Age demographics and economic growth

A study of Sweden and Finland 1960-2020

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Abstract

This thesis explores the subject of age demographics and economic growth, measured in GDP per capita, in Sweden and Finland between 1960-2020. The chosen method was to compile a number of variables that aim to explain how the age demographics are affected in the two countries and was analysed using OLS-regression. Three different regressions were complied, one for each nation and one that attempts to account for global external factors such as global economic trends and technological change. The results depict that age demographics is correlated with economic growth in Finland and when accounting for confounding factors. This might lead to future problems as the age demographics continue to develop. Over time there might be a shift in government spending and on the labour markets.

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1. Introduction

Over the last century the age demographics have changed rather drastically in many countries all over the world, in the last 20 years the life expectancy has increased by more than six years (WHO 2022). This demographic change can impact countries in different ways. An older population would require more funds to be spent on health care and would see a larger proportion of the population being outside of the work force (European Commission 2020). As the population has become older, the number of children born has decreased, and the EU is projecting that the population in Europe will start to decrease in the next coming decades (European Commission 2020). The shift in age demographics will have different implications for different countries, ranging from pure economic implications such as budgeting to more social implications such as housing and welfare (European Commission 2020).

This thesis will focus on the two Nordic nations of Sweden and Finland. On how the demographic changes in the two countries have impacted the economic growth, measured in gross domestic product (GDP) per capita, between 1960 and 2020 (will be referred to as "time-period" in the thesis). The reasoning behind choosing to examine these countries stems from the fact that both countries have experienced economic growth over the chosen time-period, along with the fact that the demographics are changing. Both countries are experiencing an increase in elder populations which might impact the future economic growth. There is a gap in the literature, both concerning the two countries, but also with research that tries to account for external confounding factors.

The aim of this research will be to determine if there is a correlation between age demographics and economic growth, measured in GDP per capita, in Sweden and Finland between 1960 and 2020.

This thesis will be structured as follows; a background where Sweden's and Finland's demographic changes are displayed along with the changes in GDP per capita and a review of previous relevant literature is displayed in chapter 2. Followed by a conceptual framework that describes the underlaying macro-economic theories in chapter 3. Chapter 4 contain the chosen method and data,

followed by the results and discussion in chapter 5 and 6 respectively. Closing with a conclusion.

2. Background

2.1 Demographic changes

Between 1960 and 2020 both Sweden and Finland have had drastic changes in their populations, both in terms of demographics as well as in terms of population size. Sweden's population has increased by 38.4 percent (SCB 2022) and Finland's by 24.5 percent (Statistikcentralen 2022) from 1960 to 2020. This increase in the population size and the change in demographics has likely impacted the two countries' economies and will continue to do so. Countries with an increase in population will have more people over time to being able to work and contribute to society. An older population can reflect the overall health of the population in a country, and in general healthier workers are more productive (CDC 2015). As the EU study from above discusses it is likely that the population in Europe will decrease over time, which is also likely to be the case in both Sweden and Finland. This is in parts evident from the fact that the fertility rates of women have decreased in both countries. In Sweden it decreased from 2.17 in 1960 to 1.66 in 2020; and in Finland from 2.72 in 1960 to 1.37 in 2020 (Worldbank 2022a).

2.1.1 Sweden

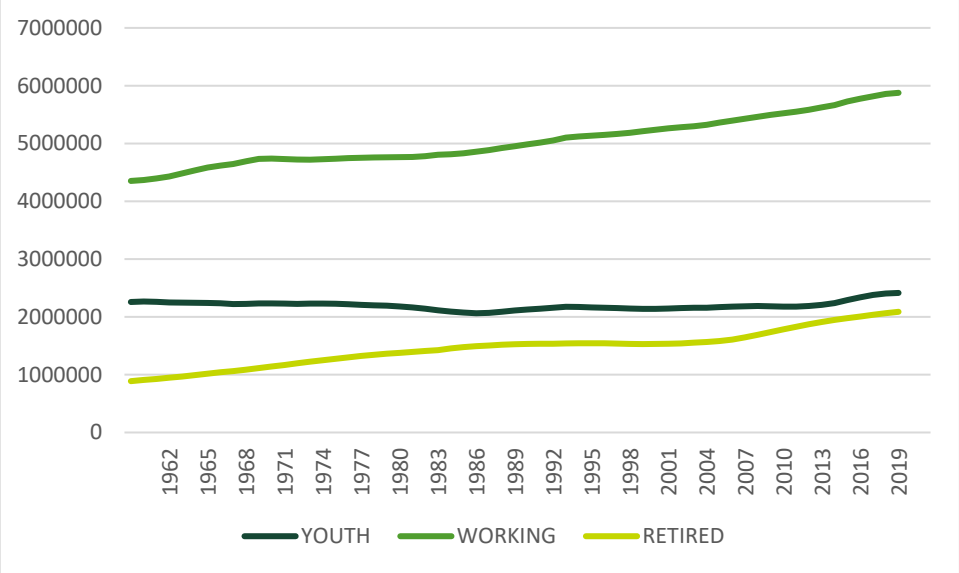

Figure 1. Age demographics in Sweden 1960-2020.

The figure 1 shows how the demographics in Sweden has developed during the time-period. From the graph it is evident that the demographics have shifted somewhat. The amount of youth (aged 0-19) in the country have been rather constant, having around 200 000 at all times. As the number of youths have not changed as the population has grown, this means that the proportion of youth have decreased over time. Both the amount of people in the work force (aged 20-64) and retirees (aged 65 and older) have increased over the same time. As the number of retirees have increased it is reasonable attribute this to the increase in life expectancy, as this population-group will increase when people live longer. In 1960 the life expectancy was 73.0 and has increased by a bit over nine years to 82.1 in 2020 (Worldbank 2022b).

2.1.2 Finland

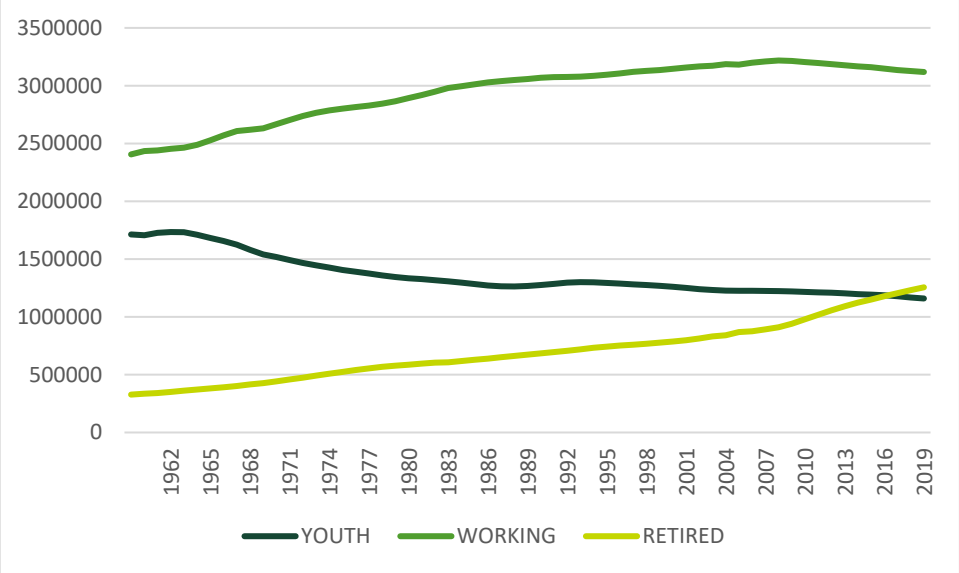

Figure 2. Age demographics in Finland 1960-2020.

When comparing Sweden and Finland it is evident that their age demographics are different in construction and in development. Figure 2 depicts the age demographics in Finland between 1960 and 2020. From the figure we can see that the number of youth (aged 0-19) in Finland has decreased over the entire period. This might be a factor to take into account when looking at the amount of people in the work force (aged 20-64). The first decades saw an increase in the work force but has decreased in recent years. This might lead to problems in the future as there will be a less people working. The life expectancy has increased from 68.8 in 1960 to 82.1 in 2020, an increase by 13.3 years (Worldbank 2022b). As the life expectancy has increased, so has the elder population (aged 65 and older) in Finland. At the beginning of the time-period there was a distinct difference between the number of youth and retirees in Finland. However, the retirees are now a larger group than the youth.

2.2 Economic change

Both Sweden's and Finland's economies has developed during this time. Since 1960 Sweden has had a real GDP per capita increase of 211.9 percent, and Finland a 291.9 percent increase in the same time (Worldbank 2022c). These percentages are inflation adjusted, using constant 2015 US dollars. There are many reasons for economic change, both increases and decreases. Changes in human capital, technological change, wars and the overall state of the world and domestic politics all influence the economy. Both Sweden and Finland has had periods of economic

growth and stagnation during this time period, some of which were due to the same reason but affected the countries differently. For example, during the 2008 global financial crisis both countries were affected. However, Sweden recovered quicker, reaching a higher level of GDP per capita in 2011 compared to 2007 (Worldbank 2022c). Finland took a longer time to recover and is yet to reach the same level of GDP per capita that the country had in 2007 (Worldbank 2022c). There have been some major events that separate the countries, taking the example from above, it is likely that the slower recovery in Finland is due to the fact that they are a nation that uses the euro, unlike Sweden that has uses an own domestic currency. Moreover, Finland was a part of the second world war, which Sweden was not, it is likely that this has affected Finland's economic state, especially in the earlier years in the time-period. Culturally the countries are fairly similar, almost as similar as two different nations get, which makes it interesting to compare them in this type of study.

2.2.1 Sweden

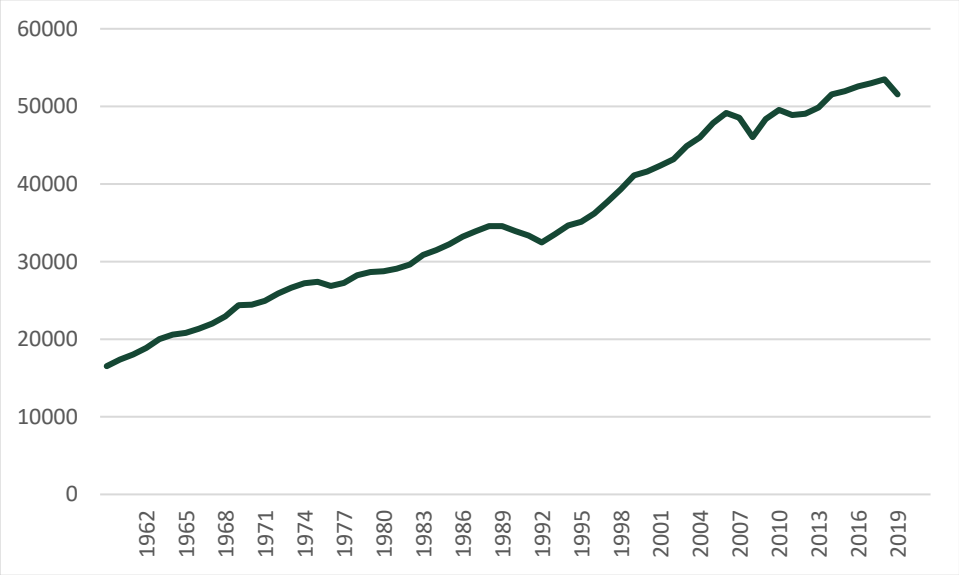

Figure 3. GDP per capita in Sweden 1960-2020.

Figure 3 depicts Sweden's GDP per capita. It shows that the economy has increased fairly steadlity over the time-period, with some recessions which are caused by global events (tech bubble, financial crisis and corona virus outbreak most notably). It is also noteworthy when comparing the two graphs that Sweden has not had as volatile movement as Finland.

2.2.2 Finland

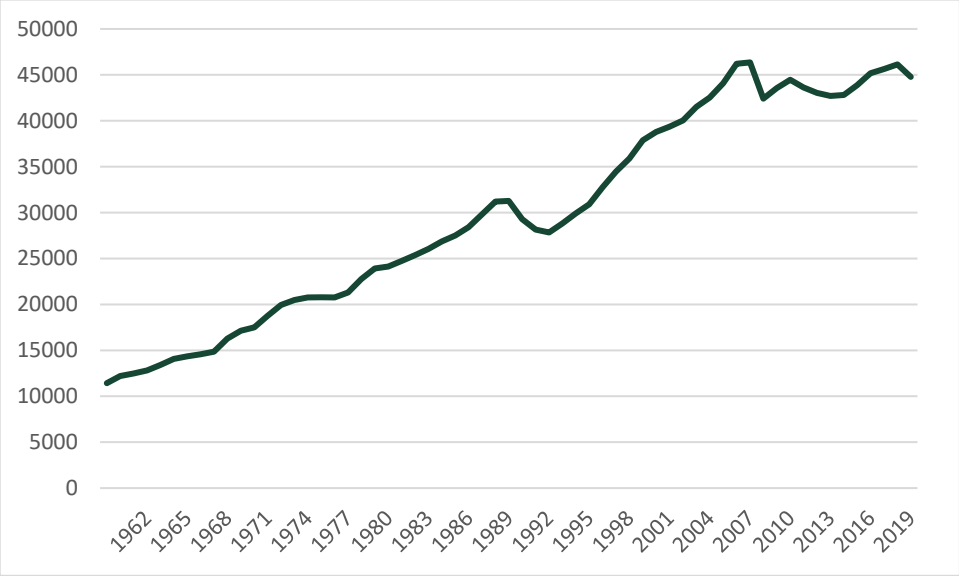

Figure 4. GDP per capita in Finland 1960-2020.

From figure 4 it is clear that Finland has a more drastic increase in GDP per capita in the same time period compared to Sweden. Finland has experienced more drastic growth and recessions. The reason for this might be due to the fact that they have had a different demographic structure than Sweden. Finland is has shifted more towards an ageing population compared to Sweden, which could have led to a period of rapid growth, but as the work force is starting to decrease so has the GDP per capita growth rate. However, there is not enough data to support this, there are too many other likely theories to why this might be.

2.3 Age demographics

Moving on to more general theories and literature concerning both population pyramids and age demographics. A population pyramid is a type of histogram, containing information about a country's age and gender demographics (National Geographic 2022). For this thesis the gender aspect will not be regarded as it is outside of the scope for this study. When examining a population pyramid one can get information about a certain country's economic state. In general less developed regions and countries have a more pyramid shaped population pyramid, that is, a

younger population and lower life expectancy; and more developed regions have a more equal age distribution (UN 2007). This can be applied to this paper since more developed countries have a higher GDP per capita in general than less developed countries. Therefore, we can assume that as the age demographics have shifted, so has the economy and vice versa. In Finland, figure 2 shows that their age demographics have shifted drastically over the time-period and they are now experiencing a decline in the working force (working ages) and an increase in retirees. An interpretation of this is that Finland is a very developed country. Moreover, this could be an insight to how Sweden's population will develop in decades to come, if we assume that Finland's more aged population can reflect what will happen to the age demographics in Sweden and in turn reflect how this development will affect other factors. As the age demographics change, so does the dependency ratio in the countries. The dependency ratio is calculated by dividing the portion of the population outside of the work force by the work force. In Sweden the dependency ratio has been fairly unchanged throughout the time period, but in Finland it has shifted. At the start of the time-period the Finnish dependency ratio decreased rather rapidly, due to the changes in age demographics. However, this has changed in the last decades as the percentage of population in the work force has started to decrease. This might results in some complications for Finland as an increase in dependency ratio can be linked to economic stagnation, due to a multitude of factors including shifting consumption patterns and increased savings (Santacreu 2016).

2.4 Literature review

In 2015 Oliver published a study that focused on ageing population and economic growth in Japan. The aim was to examine how age demographics in Japan related to economic change measured in GDP per capita. In this paper the author found that if the working age population decreases, so does the real GDP per capita ceteris paribus. As Japan's population is ageing, this might lead to complications in the future. Oliver uses a youth dependency ratio variable (similar to the dependency ratio in this study) and found that this variable is important for policy makers as it can help predict the turning point of GDP per capita growth.

Han and Lee examined how demographic change and human capital affects economic growth in Korea, a country with decreasing population aged 25-64 (a decreasing work force). They found that human capital contributes significantly to economic growth. This is of importance for two reasons for this thesis firstly; as education increases in the two countries, so does human capital; secondly a way to

combat the negative aspects of economic growth that an ageing population has could be to make efforts to increase human capital.

An interesting paper on this subject was completed by Crenshaw, Ameen and Christenson in 1997, where they examined the economic growth rates of 75 developing countries. They looked at GDP per capita growth rates and regressed it to demographic models that contained information either total population growth rates or age-specific growth rates. The researchers found that an increase in younger age groups decreases economic growth and an increase in adult age groups increase economic growth. Moreover, they discuss on the effects of a “baby boom” which might slow economic growth for a time, but as the generation ages and contributes economically to society there might be an increase in economic growth.

Malmberg (1994) published an article where he researched the age structure effects on economic growth in Sweden. He found that age demographics have been decisive in determining the growth rate of Swedish economic growth. This is explained in part by savings patterns. Before retirement age-specific savings increase with age, thereby also increasing the accumulation of capital.

3. Conceptual framework

3.1 Gross domestic product

Gross domestic product (GDP) is a measurement of a country's production of goods and services over a time-period, usually a year, and is therefore an assessment of the economic activity in a country (Fregert & Jonung 2018). By using GDP as a measurement of an economy it is clearly demonstrated how a country is performing in strict economic terms. One can compare a country over time or different countries with each other. In order to study different countries, it is common to divide the GDP with a country's population, one attains the country's GDP per capita.

3.2 Calculating GDP per capita

There are three main methods to calculate a country's GDP; the production approach, income approach and expenditure approach (Fregert & Jonung 2018). In the most basic model for both the income and expenditure approach it is assumed that all production factors is owned by the households, by supplying businesses with labour and capital the households acquires incomes. The income can then be used for the households to purchase goods and for investments. The value of the labour and capital supplied equals the value of the income. The production approach states that the value of GDP is the sum of the value added (Freger & Jonung 2019). The value added is the selling price minus the costs for all means of production.

3.3 Implications for research question

The implications that this has for age demographics impact on GDP per capita is due to the fact that labour is central when estimating the GDP per capita. As the amount of labour increases in a country, so does the potential increases in GDP per capita. In both Sweden and Finland the labour depends a lot on the amount of people in the work force, as more people are aged between 20 and 64 the work force will increase. On the contrary, as the proportion of the population is aged either younger than 20, or older than 64, more resources will have to be allocated to satisfier their needs. When the population gets older, it is reasonable that more resources will have to be used for health care and other government expenses, which in turn will not allow for as many resources to be used for investments, research and development (R&D) and such. As stated above, the amount of labour is determined by the size of the working population. When the work force increases so does the amount of available working hours which increases the possibility for businesses to expand. This can in turn increase the income for the households and more capital can be invested which will continue to increase the GDP.

4. Method and Data

The collected data was analysed through a regression analysis, more specifically through ordinary least squares (OLS) regression. Setting GDP per capita as the dependent variable and dependency rate, fertility rate, life expectancy and education as the explanatory variables. This reflects the change in GDP per capita as a function of the different variables. Due to the risk of collinearity the variables of youth, working and retired (the age groups) were dropped. This is due to the fact that these variables are directly correlated with the depend variable, as the dependency rate variable is directly calculated from these variables.

4.1 OLS regression

The linear regression is a line that describes the expression of a data set. This is done by setting a variable as a dependent variable and a set of variables as independent variables. The independent variables describe their respective relationship with the dependent variable, ceteris paribus. Using the results from the obtained equation one can attempt to explain how the independent variables affect the dependent variable and can make future forecast on how the dependent variable will be affected by the other variables.

In these regressions robust standard errors were used. This is because by using robust standard error one gets a result that is valid whether or not the errors are heteroskedastic, meaning that one does not have to account for heteroskedasticity when using robust standard errors.

$$GDPpc_{it} = \beta_0 + \beta_{it} X_{it} + \varepsilon \quad (1)$$

Y is the dependent variable, GDP per capita in Sweden and Finland respectively
Where β_0 is the intercept for the regression line, that is where $X = 0$.
β_i is the coefficient for the i^{th} variable.
X_i is the i^{th} variable, a demographic measure.
The t^{th} variable is the different years

This research will compile two different regression equations, one for Sweden ($GDPpc_{st}$) and one for Finland($GDPpc_{ft}$). Later the two different equations will later be subtracted, $GDPpc_{st} - GDPpc_{ft}$ to form $GDPpc_{dt}$ (d is for difference). The reasoning behind this is to account for some global external confounding factors such as the global economy or technological change.
Each variable will be subtracted where $X_{ist} - X_{ift} = X_{idt}$ (2)
After each variable difference is calculated a new equation as in equation 1 will be calculated in order to estimate this effect.

Both $GDPpc_{st}$ and $GDPpc_{ft}$ will contain information about the explanatory variables. However, the variables chosen will not depict the full picture. There will be some external factors affecting the regression results. In this case, where GDP per capita is looked at, those factors could be global financial crises or technological change. Given this information by subtracting the two regressions these external factors (assuming they are the same) will be eliminated, therefor painting a better picture concerning the age demographic's impact on GDP per capita.

4.2 Variable description

GDPpc – Gross national product per capita. The value created in a country over a time span, in this case annually, divided by the total population. A common measurement to see how a given country is doing economically. The data is collected from the Worldbank (2022c), using 2015 constant USD for both countries. This is in order to not having to account for inflation, as that would affect the results.

The age groups – There are three different age groups as variables. This data is collected annually and describes the two countries age demographics in five-year groups, which has been complied in to three different categories (see below). This is used to sort the different ages and to see how the demographics change over time.

Youth – the total amount of people that are aged 0-19 in the two countries for each given year. These people are younger than the normal working age.

Working – the total amount of people that are aged 20-64 in the two countries for each given year. These people make up the working force.

Retired – the total amount of people that are aged 65 and older in the two countries for each given year. These people are in general retired and older than the working age, in both countries the normal retirement age is 65 years old.

DEP – The dependency ratio in the chosen countries. In this thesis the ratio is calculated by adding the population that is younger than 20 years old and the population that is older than 64 years old and dividing it by the remaining ages. This variable shows how the ratio is between the ages in the population that is expected to be provide for and the groups that are expected to provide for. A higher ratio implies that the economy would be more stressed.

$$Dependancy\ ratio = \frac{(Population\ aged < 20) + (Population\ aged > 65)}{Population\ aged\ 20 - 64}$$

A way to demonstrate this effect is to apply it to an example. If one was to apply this same logic to a single household the effect is very clear. In this example the population in the denominator would be the working adults, and the population in the numerator would be the children in the household. A family with more children would need to stretch their resources thinner than in a household with fewer children, assuming the income does not change.

FR – Fertility rate. The number of children born to a woman in a country, if the woman was to live to the end of her fertile years and have children in accordance too what is expected for her age. The data is collected annually for each country. This variable is of importance since the fertility rate, in part, determines a country's population growth.

LE – Life expectancy. How long a new-born in a country would be expected if the same patterns of morality would be the same. Life expectancy tells us two important things; how much older a population is getting, how the demographics changes and it can measure a country's health.

EDU – Education. Measured in mean years of schooling, how many years the mean person in a country goes to school.

5. Results

After compiling the data an OLS-regression was ran through the statistical software STATA.

Table 1. Regression results for each country and the difference.

	$GDPpc_s$	$GDPpc_f$	$GDPpc_d$
EDU	175.14(0.774)	1980.18(0.000)***	409.71(0.175)
LE	3446.18(0.000)***	1255.13(0.000)***	-449.22(0.172)
FE	-68.92(0.952)	1216.39(0.168)	4441.45(0.000)***
DEP	5.42e-07(0.352)	-14399.83(0.001)***	-21172.03(0.000)***
Constant	-234923.9(0.000)***	-73233.56(0.001)***	5906.33(0.000)***
R^2*-value*	0.9781	0.9773	0.5757
Number of observations	61	61	61

Variable significant at 90%=, 95%=**, 99%=****

5.1 Sweden

The results for Sweden are evident in table 1. From the results it is evident that the regression is not optimal. There is only one significant independent variable, life expectancy. From this result we can determine that the as the life expectancy increases, so does the GDP per capita ceteris paribus. A one-year increase in life expectancy is correlated with a roughly 3446 USD increase in GDP per capita.

5.2 Finland

The results for Finland are a bit more interesting compared to the ones for Sweden. Every variable is significant at 99%, with fertility rate being the exception. Both education and life expectancy are positively correlated with GDP per capita in Finland during this time-period and dependency rate is negatively correlated with GDP per capita. This means that as people live longer and get more educated the economic development will continue, and as the relationship between people

outside of the work force and in the work force grows larger the GDP per capita will decrease.

5.3 Difference between Sweden and Finland

The final regression, concerning the difference between the two countries has two significant variables, both at 99%. The dependency rate is negatively correlated with GDP per capita when accounting for global external factors, the same as in Finland. This is the only regression where fertility rate is significant, this positive correlation means that as there are more children born the economic development will increase.

6. Discussion

Given the results above one can conclude that there seems to be a correlation between age demographics and economic growth. This case is strongest in Finland and when accounting for external factors. This is drawn from the fact that the dependency rate is the significant in both regressions, which is the main variable used in order to describe this relationship since it is the only variable that is directly linked to the age demographics. From this result one can conclude that as the dependency ratio increases, the GDP per capita will decrease in Finland and when accounting for external factors. This result is expected as the dependency rate is a measurement on how stressed the economy is. As Santacreu (2016) has previously stated, an increase in dependency ratio could lead to economic stagnation, which is the case in this regression analysis.

This result is very reasonable since a population that must depend on a smaller proportion of the population will likely not be able to raise enough capital in the long run to support the entire population. Moreover, as the dependency rate shifts, either increases or decreases, there are likely going to be implications for the labor market. A shift can either occur due to a shift in the working ages or due to a shift in the youth and retired population. An increase in the elder and younger populations will result in that resources will have to be allocated in a different way. As the number of youths and elders increases more resources will be needed in both education and health care. In both Sweden and Finland a great part of the education system and health care system is government financed, meaning that the increase in dependency ratio might lead to increased government spending. However, the shift might also lead to a higher demand for teachers and doctors. Moreover, there are likely going to be a shift in consumption patterns. Youths and elders usually have different consumption priorities compared to people in the working ages.

If the change in dependency ratio is due to a decrease in the work force the implications would be different. Having fewer people in the work force would increase the demand for qualified workers and could in time increase the average income for workers. But another effect could also be that there are not enough workers for different businesses. If this would be the case there might be some future negative implications. An effect of increased wages, as an effect of a labour

deficit, could be inflation which in turn may harm the economy. Moreover, a labour shortage might lead to an overall decrease in GDP growth, which the results indicate.

There are many problems with the regressions concerning Sweden, most notably the fact that there are many insignificant variables. Even though these problems exist there is still information that can be gathered. The life expectancy variable is somewhat in line with what was expected. Life expectancy is connected to the health of a country, as people are healthier, they tend to live longer. As people get healthier the number of sick days are expected to decrease, meaning that the average amount of work days increases and therefore also increases the productivity. However, one could also expect this variable to be negative. This conclusion is based on the fact that as the population gets older, the number of retirees increases and the dependency ratio would be expected to shift.

In Finland education is a significant variable and positive. This is in line with what was expected. As education increases so does human capital. With this increased human capital, the work force is likely able to perform more complex tasks and create new innovations that will further the development in the country. The fact that this effect is not significant when accounting for external factors can be explained by the fact that education could be linked to technological change, which is attempted to be accounted for in the external factors. A positive correlation between education and GDP per capita will likely have positive implications in Finland. As the human capital increases the GDP per capita, this might be able to combat some negative effects of the shifting age demographics.

When accounting for external factors, fertility rate is highly significant and positively correlated with economic growth. This is both simultaneously surprising and unsurprising. Based on previous literature the fertility rate can both be expected to be negatively and positively correlated, both cases being reasonable. More developed countries are usually have a lower fertility rate, meaning that as the population gets more wealthy, families have fewer children. This would indicate that in the long run fertility rate should be negatively correlated with GDP per capita. However, as the fertility rate increases so does the population. Over time this would also mean that the work force over time would increase which is expected to be positively correlated with economic development.

In order to build further this research, it would be interesting to add more data points, mainly in years studied (observations). This would allow for a clearer correlation between age demographics and economic growth. More variables would also increase the assurance of a correlation between the two fields. These variables

could be immigration since an increased immigration affects the demographics of a nation. Another variable that would be interesting to include would be unemployment rate. This would in part measure economic stability since unemployment rates tend to increase during crises. More importantly this could indicate how large the actual workforce is, compared to how many people are in those ages, which is likely to have an impact on the economic growth. Moreover, including gender as a variable could be interesting. This could depict how gender equality in the workforce affects GDP per capita.

7. Conclusion

The purpose of this thesis was to examine the correlation between age demographics and GDP per capita in Sweden and Finland between 1960 and 2020. This was done considering the shifting age structures in both Sweden and Finland. Over the time-period both Sweden and Finland has experienced economic growth and shifts in their age demographics. The proportion of elders has increased rapidly in both countries. As the demographics change, so does the potential work force and the share of population that has to be supported increases. This has affected the dependency rate in both countries which might lead to future implications for the two countries. In order to determine how this has and will affect the countries' economies, by OLS-regression analyses using annual data for each year in the time period. In the regression, variables were used that aim to explain how the age demographics change over time. These variables were dependency ratio, life expectancy, education and fertility rate. Three age group variables were dropped due to collinearity reasons. The results indicate that there seems to be a correlation with age demographics and economic growth measured in GDP per capita. This effect is more visible in Finland and in the regression that attempts to account for external factors. In Sweden, the correlation is not as visible, mainly due to the fact that dependency rate is not significant in the regression along with the fact that there is only one significant variable. This correlation is likely to have policy implications, concerning labor effects and future problems if the trend continues. In order to formulate a more precise conclusion it would have been advantageous if the regressions had more similar results.

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