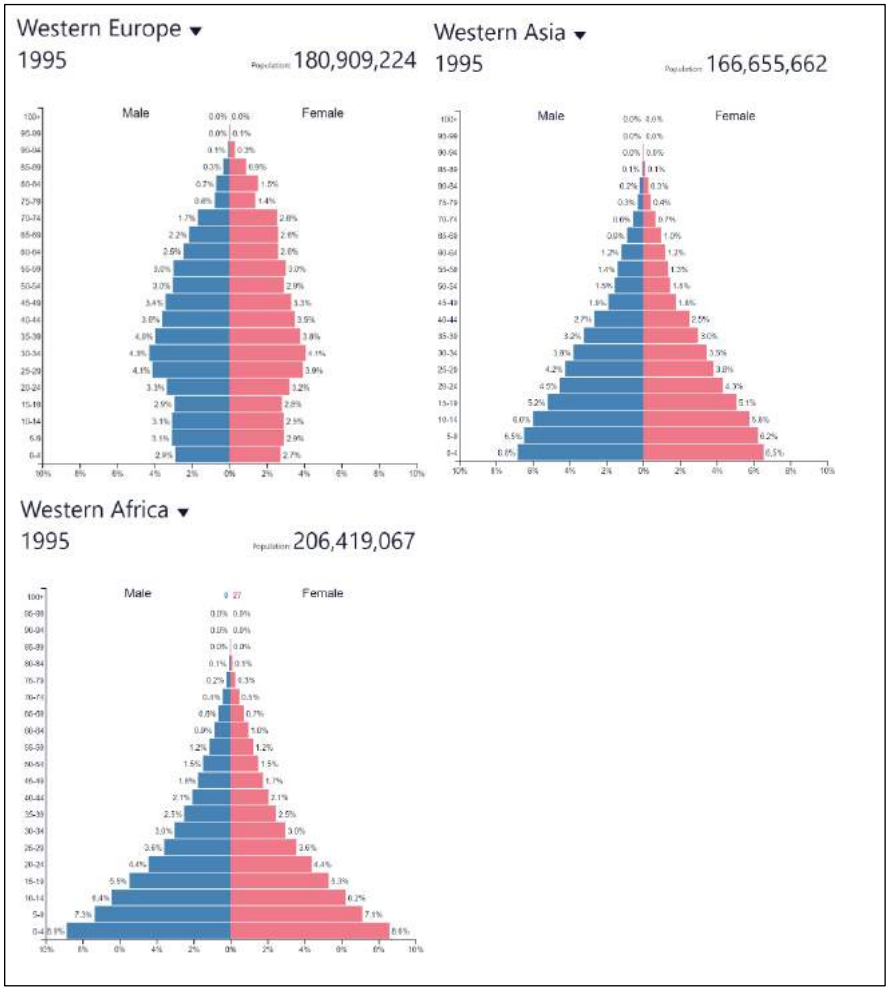
(US Census Bureau, 2016)

F. Population Pyramid United States (1970)



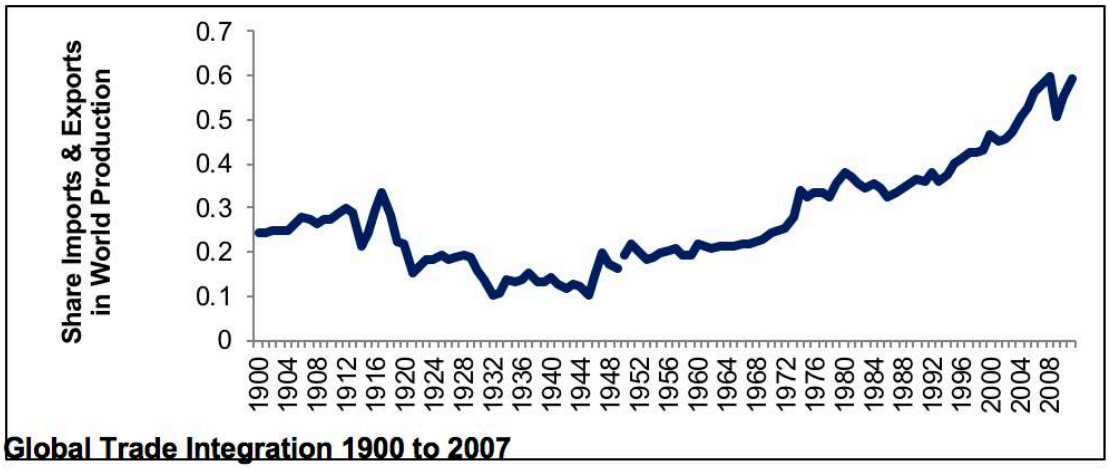
(US Census Bureau, 2016)

G. Population Pyramids Europe, Asia, and Africa (1995)



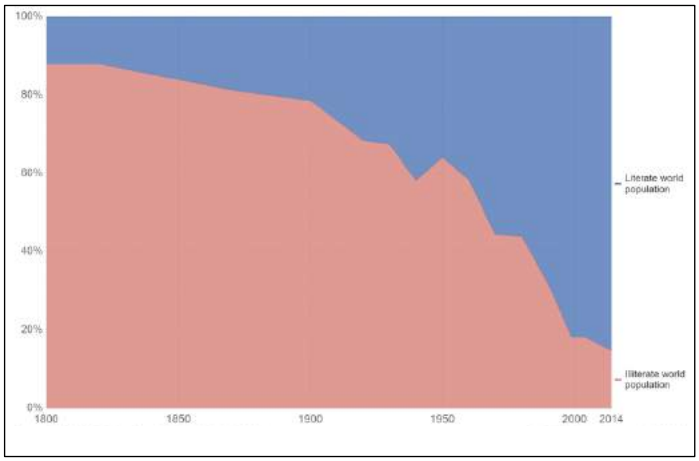
(PopulationPyramid, 2017)

H. Global Trade Integration 1900 to 2007



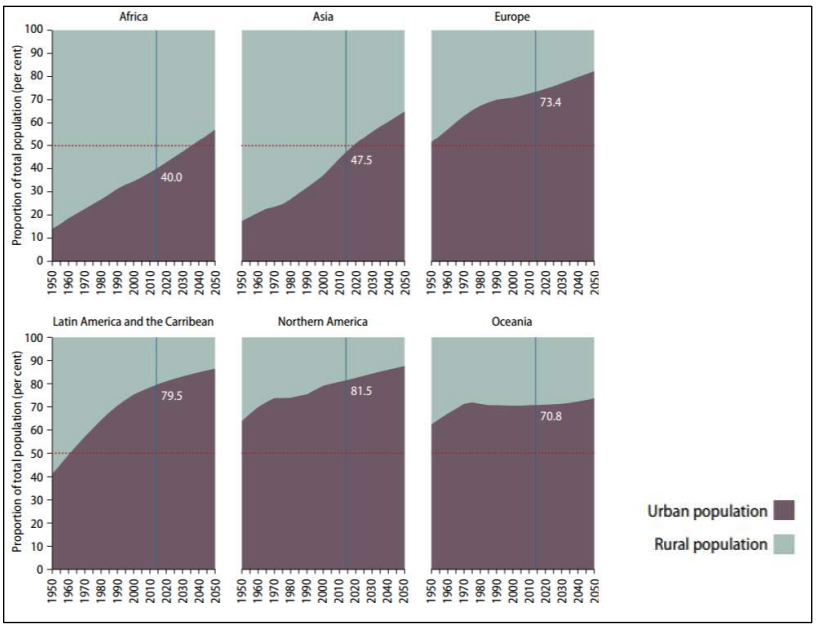
(Roser & Ortiz-Ospina, 2017a)

I. Evolution of Global Illiteracy Rates



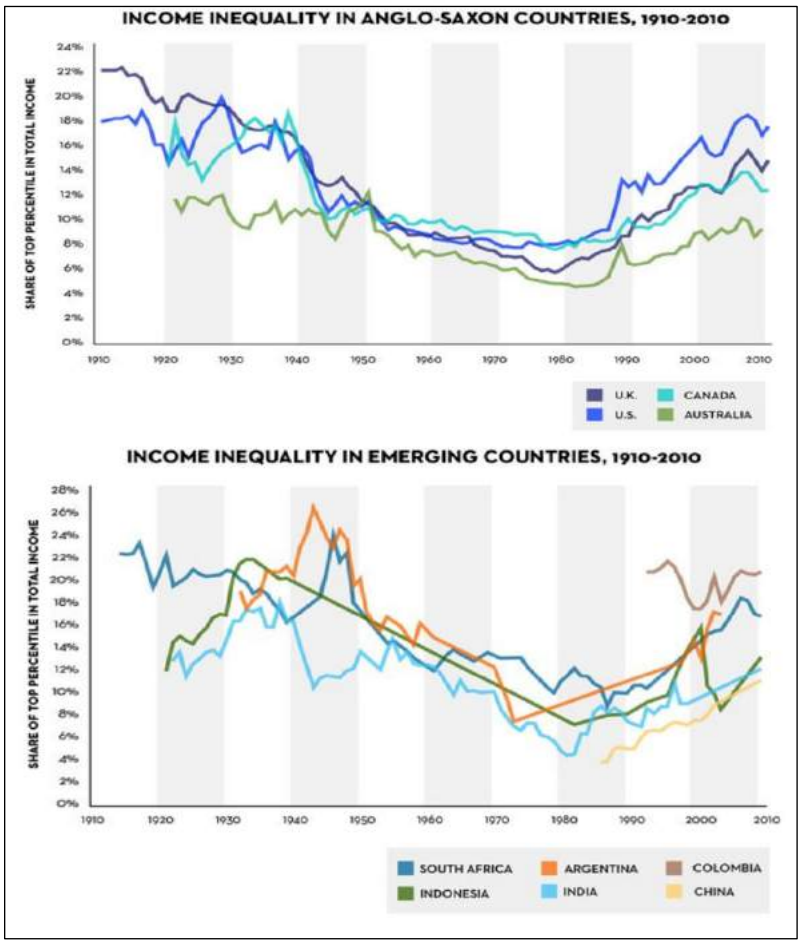
(Roser & Ortiz-Ospina, 2017b)

J. Urbanization in Different Parts of the World



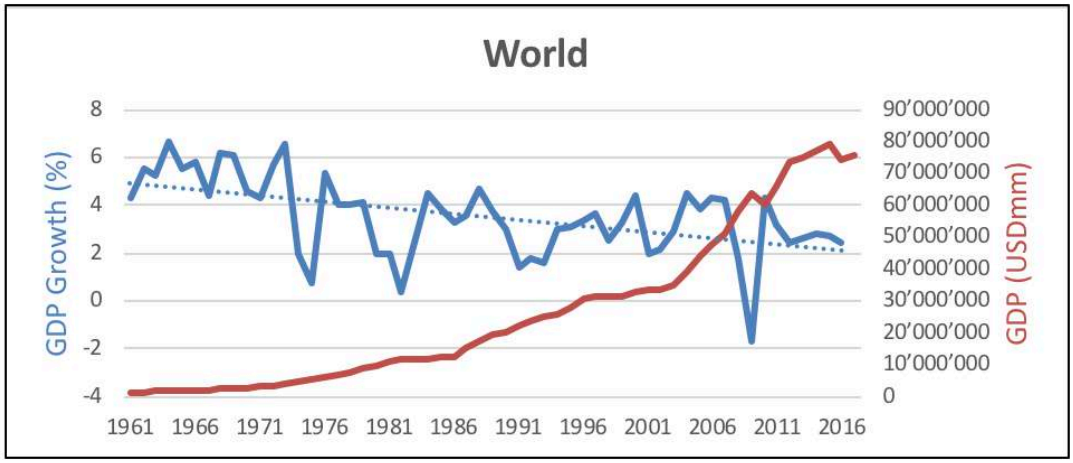
(United Nations, 2014, pp. 8)

K. Thomas Picketty's Income Inequality



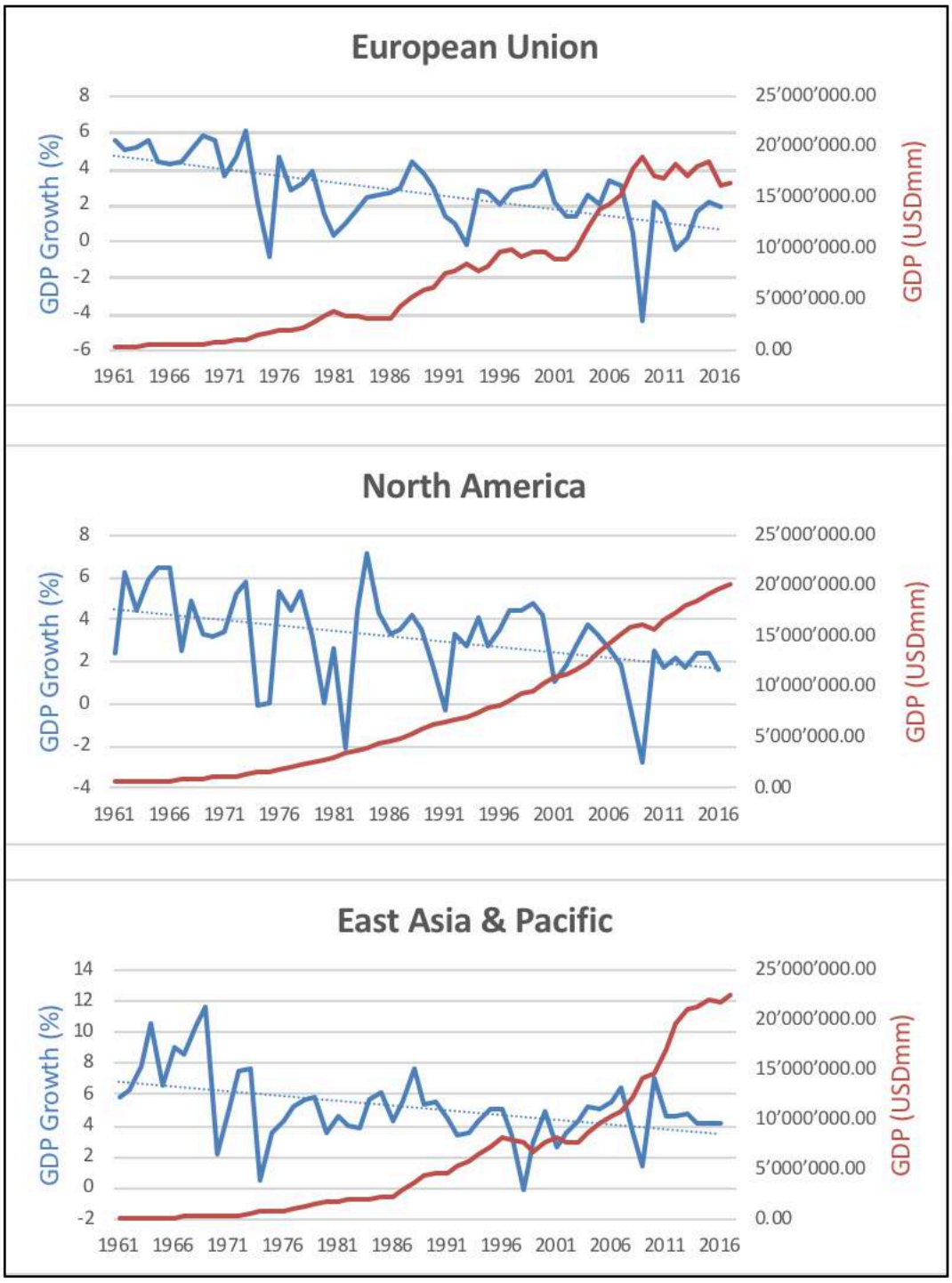
(Cassidy, 2014)

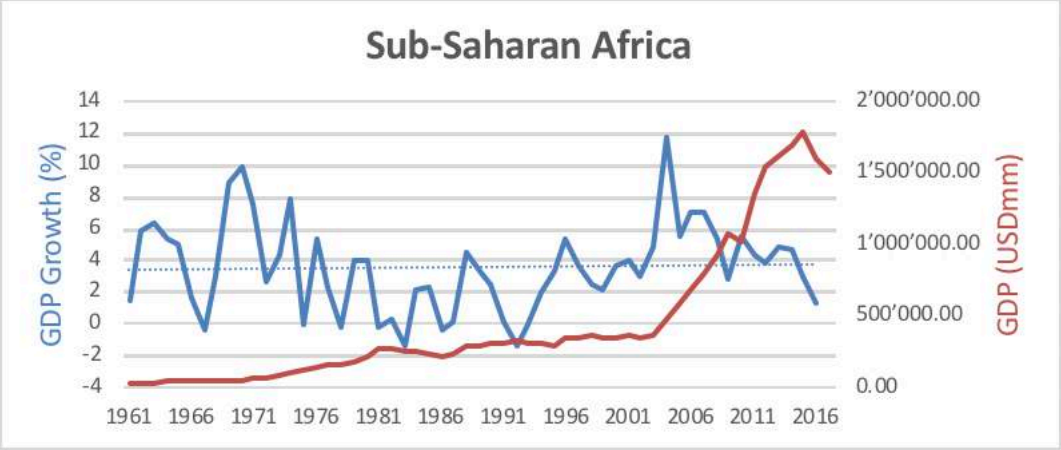
L. World GDP (USD) and GDP Growth (%) (1960-2016)



(The World Bank Group, 2017)

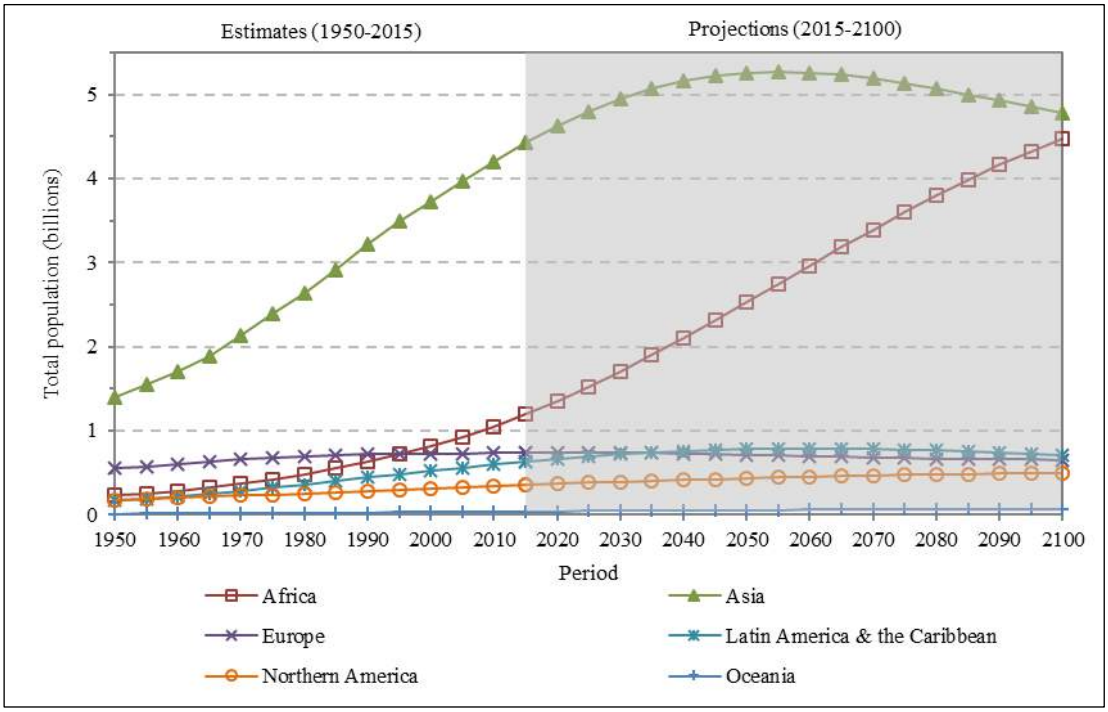
M. GDP (USD) and GDP Growth (%) of Selected Regions (1960-2016)


European Union
GDP Growth (%)
GDP (USDmm)
8
6
4
2
0
-2
-4
-6
25'000'000.00
20'000'000.00
15'000'000.00
10'000'000.00
5'000'000.00
0.00
1961 1966 1971 1976 1981 1986 1991 1996 2001 2006 2011 2016
North America
GDP Growth (%)
GDP (USDmm)
8
6
4
2
0
-2
-4
25'000'000.00
20'000'000.00
15'000'000.00
10'000'000.00
5'000'000.00
0.00
1961 1966 1971 1976 1981 1986 1991 1996 2001 2006 2011 2016
East Asia & Pacific
GDP Growth (%)
GDP (USDmm)
14
12
10
8
6
4
2
0
-2
25'000'000.00
20'000'000.00
15'000'000.00
10'000'000.00
5'000'000.00
0.00
1961 1966 1971 1976 1981 1986 1991 1996 2001 2006 2011 2016



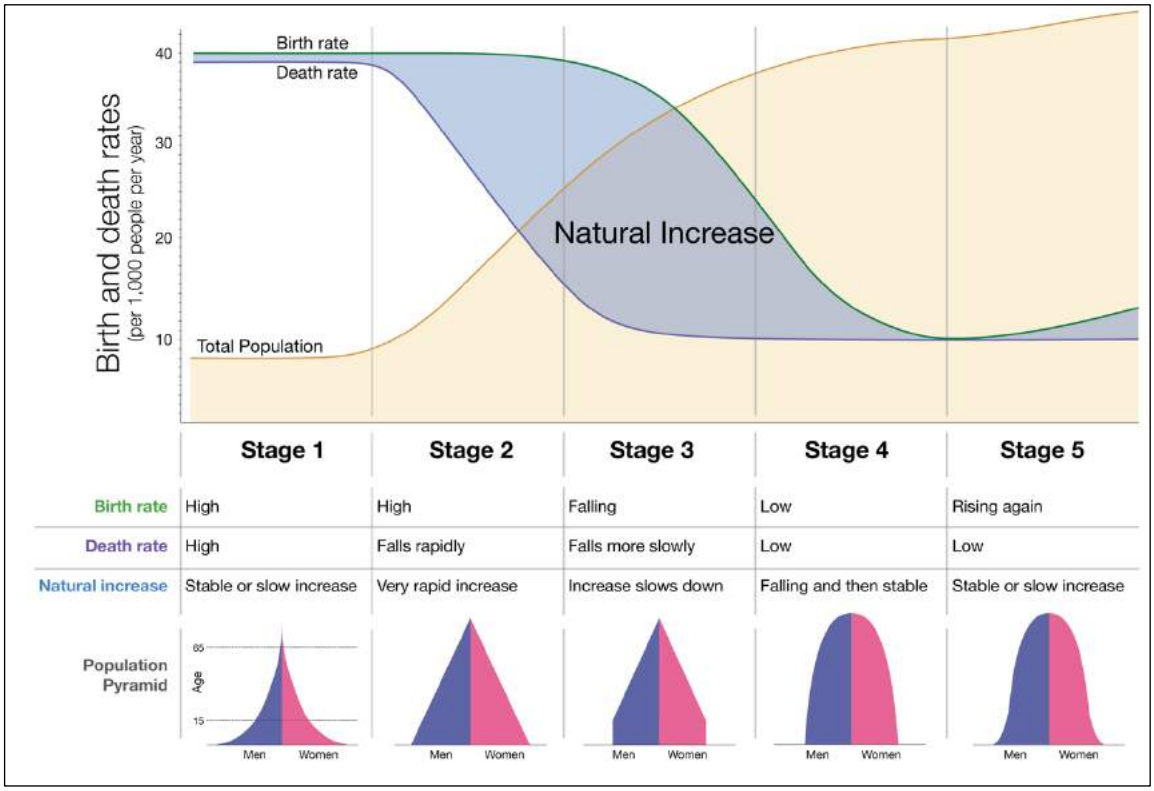
(The World Bank Group, 2017)

N. Development of Total Population Across Continents



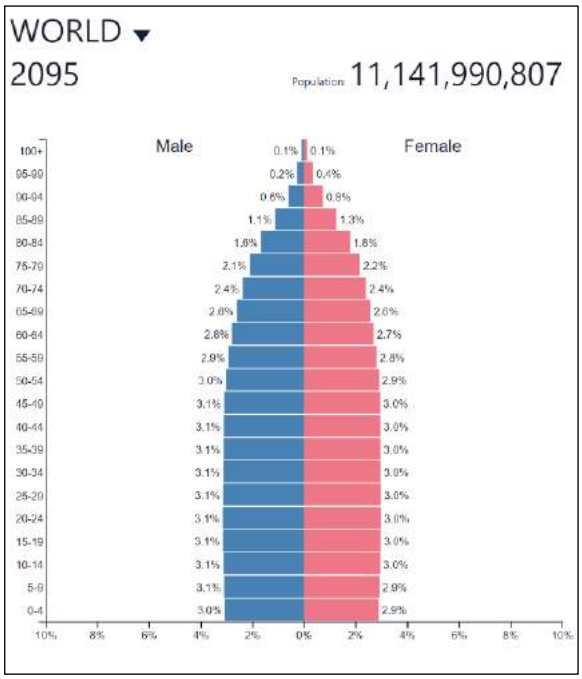
(United Nations, 2017b, p. 21)

O. The Demographic Transitional Model



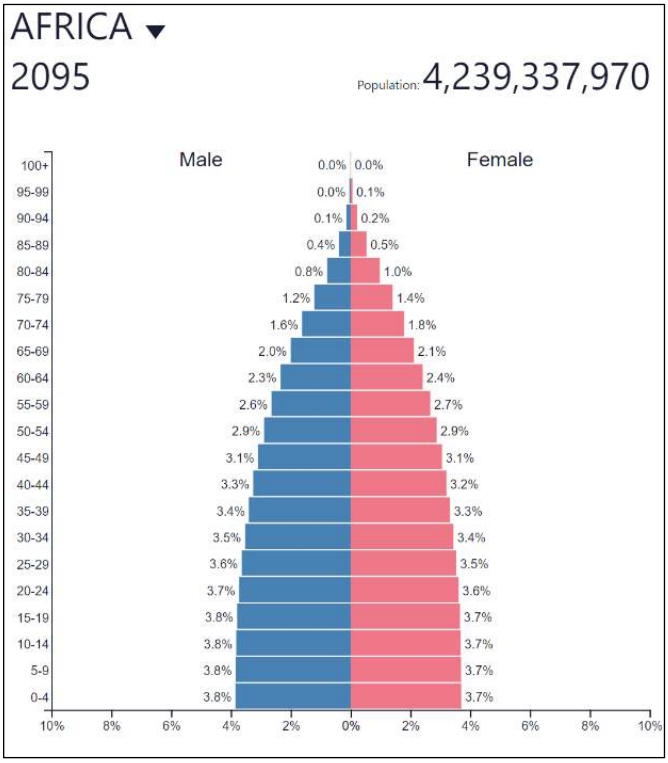
(Roser & Ortiz-Ospina, 2017b)

P. World Population Pyramid (2095)



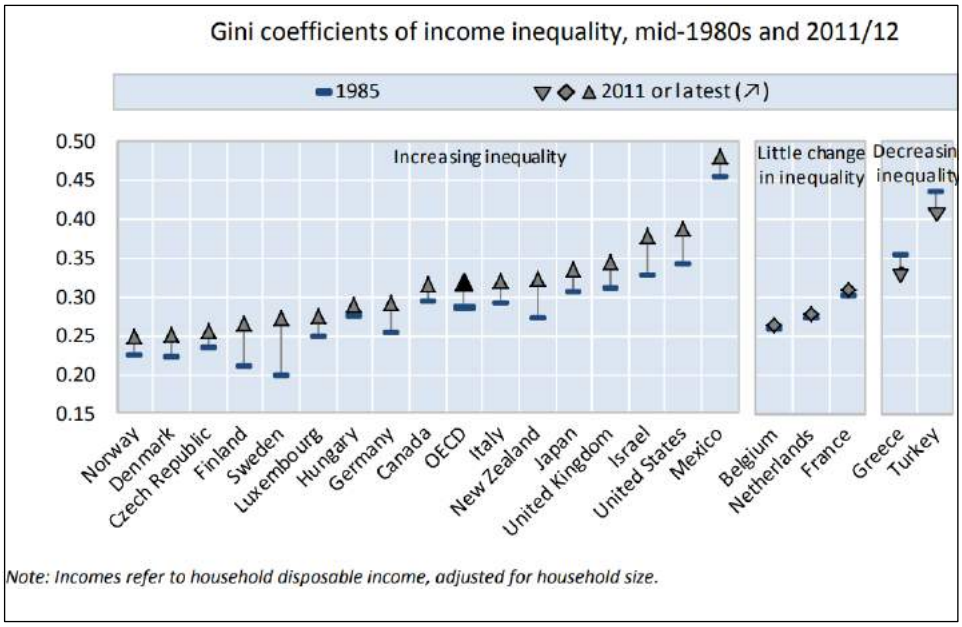
(PopulationPyramid, 2017)

Q. Population Pyramid Africa (2095)



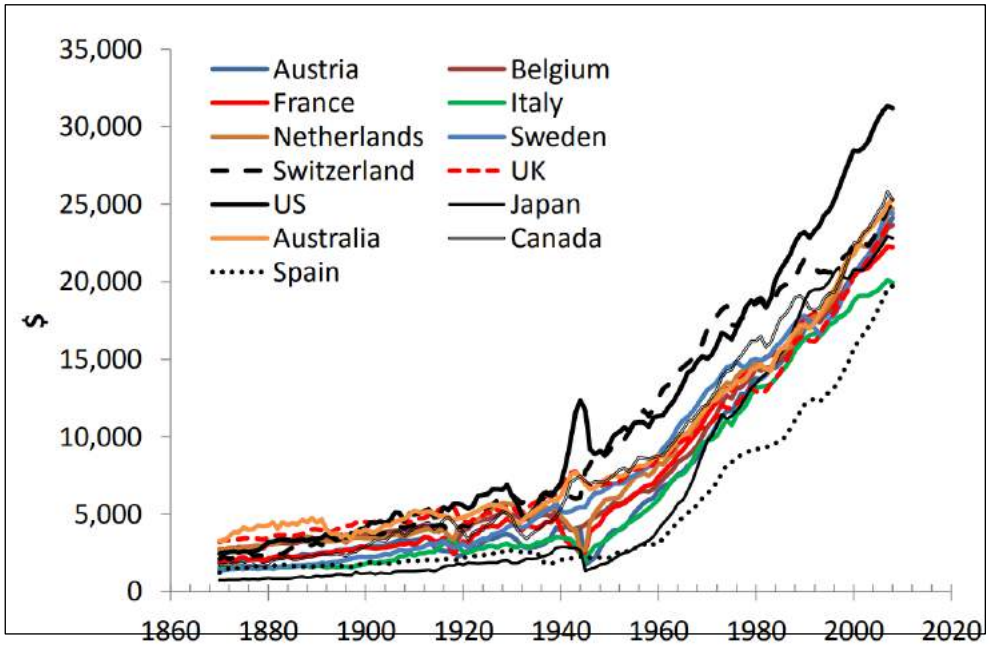
(PopulationPyramid, 2017)

R. Gini Coefficients of Income Inequality (1985- 2011)



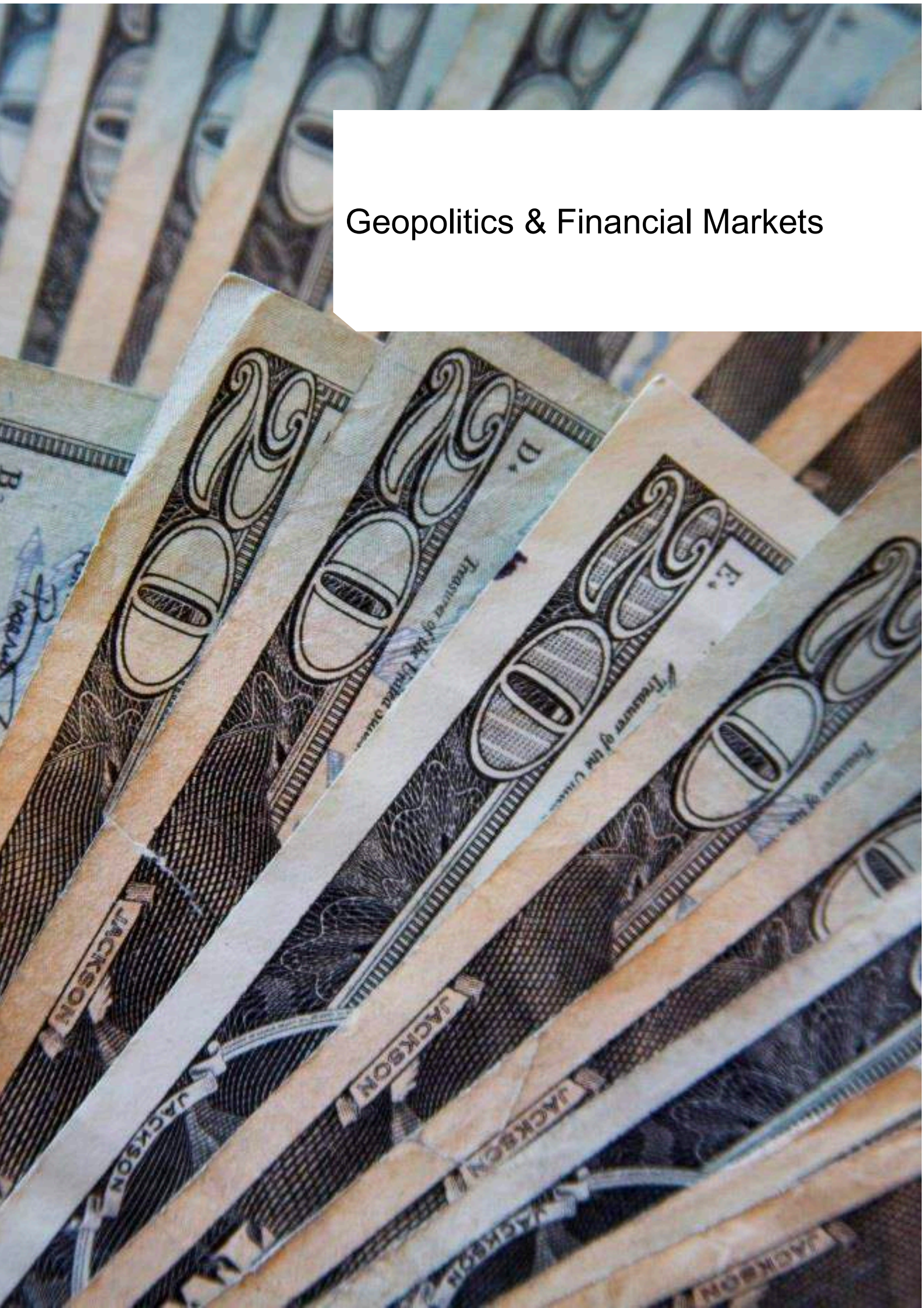
(OECD, 2014a)

S. The Evolution of Real GDP per Capita of Thirteen Developed Countries



(Kitov, I. & Kitov, O., 2012)

Geopolitics & Financial Markets



G. Low interest rates – what does it mean for retirees? Who are the beneficiaries and who are the losers?

by Laura Avagnano, Maximilian Hörwick and Emanuel Staubli

Throughout the developed world, the effect of aging societies in combination with declining fertility rates have exerted severe financial pressure on old-age provision systems and will continue to do so. The situation is further aggravated through historically low –and potentially long lasting– interest rate levels. These developments do not only threaten the financial sustainability of such systems but will ultimately lead to intergenerational inequalities and tensions.

Pension systems play a pivotal role in smoothing life-time consumption. The widespread multi-pillar structure consists of a state-managed poverty prevention scheme, an occupational income replacement model and a voluntary private pension savings plan. Essentially, pension systems can be set up as pay-as-you-go scheme or as capital funded system. Pay-as-you-go systems utilise contributions of the current workforce to directly finance current pension benefits. In funded systems, pension benefits are a direct result of the amount of capital payed in by individuals during the professional life and of the investment results generated with this capital. Hence, the effect of low interest rates can be neglected for pay-as-you-go schemes while being crucial for capital funded systems.

High quality government bonds are not able to generate required returns anymore and therefore force pension funds to shift their asset allocation towards higher risk exposures and alternative investment products. While the burden of unsustainable pension funds will be mostly carried by the generation of today's young professionals, the interest rate environment nevertheless affects the current retirees directly. When trying to capture the full impact of low interest rates on the financial situation of retirees, all their personal assets need be taken into account. Transfer payments, bank savings and asset holdings are of varying importance for the individual, overall wealth situation of retirees. Consequently, also their exposure to the different impact channels of interest rates varies.

Solutions to overcome the aforementioned challenges can be categorized into two main categories: Pension reforms and market driven solutions. Reforms concern improvements of existing pension systems such as increasing contributions, adjusting the statutory retirement age or cutting benefit payments. Market solutions on the other hand aim at compensating lower returns from the fixed income business by pursuing alternative investment strategies, enhancing risk exposure or reducing operational costs.

Synthesising the results of this research paper reveals that asset-wealthy retirees belong, together with the providers of alternative investment products, to the clear beneficiaries of the

low interest rate environment. Current retirees are at most marginally affected by low interest rates, while young professionals are expected to shoulder the largest part of the financial burden, should no measures be taken to restore intergenerational fairness

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1. Introduction

A better standard of living, technological and medical advances as well as a lower mortality rate for children under 5 years have increased the life expectancy with a continuing trend on a global scale. This improvement of life expectancy can not only be observed in relatively poor countries, but also in high income countries on which we will focus in this paper. In those nations, the population is expected to grow even older than it is already the case today. At the same time, fertility rates have sharply decreased on average since the 1950s, leading to a shift of the generational balance. To make matters worse, we are currently experiencing a period of extremely low interest rates in much of the developed world, which might even settle down at this low level.

These developments put severe pressure on the old-age provision systems as they are in place throughout most of the high-income nations. Through the shift in demographics, systems based on intergenerational solidarity reach their capacity limits. Capital based systems do not fare much better due to their inability to produce substantial returns when sticking to relatively low risk investment strategies. In any case, quick and substantial measures must be undertaken to prevent old-age poverty, social unrest and intergenerational tensions. Since demographic developments are difficult to influence and any possible measures would need at least one generation to translate into results, this paper will focus on the causes, effects and possible remedies to a low interest environment.

To start-off, we will analyse the socio-economic environment and provide evidence for the just mentioned demographic and economic trends. In the following, we will present the most prevalent ways in which pension schemes tend to be organized in much of the developed world. Moreover, we are going to analyse the wealth composition and the income sources of pensioners in order to assess in the third chapter, how low interest rates might affect the financial situation of retirees. Having established an understanding of the socio-economic environment and its effects on old-age provision systems and pensioners on a private level, we will finally turn to possible coping strategies in the fourth chapter. Here, we will follow a structured approach to investigate what could be done to reform the pension system itself, but also what could be done from an asset management perspective. We will conclude this seminar paper by summarizing and synthesizing the key findings. This will also include a summary of the beneficiaries and losers of the current environment. Additionally, we will point out the limitations of this paper and present ideas for further research.

2. Socio-economic environment

In order to facilitate a better understanding of our main discussion, an overview of the most influential factors shaping the current situation of pension funds will be provided. First, an introduction to the relevant demographic trends will be given. After that, the low level of global interest rates will be discussed. In the following, the authors will analyse the wealth-distribution of pensioners to correctly asses their exposure to interest rates. Lastly, the most prevalent models for pension schemes will be presented.

2.1. Demographic trends

Through an improved standard of living, advances in health care and lower mortality rates for children under 5 years, the average life-expectancy has reached its highest level in human history on a global scale. This also applies to the group of high income countries (as defined by the United Nations Population Division). According to the UN, the overall population in these countries will most likely reach a plateau in terms of total population around 2050. Throughout this period, the population group of age 65 years and older will increase over-proportionally, while fertility rates are expected to stay on a low level after having dropped substantially between the 1950s and 2000. Interestingly enough, the fertility rate is estimated to increase again slightly until 2100. (UN Population Division, 2017)

2.2. Low-interest rate environment

Compared to the global interest rate level of much of the 20th century, the current global (inflation adjusted) interest rate level has reached a low plateau.

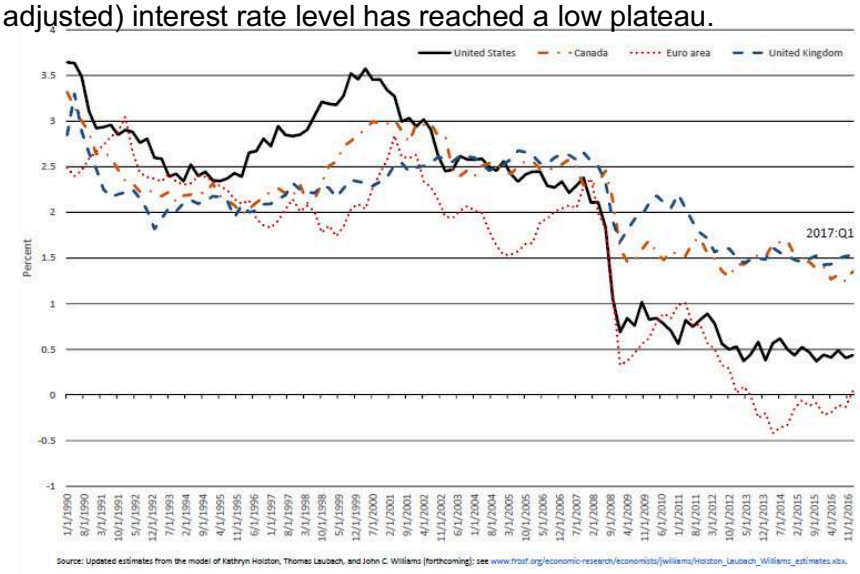

FIGURE 1: GLOBAL INTEREST RATE DEVELOPMENT 1990-2017 (FISCHER, 2017)

The observed level of low interest rates seems to be less a temporary result of a current economic cycle, but rather a new equilibrium level of real interest rates that has been reached

according to Stanley Fischer, Vice Chairman of the Federal Reserve. This has become especially apparent since interest rates only showed little tendency to increase again after the financial crisis as illustrated in Figure 1.

The impact of quantitative easing and the increased demand for securities of advanced-economy governments as a “safe haven” for money are mentioned as some of the responsible short-term factors. Using the economic situation of the United States as a proxy for many other high-income nations, further and more fundamental factors were identified for being responsible for a more permanent low interest rate environment. Namely, (1) slower trend economic growth, (2) an aging population and demographic shifts, and (3) relatively weak investment. Slower economic growth will lead to higher savings and lower investment rates. An aging population not only further decreases the lower economic growth, as larger parts of the population drop out of the labour market, but also tends to save more and not invest money in the years before retirement. The third factor, weak investment, is driven by slow growth, but also by heightened economic and political risk. One aspect thereof is for instance the uncertainty about disruptive technologies, potentially threatening many long-lasting business models. A further possible driver for low interest rates could be the low level of within-industry competition allowing companies to generate high profits without having to increase production. According to Fischer, the above-mentioned aspects for the US economy will most likely depress the interest rates in other countries in a similar way. Moreover, Fischer also considers global spill-over effects as a possible explanation. (Fischer, 2017)

2.3. Wealth distribution and income sources for elderly people

The following paragraph depicts the recent economic situation of the population group being 65 years and older. Figure 2 shows the mean wealth for the total population compared to the mean wealth of older generations in 2010.

Mean wealth per capita				
		Total Population	65-74	'+74
Belgium	*Euro*	320'712	500'494	432'402
France	*Euro*	213'900	324'618	241'871
Germany	*Euro*	182'532	248'484	166'622
Greece	*Euro*	146'907	151'706	114'337
Italy	*Euro*	272'689	324'161	235'637
Luxembourg	*Euro*	693'246	1'245'771	882'179
Netherlands	*Euro*	166'000	269'500	222'000
Portugal	*Euro*	150'710	164'864	135'755
Slovak Republic	*Euro*	78'882	71'517	76'598
Spain	*Euro*	286'293	330'827	268'221
United States	*US Dollar*	452'900	821'000	646'100

FIGURE 2: MEAN WEALTH PER CAPITA FOR DIFFERENT COUNTRIES (OWN REPRESENTATION BASED ON: OECD WEALTH DISTRIBUTION DATABASE)

Because of their advanced age, older generations have been able to accumulate more wealth during their lifetime. In the OECD member countries, 76% of retirees own an apartment or a house, which means that a major part of their wealth is invested in their home. (OECD, 2014, p. 84)

The analysis of retirees' sources of income reveals further information about their economic situation. Figure 3 shows that on average 59% of their income stems from transfer payments. In Hungary, Luxembourg, Belgium and Austria state pensions make up more than 80% of their income, compared to less than 20% in Chile and Korea. In Chile, Korea and Mexico elderly people (65 years and older) obtain more than 50% of their income from employment.

In general, it can be said that the income of less wealthy pensioners consists mainly of transfer payments while wealthy pensioners enjoy additional private pensions and capital gains. (OECD, 2014, p. 76-77)

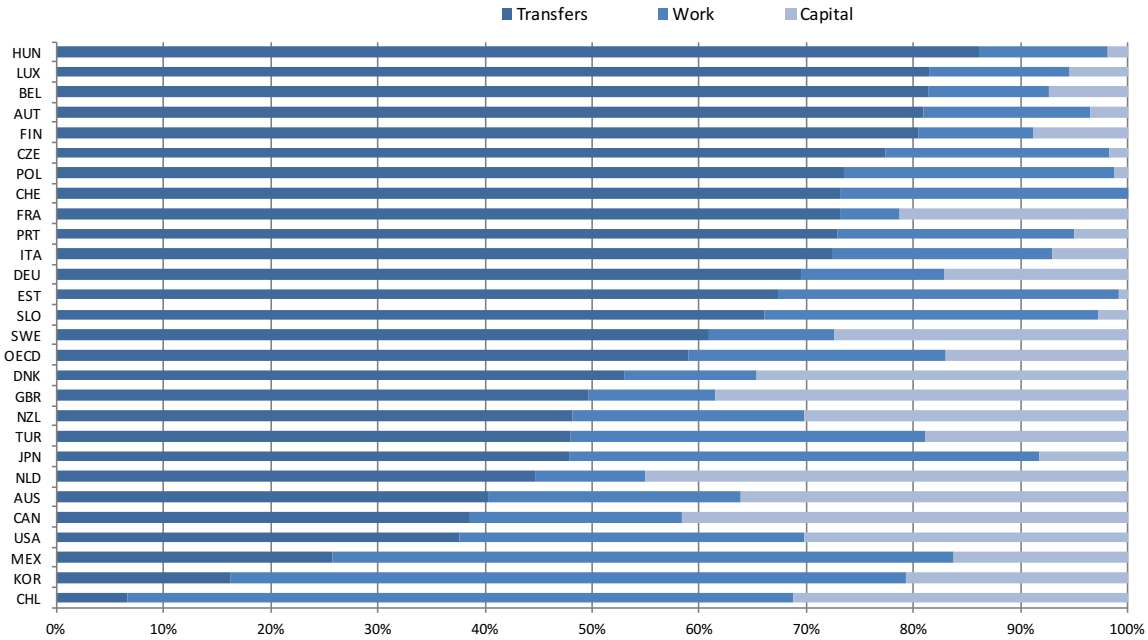

FIGURE 3: INCOME SOURCES PER COUNTRY[9] (OWN REPRESENTATION BASED ON: OECD, 2014, P. 76)

2.4 Typology of pension schemes and old-age provision systems

The most commonly found elements of pension scheme systems are referred to as "three pillars". The first pillar describes the part of the pension system, which is geared towards avoiding old-age poverty. This first pillar is typically state managed and usually has no directly

[9] Note: Income from work includes both earnings (employment income) and income from self-employment. Capital income includes private pensions as well as income from returns on non-pension savings.

proportional link between contributions and benefits[10]. This system aims at providing basic financial security to the entire population, regardless of their income situation. The second pillar on the other hand is contribution based and should replace a substantial part of the income enjoyed while working in order to smooth lifetime-consumption. It can be organized in two ways. One way would be the organisation as a pay-as-you-go system (PAYG), where one generation basically pays directly the pensions of the previous generation. The other way would be a funded system, where only the contribution payments plus the amount earned on the paid-in capital can be distributed as a benefit. For funded systems, there are again two possible options of setting up such a system: Either by defining the benefit amount which will be paid out when reaching retirement age ("defined benefit scheme") or by defining the amount which should be paid in every period ("defined contribution scheme"). With the defined contribution scheme, the amount of the pension payments cannot be anticipated with certainty but rather depends on the success of the asset management. With defined benefit schemes, the amount of the pension payments is certain, but the contribution payments can vary, depending on the success of the asset management. PAYG systems are more dependent on demographic trends as they are not only exposed to longevity risk, but also to the risk of a falling fertility rate. Funded systems are also affected by demographic trends but only via longevity risk while more emphasis needs to be put on financial risk management. The third pillar describes voluntary private pension saving, which is in many cases government supported, for instance via tax breaks. This can be facilitated by paying money into a dedicated, blocked account or fund, which can only be accessed upon retirement. (European Parliament, 2014, pp.14-26)

Four main risks can be identified when examining pension schemes, namely: Financial, longevity, behavioural and regulatory risks. Financial risk describes the exposure to uncertain developments in the financial markets. Longevity risk describes the uncertainty arising from people's stochastic life-expectancy and the resulting danger of outliving one's financial assets, respectively by receiving more benefits from a given pension system than it was designed to generate. Behavioural risk in this context is closely related to financial risk and describes the dangers of behaviourally driven mistakes in the asset management (e.g. undiversified or too risky assets). This risk is especially relevant for individually and non-professionally managed portfolios. Finally, regulatory risk describes the potential inability to change pension providers or inadequate transparency rights with respect to the pension providers concerning fees charged or products chosen. (European Parliament, 2014, p. 10)

[10] For instance, high income individuals pay in higher contributions as low income individuals while receiving the same or very similar benefits.

3. Effects of low interest rates

The following chapter analyzes the effects of low interest rates on the financial situation of elderly people. This is done by differentiating between impacts on retirement income and on retirement wealth.

3.1. Impact on retirement income

Each income source is affected in a different way and to a different extent by the low interest rate environment. The first pillar is mostly financed on a pay-as-you go basis (European Parliament, 2014, p. 28). The working population and their employers pay in monthly contributions, that are used to fund the pensions currently paid to the retirees. For this reason, the effect of low interest rates on the first pillar can be neglected. Matters are quite different for the second pillar, which is typically organized as a capital funded system. This can be exemplified by a survey of nearly 200 Swiss pensions funds, which showed that the prevailing low interest rate environment is their greatest challenge (Credit Suisse, 2017, p.12). The following section explains the effects of low interest rates using the example of Switzerland.

In addition to the two main premium payers, employees and employers, there is also the so-called third contributor, which is the capital market (Eling, 2012, p.5). The Swiss government sets a nationwide mandatory minimum rate of return, which has to be granted to the pensioners, regardless of the effective performance of a pension fund. Since 2017, the minimum rate of interest is 1%, which at first sight seems to be low, but should not be underestimated given the current conditions. For instance, a 10 Year CHF obligation, which is often used as a low-risk investment, has a negative yield since 2015. Also, the 3 month CHF LIBOR, a common benchmark rate, is negative since 2014. These examples clearly show the challenges associated with realising the legally regulated rate of return at low risk levels and reveals the resulting need to increase profitability.

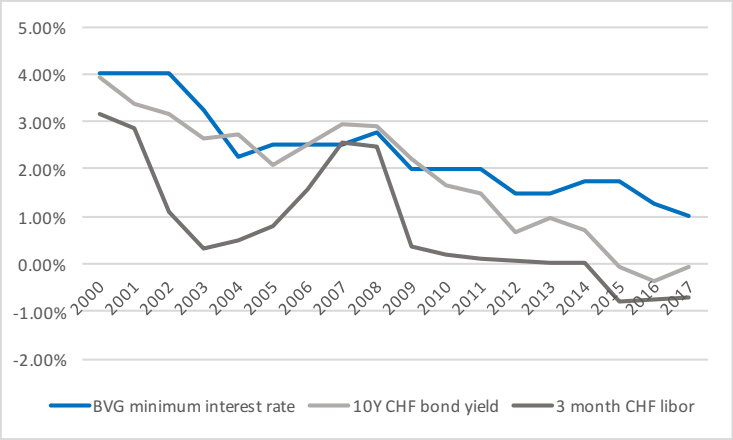

FIGURE 4: COMPARISON BETWEEN THE MINIMUM INTEREST RATE AND RISKLESS RATES (OWN REPRESENTATION BASED ON: DATA FROM SNB DATABASE AND BSV DATABASE)

The high conversion rates [11] and the minimum rate of interest lead to an unintended redistribution from the working population to the pension recipients. Today, most pensions funds guarantee conversion rates that exceed the mathematically correct pension rates. As the pensions of the present retirees are difficult to adapt, the gap between pension promises and the correct actuarial figure needs to be filled by the contributors, which are clearly in a disadvantaged position. In Switzerland, CHF 5.3 billion have been redistributed form the working population to the retired population alone in 2015. (Credit Suisse, 2017, p.15)

The effect of low interest rates on the performance of assets in the third pillar depends on the asset allocation chosen by the retiree. Due to the current low interest rates investment grade bonds generate insufficient income. By investing into bonds of riskier governments or companies this income stream could be increased. Chapter *4.2.1 Assets* will provide an overview of alternative assets, which can also improve the performance.

3.2. Impact on wealth of retirees

The effect of low interest rates on the financial situation of pensioners includes also the impact on their private wealth and asset holdings. As described in previous chapters, on average 76% of retirees in the OECD countries own their houses or apartments. This number varies strongly across the countries. In Switzerland for example, 40% of retirees are complete owners of their properties, which means they have amortized their mortgages. In Hungary, Australia and in the US, more than 80% of the retirees own their house. Nevertheless, a fraction of these owners still has mortgage and therefore pays interest[12] on a regular basis. (OECD, 2014, p. 83)

If we compare the average value of a home ownership (appendix A) to the average wealth per country, it can be assumed that a considerable part of retirees' wealth is tied up in their home. Empirical studies found that interest rates have a significant effect on private real estate (house and flat) prices. The negative correlation leads to an immediate increase in both house and flat prices, after a decrease of the three-month target LIBOR rate. (Berleman & Freese, 2013)

[11] All the pension fund contributions are combined and the sum equals the retirement savings. The yearly pension is calculated by multiplying the conversion rate with the retirement savings.

12 In case of an adjustable-rate mortgage the interest rates adjust quickly to the low interest rate environment. For a fixed rate mortgages these adjustments need more time.

4. Overcoming the low interest rate challenge

In many developed countries, an aging society with low fertility rates exerts increasing financial pressure on PAYG pension systems as benefit payments to retirees increase while contributions to the pension funds decrease. The situation is aggravated through historically low interest rates that reduce the return in capital funded schemes and thereby threaten their financial sustainability.

Recognizing that old-age provision systems are of paramount importance for the smooth functioning of our societies, the purpose of this chapter is to outline solutions, which allow to overcome the low interest rate challenge, and to understand who will benefit / lose from these possible amendments.

The low interest rate challenge can either be addressed through reforms of the pension systems or market solutions as illustrated in Figure 5 (PPC Metrics, 2016). Alternatively, one could just accept the current low interest rate environment as a short-term phenomenon that does not require any specific action.

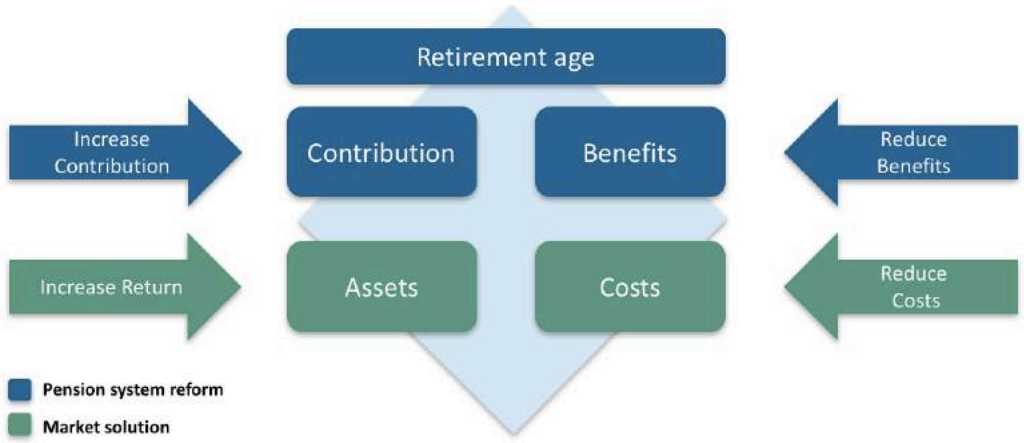

FIGURE 5: SOLUTIONS TO THE LOW INTEREST RATE CHALLENGE (OWN REPRESENTATION BASED ON: PPC METRICS 2016)

4.1. Pension system reforms

One strategy to address the low interest rate challenge is reforming the existing pension systems. Considering the multifaceted nature of pension systems in different countries, there is no one-size-fits-all reform type. A successful reform has to be tailored to the particular pension system and take a country's economic, social and cultural circumstances into account. Hence, this chapter aims neither at analysing nor proposing specific pension system reforms, but rather at offering an overview over more generic reform approaches.

The focus lies on parametric reform types that do not affect the overall structure of existing pension systems, as for example changing the three-pillar-structure. Parametric reforms either

concern the contributions, benefits or retirement age (Pamp, 2015, p. 103). Structural changes in pension systems could also be employed to cope with low interest rates, but often involve broader inter-generational negotiations that are beyond the scope of this paper.

4.1.1 Contributions

Contributions represent the primary source of income for any type of pension system and can be either social insurance contributions or taxes (Schmähl, 2000, p. 127). Thus, increasing the contribution results in higher revenue for the pension fund and can, depending on the magnitude of the raise, offset the negative effect of low interest rates.

When it comes to the design of a pension system contribution reform, there is a crucial difference between an increase in social contributions and an increase in taxes. The former reform type is likely to benefit from a higher public acceptability as social contributions result in an entitlement to a benefit in return[13]. In contrast, taxes are an instrument that are suited for interpersonal wealth- or income redistribution. (Schmähl, 2000, p. 127)

Occupational pension schemes are in many countries co-funded by contributions from employers and employees. In the OECD average, employees' contributions accounted in 2012 for 1.8% of GDP and employers' contributions for 3.0% of GDP. Depending on (a change in) this ratio, the burden of a contribution increase has to be carried by employers and employees to a varying extend. However, one should be cautious to impose too much costs on the employers as this is often passed on to employees in the form of lower wages or fewer jobs. (OECD, 2013, pp. 168-169)

4.1.2 Benefits

Benefits represent the primary source of capital outflow in pension systems and should according to Kolitkoff (1999) "replace a reasonable fraction of pre-retirement income, i.e., they should be consistent with lifetime consumption smoothing" (p. 5).

Three different forms of benefit payments can be distinguished according to the OECD. A lump-sum payment is a single transaction that transfers the total value of the accumulated retirement capital to the pensioner at retirement age. In contrast, programmed withdrawals are a series of fixed or variable payments that draw down the pensioner's retirement capital until his death. Any remaining funds are signed over to the family. Finally, a life-annuity provides a constant income stream for as long as the retiree lives independent of his capital stock. (OECD, 2008, pp. 6-7)

13 Social contributions are paid on a compulsory or voluntary basis by employers, employees and self- and non-employed persons. (Eurostat, 2016).

Depending on the current benefit level in a country, a pension reduction could represent an economically viable option to counterbalance the financial challenges of low-interest rates. A widely-used measure to compare the pre-retirement consumption with post-retirement benefits is the replacement rate (Grech, 2013, p. 5). With an average replacement rate of 68%, most OECD countries surpass the ILO recommended replacement rate of 45% and would theoretically have some room for maneuver (OECD, 2015a, p. 146 & ILO, 2012).

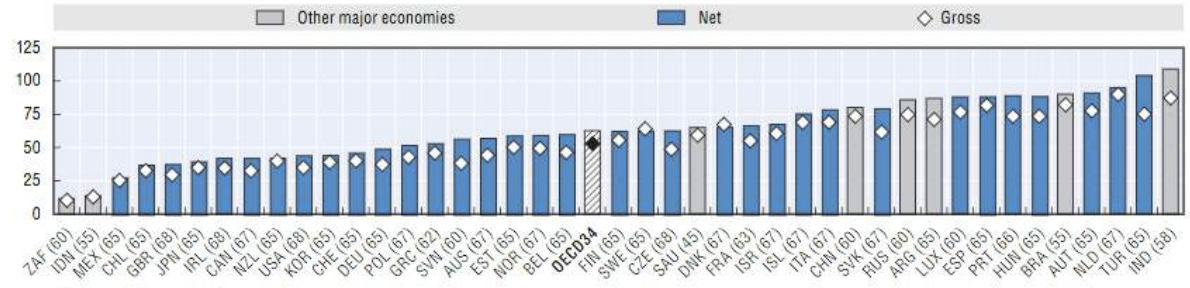

FIGURE 6: NET PENSION REPLACEMENT RATES: AVERAGE EARNERS (OECD 2015)

In practice, pension reductions are less favorable than other reform types as they increase the risk of old-age poverty (Kashiwase, Nozaki & Tokuoka, 2012, p. 16). Especially in democratic countries, benefit cut reforms have a very difficult stance. Many current and future retirees paid pension contributions throughout their entire working life in expectation of a certain benefit level and are therefore less likely to accept a pension cut to their own disadvantage.

4.1.3. Retirement age

The retirement age is a key parameter for balancing revenues and expenditures of pension systems. Postponing the statutory retirement age has a doubly positive effect on the financial sustainability of pension systems. For every additional year of work, people generate an income upon which they pay taxes and social security contributions and do not draw on pension benefits (European Parliament, 2011, p. 60).

The statutory retirement age defines the age upon which employers are allowed to retire from the workforce while receiving full pension benefits (Kalisch & Aman, 1998, p. 28). In 11 out of 34 OECD countries, retirement age for men and women is still different. The OECD average statutory retirement age in 2014 was 64 years for men and 63 years for women. Across countries, there is a great variance between the lowest retirement age of 58.7 for men in Slovenia and the highest retirement age of 67 in Norway (OECD, 2015a, p. 130).

The effective labor market exit age in the majority of the OECD countries is below the official retirement age for various reasons (OECD, 2015a, p. 128). Many countries offer different retirement options on a voluntary basis, such as early retirement in return for lower benefits or incentives for late retirement. Other people are no longer able to participate in the labor market

due to more difficult job prospects, long-term illness or disability (European Parliament, 2011, p. 62).

Despite being the politically most viable reform option, Staubli and Zweimüller (2012) argue that an increase of the statutory retirement age is not an effective policy instrument. Increasing the retirement age might not solve the problem, as elderly employees face harsh labor market conditions and a resulting higher unemployment rate causes an additional burden on the social security systems. Secondly, such a reform most negatively affects the less healthy, low-paid blue collar workers with the weakest labor market position, while the well-educated and healthy white collar workers are less constrained by the retirement age.

4.2. Market solutions

Pension system reforms focus on collecting and spending funds as opposed to market solutions, which involve changes in the way funds are invested and managed. Namely, market solutions promise to improve the profitability of pension funds. This can be achieved either through alternative investment strategies that compensate the lower returns from the fixed income business or with lower costs in managing pension funds.

4.2.1 Assets

Traditionally, pension funds have a strong investment focus on traditional asset classes. In 2014, the portfolio of pension funds in OECD countries consisted on average of 51.3% bills and bonds, 23.8% equities and 9.6% cash and deposits amounting up to an asset allocation in traditional asset classes of 84.7% (OECD, 2015b, p. 6). The OECD Business and Finance Outlook 2015 expressed concerns that portfolio compositions are changing towards riskier investments as pension funds engage in the so-called search for yield (OECD, 2015c).

In small countries, pension fund's preferred investment strategy in the search for yield seems to be an asset reallocation from bonds and bills to equities. This is usually a cheap and efficient measure to achieve a higher risk-return profile. The asset allocation of pension funds has already changed in the past decade. For example, in Switzerland pension funds clearly reduced their bond share in favour of real estate and alternative investments (Credit Suisse, 2017, p 9). With more than CHF 800 billion of assets under management, pension funds are among the largest investors (Hochegger, 2017). Alternative investments might therefore experience an increase in demand. Increasing investments abroad can also be an expression of the search for yield. However, to qualify as such, a higher risk-return profile is required and depends on the investment amount, the exchange-rate risk and the targeted capital market. In large pension markets, the search for yield primarily takes place in the form of an increasing share of alternative investments in pension funds' portfolios. (OECD, 2015b, pp. 16-26)

Alternative investments and the associated new risk premiums have gained increasing traction in the pension fund industry. However, in many countries pension funds are still hesitating to increase their exposure in this asset class. Alternative investment includes all assets classes except for equities, bills, bonds, cash and deposits and forms a heterogeneous group that ranges from commodities over real-estate and private equity to derivatives. Not all asset classes within alternative investments enjoy the same popularity in all countries. The highest growth rate over the last ten years occurred in mutual funds, i.e. collective investments schemes not investing in equities, bonds, cash or real-estate and in other investments which include financial instruments such as derivatives, commodities and trade credits (OECD, 2015b, p. 21).

Investing in alternative investments promises a higher-risk return profile, but also requires more knowledge from the pension fund managers. Every additional instrument in the portfolio has to be analysed carefully along multiple dimensions as illustrated in Figure 7 to ensure an adequate type of exposure for the beneficiaries (PPC Metrics, 2016).

FIGURE 7: OVERVIEW NEW RISK PREMIUMS IN ALTERNATIVE INVESTMENTS (PPC METRICS 2016)

Regulators in most countries have addressed the risks associated with the different asset classes through ceilings per asset allocation. Except for some of the largest pension markets, most countries have restricted the share of alternative investments in pension funds' portfolios. This might be due to more dynamic markets resulting from a higher degree of competition. However, there seems to be a trend towards a less stringent regulation regarding alternative investments (OECD, 2015b, p. 23).

The Bank for International Settlement recommends that increased risk-return profiles of pension funds have to be accompanied by rigorous risk management strategies and supervisory constraints such as risk-based capital requirements (2011, p. 44).

4.2.2 Costs

Pension funds operate in a triangle of risk, return and costs that determines their profitability and financial sustainability (Novarca, 2015). Costs are the only factor that pension funds can directly influence, while their risk capacity and return potential is determined by the regulatory- and market environment. Reducing the operating costs is therefore considered as a viable answer to the low interest rate challenge in the short-term.

Comparing pension funds' operating costs as a share of total investments reveals great disparities between OECD countries (appendix B). Certain countries like Finland or Denmark have already optimized their operating costs, while others like the Czech Republic, Estonia or Spain still have room for improvements. Smaller pension funds might not be able to achieve equally low cost structures as they can't benefit from the same economies of scale as larger funds. (OECD, 2011, p. 19)

5. Summary

In this paper, we analysed the challenging environment for pension schemes, given the current demographic and economic trends. Although challenging, we found the situation not to be hopeless. Rather we discovered ways to adjust the systems in place today and explored ways of how the capital markets could help in providing remedy.

5.1. Summary and effects on stakeholders

During the course of this paper, we have established that the pension systems of high-income countries are exposed to two closely interlinked challenges that threaten the sustainability of many pension schemes in place today. On the one hand, the increasing life-expectancy and the declining fertility rates lead to a demographic shift bringing pay-as-you-go pension systems out of balance. At the same time, low interest levels throughout the leading economies of the world have made it difficult to generate adequate returns and thereby put severe pressure on capital funded systems. To make matters worse, the current low interest rate environment might be of more permanent character according to some economists.

We discovered two main coping strategies: Reforms to the pension systems and improvements concerning the market participants. Reforms of the pension systems involve questions about retirement age, eligibility of pension claims and the general organization of old-age provisions. This typically also includes a discourse about intergenerational solidarity. On a more general level, pension reforms usually are concerned with the retirement age, benefits and contribution. Market driven solutions entail the adaptation of asset allocations and the reduction of the cost base for pension funds. Including more alternative asset classes like private equity, infrastructure investments or senior loans helps to achieve better risk-return profiles compared to portfolios consisting only of traditional investment classes. Moreover, costs can be reduced by lower management fees, a shift away from actively managed funds and the realization of scaling effects.

When synthesising the results of our research and thinking about how the discussed effects influence the stakeholders involved, we can identify a number of losers and some beneficiaries. The situation for the current retirees is in many cases not or only slightly affected. Often, pension benefits are guaranteed and therefore need to be financed by younger generations, regardless of whether sustainable or not. If there are any, pension cuts will only be made slowly and incrementally, no necessarily reflecting economic realities. Wealthy retirees which hold their wealth mainly in bank deposits are negatively affected by the low interest rates as under these conditions, net-borrowers profit compared to net-savers. Wealthy retirees which hold assets or real estate on the other hand have enjoyed an increase in wealth over the last years due to the rising asset prices. Clearly on the losing side with respect to old-age provisions is

the generation which is now at the early stage of their careers. This generation will have to shoulder the burden of the demographic shift and is additionally confronted with low interest rates making it difficult for them to accumulate capital for their retirement. Apart from the current (asset-wealthy) retirees, providers of alternative investments are also among the clear beneficiaries of this current environment. Their products experienced high demand and will mostly enjoy further growth as they become more widely accepted as asset classes. One thing is very clear however: intergenerational fairness will need to be restored and unsustainable systems need to be reformed rather sooner than later. Otherwise, most high-income societies will face large intergenerational redistributions to the disadvantage of the generation just entering the workforce and large shares of the population of future retirees will be exposed to old-age poverty risk.

5.2. Self-Criticism and Limitations

The most important limitation of this paper is the fact that we approached the challenges faced by many pension systems from a very technical point of view, neglecting social and political factors to a large extend. Reforming pension schemes can be a rather politically sensitive topic and although some measures sound straight forward in theory, they might be difficult to implement. Also, the fact that many of the people in charge of politics and the economy tend to be generally of advanced age themselves could potentially complicate matters further. They might be biased and reluctant to implement drastic reforms which represent disadvantages for their own generation, even when being helpful and necessary for the generations to come. We did not discuss these issues since the political environment and the reforms needed differ from country to country and would need to be discussed on a one by one basis. This would exceed the scope of this paper by a large extend.

Moreover, due to the brevity of this paper, we were not able to explore all issues raised in their entirety, although we know the devil often lies in the detail. Lastly, it has to be mentioned that we focused on the status quo and did not consider out of the box ideas as radical changes are hard to implement in most political systems.

5.3. Outlook on Further Research

Further research could be conducted in three areas: First of all, the implementation of the measures proposed in chapter four could be discussed on a more operational level exploring how reforms and adjusted asset management strategies could be best adapted. Second of all, as mentioned in the previous paragraph, the most severe political obstacles for implementing reforms could be identified and possible strategies to overcome these challenges could be developed. This however, would require a case by case analysis. Lastly, due to the increased life-expectancy and the shift away from physically demanding labour in high-income countries,

more research could be dedicated to develop strategies on how older people could still be a productive part of the workforce. For instance, pensioners could work adjusted hours, work from home or take on different positions more suitable for their current stage of life in return for a reduced salary. This could have two positive effects: On the one hand, it would reduce the financial strain on pensioners and the younger generations which need to support them. On the other hand, this would provide a sense of purpose to pensioners and facilitate a smooth transition from work to retirement, which is associated with supporting good health among retirees (Skerrett, 2012).

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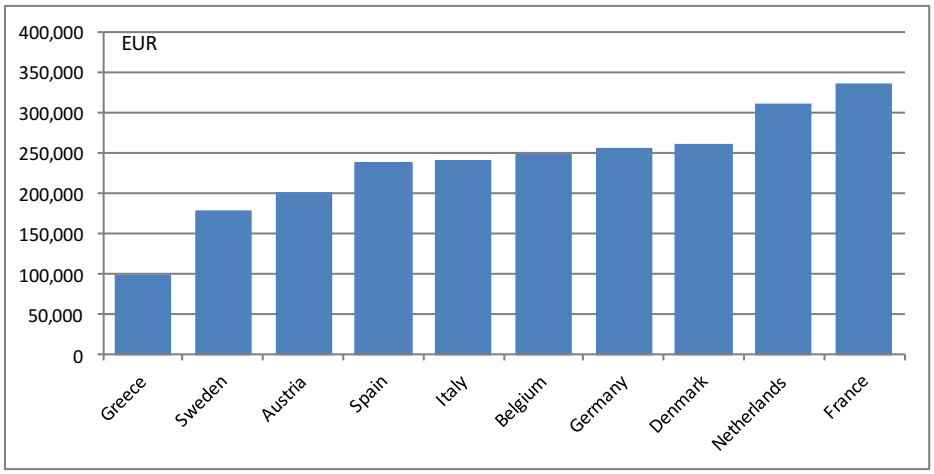
https://esa.un.org/unpd/wpp/Graphs/DemographicProfiles/

7. Appendix

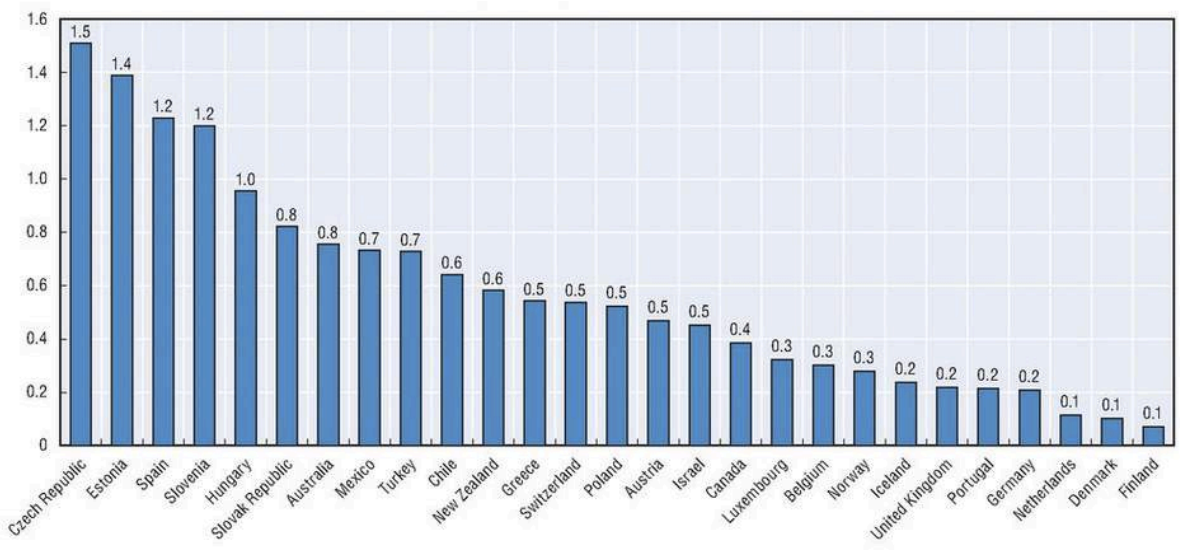
Appendix A: Average Value of home ownership

(OECD, 2014, p. 97)



Appendix B: Pension funds' operating expenses as a share of total investment

(2013) (OECD, 2015, p. 197)



H. Why demography matters: Population dynamics and its impact on the wealth of nation

by Thomas Alexander van Meerkerk

1. Introduction

The expected demographic change in the future is going to be a large-scale one. What will be the impact of this change on the economies of developed and developing countries? Should governments influence the population dynamics of their country? If so, what policies should governments implement to positively influence the wealth of their nation? This paper tries to answer these questions by means of a quantitative research based Batini et al (2004).

2. Econometric analysis

For analyzing the relationship between demographic variables and per capita GDP growth rate, the level of savings, capital investment, current account balance and fiscal balance, panel data from 1960 to 2000 on 115 countries has been used. (Batini et al, 2004). As for basic results of analysis of this data, by changing some exogenous factors, the following analysis results have been obtained.

	Growth in Real GDP per Capita	**Saving /GDP**	**Investment /GDP**	**Current Account/GDP**	**Budget Balance/GDP**
Share of working-age population	**0.08**	**0.72**	**0.31**	**0.05**	**0.06**
Share of elderly population	**-0.041**	**-0.35**	**-0.14**	**-0.25**	**-0.46**

Table 1: Macroeconomic impact of demographic changes. Source: Batini et al (2004).

The per capita GDP growth rate shows a positive correlation with the change in the relative size of the working-age population, while there is a negative correlation with the change of the size of the elderly proportion. This result is consistent with the result of previous research, and it partially reflects the direct influence of the size of the labor force on productivity. Furthermore, if the elderly population ratio is low, savings will increase, which will lead to promotion of financing for capital investments along with increasing levels of production. Several research findings (Bloom et al, 2001) suggest that if the initial level of national income per capita is low, the impact on declining birthrate will be greater. Other studies (Bloom et al, 2001) suggest that the impact of demographic dynamics on economic growth is strongly related to the regional institutional and policy framework. For example, because East Asian countries are relatively superior in relation to such factors as markets being open and competitive, sufficient

investments being made into basic education, fiscal discipline being maintained and the financial sector being developed, it can be said that it was possible to get better benefits (dividends) from the factors of demographic dynamics. When analyzing the relationship between the GDP growth rate and life expectancy, it is difficult to appropriately quantify and control the variables related to "institutional quality", which seem to have a correlation with both of them. So even though there is a constraint that such difficulty may be reflected in the estimate results, the research results clearly show that life expectancy has a direct influence on the productivity of labor. Moreover, through promoting investment in human and material capital, the per capita GDP growth rate and life expectancy will be in strong positive correlation with each other.

There is a stable and meaningful relationship between demographic variables and savings. According to the "life cycle hypothesis" on savings, people try to maintain a stable consumption pattern throughout their lifetime. This means that if the current income is lower than the average income throughout lifetime, the savings will be smaller, and if the current income is higher, savings will be larger. There is a tendency for net borrowing by young people, while those at the peak of their lifetime wages tend to save a lot. Also, the elderly population tends to draw on their savings or at least save only a little compared to the times when they worked. There are debates about validity of the "life cycle hypothesis": specifically, there is an argument as to whether the elderly will in fact reduce assets after retirement. However, as in many other comparative studies, the demographic dynamics factor (along with income growth rate, the real interest rate, public savings, etc.) plays a role in influencing saving behavior. Specifically, savings increase as the proportion of the working-age population increases and they decrease as the proportion of the elderly population increases.

The working-age population ratio also correlates with capital investments. Capital investments are influenced by demographic dynamics with stimuli for savings as well as by the reason of changes in labor supply influencing returns on investment.

Current account balance increases at a relative scale to the working-age population and decreases as the ratio of elderly people increases. Although both savings and investment are affected by the age composition of the population, the magnitude of the impact of demographic changes on current account balance does not become immediately apparent.

The elements of demographic dynamics also affect fiscal balance. Particularly, a government’s budget is pressured by the increase in expenditures for pensions, medical and housing measures as the aging of population progresses. According to a research (Burniaux et al, 2003) on long-term financial burden caused by the aging of the population, additional expenditures on medical care will exceed pension expenditure from the year 2000 until 2050 in many OECD

countries. Expenditures related to old age are expected to rise to nearly 7% of the GDP. If the working-age population is small, fiscal revenue will be reduced accordingly.

Econometric results suggest that anticipated changes in demographic dynamics may have a significant impact on future economic performance. By linking the shown estimated value of the correlation coefficient with the UN population estimate, one can understand the meaning of its potential influence and learn how it differs for each country.

In developed countries, it is supposed that the impact of coming demographic changes on economic growth will be serious. Regarding the interrelation that exists between demographic dynamics and macroeconomic variables, it is suggested (reference) that the anticipated increase in the dependence rate of older people and the decrease in working-age population will slow the growth of GDP per capita and lead to lower savings and investment levels. For example, regarding demographic changes, there are estimation results that by 2050 the real GDP growth per capita in developed countries will be reduced by 0.5% on average. That is, if it is assumed that the demographic structure is still in the same state as in 2000, it will be 0.5% lower than the achieved growth rate. As for the growth rate, Japan will be most affected, while the United States will have less impact.

The impact on economic growth in developing countries varies depending on the region. In African and the Middle East region, the per capita growth rate will be accelerated by the increase in working-age population. According to estimation results (Burniaux et al, 2003), the per capita economic growth rate in 2050 will be 0.3 and 0.1% higher in those regions respectively. However, these results do not take into consideration the fact that the epidemic of HIV/AIDS may continue to have a serious impact such as macroeconomic outcomes being severely compromised in countries of those regions. In contrast with that, the demographic dynamics until 2050 is a burden for growth in the Central and Eastern European countries, and the same is true for Asian and Latin American countries, although not as much. (In the latter two regions the degree of impact will be different depending on each country.) Changes in demographic dynamics in the future are very likely to bring about major changes in current account balances. In advanced countries aging populations will have a negative impact on savings, and as a result, the current account balances will generally worsen. Among them, the current account balance in Japan is expected to worsen on the scale of about 2.5% of the GDP ratio. The exception to this is the United States, as the current account balance there will be improved by more than 1% of the GDP ratio as demographic dynamics progress. In developing countries demographic dynamics will have an effect of improving current account balances for Africa and the Middle East, but in case of Central and Eastern European countries the current account balance will worsen.

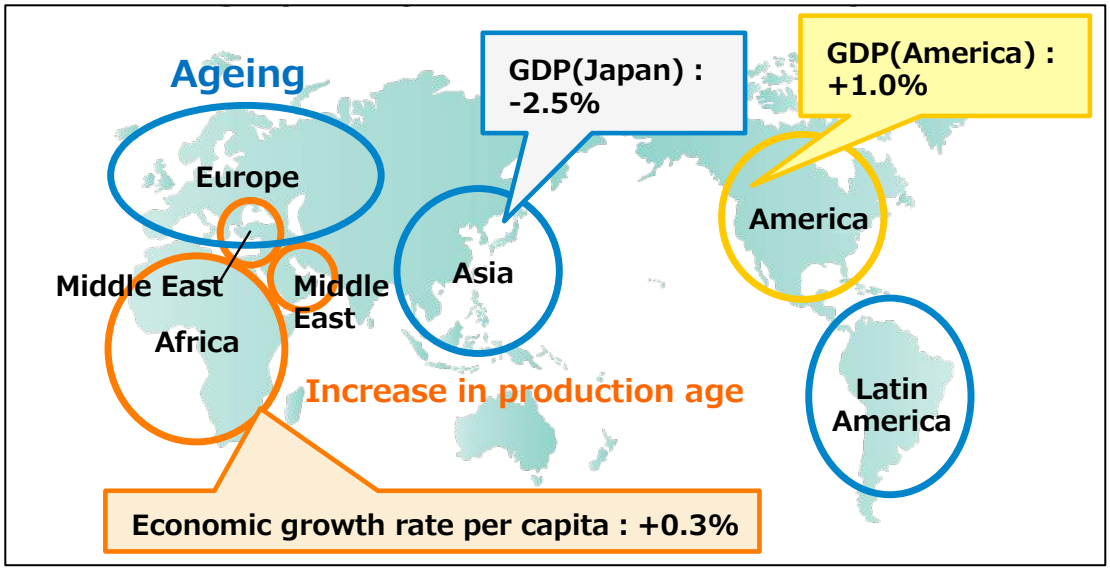


Figure 1: Demographic dynamics of the world by 2050.

3. Policy response to changes in world demographics

What can we do for economic challenges arising from demographic changes? Certainly, there are numerous policy responses that can be adopted at the national and international levels, and several of those policies are already subject to discussion, especially in countries where demographic changes are becoming the most serious and imminent issue. Developed and developing countries face different challenges due to demographic changes, however policies that are effective against demographic changes at a wide range of levels will have to promote labor supply as well as to improve savings rate and productivity.

Assuming that the participation rate in the labor market does not change, the progress of demographic change will result in a reduction in labor supply in many developed countries over the next 50 years. In the study done by Burniaux et al (2003), it was estimated that labor supply will decrease by 35% in Japan, 30% in Italy and 17% in Germany. Policies to improve the pension system and work motivation will increase the participation rate of women and the elderly (both male and female) in the labor market, and measures to increase labor supply have been studied with considerable interests. Nevertheless, in order to maintain the ratio of the labor force population to the current population, the participation rate in the productive age population needs to increase greatly. For developed countries, participation rates need to increase by an average of 11 percentage points, however the required increase is higher in Europe and South Korea rise compared to that in the United States. For Japan, even if participation rate reaches 100%, it cannot compensate for the decrease in the productive age population. Labor can also be increased by admitting more immigrants. However, even in this case, the number of immigrants needed to maintain the current workforce population ratio is quite large. In particular, in recent situations where the number of immigrants is generally at a

low level, the required number of immigrants will be even larger. Extension of the retirement age will be effective in alleviating the impact of the decrease in productive age population. In developed countries, in order to keep the productive-age population ratio at the current level, it is necessary to extend the retirement age, the required extension length of retirement age vary for each country.

For policies to increase birthrate, various proposals have been made as measures against current demographic changes. However, even if such a policy is effective and birthrate increases, it will take quite a long time for the labor force to increase. Although there are significant evidences that the government's public policy plays an important role in reducing birthrate in developing countries, the ability of birthrate-related public policy to boost the birthrate in countries with low fertility, still needs to be discussed. People who actively support the government's public policy to increase the birthrate often quote Scandinavian countries. In the Scandinavian countries, policies are being implemented to establish women's rights and to enable women to easily enter the labor market, which led to a recent increase in birthrate. (however, these policies are aimed at wider social goals rather than an explicit goal of increasing birthrate.) Of course, it is not easy to answer whether these policies contribute to the increase in birthrate. In particular, despite the fact that such policies were not implemented in the United States, birthrate has been increasing greatly in recent years. However, in the United States, the private sector responds to the growing demand on nursing care facilities for young children, which supports the social advancement of women labor force.

In contrast, in developing countries, the most important policy issue related to labor market is to provide employment to the growing productive age population. For this purpose, it is necessary to enrich education and training to improve vocational abilities necessary for employment, but at the same time, reform is necessary to increase the flexibility of the labor market (Fasano & Goyal, 2004).

If we correlate the present labor force with a capital stock that has a better labor efficiency, it seems to be helpful in alleviating the effect of a decrease in labor supply. To do this, there is a need to increase savings. One way to increase savings rate is to increase the government's savings before the population of the concerned country ages more rapidly. Discussions on how developed countries should maintain a basic fiscal surplus and reduce government debt by this method can be found in May 2001 issue of the IMF's "World Economic Outlook" and Heller (2003). However, it is highly possible that factors that are not related to population aging and population dynamics (such as the cost of new technologies and drug development) will greatly increase the social security expenditure on medical care in the future, making such financial efforts to become more difficult. The pension system reform should help to curb public sector expenses, while also contributing to the increase of personal savings. However, depending on the nature of the pension system reform itself, the level of its contribution to the increase in

personal savings depends on its ability to stimulate the people's willingness to work and to encourage savings in preparation for retirement. In developing countries, a strong and stable macroeconomic framework with institutional reform, in other words, the policy basis that keeps the inflation rate low and keeps the level of public debt sustainable, is an important element in creating an environment that can promote domestic savings, capital inflow from overseas and capital accumulation.

For developing countries that are aging relatively rapidly, more efficient utilization of existing capital and labor could be important measures to mitigate the impact of reduced labor force (and possibly capital reduction). Therefore, structural reforms to improve productivity by eliminating obstacles to competition, increasing flexibility of labor market and price, and further accelerating innovation, are important. (however, it is quite difficult to accurately estimate the effect that such structural reforms will bring.) However, if pension benefit amount is designed to be linked with wage, even with an increased productivity, it will not help in reducing the financial pressure on the pension system as incomes generally increase. Nevertheless, the increase in income will generally lead to an environment that makes it easier to implement structural reforms. Even in other developing countries, improving productivity will be an important complementary material to the positive effect of demographic changes on per capita GDP growth in the future.

In the case where the scale of required reform in a specific area is extremely large, and thus it is politically and economically difficult to realize the reform, it may be necessary to deal with the impact of demographic changes by extensively combining the various policies mentioned above. As a whole, in order to stabilize the ratio of labor force at the current level in developed countries, it is necessary to solve each problem separately by using various efforts to increase participation rate in the labor market, increase immigration, or extend the retirement age at considerable scales. The extent of expansion required in this case is beyond past experience and actual values. However, as all these policies are to be enforced in line with reforms, the range of expansion required should be smaller. It is possible to maintain the ratio of the labor force's population to the current level until 2050 by increasing participation rate in the labor market by 3.75 percentage points, accepting immigration to 10% of the population, and extending the retirement age by 2.3 years. Although seems difficult, the widths of these figures are within the range of fluctuations that we have experienced in the past 40 years in some developed countries. Regarding the extension of retirement age, legislations has actually been implemented in some countries in recent pension system reforms. In addition, these policy responses are interrelated and supplemented, and are useful for maximizing the effects of individual reforms. Extension of retirement age will not only reduce the burden on the pension system, but may also lead to an increase in potential labor supply by keeping older people longer in the labor market and affecting their saving behavior.

Policies at the international level are important in countering the effects of changes in demographic dynamics. Worldwide coordination for different population aging speeds by country / region can be achieved by moving commodities, capital, and labor in a multilateral manner. However, such movements are considerably large. Redistribution of resources on a global scale will be most efficiently achieved if there is a smooth movement in all areas of goods, capital and labor. In addition, if all fields share the role of coordination, the burden on each field will be even further reduced. Nevertheless, policy makers need to balance their economic, political and social considerations. For example, accepting immigration expansion in developed countries will act as a cushion to mitigate the impacts of aging population on labor force, but at the same time, it is important to recognize social influences that may occur. Thus, it is necessary to consider the ability to combine and the influence of immigrants on population density. (regarding population density, Europe and Japan are already at high levels.) Regarding the liberalization of capital transactions, this will provide opportunities to increase the function of attracting foreign currency funds to developing countries and to promote investment and growth, but at the same time, if it is not sufficiently robust it also leads to an increased risk of the financial crisis in particular economic policies and institutions. Increasing the mobility of labor will bring important revenue sources by "remittance to home country" to developing countries, but the "brain drain" of highly educated people from developing countries will increase and may cause economic losses. Strengthening international coordination is necessary to coordinate the movement of these resources among nations in order to minimize the complex risks as much as possible.

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IV. NEW BOOK PUBLISHED BY THE LECTURER

Failure to address Africa's rising population is not an option

Africa will dominate global population growth in the 21st century. Almost 1bn people, or 13 per cent of the world's population, live in sub-Saharan Africa today. That number will more than double by 2050 and 4bn people (or 36 per cent of the world's population) could live in the region by 2100, according to a projection last month by the UN Population Division.

The main reason for the rapid growth is a sharp decline in infant and child mortality, with no associated reduction in birth rates. Today, sub-Saharan women have five children on average, compared with 6.7 in 1970.

Growing populations in the sub-Saharan region will influence societies, economic outcomes and geopolitics. In addition, the expected effects on food and water security (exacerbated by climate change) will be unprecedented.

These trends will impact not only the region but the rest of the world. Europe appears to be particularly vulnerable as migration from sub-Saharan Africa is likely to intensify in coming decades.

The good news is that African demographics appear to be commanding more international attention. The G20-Africa Partnership Conference, held in Berlin in June, focused specifically on Africa's population boom. The G20 Summit in Hamburg this weekend will also address Africa's population size and highlight the need for better employment opportunities.

Sub-Saharan Africa is at a crossroads regarding the potential to capture a demographic dividend — an economic surplus triggered by the decline in birth rates, a decrease in the number of young dependents and an increase in the proportion of working-age adults. But the pressing policy question is whether the region can replicate the conditions that enabled several East Asian countries to prosper from their own demographic dividends from the early 1960s to the 1990s.

For this to happen, public policies will need to manage a rapid and significant decline in fertility. To trigger such a sharp fall, countries must achieve a contraceptive revolution, in which more than 75 per cent of couples are using modern contraceptive methods. The current rate in sub-Saharan Africa is only 26 per cent.

The mere supply of family planning services will not be enough, however. Much more work is needed to promote the idea that smaller families are beneficial.

Policymakers and their development partners need to understand the implications of demographic dynamics and the crucial role of fertility reduction. Too many African policymakers, scholars, opinion leaders and business planners still believe that education and

economic growth alone will trigger a fertility decline. As a result, African leaders remain diffident about intervening proactively in the debate.

In addition, Africa needs continued investment and improvement in its healthcare systems. The hope for fertility decline will depend on further improvements to women's rights, such as combating child marriage.

Making sure that women are able to access contraceptives is a priority. This month, the second London Family Planning Summit will rekindle international efforts to increase access to modern family planning for African women and girls.

Last but not least, Africans urgently need jobs. There will be no demographic dividend without job creation. According to the International Monetary Fund, between 18m and 20m new jobs — roughly equal to the population of Mali or Niger — will be needed annually over the next 25 years on the continent. If these trends are extrapolated until 2050, the new jobs required would be almost equivalent to the entire European population. The prerequisites to meet this huge challenge are education and better healthcare, followed by investment based on stable economic and political conditions.

The task ahead is formidable, not only for sub-Saharan Africa but also for the rest of the world. Failure is not an option: a bad outcome would harm both the region and the world. Failing to capture its demographic dividend would lead to millions of sub-Saharan Africans living in poverty and in slums. It would result in a restless young population and provoke social disruption and human suffering that could spill over well beyond the continent.

John May is visiting scholar at the Population Reference Bureau, Washington DC.

Hans Groth is chairman of the board at the World Demographic & Ageing Forum, St Gallen. They recently published the book 'Africa's Population: In Search of a Demographic Dividend' (Springer, 2017)

Reference of the Book

Hans Groth & John F. May "Africa's Population: In Search of a Demographic Dividend", Dordrecht: Springer Publishers, 2017 (ISBN 978-3-319-46887-7). See also: http://www.springer.com/us/book/9783319468877

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Hans Groth · John F. May *Editors*

Africa's Population: In Search of a Demographic Dividend

This book examines the promises as well as the challenges the demographic dividend brings to sub-Saharan Africa as fertility rates in the region fall and the labor force grows. It offers a detailed analysis of what conditions must be met in order for the region to take full economic advantage of ongoing population dynamics. As the book makes clear, the region will need to accelerate reforms to cope with its demographic transition, in particular the decline of fertility. The continent will need to foster human capital formation through renewed efforts in the areas of education, health, and employment. This will entail a true vision and determination on the part of African leaders and their development partners. The book will help readers to gain solid knowledge of the demographic trends and provide insights into socioeconomic policies that eventually might lead sub-Saharan Africa into a successful future.

« Africa needs a serious dialogue on population, the demographic transition, and the demographic dividend. This book with its comprehensive approach to the subject, makes an invaluable contribution. A must read for policymakers and development practitioners. »

Ngozi Okonjo-Iweala, former Finance Minister of Nigeria and former Managing Director of the World Bank Group.

« Everyone concerned about human welfare in sub-Saharan Africa should know about the demographic dividend, what it is, what causes it, and how to strengthen it. This volume provides an excellent summary of these crucial issues. The sooner policymakers pay attention and take the proper actions, the better. »

John Bongaarts, Vice President of the Population Council

« There is no more important socioeconomic issue for this century than that of whether Africa's currently rapid population growth turns out to be a dividend or a curse. As a comprehensive, up-to-date guide to the potential and the challenges, this book deserves to be widely read and debated. »

Bill Emmott, former Editor-in-Chief of The Economist, Chairman of the Wake Up Foundation

« This book is of utmost strategic relevance for any globally active company. For Africa in particular, the role of demographic change and the potential economic opportunities are all too often disregarded. »

Reto Francioni, Chairman SWISS International Airlines, former CEO Deutsche Börse

Social Sciences

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Africa's Population: In Search of a Demographic Dividend

Hans Groth · John F. May *Editors*

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Springer