Post-Soviet mortality trends in Poland and the Russian Federation

An analysis of cardiovascular and manmade diseases in Poland and the Russian Federation

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Summary

Mortality trends in countries throughout the history can be put roughly into three stages, the stage of reduced mortality due to infectious diseases, the cardiovascular revolution and the fight against aging. This thesis is focused on the second stage, the cardiovascular revolution, and takes a closer look to the mortality trends of Poland and the Russian federation in the post-Soviet era. WHO data will be used in order to make an age specific decomposition of gain in life expectancy in both countries. Before the fall of the Soviet Union the life expectancy trends of these countries were converging. When the Soviet Union fell a sharp drop in life expectancy occurred in Russia while the life expectancy of Poland kept rising and entered the cardiovascular revolution. Substantial gains in life expectancy were made due to a decrease in cardiovascular mortality in Poland. Russia eventually followed this trend and the same pattern can be observed in the period 2005-2015. Manmade diseases play an important role in both countries were alcohol and tobacco consumption used to be high leading to more cardiovascular and other diseases. Three factors can be identified in order to explain the trends of life expectancy in both countries. Institutional changes, economic changes and behavioural changes. Due positive changes in these factors, the life expectancy of Poland rose and due to negative changes the life expectancy in Russia dropped.

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1. Introduction

The fall of the Soviet Union was a huge geopolitical event in history, a lot of new states were born and states in Eastern Europe like Poland, East Germany and the Czech republic were no longer under influence by the Soviet Union. During the Soviet Union times, healthcare was free for everyone and state controlled, but after the fall of the Soviet Union this was not the case anymore. Poland and the Czech republic made significant progress and the life expectancy rose, while Russia experienced further deterioration of the health system leading to stagnation and even a sharp drop in life expectancy. A notable difference is that life expectancy in Poland significantly rose while life expectancy of Russia did not rise and even declined. However in the last decade the life expectancy of Russia started to rise again. Grigoriev et al. (2014) argue that Russia has finally entered the cardiovascular stage and is finally catching up. The central question that arises from this situation is:

How can the difference between life expectancy and mortality trends between post-soviet Russia and Poland be explained with the help of the concept of the cardiovascular revolution and manmade diseases?

As stated above, the healthcare systems were similar in both countries before the fall of the Soviet Union. Yet, there is still a difference between life expectancy right before the fall of the Soviet Union (Grigoriev et al., 2014). In order to answer the research question it is important to briefly describe the situation and provide some historical background before the fall of the Soviet Union in both countries. One of the sub questions that emerges from this is: *What was the situation, related to life expectancy and mortality, in Russia and Poland before the fall of the Soviet Union?*

In order to compare Poland and Russia with each other, it is important to zoom in on both countries and try to explain the trends in life expectancy in both countries after the fall of the Soviet Union with the help of different factors. The two sub questions that emerge from this are: *How did cardiovascular and manmade diseases influence the life expectancy trend in Poland?* And: *How did cardiovascular and manmade diseases influence the life expectancy trend in Russia?* The literature framework will provide an explanation of the cardiovascular revolution and manmade diseases. Data from mainly the WHO (2019) and literature research will be used to determine the causes of trends in mortality in both countries.

2. Theoretical framework

One of the most known models in demography is the demographic transition model (DTM). It provides a framework to show the relationship between mortality decline and fertility decline, leading to population growth and eventually leading to an equilibrium between fertility rates and mortality rates (Holdsworth et al., 2013).

The DTM is a good example of why transition models are a popular approach in demography. In the past two hundred years, life expectancy of humans has greatly increased in almost all countries in the world. This increase in life expectancy can be explained by the epidemiological transition model introduced by Omran (1971), which is associated with the DTM. This model consists of three stages and presents the evolution through these stages. The stages are the age of pestilence and famine, the age of receding pandemics and the age of degenerative and manmade diseases. In the age of pestilence and famine, mortality was high and fluctuating heavily and life expectancy was under 30 years on average. In the age of receding pandemics, life expectancy rose from 30 to 50 years due to better hygiene, medical treatment and health awareness among the population. In the age of degenerative diseases and manmade diseases, life expectancy rose even further due to the extermination of almost all infectious diseases, because of this degenerative diseases and manmade diseases, like smoking, became a more important cause of death.

This epidemiological transition is the central theme of the paper of Vallin & Meslé (2005). In this study, it is shown that the epidemiological model is useful to explain trends in mortality and life expectancy in countries and that three major stages in life expectancy trends and mortality trends can be found. The first stage is the extermination of most infectious diseases, which is in fact the epidemiolocal transition model, the second stage is the cardiovascular revolution and the third is the fight against aging. Most developed countries are currently in the third stage, however it is argued that a country can enter a next stage without completing the previous stage. Eggleston & Fuchs (2012) findings about a new stage in the DTM correspond with these stages of Vallin & Meslé (2005). In the new stage of the DTM the most gains in life expectancy are realized in late life. Extra gains in life expectancy were previously gained at young ages, but nowadays most gains in life expectancy are made in the late life stage (Eggleston & Fuchs, 2012). These findings support the last stage of Vallin & Meslé (2005) that states that improvement in life expectancy is a battle against aging. Disparities in the word are the cause that some countries are still stuck in the first stage while other countries are already in stage three. Disparities within a country, like socio-economic differences, gender difference and geographical difference can also cause a temporary convergence in life expectancy (Vallin & Meslé, 2005). The short article of Gaziano (2010) shows us that the manmade disease obesity is becoming more and more of a problem in today's western society, making it a possible next stage in the epidemiological transition model.

Grigoriev et al. (2014) use the findings of Omran (1971) and Vallin & Meslé (2005) to explain the development of life expectancy in Russia. They state that Russia is now finally entering the cardiovascular revolution or the second stage of life expectancy trend as discussed by Vallin & Meslé (2005). In the Soviet Union the country was already in a mortality crisis, life expectancy was fluctuating between 60 and 65 while other countries like France were making significant advances in life expectancy. This mortality crisis was due to the poor health services in the Soviet Union and the bad lifestyle of the citizens. After the fall

of the Soviet Union the lifestyle of the Russian citizens did not improve. Manmade diseases mainly caused by smoking and alcohol consumption, stayed prevalent in the freshly formed Russian federation and due to the fast happening socio-economic reforms the Russian citizens experienced a lot of psychological stress. This factors led to a high mortality among middle aged men due to accidents and fighting and a high prevalence of cardiovascular diseases among older men. Grigoriev et al. (2014) argue in their paper if Russia has recently entered the cardiovascular revolution or also known as the second stage as discussed by Vallin & Meslé (2005).

Poland was the first communist country that showed a stagnation in life expectancy. However Poland was also, together with the Czech Republic that made a sustained increase in life expectancy as a former communistic country. During the Soviet Union era the health care was centralized and failed to provide their population with the accurate specialized healthcare to treat cardiovascular and degenerative diseases. But after the fall of the Soviet Union, the life expectancy in Poland increased significantly. This is because of reforms in the political and economic system, changing attitude and behaviour of the Polish population and due to a shift in education. The leading causes of death in Poland and Russia before the fall of the Soviet Union were cardiovascular diseases, smoking related cancers and car accidents, mainly because of alcohol abuse (Fihel & Pechholdova, 2017).

Deaths due to alcohol consumption or tobacco consumption could also be called avoidable mortality or even more specific causes amendable to intersectional health policies (Andreev et al., 2003). Omran (1971) would identify these causes as manmade diseases, some cardiovascular diseases are also manmade diseases, because they are caused by alcohol and tobacco consumption. For this analysis it is also important to take these manmade diseases in account because both Fihel & Pecholdova (2017) and Grigoriev et al. (2014) have identified that alcohol and tobacco consumption had a significant impact on the life expectancy in both Poland and Russia. Cornia,& Paniccià (2000) also state that alcohol and tobacco are used as stress relievers, so in periods where there population experiences a lot of stress the alcohol and tobacco consumption will rise and thereby smoking and alcohol related causes of death will also rise. Cornia,& Paniccià (2000) argue that this is especially relevant for eastern European countries because of their political and economic transition in the 1990s leading to high amounts of stress.

Fihel & Pecholdova (2017) have identified three main factors that influence life expectancy. First of all institutions play an important role, they decide largely the healthcare expenditures and the health policy of a country. Beside the government, NGO's also have influence on the health care system. Fihel & Pecholdova (2017) argue that integration with western healthcare also plays an important role in mortality trends. Another factor is behavioural changes, Grigoriev et al. (2014) argue that shifting attitudes towards diet, alcohol and smoking can have a major impact on life expectancy, especially in Poland and Russia were a lot of life expectancy could be gained if the population changes its attitudes towards their diet, alcohol consumption and amount of cigarettes. Fihel & Pecholdova (2017) state that educating the population about their diet and alcohol and tobacco consumption could trigger this change in behaviour. The last main factor is the economy. Higher incomes lead to a rise in life expectancy and changes in taxes for Alcohol and tobacco could also influence the consumption and thereby the life expectancy. Education also plays a part in the economy factor because a higher education leads in general to a higher income. These three factors all

influence another factor called stress, institutional and economic changes can influence the amount of stress a person can experience which may cause behavioural changes. Cornia,& Paniccià (2000) state that stress is one of the main drivers behind manmade diseases and changes in behaviour.

2.1 Conceptual model

In brief, institutional changes, economic changes and behavioural changes can be identified as the three main drivers that contribute to the cardiovascular revolution and thus contribute to a rise in life expectancy. These changes happen because of different factors, as can be observed in the conceptual model (Figure 1). Institutional changes and economic changes influence the access and quality of healthcare, while behavioural change is more focussed on the awareness of the population about certain diseases and thereby does not directly influence the quality and access of healthcare. Behavioural changes also influence cardiovascular diseases since some of these diseases are caused by alcohol and tobacco consumption. Some factors can contribute to more than one change, like education influences not only income and thereby economic change but also behavioural change as stated by Fihel and Pechholdova (2017). Note that the conceptual model is not a checklist for every country in order to undergo the cardiovascular revolution, a change in political landscape is not always necessary but can be a factor like in Russia and Poland. The conceptual model can be used to identify if Russia is indeed entering the stage of cardiovascular revolution or not as discussed by Grigoriev et al. (2014). The conceptual model includes alcohol and tobacco consumption because the analysis is not merely focussed on the cardiovascular revolution. It also focusses on the decrease of manmade diseases, which according to Fihel & Pecholdova (2017) happened in the case of Poland around the same time as the cardiovascular revolution. The three factors also influence the amount of stress of a person which influence the amount of manmade diseases. The factor amount of stress is influenced by institutional changes, economic changes and behavioural changes. At the same time it also influences behavioural changes since economic changes and institutional changes can influence amount of stress which could influence the behaviour of a person. (Cornia,& Paniccià, 2000). This means that the relation between amount of stress and behavioural changes is bilateral. The conceptual model is only focussed on the cardiovascular revolution and manmade diseases in order to keep it legible and concise, if all the other stages as described by Vallin & Meslé (2005) would have been added then the model would be unclear and it would not apply to the case of Russia and Poland.

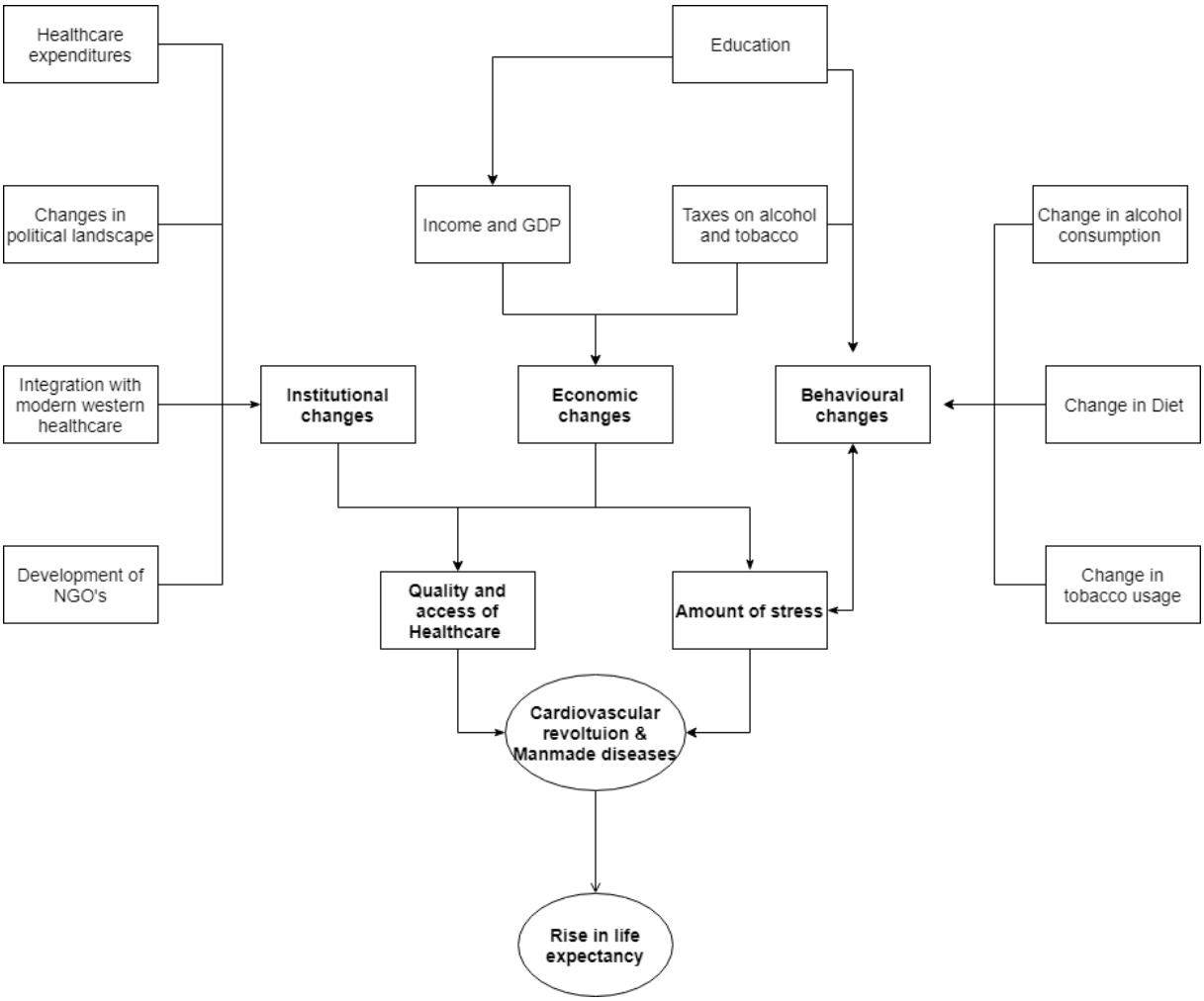


Figure 1: Conceptual model

2.3 Hypothesis:

The main question this thesis tries to answer is: *How can the difference between life expectancy and mortality trends between post-soviet Russia and Poland be explained with the help of the concept of cardiovascular revolution and manmade diseases?* As already stated in the theoretical framework the difference is likely caused by the fact that Poland went through a cardiovascular revolution (Fihel & Pechholddova, 2017) and Russia has yet to go through this revolution or is currently undergoing this cardiovascular revolution, however data needs to back this claim up. If the last claim is true then the assumptions of Grigoriev et al. (2014) are correct. If Russia is currently in the cardiovascular revolution then a converging trend will likely happen between the life expectancy trends of both countries according to the model of Vallin and Meslé (2005). If Russia is currenlty not undergoing the cardiovascular revolution then it is likely that a divergence in life expectancy will happen between Russia and Poland. This is a likely scenario because of all the current economic sanctions against Russia.

3. Methodology

3.1 Life expectancy

Two methods can be used to calculate the projected life expectancy of a country, the cohort lifetable and the period lifetable (Office for national statistics GB, 2017). Life expectancy is a statistical measure of the average time somebody is expected to live, based their birthyear, age and other demographic factors like their sex. The cohort lifetable focusses on persons from a certain cohort, typically from the same age or age group, and calculates the probability of these persons dying at each age over their course of their lifetime. The other approach is the period lifetable approach or life expectancy at birth, as the WHO (2006) calls it. This is the average number of years someone is expected to live at birth if the current mortality rates stay the same over the course of their life. Period life expectancy tends to be lower than the cohort life expectancy because it assumes that the current mortality rates stay the same while the cohort lifetable makes a projection of how mortality rates will change. In this thesis the period life expectancy will be used.

3.2 Ethics

This thesis will not only consist of a literature review but will also use secondary data which will be analysed quantitatively. With secondary data it is important that the researcher gets the data from a reliable source (Clifford et al., 2010). Problems with secondary data include that it is robust or manipulated to answer another research question (Clifford et al., 2010). This is why the period lifetable will be used instead of the cohort lifetable because data about the cohort lifetable is simply not widely available in Russia and Poland. The mortality data will be analysed by using descriptive statistics. Because secondary data is used ethical problems are less prevalent then when using primary data. However it is important that the researcher still needs to be neutral and transparent when analysing secondary data. All databases that are being used are listed in the references and their limitations are being discussed in order to follow the principle of transparency. The variables that are being used are listed in figure 2. This way the research that is being done is transparent and is reproducible.

3.3 WHO database and variables

The data that will be analysed in order to answer the research question will be secondary data. For this research a quantitative analyse will be performed. The data that will be used comes from the WHO mortality database (WHO, 2019). This database is a compilation of mortality data by age, sex and cause of death, as reported annually by Member States of the WHO from their registration systems. The WHO mortality database contains absolute data from 1950 to 2016 and only uses medically certified deaths. The mortality data is coded according to the ICD system (International Classification of Diseases and Related Health Problems). There are different ICD versions, Russia and Poland currently both use the ICD 10 version. Before 1999 Poland used the ICD 9 09A coding system and Russia the ICD 9 09N version. Poland is using a broader classification system for causes of death than Russia does. This is were the first data limitations become prevalent because of the different classification systems used by both countries. All the data needs to be converted to one uniform classification system in order to analyse the data (WHO, 2019). According to a report of the WHO (2014) the range of completeness of the mortality datasets of Russia and Poland are both 100% and the average usability is 74% for Poland and 95% for Russia. Demographic techniques like the Brass Growth–Balance method, Generalized Growth–Balance method or Bennett– Horiuchi method were used by the WHO to calculate the range of completeness. The usability is calculated by the WHO as follows:

$$(Percent\ Usable) = Completeness\ (\%) * (1 - Proportion\ Garbage\ causes)$$

In Poland there is a slight limitation due to a high amount of the so called garbage causes. These are ill defined causes like I519 which stands for heart disease, unspecified. This limitation can be solved by the choice of putting all the cardiovascular diseases into one category in order to keep the analysis reliable (Fihel & Pechholdova, 2014).

Cause of death	ICD 10 codes (104 system)	ICD 10 code (101 coding system)	ICD 9 Codes (based on 101 coding system)
Cardiovascular diseases	I00-I99	1064	B25-B309
Alcohol & smoking related cancers	C00-C16, , C18- C22, C32-C34, C50	1027-1029,1030-1031, 1033-1034,1036	B08, B090-B091, B094-B095, B100-B101, B113
Alcohol-related cause of death	F10-F19, K70-K76, X40-X49	1056, 1080, 1100	B215- B216, B347, B48
Chronic respiratory disease	J40-J47	1076	B320, B323-B325

Figure 2: Table with relevant causes used in this analysis.

Figure 2 shows all the relevant causes and their corresponding ICD codes that are used for this analysis. Grigoriev et al. (2014) and Fihel & Pechholdova (2017) have identified that diseases of the circulatory system can be classified as cardiovascular diseases, the corresponding ICD 10 codes are I00-I99 and 1064. Griogriev et al. (2014) identified the cause G45 as a cardiovascular disease, but the corresponding 101 code is 1058 (diseases of the nervous system). This 1058 code contains the causes G00-G98. By including the variables G00-G98, a distorted image will be produced about mortality related to cardiovascular since only G45 is a relevant cause. That is why G45 is not included in this analysis.

For the manmade diseases that are linked to alcohol and tobacco consumption Corraro et al. (2004) have identified the cancers that are related to alcohol and Lopez et al. (1994) have identified the cancers and diseases related to tobacco. Another limitation emerges when looking at the causes of death that are caused by alcohol and tobacco. Most of the causes overlap, like cancer to the lip, oral cavity and pharynx that is both causes by alcohol and tobacco consumption. To prevent causes of death to be included double in the analysis, the cancers related to alcohol and tobacco have been merged into one cause. Other causes related to tobacco or alcohol, like chronic lower respiratory diseases, are still each a separate variable. The alcohol related causes are more acute causes of death like poisoning but the cancers related to alcohol and smoking and the smoking related causes are not acute causes but take time to develop. This is why it is likely that more fluctuation of the alcohol related causes can be observed . Alcohol and tobacco consumption also influence some cardiovascular diseases.

The data pulled from the WHO website will mainly be used for descriptive statistics, like graphs that show the development of these causes of death through time for both countries. Decomposition in life expectancy over periods of five years will also be used to show which diseases became more prevalent over certain years, leading to a higher mortality rate and thereby a decrease in life expectancy. With this analysis, a comparison, related to the cardiovascular revolution and manmade diseases, between Russia and Poland can be made. The analysis will be made with the help of the formula's created by Arriaga (1984). With these formula's a comparison of two periods can be made resulting in age-and-cause specific contributions to life expectancy at birth.

3.4 Other databases

Other indicators in the conceptual model can be used to see if they have an impact on life expectancy using a regression analysis, where each year is a case. Data about alcohol consumption and smoking, GDP per capita and education can be found for both Poland and Russia (OECD, 2019; Worldbank, 2019; Worldbank, 2019). Institutional changes are difficult to measure with quantitative data and no databases can be found about these changes. However most data found on alcohol consumption and education is not broad enough to perform a regression analysis. GDP per capita in $ is the only variable on which a regression analysis could be performed. Due to this lack of data, a regression analysis will not be performed in this analysis.

3.5 Data limitations

Data for Russia in the databases that were looked into is often very limited, Russia uses 101 different causes of death while Poland has a significantly more different causes of death. When comparing the two countries, the Russian classification of causes of deaths (ICD 10 code 101) will be used with the corresponding 104 codes of Poland. By using the Russian classification system, variables that are not relevant for this analysis are being put into the equation when calculating the gain in life expectancy over a certain period. The other way around this also holds true. Some relevant causes are left out of the analysis because they were part of a bigger cause of death, an example of this is the cause accidents, Grigoriev et al. (2014) state that alcohol plays a role in the cause accidents, however there are no statistics about how many accidents were caused by alcohol in Russia. This problem causes that the results of the analysis are more unreliable since these results can be influenced by the unnecessary variables in the analysis or by variables that are left out of the analysis. The choice to leave the cardiovascular cause G45 out of the analysis is because of the limited cause specific data of Russia as mentioned in the methodology. However, when looking at how much G45 contributes to the overall cardiovascular diseases an interesting result

emerges. Poland has zero registered deaths for the cause G45 in the years 2015, 2010 and 2005. There are two explanations for this, G45 has no significant impact on cardiovascular disease or Poland does not define G45 as a cause. It is thereby justified to leave the whole cause 'diseases of the nervous system' (1054) out of the analysis. The data about alcohol and tobacco consumption is also limited and only available for a few years, this makes it difficult to perform a good regression analysis with multiple independent variables because there are simply not enough cases. Another limitation was that alcohol and tobacco consumption also influence some cardiovascular diseases. In theory it would be better to split the cardiovascular diseases into two categories. One category with cardiovascular diseases related to alcohol and tobacco and one category related to other causes. However because of the limited classification that Russia uses and the unreliability of the data in Poland, this was not possible for this analysis. That is why it is important to stress the fact that some of the cardiovascular diseases are also manmade diseases. The mortality data of the Russian Federation is, in general, of good quality, this is partly because Russia does not use a broad classification system of the causes of death unlike Poland. However Timonin et al. (2017) state that some problems are prevalent with mortality data for older ages, especially at the age of 80 and over. This problem is prevalent in almost all developed countries and according to a report of the WHO (2014) there is no evidence that the mortality data of Russia is not trustworthy. The limitation with the mortality data of Poland is the high amount of ill-defined causes or the so called garbage causes (Pikala & Maniecka-Bryła, 2017) however as previously discussed, this is not a major problem for the analysis. A survey from the WHO (2005) about the mortality data shows that in Russia 19% of the deaths are registered in a hospital or medical institution. Compared to the other countries this is very low. In 39% of the cases an autopsy is performed which is about the same percentage as other western countries. Poland did not respond to this WHO survey so no data is available.

Another problem with the Polish mortality data is that Poland does not always register emigration. For about 40 years Poland has experienced an outflow of migrants, whilst these migrants are still registered as Polish citizen, they do not actually reside in Poland. So the de jure population in Poland has been higher than the de facto population over the past 40 years. However Fihel & Pechholdova (2017) argue that these unregistered migrants are mainly young males. This age group has little impact on the mortality data, the 9% population loss of males aged 25-29 only accounted for a 1.7% increase in the age standardized death rate and a 0.31 year decrease in life expectancy. The most notable impact of this unregistered migration is that the age standardized death rates due to transport accidents rose with 4% due to population loss. This is another reason why the cause accidents has not been included into the analysis. Other problems with the data include the transition from ICD 9 to ICD 10 which could cause a disturbance in the mortality data (Grigoriev et al., 2014). Also the age groups of 85-89, 89-95 and 95+ have been combined into one age group of 85+. This is due to lack of data of the age groups 89-95 and 95+ in both Russia and Poland. This conversion to one age group further contributes to the questionability of mortality data of the older age groups. Another limitation is that Russia has a high amount of unknown deaths which could not be classified into an age group, instead of distributing these causes equally over each age group, the choice has been made to keep these unknown causes out of the analysis in order to avoid distortion of the age specific data. By keeping this unknown causes out of the data it does impact the life expectancy because the actual amount of deaths was higher than the amount of deaths used in this analysis. However this impact is very little since the unknown causes only are a small portion of the known causes.

4. Results

4.1 Life expectancy

Figure 3 shows the life expectancy at birth for Poland and the Russian Federation. As can be observe, the life expectancy of Poland and Russia were converging before the fall of the Soviet Union but after the fall of the Soviet Union a sharp drop in life expectancy can be observed in the Russian Federation while the life expectancy of Poland keeps rising. In the last 10 years, convergence between the two countries can be observed although the gap between life expectancy is still relatively big.

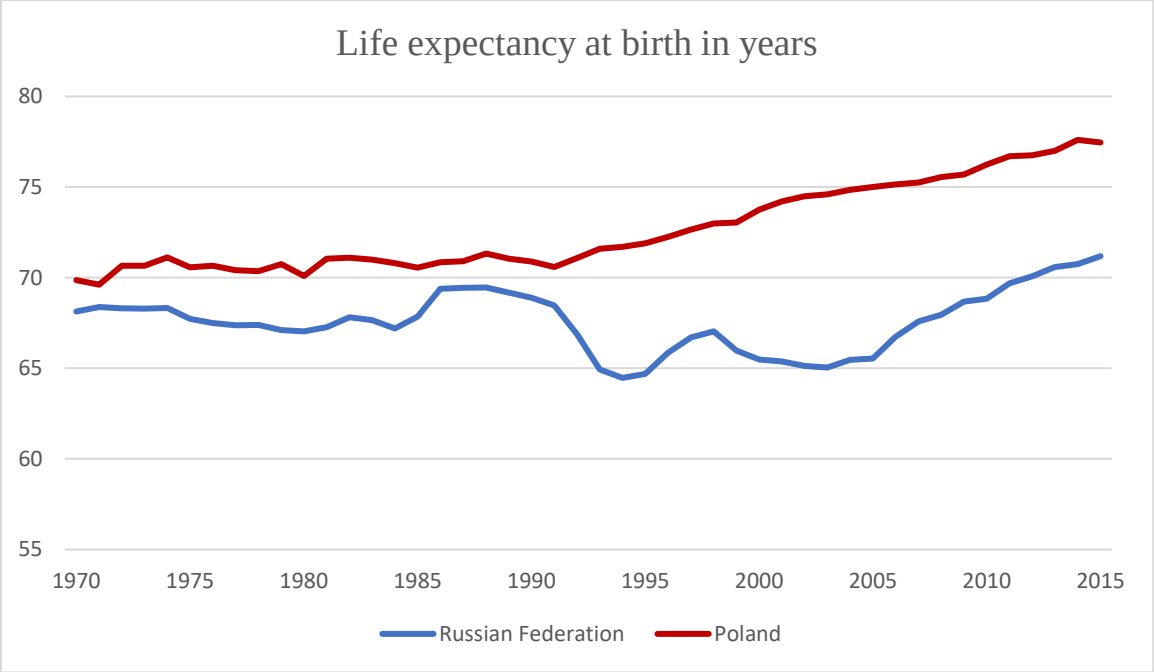
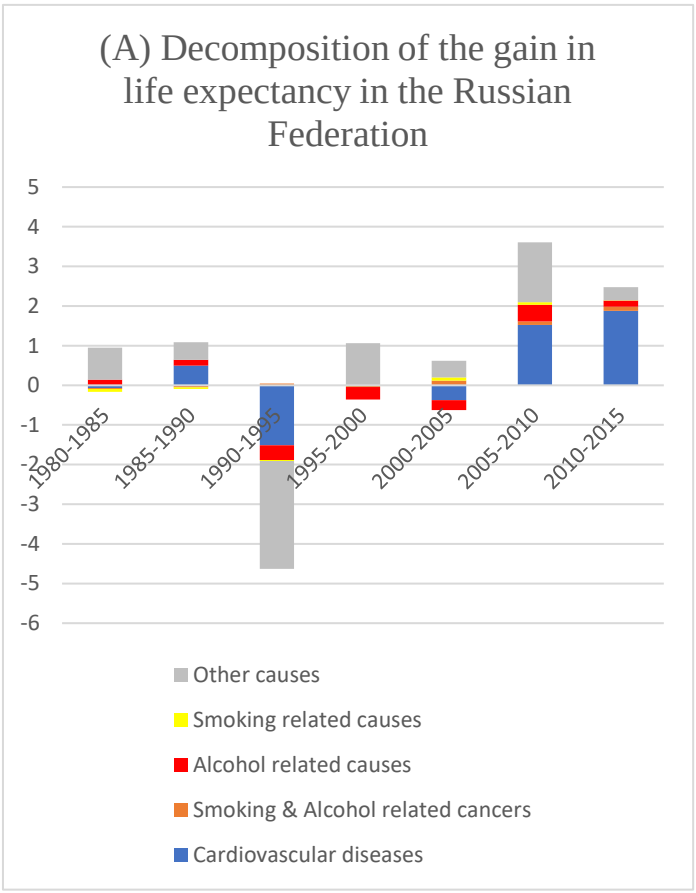


Figure 3: Life expectancy in Russia and Poland. Source: WHO (2019)

4.2 Decomposition of gain in life expectancy

Figure 4 shows the decomposition of the gain in life expectancy of both Russia and Poland. At first sight, it can be seen that the gain in life expectancy heavily fluctuates in Russia while in Poland the trend is more stable. The convergence before 1990 can be observed as Russia makes more gain in life expectancy than Poland mainly due to the factors other causes and cardiovascular diseases. Poland in the period 1980-1985 is losing life expectancy due to alcohol and smoking related causes and cardiovascular diseases. However after 1990, the fall of the Soviet Union, Russia's life expectancy makes a sharp drop mainly due to the other causes but also due to cardiovascular diseases and alcohol related causes. Poland on the other hand is making gains in life expectancy and it seems that this period was the start of the cardiovascular revolution since each period after 1990-1995 substantial gains in life expectancy due to cardiovascular diseases can be observed. As can be observed in the period 2000-2005 there are no signs of a cardiovascular revolution happening in Russia. The periods 2005-2010 and 2010-2015 show that cardiovascular diseases and alcohol related causes significantly contribute to the gain in life expectancy in these periods. Especially in the period 2010-2015 where cardiovascular diseases account for 75,0% of the rise in life expectancy. This rise in life expectancy in Russia in 2005-2015 could indicate that Russia has entered the cardiovascular revolution.



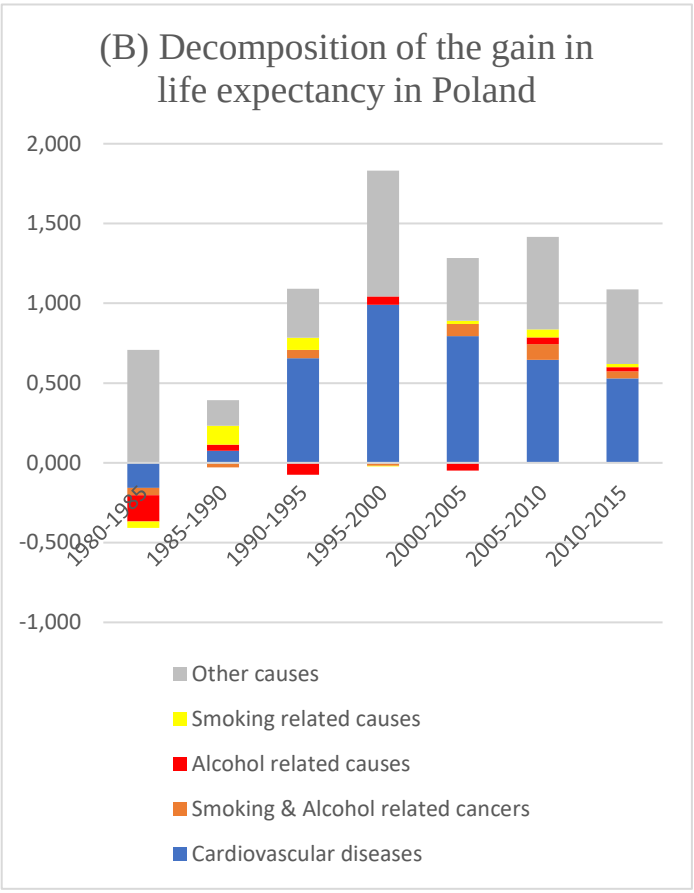


Figure 4: Source: WHO (2019)

4.3 Age specific decomposition of life expectancy before and after the fall of the Soviet Union

In order to get a better understanding about how the life expectancy developed in Poland and the Soviet Union figure 5 shows the age specific decomposition of life expectancy in the periods 1985-1990 and 1990-1995. In both countries, infant mortality has been reduced in 1985-1990, and in both countries the age groups above 70 mainly gain in life expectancy due to a decrease in cardiovascular diseases. The period 1985-1990 was a period were convergence between the two countries occurred but the sharp drop in life expectancy in Russia across all age groups, especially between the age of 40-59 led to divergence between the two countries. The drop across these age groups is mainly caused by the factor other causes but cardiovascular diseases and alcohol related causes also contribute to the loss in life expectancy. In this same period the life expectancy in Poland keeps rising, mainly due to cardiovascular diseases. Alcohol seems to be of a small negative impact on the age group 35-69.

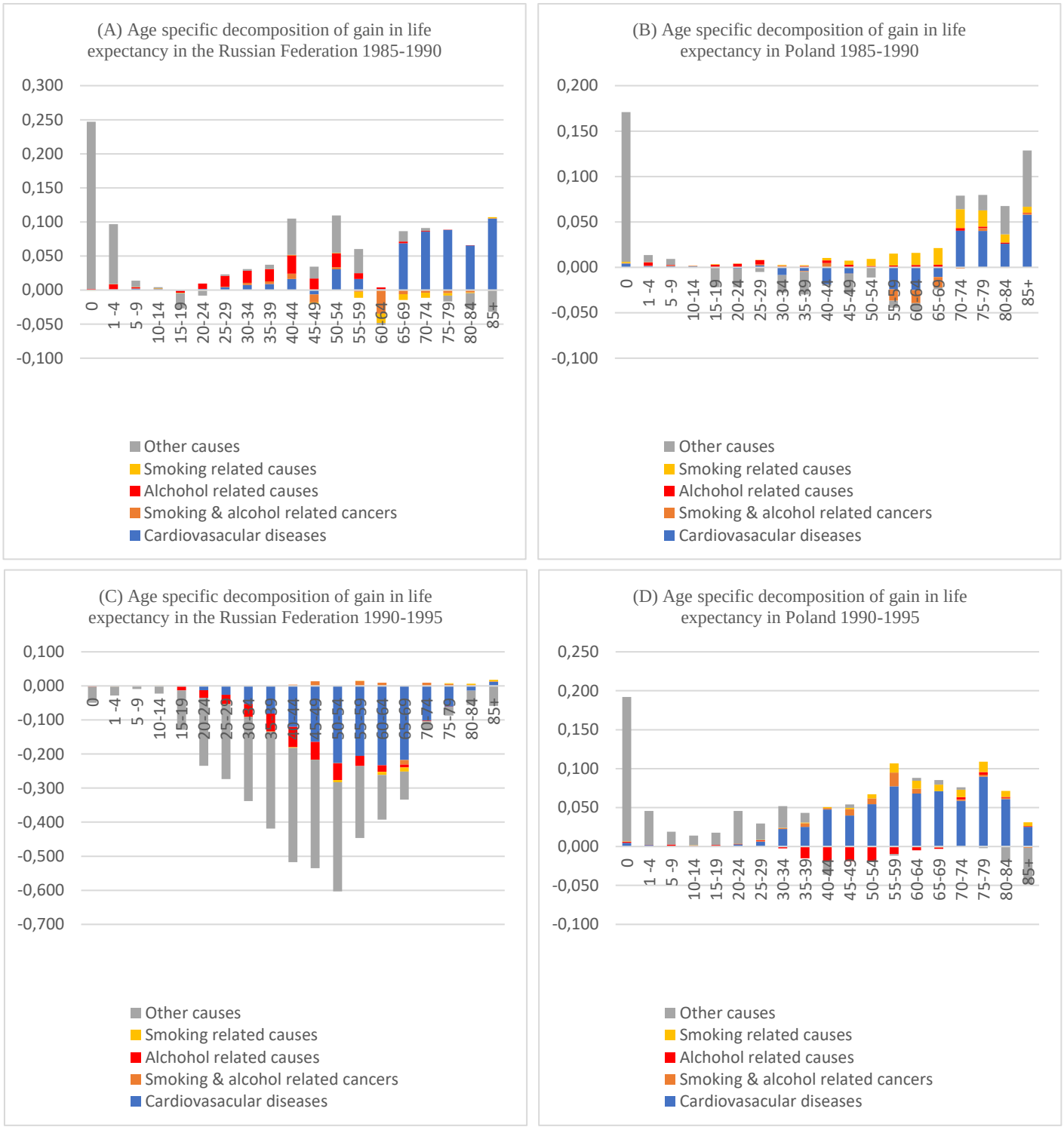


Figure 5: Age specific decomposition of gain in life expectancy in the Russian Federation and Poland in the periods 1985-1990 and 1990-1995. Source: WHO (2019)

4.4 The cardiovascular revolution

Figure 6 shows the period 2005-2015 for the Russian Federation and the period 1995-2005 in Poland, in these two periods of 10 years both countries made the most gain in life expectancy due to cardiovascular diseases. Figure 7 shows the periods of 2005-2010 and 2010-2015 for the Russian Federation, in these periods Russia has made the most gain in life expectancy due to cardiovascular diseases. Figure 8 shows the periods 1995-2000 and 2000-2005 for Poland, also the two periods were Poland has the most gains in life expectancy due to cardiovascular diseases. This way the cardiovascular diseases in both countries can be compared. In order to get a better visualization of the cardiovascular, the 'other causes' of the age group 0-1 has been left out of left graph in figure 8 (Poland, 1995-2000) since this analysis is not focussed on infant mortality. Gains in life expectancy due to cardiovascular diseases can be observed in both countries from the age above 40 but especially in the age group of 60+. The pattern of gain in life expectancy due to cardiovascular diseases is very similar in both countries, although it is important to keep in mind that different periods are used for both countries. What is a difference between the two countries is the gain in life expectancy in Russia due to other causes and alcohol related causes, especially in the 2005-2010 period, this could be a recovery from the sharp drop in life expectancy in the period of 1990-1995 which was also due to other causes. The negative contribution above the age of 65 in Russia is also noticeable since the trends of other causes and cardiovascular diseases tend to follow each other in Russia. Based on this analysis an accurate explanation for the negative contributions cannot be given.

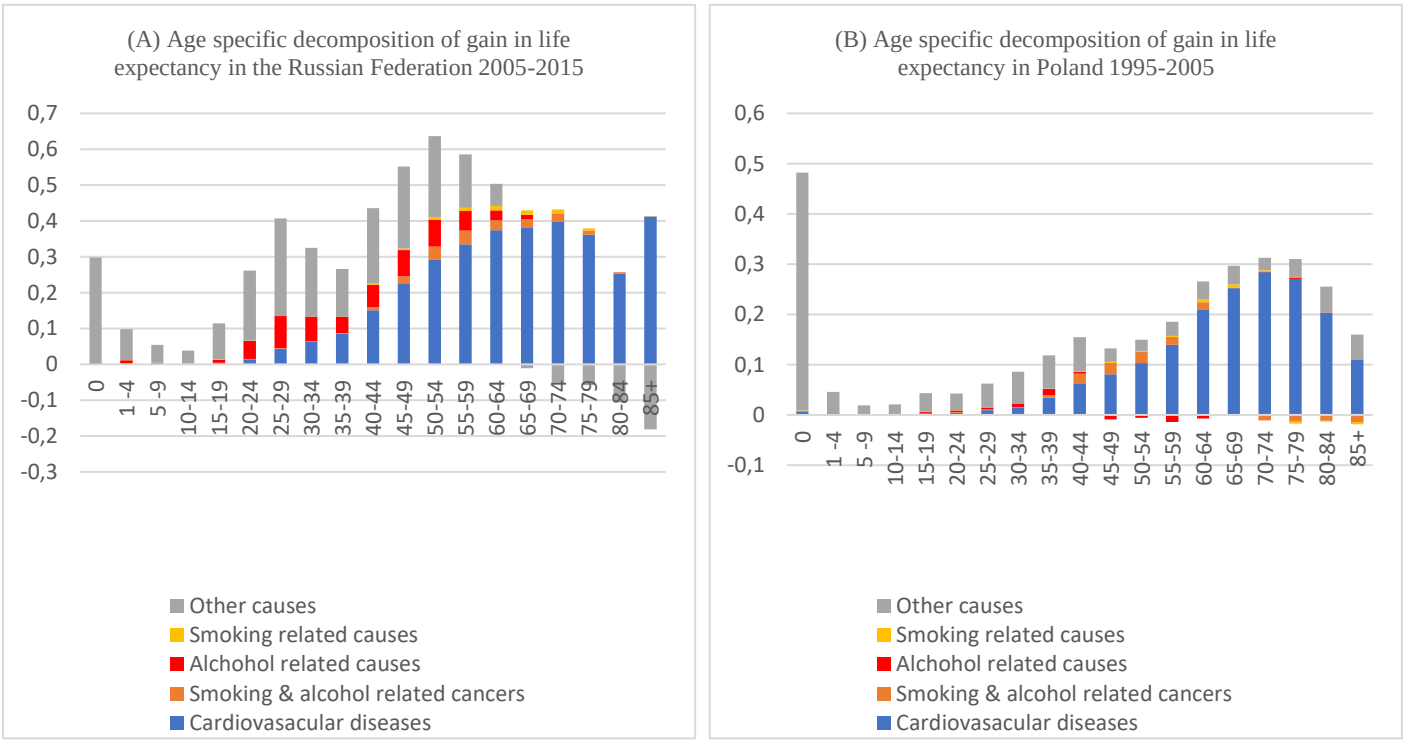
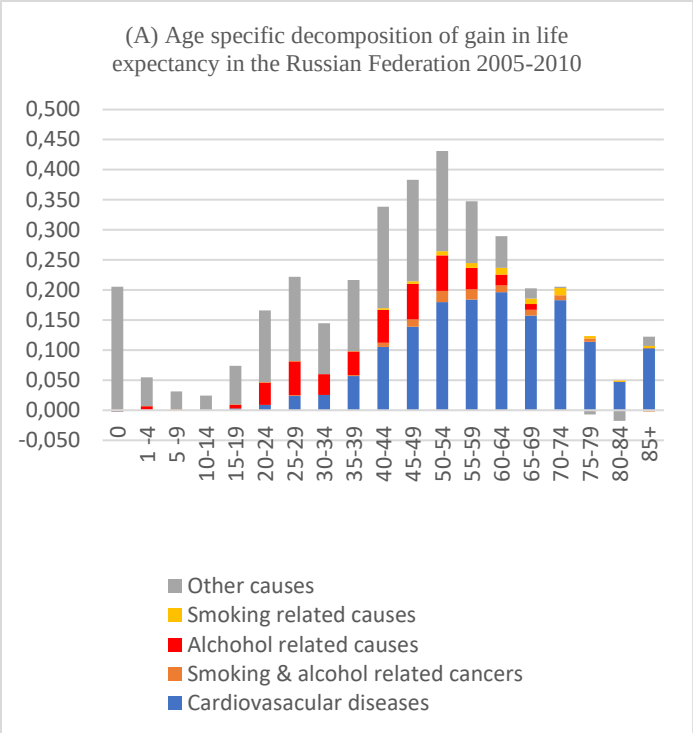


Figure 6: The cardiovascular revolution in the Russian federation and Poland. Source (WHO, 2019).



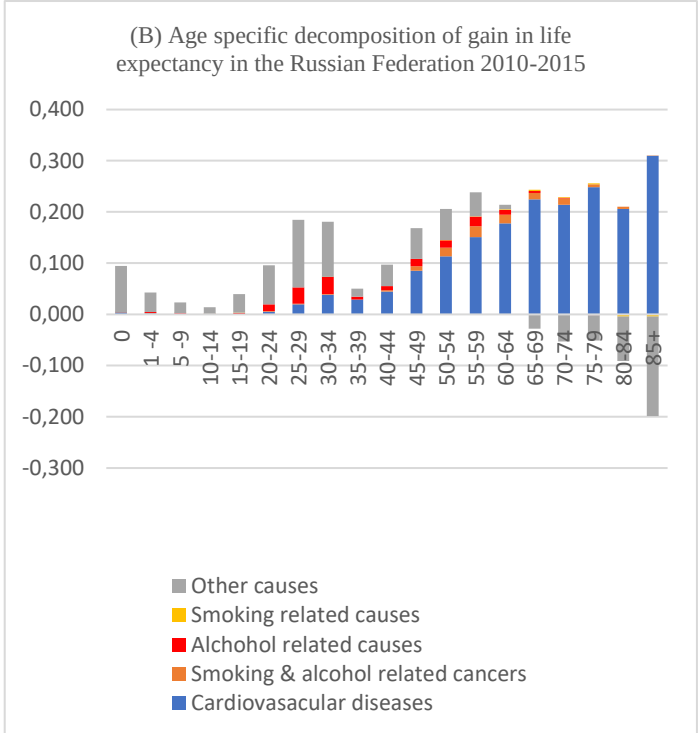
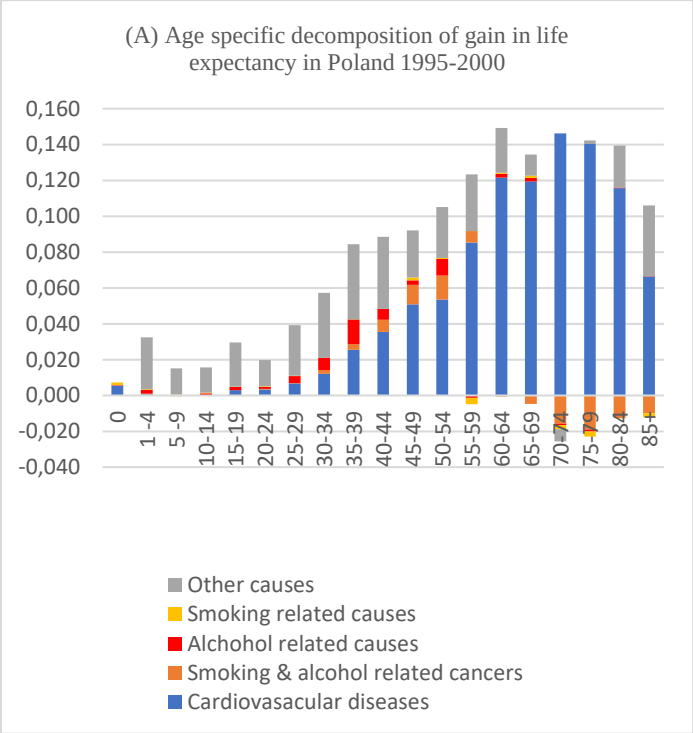


Figure 7: The cardiovascular revolution in Russia 2005-2015.(WHO, 2019).



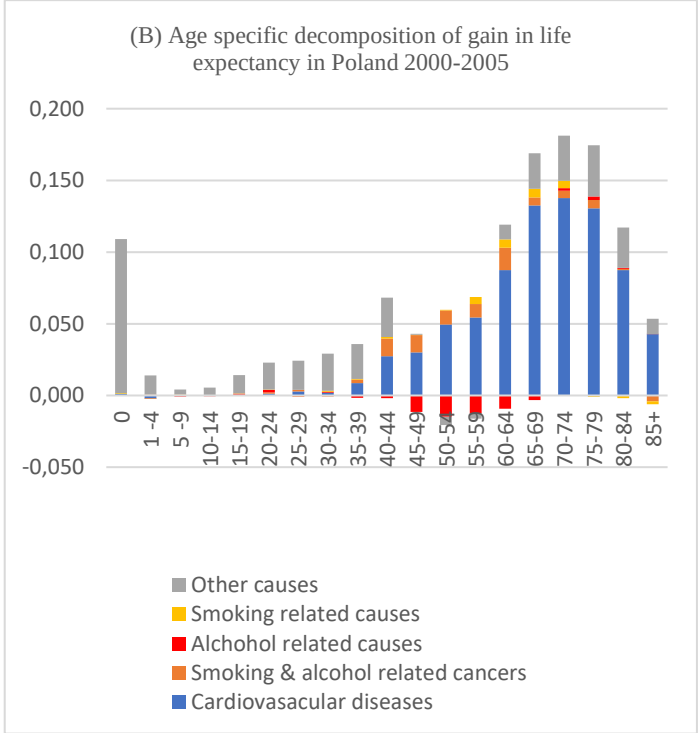


Figure 8: The cardiovascular revolution in Poland 1995-2005. Source: WHO (2019)

4.5 Manmade diseases

Figure 9 shows the development of Manmade diseases in the Russian federation and in Poland. The alcohol related causes are heavily fluctuating in both countries like predicted in the methodology. This is because the identified alcohol related causes are all acute causes. The smoking related causes and the cancers take time to develop, it is thereby difficult to assess the impact of alcohol and smoking on the cancer related causes of death. In the period after the Soviet Union collapsed a loss in life expectancy can be observed due to alcohol related causes in both countries. The trend reversal of alcohol related causes in Russia between 2000-2005 and 2005-2010 is also notable.

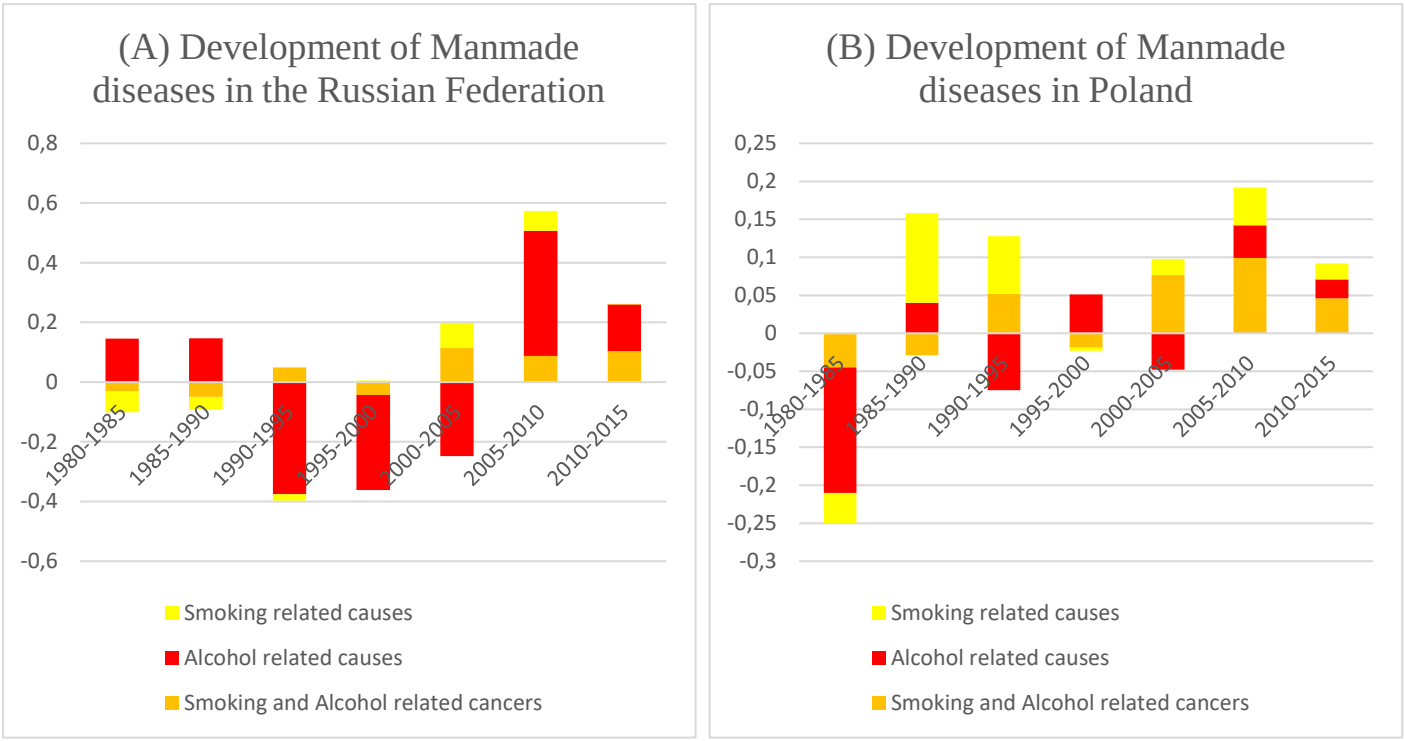


Figure 9: Development of Manmade diseases in Poland and Russia. Source: WHO (2019)

5. Discussion

The question remains how the results that have been found can be linked to the conceptual model. In the conceptual model, three main factors that influence life expectancy have been identified. Institutional change, economic change and behavioural change. The results have shown the mortality trends related to cardiovascular diseases and manmade diseases but how can these results be explained for both countries?

In the case of Poland, first of all a shift in the political and economic system occurred in 1992 because of the fall of the Soviet Union. Poland was subdued to the so called shock therapy were the markets went from heavily regulated by the communist party to a free market. This first led to hyperinflation and unemployment and a slight increase in alcohol related mortality can be observed in this period for Poland, possibly due to the increase in stress. After this 'shock' the economy quickly started to recover and improve, leading to higher incomes. Healthcare became decentralized and private healthcare made an appearance in Poland. Because of the higher incomes the health expenditures and thereby the overall quality of healthcare rose in Poland. Holdsworth et al. (2013) also state that high incomes are a characteristic of low mortality societies. Poland became integrated with the European Union and thus were able to integrate their modern health policies which positively affected the life expectancy. The upcoming presence of NGO's also contributed to a better health care system, this all led to a higher life expectancy and a decrease in cardiovascular mortality (Fihel & Pechholdova, 2017). The second factor was a change in behaviour and attitude of the Polish population towards smoking, diet and alcohol. Smoking became less popular among men due to more awareness of the consequences and stricter regulations. The diet of the Polish population became more diversified and healthier. The overall alcohol consumption did not change. It shifted from spirits (around 60% alcohol) to beers (around 5% alcohol), this had a small positive impact on the mortality rates related to alcohol as can be seen in figure 9. Another factor is education, Fihel and pechholdova (2017) argue that due to a lack of data this cannot be directly proven. However there might be a link between level of education and mortality. It is stated that higher educated persons have a higher income and thus a better access to healthcare. Higher educated persons have a better awareness of their own health leading to healthier lifestyles.

The institutional changes and economic changes also happened in Russia but yet the life expectancy sharply dropped in Russia. A possible explanation for this phenomenon is because the shock therapy did not work as it did for Poland. Russia dealt with rising poverty, already before the fall of the Soviet Union. As stated in the literature, high income leads to higher life expectancy but poverty has a negative effect on life expectancy. On top of that the health care system collapsed in Russia due to the weakening of the state, negatively affecting life expectancy. All the institutional and economic changes led to great stress among the population of Russia. The amount of stress combined with the poverty caused a behavioural shift in Russia. Consumptions of stress relievers like alcohol and tobacco heavily increased and due to the changing prices the diet of the Russian population negatively changed. Cornia & Paniccià (2000) state that these behavioural changes, caused by economic and institutional changes led to a sharp increase in cardiovascular mortality, manmade diseases and more violence, suicides and accidents. The causes violence, suicides and accidents could explain the big share of other causes in our results during the period 1990-1995 in Russia. In the period 1995-2005 Russia struggled to improve their life expectancy but in the period 2005-

2015 significant gains have been made in life expectancy. Grigoriev et al. (2014) states that the alcohol consumption has decreased and the health expenditure has risen sharply due to the upcoming economy of Russia. The Russian population is also becoming more aware of the consequences of smoking, diet and alcohol consumption. This caused mortality rates to drop and life expectancy to rise in the last few years but yet there are still problems, smoking and alcohol abuse remain a problem in today's Russian society and the economic growth has been slow down because of the economic sanctions.

6. Conclusion

The question of how the difference in life expectancy in between Poland and Russia can be explained is answered by the figures in the results and the literature. Poland has made a better transition from a communistic economy to an open market economy than Russia in terms of mortality. A few factors could explain why Poland was able to make this transition better than Russia. First of all the life expectancy in Poland was already higher before the fall of the Soviet Union, this indicates that the overall quality and accessibility of health care in Poland was already more advanced than the Soviet Union. Secondly in Russia there are bigger urban-rural differences in comparison to Poland, this makes it harder for Russia to make quality health care accessible for everyone especially during an economic crisis. The rural-urban difference also contributes to a lower level of education of the population in Russia especially when the whole state system collapsed. (Cornia & Paniccià, 2000). Lastly the western European countries integrated Poland, mainly due to geopolitical reasons, in the system of the European Union, and thus also into the western healthcare which was more advanced than the Soviet healthcare. This led to a rise in life expectancy in Poland and a drop in life expectancy in Russia.

All in all it could be stated that the transition in Poland was more successful than in Russia, this made it possible for Poland to enter the so called cardiovascular revolution shortly after the collapse of the Soviet Union due to positive institutional, economic and behaviour changes that lead to steady gains in life expectancy. The transition of Russia was far from successful and this led to a sharp decrease in life expectancy, mainly due to an increase in cardiovascular diseases, manmade diseases and other causes. After this sharp drop a trend reversal occurred. Russia made a recovery in the last few years and the life expectancy rose sharply since 2005 due to the cardiovascular revolution which is caused by mainly behavioural changes but also by economic and institutional changes. For a future research it would be interesting to zoom in on what other causes were of influence on the sharp drop in life expectancy in Russia in the period 1990-1995. It would also be interested to see how the alcohol and tobacco related cancers develop in both countries in the future since these cancers take time to develop. For this future research it is important to keep in mind the data limitations for both countries which make it difficult to make a detailed analysis. The question that remains is if Russia can sustain this trend of increasing life expectancy due to all the current economic sanctions.

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