SCHOOL OF
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The effects of the 2015 migration crisis on Sweden's economic growth

Hedda Carlsson

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Mentor Pontus Hansson

Nationalekonomiska institutionen vid Lunds Universitet

Faculty of Economics, Lund University School of Economics and Management

Abstract

The purpose of this essay is to investigate the effects of the 2015 migration crisis on Sweden's economic growth and GDP per capita levels, along with the general effects of migration on economic growth in Sweden and the world. Further the possible effects of an employment rate of the migrant labor force equal to that of the native labor force is investigated, and the effect this would have on economic growth. This is examined by on one hand quantifying the effects by calculating Sweden's future economic growth for six different scenarios with a modified version of the Uzawa-Lucas model, and on the other hand by compiling and analyzing previous research on the topic. It is found that Sweden's anticipated GDP per capita is higher than it would have been without the migration crisis, that a higher employment rate for migrants could increase the GDP per capita further and that migration tends to have a positive effect on economic growth.

Definitions

2015 migration crisis: Despite its name, the crisis is usually defined to have started in 2014.

Human capital: A worker's general skill level

Origin country: The country migrants leave

People of migrant background: People born in another country and people born in Sweden with two parents born in another country.

People of Swedish background: People born in Sweden with either one or two parents also born in Sweden.

Receiving country: Country receiving migrants

R&D: Research and Development

1. Introduction

The main objective of economic growth studies is the development of countries' output levels, measured annually or over longer periods. One of the main questions that the study of economic growth aims to answer is "what is the engine of economic growth?". This essay adopts the approach of human capital as the engine of economic growth, by using the Uzawa-Lucas growth model. Further it is discussed and investigated whether migration could be a driver of growth. In 2015, Sweden was hit by the migration crisis. In the political debate the negative economic effects of the crisis were frequently discussed. It was from this an interest rose to investigate the economic impact of migration.

The purpose of this essay is to investigate the possible effects of the 2015 migration crisis and migration generally on Sweden's future economic growth and GDP per capita levels, more specifically from 2020 to 2040. This is examined by estimating outcomes of potential future growth for six different scenarios using a modified version of the Uzawa-Lucas model. Since the possibilities of investigating the effects of the migration crisis on the economic growth of Sweden in the framework of a growth model are limited, more general effects of migration on growth in Sweden specifically and internationally will also be taken into consideration. Previous research on the relationship between migration and growth is compiled and presented. The results show that Sweden's expected future GDP per capita is higher than if the migration crisis had not occurred. Further higher GDP levels would be expected from an increased employment rate of the migrant labor force.

The essay will be structured as follows: Firstly, background information of economic growth and migration will be introduced separately, followed by previous research on their relationship. The next section presents the situation of migration and growth in Sweden specifically. Further the theoretical growth model used for calculations is introduced, along with its modifications. In the section of simulations, the six simulated scenarios are defined and explained. The following section presents the results of the simulations. Thereafter the results are discussed and lastly, the content of the paper is concluded.

2. Background

2.1 Economic growth

The study of economic growth has been an important part of the study of economics since the 1980s (Jones 2013). It mainly concerns the development of countries' output levels and growth, primarily and most commonly measured by GDP per capita annually or over longer periods. "Growth" as a concept refers to the pace at which the GDP level is increasing, and not the actual level. However, the study of economic growth refers to studies of both growth rates and GDP levels, despite its name. This essay will focus on the investigation of what drives economic growth and examine the role of migration in relation to this. In the study of economic growth, a long-term perspective is generally applied. The annual economic growth is thought to be affected by for example the state of the economic cycle, which can fluctuate from year to year, while the long-term growth path is not (Hansson, 2020). Therefore, applying a long-term perspective is appropriate when studying economic growth.

2.1.1 Growth models and drivers of economic growth

Growth models are used to describe what impacts economic growth, to what extent and how the determining factors relate to one another. It is widely debated what is the actual engine of economic growth (p.100 Jones 2013). There are a great number of growth models but not a consensus of which ones best describe reality, and thereby neither of what actually drives economic growth. However, some common features of most growth models exist; that capital accumulation and population growth affects economic growth, and that technological progress drives economic growth (p.257-258 Jones 2013) However the conceptions of what actually generates technological progress vary, whether it is mainly entrepreneurship and innovation, education, capital accumulation or something different. Most recent studies on economic growth indicate that human capital and its accumulation has a positive effect on growth, see for instance (p.5 Arnold 2007).

2.1.1.2 Steady state

An important part of the study of economic growth is the study of steady state, a level at which the economy grows at a constant rate. It seems that countries are generally on their

way towards their own steady state growth rate. The further away an economy is from its steady state, the higher the expected growth rate (p.69 Jones 2013).

2.1.2 Endogenous and exogenous economic growth

In exogenous growth models, changes of government policies cannot have permanent effects on the growth rate of the economy. Policy changes are instead believed to have so-called level effects, meaning that the growth rate rises temporarily, as the economy rises to a higher GDP level, but at some point returns to its initial level, at which the GDP grows at the same pace as before the policy reform. Endogenous growth models entail that the same policy reforms could affect the growth rate permanently and have a so-called growth effect, implying a sustained increased growth level, at which GDP grows faster than before the reform (p.216 Jones 2013).

2.2 Migration

In a report from UNECE from 2005, migration is defined as follows: "...the movement of a person or group of persons from one geographical unit to another across an administrative or political border, and wishing to settle permanently or temporarily in a place other than their place of origin." (Bauer 2005). The report further defines that migration within a region is commonly called internal migration, whereas migration crossing international borders is called international migration. It also differs between the country of origin and the receiving country (Bauer 2005). In this essay, solely international migration and its effects on a receiving country will be studied.

2.2.1 Reasons for migration

The most important reason to accept migration is the humanitarian, which could regard family reunification, political asylum etc (Bauer 2005). This essay does in no way declare that migration should be seen as a solution to economic problems, or a purely economic matter. It simply aims to analyze and broaden the view of the economic effects of migration, and in no way claims that they are what is most important, nor that they should be considered in political decision making.

2.2.2 General trends of migration

In 2019, the UN estimated that 272 million people worldwide live in a country other than their countries of birth. This corresponds to 3.5% of the world's population and has increased significantly over the past five decades (p2 IOM 2020). The same study states that 74% of international migrants were of working age, and that 61% of the migrants were hosted in Europe or Asia (p.21-24 IOM 2020). A trend that has arisen in recent years is the increased migration of high-skilled workers, along with increased demand of highly skilled workers around the world, especially in highly developed countries (p.126 Bauer 2005).

2.3 Migration and growth

Since migration most certainly affects the population size, labor force size, human capital accumulation and capital accumulation of a receiving country, it is highly interesting to investigate the connection between migration and economic growth. In the next section the effects of migration on these variables will be explored. Migration, and in particular large migration waves, can result in large transformations of society and possibly affect economic growth further than what is analyzed in this essay.

3. Previous research

The worldwide trend of increased migration has, presumably, caused the expansion of the studies of migration's effects on economic growth seen in recent years. The impact of migration on economic growth is currently widely researched. A report from the IMF published in 2020 states that migration raises the world GDP (p.79 Engler 2020). The report further presents a large positive impact of immigration on income per capita long term, for countries of all development levels (p.91 Engler 2020). Most research seems to confirm this positive impact of migration on the receiving country.

3.1 Labor force and population

The most obvious impact of migration on the receiving country is the addition to the population, and thereby to the labor force. Further it is found that immigrants in advanced economies increase the country's output and productivity, and that natives' per capita income tend to rise from immigration (p.79 Engler 2020). Immigrant and native workers contribute with different sets of skills to the labor market that can complement each other, and thereby increase productivity. That migration has a positive impact on productivity in receiving countries is an important empirical finding and an outcome that many studies conclude. These studies further emphasize the importance of complementarity between natives and migrants for productivity to increase (p.90 Engler 2020).

An article from OECD from 2014 states that employment is the most important determinant of migrants' contribution to the economy (p.1 OECD 2014). The article then declares the following: "Raising immigrants' employment rate to that of the native-born would entail substantial fiscal gains in many European OECD countries, in particular in Belgium, France and Sweden, which would see a budget impact of more than 0.5% of GDP." (p.3 OECD 2014). This emphasizes the importance of migrants' employment rate for the economic growth of the receiving country.

3.1.1 Age distribution

The population in many European countries and advanced economies is rapidly ageing, putting high pressure on social security systems (p.111 Bauer 2005, p.94 Engler 2020). This is a result of emerging problems of low fertility rates and increasing life expectancy. A

decline of the working age population this severe could cause big economic problems, especially for a sustained future economic growth (s.119 Bauer 2005) In contrast, developing and emerging economies' population growth is continuously high (p.94-95 Engler 2020). Further migrants are usually younger and to a larger extent economically active than natives (p.4 OECD 2014). This suggests that migrants could be an important contribution to the labor forces of advanced economies, and thereby to sustaining these economies' future economic growth.

3.1.2 Distributional effects

Distributional effects is one of the main concerns of migration for the receiving countries. Natives whose skills are complementary to those of migrants can expect gains from migrants arriving, however those whose skills are similar to those of migrants can expect higher competition on the labor market. These distributional effects give rise to resistance against migration. The IMF points out that adequate policies can distribute the large positive effects from migration so that it benefits as many as possible (p.79 Engler 2020). Apart from increased competition on the labor market, product and labor demand tend to be positively affected by migration. This makes it possible that native workers may actually not be negatively affected by an increase of migrants in the labor force, even considering distributional effects (p.125 Bauer 2005).

3.1.3 People of migrant background

An indirect impact of migration on the labor force and human capital springs from the children of migrants born in the receiving country. These children are natives of the receiving country, but since one or both of their parents are migrants, it could be argued that their contribution to the economy should be considered as contribution of the migrant population.

3.2 Human capital

A large study of OECD countries shows a small but positive impact of migrants' human capital on economic growth (p.4 OECD 2014). Another study from the IZA concludes the same, that migrants' human capital has a positive effect on economic growth (s.4 Boubtane 2014). An important distinction is that whereas natives generally accumulate human capital in the country in question, migrants arrive with an already obtained level of human capital, that was accumulated in another country. This results in "free" human capital that does not

result in costs, at least not as large, as for the native population's human capital accumulation. Costs of Swedish courses along with possible complementary Swedish education can arise, however these costs are significantly lower than the total costs of a native's education (p.2 Edström 2015). An IZA study presents that migration can decrease R&D costs, and thereby increase growth (s.5 Boubtane 2014), which is in line with this argument.

3.2.1 Educational level

European countries typically have high demands for highly skilled labor, along with supply shortages (p.111 Bauer 2005). It is therefore beneficial for these countries that a trend of migration of highly skilled workers has emerged worldwide (s.119 Bauer 2005). As educational level is a determinator of human capital it can be expected to positively affect the output of the economy, and if migrants have a general high education level this implies a positive effect of migration on growth.

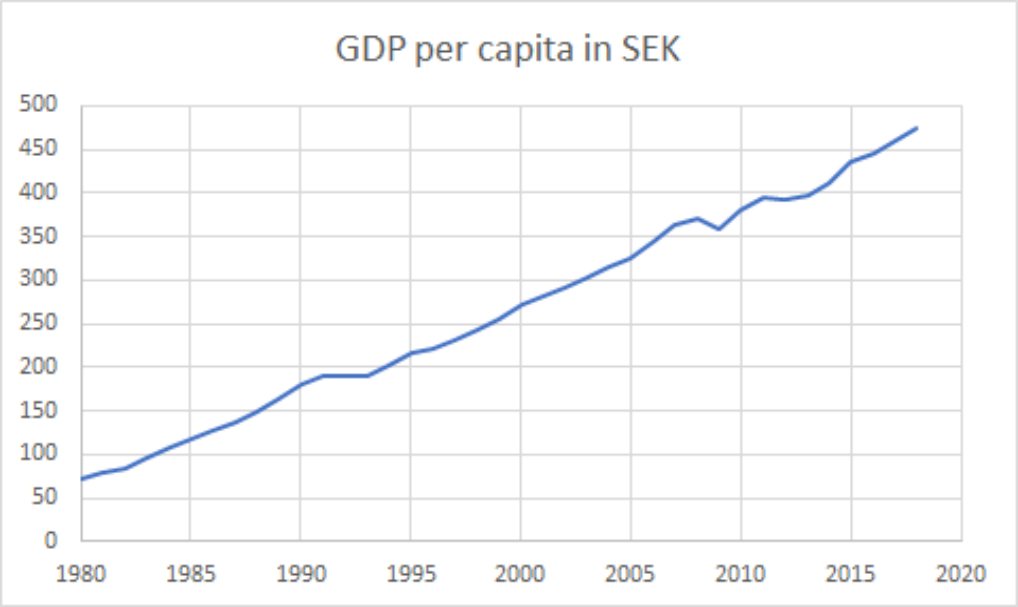
3.2.2 Technological progress

"When migrants move from one country to another, they carry a new range of skills and perspectives, which nurture technological innovation and stimulate economic growth." (p.227 Bove 2017), and contribute to the human capital accumulation of receiving countries (s.1 OECD 2014). Studies from the US show that skilled immigrants largely contribute to research and innovation, and thereby to technological progress (p.4 OECD 2014). Further, the more people in an economy, the more ideas emerge that could possibly result in innovation (p.93 Jones 2013). An important contribution of immigrants to the economy is their entrepreneurship. A study from OECD from 2010 presents a tendency of immigrants being more prone to engage in entrepreneurial activities than natives. The report further presents that the share of entrepreneurs in the migrant population is 12.7% compared to the 12% share of the native population, as an aggregate for OECD countries (s.13-14 OECD 2010).

4. Sweden

4.1 Sweden's economic growth

Sweden has a rather high GDP per capita and has had for many years, currently the 18th highest in the world. As for the annual economic growth, that is the GDP per capita growth, Sweden has in the last two decades had an average annual growth rate of around 4% (SCB 2019).



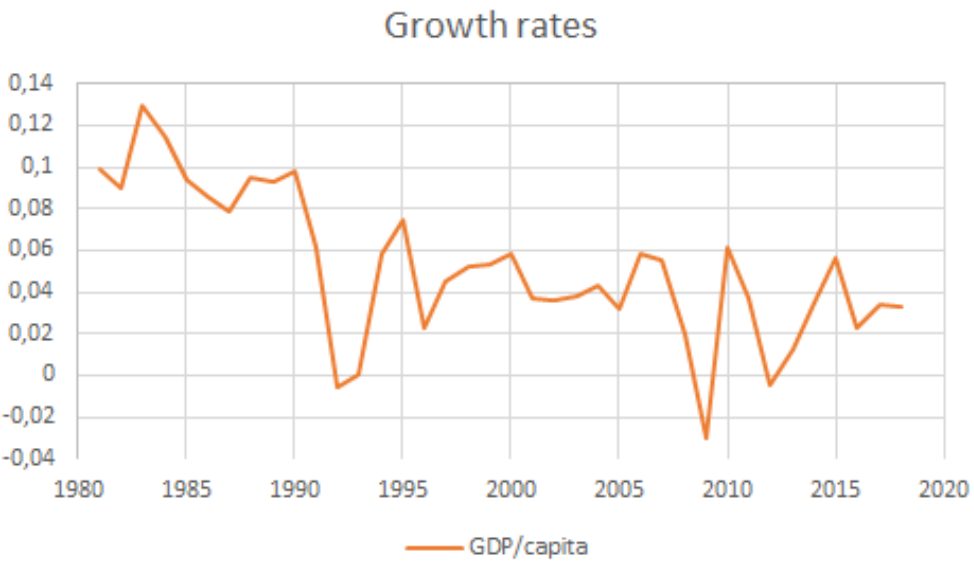


Diagram 1 & 2. Sweden's GDP per capita level in thousands SEK & GDP/capita growth from 1980-2019. Source SCB

4.2 Migration to Sweden

Sweden has in recent years experienced increased immigration, not least in connection to the 2015 migration crisis. The crisis resulted in a large increase of asylum applicants in 2014 and 2015, as shown in diagram 3. Diagram 4 shows the development of the migrant population of Sweden, which has doubled since 2000, from one million to two million. The migrants counted into the population are those officially registered in Sweden, with an approved residence permit valid for at least one year . Those who are either in the application process or in Sweden illegally are not counted into the population, since it is not possible to keep statistics of people who are undocumented (SCB 2020). The possible effects of these people is important to consider. but not accounted for in this essay. In this section statistics of migrants in Sweden is presented specifically, separated into economic growth factors.

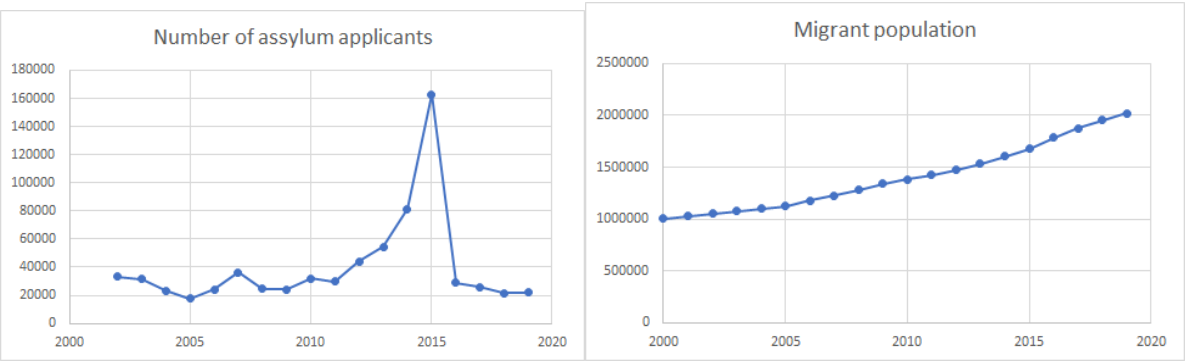


Diagram 3. Number of asylum applicants in Sweden between 2002-2019. Source: SCB

Diagram 4. Number of migrants in the Swedish population between 2000-2019. Source: SCB

4.2.1 Labor force

As employment was stated to be the most important determinant of migrants' impact on the economy (p.1 OECD 2014), the situation of employment rates is investigated here. Migrants have a lower employment rate than natives, presented in table 1 below. As for people of migrant background in the labor force, the employment rate of this group is not possible to investigate with current existing data, at least to my knowledge. SCB:s statistics of employment rates only differ between the groups natives and migrants.

Year	Natives	Migrants
2015	0,684	0,595
2016	0,688	0,601
2017	0,695	0,617
2018	0,702	0,616
2019	0,703	0,616

Table 1. Employment rates of the labor forces. Source SCB

4.2.1.2 Rejuvenation of the population

In Sweden there is a significant difference in the age distribution between natives and migrants, presented in diagram 5 and 6 below. The current share of the populations of working age (16-64) is 58% for natives compared to 78% for migrants. The fertility rate of migrants is also considerably higher than that of natives, presented in diagram 7.

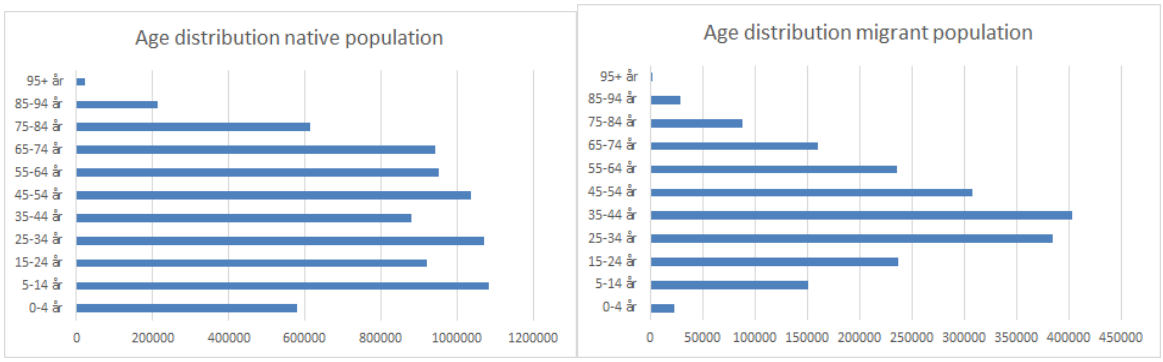


Diagram 5&6. The 2019 age distribution of the native and migrant population respectively. Source SCB

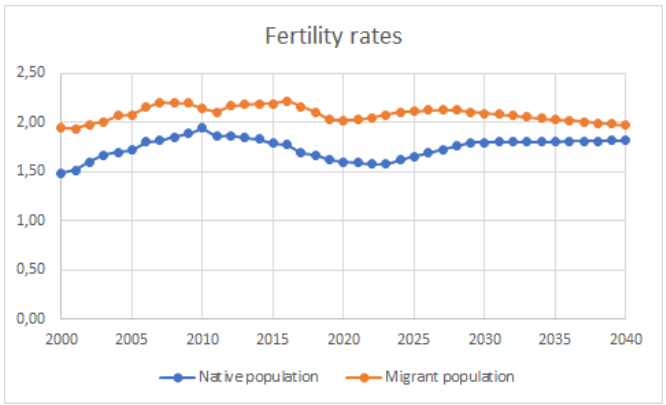


Diagram 7. Current and predicted fertility rates of the native and migrant population. Source SCB

4.2.2 Technological progress

Considering migrants' entrepreneurship in Sweden, OECD declares that Sweden is one of the countries in which the difference in self-employment between migrants and natives is larger than the average for OECD countries. From 1998-2008 the migrant share of entrepreneurs has been 10-12% in Sweden, while the native share has been approximately 8.5% (p.28 OECD 2010).

4.2.3 Educational level

A report from 2019 from Jusek concludes that highly educated migrants are to a lower extent employed in jobs that match their education level than natives (Jusek 2019). Further a report from SACO from 2015 presents detailed statistics of the educational levels of the highly educated people in Sweden 2012. It is established that the share of academics with a higher education of four years or more, is substantially higher among migrants than natives with 57% compared to 43% (p.16 Edström 2015). Lastly, considering the share of the population working in R&D, diagram 8 illustrates that the share of the migrants population with doctoral degrees are about twice as big as the native share. This could be an indication that migrants work in R&D to a larger extent than natives.

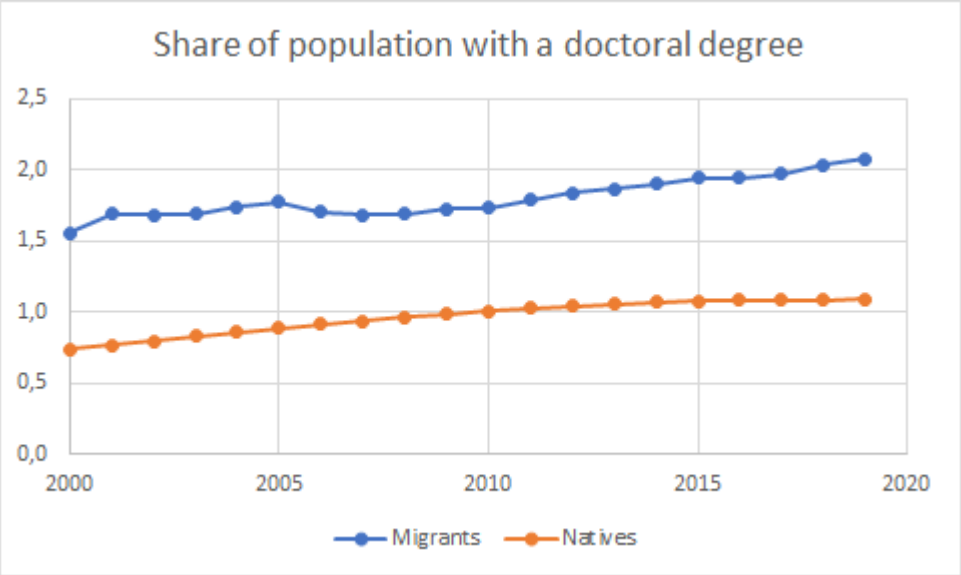


Diagram 8. Share of the population with doctoral degrees in Sweden, Source SCB.

Considering the educational level of people of migrant background, it seems that their enrollment in higher education ratio is higher than that for people of Swedish background, see diagram 9. Something supported by extensive empirical evidence is the fact that parental education is important for an individual's educational attainment. "A receiving country which manages to attract immigrants with a high education profile will tend to experience well integrated and economically successful generations of these immigrants' children" (p.125 Bauer 2005). As migrants in Sweden generally have a high educational level, this further supports that the children of migrants would enroll in high education to a large extent.

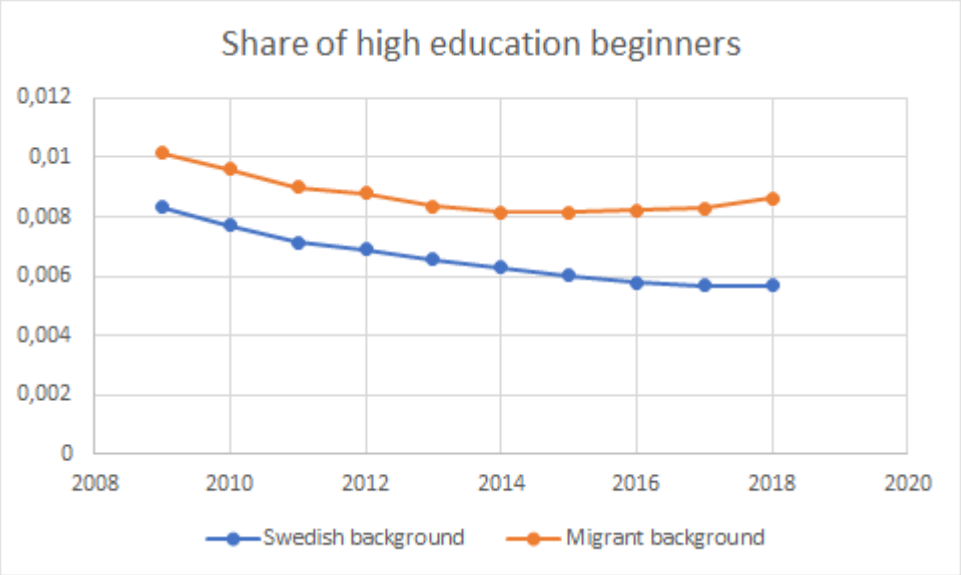


Diagram 9. Share of population enrolling in higher education in Sweden. Source SCB

4.2.4 Capital stock

If the migration crisis supposedly caused large costs for Sweden, this could be expected to have caused a decrease in the capital stock growth since 2014. Looking at diagram 10 we can distinguish that this has not been the case. An article from OECD from 2014 also presents that migrants "contribute more in taxes and social contributions than they receive in benefits" (p.1 OECD 2014). No research that I have come across presents a view in which migration should cause a decline of the capital stock growth, nor that natives and migrants contribute to the capital stock to different extents.

Diagram 10. Annual capital stock growth in Sweden from 2000-2018. Source SCB

5. Theoretical model

To attempt to calculate values of Sweden's output level and economic growth in the period 2020-2040, a growth model is introduced. To capture the effects of education levels, it is appropriate to use a model including human capital. I decided to use a modified version of the Uzawa-Lucas model. This section explains why this model seemed most appropriate for the cause, as well as presents the model and its features.

5.1 Uzawa-Lucas model

A study for OECD investigates how human capital accumulation affects economic growth, and whether this impact is more consistent with the Solow or the Uzawa-Lucas model. This study is performed by studying 21 OECD countries the years 1971-2004. The results are compatible with an endogenous growth model in which human capital accumulation can have a sustained effect on growth, which the Uzawa-Lucas model embodies. The conclusion drawn is therefore that the economic growth of these countries is better explained with the Uzawa-Lucas model than the Solow model (s.21 Arnold 2007).

The Uzawa-Lucas model is one of the most prominent models of economic growth, and it is presented in its original form below. The Uzawa-Lucas model is an endogenous growth model that includes the variable human capital, A feature of the model is that an individual's current time allocation between production and human capital accumulation affects their level of human capital in future periods. To explain how human capital develops over time, the variable *h* is introduced, the change in h from one period to another (p.17-18 Lucas 1988).

GDP:

$$Y=K^{\alpha}(uhL)^{1-\alpha}$$

GDP/capita:

$$y = \frac{Y}{L} = \frac{K^{\alpha}(uhL)^{1-\alpha}}{L}$$

Growth rate:

$$g_y = \frac{\dot{y}}{y}$$

Y=GDP

K=Capital stock

u=Share of lifetime spent in production

h=Human capital

L=Population

α=Capital-labor share of output

Change in human capital:

$$\dot{h} = B_h(1-u)h$$

$\dot{h}$ *=Change in human capital*

B_h*=Maximal growth rate of human capital*

(1-u)= Share of lifetime spent in education and R&D

h=Previous value of human capital

5.2 Modified model

To enable investigating the effects of the migrant and native labor forces on economic growth separately, a possibility for the groups to differ had to be included in the model. When researching this, existing models in which the population was split into different groups were found, however these were deemed too advanced for the level of this essay. Therefore, I together with my mentor decided to use a growth model that I recognize and have studied previously but modify it to enable different populations to be included.

The modifications made were the following: the variables inside of the parenthesis (uhL) were divided into two groups, natives (1) and migrants (2) to enable these values to differ between the groups. As the employment rate is stated as the most important determinant for migrants' contribution to the economy, I found it interesting and reasonable to enable a comparison of the employment rates for natives and migrants respectively. So, the variable *z*, the employment rate of the labor force, is added for each group. Further the labor force and the population were separated, as the people in the labor force are the main contributors to output and most interesting to investigate here. However the GDP per capita level should still be calculated using the population size. The modified model is presented below.

GDP:

$$Y = K^{\alpha}(z_1u_1h_1L_{F1}+z_2u_2h_2L_{F2})^{1-\alpha}$$

GDP/capita:

$$y = \frac{Y}{L_P} = \frac{K^{\alpha}(z_1u_1h_1L_{F1}+z_2u_2h_2L_{F2})^{1-\alpha}}{L_P}$$

z=Employment rate

L_F=Labor force

L_P=Population

5.2.1 Variables

This section will declare how values of the variables in the model were acquired. Some variables could simply be collected from SCB's data sets, whereas some could not and required calculation.

5.2.1.1 Capital

The capital stock measures the total value of assets within a country . The previous values of the capital stock were collected from the data set "Total assets" from SCB. Future values were calculated using a regression of the values from the previous 20 years.

5.2.1.2 Labor force

The labor force is here considered all those in working age, 16-64. The previous labor force sizes were collected from the "Population" data set from SCB. The future labor force sizes of natives and migrants were calculated in a few steps. Firstly, the shares of the populations in the age 16-64 were calculated as a regression of the current shares and the expected shares in 2070. These regressions were used to calculate the expected shares for the period 2020-2040, and then multiplied by the expected population sizes of the same year.

5.2.1.3 Population

The previous values of the population size were collected from SCB. The future values were collected from SCBs predictions of Sweden's future population, their "Population prognosis".

5.2.1.4 Human capital

$$\dot{h} = B_h(1-u)h$$

Human capital refers to a worker's general skill level. In this formula for calculating the change in human capital, the time devoted to human capital accumulation (1-u) determines the change of the human capital level between two periods (p.17-18 Lucas 1988). $\dot{h}$ is calculated as the h-value of the current period minus the value of the previous period. The formula also includes the previous value of h which is not previously known, nor possible to measure. So we conclude that some original level of h is a prerequisite to calculate future values of $\dot{h}$ and thereby h, this has to be obtained. Since previous values of all other variables in the Uzawa-Lucas model are possible to obtain, the previous values of human capital are calculated as residuals of the growth formula. The future values are then calculated using $h_n = h_{n-1} + \dot{h}$ for year n.

Rearranged growth formula:

$$h = \frac{Y}{\frac{K^{\alpha}}{(zuL)^{1-\alpha}}}^{\frac{1}{1-\alpha}}$$

These residual values then account for all economic growth that is not explained by K, z, u or L. This results in an unsure measure which accuracy can be questioned; that nothing aside from these five variables should affect the output level seems unlikely. However, due to the absence of a way of measuring human capital this is the method used for this essay.

5.2.1.4.1 Share of lifetime spent accumulating human capital

The average share of lifetime spent accumulating human capital, (1-u), is calculated by firstly dividing the population into two groups: people that work in R&D and people that do not. The share of the labor force in R&D was calculated by dividing the number of people working in R&D by the total labor force. An average for the past 10 years was then calculated as a constant. Note that it is a share and therefore has an interval of 0-1.

To then calculate the total time spent in education and R&D, the average time (1-u) was calculated for the two groups, people that work in R&D and people that do not. To calculate the average share of lifetime spent in education, median years of education divided by

expected lifetime was used. A regression of previous median years of education, obtained from HDI, was used to calculate future median years, these were then divided by expected lifetime obtained from SCB, and used as (1-u) for the people not working in R&D. For people working in R&D a constant value of 60 years was used, the number of years from that an individual enters school at age 5 until the average retirement age of 65, divided by expected lifetime. A rate weighted according to the population sizes of the two was then calculated. The variable u was then calculated using 1-(1-u).

5.2.1.4.2 Maximal growth rate of human capital

The variable B is called delta ($\boldsymbol{\delta}$) in Lucas' article, and described as the maximum growth rate of human capital (p.19 Lucas 1988). Since $\dot{h}/h=g_h=B(1-u)$, the maximum growth rate would occur if (1-u) equals 1, and so equal B. The value of B was calculated using the $\dot{h}$ formula, since 1-u, $\dot{h}$ and h were calculated. This value differed substantially over the years, here an average of the values from the past 20 years was calculated to use as the constant B. How this value is determined could be questioned.

Maximal growth rate:

$$B = \frac{\dot{\mathrm{h}}}{(1-\mathrm{u})\mathrm{h}} = 0{,}1311$$

5.2.1.5 Employment rate

The variable z, the employment rate, is included in the model to represent the share of the labor forces that are utilized in each group respectively. The employment rates have not changed much over the past ten years and remained exactly the same for both groups for the past three years. I decided to assume the rates of the past three years as constant parameters for the upcoming twenty years.

$z_1=0.70$
$z_2=0.62$

5.2.1.6 Capital-labor share of output

Alpha (α) is a measurement of the capital-labor share of the model. The variable represents a rate and therefore has an interval from 0 to 1. However, it is often generalized and set to ⅓ (Hansson 2020), an assumption used in this essay.

6. Simulations

In this section six different scenarios with different features are defined and simulated:

1) Anticipated
2) Without the migration crisis
3) Employment rate of migrants arriving during the crisis equals that of natives
4) Migrants spend more time on education and R&D than natives
5) Without migrants
6) Employment rate of migrants equals that of natives

Scenario 1,2 and 3 are used to study the effects of the migration crisis on Sweden's future GDP per capita level. Scenario 4, 5 and 6 do not illustrate effects of the migration crisis specifically, but of migration in general.

Firstly, some general explanations are in place. It was assumed that the capital per capita level should be adjusted to the same for all scenarios, since there is not a way of distinguishing values of the different groups' contributions. Secondly, the previous and future human capital levels of migrants and natives are assumed identical in the calculations, except from in scenario 4. The values of human capital are calculated as residuals, and to calculate separate values of previous human capital levels for natives and migrants is not possible with the information at hand.

6.1 Anticipated

This scenario is the expected GDP per capita level of Sweden.

6.2 Without the migration crisis

This entails the expected output level if no migrants would have arrived in Sweden between 2014-2017. The number of migrants that were added to the population during these years, approximately 340,000, were subtracted from the migrant labor force and the total population. Further the capital stock is adapted accordingly so that the value of capital per capita is the same as for the "anticipated" scenario. This is an improbable simulation, that no migrants at all would come to Sweden if the migration crisis had not occurred. However, it is

difficult to distinguish which of the 340,000 habitants Sweden gained those years were actually due to the crisis and which were not. I therefore chose to assume the extremity that no migrants arrived during these years.

6.3 Employment rate of migrants arriving during the crisis equals that of natives

In this scenario it is assumed that all migrants who arrived in Sweden between 2014-2017 have the same employment rate as natives. These people are then subtracted from the migrant labor force and added to the native labor force. This scenario represents the potential growth Sweden could experience as a result of the migration crisis.

6.4 Migrants spend more time on education and R&D than natives

As has been mentioned throughout this essay, it seems that 1) people of migrant background enroll in higher education to a larger extent than natives, 2) highly educated migrants are on average more highly educated than natives and 3) migrants have doctoral degrees to a larger extent than natives. Considering this, it could be possible that migrants on average spend more time in education and R&D, and thereby have a higher value of (1-u) than natives. To try and simulate this scenario, the (1-u) value of migrants is set slightly higher than that of natives. This is done by adding 1 year to migrants' "median years of schooling" compared to natives, and setting the share of the migrant labor force working in R&D to 1.8% compared to the native share of 1.67%.

6.5 Without migrants

This scenario simulates the expected economic growth in Sweden without any migrants. The migrant labor force is removed, and the migrant population is subtracted from the total population. The capital stock is also adjusted to the same capital per capita level as for the "anticipated" scenario.

6.6 Employment rate of migrants equals that of natives

This scenario illustrates the situation in which the employment rate of migrants was to rise to that of natives. In other words, setting z_2 to the values of z_1, to spot the possible difference in growth if the two groups would have the same employment rates.

7. Result

7.1 Future GDP per capita

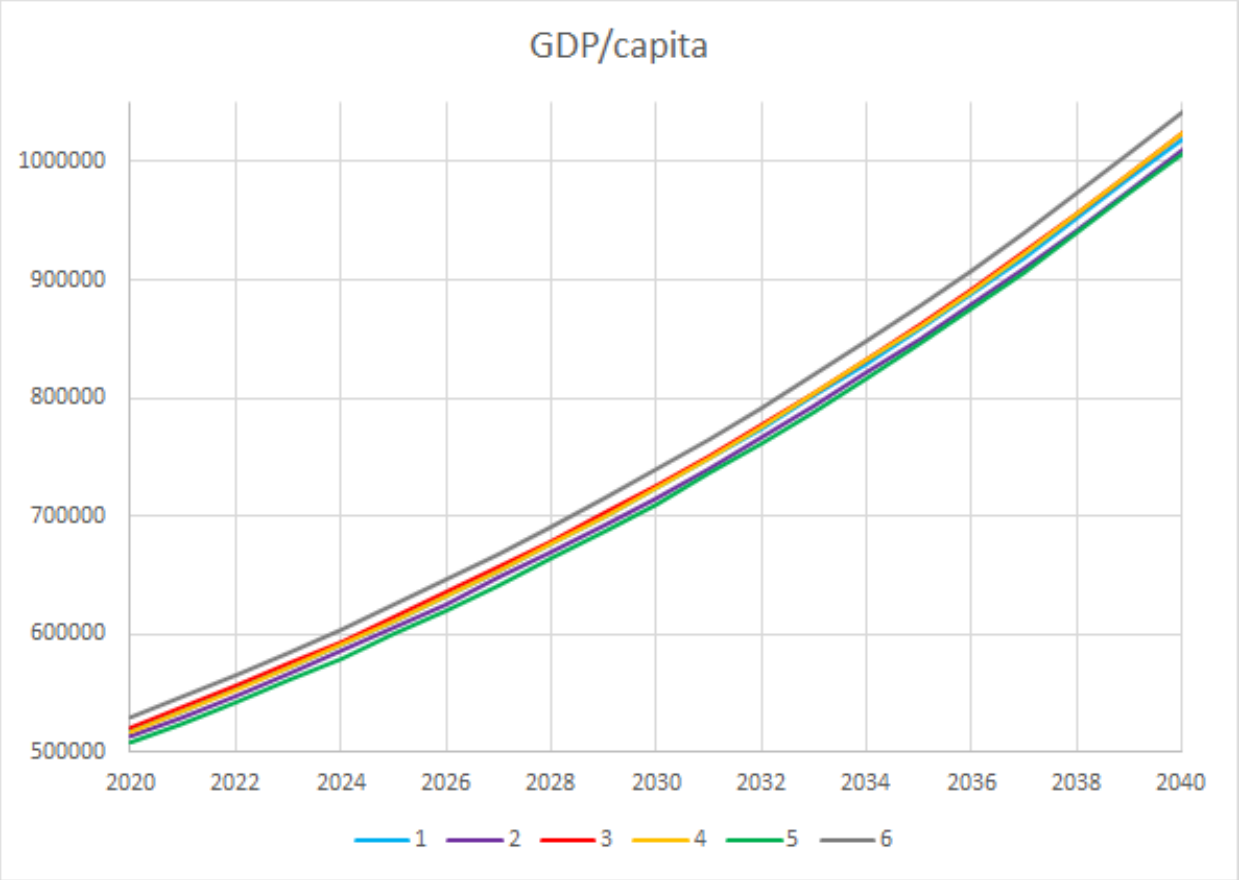


Diagram 11. Future GDP per capita in SEK for scenario 1-6

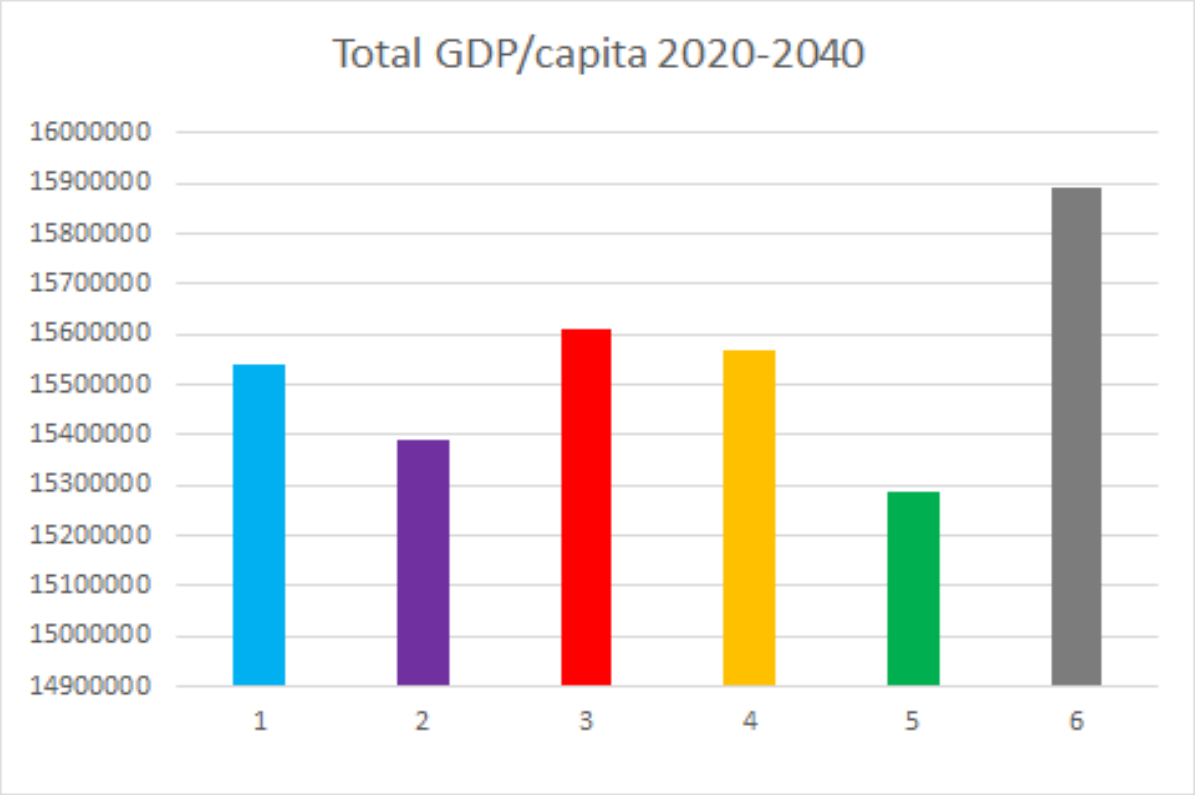


Diagram 12. Total GDP per capita in SEK for the 2020-2040 period, for scenario 1-6

	GDP/capita					
Year	**1**	**2**	**3**	**4**	**5**	**6**
2020	518,40	513,07	520,73	517,86	507,83	529,25
2021	535,68	530,20	538,07	535,24	524,84	547,03
2022	553,63	548,00	556,09	553,31	542,55	565,50
2023	572,24	566,45	574,77	572,05	560,93	584,64
2024	591,54	585,58	594,13	591,49	580,02	604,46
2025	611,53	605,39	614,20	611,63	599,82	624,98
2026	632,25	625,93	634,99	632,52	620,36	646,24
2027	653,75	647,24	656,57	654,20	641,71	668,29
2028	676,06	669,34	678,96	676,69	663,88	691,15
2029	699,20	692,27	702,19	700,04	686,90	714,86
2030	723,24	716,09	726,32	724,30	710,83	739,49
2031	748,21	740,82	751,39	749,50	735,72	765,07
2032	774,15	766,52	777,43	775,69	761,58	791,63
2033	801,08	793,19	804,46	802,88	788,46	819,19
2034	829,03	820,87	832,52	831,11	816,38	847,80
2035	858,03	849,59	861,63	860,41	845,36	877,47
2036	888,11	879,37	891,83	890,80	875,45	908,23
2037	919,31	910,26	923,15	922,32	906,68	940,13
2038	951,65	942,28	955,61	955,01	939,08	973,20
2039	985,17	975,48	989,27	988,91	972,70	1007,46
2040	1019,92	1009,88	1024,15	1024,05	1007,57	1042,97
Total	15542,19	15387,81	15608,47	15569,99	15288,65	15889,04

Table 2. GDP per capita in thousands SEK for scenario 1-6

7.1.1 Differentials from scenario 1

		GDP		GDP/capita	
		Total	Annual average	Total	Annual average
	2	-7,002E+12	-3,501E+11	-154382,56	-7719,13
	3	7,361E+11	3,681E+10	66283,81	3314,19
	4	3,166E+11	1,583E+10	27795,85	1389,79
	5	-4,011E+13	-2,005E+12	-253537,27	-12676,86
	6	3,857E+12	1,928E+11	346846,28	17342,31

Table 3. Differentials in SEK between Scenario 1 and scenario 2-6, in GDP and GDP/capita in total for 2020-2040 and the annual average.

7.1.2 GDP per capita growth rates

Calculated according to:

$$g_y = \frac{\dot{y}}{y} = \frac{(y_n - y_{n-1})}{y_{n-1}}$$

Diagram 13. Annual growth rates in GDP per capita for scenario 1-6

Year	s1	s2	s3	s4	s5	s6
2020-2021	0,03332331	0,03338837	0,03329041	0,03356228	0,03350404	0,03359284
2021-2022	0,03351285	0,03356944	0,03348293	0,03375878	0,03373678	0,03375353
2022-2023	0,03362152	0,03367319	0,03359326	0,03387322	0,03387823	0,03384236
2023-2024	0,03372277	0,03376853	0,03369636	0,0339796	0,03402827	0,03390549
2024-2025	0,03379492	0,03383701	0,03376966	0,03405562	0,03413379	0,0339537
2025-2026	0,03388023	0,03391825	0,03385628	0,03414392	0,03425291	0,03401292
2026-2027	0,03400902	0,03404183	0,03398687	0,03427478	0,03441345	0,03411609
2027-2028	0,03412002	0,034149	0,03409924	0,03438737	0,03454627	0,03421119
2028-2029	0,03423276	0,03425814	0,03421331	0,03450127	0,03467791	0,03431037
2029-2030	0,03438223	0,03440326	0,03436446	0,03465174	0,03484145	0,03445119
2030-2031	0,03453113	0,03454772	0,03451505	0,03480111	0,03500618	0,03458852
2031-2032	0,03466685	0,03467951	0,03465225	0,03493692	0,03515661	0,03471312
2032-2033	0,03478659	0,03479593	0,03477324	0,03505642	0,0352899	0,03482236
2033-2034	0,03489113	0,0348977	0,03487881	0,03516041	0,03540691	0,03491688
2034-2035	0,03498117	0,03498551	0,03496968	0,03524961	0,03550836	0,0349975
2035-2036	0,03505669	0,03505931	0,03504582	0,035324	0,03559449	0,03506383
2036-2037	0,03512281	0,03512405	0,03511244	0,03538867	0,03567056	0,03512079
2037-2038	0,03517922	0,03517942	0,0351692	0,0354433	0,03573627	0,03516807
2038-2039	0,03522913	0,03522854	0,03521938	0,0354911	0,0357949	0,03520872
2039-2040	0,03527326	0,03527212	0,03526369	0,03553287	0,03584687	0,03524401

Table 4. Annual GDP per capita growth rates scenario 1-6.

7.2 Future human capital

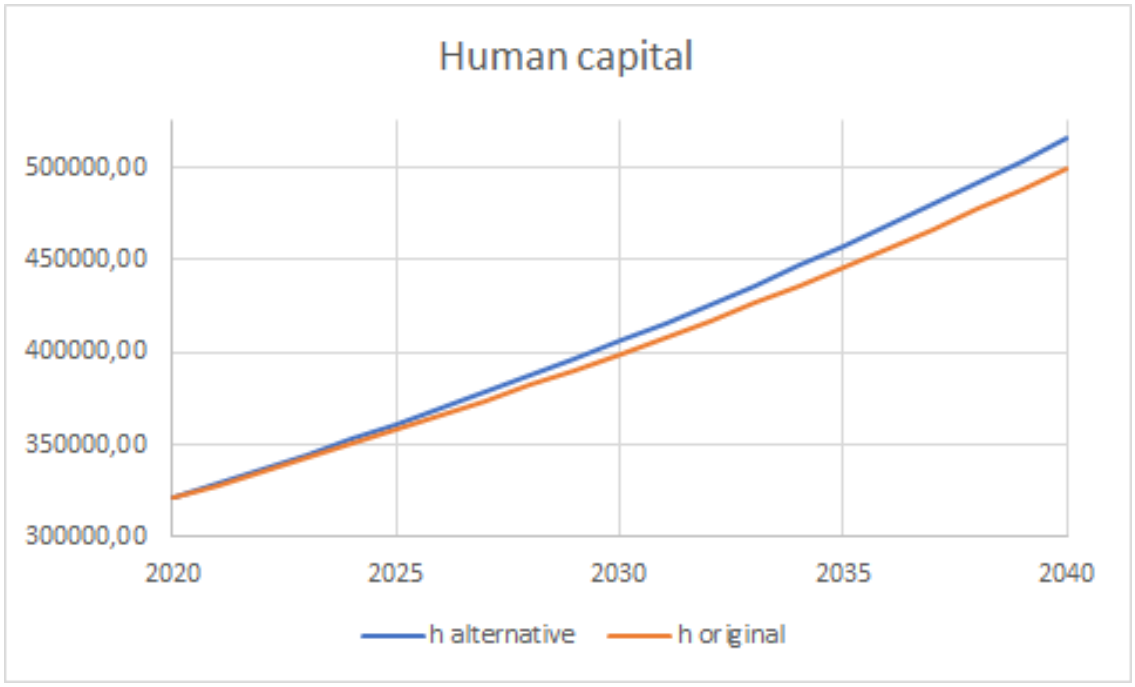


Diagram 14. Human capital values: “h original” for both groups in scenario 1,2,3,5,6 and group 1 in scenario 4 and “h alternative” for group 2 in scenario 4.

Year	h original	h alternative
2020	321437,45	321954,60
2021	328392,50	329448,81
2022	335519,94	337138,23
2023	342824,35	345028,28
2024	350310,46	353124,56
2025	357983,10	361432,80
2026	365847,27	369958,91
2027	373908,09	378708,99
2028	382170,82	387689,29
2029	390640,89	396906,27
2030	399323,86	406366,56
2031	408225,48	416077,00
2032	417351,62	426044,62
2033	426708,36	436276,67
2034	436301,93	446780,59
2035	446138,73	457564,08
2036	456225,36	468635,03
2037	466568,60	480001,59
2038	477175,43	491672,12
2039	488053,03	503655,27
2040	499208,77	515959,92

Table 5. Human capital levels 2020-2040.

8. Discussion

8.1 GDP per capita levels

First off, the results of the scenarios connected to the migration crisis will be analyzed. The "without crisis" scenario would result in a total loss of approximately 154,000 SEK per capita compared to the "anticipated" scenario as shown in table 3. Further scenario 3 "employment rate of migrants arriving during the crisis equals that of natives" results in a gain of approximately 66,000 SEK per capita compared to the "anticipated" scenario.

Secondly the three scenarios not connected to the migration crisis specifically will be analyzed. In scenario 4 "migrants spend more time on education and R&D than natives", the total GDP per capita would be 28,000 SEK higher than in the "anticipated" scenario. Scenario 5 "without any migrants" results in the huge loss of 254,000 SEK per capita compared to the "anticipated" scenario. Lastly scenario 6 "employment rate of migrants equals that of natives" entails a huge gain of nearly 350,000 SEK per capita over the upcoming 20 years.

Evaluating the overall results, it is possible to detect that in both scenarios with less migration than in the "anticipated" scenario, the expected GDP per capita levels are lower. The two scenarios with higher employment rates for migrants than the "anticipated" scenario both result in higher expected GDP per capita. Lastly the scenario in which migrants spend more time accumulating capital than natives result in a higher GDP per capita.

8.2 GDP per capita growth rate

As for growth rates, scenario 4 and 5 have higher growth rates than the other scenarios, as can be seen in diagram 8. The other scenarios, 1,2,3 and 6 seem to all converge towards approximately the same growth rate. Furthermore, the growth rates are increasing with time in all six scenarios, although at a decreasing pace. That scenario 4, in which migrants accumulate human capital at a higher rate than natives, induces higher growth is in line with the theory that human capital accumulation increases economic growth. That scenario 5 on the other hand, the "without migrants" scenario, has the highest expected growth might seem out of line with the theories presented. However, considering that the GDP per capita levels

for scenario 5 are considerably lower than all other scenarios, it seems reasonable that the growth rate could be higher. Possibly the output and growth level of this scenario is further away from its steady state than the others, and therefore grows faster in its transition phase. It seems unlikely that this growth rate would be this much higher in the longer term.

That the growth rates are all increasing indicate that Sweden is not in its steady state, nor will be for the upcoming twenty years. Although, the growth rates seem to be on their way towards stagnation as the slopes are levelling out, which could be an indication that at the end of the time period Sweden will be close to its steady state for the scenarios respectively. Diagram 13 further illustrates increasing growth rates for all scenarios, which illustrates either an on-going growth effect in which the growth rate is permanently affected. It could also be a long transitional phase of a level effect, proposing that the growth rates would eventually go back to their original levels.

8.3 Human capital

Diagram 14 shows the development of human capital on one part for both groups in scenario 1,2,3, 5 and 6 along with group 1 in scenario 4, the orange curve. The blue curve shows the development of human capital for group 2 in scenario 4, that is for migrants assuming that they spend slightly more time accumulating human capital than natives. This shows that if migrants have a higher value of (1-u) than natives, the expected human capital growth and thereby economic growth can be expected higher than in the “anticipated” scenario in the upcoming 20 years.

8.4 General reflections

One thing that should be considered is that the current covid-19 pandemic has not been taken into account in these calculations. It is probable that the pandemic will affect the inflow of migrants as well as the capital and GDP per capita levels and growth for many years ahead. Another thing to take into account is that many assumptions are made in order to enable these simulations, and this is possible, even probable, to affect the accuracy of the results.

9. Conclusion

This essay investigates the future economic growth and GDP per capita level of Sweden, and how these are expected to be affected by the migration crisis as well as migration in general. The majority of previous research concludes that migration has a positive impact on the economic growth of the receiving country. It was further concluded that migration seems to have positive effects on Sweden's growth and GDP level more specifically. The size of the positive effects is found to depend on the human capital level, employment rate and age distribution of migrants.

Previous research finds a significant positive impact of migrants' human capital on economic growth. Sweden seems to mainly receive highly skilled migrants, which is beneficial for current and future GDP levels. The fact that many highly educated migrants are unemployed results in further loss than that of an average skilled worker, as these individuals carry more human capital than the average worker. Technological progress is positively affected by migration, not least because of the large share of entrepreneurs in the migrant population. The rejuvenation of the population is of utmost importance as Sweden faces a rising problem of an ageing native population. The migrant population is both younger and has higher fertility rates than natives, suggesting that the migrant population could largely contribute to solving future labor force shortages and ease the pressure on social insurance systems.

The problem of distributional effects is a sensitive discussion, in which it is difficult to conclude what is right. Most literature and research on the topic states that the economic gains of complementarity of the native and migrant labor force innovation should counteract the negative distributional effect on natives, and that natives' output levels actually tend to be positively affected by immigration. It is further presented that policies could possibly distribute the positive effects accordingly, to counteract distributional effects of migration.

The importance of the employment rate is emphasized, by OECD considered the primary determinant of migrants' contribution to the economy. This is an important find, that seemed important to therefore include in the model. A modified version of the Uzawa-Lucas model is introduced, featuring a separation of the native and migrant labor force, human capital accumulation and employment rates. Using the Uzawa-Lucas model it is presumed that human capital accumulation is the engine of economic growth. Further investigating whether

migration could be a driver of growth, it seems that it contributes to driving economic growth, although it is not claimed to be the main driver of growth.

The fact that people of migrant background are counted towards the group "natives" in the calculations implies that the actual effects of migration on Sweden's economic growth could be larger than what is concluded here. Underestimation of the positive impacts of migration can also be expected more generally as a result of this group not being included sufficiently in statistics. It is found that people of migrant background currently enroll in higher education to a larger extent than natives. The impact of this group on the output level would be interesting to investigate further, but this was not possible since the data necessary for the analysis was not separated between people of Swedish background and people of migrant background.

The scenarios with the highest and second highest expected GDP per capita levels were the two in which some or all migrants are employed at the same rate as natives, emphasizing the importance of migrants' employment rates on the future GDP per capita. The distinctly lower GDP per capita levels in the scenarios with less or no migrants indicate that migration does have a positive impact on Sweden's economic growth. The scenario in which migrants spend more time accumulating capital than natives result in a higher growth rate, that could possibly be a sustained effect that goes beyond this time period. This scenario assumes current employment rates, so if the employment rates were to rise even higher growth and GDP levels could be achieved.

I have in this essay presented migration and economic growth as such, the previous research of their relationship, used the Uzawa-Lucas model to calculate and quantify effects of the migration crisis and migration in general on Sweden's future economic growth. It is concluded that migration seems to have a general positive impact on economic growth of the receiving economies, such as Sweden. That the migrants arriving to Sweden are generally young and highly educated argues that Sweden surely experiences positive effects of migration. The migration crisis is concluded to expectedly have positive effects on Sweden's future GDP per capita levels. The focus of the economic losses of the migration crisis and of migration over all in the political debate seems unjustified in this sense.

10. References

Arnold. Jens, Bassanini. Andrea & Scarpetta. Stefano (2007). "Solow or Lucas?: Testing Growth Models Using Panel Data from OECD Countries", *OECD Economics Department Working Papers No. 592*, OECD Publishing. https://www.oecd-ilibrary.org/economics/solow-or-lucas-testing-growth-models-using-panel-data-from-oecd-countries_028487061153

Bauer. Thomas K, Haisken-DeNew. John P & Schmidt. Christoph M (2005). "CHAPTER 7- INTERNATIONAL LABOUR MIGRATION, ECONOMIC GROWTH AND LABOUR MARKETS: THE CURRENT STATE OF AFFAIRS", *The New Demographic Regime Population Challenges and Policy Responses*, UNECE. https://unece.org/fileadmin/DAM/pau/_docs/pau/PAU_2005_Publ_NDR.pdf#page=124

Boubtane. Ekrame, Dumont. Jean-Christophe & Rault. Christophe (2014). "Immigration and Economic Growth in the OECD Countries, 1986-2006", *IZA Discussion Paper No. 8681*, IZA (The Institute for the Study of Labor). http://ftp.iza.org/dp8681.pdf

Edström. Josefin (2015). "Sveriges utrikes födda akademiker", Saco. https://www.saco.se/opinion/rapporter/sveriges-utrikesfodda-akademiker/

Edström. Josefin (2015). "Vad kostar en akademiker?", Saco. https://www.saco.se/opinion/rapporter/vad-kostar-en-akademiker/

Engler. Philipp, Honjo. Keiko, MacDonald. Margaux, Piazza. Roberto (lead) & Sher. Galen, under the guidance of Florence Jaumotte (2020). "CHAPTER 4- THE MACROECONOMIC EFFECTS OF GLOBAL MIGRATION", *World Economic Outlook*, IMF. https://www.elibrary.imf.org/view/IMF081/28950-9781513539744/28950-9781513539744/ch04.xml?redirect=true

Hansson. Pontus (2020). Kompletterande kompendium, Ekonomisk tillväxt, Lunds Universitet.

Jusek (2019). “Rätt jobb åt utrikes födda akademiker”, Jusek.
https://www.jusek.se/press/statistik-och-rapporter/

IOM (2020). “World Migration Report 2020”, IOM (International Organization for Migration).
https://publications.iom.int/books/world-migration-report-2020

Jones. Charles I. & Vollrath. Dietrich (2013). *“Introduction to economic growth”*, W.W. Norton & Company, Inc.

Lucas. Robert E. (1988). “On the mechanics of economic development”, *Journal of Monetary Economics 22 (1988) 3-42 North-Holland,* University of Chicago.
https://www.sciencedirect.com/science/article/pii/0304393288901687?via=ihub

MacDonald. Margaux, Engler. Philipp, Piazza. Roberto & Sher. Galen (2020). “Migration to Advanced Economies Can Raise Growth”, IMF blogs.
https://blogs.imf.org/2020/06/19/migration-to-advanced-economies-can-raise-growth/

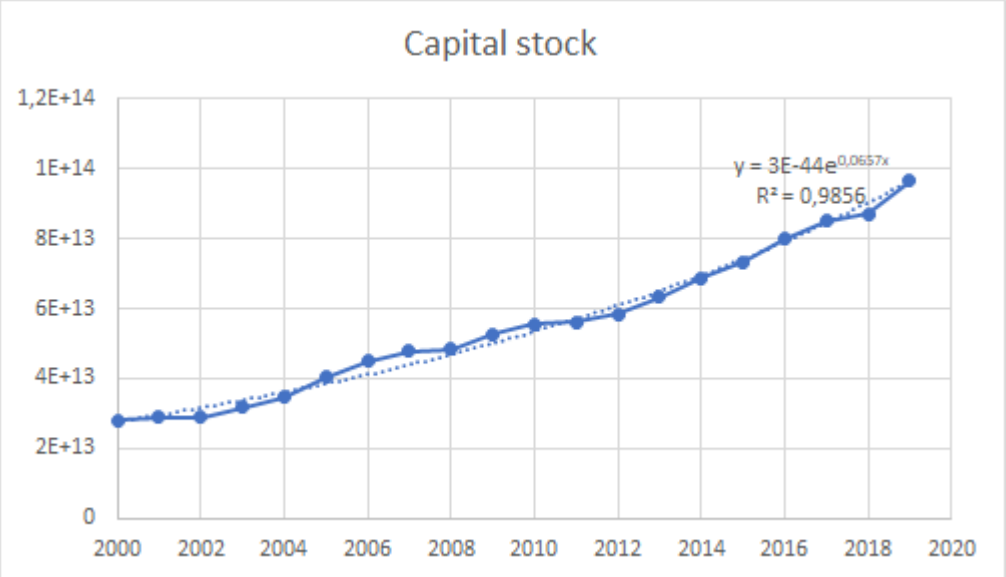
OECD (2010). “Open for Business: Migrant Entrepreneurship in OECD Countries”, OECD Publishing.
https://www.oecd-ilibrary.org/docserver/9789264095830-en.pdf?expires=1608379118&id=id&accname=ocid177253&checksum=7DE0AEBD657B221F92453552EEEAD944

OECD (2014). “Is migration good for the economy?”, *Migration Policy Debates,* OECD.
https://www.oecd.org/migration/OECD%20Migration%20Policy%20Debates%20Numero%202.pdf

SCB (2020). Statistik om invandring – frågor och svar.
https://www.scb.se/hitta-statistik/statistik-efter-amne/befolkning/befolkningens-sammansattning/befolkningsstatistik/produktrelaterat/Fordjupad-information/statistik-om-invandring---fragor-och-svar/

11. Appendix

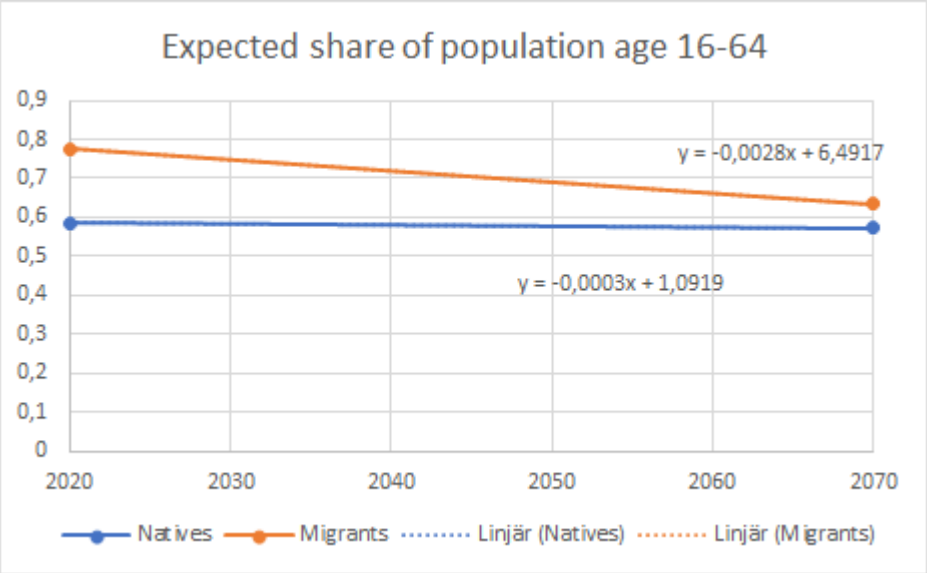
11.1 Capital



Year	Capital
2000	2,81E+13
2001	2,89E+13
2002	2,89E+13
2003	3,16E+13
2004	3,46E+13
2005	4,04E+13
2006	4,5E+13
2007	4,77E+13
2008	4,84E+13
2009	5,26E+13
2010	5,55E+13
2011	5,61E+13
2012	5,83E+13
2013	6,33E+13
2014	6,86E+13
2015	7,32E+13
2016	7,98E+13
2017	8,51E+13
2018	8,7E+13
2019	9,66E+13

Year	K	k	K scenario 2	K scenario 5
2020	1,12E+14	10717694	1,0795E+14	8,93983E+13
2021	1,19E+14	11357229	1,1531E+14	9,50927E+13
2022	1,27E+14	12041434	1,2317E+14	1,01182E+14
2023	1,36E+14	12770386	1,3156E+14	1,07685E+14
2024	1,45E+14	13547553	1,4053E+14	1,14656E+14
2025	1,55E+14	14374504	1,501E+14	1,22113E+14
2026	1,66E+14	15255182	1,6033E+14	1,30095E+14
2027	1,77E+14	16195221	1,7125E+14	1,38641E+14
2028	1,89E+14	17197550	1,8291E+14	1,47776E+14
2029	2,02E+14	18266497	1,9537E+14	1,57539E+14
2030	2,15E+14	19408561	2,0867E+14	1,67963E+14
2031	2,3E+14	20629205	2,2287E+14	1,79102E+14
2032	2,46E+14	21933348	2,3804E+14	1,91004E+14
2033	2,62E+14	23325947	2,5424E+14	2,03724E+14
2034	2,8E+14	24812203	2,7153E+14	2,17317E+14
2035	2,99E+14	26397552	2,9001E+14	2,31844E+14
2036	3,19E+14	28087640	3,0974E+14	2,4737E+14
2037	3,41E+14	29888745	3,308E+14	2,63966E+14
2038	3,64E+14	31807396	3,5331E+14	2,81708E+14
2039	3,89E+14	33850719	3,7734E+14	3,00677E+14
2040	4,15E+14	36026234	4,03E+14	3,2096E+14

11.2 Population and labor force

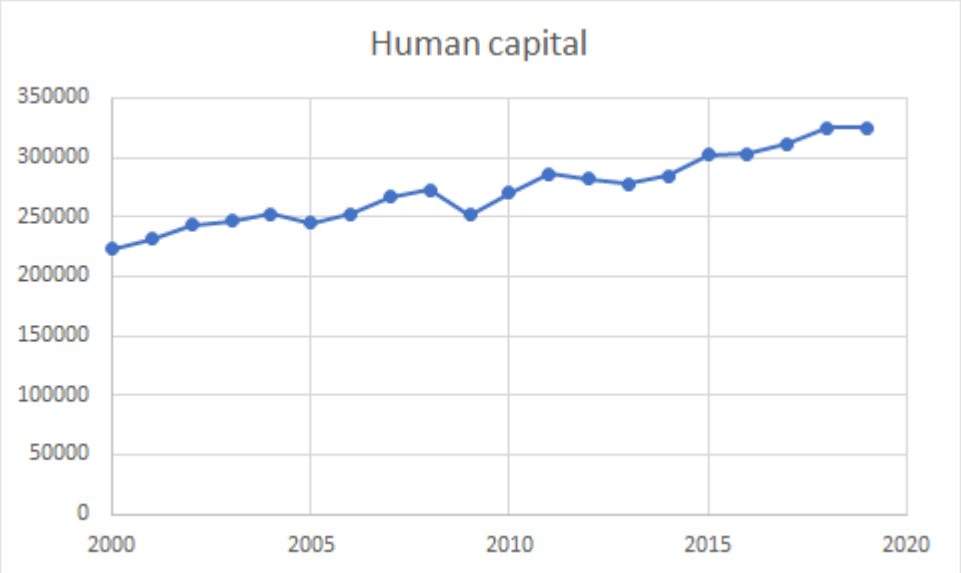


Year	L1	Share 16-64	LF1	L2	Share 16-64	LF2	Total population size
2020	8341190	0,5855	4883767	2074375	0,7735	1604529	10415565
2021	8372878	0,5853	4900645	2123633	0,7707	1636684	10496511
2022	8402831	0,5851	4916496	2169537	0,7679	1665987	10572368
2023	8432370	0,5849	4932093	2213462	0,7651	1693520	10645832
2024	8463242	0,5847	4948458	2253331	0,7623	1717714	10716573
2025	8495109	0,5845	4965391	2290808	0,7595	1739869	10785917
2026	8527910	0,5843	4982858	2325487	0,7567	1759696	10853397
2027	8560611	0,5841	5000253	2357044	0,7539	1776975	10917655
2028	8592869	0,5839	5017376	2386637	0,7511	1792603	10979506
2029	8624468	0,5837	5034102	2414469	0,7483	1806747	11038937
2030	8654065	0,5835	5049647	2440808	0,7455	1819622	11094873
2031	8681942	0,5833	5064177	2465272	0,7427	1830958	11147214
2032	8708399	0,5831	5077867	2487966	0,7399	1840846	11196365
2033	8733796	0,5829	5090930	2509039	0,7371	1849413	11242835
2034	8758486	0,5827	5103570	2528629	0,7343	1856772	11287115
2035	8782797	0,5825	5115979	2546886	0,7315	1863047	11329683
2036	8807094	0,5823	5128371	2563923	0,7287	1868331	11371017
2037	8831633	0,5821	5140894	2579796	0,7259	1872674	11411429
2038	8856682	0,5819	5153703	2594564	0,7231	1876129	11451246
2039	8882445	0,5817	5166918	2608245	0,7203	1878719	11490690
2040	8909053	0,5815	5180614	2620920	0,7175	1880510	11529973

Expected share(1)*Expected population size(1)= Expected labor force(1)= L_{F1}

Expected share(2)*Expected population size(2)= Expected labor force(2)= L_{F2}

11.3 Human capital



Past values, calculated as residuals according to:

$$h = \frac{Y^{\frac{1}{1-\alpha}}}{\frac{K^{\alpha}}{(zuL)^{1-\alpha}}}$$

A combined value of z was calculated:

$$z = \frac{(z_1 * L_1)+(z_2 * L_2)}{L} = 0.69$$

Year	Human capital total	*h*	B
2000	222655,22	9134,10	0,268
2001	231789,32	11860,29	0,332
2002	243649,61	2847,38	0,075
2003	246496,99	6181,69	0,160
2004	252678,67	-7532,58	-0,183
2005	245146,09	7609,44	0,190
2006	252755,53	14433,86	0,350
2007	267189,40	5676,83	0,129
2008	272866,23	-20888,77	-0,478
2009	251977,46	18207,72	0,452
2010	270185,18	15892,59	0,366
2011	286077,77	-4035,44	-0,087
2012	282042,33	-4184,61	-0,092
2013	277857,72	6486,43	0,147
2014	284344,15	18041,44	0,398
2015	302385,59	964,02	0,020
2016	303349,60	8008,12	0,165
2017	311357,72	14040,43	0,282
2018	325398,16	-67,99	-0,001
2019	325330,16		

$\dot{h} = h_n - h_{n-1}$

$B = \dot{h}/((1-u)*h)$

B average= 0,1311

Y featured from SCB:

Year	GDP
2000	2,41E+12
2001	2,50E+12
2002	2,60E+12
2003	2,70E+12
2004	2,83E+12
2005	2,93E+12
2006	3,12E+12
2007	3,32E+12
2008	3,41E+12
2009	3,34E+12
2010	3,57E+12
2011	3,73E+12
2012	3,74E+12
2013	3,82E+12
2014	3,99E+12
2015	4,26E+12
2016	4,42E+12
2017	4,63E+12
2018	4,83E+12
2019	5,02E+12

11.3.1 Share of lifetime spent accumulating human capital

$(1-u) = ((A_{Ed}/A_{Ex})*L_X)+((60/A_{Ex})*L_R)$

A_{Ed}=Median years of education year n

A_{Ex}=Life expectancy year n

L_R=Share of labor force in R&D

L_X=Share of labor force not in R&D

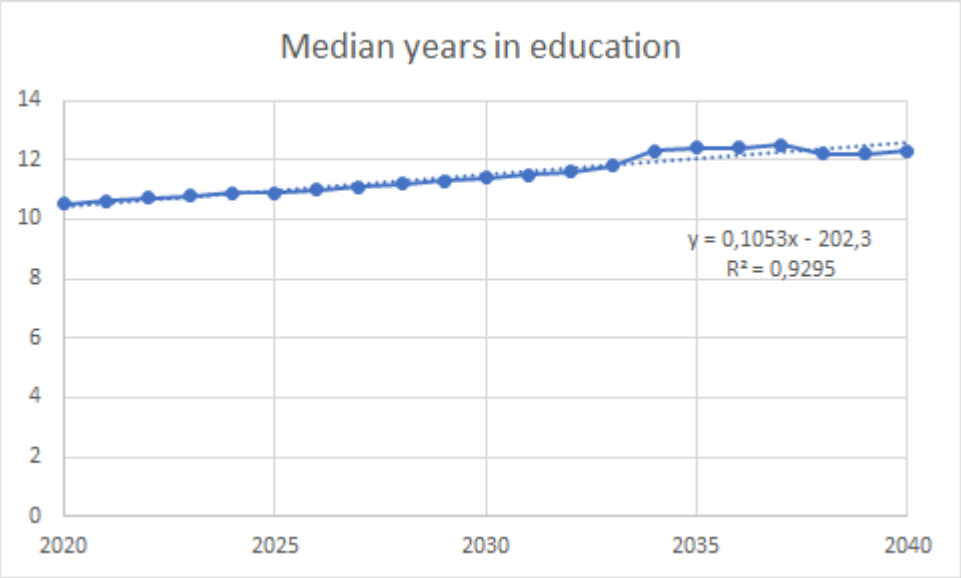
60= Nr of years from school start to average retirement age in Sweden (age 5-65)

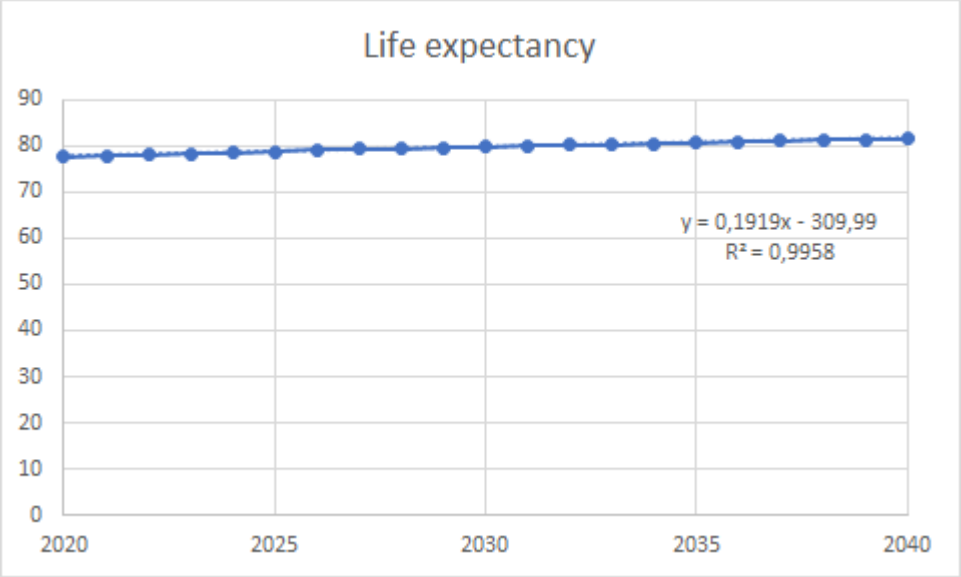
Year	A_{ed}	A_{ex}	1-u	u
2000	11,40	79,70	0,153	0,847
2001	11,50	79,90	0,154	0,846
2002	11,60	80,10	0,155	0,845
2003	11,80	80,20	0,157	0,843
2004	12,30	80,40	0,163	0,837
2005	12,40	80,60	0,164	0,836
2006	12,40	80,80	0,163	0,837
2007	12,50	81,00	0,164	0,836
2008	12,20	81,20	0,160	0,840
2009	12,20	81,30	0,160	0,840
2010	12,30	81,50	0,161	0,839
2011	12,40	81,70	0,162	0,838
2012	12,40	81,80	0,161	0,839
2013	12,20	82,00	0,159	0,841
2014	12,30	82,10	0,160	0,840
2015	12,40	82,30	0,160	0,840
2016	12,40	82,40	0,160	0,840
2017	12,40	82,50	0,160	0,840
2018	12,40	82,70	0,160	0,840
2019	12,50	82,80	0,161	0,839
2020	12,90	83,21	0,164	0,836
2021	12,97	83,39	0,165	0,835
2022	13,05	83,57	0,166	0,834
2023	13,12	83,74	0,166	0,834
2024	13,19	83,92	0,167	0,833
2025	13,27	84,10	0,167	0,833
2026	13,34	84,28	0,168	0,832
2027	13,41	84,46	0,168	0,832
2028	13,49	84,64	0,169	0,831
2029	13,56	84,82	0,169	0,831
2030	13,63	85,00	0,170	0,830
2031	13,71	85,17	0,170	0,830
2032	13,78	85,35	0,170	0,830
2033	13,85	85,53	0,171	0,829
2034	13,93	85,71	0,171	0,829
2035	14,00	85,89	0,172	0,828
2036	14,07	86,07	0,172	0,828
2037	14,15	86,25	0,173	0,827
2038	14,22	86,42	0,173	0,827
2039	14,29	86,60	0,174	0,826
2040	14,37	86,78	0,174	0,826

“original” future values.

Year	(1-u)	u
2020	0,177034	0,82296648
2021	0,177516	0,82248363
2022	0,177997	0,82200283
2023	0,178476	0,82152409
2024	0,178953	0,82104739
2025	0,179427	0,82057271
2026	0,1799	0,82010004
2027	0,180371	0,81962937
2028	0,180839	0,81916069
2029	0,181306	0,81869398
2030	0,181771	0,81822924
2031	0,182234	0,81776644
2032	0,182694	0,81730558
2033	0,183153	0,81684664
2034	0,18361	0,81638962
2035	0,184066	0,8159345
2036	0,184519	0,81548126
2037	0,18497	0,81502991
2038	0,18542	0,81458041
2039	0,185867	0,81413278
2040	0,186313	0,81368698

“alternative” future values.





11.4 Employment rate

	z1	z2
2015	0,68	0,60
2016	0,69	0,60
2017	0,70	0,62
2018	0,70	0,62
2019	0,70	0,62