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Borderless Welfare State

The Consequences of Immigration for Public Finances

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This is the Technical Appendix to the report Borderless Welfare State: The consequences of immigration for public finances.

The appendix explains the method used in the current report. This facilitates understanding and review.

The conclusion of the report is severe. Continuing immigration with its current size and cost structure will put increasing pressure on public finances. Curtailment of the welfare state and/or immigration will then be inevitable.

The appendix enlarges the possibility of replication of the calculations. The authors hope this promotes the periodic actualization of the report.

Technical Appendix

to the second edition of the report

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1 Introduction

This is the Technical Appendix to the report *Borderless welfare state: The consequences of immigration for public finances*.[1] To avoid confusion, this Technical Appendix refers to the report Borderless Welfare State as "the current report" or "the current study" and to this Technical Appendix as "this appendix". The method used in the current report is explained in this appendix. This is intended to facilitate understanding and review of the current report. In addition, in principle[2] it creates the possibility of replication of the calculations. After all, an underlying aim of the current report is the periodic production of current generational accounting.

This appendix is structured as follows. Chapter 2 deals with the method of generational accounting. §2.1 first provides a general explanation of the generational accounting method used. §2.2 provides an illustration of the structure of the net contribution per year of life on the basis of the main government income and expenditure items. In §2.3 it is explained how generational accounting has been applied for first-generation immigrants. In §2.4 the same is done for second-generation immigrants.

Chapter 3 describes the study population and provides an overview of the main Statistics Netherlands microdata files used for the current study. In Chapter 4 some socio-demographic variables are described, such as age, generation, education level, Cito score, immigration motive and region of origin. Chapter 5 contains a general description of the operationalisation of the cost and benefit items. A general overview of the cost and benefit items (§5.1) is followed by a detailed explanation of the operationalisation of individual items (§5.2 to §5.8). Chapter 6 deals with 'start-up costs' – costs that occur at the start of the immigration process – and costs that occur after possible remigration. §6.1 and §6.2 deal with the start-up costs for asylum reception, residence permits issuance and civic integration that can be involved with first-generation immigrants. §6.3 deals with the costs after remigration of first-generation immigrants, in particular accrued state pension rights.

Chapter 7 deals with the operationalisation of birth, death and migration. A number of demographic calculations relating to population growth and ageing are also explained. In Chapter 8, the anchoring in the CPB ageing studies is explained and a comparison is made with the CPB report *Immigration and the Dutch Economy*, of which the current report is an update.

Chapters 9 to 11 contain some divergent matters. Chapter 9 deals with some important points regarding the interpretation of the results. Sampling is discussed in Chapter 10. In Chapter 11 the strengths and weaknesses are discussed and some suggestions for further research are made.

[1] English: Van de Beek, J. H., J. Hartog, H. J. Roodenburg & G. W. Kreffer (2021) *Borderless Welfare State:* The consequences of immigration for public finances, ISBN: 9789083334820, Dutch: Van de Beek, J. H., J. Hartog, H. J. Roodenburg & G. W. Kreffer (2021) *Grenzeloze verzorgingsstaat: De gevolgen van Immigratie voor de Overheidsfinanciën,* ISBN: 9789083334806, see https://demo-demo.nl/en/

[2] Replication of the results of the research *Borderless welfare state* requires access to Statistics Netherlands microdata. The results are based on the calculations of the University of Amsterdam, Amsterdam School of Economics, based on non-public microdata from Statistics Netherlands. These microdata are accessible under certain conditions for statistical and scientific research. For more information see microdata@cbs.nl.

2 Generational accounting

2.1 Generational accounting and net contribution

The method used in the current report to calculate the costs and benefits of immigration is known as generational accounting.[3] The essence of generational accounting[4] is that for people of a certain group for each year of age one adds up all the amounts that a person on average pays to the government and subtracts all the amounts that this person receives from the government. By doing so, an age profile is created for the *net contribution per year of age*. Addition of these net contributions over all (future) years of life gives the net contribution over the life course of members of the group concerned.

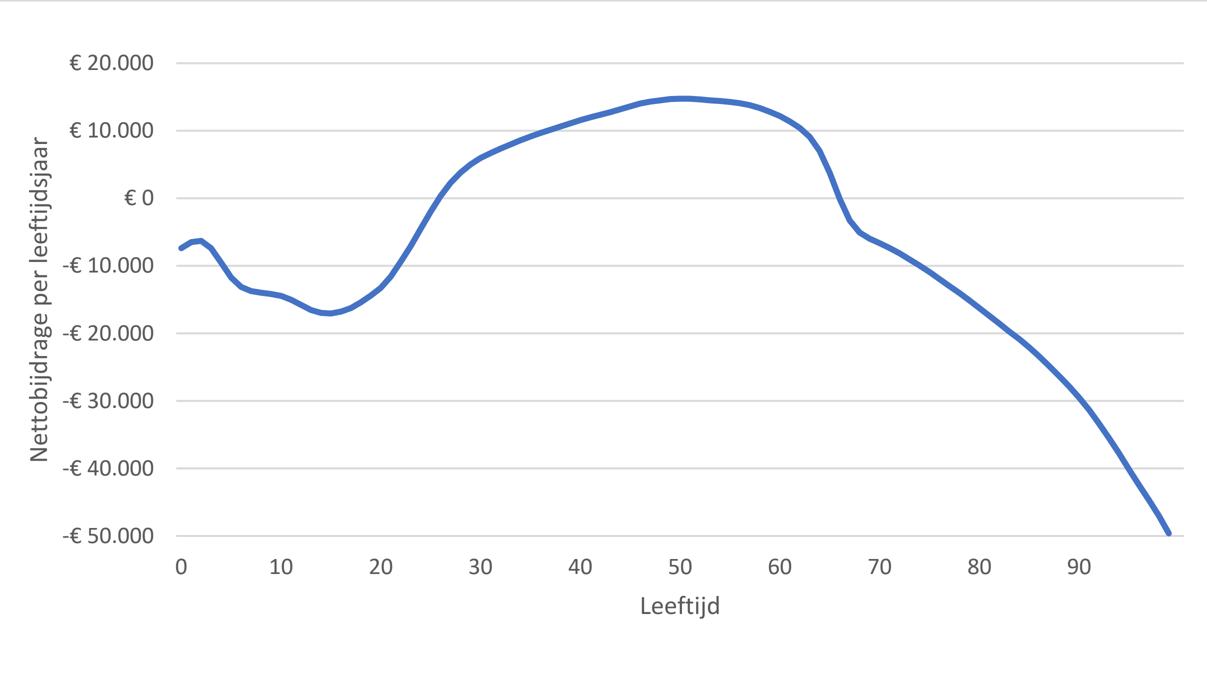

Figure 2.1 Net contribution by year of age of the average Dutch person in 2016.

Net contribution per year of age is a key concept in the current report. It is the net amount of money that flows from a person to the treasury in a given year of age. If someone contributes more to the treasury in a certain year of age than he or she receives, the net contribution is positive in that year of age. If someone costs the treasury more than he or she contributes in a certain year of age, then the net contribution is negative in that year of age. For all sorts of practical reasons, it is very difficult to

[3] See also Chapter 3 and §4.1, in particular Box 4.1 and the Glossary in Van de Beek, J. H., J. Hartog, H. J. Roodenburg & G. W. Kreffer (2021)

[4] The word 'generation' in 'generational accounting' can potentially lead to confusion. Originally, this method was designed to investigate fiscal imbalances between different birth generations, hence the name 'generational accounting'. It was therefore not a question of generation in the sense of immigration generation, but of generations in the population in a general sense. However, this method can also be used for a dynamic approach (see §3.1) regarding the costs and benefits of immigration, as is done in the current study. In order to obtain as much data as possible with a view to splitting it up into groups of origin, immigration motive, etc., in general, calculations have not been carried out per birth generation, but all data has been used. In practice, in a number of cases a generation does cover more or less a birth cohort, as in the case of the net contribution by Cito score (cohort 2006-2018) and immigration motive (cohort 1995-2015), but this is dictated by data availability. Furthermore, in a number of cases a classification has been made according to immigration generation, according to the definitions of Statistics Netherlands (see §13.7).

follow large groups of people over their entire life course. Therefore, the current report used 2016 data from people of all ages to create the age profiles for the net contribution over the entire life course.

In general, a net contribution profile is drawn up for a group of people. Figure 2.1 shows the age profile for the entire Dutch population (i.e., people with and without an immigration background) in 2016. It can be seen that the profile is below the zero line during the youth and study period and during the retirement age. During these periods, the net contribution per year of age of the average Dutch person is therefore negative and he or she costs the government money. For working age, the net contribution is above the zero line. During this period, the average Dutch person therefore makes a positive net contribution and provides the treasury with money. In 2016 – as mentioned, the reference year of the current report – the contribution was positive for ages 26 to 65 and negative for the other ages. The *net contribution*[5], another key concept from the current report, is calculated by adding up all amounts over the entire life course – i.e., for each year of age. That is the net amount that a person, calculated over his entire life course, contributes to the treasury or receives from the treasury.

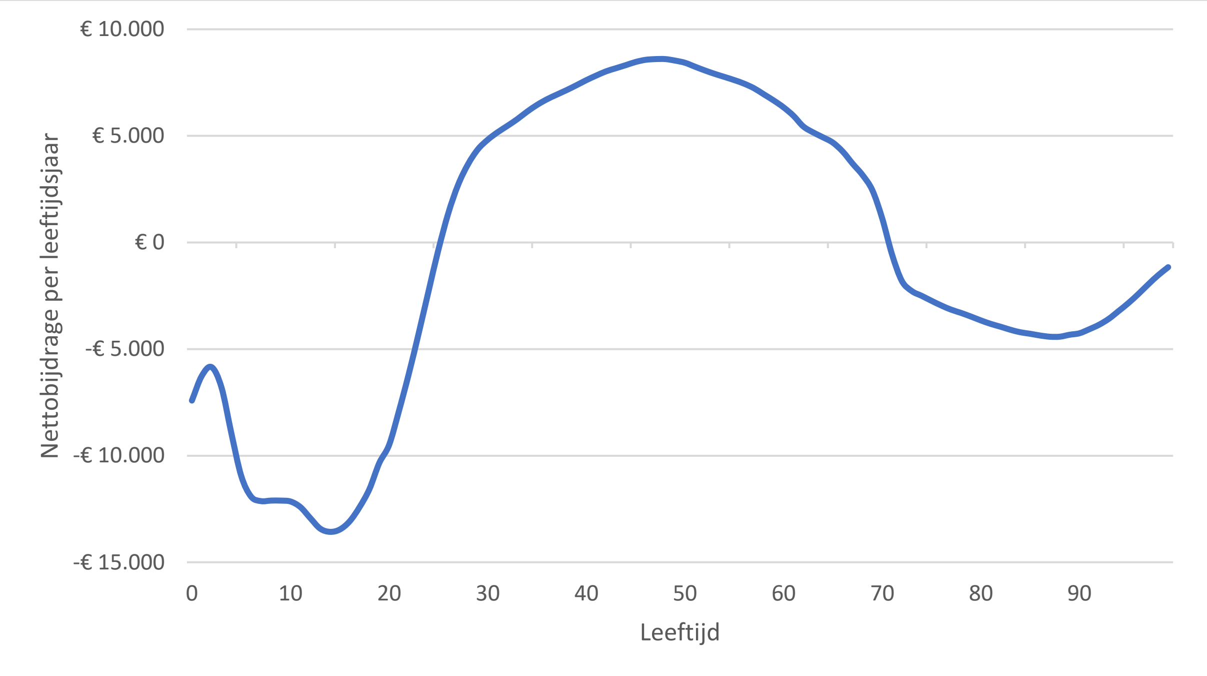

Figure 2.2 Net contribution by age for an average Dutch person, born in 2016, adjusted for mortality probabilities and expressed in euros for 2016, Source: our own calculation based on Statistics Netherlands microdata.

When calculating the net contribution over the life course, mortality probabilities are taken into account; Dutch people who are very old cost the treasury a lot of money on average, but not everyone reaches an advanced age. By taking the mortality probabilities into account, a realistic picture emerges. Furthermore, the amounts are expressed in euros for 2016 (discounted).[6] Due to both adjustments,

[5] In full 'total net contribution over the life course', but for brevity the current report refers to net contribution.
[6] The amounts for government income and expenditure are discounted. So-called time preference is taken into account; a euro that is available now has a higher value than a euro that is available in the future. Future amounts are therefore discounted, i.e., expressed in euros for 2016 by depreciating them at a certain interest rate. See also the glossary in the current report. The actuarial interest rate used is 1%, in line with the interest rate used by the CPB at the time of writing the current report.

amounts at an advanced age and amounts in the distant future count much less heavily. This is illustrated in Figure 2.2 by correcting for mortality and discounting the net contributions from Figure 2.1[7] In Figure 2.1 the costs for people in their nineties are €30,000 to €50,000. In Figure 2.2 the costs for people in their nineties are less than €5,000, due to the discounting and the fact that not everyone lives to be that old.

2.2 Government revenue and expenditure

To gain insight into how a net contribution profile as in Figure 2.2 is established, it is necessary to look at the individual ingredients. This is done by looking broadly at the revenues and expenditure that the government makes for Dutch residents.

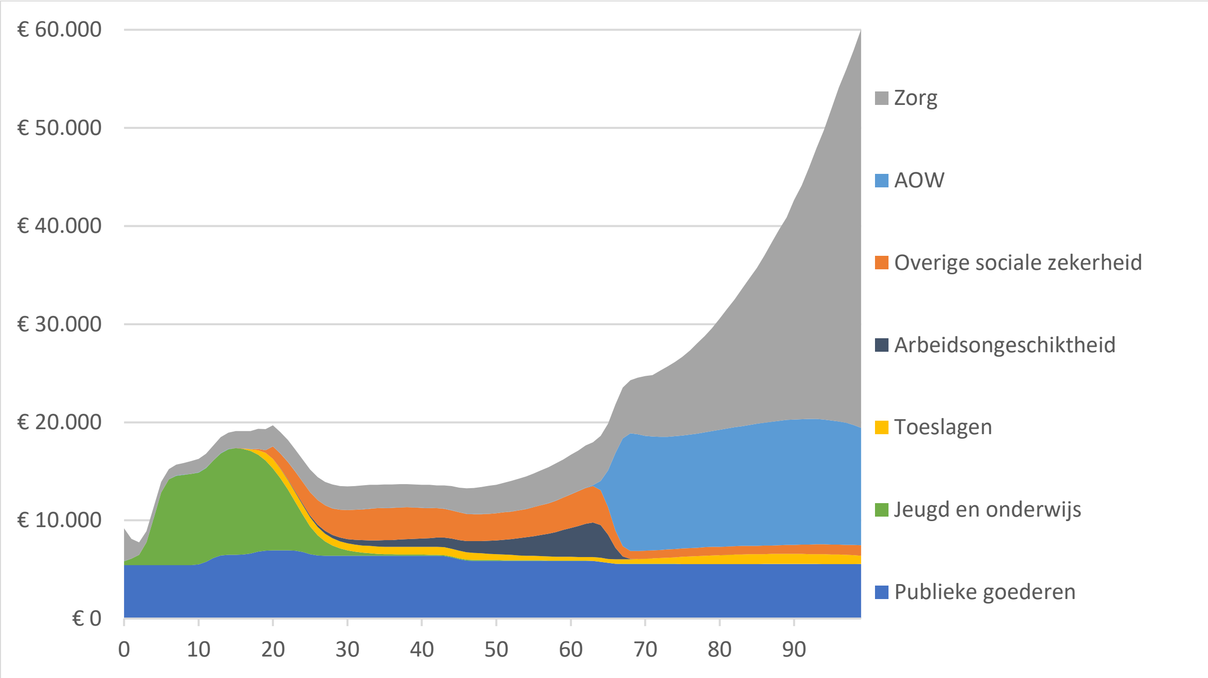

Figure 2.3 Fiscal costs by age (source: our own calculation based on Statistics Netherlands microdata).

On the expenditure side, Figure 2.3 provides insight into the most important items. A number of items have been assumed to be the same for all ages. Many of these items have been brought together under the heading of public goods. This includes public administration, defence, investments in buildings and infrastructure and transfers abroad (development aid and the like). The implicit assumption is that all ages benefit from – and contribute to – these costs equally. In addition, the costs of security are grouped under public goods. These costs are age-dependent and relate to the investigation and possible prosecution and punishment of suspects of crimes.

For the rest, the life course can be divided into three parts, as stated earlier. For the younger years – and in particular the period between 4 and 20 years – education is the major item. For the middle part of life – approximately between the ages of 20 and 65 – social security is a major item, whereby it is

[7] This is based on Statistics Netherlands StatLine data on the expected mortality probabilities of a person born in 2016 as used in the Statistics Netherlands forecast 2017-2060, table *Prognose periode-levensverwachting; geslacht en leeftijd, 2017-2060*, retrieved 13-9-2020 from: https://opendata.cbs.nl/statline/portal.html?_la=nl&_catalog=CBS&tableId=83795NED&_theme=91. These data are available until 2060. For the years thereafter, the mortality probabilities of 2060 have been used.

striking that disability is strongly age-dependent. The allowances item (rent subsidy, child budget and childcare and healthcare allowance) is relatively small in size, but does cover a large part of one's life. From retirement age, the state pension and healthcare are major items, which again shows that healthcare is strongly age-dependent. It should be borne in mind, however, that mortality means that the sky-high healthcare costs at a very old age only partly count in an average life. Part[8] of that effect can be seen by comparing Figure 2.1 with Figure 2.2.

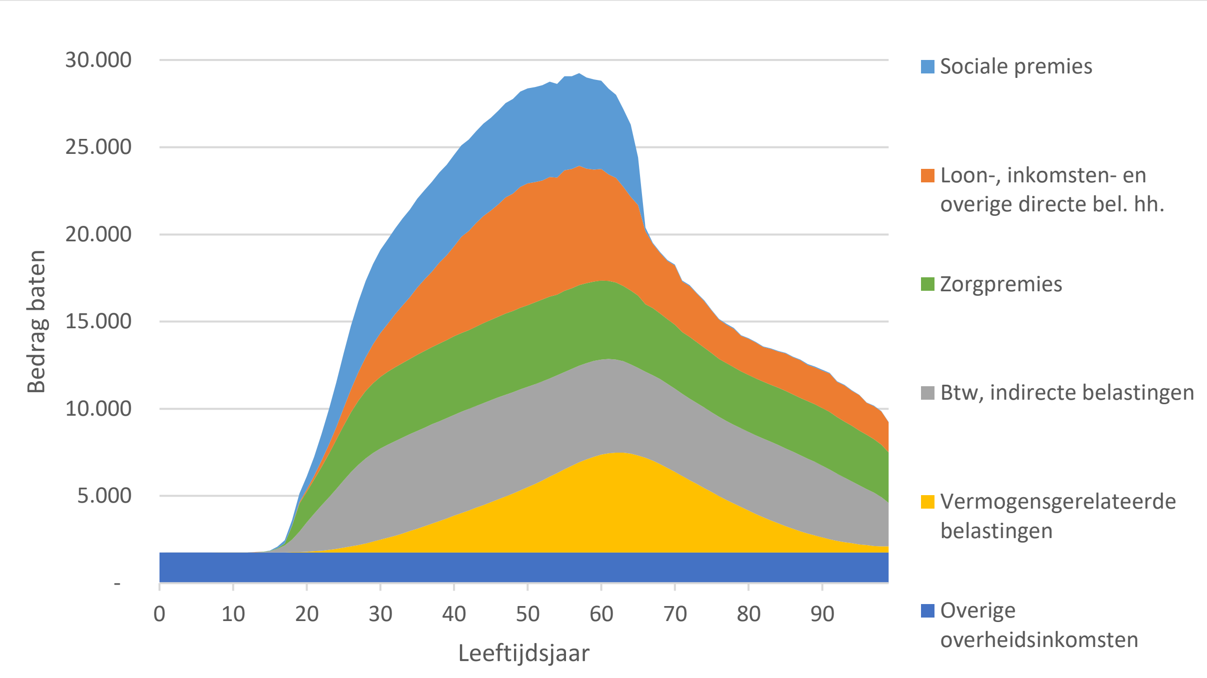

Figure 2.4 Fiscal benefits by age. Source: our own calculation based on Statistics Netherlands microdata. The other government revenues are based on CPB data.

On the income side, a comparable division of the life course into three parts can be made (see Figure 2.4). Following the CPB, the income under the heading of other government income (net land sales, part of the non-tax resources) is allocated equally to all residents, including children. Until about 20 years, this is virtually the only contribution to the treasury. Between roughly the age of 20 and 65, contributions to taxes and premiums are relatively high, with a peak around age 55. For people in their twenties, there is a fairly strong increase in contributions every year, around the age of 65 there is a fairly strong decrease because of the state pension age.

The contributions are also clearly age-dependent, which is mainly due to the fact that wage tax, income tax and social security contributions are mainly paid during the working part of life. From retirement age, tax payments and, in particular, premium payments are significantly less. Indirect taxes (e.g., VAT) and other taxes and non-tax resources, on the other hand, are a much more evenly developing source of income for the government from about 20 years on. Figure 2.4 also includes the healthcare premiums, both the premiums paid by employers and employees and the compulsory insurance premiums for health insurance. Finally, there are corporate taxes, indirect taxes through companies and inheritance tax, which are grouped under the collective term wealth-related taxes. These taxes are related to the direct and indirect property of companies and are related, among other things, to income from

[8] The other part of the difference is due to discounting.

private limited companies, home ownership and especially the build-up and reduction of pension assets.

By subtracting government revenues and expenditures, the age profile for the net contribution from Figure 2.1. is obtained. This is illustrated in Figure 2.5. The total of the costs from Figure 2.3 is shown in Figure 2.5 with a red dotted line and the total of the benefits from Figure 2.4 with a green dotted line. By deducting the costs per year of life from the benefits, the age profile for the net contribution is obtained. This is the black line in Figure 2.5 which corresponds to Figure 2.1.

The combination of costs and benefits makes it clear how the threefold division of youth, working life and pension comes about. During childhood, the government has considerable costs, but virtually no income. During the working period, the government has large income from taxes and premiums and relatively low costs. Finally, there is still income for the government during retirement, but it is increasingly exceeded by the costs of state pension and healthcare.

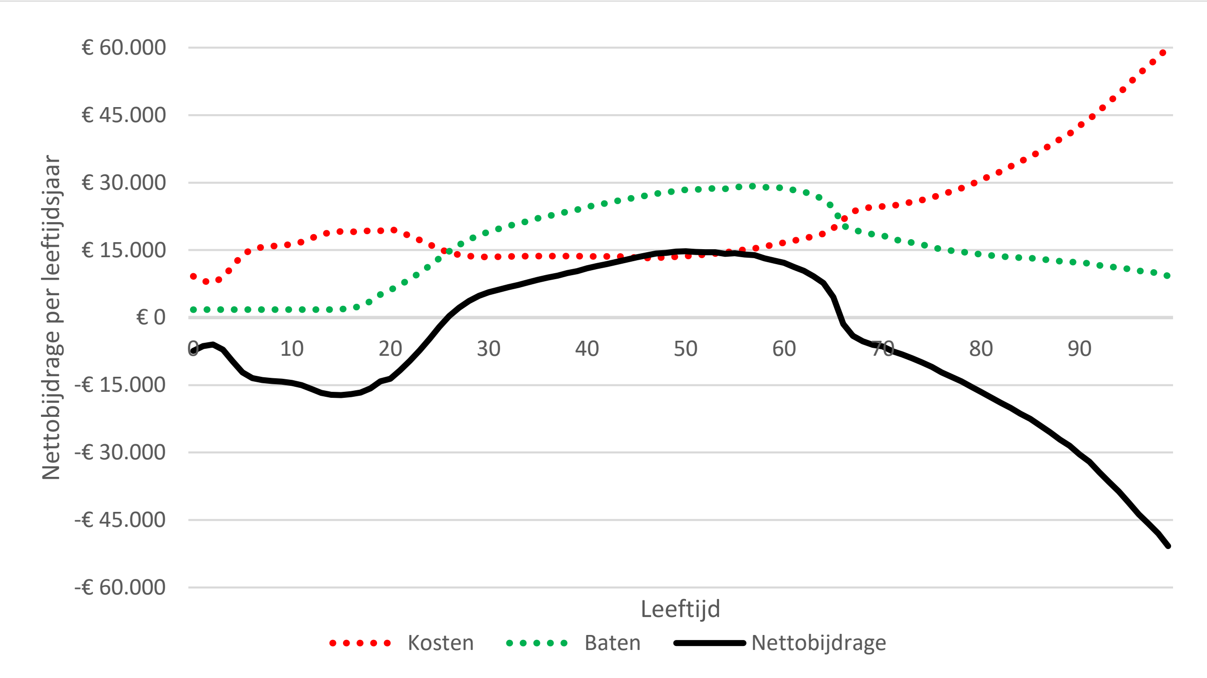

Figure 2.5 Fiscal costs and benefits and the net fiscal contribution by age. Source: our own calculation based on Statistics Netherlands microdata.

2.3 Generational accounting for the first generation

Generational accounting can also be done for immigrant groups. In that case, some adjustments are necessary. The most important adjustment is that, in principle, only the costs and benefits should be counted for the years that an immigrant resides in the Netherlands. The period before the moment of immigration does not count. If the immigrant remigrates again, most of the costs stop, although in the concrete case of the Netherlands, remigrants sometimes retain the accrued state pension rights or access to Dutch healthcare. It is also important what the age distribution is of the immigrant group concerned, because the amount of the net contribution also depends on the age at the time of immigration. Finally, there may also be initial costs that occur around the time of immigration, such as the costs of issuing residence permits and the reception of asylum seekers. These matters are briefly explained in this section. For simplicity and comparability, this section is based on data from the same group as the previous section, i.e., people with the characteristics of the average resident of the Netherlands.

As mentioned, all costs and benefits should only be added up for the ages from the time of immigration. The *entry age* – the age at the time of immigration – is therefore very decisive for the net contribution over the (remaining) life course. The entry age is therefore an important core concept in the current report. This can be seen by looking at different entry ages.

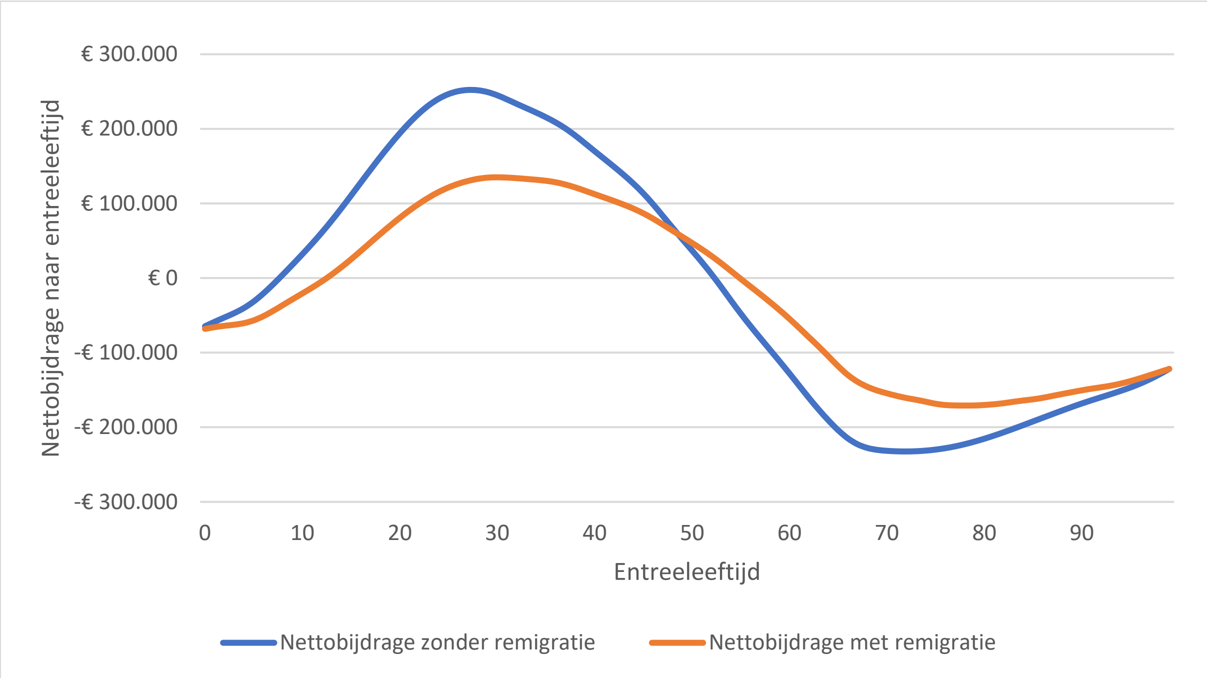

Figure 2.6 Net contribution over the life course by entry age, with and without remigration. Source: our own calculation based on Statistics Netherlands microdata.

Figure 2.6 shows how the net contribution over the remaining life course – i.e., from the moment of immigration – depends on the entry age, i.e., the age the immigrant was at the time of immigration.[9] This is based on an immigrant with the characteristics of the average resident of the Netherlands. The blue line shows the net contribution for all possible entry ages between 0 and 99 years if there is no remigration. It can be seen from Figure 2.6 that the highest net contribution is made by immigrants with an entry age between 25 and 30 years. There is a positive net contribution for entry ages from 8 to 53 years. According to this scenario, immigrants who come to the Netherlands at a very young age (up to 8 years) and immigrants who come from middle age (from 53 years) always cost the treasury money on average, even if they make the same net contribution every year as the average resident of the Netherlands. This can be understood on the basis of two concrete examples.

For example, if an immigrant arrives at the age of seventy with the same net contribution per year as the average resident of the Netherlands, the net contribution over the remaining stay in the Netherlands is on average always negative. This can be concluded from Figure 2.1 because the net contribution per year of age is negative for all ages from 70 years. Because discounting and accounting for the mortality probabilities do not affect the sign (positive or negative) of the amounts, the net contribution

[9] In the standard scenario with adjustment of the state pension age to 69.5 years in 2060 and mortality probabilities constant from 2060.

(over the remaining life course) for an immigrant immigrating at age seventy is negative, as shown in Figure 2.6 where the blue line for a person of 70 years shows a negative value of –€230,000).

On the other hand, if an immigrant comes to the Netherlands at the age of twenty-five, for example, then all costs and benefits before the age of twenty-five do not have to be included. After all, the Netherlands did not have any costs for education, healthcare and the like for this immigrant. For a twenty-five-year-old immigrant with the same net contribution profile as the average resident of the Netherlands, it can be concluded from Figure 2.1 that he or she will immediately make a positive contribution. In the end, old age and the associated net costs also come for this immigrant. However, calculated over the entire remaining life – thus discounted amounts summed up[10] from 25 years to the time of death and taking into account the mortality probabilities – the net contribution for an immigrant with entry age 25 is positive, as shown in Figure 2.6 (the blue line has a positive value of almost €250,000 for a twenty-five-year-old).

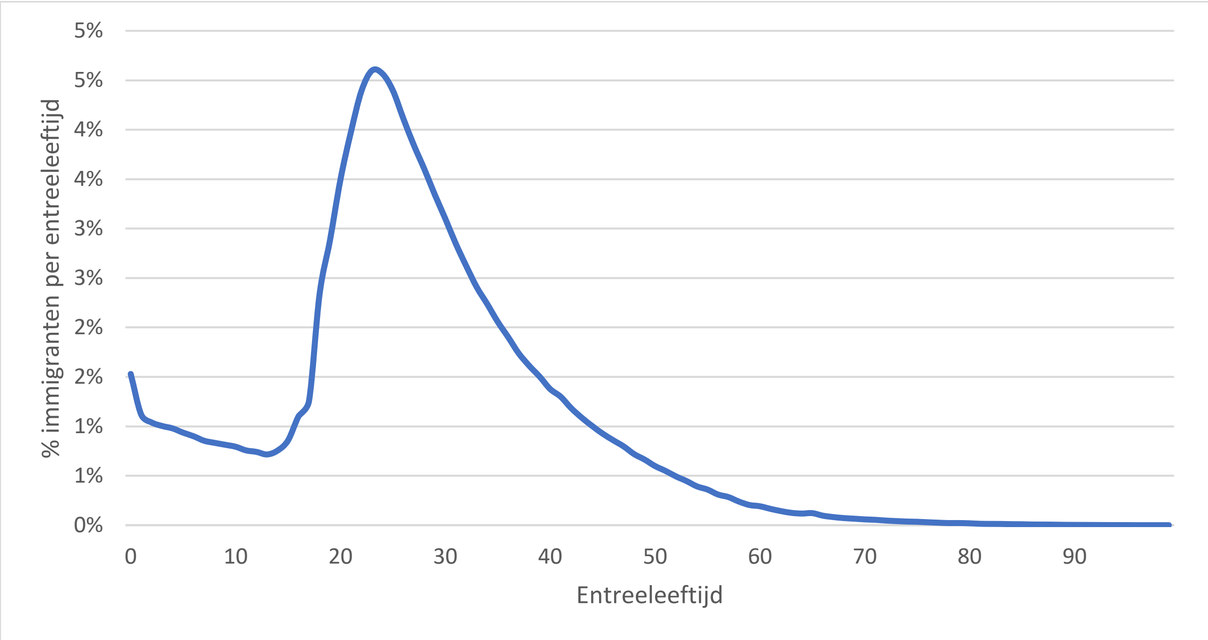

Figure 2.7 Percentage of immigrants by entry age (immigration profile), first generation immigrants, 2011-2017. Source: our own calculation based on Statistics Netherlands microdata.

Because the entry age is such a determining factor for the net contribution, it is necessary to know precisely how immigrants are distributed over the different entry ages in percentage terms. Figure 2.7 shows the *immigration profile* – the percentage distribution over entry ages – for all first-generation immigrants from the period 2011-2017. The immigration profile is an important core concept in the current report. It makes a big difference whether the majority of immigrants arrive at favourable or unfavourable entry ages. It can be seen that the peak in Figure 2.7 is around the age of 25, which is also approximately the age at which the net contribution in Figure 2.6 is highest. For the scenario used here, both peaks therefore coincide favourably. By weighing the net contribution by entry age in Figure 2.6 (the blue line, without remigration) with the immigration profile in Figure 2.7, the net contribution

[10] In fact, the sum is for a figure similar to Figure 2.2, but then starting at 25 years and calculated for the mortality probabilities that a 25-year-old has from 2016.

over the life course can be determined, in this case for immigrants with the characteristics of the average resident of the Netherlands and without remigration.

Of course, immigration always involves significant remigration, especially of the first generation.[11] For example, the majority of Western labour immigrants in many groups have emigrated again within 10 years. This must also be taken into account for a realistic calculation. The orange line in Figure 2.6 shows the net contribution for all entrance ages in case of remigration. This is again based on immigrants with the characteristics of the average resident of the Netherlands, but this time with the assumption that they exhibit the same remigration behaviour as the average first-generation immigrant.[12] These hypothetical immigrants therefore earn as much as the average resident of the Netherlands, receive benefits just as often, consume the same amount of education and healthcare, in short, they have a net contribution per year that is (*grosso modo*[13]) equal to that of the average resident of the Netherlands (see Figure 2.1). Furthermore, they have the same remigration probability as the average first-generation immigrant for every entry age and length of stay. It can be seen that in this scenario remigration makes both the positive and negative values for the net contribution less extreme. [14] In addition, the age range in which immigrants have a positive net contribution shifts a few years towards the higher ages.

Throughout this section, the data of the average resident of the Netherlands has been used. First-generation immigrants sometimes differ significantly in positive or negative terms from the average resident of the Netherlands. This means that their overall net contribution profile will be above and below the line in Figure 2.1, respectively, with correspondingly higher or lower net contributions.

Finally, there are a few other cost and benefit items that do not play a role or are less important for residents who are not (first-generation) immigrants. First of all, there are the start-up costs of immigration. The reception of asylum seekers, the issuing of residence permits and the integration of immigrants entail government costs and these should ideally be included in the calculation for the groups concerned. Furthermore, some costs, such as healthcare costs and state pension, may continue after remigration and these should ideally also be taken into account for a total calculation of the total net contribution over the life course. The empirical interpretation of this is given in §6.1 to §6.3

[11] For the course of the remigration for different groups, see §2.2 of the current report.
[12] As observed from the 1995-2017 data.
[13] Not exactly equal, because it concerns persons with the net contribution characteristics of the average Dutch person and the immigration characteristics of the average immigrant, in which case the net contributions per year are equal to those of the average Dutch person, *except for pension accrual and entitlements to the state pension and the use of social assistance from the age of 65*, because these depend on the length of stay and the accrual of state pension rights. In this way, for example, the native Dutch reference (an 'immigrant with the characteristics of the average native Dutch person') is calculated in the current report.
[14] In this example at least, because the exact effect of remigration on the net contribution by entry age partly depends on the profile for the net contribution by year of age.

Table 2.1 Size class distribution by age group for 46 groups with a 2^{nd}-generation immigration background.

	Number of groups that fall into size class per age group:						
Age group	**0 (no observa-tions)**	**10 to 25**	**25 to 100**	**100 to 400**	**400 to 1600**	**More than 1600**	**Total**
0 year	0	0	1	13	24	8	**46**
1 year	0	0	1	15	22	8	**46**
2 years	0	0	1	16	21	8	**46**
3 years	0	0	1	16	21	8	**46**
4 years	0	0	1	15	22	8	**46**
5 years	0	0	1	17	20	8	**46**
6 years	0	0	1	17	20	8	**46**
7 years	0	0	1	17	21	7	**46**
8 years	0	0	1	17	21	7	**46**
9 years	0	0	1	18	19	8	**46**
10 years	0	0	1	18	19	8	**46**
11 years	0	0	1	18	19	8	**46**
12 years	0	0	1	18	20	7	**46**
13 years	0	0	1	18	20	7	**46**
14 years	0	0	1	18	20	7	**46**
15 years	0	0	1	19	19	7	**46**
16 years	0	0	2	19	20	5	**46**
17 years	0	0	1	19	21	5	**46**
18 years	0	0	1	23	17	5	**46**
19 years	0	1	2	20	18	5	**46**
20 to 22 years	0	0	1	9	24	12	**46**
22 to 24 years	0	0	1	12	22	11	**46**
24 to 26 years	0	0	2	11	23	10	**46**
26 to 28 years	0	0	2	13	23	8	**46**
28 to 30 years	0	0	4	13	23	6	**46**
30 to 32 years	0	0	4	17	19	6	**46**
32 to 34 years	0	0	7	16	17	6	**46**
34 to 36 years	0	1	6	18	15	6	**46**
36 to 40 years	0	0	6	12	17	11	**46**
40 to 44 years	0	1	10	12	11	12	**46**
44 to 48 years	0	2	10	14	10	10	**46**
48 to 52 years	5	3	8	16	8	6	**41**
52 to 56 years	14	2	9	9	8	4	**32**
56 to 60 years	14	3	11	8	6	4	**32**
60 to 64 years	18	4	8	6	6	4	**28**
64 to 68 years	18	5	8	5	6	4	**28**
68 to 72 years	23	4	4	5	7	3	**23**
72 to 80 years	28	2	3	8	2	3	**18**
80 to 90 years	31	0	6	6	1	2	**15**
90 years and older	39	1	3	1	1	1	**7**

2.4 Generational accounting for the second generation

The fiscal impact of immigration is not limited to the first generation. For example, if the immigrant settles permanently and has children, these children will also make a net contribution to the treasury over their life course, which can have a positive or negative effect. There can also be a large difference between the first and second generations in terms of education level and labour market performance. This makes it possible, for example, for the first generation to make a negative net contribution and the second generation to make a positive contribution, or vice versa. It is therefore necessary to include at least the second generation in the calculations.

In the 2003 CPB study it was assumed that the second generation of non-Western immigrants would be halfway between the non-Western first generation and the average resident of the Netherlands in terms of labour market characteristics. In the current report, that idea is further developed by replacing this assumption of '50% integration' with an estimate of the degree of integration based on Statistics Netherlands microdata. It is assumed here that the net contribution profile for the second generation is in principle always a linear combination of the reference profile for native Dutch people (full integration, or 100% integration) and the reference profile for the non-Western first generation (no integration, or 0% integration). This has been done using the available data for the net contribution of the second-generation.

However, there are some limitations in calculating the net contribution of the second generation. The first of these is lack of data. There is sufficient data for most European regions and countries of origin and for countries such as the US, Indonesia and China. But for important countries of origin such as Turkey and Morocco, the number of second-generation people for ages above 50 years is very small and the data between the ages of 40 and 50 is limited. There is even less data for some countries and regions. An overview of the distribution by age group is given in Table 2.1.

Non-Western immigration, in particular, is a recent phenomenon. Until the Second World War there was little immigration and most immigrants came from neighbouring countries and the colonies. Then immigration increased. From the late 1940s, there was initially a fairly extensive immigration of Indo-Dutch citizens, who, incidentally, are categorised as Western by Statistics Netherlands. Subsequently, from the late 1960s, guest labour took on substantial proportions. In the mid-seventies – around the time of the Surinamese independence – immigration from Suriname became extensive. Asylum immigration only became significant in the mid-1980s, with 1985 being the first year with more than 5,000 asylum seekers. In short, for many groups the second generation is still young.

A second challenge in reliably determining the net contribution of the second generation are so-called cohort effects.[15] A cohort is understood here to mean a group of people who have all immigrated during the same period. Immigrants from different cohorts clearly have different characteristics for some origin groups, so that the net contribution of the current second generation cannot be accurately determined on the basis of the data for the older ages. Immigration from overseas regions such as Suriname, for example, shifted in the Netherlands from limited elite immigration to more massive

[15] Cohort effects and lack of data are often related, because it often involves the transition from limited elite immigration (little data) to larger-scale (a lot of data) and less-selective immigration, for example through asylum, recruitment of guest workers, or colonial immigration and the subsequent ensuing family immigration.

immigration of the middle and low-skilled around the period of Surinamese independence.[16] This transition is expressed in differences in net contribution between cohorts of Surinamese immigrants: second-generation immigrants aged 42 and older (in 2016) have a relatively high net contribution compared to later cohorts (those who were younger than 42 in 2016).

The cohort effects differ per category of origin group and are often clearly visible in the second generation from a certain age. For Surinamese, the turning point is at around 42 years of age, which is exactly the duration of 2016, calculated back to the period before independence in 1975. For Turks, Moroccans and a number of other recruiting countries for guest workers, the turning point is at approximately 45 years. For many areas of origin in Africa and Asia that are important in terms of immigrant numbers, the increase in asylum immigration and the ensuing family immigration since the mid-1980s is the moment when immigration increased. In these groups it is expected that possible cohort effects will occur at the age of 35 years or younger.

The objective in estimating the net contribution of the second generation has been to provide the best estimate for Dutch-born children of first-generation immigrants who were born in the reference year 2016.[17] To achieve that goal, all cohort effects must be filtered out as much as possible. *It was therefore expressly not the intention to find the net contribution profile that best fits all available data*. That would have been much easier, but would almost certainly lead to impurity ("bias") (in relation to the objective given in the first sentence of this paragraph). In the methods presented here, there is no doubt also impurity, because the future is unknown. Impurity or bias is unavoidable, but the impurity that could arise from cohort effects etc. in the past can be avoided and this has been done as much as possible in the methods described below.

The foregoing has shown that there is often insufficient data to create net contribution profiles for the entire life of second-generation immigrants. Obviously, one cannot create data that are not there, but one can make use of surrounding data to fill in the gaps as much as possible. In an effort to minimise estimation errors, the degree of integration of the second generation has been estimated with four different methods.

In three of the four methods described below, Cito scores and school performance play a role in the calibration of the method. As described in Chapter 9 of the current report, both the Cito score and the highest level of education attained are very decisive for the net contribution over the life course. On average, a higher level of education also means a higher net contribution. The same applies to Cito scores, which strongly determine the highest education attained and thus the net contribution. For example, for the Dutch population as a whole, every higher Cito point yields roughly €20,000 extra net contribution over the life course. This knowledge was used to calibrate three of the four methods. For

[16] "The second important immigration movement in the 1970s was that of the *Rijksgenoten* (fellow citizens), especially the Surinamese. From 1880 to 1950 there was limited immigration of Surinamese from the (official) elite, often with the aim of returning to Suriname after completing an education in the Netherlands. Part of this group stayed in the Netherlands and, thanks to their good education, could fairly easily acquire a position in the Netherlands. From 1950 onwards, the immigration of people from the middle class increased, including a limited number of labour immigrants. Surinamese had free access to the Netherlands on the basis of the *Koninkrijksstatuut* (Kingdom Statute) (1954). In the 1960s, the net migration gradually increased from 400 in 1960 to 4,400 in 1969. From 1970, immigration expanded further to include low-skilled Surinamese with a limited orientation towards the Netherlands, and the number of immigrants also increased", Van de Beek, JH (2010)

[17] And in view of the calculations in §7.2-§7.3 of the current report, also a best estimate for persons with a second-generation immigration background born between 1995 and 2019.

the calibration of methods 1 and 2, data from Cito tests taken between 2006 and 2018 were used. Because the Cito test is usually taken at the age of 11 or 12, this concerns people who were born in the period 1994-2007. For method 4, the secondary school level of 15-year-olds was used for the reporting years 2007 to 2017. This concerns persons born between 1992 and 2002. In both cases, these are birth years that are reasonably close to the reference year, 2016, used in the current report.[18] By way of comparison: the direct observation of 46-year-olds concerns persons who were born around the year 1970. The assumption under three of the four methods used here is that Cito scores of the 1994-2007 birth cohort and the education level of the 1992-2002 birth cohort are better predictors of the future net contributions of persons of the second generation who were born around reference year 2016 than direct observations of persons with a second-generation immigration background from cohorts born in the 1960s and 1970s.

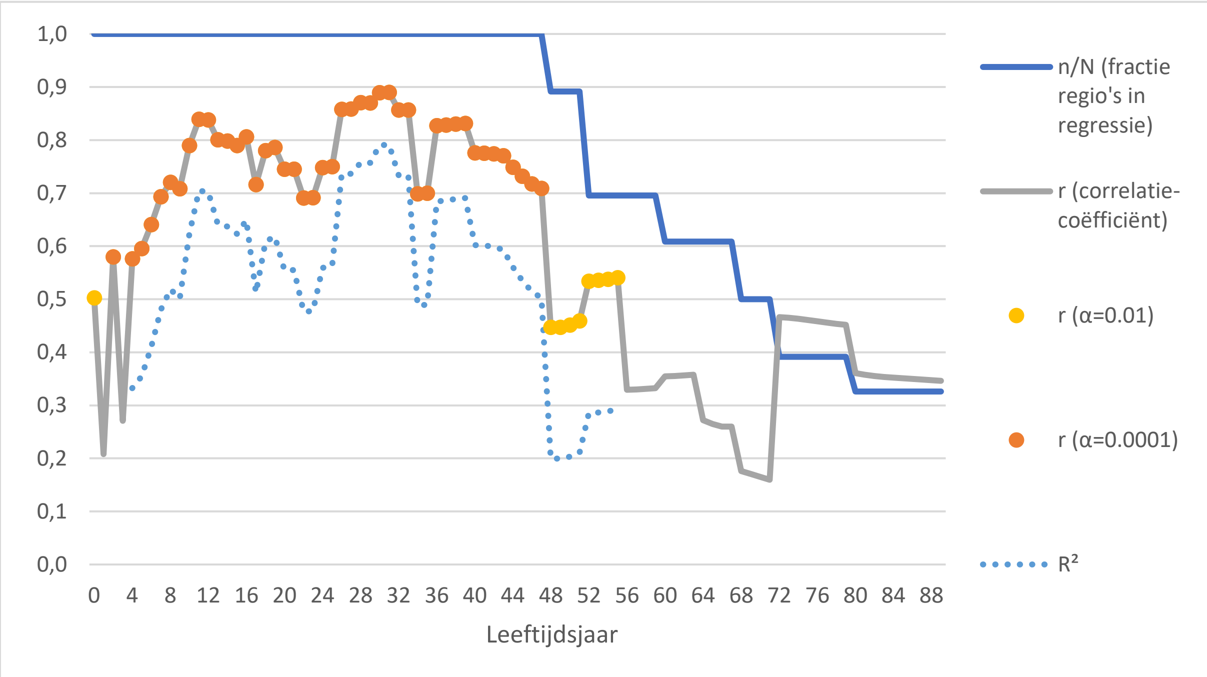

Figure 2.8 Pearson's correlation coefficients (and their squares R^2) for the correlation between the mean Cito score (2006-2018) for all ages together and the net contribution per year of life separately for second-generation immigrants for 46 second-generation groups, being the 42-part division into regions of origin (excluding the Netherlands), and for the origins Indonesia, Turkey, Morocco, Suriname, Aruba and the (former) Dutch Antilles broken down by the number of parents born abroad. The fraction n/N stands for the quotient of the number of groups n included in the regression and the total number of groups N = 46. Significant correlations at significance level 0.01 and 0.0001 are highlighted.

In explaining the first two methods, it is important to know that the net contribution of the second generation strongly correlates with the average Cito score of the second generation of the origin group. This is illustrated in Figure 2.8, where for 46 second-generation groups[19] for each year of age separately the (Pearson's) correlation coefficient is given between, on the one hand, the average Cito score for

[18] In addition, the birth cohorts for which Cito and education data are available overlap well with the period 1995-2019 for which the net contribution was calculated in §7.2-§7.3.

[19] The calculations in this section concern 41 regions of origin (the 42-part division minus the Netherlands), with Indonesia, Turkey, Morocco, Suriname and Aruba and the (former) Dutch Antilles further broken down for the number of parents born abroad.

the relevant group for all years of age together (i.e., calculated over the entire group) and, on the other hand, the average net contribution for the group concerned per year of age separately.

The pattern in Figure 2.8 can be tentatively explained as follows.[20] From primary school age onwards, the correlation increases because education and healthcare are then the major expenditure items and both are strongly related to Cito scores (see §9.4 of the current report). It stays that way until age 16. From the age of 17 to 26, there are probably different opposing forces at work, among other things because some of the young people with a Cito score around the average start working after the end of compulsory education (whether or not via a work-study program) and start paying taxes, and people with a higher Cito score, on average, are more likely to study longer and work later. This may explain why the correlation between Cito and net contribution is lower in this life stage, especially from 20 to 26 years of age (compare §9.4 of the current report). From 26 to 48 years, the correlation coefficient moves between 0.7 and 0.9 and there is a strong correlation between the mean Cito scores and the annual net contribution of the second generation. Before these ages, a large proportion of people have completed their education and the level of education strongly determines their income and thus the net contribution. For ages 48 to 56, the data limitations and cohort effects (the Cito scores decreased in the period 2006-2018) will play a major role and the correlation will be weaker and more erratic. From the age of 56, there is usually[21] no longer any significant correlation for the 42-part division into regions of origin (excluding the Netherlands).

The strong correlation between Cito score and net contribution is then used as an aid in determining the net contribution of the second generation. The method used for this is based on extrapolation[22] of the observations between the ages of 4 and a maximum of 55 years, to the rest of life. For this, 301 profiles were examined (automated, with a brute force method): 99 profiles between the reference profiles of the native Dutch people and non-Western first-generation immigrants, 101 profiles greater than or equal to the native Dutch profile and 101 profiles less than or equal to the profile of the non-Western first generation. As stated before, each profile is a linear combination of the reference profile for native Dutch people and the reference profile for the non-Western first generation. Each profile is fitted to the observations for the net contribution of the relevant second-generation group for the ages between 4 and 55 years. When creating the profiles, the same step size was always used: 1 percent of the difference between the profile for native Dutch people and the profile for non-Western first-generation immigrants.

In formula form, each of the extrapolation profiles is a vector NB^{Ext} of length 100 (0 to 99 years) whose elements are given by:

$$NB_j^{Ext} = \frac{i}{100} \cdot NB_j^{Aut} + \left[1 - \frac{i}{100}\right] \cdot NB_j^{NW1} \quad for\ 0 \leq j \leq 99\ \ and\ -100 \leq i \leq 200$$

[20] The block-like profile of the 'curve' is due to the fact that the data limitations also make it necessary to sample the somewhat higher ages per age group, especially in smaller groups.

[21] Exceptions: 0 years, 2 years and (calculated over a small group of countries) 72-79 years, the latter with p-values just under 5%.

[22] In essence, interpolation is also used (profiles are fitted between two reference profiles for native Dutch people and first-generation non-Western immigrants), but because there is always extrapolation (both to older ages and to profiles that, for example, are above the reference profile for native Dutch people) we have chosen to consistently use the term extrapolation.

Here, j stands for year of age and i for the degree of integration. Furthermore, NB_j^{Aut} stands for the net contribution of native Dutch people in year of age j, NB_j^{NW1} stands for the net contribution of the non-Western first-generation immigrant in year of age j and NB_j^{Ext} stands for the value of the extrapolation profile in year of age j.

The number associated with the best fitting profile can be interpreted as the degree of integration. A value of 100 here stands for perfect integration and could be interpreted as '100% integrated', in the (limited) sense that the net contribution is equal to that of the average native Dutch person. A value greater than 100 means a higher net contribution than the average native Dutch person. People are then, as it were, 'more than integrated', in other words, perform better than a native Dutch person when it comes to the net contribution to the treasury over the life course. A value smaller than 100 means a lower net contribution than the average native Dutch person. A value of 0 here represents a net contribution equal to the average first-generation non-Western immigrant and can be interpreted as '0% integrated'. A value of 40 could be interpreted as '40% integrated', again in the limited sense of the degree of net contribution, because this is not about socio-cultural integration and the like.

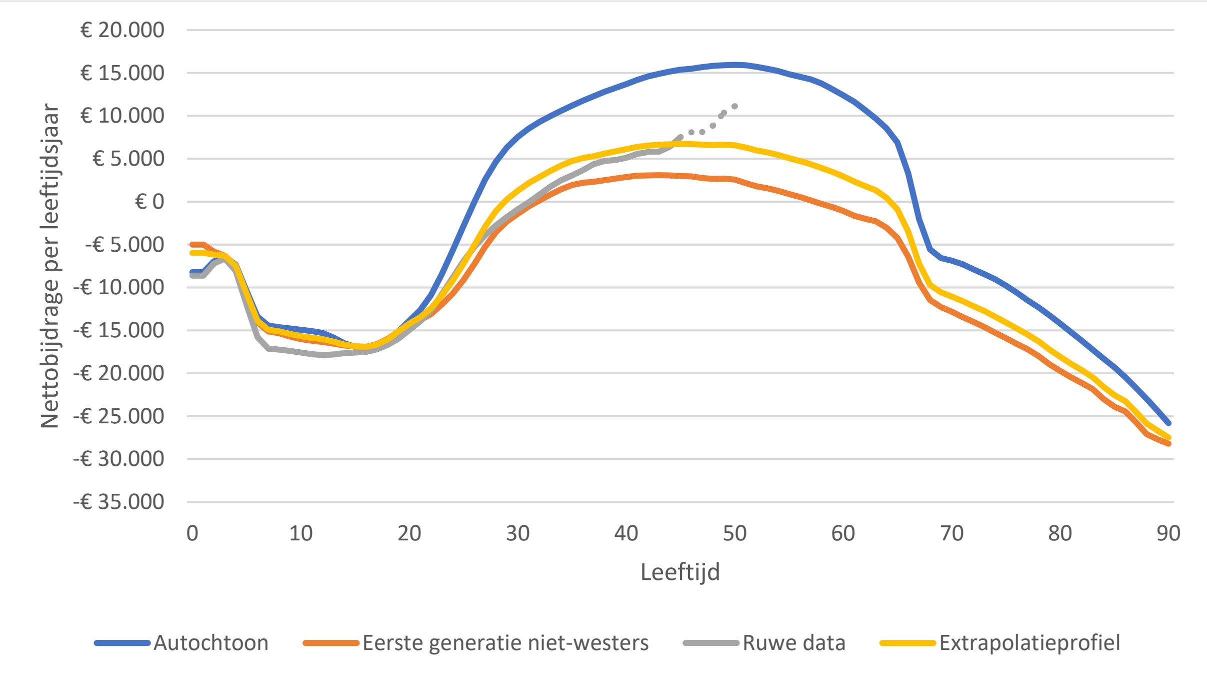

Figure 2.9 Schematic representation of a possible extrapolation profile for the data for the net contribution profile (raw data, without remigration, discounting, etc.) for people with a second-generation immigration background. The dotted line means that there is little data and/or that there is a cohort effect, for the purpose of discussing method 1.

The determination of the degree of integration for the first method is schematically shown in Figure 2.9 for people with a certain second-generation immigration background which we refer to as $G2$. The blue line shows the net contribution of native Dutch people. The orange line represents the net contribution of all first-generation non-Western immigrants. The yellow line is a possible (linear) combination of native Dutch people and first-generation non-Western immigrants. The grey line shows the available data from the second-generation group G2. This data has two potential problems: too few observations per year of age and cohort effects. The years of age with few observations are indicated by dashing part of the grey line. The dotted part in this figure also represents a trend break with the rest of the grey profile, in the sense that it increases relatively steeply in relation to the profile for native Dutch people (blue) and first-generation non-Western immigrants (orange). The intuition behind method 1 is to determine a year of age from which the dotted part of the grey profile is no longer included in the determination of the best-fitting (yellow) extrapolation profile.

The way in which the problem of few observations is solved in method 1 is not to include years of age with too few observations in the calculation. However, it is not possible to determine a priori when there are 'too few observations'. For this reason, method 1 used six so-called sample norms $SN \in (5, 10, 20, 50, 100, 200)$.[23] An age L_{SN} is then chosen for each of the six possible values of SN such that:

$$N_j^{G2} \geq SN \; for \; j < L_{SN} \quad and \quad N_j^{G2} < SN \; for \; j = L_{SN}$$

Here N_j^{G2} is the number of observations for age year j for the present second-generation group $G2$.[24] In words, for a given sample norm SN, L_{SN} is the youngest age for which the number of observations N_j^{G2} is smaller than the relevant sample norm SN. Subsequently, L_{SN} was capped at 56 years.

The way in which the problem of the cohort effects is solved in method 1 is by minimising the distance between the extrapolation profile NB^{Ext} (the yellow line in Figure 2.9) and the observations of the net contribution NB^{G2} for the concerned second-generation group (the grey line in Figure 2.9). That distance is operationalised for a given sample standard SN with a variant of the least squares method,[25] namely with the following formula:

$$KS_{SN} = \sqrt{\frac{\sum_{j=4}^{L_{SN}-1} \left(\frac{i}{100} \cdot NB_j^{Aut} + \left[1 - \frac{i}{100} \right] \cdot NB_j^{NW1} - NB_j^{G2} \right)^2}{L_{SN} - 4}}$$

The square root serves to size-limit the terms, and the term $L_{SN} - 4$ serves to make the sum of squares KS_{SN} invariant for the maximum age $L_{SN} - 1$ being summed up. The thus measured distance between the yellow extrapolation profile and the grey observations in Figure 2.9 is maximised with a maximum sum of squares KS_{max}.

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[23] With the minimum of 5, all available data up to the age of 36 are de facto included, because the minimum number of observations per age group (not per age!) is 10, due to the Statistics Netherlands requirements with regard to disclosure risk. The age groups up to 20 years cover one year and from 20 to 36 years two years, so the minimum number of observations is therefore always five per age. Age groups from 36 to 56 years span four years. In the latter case, at least 10 / 2 = 2.5 persons per year of life have been sampled and part of the observations at the threshold value of five observations per age will therefore not be included in a number of cases. In the case of the Former Soviet Union, the situation is different in that for all ages up to 80 years there are (often many) more than 10 observations per age year, with the exception of the years of age between 36 and 44 for which there are only 8.25 observations per year of age and these years are treated in method 1 and 2 as if they were 10 observations in order to be able to include the 320 observations between 44 and 56 in the estimate.

[24] Due to the small amount of data, sampling was not done by age for older ages, but by age group. If age L belongs to age group G, then the standardised sample size N for age L is equal to the number of persons in age group G divided by the number of years that age group G covers. Thus, if there are 40 observations for age group 36 to 40 years, the standardised sample size is 40 / 4 = 10.

[25] The limitation at 55 years is inspired by the observation that from 56 years the correlation between net contributions per year of age with the average Cito score (measured over all years of age) decreases sharply.

The underlying idea is that a cohort effect such as the increase in the dotted part of the grey line in Figure 2.9 should not make the sum of squares KS_{SN} too large. Because it is not possible to determine a priori when the sum of squares is 'too large', the calculation has been performed repeatedly for different upper bounds KS_{max}. 160 upper limits were used, from 400 to 16,000, initially with a step size of 400, after which the search was continued around the optimum with a step size of 100. There are then always two options. Either $KS_{SN} > KS_{max}$ for all $-100 \leq i \leq 200$ in which case there is no solution, or for the given combination of SN and KS_{max} there is an i for which the sum of squares KS_{SN} is minimal. This i then gives the best fitting extrapolation profile for the relevant second-generation group $G2$ for this combination of SN and KS_{max}.

This entire calculation exercise thus yields a maximum of six solutions for each KS_{max},[26] after all, for a given KS_{max} there is at most one solution for each SN and there are six different SN namely 5, 10, 20, 50, 100 and 200. The highest and lowest estimates were then removed from the estimates found and the average of the other estimates was taken. This is done for every KS_{max}. Subsequently, it was investigated in which of the KS_{max} the best extrapolation is found. The criterion was the strength of the correlation with the mean Cito scores for the second generation. This is done for the 42-part division minus the Netherlands, with the five major countries of origin Indonesia, Turkey, Morocco, Suriname and the (former) Dutch Antilles divided into the subgroups with one or two parents born abroad. This correlation was maximal for $KS_{max} = 3.000$, $r(44) = .91$, $p \ll .0001$.

For the second method, just as with the first method, a linear combination of the net contribution profile of the native Dutch people and the net contribution profile of the first-generation non-Western immigrants is fitted to the observations NB^{G2} for the relevant second-generation group $G2$. This is also done using a (different) variant of the least squares method. The same two problems also need to be solved: there are cohort effects for some groups and there are sometimes too few observations for older years of age.

The problem of too small a number of observations is solved in method 2 in two steps. First of all, an age L has been chosen such that:

$$N_j^{G2} \geq 10 \; for \; j < L \quad and \quad N_j^{G2} < 10 \; for \; j = L$$

Here N_j^{G2} is again the number of observations for year of age j for the present second-generation group $G2$. In words, L is the youngest age for which the number of observations is less than 10. Also in method 2 L is maximised at 56.

In addition, the average number of observations N_j^{G2} per year of age is also directly included in the sum of squares KS (see formula below). If N_j^{G2} was 100 or greater, weight 1 was used, and if N_j^{G2} was below 100, weight $N_j^{G2}/100$ was used. This ensures that years of age with a small number of observations would not have too great an influence on the sum of squares KS.

The problem of possible cohort effects is solved in method 2 by directly taking into account the sum of squares of the explained variances R_j^2 (see the blue line in Figure 2.8) of the linear regressions of the net contribution per year of age j on the group means of the Cito scores (all years of age together) for the relevant second-generation origin group. The underlying idea is that the average Cito scores

[26] In practice it is not always possible to make all six estimates and in a single case there were three estimates.

determine the future net contribution of groups so much that lower correlations with the Cito score for people over thirty are an indication of cohort effects.

All this together gives the following formula for the sum of squares:

$$KS = \sum_{j=0}^{L-1} R_j^2 \cdot \min\left(1, \frac{N_j^{G2}}{100}\right) \cdot \left(\frac{i}{100} \cdot NB_j^{Aut} + \left[1 - \frac{i}{100}\right] \cdot NB_j^{NW1} - NB_j^{G2}\right)^2$$

Again the i for which the sum of squares is minimal is taken as a measure of the integration for the group concerned. This second method also provides a strong correlation with the mean Cito scores of the 46 second-generation groups, *r*(44) = .90, *p* ≪ .0001.[27]

The third method is similar to the second method, with some differences. First of all, R_j^2 is not included in the sum of squares. Secondly, no minimum of 10 observations per year of age has been set and for mutual comparability it has therefore been decided to only include years of age up to 48 years, because data are available for all groups up to at least 48 years. In this method, the sum of squares KS is therefore only weighted with the average number of persons N_j^{G2} per year of age, as described in method 2, with the understanding that a stricter standard is used: If N_j^{G2} was 400 or greater, weight 1 is used and if N_j^{G2} is less than 400 weight $N_j^{G2}/400$ is used. Two variants of this method have been calculated. The first variant for ages 0 to 48 years and the second variant for ages 25 to 48 years. The average of both variants has been taken. The rationale behind this is to reduce sensitivity to differences in study costs (e.g., groups with a relatively large number of non-EER students or relatively high student weights). The period 25 to 48 years gives a good picture of career development without such disruptions. The disadvantage, however, is that any cohort effects also weigh relatively more heavily.

All this together gives the following formula for the sum of squares (of both variants, i.e., from 0 years and from 25 years):

$$KS = \sum_{j=0 \ of \ j=25}^{47} \min\left(1, \frac{N_j^{G2}}{400}\right) \cdot \left(\frac{i}{100} \cdot NB_j^{Aut} + \left[1 - \frac{i}{100}\right] \cdot NB_j^{NW1} - NB_j^{G2}\right)^2$$

Here too, the i for which the sum of squares is minimal is taken as a measure of the integration for the group concerned.

This method also has a strong correlation with the mean Cito scores of the 46 second-generation groups, *r*(44) = .90, *p* ≪ .0001.[28] Note that unlike the first two methods, this method does not a priori use information about the correlation with the Cito scores, and that the correlation is also very strong. This underlines once again that the correlation between degree of integration and Cito score in the first two methods is not an artefact of calibration on the Cito score. It is also striking that calculation over 25-47 years gives a slightly stronger correlation (*r*(44) = .90, *p* ≪ .0001) than calculation over 0-47 years (*r*(44) = .89, *p* ≪ .0001). In general, the scores for calculation over 0-47 and 25-47 years are close to each other. For a number of groups, calculations over 25-47 years are considerably higher and

[27] Again for the 42-part division minus the Netherlands, with the five major countries of origin Indonesia, Turkey, Morocco and Suriname, the (former) Dutch Antilles are divided into the subgroups with one or two parents born abroad.
[28] See previous footnote.

the differences can mainly be traced back to cohort effects, but calculations over 25-47 years have nevertheless been included in order to remain on the 'cautiously positive side'.

Finally, a fourth method was used. For the fourth method, for ages L between 20 and 48 years, the sums $S_L^{G2} = \sum_{j=0}^{L} NB_j^{G2}$ are determined by adding the net contributions NB_j^{G2} from 0 to L of the relevant second-generation group $G2$. In a similar way, the sums for native Dutch people $S_L^{Aut} = \sum_{j=0}^{L} NB_j^{Aut}$ have been determined and the sums for the non-Western first-generation immigrants[29] $S_L^{NW1} = \sum_{j=0}^{L} NB_j^{NW1}$ in the same way. The degree of integration for a given L is then calculated as a ratio:

$$i = 100 \cdot \frac{\left(S_L^{G2} - S_L^{NW1}\right)}{\left(S_L^{Aut} - S_L^{NW1}\right)}$$

For mutual comparability, as with method 3, ages up to 48 years were chosen, because data are available for all groups up to at least 48 years. Thus, the maximum value of L is 47 years. Note that this method differs fundamentally from the first three methods, as it does not work with reference profile interpolation.

In method 4, i depends on L (i.e., i is a function of L). It is not possible to determine *a priori* which $20 \leq L < 48$ gives the best integration measure i. Certainly for people in their forties, there are sometimes small numbers of observations, and therefore including all data up to (but not including) the age of 48 is probably not the best choice. Because it is not possible to decide beforehand which L gives the best integration measure, this method is calibrated on the proportion of upper secondary education (HAVO/VWO) students aged 15 minus the proportion of learning support, practical, and special (secondary) education (PRO/SVO/LWOO) students aged 15. This difference gives a very good indication of the later highest education attained and thus of the net contribution. The age L that gives the highest correlation between the aforementioned difference and the integration measure i has been used as a limit and this appears to be the case for L = 41 years, $r(44) = .90$, $p \ll .0001$ (calibration based on mean Cito scores also gives L = 41 years, $r(44) = .90$, $p \ll .0001$). Up to age 36, there are three groups with small *N*: Japan, the Former Soviet Union and the Horn of Africa and Sudan. These have a fairly regular course up to 40 years. From the age of 36 and especially from the age of 40, there are more groups with a small *N* and this method is not weighted for this. Apparently, the advantage of more data from the age of 42 is outweighed by the disadvantage of cohort effects and increasing variance due to small N and this reduces the correlation with the school level of the 15-year-olds.

This fourth method also gives an indication of the degree of overestimation of the first three methods. After all, this method is directly based on the observed net contribution for the first 41 years of age. The regression line for the fourth method is certainly well below that of the other three methods for the groups with a low estimate for the degree of integration. This indicates that the mean of the four methods is almost certainly an overestimation, certainly for the groups with a low estimated integration.

[29] In addition, the net contribution for the first-generation non-Western immigrants for ages 0 and 1 has been equated to the net contribution for native Dutch people of 0 and 1 year respectively, in order to take into account the costs of birth care, etc.

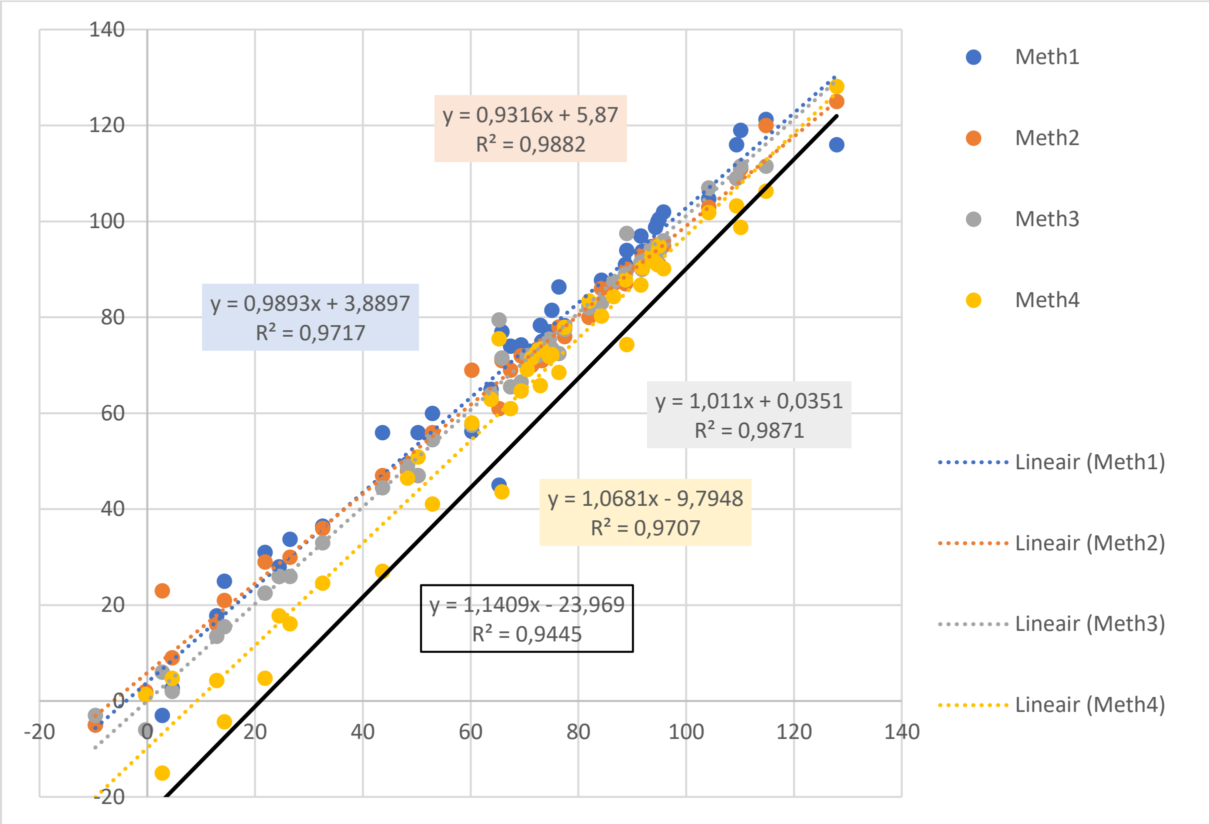

Figure 2.10 Correlation between four methods to estimate the degree of integration of the second generation for 46 second-generation groups. The fourth method (Meth4) is based directly on the observed net contribution over the first 41 years of age and represents the lowest estimate; the other three methods therefore overestimate the degree of integration. The values on the horizontal axis are the means of methods 1 to 4. The thick black line is the regression equation of an estimate of the degree of integration based on the direct observations of the net contribution over the first 35 years of age.

If we only use the observations over the years of age for which there is a reasonable amount of data for all groups (with the exception of Japan, the former Soviet Union and the Horn of Africa and Sudan), this would lead to much lower estimates for the degree of integration. The solid black line Figure 2.10 shows, for example, the trend line (without the cluster of points) if one only assumes the observations up to 36 years. Then the integration percentage for the groups with the least estimated degree of integration is about 25 percentage points lower than is the case with the integration measure currently used.

As more data becomes available over time, it will become clear which estimates are closest to reality. In any case, it is certain that in method 2 – which is based on ages up to 56 years – part of the cohort effects are included in the sum of squares, which means that this is most likely an overestimation. The same applies to method 1, but that method is designed in such a way that it is less sensitive to cohort effects and that results in lower results, especially for the groups with a low (estimated) degree of integration. In method 3 – which is based on ages up to 48 years – cohort effects are also taken into account, but less so and that results in a lower estimate. Method 4 uses direct observations of the net contribution per year of age up to age 42 and again gives a lower estimate than method 3. And the variant of method 4, which is based on the observations up to 36 years, gives an even lower estimate. It is clear: the lower the maximum age, the fewer cohort effects and the lower the integration estimate.

The lower the maximum age, the closer one is also to the observations for the 'target group' of this calculation exercise: the Dutch-born (second generation) children of immigrants who immigrated or will immigrate during the period 1995-2040. In general, it is also not the case that data on a lower maximum year of age will always necessarily provide a better estimate for the aforementioned second-generation group. If a lower upper limit is used, possible disturbances in the reference profile for first-generation non-Western students, for example due to pupil weights, crime figures and the proportion of non-EEA students, may again be weighted more heavily. That is why method 4 has been chosen to embed in the education levels at secondary school, of which the predictive power for the net contribution over the life course is in any case certain.

In method 1, data is included for the maximum number of years of age to be accounted for, with filtering out the cohort effects, correction for small N and calibration on Cito scores. This method can be regarded as an optimistic upper limit. Method 4 is a method anchored in secondary school performance, in which an average number of years of age is included, whereby 42 years also roughly coincides with the cohort effects for crucial groups (Surinamese, Turks, Moroccans) being clearly visible. This method can be regarded as a cautiously optimistic lower limit. The variant of method 4 based on observations up to 36 years (the solid black line in Figure 2.10) can be regarded as a perhaps somewhat pessimistic lower limit.

Simulation shows that in the base scenario with remigration, the effect per percentage point of integration on the total amount is on average in the order of magnitude €1,000 and for the groups with the lowest estimated degree of integration, the maximum effect is €2,000. Assuming that the range of most likely outcomes lies between the first and fourth method, the amounts can be up to €6,000 higher or €20,000 lower. This range applies mainly to the groups with the lowest estimated degree of integration, for the other groups the range is much smaller.

The results of the four methods were then compared. They appear to correlate very strongly with each other and also strongly correlate with the Cito score, see Table 2.2. The average of the four methods discussed above has been used as an operationalisation of the degree of integration of the second generation. This mean shows a strong correlation ($r(44) = .91$, $p \ll .0001$) with the second-generation Cito scores.

Table 2.2 Correlations between four methods to estimate the degree of integration of the second generation, the average of those four methods (Average 1-4) and the Cito scores, for the 42-part division, excluding the Netherlands, with Indonesia, Turkey, Morocco, Suriname and the (former) Antilles broken down by the number of parents born abroad.

	Avg. 1-4	Method 1	Method 2	Method 3	Method 4	Cito
Avg. 1-4	1					
Method 1	0,99	1				
Method 2	0,99	0,98	1			
Method 3	0,99	0,97	0,99	1		
Method 4	0,99	0,95	0,97	0,98	1	
Cito	0,91	0,91	0,90	0,90	0,90	1

The operationalisation of the degree of integration of the second generation as explained above is used to fill in the net contribution profile of the second generation for (roughly) the second half of life. This is done as follows. As a first step, an extrapolation profile *Extrapol* was made for each group, based on the estimate of the degree of integration. This *Extrapol* profile is a linear combination of the net contribution profile for native Dutch people and the net contribution profile for the first generation of non-Western immigrants. These profiles have been made scenario-dependent, i.e., using the discount rate, mortality probabilities, etc. for the relevant scenario (and therefore not, as in the previous case, based on the raw data for the net contribution). In fact, the profiles are used for this of people with the characteristics (in terms of income, taxes, use of facilities, healthcare costs, etc.) of the average native Dutch person or first-generation non-Western immigrant, but without remigration and with full state pension rights. For a zero-year-old, the present value of the net contribution is calculated separately for each future year of life, taking into account mortality probabilities and the like.

As a second step, a *Gen2* net contribution profile was created for the second generation of the group concerned according to the same scenario, based on the observations. The weighted average *NBgen2* was then taken from the *Extrapol* and *Gen2* profiles. Weighting was carried out according to the number of observations *N* per age. If *N* was 100 or greater, weight 1 was used for profile *Gen2*, and if *N* was below 100, weight *N* / 100 was used. This prevents small numbers from having too much of an influence. In addition, we weighted with the sigmoid function $(1 + e^{L-35})^{-1}$ for ages *L* to ensure a smooth transition between observations *Gen2* (almost completely counts up to 30 years) and extrapolation profile *Extrapol* (almost completely counts for ages from 40 years).

In the manner outlined above, the profile is based as much as possible on the real data for the first one third of life and further supplemented on the basis of the estimated degree of integration. The advantage of this is that amounts in the remaining part of life, due to death and discounting, count less heavily than the amounts in the first half of life, so that the effect of any estimation errors will be reduced. By way of illustration: at a discount rate of 2.5% and a growth rate of 1.0%, the weight of the Statistics Netherlands table population for 2016 is weighted against the sigmoid function defined in the previous paragraph. In other words, 58% of the second-generation net contribution is based on direct observation and 42% is based on extrapolation, based on direct observations up to (depending on the method) age 42…56.[30]

The previous methods lead to an estimate of the degree of integration for the 42-part division into regions of origin (minus the Netherlands). For the Netherlands as the origin, the degree of integration has been set at 100 (full integration), for the purpose of calculations for the native Dutch reference, i.e., the hypothetical immigrants with the characteristics of the average native Dutch person. This estimate for the 42-part division forms the basis for the degree of integration for the other origin groups by origin and/or motive. This is done as follows.

First, the integration estimates for the region divisions above the 42-part division were made synthetically as a weighted average of the estimates for the 42-part division. This weighting is based on the size of the population up to 25 years of age. After all, the intention is to make the best estimate for the

[30] The same simulation shows that when using the sigmoid function $(1 + e^{L-42})^{-1}$ (42 years is used as the limit value in method 4) even 66% of the total net contribution of the second generation is based directly on observations, but in that case the cohort effects will visibly play a role. That is why it has been estimated that including fewer observations leads to a better estimate.

Netherlands-born (second-generation) children of immigrants who immigrated or will immigrate in the period 1995-2040, hence the emphasis on young people. For the five major countries of origin Indonesia, Turkey, Morocco, Suriname and the (former) Antilles, the estimate is the weighted average of the group with one parent born abroad and the group with two parents born abroad. For the other composite regions in the 12-part division – such as, for example, the European Union or Africa (excluding Morocco) – the weighted average based on the 42-part division is the preferred estimate, because it provides the most detail for these regions. For these groups, the estimate based on the breakdown by the number of parents born abroad has been calibrated against the synthetic estimate based on the 42-part division.

Furthermore, based on the estimate of the degree of integration for the 42 world regions, an estimate has also been made for combinations of immigration motive and regions of origin, such as 'labour immigration from the European Union'. The foregoing methods cannot be directly applied to immigration motive due to lack of data. After all, immigration motives have only been recorded since 1995, so that in 2016 – the reference year for the current report – data are only available for just over 20 years.

In order to arrive at the most adequate estimate possible for immigration motives as well, we have made use of the observation that for the 42-part division into regions of origin there is a strong correlation between the Cito score of the second generation and the degree of integration of the second generation. For the second generation, simple regression of the estimated integration percentage on the Cito score shows that each point increase in the mean Cito score results in an average increase in the integration percentage of approximately 10.0%. That is why a correction has been made for the Cito scores for the second generation, for which there is ample data available per subgroup. This is done as follows. First, the absolute difference in Cito score was determined between the region as a whole and the relevant combination of motive and region. From this difference 1.645 times the standard error was subtracted and if the resulting number was positive the degree of integration was adjusted accordingly, taking into account the sign of the non-absolute difference, of course. In the same way, for underlying regions, i.e., refinements of the 42-part division (being the 87-part division), an estimate has been made of the net contribution for the second generation by adjusting for the difference in Cito scores, if there is little or no data available for the higher ages.

2.5 Sensitivity analysis

Of course, the calculations made are sensitive to assumptions about the operationalization of variables. In §6.5 of the current report, a sensitivity analysis has been made for some variables. First of all, it has been made clear that the degree of refinement of the division of the world into regions (see §4.4 of this appendix) can make differences between countries more or less visible. This analysis needs no further explanation.

Furthermore, §6.5 of the current report provides insight into the effect of the discount rate, by also performing the calculations with a discount rate of 1.5% (i.e. 1% lower than the discount rate of 2.5% in the standard scenario). This has been achieved by reducing the real interest rate accordingly in the model i (see Chapter 12 of this appendix; for more information on the discount rate, see Chapter 8 of this appendix). Also, §6.5 of the current report shows the effect of an AOW pension age of 65. A brief explanation of this calculation is given §8.1 of this appendix.

Table 2.3 Allocation of the costs of public goods to persons in a mixed scenario (amounts in billions of euros).

Item no.	Post	MACRO AMOUNT			
	TOTAL EXPENDITURE*	307,5			
	Interest paid* (not allocated to persons)	7,6			
	Attributed to persons*	**299,9**			
1	Public administration*	64,9			
	Minus: security (crime, police, justice)**	10,0			
	Plus: fundamental research (from education)**	3,7	±		
	Adjusted item Public administration**	58,2			
				Pro rata allocation:	
				GDP	**Population**
	Adjusted item Public administration**	58,2		20%	80%
2	Defence*	6,9		100%	0%
10	Transfers abroad*	10,5		100%	0%
13	Gross investment in buildings*	8,5		20%	80%
14	Gross investment in infrastructure*	10,1		20%	80%
	TOTAL	**94,1**		**32,7**	**61,4**
	Breakdown in %	**100%**		**35%**	**65%**

*Macro amounts of the budget 2016 according to CPB2018 dataset (see Chapter 8 of this appendix). 'Item no.' and 'TOTAL EXPENDITURE' refer to Table 5.1. All macro amounts marked with * have also been used in the current report.
**Macro amounts used in the current report that differ from the CPB2018 dataset macro amounts.

Finally, §4.2 and §6.5 of the current report discuss an important difference with the calculations in the CPB study *Immigration and the Dutch Economy* from 2003. In that CPB report, the costs for public goods such as public administration, defence and the like were allocated to individuals in proportion to the extent to which these persons contributed to the gross domestic product.[31] In the current report, such public goods are allocated equally to every resident of the Netherlands and thus the costs are allocated in proportion to the size of the population. This is in accordance with the CPB ageing study *Minder zorg om vergrijzing* from 2014 and the CPB2018 dataset (see also §8.1) on which the current report is largely based.[32] That, of course, gives different outcomes. In the sensitivity analysis in §6.5 of the current report, two variants to the baseline scenario have therefore been calculated.

The first variant to the baseline scenario – <u>35% GDP-related</u> – assumes <u>35</u>% allocation of the costs of public goods in proportion to the contribution of persons to GDP, and the other 65% in proportion to the population. Public goods are understood to mean the items Defence, Transfers abroad, Gross Investment in buildings, Gross investment in infrastructure and the 'Adjusted item Public administration'. The Adjusted item Public administration is the item Public administration from Table 5.1

[31] Roodenburg, H., R. Euwals & H. ter Rele (2003), pg. 67

[32] "Other expenditure, such as public administration and defence, is a fixed fraction of GDP. Their benefits, in the absence of information, are assumed to be the same for all citizens." ("De overige uitgaven, zoals openbaar bestuur en defensie, vormen een vaste fractie van het bbp. De baten ervan worden, bij gebrek aan informatie, voor alle burgers gelijk verondersteld.") Smid, B., H. ter Rele, S. Boeters, N. Draper, A. Nibbelink and B. Wouterse (2014), retrieved 17-1-2022 from: https://www.cpb.nl/sites/default/files/publicaties/download/cpb-boek-12-minder-zorg-om-vergrijzing.pdf page 31 and the CPB2018 dataset used (see chapter 8 of this appendix), in which these items are assumed to be the same for all inhabitants.

excluding the costs for Security (crime, police and justice) and including the costs for fundamental research (which is part of the item Education in Table 5.1). For details of the calculation see Table 2.3.

The calculation for the <u>35% GDP-related</u> variant is as follows. In the CPB-report *Immigration and the Dutch Economy* from 2003, GDP-related costs were allocated in proportion to the product of wages relative to Dutch natives and labour participation relative to Dutch natives.[33] In the current report, personal primary income (PPI) has been taken as a proxy for the contribution to GDP. Based on CBS microdata, the age-adjusted average of the PPI for the 16-68 age group was calculated. This PPI is expressed as the percentage $\%PPI$ of the PPI of native Dutch people, see column 2 in Table 6.4 of the current report. Subsequently, for each group in the 42-part division, the macro amount of the public goods PG was calculated. Then, if NB is the net contribution for a particular group, the net contribution NB' according to the 35% GDP-related variant is equal to $NB' = NB + 0{,}35 \times PG \times (\%PPI - 1)$.

The rationale behind the choice of 35% is as follows. Certain government expenditure is indeed, as stated in *Immigration and the Dutch Economy*, more related to GDP than to population. These include obligations such as EU contributions and international agreements like development cooperation and defence, which are expressed as a percentage of GDP. However, we estimate that most other expenditure follows the evolution of the population to a fairly large extent. Hence, our beforementioned choice to follow the approach of the 2014 CPB ageing study *Minder zorg om vergrijzing* and the CPB2018 dataset. The reasoning is as follows. The total macro amount for the items concerned is 94.1 billion euros (see Table 2.3). Of this, 17.4 billion (18.5%) relates to the items Defence and Transfers abroad. We have assumed that these items are 100% GDP related. The other items relate to Gross investment in buildings, Gross investment in infrastructure, and the Adjusted item Public Administration. The Adjusted item Public Administration is probably largely scale-dependent, as a large part of the costs are staff costs, for example for civil servants working in various executive services – such as the tax authorities – whose size largely depends on the size of the population. The costs for Gross investment in buildings are partly related to the size of the civil service and therefore indirectly to the size of the population. In a densely populated country like the Netherlands, the costs of infrastructure might be more than proportionally (i.e. progressively) related to population size due to congestion phenomena. It would be going too far for this sensitivity analysis to estimate for each item a function of the degree of dependence on GDP and/or population size. Instead, a computational example has been provided in which Defence and Remittances Abroad are 100% GDP-related, and the other items are 20% GDP-related. This gives 35% GDP-related costs for public goods, for details of the calculation see Table 2.3. The resulting 35% GDP-related variant gives an impression of the net contributions if a smaller share of the public goods costs are GDP-related.

On the second variant, we can be brief. The main text of the current report explains that, for various reasons, many sub-items of the Public Goods item may well increase disproportionately with population growth due to immigration. For this variant, an in itself arbitrary 20% increase in Public Goods costs was assumed. The effect of this on the net contribution is more or less linear with the percentage chosen, so the reader can work out the effects of larger or smaller values by interpolation or extrapolation.

[33] Roodenburg, H., R. Euwals & H. ter Rele (2003), pg. 64-67

3 Study population and microdata files

Statistics Netherlands microdata has been used as much as possible for the calculations in the current report. These are very detailed and anonymised data, which are available on a personal level for (almost) all residents of the Netherlands. The Statistics Netherlands microdata database consists of a large number of tables, which can be interconnected via key variables. In this appendix, continuous reference is made to the Statistics Netherlands microdata files used. Extensive documentation can be found on the Statistics Netherlands website under the heading Microdata catalogue.[34]

In principle, the fiscal cost-benefit analysis is based on the living population of 16,979,120 people on 1 January 2016, according to the Statistics Netherlands StatLine. The Statistics Netherlands microdata file INPATAB is available for this population, containing income data for virtually the entire population. However, this file does not include children born in 2016 and zero-year-olds who immigrated in 2016. To include these in the calculation, all zero-year-olds from the Statistics Netherlands microdata file ZVWZORGKOSTENTAB were also included. This way, the healthcare costs for zero-year-olds can be included in the analysis. In this way, 170,976 zero-year-olds were added. These two groups – the population of 16,979,120 people living on 1 January 2016 and the 170,976 people born in 2016 for whom healthcare costs are known – form the study population in the current report, see Table 3.1.

Table 3.1 Study population.

	Study population		Not part of the population on 1 January 2016	Total
	0 year*	1 year and older*		
Study population	170,976	16,979,120		17,150,096
Of which in Statistics Netherlands microdata file:				
INPA2016TABV1		16,979,120		16,979,120
ZVWZORGKOSTEN2016TABV1	170,976	16,765,505	148,391	17,084,872
*Age at the end of 2016				

In addition to INPATAB, data from a number of other Statistics Netherlands microdata files were also used for the study population. Also based on ZVWZORGKOSTENTAB, the healthcare costs of people belonging to the study population who were one year old or older at the end of 2016 have also been added. GBAPERSOONTAB and KINDOUDERTAB are used for the personal data. In addition, data on educational participation, Cito scores and the highest education attained were used (respectively ONDERWIJSDEELNEMERSTAB, CITOTAB and HOOGSTEOPL). A large number of other microdata files were also used: INHATAB for household incomes, KINDEROPVANG for childcare amounts allocated to applicants and partners, GBAMIGRATIEBUS and VRLMIGMOTBUS for immigration and immigration motives and finally the pension entitlement file PAS.

[34] Access to this data can be requested from Statistics Netherlands. When used, all microdata remains within Statistics Netherlands for privacy reasons. Only aggregated data that cannot be traced back to individuals may be published under strict conditions and after checking by Statistics Netherlands. Replication therefore requires access to this microdata. For more information, see the Statistics Netherlands website and the microdata catalogue, retrieved 19-4-2023 from: https://www.cbs.nl/nl-nl/onze-diensten/maatwerk-en-microdata/microdata-zelf-onderzoek-doen/catalogus-microdata

For people born in 2016 or immigrated as zero-year-olds in 2016, only the healthcare costs are included as well as all costs that are equally allocated to all people, such as the costs of public administration. For people who were one year old or older at the end of 2016, the data from all the microdata files used were only included insofar as the people concerned appeared in INPATAB, reporting year 2016, because it was considered of little use to include people for whom there is no information about matters that are crucial for costs and benefits, such as income, taxes, premiums, benefits, subsidies and the like. As mentioned, this approach results in a study population that is equal to the Statistics Netherlands StatLine given for 2016 plus all zero-year-olds (year-end 2016) from the Statistics Netherlands microdata file ZVWZORGKOSTENTAB. The operationalisation of the various variables is further explained in the following chapters. If in the future reference is made to ZVWZORGKOSTENTAB and the like, this refers to the data insofar as it relates to people in the study population.

4 Socio-demographic variables

4.1 Age and generation

The socio-demographic variables have been added based on the Statistics Netherlands microdata file GBAPERSOONTAB for the reporting year 2017, which includes the variables of origin (first and second) generation and year and month of birth. The age can be calculated from the year of birth and month of birth. The date of birth is missing from the microdata file and it is assumed that everyone was born on the 15th of the month as an approximation. The age at the end of 2016 was calculated from this. The variable generation is also included in GBAPERSOONTAB, insofar as it concerns the first and second generations, as well as the number of parents of the second generation born abroad.

The third generation is derived by combining different Statistics Netherlands microdata files. Statistics Netherlands gives the following definition of the third generation: “A person belongs to the third generation if both parents were born in the Netherlands and at least one of the four grandparents was born abroad. People who were born in the Netherlands and of whom at least one parent was born abroad, therefore, do not belong to the third generation, but to the second”.[35] The third generation is part of the group of people with a Dutch background, which are defined as: “Persons whose parents were both born in the Netherlands, regardless of the country where the person was born”.[36] In addition to a Dutch background, for a third-generation person, one or both parents must have a second-generation immigration background, which is defined as a “Person who was born in the Netherlands and of whom at least one parent was born abroad”.[37] Combining the last two definitions yields the first definition.

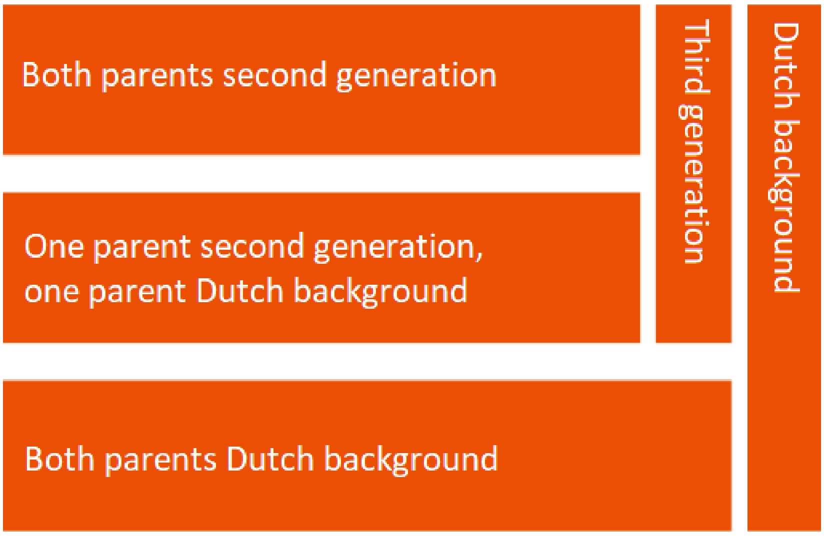

Figure 4.1 Schematic representation of people with a Dutch background.

Source: Statistics Netherlands (2016). Wie zijn de derde generatie? *Retrieved 2-2-2022 from: https://www.cbs.nl/nl-nl/nieuws/2016/47/wie-zijn-de-derde-generatie- Edited excerpt from original image.*

Statistics Netherlands determines the background of the third generation on the basis of the background of the parents “whereby the background of the mother is decisive, unless she has a Dutch or

[35] Retrieved 19-4-2023 from: https://www.cbs.nl/nl-nl/nieuws/2016/47/wie-zijn-de-derde-generatie-
[36] Retrieved 19-4-2023 from: https://www.cbs.nl/nl-nl/onze-diensten/methoden/begrippen?tab=p#id=persoon-met-een-nederlandse-achtergrond
[37] Retrieved 19-4-2023 from: https://www.cbs.nl/nl-nl/onze-diensten/methoden/begrippen?tab=p#id=persoon-met-een-tweede-generatie-migratieachtergrond

unknown background. Then we take the background of the father".[38] This system was also followed in the current study.

The third generation is derived from the information from the GBAPERSOONTAB file that contains the origin of father and mother as far as known. With the help of the Statistics Netherlands microdata file KINDOUDERTAB, it can be deduced who belongs to the third generation. By definition, those who belong to the third generation of which both parents are second generation or of which one parent is second generation and one parent has a Dutch background. Subsequently, the origin of the child is equated with the origin of the mother, unless she had a Dutch or unknown background, in which cases the origin of the child is equated with the origin of the father. There is also a group of which it is not possible to determine whether they belong to the third generation. In practice, in the current study, the third generation is limited to people whose generation of both parents is known, whereby a distinction is made between one second-generation parent and two second-generation parents.[39] Incidentally, little public data is available for the third generation, except for a single Statistics Netherlands StatLine file[40] or Statistics Netherlands customised file.[41]

4.2 Education level and Cito scores

Education level is derived from the Statistics Netherlands microdata file HOOGSTEOPL for the reporting years 2007-2017. This file gives, among other things, the highest level of education attained as of 1 October of the reporting year. For the highest level of education, a total of 6.9 million observations were used.

In addition, for a number of partial calculations, the Statistics Netherlands microdata file ONDERWIJSDEELNEMERSTAB for the reporting years 2007-2017 was also used to determine the current education. Data of 2.7 million persons are used for the current education.

The classification of educational levels in the current report is based on the Statistics Netherlands SEC. SEC stands for Standard Education Classification (in Dutch *Standaard Onderwijs Indeling,* SOI, see for more information the term Standard Education Classification in the Glossary in the current report). Mostly, the so-called SEC 5-part and 8-part divisions are used.

The Cito scores are derived from the Statistics Netherlands microdata file CITOTAB for the reporting years 2006-2018. These files contain the Cito scores of a total of 1.8 million people. This data is aggregated for the variable CitoStandaardScore (range 501-550) and other relevant variables.[42]

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[38] Retrieved 19-4-2023 from: https://www.cbs.nl/nl-nl/nieuws/2016/47/wie-zijn-de-derde-generatie-

[39] Compare with the explanation of the Statistics Netherlands dataset Third Generation Tables on the third generation, retrieved 19-4-2023 from: https://www.cbs.nl/nl-nl/maatwerk/2020/46/personen-met-ouders-van-tweede-generatie-1-januari-2020 and https://www.cbs.nl/-/media/_excel/2016/47/maatwerktabellen%20derde%20generatie%20-%201%20januari%202016.xlsx see also: https://www.cbs.nl/nl-nl/nieuws/2016/47/wie-zijn-de-derde-generatie-

[40] Retrieved 19-4-2023 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/70688ned/table?dl=18BAC

[41] There are custom files for 2016 and 2020, see previous notes and also the following source, retrieved 19-4-2023 from: https://www.cbs.nl/nl-nl/maatwerk/2020/46/personen-met-ouders-van-tweede-generatie-1-januari-2020

[42] With a view to possible replication, it is important to know that the regions of Israel and the Arabian Peninsula, Jordan and Lebanon initially formed one region, which was subsequently split into two separate regions and in a single case the data for these regions were obtained by imputation or deduction.

These data for Cito scores and highest and current education have been used in particular in Chapter 9 of the current report. In this chapter, five types of calculations are made based on CBS microdata: (I) calculations with regard to group averages of educational level and/or Cito score, (II) calculations of net contribution by educational level, (III) calculations of net contribution by Cito score, (IV) calculations of the net contribution of the 2nd generation, as shown in Table 9.4 of the current report and (V) indicative calculations to determine to what extent group differences in net contribution arise from group differences in educational level at the time of immigration, or group differences in Cito return, or group differences in education return (for the concepts mentioned, see the Glossary).

(Ad I) The calculations with regard to group averages of education level and Cito score have been carried out as follows. For the Cito score, the average of the years 2006-2018 is used. For the current education (those enrolled at an educational institution), the average of the years 2007-2017 is used. For the highest obtained education, data from 2016 have been used. The result of this is that the figures for the 1st, 2nd and 3rd generation generally relate to different cohorts. In general, it is not the case that a group for which an average has been calculated for the 2nd generation actually concerns the children of the group for which an average has been calculated for the 1st generation. A concrete example: the average Cito score for the Turkish 2nd generation is based on the data of a group of people who, in practice, can never be the children of the group of people on which the average Cito score for the Turkish 1st generation is based. This is important, for example, when interpreting Figures 9.20, 9.21, 9.23 and 9.24 from the current report. For education actually followed, the chance that part of the 2nd generation are actually the children of the 1st generation is slightly greater, because both children and adults are in education, although here too the chance will be small (few adults are enrolled in VWO secondary school, for example). This is because the Cito score and the current education are snapshots and the period for which observations are available is too short. The highest obtained education, on the other hand, concerns people of all ages for which data is available. Here, for example, there is a much greater chance that the group of people on which the average level of education for the German 2nd generation immigration background is based are actually partly the children of the group of people on which the average level of education for the German 1st generation immigration background is based. The same applies to combinations of average educational level with average Cito score as in Figure 9.11 from the current report.

(Ad II) Furthermore, calculations have been made for the net contribution by level of education for the entire population and broken down by immigration background (western and non-western). To this end, profiles have been constructed (like Figure 9.6 in the current report) for the net contribution per age year, broken down by level of education. These profiles are in principle composed of the net contribution profiles for current (CUR) and highest achieved/attained (HA) education according to the Statistics Netherlands SEC 8-part division, which will from now on be referred to as 'CUR profile' and 'HA profile' respectively in the rest of this paragraph.[43] This is done as follows.

[43] Thus, there are 16 net contribution profiles in total, two for each level in the Statistics Netherlands SEC 8-part division. Concrete example: for the level MBO4 there is a profile for the education currently followed (CUR profile) for those who are studying and are enrolled in an educational institution at the MBO4 level, and a profile for the highest achieved (HB profile) for those who are not studying and have MBO4 as the highest achieved level of education.

For ages 0 to 4 years, the profiles are constructed based on the population as a whole. For the ages 4 to 11, the CUR profile was used for primary education, corrected for the average Cito score[44] of the eventual highest education attained. For the ages from 12 to a maximum of 23 years, it has in principle been assumed that one of the following two nominal study paths is followed until the relevant highest education attained (for the sake of readability, the levels in the Statistics Netherlands SEC 8-part division are underlined):

- The first study path is primary education, possibly followed by five years of lower secondary vocational education (VMBO B/K), possibly followed by two years of upper secondary vocational education (MBO2, 3), possibly followed by one more year of upper secondary vocational education (MBO4).
- The second study path is three years lower secondary theoretical education (VMBO G/T), possibly followed by three years of upper secondary theoretical education (HAVO, VWO), possibly followed by three years of tertiary education (bachelor), possibly followed by one more year of tertiary education (master).

If the first study path is completed without a diploma, the highest level of education attained is primary education, whereby in connection with compulsory education it is assumed that five years of lower secondary education (VMBO B/K) have always been pursued. Subsequently, for ages up to 21 or 22 years, all profiles of the net contribution profile were supplemented, if necessary, based on the average Cito score for the relevant highest education attained.[45]

These two nominal study paths were then supplemented as follows for the remaining years of life. If MBO2, 3, MBO4, bachelor or master is the highest attained education, the weighted average of the HA profile and the CUR profile for the relevant highest attained education was taken for all ages from 21[46] to 39 years. This is weighted on the basis of the ratio between highest attained education and the education currently being pursued. For upper secondary theoretical education (HAVO, VWO), the weighted average was only taken for 21-year-olds. No weighted average was taken for the other three levels and only the HA profile was used from the age of 22.[47] For ages from 39 years, only the HA profile for the highest attained education in question was used. The small number of people aged 39 and over who are still enrolled in education at level s are assumed to have the same net contribution as people who have s as their highest level of education. When broken down by immigration background, there was little data for ages from 72 years. In these cases, the net contribution profile is supplemented by the most suitable profile, whereby the profile of the relevant study program without a breakdown by

[44] The net contribution also depends on the Cito score, see (Ad III).
[45] This average Cito score for the highest education attained was obtained from the matrix calculations described earlier. Due to the lack of data up to ages 21 or 22, this is used as a proxy for the weighted mean of the CUR profile and the HB profile used for ages from 21 years. In order to minimise measurement errors, the average of the relevant average Cito score and the two scores immediately above and below it has been used in the calculation.
[46] With master from 22 years.
[47] NB: this does not result in a major distortion because the fact that there are no data for these CUR profiles for certain ages implies that, in practice, following these courses for the relevant ages does seldom occur and therefore the HB profile provides an adequate description of reality.

immigration background is weighted 0.25 in the sum of squares.[48] Finally, based on Statistics Netherlands customised data, the mortality probabilities have been adjusted to the level of education.[49]

(Ad III) In addition, in Chapter 9 of the current report, some calculations have been made for the net contribution per Cito score (see Figure 9.3, 9.8, 9.9 and 9.18). For these calculations, longitudinal data have been used, namely for the Cito score over the period 2006-2018 and for the current and highest obtained education over the period 2007-2017. These periods are too short for a calculation in one go. Therefore, the data of different cohorts have been combined. The figures mentioned are therefore synthetic (see this term in the Glossary of the current report), i.e. composed of different components. In general terms, this has been done as follows:

i. 0 to 4 years: based on observations of the net contribution for the whole population.
ii. 4 to 12 years: based on observations of the net contribution per Cito score.
iii. 12 to 21 years: based on observations of the net contribution per Cito score.
iv. 21 to 39 years: based on observations of the net contribution per educational level in combination with transformational matrices that give the distribution over educational levels up to 39 years of age per Cito score.
v. 39 years and older: based on observations of the net contribution per educational level in combination with the observed distribution over educational levels per Cito score for 38-year-olds.

Table 4.1 Composition of Cito cohorts by age and year the test was taken.

Number of persons for whom CITOJJTAB contains data, by year of collection (2006-2013).										
age at end of			number of persons per year the test was taken							
2015	2016	2017	2006	2007	2008	2009	2010	2011	2012	2013
16	17	18				34	1.502	85.252	49.730	2.820
17	18	19			26	1.468	81.219	49.428	2.716	31
18	19	**20**		26	1.433	80.338	46.929	2.681	23	16
19	20	**21**	31	1.338	80.011	49.260	2.779	21	35	
20	21	**22**	1.351	80.015	49.995	3.066	48	17		
21	22	23	81.921	51.742	3.409	35	29			
22	23	24	51.152	3.331	53	25				

Step i (0 to 4 years) does not require any additional calculation work, as this can be directly taken over from the calculations of the net contribution per age year for the population as a whole, as described Chapter 2 of this appendix. For *Step ii* (4-12 years), an additional calculation was made to determine the average education costs per Cito score (there are differences in costs between types of education such as regular and special primary education and also the so-called pupil weights lead to cost differences, see also §5.3 of this appendix) and health care costs (see Figure 9.7 in the current report for details). This is because these are the only cost items that can differ significantly between individuals

[48] The method is comparable to the one applied for the second generation, see §2.4.
[49] Life expectancy is lower for the lower educated and higher for the higher educated. The magnitude of this effect has been estimated on the basis of publicly available data and the mortality probabilities have been corrected accordingly.

for this age group.[50] For *Step iii* (12 to 21 years), the cost and benefit items needed to calculate the net contribution per age year are aggregated to the cito scores (observations 2006-2018), which is a calculation similar to those explained in Chapter 2 of this appendix.

The calculation in *Step iv* (21 to 39 years) is considerably more complex and consists of several components. First, three cohorts – called Cito cohorts – from CITOTAB were followed, who were 20 years old at the end of 2015, 2016 and 2017 respectively. This involved a total of 399,413 individuals whose final cito test was taken between 2006 and 2013, see Table 4.1. In this table, each cohort has its own colour: blue for the cohort aged 20 at end of 2017, green for the cohort aged 20 at year-end 2016 and yellow for the cohort aged 20 at end of 2015. The distribution of these cohorts is determined on the basis of the highest achieved or current education (HAC for short) at the age of 20.[51] In other words: for each of these three cohorts separately, it was determined whether they were studying or not studying at the age of 20, with the students' current education being determined and the non-students' highest education.

Table 4.2 Schematic overview of the HAC cohorts used to determine the net contribution per Cito score. The per-cent-ages refer to the availability of HAC data.

data			age	percentage data for which HAC is missing										
				without NIRWO						with NIRWO				
available	HAC un-known	data used	U17	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
209.680				7,4%	6,8%	6,2%	5,6%	4,9%	4,2%	2,4%	1,5%	0,6%	0,1%	0,0%
201.353	6,5%	188.342	28	7,7%	7,0%	6,5%	5,9%	5,2%	4,3%	2,4%	1,5%	0,7%	0,1%	0,0%
198.011	7,0%	184.065	29	7,7%	7,0%	6,5%	5,8%	5,1%	4,2%	2,2%	1,4%	0,7%	0,1%	0,0%
197.883	8,7%	180.642	30	8,7%	8,0%	7,4%	6,6%	5,9%	5,0%	2,1%	1,4%	0,7%	0,1%	0,0%
195.122	**Total**	**553.049**		12,4%	11,6%	10,7%	9,9%	9,0%	8,1%	2,2%	1,4%	0,7%	0,1%	0,0%
186.545	2,4%	182.050	32	16,7%	15,6%	14,7%	13,6%	12,5%	11,3%	2,4%	1,5%	0,8%	0,2%	0,0%
177.831	2,6%	173.270	33	20,3%	19,1%	18,1%	16,8%	15,4%	14,1%	2,6%	1,7%	0,9%	0,2%	0,0%
166.724	2,8%	161.979	34	22,7%	21,5%	20,3%	18,9%	17,1%	15,5%	2,8%	1,9%	1,0%	0,2%	0,0%
162.185	**Total**	**517.299**		23,0%	21,6%	20,4%	18,8%	16,8%	14,9%	2,9%	2,0%	1,1%	0,3%	0,0%
161.689	3,1%	156.746	36	22,0%	20,5%	19,3%	17,6%	15,5%	13,3%	3,1%	2,1%	1,2%	0,3%	0,0%
160.056	3,2%	154.932	37	22,6%	21,1%	19,8%	18,0%	15,7%	13,3%	3,2%	2,2%	1,4%	0,3%	0,0%
151.471	3,3%	146.444	38	23,5%	22,0%	20,7%	18,8%	16,4%	13,9%	3,3%	2,3%	1,4%	0,3%	0,0%
149.479	**Total**	**458.122**		24,0%	22,6%	21,3%	19,3%	16,8%	14,2%	3,3%	2,3%	1,5%	0,4%	0,0%

Then, based on three other cohorts – called HAC cohorts – a transformation matrix was determined from the HAC for 20-year-olds to the HAC for ages up to 30. Table 4.2 shows how this was done. The HAC evolves over time: as the age group advances, there is an increasingly larger proportion that is no longer studying and the average level of education also increases. The blue cito cohort from Table 4.1 is 20 years old at the end of 2017. In order to follow their HAC development from age 20 onwards, the HAC cohort that is 28 years old at the end of 2017 is taken, see the upper blue HAC cohort in Table

[50] Other cost and income items such as taxes, premiums, pensions, benefits, etc. do not yet apply to this age group or are equally high for all groups.

[51] Because the exact school level is still very decisive for these ages, for this step, this was done for a customized HAC classification into 10 current education levels and 9 highest attained education levels, composed of a combination of the Statistics Netherlands SEC 8-part division and 18-part division. Using only the SEC 18-part division would have given too many cells with a low number of observations.

4.2.[52] This cohort was 20 years old at the end of 2009. With the middle blue cohort in Table 4.2, the development is further followed until 32 years old (end of 2017) and with the bottom blue cohort until 36 years old (end of 2017). Something similar applies to the green cohorts, with the proviso that everything has been moved up one year: this cohort is already 20 years old in 2008 and 29 years old at the end of 2017. With the middle and lower green cohorts, the HAC development can be followed up to 33 and 37 years of age respectively (end of 2017). Something similar applies to the yellow cohorts, albeit that everything has been moved up another year. With the yellow cohorts, HAC development can be followed up to the age of 38 (end of 2017).

Note that for the lower six cohorts in Table 4.2 the so-called 'with NIRWO' variant was used, which is recommended by Statistics Netherlands.[53] Only five years could be used for these cohorts because the 'with NIRWO' variant was only available for the years 2013-2017.

Subsequently, transformation matrices from Cito scores to HAC for the ages 21-38 are made through matrix multiplication (performed in Excel). With these transformation matrices, it is possible to predict the distribution of the highest attained or current education for all mentioned ages, given a certain Cito score. This has been done for the population as a whole, for natives and for the second generation, broken down into western and non-western. Because for each of these groups, the net contribution per level of education for students (CUR profile) and non-students (HA profile) is known, the net contribution per Cito score can be determined by matrix multiplication, that is by multiplication of the aforementioned transformation matrices with the matrix of age-specific net contributions per current and highest attained level of education.

Finally, *Step v* (from 39 years of age) was carried out as follows. A very small fraction of people are still studying at the age of 38. Based on available microdata on educational participation D_L for ages $0 \leq L \leq 99$, a profile $\overrightarrow{P_L}$ can be established with $P_L = 1$ for ages $L \leq 38$ and $P_L = \frac{D_L}{D_{38}} < 1$ for ages $L > 38$. The profile $\overrightarrow{P_L}$ decreases gradually and equals 0 from age 85. This profile gives the proportion of students in the total population for 39 years of age and older, and is used (by vector multiplication) to gradually decrease the proportion of students and increase the proportion of non-students accordingly. How this is done is explained using a concrete example. Suppose that, of a certain group, $1‰$ of the 38-year-olds are enrolled in an educational institution at the MBO4 level and 10% have MBO4 as their highest level of education. For ages $L > 38$, the proportion of people currently enrolled at MBO4 is then set at $1‰ \times P_L$ and the proportion of people who have MBO4 as their highest attained level is set at $10\% + 1‰ \times (1 - P_L)$. Subsequently, for the ages from 39 onwards, the net contribution per age year can be obtained by matrix multiplication with the age-specific net contributions by current education and by highest attained education.

Net contribution profiles by Cito score as, for example, shown in Figure 9.8 of the current report can then be (synthetically) created by combining the information obtained from *Step i* to *Step v* described above. Such profiles are made for the population as a whole, natives and for the groups with a 2nd

[52] For this step, a transformation matrix was created for each of the ages involved for the customized HAC classification in 19 groups explained in the previous footnote to the regular HAC classification in 16 groups (8 for Highest Education and 8 for Current Education).

[53] See for details the CBS microdata documentation (in Dutch) *Documentatie Hoogst behaald en hoogst gevolgd opleidingsniveau en opleidingsrichting van de bevolking in Nederland (HOOGSTEOPLTAB),* retrieved 19-4-2023 from: https://www.cbs.nl/-/media/cbs-op-maat/microdatabestanden/documents/2021/40/hoogsteopltab.pdf

generation western and non-western immigration background. On the basis of these profiles, it is possible to calculate the net contribution (over the life course) for each Cito score separately, whether or not broken down by immigration background, using the methods described in §2.1 of this appendix (see Figures 9.9 and 9.18 in the current report).

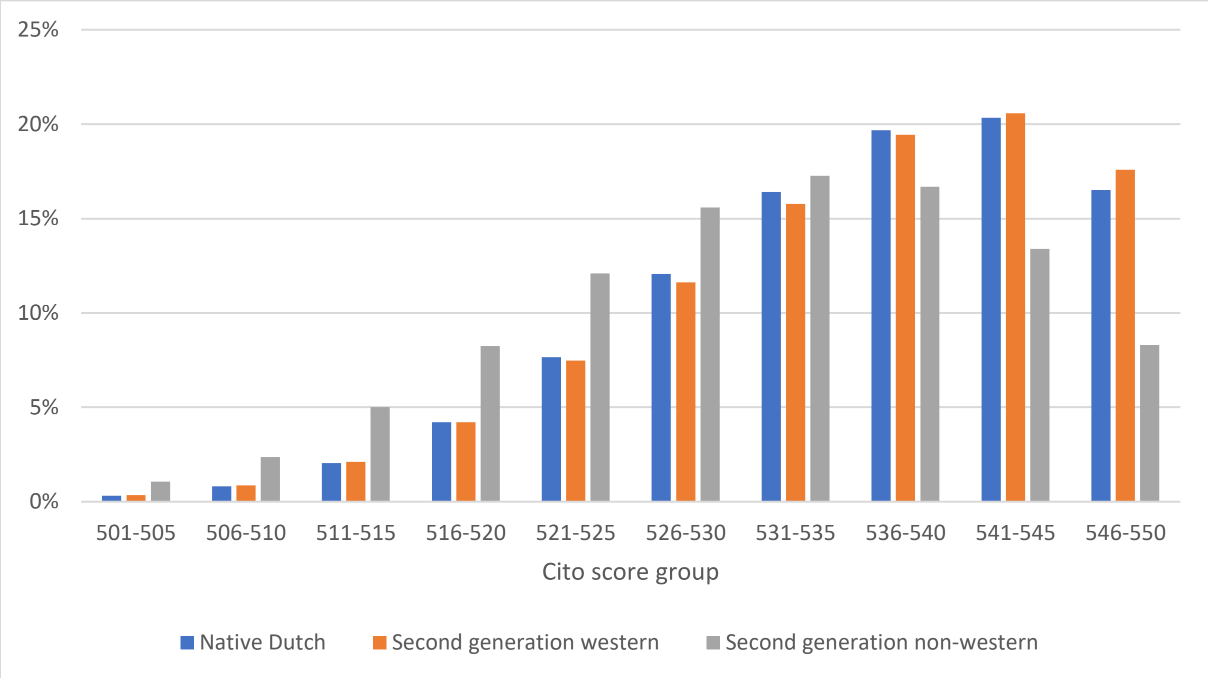

Figure 4.2 Distribution of Cito scores, split by immigration background.

As the distribution of Cito scores per immigration background is also known (see Figure 4.2), the total net contribution can be calculated from this (as a sum product). These totals turn out considerably higher than the net contribution based on direct observations (without emigration) as given in Chapters 4-6 of the current report (see Table 4.3 of the current report). The differences amount to approximately €150,000 for Dutch Natives and the entire population, €160,000 for the western second generation and €180,000 for the non-western second generation. Possible explanations for these differences are an increase in Cito scores over time[54], and an increasingly higher level of education,[55] both in general and also for persons with a migration background due to 'catching up' and especially for non-Western possibly also due to changing composition (larger share with migration background with higher education level and higher Cito scores). Because the data used for this calculation mainly relates to the fairly recent period 2006-2018, it is obvious that these possible effects would lead to higher outcomes than the calculations in Chapters 4-6 of the current report, which are based on the entire population present in the Netherlands in 2016 (who therefore probably have a lower level of education and therefore also lower net contributions than the cohorts from 2006). In Figures 9.9 en 9.18 of the current report, a correction has been made by calibrating to the net contribution for the population as a whole. The mutual relationships between native Dutch and western and non-western second generation migrants remain unchanged. The rationale behind this correction is in the first place to better

[54] Compare Statistics Netherlands StatLine *Score eindtoets basisonderwijs Cito; gezinskenmerken, 2005-2010*, retrieved 19-4-2023 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/81788NED/table?dl=68067
[55] Compare *CBS Jaarrapport integratie 2020*, Hoofdstuk 2, retrieved 19-4-2023 from: https://longreads.cbs.nl/integratie-2020/onderwijs/

align the results with the other results in the current report. In addition, no correction will lead to much higher total net contributions to the public treasury, and the unprecedented large structural budget surpluses associated with this do not provide a realistic scenario either. Finally, this whole calculation exercise is mainly about demonstrating the large effect of Cito score on net contribution and the differences that occur in this respect between native Dutch and western and non-western immigration background, and thus mainly about the interrelationships of the amounts.

Finally, the explanation of some claims with regard to Figure 9.18 of the current report. The average difference in net contribution per Cito point between native Dutch on the one hand and second generation Western and non-Western on the other hand is calculated as:

$$\frac{1}{50} \cdot \sum_{c=501}^{550} (NB_{cND} - NB_{cm})$$

In which NB_{cND} is the net contribution is for native Dutch (ND) with Cito score c and NB_{cm} the net contribution for persons with a second generation migration background m (in the calculation Western and non-Western) with Cito score c, $501 \leq c \leq 550$. This results in a €59,000 difference for western and €170,000 difference for non-western. In the main text, these results are rounded up to multiples of €10,000.

The increase in net contribution per cito point higher is calculated as:

$$\left\{ \sum_{c=502}^{550} (NB_{(c+1)m} - NB_{cm}) \cdot \frac{1}{2} (N_{(c+1)m} + N_{cm}) \right\} \Big/ \sum_{c=502}^{550} \frac{1}{2} (N_{(c+1)m} + N_{cm})$$

In which N_{cm} denotes the number of observations for migration background m and Cito score c. The forms thus the distribution over Cito scores $501 \leq c \leq 550$ for the group with migration background m. This results in a €21,400 increase for native Dutch, €20,700 increase for second generation Western and €16,400 for second generation non-Western. In the main text, these results are rounded up to multiples of €1,000.

This calculation was also carried out for second generation Western and non-Western combined (the weighted average). This results in a €17,600 increase in net contribution per cito point higher. In the main text, this result is rounded to €18,000.

In addition, the increase in net contribution per Cito point was also calculated higher due to regression of the terms for migration background m

$$\overline{NB}_m = \sum_{c=501}^{550} NB_{cND} \cdot N_{cm} \Big/ \sum_{c=501}^{550} N_{cm}$$

on the average Cito score

$$\bar{C}_m = \sum_{c=501}^{550} c \cdot N_{cm} \Big/ \sum_{c=501}^{550} N_{cm}$$

To be carried out for the 42 division (minus the Netherlands). This has been carried out several times with a view to sensitivity to operationalisation (for m in the 19 division, for m in the 42 division and also with the net contributions of the population as a whole instead of native Dutch people. In all cases, the result is an increase of approximately €19,000 per cito point higher. The result of the previous paragraph and this paragraph are indicated in the main text as €18,000 to €19,000 increase in net contribution per cito point higher.

Ad (IV) The net contribution per educational level of the 2nd generation was estimated using an algorithm. In the rest of part (IV), the term education level refers to the Statistics Netherlands SEC 8-part division. This algorithm produces an estimate of the distribution across education levels for the 2nd generation for each education level of the 1st generation separately. Table 4.3 shows this schematically for the non-western migrant background. In the light grey block of this figure, the observations are given for the distribution across education levels for the 1st generation and in the sky-blue block for the 2nd generation. In concrete terms: according to observations, 30.9% of the first generation has (at most) primary school education and 4.2% of the second generation. The white block of numbers in the middle gives an estimate of the distribution of education levels for the 2nd generation for the 1st generation. In concrete terms: for the 1st generation with (at most) primary school, the estimated distribution for the 2nd generation is: 4.2% primary school, 12.5% VMBO B/K, 1.6% VMBO G/T, and so on. The lavender-coloured block shows the weighted averages produced by this estimate and it can be seen that the deviations from the observations in the sky-blue block are small. In Table 4.4, the same has been done for the western immigration background, and in Table 4.5 for the reference native. First follows the explanation for western and non-western below, then the explanation for the Native Dutch reference.

Table 4.3 Probability distribution for educational attainment of 2nd generation children by educational attainment of 1st generation immigrants, for non-western immigration background.

Distribution by level of education (non-Western)										
		observation 1st generation								
Observation 2nd generation		primary	VMBO B/K	VMBO G/T	MBO2, 3	MBO4	HAVO/VWO	bachelor	master	control
		30,9%	12,5%	4,9%	15,2%	10,0%	7,5%	11,6%	7,4%	
primary	4,2%	4,2%	5,8%	6,2%	3,9%	5,5%	3,7%	2,7%	2,8%	4,3%
VMBO B/K	9,3%	12,5%	11,9%	10,9%	7,7%	6,7%	6,4%	6,9%	4,1%	9,3%
VMBO G/T	4,5%	1,6%	6,2%	9,6%	5,7%	6,6%	6,6%	4,3%	4,9%	4,6%
MBO2, 3	17,7%	23,8%	16,9%	15,6%	17,2%	14,6%	14,7%	12,6%	11,1%	17,7%
MBO4	22,3%	30,3%	21,4%	14,3%	22,4%	18,1%	15,8%	17,9%	14,7%	22,3%
HAVO/VWO	8,9%	3,7%	10,7%	13,5%	10,7%	12,0%	15,6%	8,3%	10,9%	8,9%
bachelor	21,9%	20,6%	19,0%	17,0%	21,5%	20,7%	20,5%	28,9%	27,6%	21,8%
master	11,1%	3,3%	8,1%	12,9%	10,9%	15,7%	16,7%	18,6%	23,7%	11,1%
Total		100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%
		Weighted average level of education 2nd generation, based on ranking SEC 8-part								
		4,73	4,85	4,94	5,19	5,31	5,45	5,69	5,93	13,0%
Non-western		Estimate of net contribution 2nd generation per level of education 1st generation								control
		-€85.489	-€73.631	-€64.759	-€61.607	-€51.960	-€46.668	-€36.130	-€23.785	38,0%

The algorithm used is based on several observations and assumptions. The first assumption is that there is a strictly monotonic increasing relationship between the educational level x of the 1st generation and the educational level $f(x)$ of the 2nd generation. The underlying idea is that higher educated 1st generation parents will on average have higher educated 2nd generation children.[56] It is allowed that f(x) shows a kink. The latter is based on the observation that, at the regional level in the 42 division (minus the Netherlands), there is a positive correlation between the education level of the 1st and 2nd generation, but that the increase in the regression line for the regions with an average[57] education level less than 5 ($\hat{y}$ = 0,43 + 3,85, R^2 = .47, *N* = 26, *Spearmans rho* = .63, *p* < .001) clearly differs from the regions with an average level of education higher than 5 ($\hat{y}$ = 0,99 + 0,05, R^2 = .73, *N* = 15, *Spearmans rho* = .84, *p* < .001).[58] A possible explanation for this is that immigrants with a low average level of education more often have 'unused educational potential' which is expressed in their second generation children born in the Netherlands. The relatively high proportion with at most primary school among (especially non-Western) first generation immigrants is an indication of this. In order not to complicate matters unnecessarily, four variants have been calculated in which it has been assumed that:

$$f(x) = \begin{cases} ax + b & for\ x < 5 \quad with\ a = 0{,}4\ or\ 0{,}6\ or\ 0{,}8\ or\ 1{,}0\ and\ b = 3, 2, 1\ respectively\ 0 \\ x & for\ x \geq 5 \end{cases}$$

Table 4.4 Probability distribution for educational attainment of 2nd generation children by educational attainment of 1st generation immigrants, for western immigration background.

Distribution by level of education (Western)										
		observation 1st generation								
Observation 2nd generation		primary 16,9%	VMBO B/K 9,6%	VMBO G/T 3,8%	MBO2, 3 13,6%	MBO4 10,1%	HAVO/VWO 10,4%	bachelor 18,7%	master 16,8%	control
primary	5,1%	8,7%	9,4%	7,4%	6,2%	5,2%	4,5%	2,1%	1,5%	5,1%
VMBO B/K	8,1%	11,1%	12,5%	10,6%	10,4%	7,0%	5,9%	6,9%	3,6%	8,1%
VMBO G/T	4,1%	4,8%	5,8%	9,3%	3,2%	5,4%	4,3%	3,5%	2,0%	4,2%
MBO2, 3	14,5%	21,3%	15,3%	14,2%	15,0%	13,5%	14,2%	10,6%	12,0%	14,5%
MBO4	15,7%	18,6%	14,3%	13,3%	17,6%	17,5%	14,6%	14,8%	13,3%	15,7%
HAVO/VWO	8,7%	6,0%	9,4%	12,1%	8,8%	11,6%	11,6%	7,4%	8,1%	8,7%
bachelor	25,3%	20,9%	19,4%	16,4%	22,1%	22,2%	24,8%	31,3%	32,8%	25,2%
master	18,5%	8,5%	13,9%	16,8%	16,8%	17,6%	20,1%	23,4%	26,7%	18,4%
Total		100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%
		Weighted average level of education 2nd generation, based on ranking SEC 8-part								
		4,74	4,88	5,01	5,26	5,43	5,63	5,93	6,21	10,0%
Western		Estimate of net contribution 2nd generation per level of education 1st generation								control
		-€48.971	-€38.307	-€32.084	-€24.879	-€19.616	-€10.892	€2.427	€13.329	33,0%

It has also been assumed that <u>for each separate level of education of the first generation</u>, the distribution across educational levels of the 2nd generation must be such that a higher level of education for

[56] There is generally sufficient empirical evidence for this, see for example: Statistics Netherlands StatLine, *Jongeren (15 tot 25 jaar); onderwijsniveau, kenmerken ouders*, retrieved 15-5-2022 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/84337NED/table?dl=68046

[57] In the rest of this paragraph, the weighted average is mentioned, weighted with the ranking of the SEC 8-part division, where 'primary school' has rank 1 and hob, wo master, doctor has grade 8.

[58] Something similar also applies to the 87 division into regions of origin.

the 1st generation is always associated with a higher weighted average level of education for the 2nd generation. This assumption is an extension of the first assumption. The latter is shown for non-western immigration backgrounds in Table 4.3, where the (weighted) average educational level of the 2nd generation of children varies from 4.73 for children of 1st generation parents with (at most) primary school to 5.93 for children of parents with a master's degree. The table shows that a higher average level of education in the 1st generation always results in a higher average level of education in the 2nd generation (see Table 4.4 for western immigration background). Finally, it has been similarly assumed that for each separate level of education of the 1st generation, the distribution across the levels of education of the 2nd generation must be such that a higher level of education for the 1st generation is always associated with a higher weighted average of the net contribution of the 2nd generation.

The algorithm now works as follows. Based on the previous assumptions, the following sum of squares (consisting of 4 partial sums) KS is minimised:

$$KS = \sum_{i=1}^{8}\sum_{j=1}^{8}\frac{P_{ij}\cdot(f(j)-i)^2}{100} + \sum_{j=1}^{7} Min\left(0, S_{j+1}-S_j-100\right)^2 + \sum_{j=1}^{8}\left(T_j-1000\right)^2 + \sum_{i=1}^{8} 2(O_i-E_i)^2$$

Herein, $P_{i,j}$ is the probability that a 2nd generation child achieves educational attainment level i if the 1st generation parent has educational attainment level j. This probability is used in the first partial sum to enforce the precondition that there is an (approximate) strictly monotonic increasing relationship $f(x)$ (one of the four options described above) between the educational level of the 1st generation and the 2nd generation. Furthermore, S_j is the sum product $S_j = \sum_{i=1}^{8} i \cdot P_{i,j}$ that is used in the second partial sum to enforce the precondition that a higher level of education for the 1st generation is always associated with a higher weighted average level of education for the 2nd generation. Furthermore, the sum $T_j = \sum_{i=1}^{8} P_{i,j}$ in the third partial sum is used to ensure that the column totals are approximately 100%.[59] Finally, O_i is the observation of the share of 2nd generation with education level i (see the sky-blue blocks in Table 4.3 and Table 4.4) and E_i the estimation thereof (see the lavender-coloured blocks) given by $E_i = \sum_{j=1}^{8} P_{i,j} \cdot Gen1_j$ in which $Gen1_j$ is the percentage of 1st generation immigrants with educational level j (see the light grey blocks). This is used in the fourth partial sum to ensure that the estimated percentages are such that the actual distribution across the levels of education for the 2nd generation is approximated correctly. The lavender-coloured blocks in Table 4.3 and Table 4.4 show that this is the case, as a check. The probabilities $P_{i,j}$ in Table 4.3 and Table 4.4 were obtained by minimising 500 times the sum of squares KS with a *brute force* genetic algorithm (1 million generations, only mutations on the values (integers[60]) of $0 \le P_{i,j} \le 1000$ for $1 \le i, j \le 8$) and taking the average of these. This was done four times: once for each variant of $f(x)$.

After determining the distribution of educational levels of the 2nd generation separately for each educational level of the 1st generation, the probabilities $P_{i,j}$ are normalised to probabilities $P'_{i,j}$ in such a way that $\sum_{i=1}^{8} P'_{i,j} = 1$.[61] With these normalised probabilities $P'_{i,j}$ an estimate for the weighted average of the net contribution for the 2nd generation has been calculated for each education level of the

[59] The calculation is carried out in promilles, which is why 1.000 is used instead of 100.

[60] The calculation is performed by expressing everything in promilles rounded to integers, hence $0 \le P_{i,j} \le 1000$.

[61] The algorithm works with promilles rounded to integers so first all numbers are divided by 1000 and then multiplied by a small correction factor to compensate for small deviations and ensure that everything adds up to 1.

1st generation separately, as follows: $\overline{NB_j} = \sum_{i=1}^{8} NB_i \cdot P'_{i,j}$, in which $\overline{NB_j}$ is the weighted average of 2nd generation children of 1st generation parents with education level j and NB_i is the net contribution of the 2nd generation with educational level i. The next step is to find out for which variant of $f(x)$ the estimated net contribution $\overline{NB_j}$ of the 2nd generation most evenly[62] increases with the level of education of the first generation. This was found to be the case for $f(x) = 0{,}6x + 2$ for non-western immigrants. For western immigrants, this was the case for each of the four variants of $f(x)$. Because the upward increase for western immigrants is smaller (16.8% have primary school in the first generation compared to 30.9% for non-western immigrants), we have chosen for western $f(x) = 0{,}8x + 1$. In addition, for non-Westerners, the algorithm described above was also executed 50 times with $f(x) = 0{,}4x + 3 \; for \; x < 5$ and 50 times with $f(x) = 0{,}8x + 1 \; for \; x < 5$. Ditto, for Western, 50 times the algorithm described above has been executed with $f(x) = 0{,}6x + 2 \; for \; x < 5$ and 50 times with $f(x) = 1{,}0x + 0 \; for \; x < 5$.

Table 4.5 Probability distribution for education level of 2nd generation children by education level of 1st generation immigrants, for the reference native.

Distribution by level of education (Native Dutch reference)										
		observation 45-65 year ('1e generation')								
observation 25-45 year ('2nd generation')		primary	VMBO B/K	VMBO G/T	MBO2, 3	MBO4	HAVO/VWO	bachelor	master	control
		6,6%	10,6%	7,2%	13,4%	17,2%	8,1%	22,3%	14,5%	
primary	4,0%	10,3%	9,2%	4,0%	5,4%	2,4%	4,0%	2,3%	0,5%	4,0%
VMBO B/K	4,7%	10,2%	6,6%	8,1%	3,5%	4,2%	4,1%	4,0%	2,2%	4,7%
VMBO G/T	3,2%	8,8%	4,6%	4,5%	4,2%	1,5%	3,0%	1,9%	2,3%	3,2%
MBO2, 3	11,1%	18,5%	15,0%	14,6%	12,7%	15,8%	7,7%	5,0%	7,3%	11,1%
MBO4	16,2%	13,9%	17,0%	17,2%	16,8%	17,9%	13,1%	16,5%	14,7%	16,2%
HAVO/VWO	6,9%	8,0%	8,3%	10,1%	6,0%	4,5%	10,7%	5,7%	7,2%	6,9%
bachelor	31,8%	17,4%	25,5%	24,9%	32,9%	32,7%	32,2%	36,7%	35,6%	31,7%
master	22,3%	12,9%	13,7%	16,6%	18,5%	21,0%	25,1%	27,9%	30,1%	22,2%
Total		100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%
		Weighted average level of education 2nd generation, based on ranking SEC 8-part								
Native Dutch reference		4,74	5,20	5,46	5,74	5,92	6,08	6,33	6,48	7,0%
		Estimate of net contribution 2nd generation per level of education 1st generation								control
		-€36.629	-€21.664	-€11.762	-€1.183	€5.831	€15.039	€25.256	€30.867	28,0%

Finally, the calculation of the net contributions $\overline{NB_j}$ of the 'second generation' reference native, is based on the distribution over education levels according to the SOI8 division of the population as a whole.[63] Of course, the reference native population does not really include 1st and 2nd generations. The proxy for the 1st generation is the unweighted average of the age groups 45 to 55 and 55 to 65, and the proxy for the 2nd generation is the unweighted average of the age groups 25 to 35 and 35 to 45. Furthermore, the algorithm described above was used that was also employed for westers and non-western, except that the algorithm was run 500 times for the following variants of $f(x)$:

62 In the other three variants, successive levels sometimes almost coincided..

63 Statistics Netherlands StatLine, *Bevolking; hoogstbehaald onderwijsniveau en onderwijsrichting,* retrieved 18-7-2022 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/85184NED/table?dl=6BB0B

$$f(x) = ax + b \ for \ 1 \leq x \leq 8 \ with \ a = 0{,}6 \ or \ 0{,}8 \ or \ 1{,}0 \ and \ b = 2, 1 \ and \ 0 \ respectively$$

In addition, the algorithm has also been run 500 times for:

$$f(x) = \begin{cases} 0{,}8x + 1 & voor \ x < 5 \\ x & voor \ x \geq 5 \end{cases}$$

i.e. for the variant calculated for western also 500 times.

As a final step, a selection was made from the many hundreds of transformation matrices computed by the algorithm to reduce the group differences. The following assumptions were made. (i) the 2nd generation children of a 1st generation reference native parent with at most primary school do not have a substantially higher average educational level than western and non-western children, because western and especially non-western children have a relatively high proportion with at most primary school, which suggests that their unused educational potential is relatively high. (ii) The group differences for the tertiary educated (bachelor and master) should be limited as much as reasonably possible, because the value of these programmes, insofar as enjoyed abroad, can best be determined. The benchmark is the percentage of 2nd generation children of highly educated 1st generation (SOI 3 division) parents who themselves have a low or secondary level of education. These percentages (as well as the cells on which their calculation is based) are outlined in Tables 4.3 to 4.5 in red/green/black and marked with a yellow cell with the word 'control' in it. We chose to limit the difference between non-western and western and western and reference native, respectively, such that the percentage of low-educated 2nd generation children of highly educated 1st generation parents is 13% for non-western, 10% for western and 7% for reference native. For the percentage of middle-educated 2nd generation children of highly educated 1st generation parents, the figure for non-westerners is 38%, for westerners 33% and for reference natives 28%. These percentages correlate well with the observed differences in the weighted average of 2nd generation educational attainment as shown in Tables 4.3 to 4.5. In the selection, boundary conditions were imposed to ensure the assumption of monotonically increasing educational attainment (i.e. to ensure the assumption that for each separate educational level of the 1st generation, the distribution across educational levels of the 2nd generation should be such that a higher educational level for the 1st generation is always associated with a higher weighted average of the educational level of the 2nd generation). In the end, Tables 4.3 to 4.5 are the average of 117, 214 and 86 transformation matrices. Further narrowing the group differences between non-western, western and reference native yielded numbers that were too small.

Finally, some comments on these calculations. (a) In follow-up research, these transformation matrices would be better derived directly from CBS microdata, based on the KINDOUDERTAB. However, there was no longer access to CBS microdata at the time the importance of this calculation was recognised. (b) This estimate of the net contribution of the 2nd generation described above was used for the recalculation in Table 9.4 in the second edition of the current report. An earlier version of the first four columns of this table appeared in the Journal of Political Economy, which had been calculated in a slightly different way (among other things, the net contribution of the '2nd generation' reference native-born had been calculated on the basis of Table 4.4 for westerners) making the results slightly different. (c) This brings us right to the point of sensitivity to assumptions. Different algorithms and assumptions have been experimented with, but their effects are limited (order of magnitude €10,000 and often much less) and are dwarfed by the large differences by migration background and education level observed for the 1st generation (see Table 9.4 of the current report).

Ad (V) In order to determine the extent to which group differences in net contribution are caused by group differences in education level at the time of immigration, group differences in Cito return, or group differences in educational return (for the underlined concepts mentioned, see the Glossary), Table 9.5, Table 9.6 and Table 9.7 are presented in §9.12 of the current report. These tables differ from the corresponding tables in the 1st edition. The 1st edition used the net contributions of zero-year-olds without remigration. In the 2nd edition, the revised Table 9.4 containing net contributions by first-generation immigrants with remigration was used. The calculation method in the 2nd edition is more policy-relevant, as admission policy primarily concerns the first generation. We refrained from presenting the results of both calculation methods in the 2nd edition, as this would lead to larger tables and a lot of explanation. The calculation method used in the 2nd edition produces different and generally lower results. Firstly, because remigration tends to reduce the differences (see Table 4.3 of the current report). Furthermore, the calculation for the second generation in the 2nd edition is no longer per individual, but per first-generation immigrant. This makes differences in child numbers come into play. Also, in the calculation, only about ⅔ of that child count is counted as second generation and ⅓ as first generation. An explanation of the calculation method for each table follows.

Table 9.5 of the current report gives an indication of the effect on the net contribution by differences in Cito return, i.e. group differences in highest attained education per given Cito score that arise in the educational system among the first and second generation. In concrete terms, this concerns differences such as: 'At the age of 38, native Dutch people with a Cito score of 530 have for 30% MBO4 as their highest attained education, and Western second generation people with a Cito score of 530 have for 35% MBO4 as their highest attained education. The effect of these kinds of differences in attainment is expressed as the difference in net contribution compared to the Native Dutch reference. In essence, it is examined how for a certain group the distribution of Cito scores leads to a distribution over education levels and subsequently this distribution over education levels is weighted with the amounts for the Native Dutch reference.

The computation is done as follows. For each combination of Cito score, migration background and generation (native and 1st and 2nd generation Western and non-Western), the probability distribution over education levels is known for 38-year-olds in the form of the transformation matrices discussed earlier in this section. These probabilities are indicated as P_{csmg} where $501 \leq c \leq 550$ is the relevant Cito score, s the relevant level of education in the SEC 8-part division, m the relevant migration background and g the relevant generation. The probabilities P_{csmg} refer to both the fraction that has s as the highest level of education obtained at the age of 38 and the fraction that has s as their current education (i.e. active students, a very small part of the total for this age). The different migration backgrounds are Native Dutch reference (NDR), western (WE) and non-western (NW). The generation g can be added to these designations as a number, so $NDR1$ for 1st generation Native Dutch reference and $WE2$ for 2nd generation Western migration background. Furthermore, N_{cmg} denotes the number of observations for Cito score c, migration background m and generation g on which the calculation of the probabilities is based. Finally, NB_{smg} denotes the net contribution according to columns 2, 5 and 6 of Table 9.4 from the current report. NB_{sWE1} thus represents the net contribution of a person with 1st generation western migration background and an education at level s. For each m and g, the weighted net contribution is now calculated as:

$$GNB_{mg} = \left(\sum_{c=501}^{550} N_{cmg} \cdot \sum_{s \in SEC8} P_{csmg} \cdot NB_{sNDRg} \right) \Big/ \sum_{c=501}^{550} N_{cmg}$$

The reported differences compared to reference natives V_{mg} in Table 9.5 (columns 4 and 5) are now calculated as: $V_{mg} = GNB_{mg} - GNB_{NDRg}$. The differences in Table 9.5 are robust: in other operationalisations, like weighing against the SOI 5 division, the outcomes are very similar.

The differences reported in Table 9.5 of the current report with the reference native are very small. In practice, the differences in net contribution compared to the reference native are mainly due to group differences in educational return (Table 9.6 of the current report) and differences in the distribution across educational levels (Table 9.7 of the current report).

Table 9.6 of the current report gives an indication of the effect that group differences in educational attainment have on the net contribution relative to the reference native. Table 9.4 of the current report shows that there are substantial group differences in educational attainment, i.e. substantial differences in average net contribution by migration background for individuals with the same level of education. For instance, the net contribution of 1st generation reference natives with MBO4 is €42,000 against -€78,000 for 1st generation western immigrants with MBO4. Table 9.7 gives an indication of the effect on net contribution by (self)selection on education level, i.e. by group differences in the distribution across education levels that arise among the 1st generation due to (self)selection processes at the time of immigration. The calculations in Tables 9.6 and 9.7 proceed as follows.

Starting from Table 9.4 of the current report, for generation g the difference V_{mg} in net contribution between migration background m and the reference native RA can be calculated as:

$$V_{mg} = \sum_{s \in SOI8} NB_{smg} \cdot P_{sm1} - \sum_{s \in SOI8} NB_{sRAg} \cdot P_{sRA1}$$

Herein, P_{sm1} represents the probability based on CBS microdata that a person with first-generation migration background has m education level s. There is obviously no 1st generation for the reference native. As a proxy, the P_{sRA1} are operationalised on the basis of the unweighted average of the distribution on education levels of the Dutch population according to the SOI8 division[64] for the age groups 45 to 55 and 55 to 65.

These calculations also use the previously mentioned net contributions NB_{smg} from Table 9.4 of the current report. Note that only the distribution on education levels of the first generation comes into play, as the resulting distribution on education levels of the second generation is already discounted in the results of Table 9.4 as explained above.

Note that previous expression can be rewritten as:

$$V_{mg} = V_{mg}^{9.6} + V_{mg}^{9.7}$$

in which:

[64] Statistics Netherlands StatLine, *Bevolking; hoogs behaald onderwijsniveau en onderwijsrichting,* retrieved 18-7-2022 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/85184NED/table?dl=6BB0B

$$
\begin{cases} V_{mg}^{9.6} = \sum_{s \in SOI8} NB_{smg} \cdot P_{sm1} - \sum_{s \in SOI8} NB_{sRAg} \cdot P_{sm1} \\ V_{mg}^{9.7} = \sum_{s \in SOI8} NB_{sRAg} \cdot P_{sm1} - \sum_{s \in SOI8} NB_{sRAg} \cdot P_{sRA1} \end{cases}
$$

The differences $V_{mg}^{9.6}$ are reported in Table 9.6 of the current report. Given generation g, the $V_{mg}^{9.6}$ can be interpreted as that part of the group difference in net contribution relative to the reference native that arises from differences between the net contributions NB_{smg} for individuals with migration background m and education level s and the net contribution NB_{sRAg} for reference natives with the same education level s.

The differences $V_{mg}^{9.7}$ are reported in Table 9.7 of the current report. For given generation g, the $V_{mg}^{9.7}$ can be interpreted as that part of the group difference in net contribution relative to the reference native that arises from differences in the distribution across education levels, i.e. the differences between the probability P_{sm1} that individuals with migration background m have education level s and the probability P_{sRA1} that reference natives have education level s.

4.3 Immigration motive

The immigration motive for the first generation is derived from the Statistics Netherlands microdata file VRLMIGMOTBUS for the reporting years 2015 and 2017 and based on the classification into the five categories of the variable VRLVERBLIJFSDOEL, i.e., labour, study, asylum, family immigration and other. The VRLVERBLIJFSDOEL variable is the "immigration motive of the IND that is published after imputation (and other adjustments)."[65]

The term 'immigration motive' here is an administrative-legal concept. It is the motive on which the immigrant applied and obtained a residence permit and that does not exclude the possibility that other motives played a role in the immigration decision. In addition, this concerns data imputed by Statistics Netherlands, i.e., Statistics Netherlands has made an estimate based on the characteristics of the immigrants for whom the motive is known, of the most likely motive for the immigrants whose motive is unknown.[66] Finally, these data are only available from 1995 onwards.[67]

The immigration motive is a tricky variable that is regularly reviewed by Statistics Netherlands.[68] There are several variables related to the immigration motive that appear under different names in the Statistics Netherlands documentation, including immigration motive, immigration reason, purpose of stay and inferred immigration purpose. Comparisons of successive, at first sight apparently related tables, therefore show different results for the same reporting year and for comparable categories such as 'Asian labour immigrants', partly because tables sometimes report immigration motive and sometimes

[65] Statistics Netherlands, *Vrlmigmotbus: Migratiemotieven*, retrieved 12-2-2021 from: https://www.cbs.nl/nl-nl/onze-diensten/maatwerk-en-microdata/microdata-zelf-onderzoek-doen/microdatabestanden/vrlmigmot-bus-migratiemotieven

[66] For non-EU/EFTA immigrants this motive is unknown in about 1% of the cases, Statistics Netherlands *Statistiek Migratiemotieven*, retrieved 12-2-2021 from: https://www.cbs.nl/nl-nl/onze-diensten/methoden/onderzoeksomschrijvingen/korte-onderzoeksbeschrijvingen/statistiek-migratiemotieven

[67] See also the Statistics Netherlands microdata documentation.

[68] Compare, for example, Population Forecast 2017-2060: Migration Assumptions, Statistics Netherlands for more on the immigration rationale/motive and the Statistics Netherlands microdata documentation.

immigration reason and sometimes a breakdown is made by country of birth[69], sometimes by nationality[70] and sometimes by immigration background[71].

In addition, for certain groups, quite a few immigrants have other immigration motives in addition to or instead of the immigration motive based on the IND statistics. Statistics Netherlands therefore publishes statistics on the derived immigration target based on actual behaviour.[72] These statistics do not look at the motive (other than asylum) that people reported to the IND, but at other data such as the main source of income or the fact that someone is studying.

For the sake of clarity, the current report only used the variable VRLVERBLIJFSDOEL from VRLMIGMOTBUS, i.e., the 'migration motive of the IND', both for making the age profiles for the net contribution and for estimating the distribution over immigration motives per combination of immigration year and origin group. This is also the most policy-relevant approach because this operationalisation is directly based on the grounds of the admission policy checked by the IND.

Table 4.6 The occurrence of combinations of the immigration motive family immigration with other motives (labour, asylum, study and other) as a percentage of all possible combinations, for fathers and mothers of second-generation immigrants with simultaneous and non-simultaneous immigration.

	percentage of all possible combinations in case of immigration dates of the parents are		
	different	the same	total
mother family immigration, father other motive	39%	36%	38%
father family immigration, mother other motive	10%	6%	9%
ratio	3.9	6.1	4.2

Because people sometimes immigrate more than once, only the last motive given was used. The motive has been determined separately for zero-year-olds (year-end 2016) and for people of one year or older (year-end 2016). The motives given in 2016 from VRLMIGMOTBUS reporting year 2017 have been used for zero-year-olds. For people aged 1 year or older, the last stated motive up to the end of 2015, i.e., the motives after the end of 2015 were first removed from VRLMIGMOTBUS reporting year 2017 and then the last immigration motive was determined. This was done because for ages from one year old the analysis concerns the population residing in the Netherlands on 1 January 2016 and immigration movements from 1 January 2016 are therefore irrelevant.

An immigration motive has also been inferred for the second generation. This was done by attributing the motives of the parents to the child via the Statistics Netherlands microdata file KINDOUDERTAB. When determining the immigration motive of the child, the following definition was chosen:

- the child's motive is the same as the father's motive;
- if the father's motive is family reunification, the mother's motive is used.

[69] Retrieved 19-4-2023 from: https://opendata.cbs.nl/#/CBS/nl/dataset/70693ned/table?dl=3F3D4
[70] Retrieved 19-4-2023 from: https://opendata.cbs.nl/#/CBS/nl/dataset/84809NED/table?dl=3F3D5
[71] Retrieved 19-4-2023 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/84140NED/table?dl=3F3D6
[72] Statistics Netherlands, *Statistiek Migratiemotieven*, retrieved 12-2-2021 from: https://www.cbs.nl/nl-nl/onze-diensten/methoden/onderzoeksomschrijvingen/korte-onderzoeksbeschrijvingen/statistiek-migratiemotieven

This approach is simple, unambiguous and easy to replicate and does justice to the empirical evidence.[73] Empirically, the father often turns out to be decisive for the motive. An indication is that the combinations with 'motive mother = family immigration, motive father is different' are much more numerous than the combinations with 'motive father = family immigration, motive mother is different'. This is the case both if both parents have different immigration dates and if both parents have the same immigration date, see Table 4.6. Apparently, family immigration is often a secondary motive, whereby one parent comes with the (main) purpose of work, asylum, study or other and the other parent comes with the purpose of family immigration. For that reason, the child is assigned to the main purpose (work, asylum, study or other) because this is the underlying motive of the fact that the child is a resident of the Netherlands.

4.4 Region

In order to be able to investigate to what extent the net contribution depends on the region of origin, a geographical division of the world has been made, see Table 4.7. In principle, this is based on existing classifications by Statistics Netherlands. Where possible and useful, the division into world regions used by the United Nations was also used.[74] In addition, it was examined whether the number of observations for each region would be sufficient for the necessary computations. Where possible, geographically contiguous areas have also been chosen to avoid misleading effects when interpreting the world maps. Within the aforementioned preconditions, an attempt has also been made to combine similar countries, with explicit reference to economic development and important regions of asylum origin.

The roughest division is Dutch background versus immigration background. This is actually a dichotomy of the Netherlands and the rest of the world. There is also the Statistics Netherlands classification Western and non-Western (Statistics Netherlands uses the term 'country type' (*'landtype'*) in the microdata files). In addition, the Statistics Netherlands 12-part division was used, which Statistics Netherlands also uses for the population forecasts, for example. This division is a further refinement of the Western and non-Western regions. The Western regions are: European Union, Rest of Europe, Indonesia, Rest outside Europe. The non-Western regions are Asia (excl. Indonesia and Japan), Turkey, Morocco, Africa (excl. Morocco), Suriname, Aruba and the (former) Dutch Antilles and Latin America (excl. Suriname, Aruba and the Antilles).

This division is further subdivided into a 42-part division in the current report, as shown in Table 4.7 and Figure 4.3. This is done with an intermediate step (column 19-part division in the table). For Europe, the existing classifications of Statistics Netherlands (CBS) such as GIPS countries (Greece, Italy, Portugal, Spain, supplemented in the current report by Malta and Cyprus) and CEE countries (Central and Eastern European countries, in the current report Estonia, Latvia, Lithuania, Poland, Czech Republic, Slovakia, Hungary, Slovenia, Croatia, Romania and Bulgaria) have been used as much as possible.

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[73] The approach is inspired by the attribution of the immigration background in the second generation according to the Statistics Netherlands definition, with the difference that, based on empirical evidence, primacy has been placed with the father instead of the mother.

[74] See, for example, United Nations Statistics Division *Methodology: Standard country or area codes for statistical use (M49 Standard), Geographic Regions*, retrieved 4-7-2021 from: https://unstats.un.org/unsd/methodology/m49/

Table 4.7 Regional division.

Country type	12-part division	19-part division	42-part division
Western	Netherlands	Netherlands	Netherlands
	European Union	Western Europa (UN region)	Belgium and Luxemburg
			Germany and Austria
			France
		UK, Ireland, Denmark, Sweden and Finland	Denmark, Sweden and Finland
			UK and Ireland
		GIPS countries, Malta and Cyprus	Greece and Cyprus
			Italy and Malta
			Portugal
			Spain
		CEE countries	Bulgaria and Romania
			Hungary, Czech Republic, Slovakia, Slovenia and Croatia
			Poland and Baltic states
	Other Europe	Other Europe	EFTA, dwarf states and crown dependencies
			Former Yugoslavia (excl. Slovenia and Croatia) and Albania
			Former Soviet Union (excl. Baltic states)
	Other outside Europe	Other outside Europe	North America
			Oceania
			Japan
	Indonesia	Indonesia	Indonesia
Non-Western	Asia (excl. Indonesia and Japan)	East Asia	South Korea, Taiwan, Hong Kong and Singapore
			China, Mongolia and North Korea
		South East Asia	Philippines, Malaysia, Brunei and East Timor
			Thailand, Indochina and Myanmar
		Indian subcontinent	Indian subcontinent excl. Pakistan
			Pakistan
		West Asia	Afghanistan, Iran, Syria and Iraq
			Israel
			Arabian Peninsula, Jordan and Lebanon
	Turkey	Turkey	Turkey
	Morocco	Morocco	Morocco
	Africa (excl. Morocco)	North Africa (excl. Morocco)	North Africa (excl. Morocco)
		Sub-Sahara Afrika	West Africa
			Central Africa
			Horn of Africa and Sudan
			East Africa
			South Africa
	Suriname	Suriname	Suriname
	Aruba and (former) Dutch Antilles	Aruba and (former) Dutch Antilles	Aruba and (former) Dutch Antilles
	Latin America (excl. Suriname, Aruba and the Antilles)	Latin America (excl. Suriname, Aruba and the Antilles)	Brazil, Argentina, Paraguay, Uruguay, Chile and French Guyana
			Caribbean
			Central America and South America Other

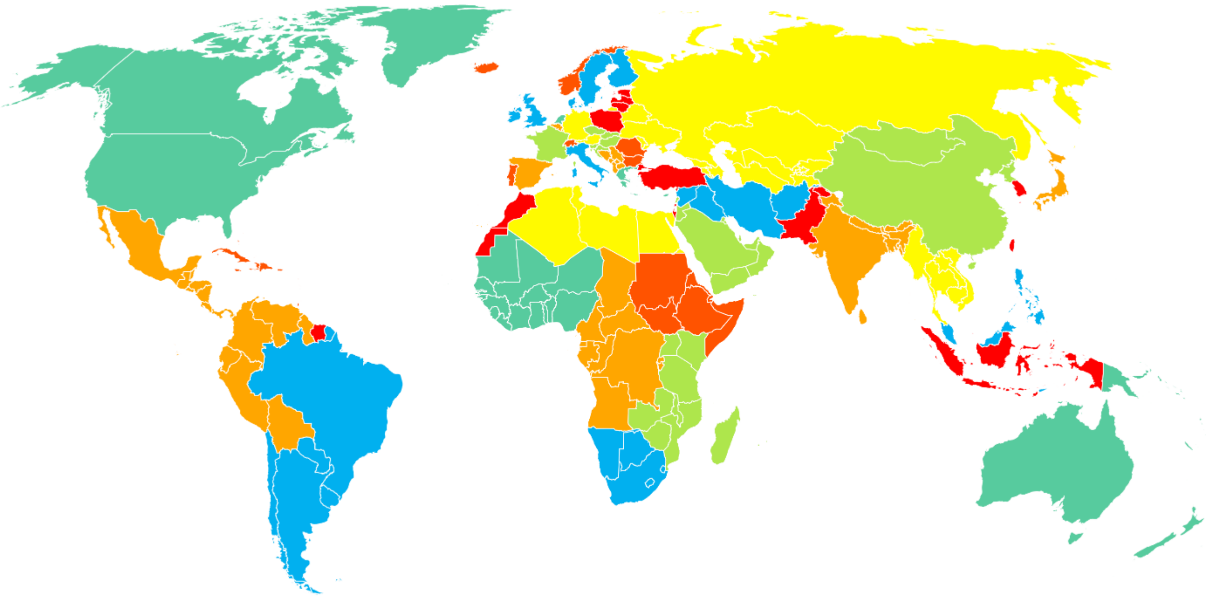

Figure 4.3 Regional classification according to the 42-part division.

Furthermore, two countries, the former Yugoslavia and the former Soviet Union, have in principle not been split up as much as possible, because there are often few immigrants from the countries that arose after the break-up. An exception is made for Croatia, Slovenia and the Baltic States that are part of the CEE countries. For that reason, the Central Asian republics of the Former Soviet Union are also not separately distinguished. The former Yugoslavia and the former Soviet Union were analysed separately. These regions further distinguish themselves from the other European countries because many asylum seekers come from them. The region EFTA, microstates and crown dependencies is a residual category that results more or less imperatively from existing Statistics Netherlands classifications.[75] Turkey is classified separately in accordance with Statistics Netherlands classifications. Oceania has been listed as a separate region in accordance with the Statistics Netherlands division into continents.

In Asia, Japan and Indonesia have been labelled as separate Western regions, following the example of Statistics Netherlands. Furthermore, the UN region divisions East Asia and Southeast Asia have been maintained (but excluding Japan and Indonesia). Within the East Asia region, the so-called Asian tigers South Korea, Taiwan, Hong Kong and Singapore have been taken separately as sub-regions. The UN region Central Asia has been eliminated due to the aforementioned restrictions on data for the former Soviet Union. The UN region of West Asia (excluding Turkey) has therefore been expanded to include Afghanistan, Iran and Iraq. In the further division of the West Asia region, Israel is classified separately because it differs in many respects from neighbouring countries. In addition, the regions of the Arabian Peninsula, Jordan and Lebanon (predominantly relatively prosperous countries) and Afghanistan, Iran, Iraq and Syria (predominantly asylum immigration) have been created. The remainder of Asia has been renamed the Indian subcontinent region, further subdivided into Pakistan and the rest of the Indian subcontinent.

In Africa, the UN division into North, West, Central and Southern Africa is in principle used. However, in addition, a Horn of Africa and Sudan region has been created (Somalia, Eritrea, Ethiopia, Djibouti, and North and South Sudan). This was done because many asylum immigrants come from this region.

[75] This has to do with avoiding the disclosure risk that could arise from combining regions.

In this way, differences between regions of asylum origin and other regions can be made transparent. In addition, Burundi and Rwanda have been added to Central Africa to prevent too small numbers of observations for certain ages. Finally, Morocco was analysed separately because of existing Statistics Netherlands classifications.

For America, the UN regions of North America and the Caribbean have been retained. In addition, Suriname and the former Antilles have been distinguished. The UN regions of Central America and South America have been reclassified due to lack of data. The more developed southern countries, namely Chile, French Guiana and the countries belonging to the so-called Mercosur customs union (Brazil, Argentina, Paraguay and Uruguay) have been separated as regions and the rest of Latin America designated as the region Central America and South America Other.

The division into regions involves a trade-off between accuracy and reliability. With a rough classification, the numbers are large, but at the same time potentially disparate countries of origin are added together. In other words, the reliability is high, but the accuracy is not. With a finer layout there is more detail, but that is at the expense of reliability if the groups are too small. In §6.5 of the current report, a division into 87 regions is used, which is a refinement of the 42-part division.

5 Cost and benefit items

5.1 Cost and benefit items

The calculation made in the current report is as close as possible to the CPB's generational accounting. The calculations are based on age profiles (0-99 years) for the Dutch population for the most important cost and benefit items, which have been made available by the CPB for the years 2016, 2021, 2030, 2040, 2050 and 2060. This data comes from a projection to 2060 for the *CPB Update Medium-Term Forecast 2018-2021* (*Actualisatie Middellangetermijnverkenning 2018-2021*, see §8.1).

These age profiles run from 0 to 99 years old and indicate for each age the amount for the relevant item in one of the six years mentioned. These profiles incorporate the expectations with regard to policy and (trend) growth that the CPB had at the time of production. That is why the reference year 2016 has been chosen in the current study, which is the start of the time series made available by the CPB. For 2016, all items and the associated macro amounts (i.e., not the amounts per age) are shown in Table 5.1.

These CPB (age) profiles have been extended by interpolation and extrapolation to all years required for the calculation.[76] By dividing all amounts by the corresponding amount for 2016, a weight has been determined for each item, age and year from 2016 by which an amount in 2016 can be multiplied to obtain the value of that amount for a future year for the relevant item and age. This weight matrix makes it possible to supplement the CPB profiles with empirical data based on, for example, Statistics Netherlands microdata and then to implement the changes expected by the CPB due to economic growth, policy changes and the like.

The division into items and the CPB profiles form the basis of the calculation. In the operationalisation of each item, the fundamental choice was always made between calculating it ourselves or based on the CPB profiles. This is shown in Table 5.1 in the Operationalisation column. If only 'CPB profile' is listed there, the CPB profile for 2016 has been used in full (this concerns items no. 2, 10, 13, 14, 22 and 23). In all other cases, the operationalisation took place wholly or partly on the basis of empirical data such as Statistics Netherlands microdata and Statistics Netherlands StatLine data. In those cases, the CPB profile for 2016 has been completely or partially replaced by a self-calculated age profile.

The resulting total amount from the model for the current report was then calibrated to obtain the relevant CPB macro amount for each of the 23 items, weighted by the age structure of the total study population described in Chapter 3.

[76] The profiles assume an economic growth of 3.5%, so the extrapolation from 2060 is in principle done with this growth rate. This was subsequently calculated back to more recent CPB estimates of the growth rate and discount rate, see Chapter 8. The interpolation was done exponentially, if possible, by estimating the growth factor and linearly for a limited number of cases where this was not possible.

Table 5.1 Operationalisation per item and sub-item and macro amount per (sub-)item in billions of euros. Only the most important Statistics Netherlands microdata files are shown. Source classification in items and macro amounts per sub-item: CPB.

No.	Item	Operationalisation	Amount
	TOTAL EXPENDITURE		**299.9**
1	Public administration	Statistics Netherlands StatLine and customised data on Security, CPB profile	64.9
2	Defence	CPB profile	6.9
3	Education	Statistics Netherlands microdata for 2015 and 2016 ONDERWIJSDEELNEMERSTAB, Statistics Netherlands StatLine, Statistics Netherlands customised tables, government budgets	31.4
4	Child benefit / Student Financing (AKW/WSF)	Statistics Netherlands microdata INPATAB 2016	5.2
5	Disability / Sickness Benefits Act (ZW)	Statistics Netherlands microdata INPATAB 2016	13.4
6	Unemployment	Statistics Netherlands microdata INPATAB 2016	6.9
7	Social assistance / Surviving Dependants Benefit (ANW)	Statistics Netherlands microdata INPATAB 2016	7.4
8	Other social security	Statistics Netherlands microdata INPATAB 2016, CPB profile	17.3
9	State pension	Statistics Netherlands microdata INPATAB 2016	36.9
10	Transfers abroad	CPB profile	10.5
11	Subsidies	Statistics Netherlands microdata INPATAB 2016	9.4
12	Healthcare	Statistics Netherlands microdata ZFWZORGKOSTENTAB and Childcare, Vektis-data, CPB profile	65.3
13	Gross investment in buildings	CPB profile	8.5
14	Gross investment in infrastructure	CPB profile	10.1
15	Gross investment in schools	Statistics Netherlands microdata for 2015 and 2016 ONDERWIJSDEELNEMERSTAB	5.9
	TOTAL INCOME		**298.8**
16	Wage and income tax and social security contributions (LIS)	Statistics Netherlands microdata INPATAB 2016	153.2
17	Other direct household taxes	Statistics Netherlands microdata INPATAB 2016	7.9
18	Inheritance tax	CPB profile in conjunction with Statistics Netherlands microdata INPATAB 2016 and Statistics Netherlands StatLine data	1.7
19	Corporate tax (VPB) and dividend tax of Dutch companies	CPB profile in conjunction with Statistics Netherlands microdata INPATAB 2016 and Statistics Netherlands StatLine data	21.8
20	Other indirect taxes and non-tax resources (IRN)	Statistics Netherlands microdata INPATAB 2016, INHATAB 2016 and Statistics Netherlands StatLine data in proportion to percentile gross income	68.1
21	Other indirect taxes and non-tax resources of companies	CPB profile in conjunction with Statistics Netherlands microdata INPATAB 2016 and Statistics Netherlands StatLine data	16.1
22	Net land sales	CPB profile	2.3
23	Other non-tax resources	CPB profile	27.8

Subsequently, the net contribution (i.e., the discounted net contribution over the life course) was calibrated. For this purpose, the net contribution *N* over the life course of a Dutch resident born in 2016 (*N*= –€54,839) has been used as a guideline, based on the basic dataset of *Minder zorg om vergrijzing* and the discount rate of 3% real and 5% nominal assumed in this report, and productivity growth of 1.5% real and 3.5% nominal. The calibration was performed using the estimate needed to configure the effect of the gradual adjustment of the state pension age[77] on social security (see also §5.6).

NB: In Chapter 8 of the current report, a number of items have been rearranged, split or combined. How this was done is explained in the introduction to the relevant sections of Chapter 8.

5.2 Security

For most expenditures that fall under the item Public administration (Table 5.1, item no. 1), it is assumed that the benefits and costs are equally distributed among all residents. This concerns a variety of matters such as executive and legislative bodies, public order and security, economic affairs and environmental protection.[78] Of this, only according to immigration background, a distinction has been made for the COFOG function of public order and security, for an amount of 10 billion euros, which is argued as follows.

The macro amount for the COFOG function of public order and safety is approximately 13 billion euros. Of this, 1.7 billion relates to the fire service. The rest relates to crime and the like. In addition, 1.2 billion euros will be spent on research and other aspects of public order and safety. The remaining COFOG police, judiciary and prison items together amount to approximately 10 billion euros.[79] The latter amount can be taken as a conservative proxy for total crime-related government spending.

It can also be argued in the following way that 10 billion euros is a reasonable and conservative estimate for the total security costs to be differentiated according to immigration background. The tables (discontinued in 2015) on the average costs for security for the years 2010-2015 show that an average of approximately 7 billion euros is spent on the investigation, prosecution, trial, enforcement and support of victims, suspects and perpetrators. In addition, 6 billion euros is spent on prevention. It is conservatively estimated that half (3 billion euros) of that money is related to the prevention of criminal offences. Together with the previously mentioned 7 billion euros, this is also an amount of 10 billion euros.[80]

Subsequently, the amount of 10 billion euros is divided among people in proportion to the number of registered suspects per 10,000 inhabitants. Statistics Netherlands StatLine data was used for the number of suspects by age (five groups) and immigration background.[81] These data are available for 70 countries of origin (first and second generation) and also for people with a Dutch and (non-)Western immigration background and several other categories. The average of these data has been taken for the years 2014-2018. In principle, this was done for the first and second generations separately. There

[77] According to the growth path that applied until the so-called pension agreement, also see §8.1.
[78] In fact, these are all COFOG functions that are not already covered by the other expenditure items in Table 5.1, retrieved 19-4-2023 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/82902NED/table?dl=308CD
[79] Retrieved 19-4-2023 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/82902NED/table?dl=308CD
[80] Retrieved 19-4-2023 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/80162NED/table?dl=31700
[81] Statistics Netherlands StatLine, *Verdachten; geslacht, leeftijd, migratieachtergrond en generatie*, retrieved 25-12-2020 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/81959NED/table?dl=486C3

was insufficient data for a number of combinations[82] of country of origin and age group. In those cases, the data is taken from both generations together. In a limited number of cases[83] this data was also not available and the average was derived from the number of suspects for all ages of the relevant group in combination with the proportions in the number of suspects between the different age groups in the population as a whole.

The previous exercise provides the number of suspects per age group, broken down by immigration background. However, there are significant group differences when it comes to the proportion of suspects who go through the different stages of the criminal justice chain. This concerns, for example, differences in the percentage of suspects who are detained. In order to take these differences into account, it has been calculated, in accordance with Statistics Netherlands' customised tables[84], how often a registered suspect is subject to prosecution, summons, conviction with a sentence and enforcement of a prison sentence. This results in five weights for the five stages of the legal chain, whereby the 'registered suspect' stage always has weight 1 and the other stages mentioned have the weight that corresponds to the overrepresentation compared to native Dutch people. The Statistics Netherlands customised table mentioned does not contain data for Western immigrants; these are estimated on the basis of Statistics Netherlands StatLine data.

Subsequently, the relative weights calculated per group for the five stages of the legal chain were weighted against the share in the costs of each stage. For this purpose, data were used on the average costs for security for the years 2010-2015 and the COFOG data for 2016.[85] [86] Assuming that half of the total amount for prevention is allocated to people, this amounts to 3 billion euros or 30% of the total assumed costs of 10 billion euros. These are allocated to all registered suspects and are assigned weight 1 of the 'registered suspect'[87] stage. Furthermore, 23% is spent on detention and this is given the weight of the 'enforcement with imprisonment' stage. Prosecution accounts for about 7% of the costs and is given the weight of the 'prosecution' stage. Investigation covers 22% of the costs and is given the weight of the 'summons' stage. The costs of trial and support for victims, suspects and perpetrators make up the remaining 11% and are given the weight of the 'declaration of guilt with punishment' stage. Although the cost items may not perfectly match the stages, cost differences between the different types of suspects are broadly taken into account.

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[82] More than two thirds of the cases concern teenagers (12 to 18 years, mainly first generation) and the elderly (65 years or older, mainly second generation), often from origin groups with a relatively small presence in the Netherlands. This limits the bias for two reasons. When aggregating over all countries according to (at least) the Statistics Netherlands 42-part division, immigration backgrounds with relatively small groups also count for little in the total per region of origin. Furthermore, net contribution data of teens and the over-65s count in determining net contribution over the life course much less than the intermediate ages, as explained elsewhere in this appendix.

[83] Twice in the age category 12 to 18 years and 27 times in the age category 65 years or older.

[84] Statistics Netherlands customised table, *Migratieachtergrond van personen in de strafrechtketen*, retrieved 12-02-2021 from: https://www.cbs.nl/nl-nl/maatwerk/2019/10/migratieachtergrond-van-personen-in-de-strafrechtketen

[85] Statistics Netherlands StatLine, *Overheidsuitgaven; naar functies 1995-2016*, retrieved 12-02-2021 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/82902NED/table?dl=308CD

[86] Statistics Netherlands StatLine, *Veiligheidszorg; kerncijfers 2002-2015*, retrieved 12-02-2021 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/80162NED/table?dl=31700

[87] There are therefore no cost differences between groups for the registered suspects, but there are for the other four stages in the legal chain.

Finally, the numbers of suspects per immigration background are multiplied by the weights discussed in the previous paragraphs. Based on the data obtained in this way, we then aggregated to first and second generation and region of origin for the Statistics Netherlands 42-part division, 19-part division, 12-part division, 2-part division and the totals for the Dutch background and first and second-generation immigration background. Age profiles were then made on the basis of this, which, based on the data on the basis of the age profile for the population as a whole, were calibrated to the macro amount of 10 billion euros outlined earlier. For education and combinations of education with the Western/non-Western classification, additional data on suspects according to education level were used as a proxy.[88]

5.3 Education and gross investment in schools

This section explains the operationalisation of the items Education and Gross investments in schools (Table 5.1, item no. 3 and 15). Most of the explanation is devoted to the item Education. Two other related items are discussed beforehand.

The first item is formed by gross investments in schools. These have been allocated pro rata to educational participants: weight one for participation in education during 2015 *and* 2016, weight two thirds for participation in 2015 alone and one third for participation in 2016 alone. Participation is operationalised as registration on the reference date 1 October of the reporting year of the Statistics Netherlands microdata file ONDERWIJSDEELNEMERSTAB. The resulting variable was then weighted according to the age structure of the total study population described in Chapter 3 and then the resulting total amount was calibrated to obtain the CPB macro amount for the gross investment in schools from Table 5.1.

The second item is formed by the education costs that are not paid for the non-EEA students. For this, a lump sum of an estimated average study duration of 2.9 years at €6,700 has been deducted from the total costs for the students concerned.[89] Higher or lower tuition fees have not been taken into account because that does not go through the fiscal channel. Nor is the degree of participation in expensive fields of study such as technical studies and medicine taken into account. This is a one-off revenue, which is deducted after calculating the net contribution.

The rest of this section deals with the operationalisation of the Education item. The costs for education are based on our own calculation of the costs per type of education in combination with the data for participation in the different types of education based on the Statistics Netherlands microdata file ONDERWIJSDEELNEMERSTAB for the reporting years 2015 and 2016. All participants in government-funded education are included in the ONDERWIJSDEELNEMERSTAB. All variables from OPLEIDINGSNRREFV20 and CTOREFV8 have been added to the ONDERWIJSDEELNEMERSTAB files via the 'help files' OPLEIDINGSNRREFV20 and CTOREFV8. Dummy variables were then added to account for the

[88] Statistics Netherlands StatLine, *Verdachte jongeren; geslacht, herkomst, opleiding en recidive, 2006-2014*, retrieved 10-2-2021 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/81978NED/table?dl=3C860

[89] Compare CPB memorandum *Economische effecten van internationalisering in het hoger onderwijs en mbo*, 2019. Figure 3.3, number of non-EEA students for 2016 and the average study duration as given in Table 5.2. The amount of €6,700 is derived from the National Budget 2016.

education types[90] primary education, secondary education (VMBO, HAVO, VWO), MBO, HBO[91], WO[92] Bachelor and WO Master, this for the purpose of calculating the costs per (cluster of) education type(s) as shown in Table 8.2 of the current report. In this, MBO1 is counted as MBO. Furthermore, dummy variables have been made for whether or not to attend learning support education (LWOO), practical education (Praktijkonderwijs) and special (primary) education. After that, costs were allocated to students for each type of education. The calculations are based on the annual reports accompanying the 2016 budget, customised tables[93] of the costs per diploma from Statistics Netherlands and Statistics Netherlands StatLine tables on the same subject.[94] The calculation for 2016 is explained below. The calculation for 2015 is similar.[95]

In order to average out measurement errors as much as possible, the calculation was performed three times. Firstly, the amounts for 2015 and for 2016 were derived from amounts stated for these years in the annual report accompanying the national budget for 2016.[96] Secondly, the amounts were calculated as much as possible on the basis of a customised calculation by Statistics Netherlands for the costs per diploma for the standard route for 2015.[97] Subsequently, the two amounts for 2015 were combined with the data on the education participants in 2015, and the amount for 2016 was combined with the education participants in 2016. Finally, these three amounts are averaged, whereby each counted for one-third.

The operationalisations of primary education, secondary education and tertiary education (MBO, HBO (bachelor and wo) are given below.

Primary education includes primary education and special (primary) education. This is not further broken down in the annual report accompanying the budget, but because the differences in costs are considerable, this has been done in the current report. The costs of special (primary) education for 2016 are based on the macro amount for 2016 given on Statistics Netherlands StatLine for government expenditure of €1,297 million and the total number of participants for 2016/2017 of 100.9 thousand students. This gives an amount of €12,854 per student.

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[90] See the term *Standard Education Classification* in the Glossary of the current report.

[91] HBO is the abbreviation of *Hoger Beroeps Onderwijs* which stands for 'higher vocational training', usually at bachelor level.

[92] WO is the abbreviation of *Wetenschappelijk Onderwijs* which stands for 'scientific education' at bachelor or master level.

[93] Retrieved 19-4-2023 from: https://www.cbs.nl/nl-nl/nieuws/2016/51/mbo-diploma-nu-net-zo-duur-als-universitaire-master

[94] Due to budget constraints and/or the lack of data, it was not always possible to extract the numbers from Statistics Netherlands microdata files ourselves, because not all file subjects were available. Sometimes amounts rounded to multiples of €100 have been taken from certain sources, sometimes amounts have been calculated ourselves and amounts rounded to euros have been used. Without wishing to falsely suggest precision, the amounts rounded to euros have been used for the calculated amounts.

[95] The amounts reported in this section for 2015 deviate slightly. Partly for this reason, the amounts reported in this section deviate from the average amounts used in the calculation as given in Table 8.2 of the current report. For the rest, minor deviations were caused by the fact that the education participants were surveyed at two reference moments (1 October 2015, and 1 October 2016), see the next paragraph.

[96] Retrieved 19-4-2023 from: https://www.rijksfinancien.nl/jaarverslag/2016

[97] Retrieved 19-4-2023 from: https://www.cbs.nl/-/media/_excel/2016/51/onderwijsuitgaven-diplomas-maatwerk.xls

The costs of regular primary education are based on the numbers of students stated in the annual report accompanying the budget for 2016. Important here is the so-called weight regulation; schools can receive extra money according to a certain system for students with less-educated parents. In 2016/2017, primary schools received extra funding for 45,950 virtual pupils in accordance with this weighting scheme.

The costs of regular primary education are based on the macro amount for 2016 given on the Statistics Netherlands StatLine for government expenditure of €9,402 million.[98] This amount is divided by the total number of participants for 2016/2017 of 1,427.3 thousand pupils[99], increased by 45,950 virtual pupils for which schools received extra funding in 2016 in connection with the aforementioned weighting scheme. This gives an amount of €6,382 per pupil for regular primary education. This amount has been increased separately for each group in accordance with the weighting system. The amounts allocated to people for the weighting scheme are explained at the end of the section, after the discussion per individual school level.

In principle, the costs for secondary education are derived from the annual report accompanying the budget for 2016.[100] Table 3.2 in the annual report shows the number of students and the average costs per student, which have been set at €8,194. Of course, there are all kinds of differences between types of education that also entail differences in costs. These differences have been ignored, in line with current calculations by Statistics Netherlands, among others.[101] However, the costs for learning support education (LWOO) and practical education (*Praktijkschool*) are significantly higher than the average costs for the other forms of secondary education, mainly due to higher personnel costs. An additional funding for 2016 has been set by ministerial regulation at €4,111.[102] Based on the amounts and numbers given in the annual report with the budget, this brings the costs for regular secondary education students to €7,699 and for learning support education (LWOO) and practical education (*Praktijkschool*) students to €11,810.[103]

The costs for the upper secondary education (MBO) are derived from the annual report accompanying the national budget for 2016 and have been set at €8,000 per pupil.[104] The costs for tertiary education (HBO) are also derived from the annual report accompanying the national budget for 2016 and have been set at €6,800 per student.[105] As a check, the costs for HBO have also been calculated by converting the costs from a customised calculation by Statistics Netherlands for the costs per diploma for the

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[98] Retrieved 19-4-2023 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/80393ned/table?dl=1528B
[99] Retrieved 19-4-2023 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/37220/table?dl=1528C
[100] Retrieved 19-4-2023 from: http://www.rijksbegroting.nl/2016/verantwoording/jaarverslag,kst233799_8.html
[101] Retrieved 19-4-2023 from: https://www.cbs.nl/nl-nl/nieuws/2016/51/mbo-diploma-nu-net-zo-duur-als-universitaire-master
[102] Retrieved 19-4-2023 from: https://wetten.overheid.nl/BWBR0038601/2016-10-13
[103] An alternative calculation is given in a study by Panteia into education funding by OCW and EZ. In the current report, the multiplication factors 1.67 and 1.58 are mentioned for OCW and EZ government-funded education respectively (see footnote 6). However, these factors seem to be too high for the year 2016 and in addition the calculation in Table 2.5 is based on the wrong (too high) amounts, namely the amounts for executive salaries instead of salaries for teaching staff (compare p. 53 of the report on funding secondary education of the Court of Audit or the relevant ministerial regulations). Calculation based on these factors yields comparable amounts with slightly larger differences between regular secondary education on the one hand and learning support education and practical education on the other.
[104] Retrieved 19-4-2023 from: https://www.rijksfinancien.nl/jaarverslag/2016
[105] Retrieved 19-4-2023 from: https://www.rijksfinancien.nl/jaarverslag/2016

standard route to costs per year.[106] This leads to €6,788 per pupil for the year 2015, quite close to the amount stated in the annual report of €6,800 for both 2015 and 2016.

Unfortunately, such a calculation is not possible for the MBO because, according to the Statistics Netherlands, "no reliable theoretical study duration" can be determined, so that calculation back to study costs per year is also not possible.[107] However, if it is assumed that the average 'study delay' is equal to the study delay for tertiary education (HBO) students, then a reduction for 2015 comes to an amount of €7,957 per student per year, close to the €8,000 for 2016 and the €8,100 mentioned for 2015 in the annual report accompanying the national budget for 2016.[108]

For WO, the annual report accompanying the national budget for 2016[109] does not differentiate between the bachelor and master phase; one amount is mentioned of €6,700 per student for tertiary education (WO) in general. Calculation of the average master's duration based on Statistics Netherlands microdata gave rise to an estimate of the costs in the bachelor's phase several hundred euros higher than in the master's phase.

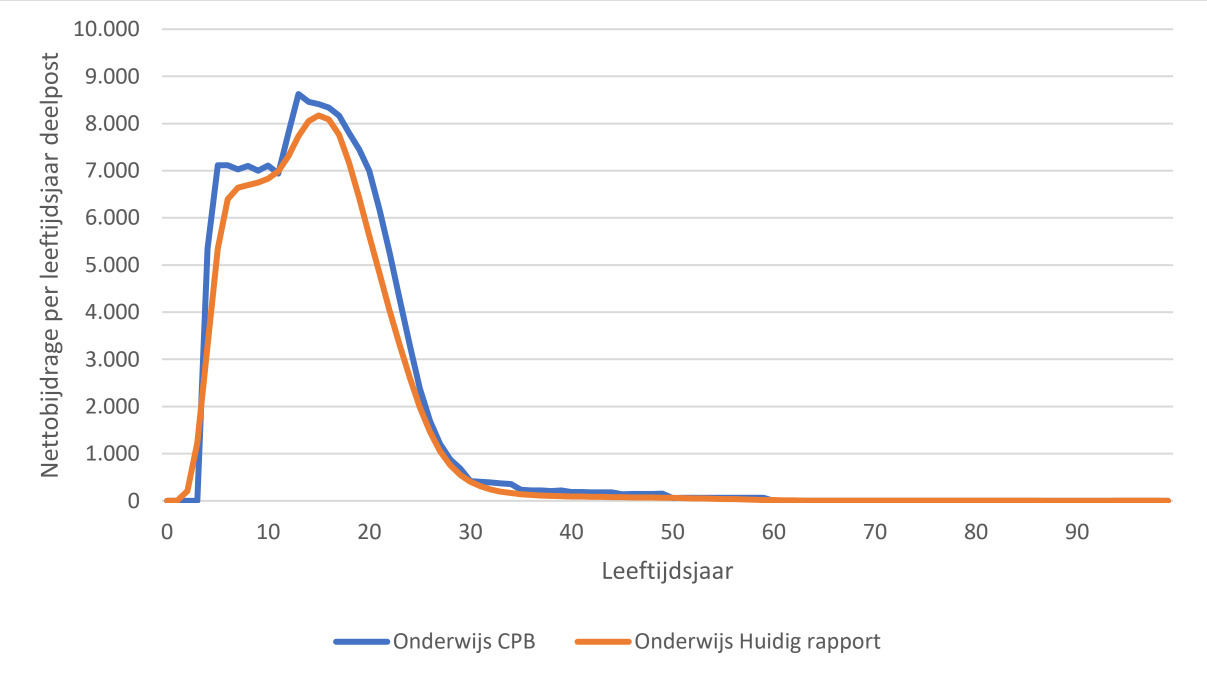

Figure 5.1 Education: comparison with the CPB profile.

For the item Education, the difference between the total amount based on Statistics Netherlands microdata and the CPB macro amount for 2016 from Table 5.1 is approximately 3 billion euros. For almost all ages, the CPB profile is above the profile based on Statistics Netherlands microdata, see Figure 5.1. In view of the higher costs for primary school age, the CPB apparently allocates 100% of the costs of the pupil weights (i.e., based on the maximum additional allowance according to the pupil weight) and

[106] Retrieved 19-4-2023 from: https://www.cbs.nl/-/media/_excel/2016/51/onderwijsuitgaven-diplomas-maatwerk.xls

[107] See the explanatory notes to this table, retrieved 19-4-2023 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/82299NED/table?dl=15295

[108] Retrieved 19-4-2023 from: https://www.rijksfinancien.nl/jaarverslag/2016

[109] Retrieved 19-4-2023 from: https://www.rijksfinancien.nl/jaarverslag/2016

not the empirically observed 50% as in the current study. In view of the study costs, especially for people in their twenties, the CPB probably assumes a higher allocation of study costs to university students, whereby both education and research costs are apparently allocated to students. The research costs represent a significant amount in the total costs of the academies. In the current study, scientific research is treated as a public good that is equally allocated to the population. This is done by allocating the difference between the age profile from the current study and the CPB profile for the entire population to a residual item that is equal for all residents, which is added to the item Public administration.[110]

Finally, an explanation of the so-called weight regulation. The weighting scheme allocates additional funding to primary schools for children of low-educated parents. These so-called pupil weights have been operationalised on the basis of the Statistics Netherlands microdata table CITOTAB for the reporting years 2010 to 2014, which include the pupil weights still applicable in 2016 (0.3 and 1.2). In principle, a school receives a reimbursement for a pupil with a pupil weight of 0.3 (30% extra funding) that is 1.3 times higher than the standard amount per pupil and for a pupil with a pupil weight of 1.2 (120% extra funding) a reimbursement which is 2.2 times higher. The pupil weights given in CITOTAB are aggregated to the groups used in the current report, with a breakdown by generation, motive and region of origin (maximum applied refinement according to the 42-part division). The averages obtained in this way have been used to increase the amounts per pupil for the regular primary school costs for the year 2016, as intended by the scheme. When talking about pupil weights in the remainder of this section, this refers to average group weights based on these Statistics Netherlands microdata.

Because the weighting scheme for 2016 has not been recorded in the Statistics Netherlands microdata files used for the current report, the figures for student numbers have been taken from data from DUO.[111] In total, schools were funded for 45,950 extra virtual students on the basis of the weighting scheme. The following formula is used for the actual allocation of the number of virtual pupils A allocated to a school:

$$A = \lfloor 0.3 \times N^{G0.3} + 1.2 \times N^{G1.2} - 0.06 \times N \rfloor$$

Here $N^{G0.3}$ is the number of students with weight 0.3, $N^{G1.2}$ is the number of students with weight 1.2 and N is the total number of students in the school concerned and the brackets symbolise a rounding down.

Note that M, the weighted average of pupil weight for a school is equal to

$$M = \frac{0.3 \times N^{G0.3} + 1.2 \times N^{G1.2}}{N}$$

and that with this the formula for A can be rewritten to:

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[110] Compare with Table 5.3 in the study *Onderwijsbekostiging OCW en EZ: Vergelijking uitgaven en systematiek 2004 – 2014,* retrieved 4-7-2021 from: https://zoek.officielebekendmakingen.nl/blg-583591.pdf or with the item 'fundamental research', which in the COFOG classification is classified under the function General government administration in Statistics Netherlands StatLine tables such as *Overheidsuitgaven, naar functies 1995-2016,* retrieved 4-7-2021 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/82902NED/table?dl=318DD

[111] The Excel dataset "02.-pupils-bo-swv-establishment,-weight,-impulse-area,-school-weight-2015-2016" which was available for download at https://duo.nl in the past (retrievable from authors).

$$A = \lfloor MN - 0.06 \times N \rfloor = N \times \lfloor M - 0.06 \rfloor = MN \times \left\lfloor 1 - \frac{0.06}{M} \right\rfloor$$

Because the number of virtual extra students in the school is equal to MN *for the application of the allocation formula* (when ignoring the rounding), the allocation fraction T_M can be written as:

$$T_M = \begin{cases} 0 & if\ M < 0.06 \\ 1 - \frac{0.06}{M} & if\ M \geq 0.06 \end{cases}$$

This formula is such that in practice, on average, only a part (for 2016: 50.1%, calculated on the basis of data from DUO[112]) of the pupil weight is included in determining the additional funding of primary schools. For schools with a low concentration of children with low-educated parents[113], the allocation rate is lower than for schools with a high concentration of children with low-educated parents. The maximum observed allocation rate in 2016 was 92.8%.[114]

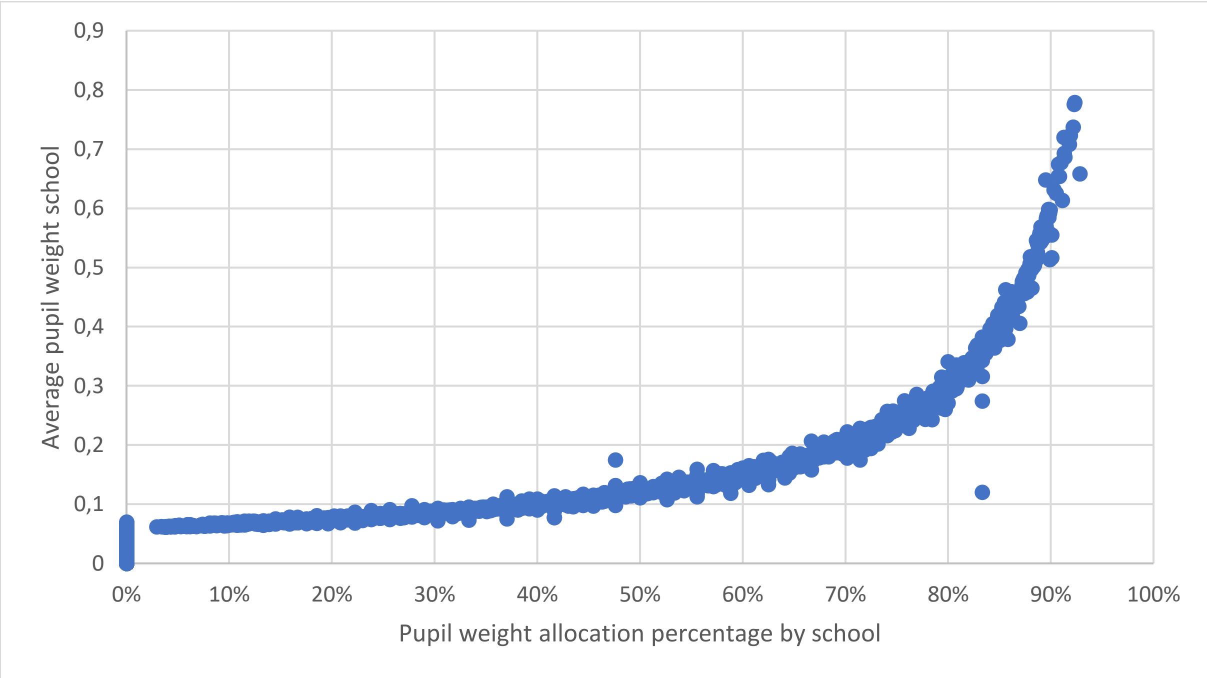

Figure 5.2 Allocation of extra funding as a percentage of the total pupil weight versus average pupil weight per school. Calculation based on data from DUO[115] for 6494 schools.

These observations reveal an operationalisation problem. The full inclusion of the pupil weight calculated on the basis of Statistics Netherlands microdata is certainly an overestimation. However, calculation based on the average (calculated over the entire population) actual allocation in 2016 almost

[112] See previous footnote.

[113] This weighting scheme would be revised (when this operationalisation is being worked out) and replaced by a system based on Statistics Netherlands models, whereby the average amounts are expected to be lower for the larger municipalities, retrieved 19-4-2023 from: https://www.cbs.nl/nl-nl/publicatie/2017/06/herziening-gewichtenregeling-primair-onderwijs

[114] As an indication: the calculation shows that the allocation percentage also depends on the ratio between the pupil weights 0.3 and 1.2 and the maximum is 95% with only pupil weight 1.2 and 92% if one half of the pupils have the weight 0.3 and the other half have a pupil weight of 1.2.

[115] The Excel dataset "02.-pupils-bo-swv-establishment,-weight,-impulse-area,-school-weight-2015-2016" which was available for download at https://duo.nl in the past (retrievable from authors).

certainly gives a significant underestimate for non-Western immigrants. The reason for this last assumption is that the percentage of actual allocation is especially high for schools with a high concentration of children with low-educated parents (see Figure 5.2, but this also follows from the above formula). By way of illustration: if the average pupil weight of a school is equal to the average pupil weight of the native Dutch people (0.03), then 0% of the extra money is actually allocated. If the average pupil weight of a school is equal to the Dutch average (0.09), 33% is actually allocated. If the average pupil weight at a school is equal to the average of all first and second-generation immigrants (0.30) and non-Western immigrants (0.41), respectively, then 80% and 85% of the extra money is actually allocated.

Due to the low average level of education of non-Western immigrants, in combination with the existence of schools with a high concentration of mainly non-Western immigrants – it can be expected that the allocation among non-Western immigrants will be relatively high. The existence of such schools is partly caused by self-selection: native Dutch parents avoid living in neighbourhoods with high concentrations of non-Western immigrants and/or avoid placing their children in schools with non-Western immigrant children. This, in combination with the average higher education level of native Dutch parents, is expected to result in children of less well-educated native Dutch parents being less likely to attend a school with a high average pupil weight. As a result, the allocation percentage will be lower for them than for children of non-Western immigrants with the same education level as the aforementioned native Dutch parents. The skewed distribution of the extra funding among schools can also be seen in Table 5.2 with the observed allocation percentages for 2016.

Table 5.2 Distribution of the allocation percentage of the pupil weight, 2016. Our own calculation based on data from DUO[116].

Allocation percentage	Number of school (abs.)	Number of schools (%)
0*	475	7%
0	4079	63%
1	0	0%
2	0	0%
3-5	25	0%
6-10	75	1%
11-20	177	3%
21-30	197	3%
31-40	214	3%
41-50	218	3%
51-60	219	3%
61-70	245	4%
71-80	301	5%
81-90	253	4%
91 or more	16	0%
Total	**6494**	**100%**

*No children with pupil weight higher than 0.

[116] See previous footnote.

In the absence of data on the exact distribution of pupils with and without an immigration background across schools, the following heuristic was applied. Suppose that half of the pupils attend a school that is perfectly mixed and the other half attend a school with only their own immigration background. In a perfectly mixed school, the pupil weight is 0.09 (the national average) and the allocation fraction is $\frac{1}{3}$. The allocation fraction for a school with average pupil weight *M* then becomes:

$$T_M = \begin{cases} \frac{1}{6} & if\ M < 0.06 \\ \frac{2}{3} - \frac{0.03}{M} & if\ M \geq 0.06 \end{cases}$$

More generally, if $0 < C < 1$ is the proportion of students in a perfectly mixed school and the $1 - C$ remaining students are in a perfectly homogeneous school where everyone has the same pupil weight, then the allocation for a student with pupil weight *M* becomes:

$$T_{CM} = \begin{cases} C \times \frac{1}{3} + (1 - C) \times 0 = \frac{C}{3} & if\ M < 0.06 \\ C \times \frac{1}{3} + (1 - C) \times \left(1 - \frac{0.06}{M}\right) = \frac{3-2C}{3} + \frac{0.06(C-1)}{M} & if\ M \geq 0.06 \end{cases}$$

It is desirable, however, that the formula for assigning the pupil weight is such that the allocation based on the Dutch average (0.09) is equal to the sum of the allocation of all subgroups with a breakdown by immigration background. For the breakdown into the 42-part division and first and second generation, this is not the case for any *C* with the above formula. In addition, the macro amount should correspond. If we assume the macro amount at 50.1% de facto allocation as applies for 2016, then based on a pupil weight of 0.09 for the average population, this yields a macro amount of approximately 475 million euros. However, if we start from the 45,950 actually allocated virtual pupil weight of pupils in 2016, the macro amount comes to 293 million euros. If we average both amounts, this comes to 385 million euros. If we assume that successful immigrant groups often attend schools with many native Dutch people, then we can take the allocation for native Dutch people as a minimum. If we further assume – inspired by the above exploration – that the allocation formula for a group with average pupil weight M is of the form $T_M = a - \frac{b}{M}$ with $0 \leq a, b \leq 1$ (and with the minimum value for native Dutch students) and that the allocation formula for the entire population and for the population broken down by immigration background according to the 42-part division should yield a macro amount of approximately 385 million euros, then the following formula will suffice:

$$T_M = Max\left(\frac{217}{1000}, \frac{508}{1000} - \frac{0.01}{M}\right)$$

The macro amount for the entire population is 381 million with this formula and for the population broken down by immigration background according to the 42-part division it is 388 million. With this assumption, the allocation percentage for native Dutch people is 21.7% (this is also the minimum for all groups) and the highest allocation percentage is 49.7%. The allocation rate for the population as a whole is 40.0%. By multiplying this fraction by the observed pupil weight and the amount per primary school pupil at €6,382 per year, the actual extra education money allocated to schools is estimated.

5.4 Childcare

This section explains the operationalisation of Childcare. The amounts for childcare are derived from the Statistics Netherlands microdata files *Kinderopvang* (Childcare) and *AanvragerKinderopvang*

(Applicant-Childcare) for the reporting year 2016, by combining them. First, it was checked whether one unique partner could be assigned to each applicant with a partner without loss of data, and that turned out to be the case. Subsequently, on the basis of the microdata file INPATAB, the personal gross income of the applicant and any partner was allocated and the allowance allocated was allocated pro rata to the applicant and any partner they had. It was then checked whether the macro amounts were correct and that turned out to be the case. The costs for childcare have been added to the item other social security, because they were included in the 2016 budget under Social Affairs and Employment.[117]

5.5 Healthcare

This section explains the operationalisation of the Healthcare item (Table 5.1, item no. 12). The healthcare costs have been calculated insofar as they relate to the Healthcare Insurance Act (*Zorgverzekeringswet*, ZVW) and have been calculated on the basis of the Statistics Netherlands micro-file ZORGKOSTENTAB. The amounts have been increased by an increment factor supplied by Statistics Netherlands with this file, which serves to correct the data. This increment factor is used in Statistics Netherlands StatLine tables. The amounts calculated for the current report on the basis of the micro-data file used correspond exactly to the StatLine data published by Statistics Netherlands.[118]

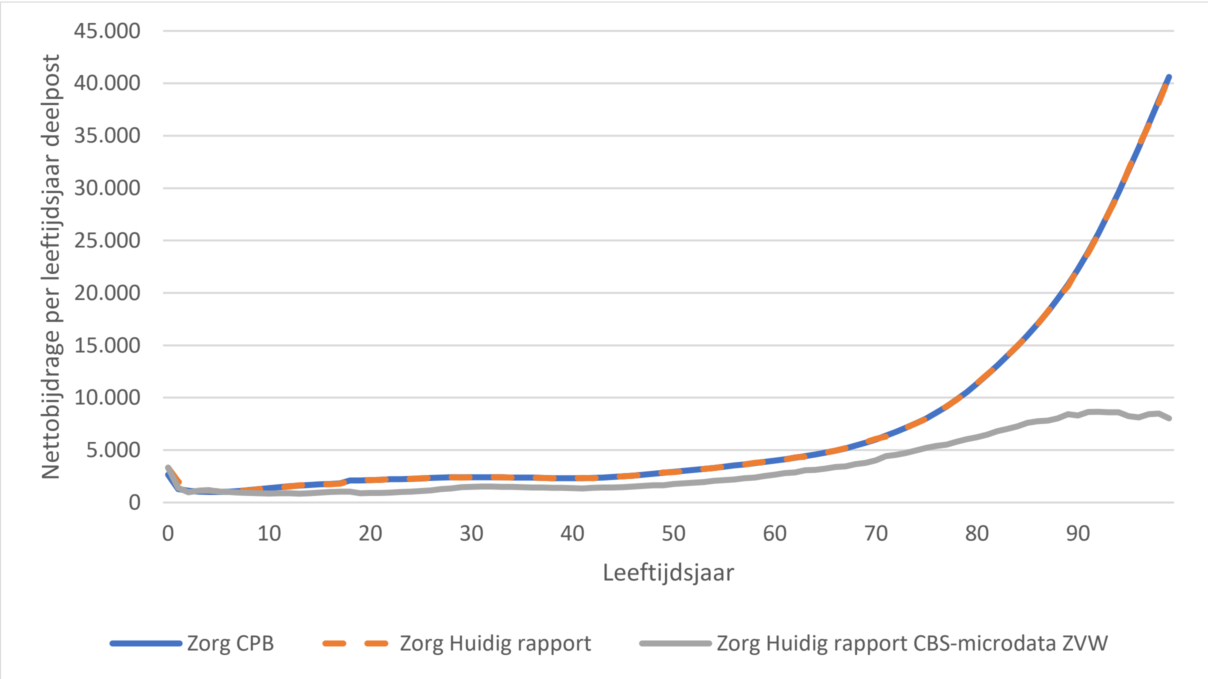

Figure 5.3 Healthcare: comparison with the CPB profile.

Subsequently, the amount for the deductible was estimated on the basis of a table from Vektis.[119] Based on this table, the deductible by age has been calculated for those between the ages of 18 and 90 years. From the age of 90, the deductible is kept constant. These data are available for 2015 and

[117] National budget, retrieved 21-02-2021 from: https://www.rijksbegroting.nl/2016/voorbereiding/begroting?hoofdstuk=40.22

[118] Retrieved 19-4-2023 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/81827NED/table?dl=1535C

[119] This was done on the basis of a revised table from the Vektis report *Verzekerden in Beeld* from 2016, retrieved 19-4-2023 from: https://www.vektis.nl/intelligence/publicaties/verzekerden-in-beeld-2016, https://www.vektis.nl/uploads/Publicaties/Zorgthermometer/Verzekerden%20in%20beeld%202016%20-%20bijlage.xlsx

based on the known differences between 2015 and 2016, a calculation has been made for 2016. The differences between 2015 and 2016 are, incidentally, minimal (per age a maximum of 3 euros higher or lower personal contribution). The deductible was then applied to all healthcare, with the exception of general practitioner healthcare (including so-called multidisciplinary healthcare), birth care and district nursing and care for young people up to the age of 18. For young people who turned 18 in 2016, the deductible was applied in proportion to the time before and after the middle of the month in which they turned 18.

The profile calculated in this way is below the CPB profile for almost all ages (see the grey line in Figure 5.3). This is because a large part of the healthcare costs is not covered by the Health Insurance Act (ZVW). The reason is that due to limitations of data and data budget, only the costs for the compulsory health insurance have been included. This has been resolved as follows. First, the profile difference between the Statistics Netherlands microdata age profile and the CPB profile for Healthcare was calculated (i.e., the difference between the blue profile and the grey profile in Figure 5.3). This profile contained some relatively small negative amounts. These amounts were set to zero and the profile was then recalibrated in such a way that after addition to the Statistics Netherlands microdata age profile and weighting against the study population, the total amount is equal to the CPB macro amount for 2016. It can be seen that the profile resulting after addition (the orange line) almost coincides with the CPB profile (the blue line).

5.6 Benefits, subsidies, premiums and taxes

This section explains the operationalisation of a large number of items from Table 5.1 (item no. 4 to 9, 11, 16, 17 and 20). This concerns Child benefit / Student financing (AKW/WSF), Disability / Sickness Benefits Act (*Arbeidsongeschiktheid*, ZW), Unemployment (*Werkloosheid*, WW), Social assistance / Surviving dependents benefit (*Bijstand* / ANW), State pension (AOW), Other social security, Subsidies, Wage and income tax (*loon- en inkomstenbelasting*) and social security contributions (*sociale premies*) (the last two items together form the item LIS). All these items have in common that they are calculated on the basis of the Statistics Netherlands microdata file INPATAB.

For the items Child benefit / Student financing (AKW/WSF), Disability / Sickness Benefits Act (ZW), Unemployment, Social assistance / Surviving dependents benefit (ANW) and State pension, the Statistics Netherlands microdata data on benefit receipts have been used. These items appear directly in INPATAB, although the composite items such as Child benefit / Student Financing (AKW/WSF) still have to be added up.

For a number of benefits (Unemployment, Disability, Social assistance / Surviving Dependants Benefit (ANW) and Other social security) premiums are paid by the benefits agency. These are added pro rata (sometimes people have more than one benefit) to the benefit(s) of the recipient. A distinction is made here between social premiums for income insurance and social provisions and the premiums for healthcare costs. Because all premiums are included on the income side under the item Wage and income tax and social security contributions (LIS), these premiums are offset against the amounts added to the payment, while the classification in items of the CPB can be maintained at the same time.

The total costs for these items were often lower than the CPB macro amount in Table 5.1. The difference between the macro amount calculated by the CPB and the sum of amounts actually paid to people calculated for the current report on the basis of Statistics Netherlands microdata has been interpreted as implementation costs.

In the discussion below, this difference is expressed as a percentage of the CPB macro amount. In general, implementation costs form a significant part of the costs and are estimated for the UWV at an average of 6.8% of the total costs[120] for 2015 and were estimated at a total of 2.9 billion euros[121] for that year. In part, the implementation costs can be directly traced back to, for example, budget documents.

For Child benefit / Student Financing (AKW/WSF), the difference (4% of the CPB macro amount) can largely be traced back to the implementation costs relating to student financing[122] and Stufi (Stufi is short for *Studiefinanciering*, a system of study grants), [123]. This is also the case for Disability / Sickness Benefits Act (ZW) (8% of the CPB macro amount) with a large number of items related to the implementation of the Sickness Benefits Act (ZW), disability insurance act (WIA) and reintegration of (partially) disabled people, which cover the vast majority of the difference[124]. In the case of Social assistance / Surviving Dependants Benefit (ANW) (18% of the CPB macro amount), a very small part can be traced back to the implementation of the Surviving Dependants Benefit (ANW) by the national government[125] and the rest has been interpreted as implementation costs of the municipalities, which are around 21%[126]. For these items, the total amount was weighted by age against the total study population described in Chapter 3 and calibrated against the CPB macro amounts in Table 5.1.

For the State pension (3% of the CPB macro amount), the relatively small difference can partly be traced back to implementation costs[127] and the remainder has been interpreted as other administrative costs and as state pension benefits to non-residents residing abroad (after all, not being registered in the Municipal Personal Records Database (GBA) means that one does not appear in the Statistics Netherlands microdata). In the current report, about a quarter of this difference (305 million euros) has been allocated to immigrants who have returned. The item State pension is calibrated on the total study population described in Chapter 3 and calibrated on the CPB macro amount minus 305 million euros as shown in Table 5.1. The 305 million euros were subsequently allocated to first-generation immigrants in proportion to the remigration probability, etc.

For Unemployment, the difference between the Statistics Netherlands microdata amount and the CPB macro amount is nil (0% of the CPB macro amount). However, the implementation costs[128] amount to 10.4% of the Statistics Netherlands microdata amount found. Here the Statistics Netherlands microdata amount has been increased by a lump-sum of 10.4% and it is higher than the CPB macro amount, where the difference is approximately the same as the 'unemployment premium at the expense of the benefits agency', which was added to the unemployment benefit in the current study.

The Other social security item could only be partly filled in by Statistics Netherlands microdata. The total amount from the Statistics Netherlands microdata therefore deviates significantly from the CPB

[120] Retrieved 19-4-2023 from: https://www.seor.nl/Cms_Media/S1183-Kosten-en-opbrengsten-terugbrengen-AOW-leeftijd-naar-65-jaar.pdf, pg. 72.
[121] Retrieved 19-4-2023 from: https://digitaal.scp.nl/publiekvoorzien/sociale-zekerheid/
[122] Retrieved 19-4-2023 from: https://www.rijksbegroting.nl/2016/voorbereiding/begroting,kst212308_21.html
[123] Retrieved 19-4-2023 from: https://www.rijksbegroting.nl/2016/voorbereiding/begroting,kst212220_23.html
[124] Retrieved 19-4-2023 from: https://www.rijksbegroting.nl/2016/voorbereiding/begroting,kst212308_21.html
[125] Retrieved 19-4-2023 from: https://www.rijksbegroting.nl/2016/voorbereiding/begroting,kst212308_21.html
[126] Retrieved 19-4-2023 from: https://www.consultancy.nl/nieuws/24796/gemeente-2900-kwijt-aan-uitvoering-bijstandsuitkering, https://www.gemeente.nu/sociaal/uitvoering-bijstand-kost-bijna-2900-euro-per-uitkering/
[127] Retrieved 19-4-2023 from: https://www.rijksbegroting.nl/2016/voorbereiding/begroting,kst212308_21.html
[128] Retrieved 19-4-2023 from: https://www.rijksbegroting.nl/2016/voorbereiding/begroting,kst212308_21.html

macro amount for 2016 from Table 5.1. The Statistics Netherlands microdata amount has been increased by a 6% allowance for implementation costs, which is derived on the basis of the Wajong costs and childcare costs. The difference between the increased Statistics Netherlands microdata amount and the CBP macro amount of approximately 13 billion euros is – in accordance with the CPB profile for Other social security – attributed equally to all residents aged 20 and over, regardless of age, origin, etc. dividing the total amount by the total study population from the age of 20.

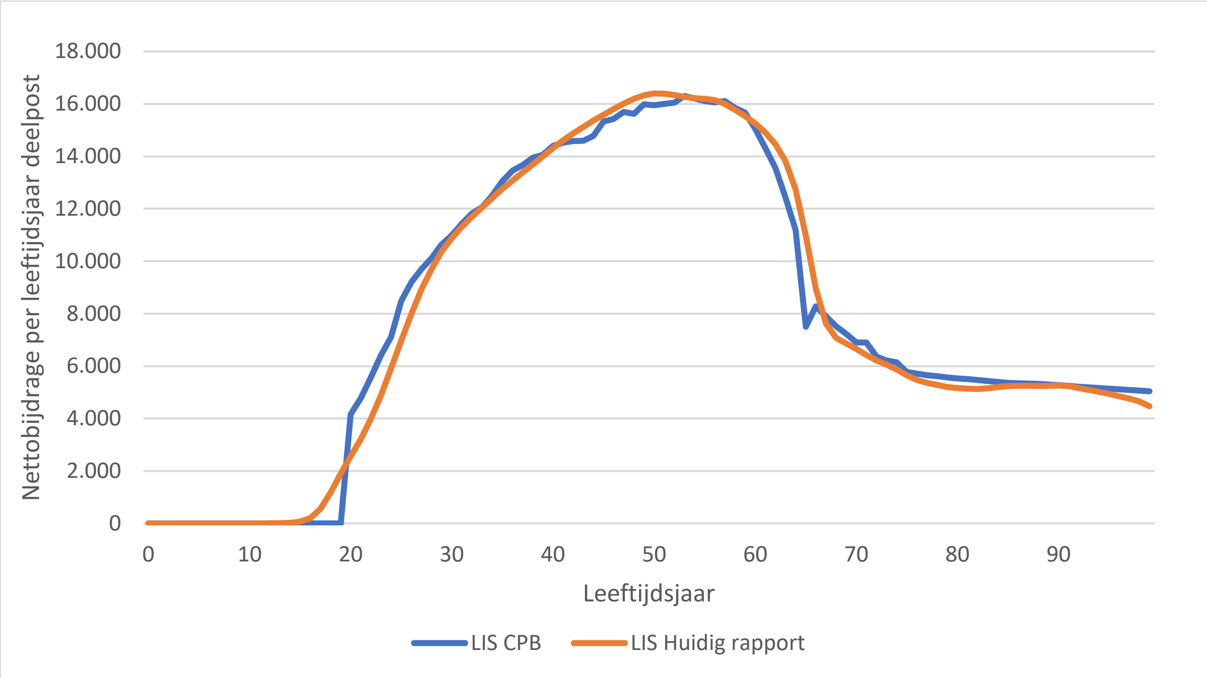

Figure 5.4 Wage tax, income tax and social contributions (LIS): comparison with the CPB profile.

The Subsidies item has been operationalised by summing the INPATAB categories Housing allowance, Healthcare allowance, Child Allowance and Child-related budget (*Huurtoeslag, Zorgtoeslag, Kindtoeslag en kindgebonden budget*). Subsequently, this item was weighted by age against the study population described in Chapter 3 and calibrated against the CPB macro amount for Subsidies in Table 5.1. The difference (2% of the CPB macro amount) corresponds to the implementation costs[129] of the allowances. This item was also weighted by age against the total study population described in Chapter 3 and calibrated against the CPB macro amount in Table 5.1. For the items Wage tax, income tax and social contributions (LIS) and Other direct taxes on households, a profile is based on the INPATAB variable INPV3900INK (Tax on income). In addition, the premiums for Unemployment, Disability and State pension that also appear as INPATAB variables are included. The premiums for Healthcare are also included. This concerns the premiums for the compulsory insurance under the Health Insurance Act (ZFW) and the premiums for the Exceptional Medical Expenses Act (AWBZ[130]). The ZFW premiums include both the employee and employer premiums, as well as the premiums for the compulsory basic insurance. The latter was done because, despite the so-called market forces, the financing of

[129] Retrieved 19-4-2023 from: https://www.rijksoverheid.nl/binaries/rijksoverheid/documenten/rapporten/2016/12/15/bijlage-beleidsdoorlichting-uitvoering-toeslagen-door-belastingdienst/bijlage-beleidsdoorlichting-uitvoering-toeslagen-door-belastingdienst.pdf, pg. 58

[130] Three acts – the Youth Act (*Jeugdwet*), the Long-term Care Act (Wlz) and the Social Support Act (Wmo) – have jointly replaced the AWBZ. However, Statistics Netherlands still uses the term AWBZ (premiums) in its internal documentation and that term has been used in the current report as well.

healthcare is mainly tax-based. The total amount obtained in this way corresponds almost exactly to the total of the items Wage tax, income tax and social contributions (LIS) and Other direct household taxes and, after weighting by age against the study population, has been calibrated to the corresponding CPB macro amounts. The resulting age profile for Wage tax, income tax and social contributions (LIS) is shown in Figure 5.4.

For the items State pension, Disability / Sickness Benefits Act (ZW), Unemployment, Social assistance / Surviving Dependants Benefit (ANW) and Other social security and the items Wage tax, income tax and social contributions (LIS), Other direct taxes and Other indirect taxes and non-tax resources (IRN), the data for the age group 65-71 years have been synthesised on the basis of the sampled data for the age range containing 64 years and the age range containing 72 years.[131] Based on the data for the entire population, the current trend of these items for the 65-71 age group has been translated into the most probable trend for other average state pension ages in the 65-71 year range. This is based on a state pension age of 69.5 years to be reached in 2060.

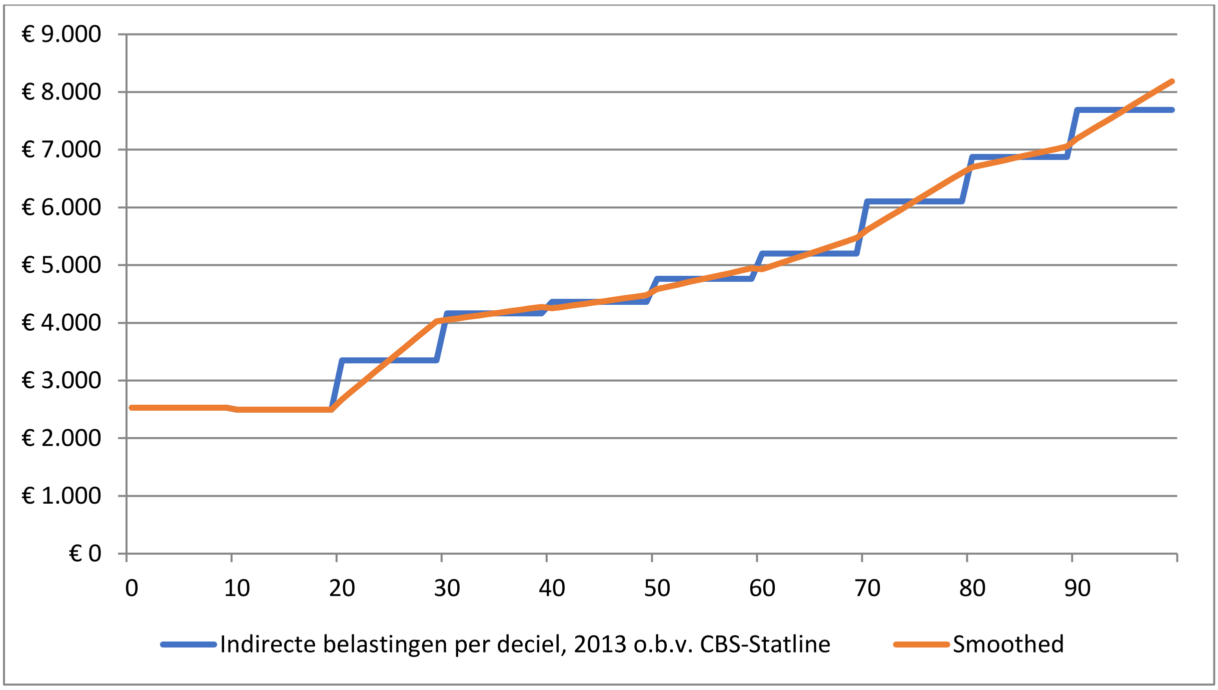

Figure 5.5 Indirect taxes per income decile and smoothed. Calculation based on Statistics Netherlands StatLine.

The amounts for unemployment described in Chapter 8 are quite high. That has various causes. First of all, the native Dutch population paid approximately €14,000 more in premiums in the 2016 reference year, summed up over all years of age, than was received in unemployment benefits.[132] In addition, young people pay a relatively large amount of unemployment insurance contributions and the elderly receive a relatively large amount of unemployment benefits, so that discounting makes the difference even greater[133]. Furthermore, CPB's assumptions are based on the developments from reference year 2016. These are specific for the development of each benefit (Unemployment, Disability,

[131] This somewhat cryptic description stems from the fact that the age categories differ in size.
[132] And for comparison: for the average residents €9,000 more, for the average second-generation immigrant almost €3,000 more and for the average first-generation immigrant €0 more.
[133] After all, the amounts received in unemployment benefits are on average further in the future and are therefore more reduced by discounting them.

Social assistance, etc.), with the macro amount for unemployment benefits initially assumed to de-crease by approximately 4.0% per year until 2021 and subsequently eventually develop towards a generic nominal growth rate of 3.5%. However, the aforementioned CPB assumptions are generic for the development of the item Wage tax, income tax and social contributions (LIS), so all contributions develop in the same way in the years from 2016, whereby the macro amount for Wage tax, income tax and social contributions and therefore also for unemployment benefits premium is actually assumed to increase by approximately 4.7% until 2021, after which it also gradually develops towards the aforementioned generic nominal growth rate of 3.5%. This makes the difference between unemployment insurance premiums and unemployment benefits in the years from 2016 even greater. This makes no difference to the total net contribution calculation, because only the total amount for Wage tax, income tax and social contributions (LIS) plays a role here and the development of this total amount is derived from the CPB. However, when splitting up the net amount for unemployment benefits, for example, it may give an overestimation. An alternative would be to perform this calculation with a constant nominal growth rate, but we have chosen to show the calculation as it was performed.

5.7 Other indirect taxes and non-tax resources (IRN)

This section explains the operationalisation of the item Other indirect taxes and non-tax resources (IRN) which includes indirect taxes such as VAT (see Table 5.1, item no. 20). Indirect taxes are a major source of income for the government. The CPB sets the item Other indirect taxes and non-tax resources (IRN) at 84 billion for 2016 (see the item taxes on production and imports on the Statistics Netherlands StatLine or the national accounts for 2016), of which 68 billion is allocated to households and the rest to companies.

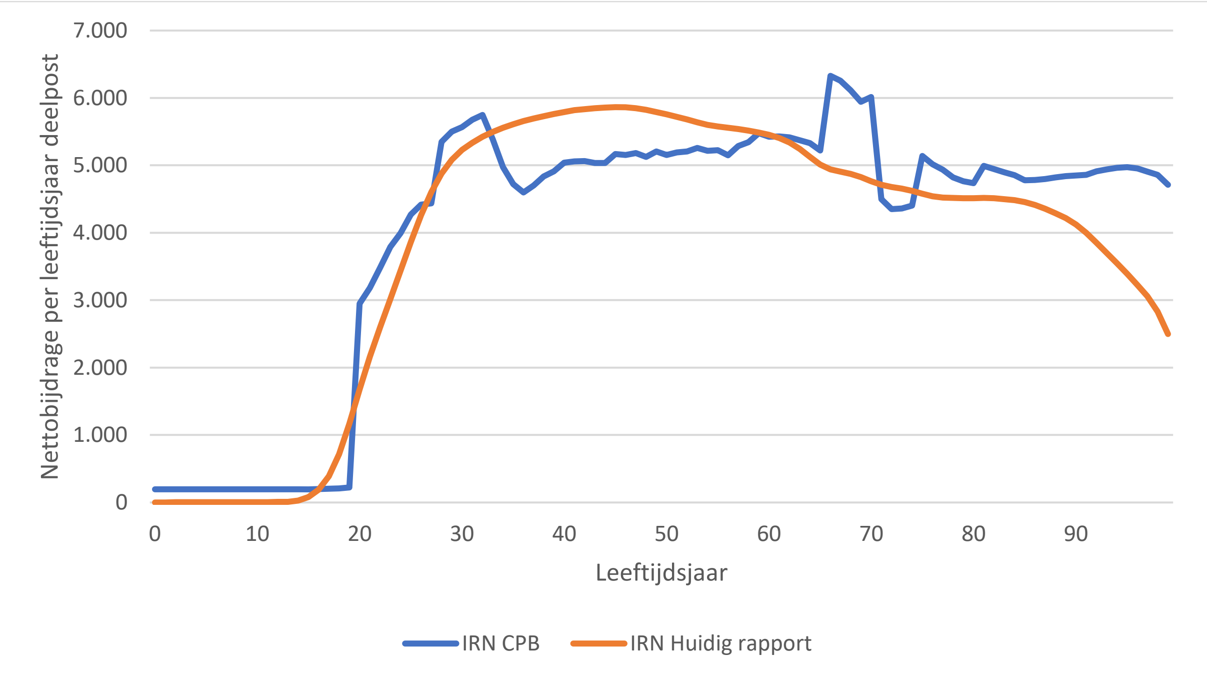

Figure 5.6 Other indirect taxes and non-tax resources (IRN): comparison with CPB profile.

There was no access to a microdata file for indirect taxes and by its very nature there is no direct personal registration at all of many indirect taxes such as VAT. Instead, calculations were made using a proxy based on a Statistics Netherlands StatLine table that includes average amounts for the deciles of the gross household income.[134] These deciles were first distributed per decile over the percentiles using a linear method in such a way that a profile was as 'smooth' as possible (Figure 5.5).

Subsequently, the Statistics Netherlands microdata files INHATAB and INPATAB were linked together via the main breadwinner, in such a way that the percentage of gross household income (if known) could be assigned to each person in INPATAB. Thereafter, the amount belonging to the percentile is allocated to the individual members of the household in proportion to the personal gross income. Negative incomes were ignored.

This operationalisation yields a total amount of 37 billion. Subsequently, the CPB macro amount was calibrated by multiplying by a factor. In fact, a macro amount of 68 billion is therefore filled in with an operationalisation that directly results in a macro amount of 37 billion. This is because the Statistics Netherlands data used does not include all items classified under Other indirect taxes and non-tax resources (IRN). Comparison of the CPB profile with this operationalisation shows that the profiles are broadly in agreement. However, the Statistics Netherlands microdata profile prepared for the current study has a somewhat smoother and more natural course (see Figure 5.6), probably because it is based indirectly on the raw, non-aggregated income data of millions of people. This operationalisation produces results that are in line with the results that would be obtained with the CPB profile.[135]

5.8 Wealth-related taxes

This section explains the operationalisation of the items Inheritance tax, Corporate tax (VPB) and dividend tax of Dutch companies and the Other indirect taxes and non-tax resources (IRN) of companies (see Table 5.1, item no. 18, 19 and 21). These taxes are related, among other things, to wealth, for example in the form of share ownership through wealth accumulation in pension funds. The Other indirect taxes and non-tax resources (IRN) of companies corresponds to that part of the item taxes on production and imports in the national accounts and Statistics Netherlands StatLine that comes through the companies into the treasury. According to the CPB, 68 billion of the total Other indirect taxes and non-tax resources will be generated directly by households in 2016 and the remaining 16 billion indirectly via companies. Corporate income tax (VPB) and dividend tax is limited to Dutch companies and totals almost 22 billion euros.[136] In total, these items therefore amount to approximately 16 + 22 = 38 billion euros.

These items are allocated to people by the CPB in generational accounting, for example for the ageing population. The CPB says about the interpretation of corporate income tax, for example:[137]

> *"The corporate tax profile, in line with wealth, gradually rises up to the age of 60 and then falls again. It is assumed that this tax is ultimately borne by shareholders."*

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[134] Retrieved 19-4-2023 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/81290ned/table?dl=15588

[135] In principle, the differences in the profiles average each other out by calibrating the CPB macro amount. Possible differences will mainly arise if ages for which the differences are greatest are given a relatively large weight due to discounting, remigration and weighing up against the immigration profile.

[136] Compare with this dataset, retrieved 19-4-2023 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/82569ned/table?dl=30C53 however, the amounts are different because not everything is counted by the CPB.

[137] Source: CPB report *Minder zorg om vergrijzing*. p. 22, retrieved 19-4-2023 from: https://www.cpb.nl/sites/default/files/publicaties/download/cpb-boek-12-minder-zorg-om-vergrijzing.pdf

The essence is therefore that the CPB will synchronise the age profile for the corporate income tax with the age profile for the wealth development of people/households. The CPB allocates both the Corporate income tax / dividend tax item and the item Other indirect taxes and non-tax resources via companies to individuals through an ideal-typical age profile (in fact, a parabola) as shown in Figure 5.7. The same applies to the Inheritance tax item.

In the current study, the total amount of 37.8 billion euros of these items is allocated to individuals in different ways. Following the CPB, the main part is still formed by (pension) assets, but the direct holdings of companies are also included. In the first place, there is direct share ownership by individuals. The total amount of 1.8 billion euros in dividends received is known from INPATAB based on the variable INPT3120DIV. This concerns domestic and foreign companies; no distinction is made.[138] For Dutch companies, the total Corporate income tax (VPB), Dividend tax, and Other indirect taxes and non-tax resources (IRN) of companies can be estimated as follows.

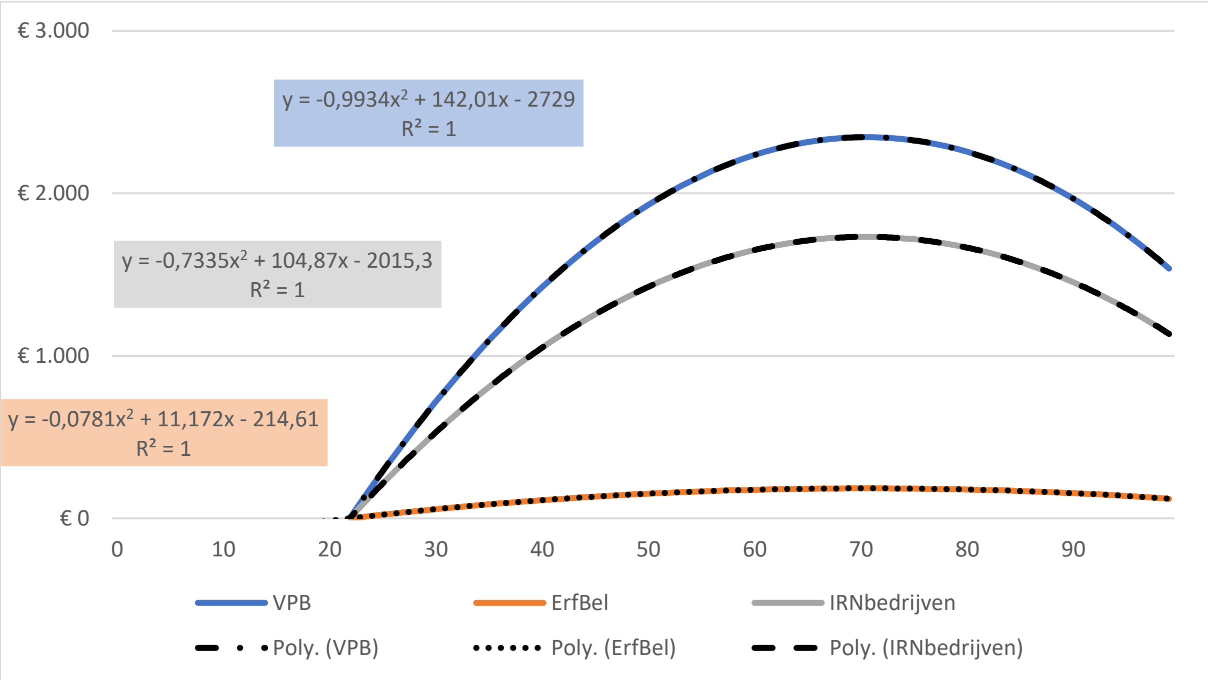

Figure 5.7 CPB profile for items Other indirect taxes and non-tax resources via companies, Corporate income tax (VPB) / dividend tax and Inheritance tax with comparison and R^2 for trend line.

Large non-financial Dutch companies paid 3.1 billion euros in dividends and 1.2 billion euros in corporate tax.[139] With a quarter[140] dividend tax, this amounts to 2 billion euros in taxes. If we assume the ratio between Other indirect taxes and non-tax resources from companies and Corporate income tax / dividend tax that the CPB uses for the macro amounts, then there is 73.8 cents of Other indirect taxes and non-tax resources from companies for every euro of Corporate income tax / dividend tax. In total, this amounts to 3.4 billion euros in tax on 3.1 billion euros in dividend, in other words 112 cents in tax

[138] Domestic and/or foreign dividend received, imputed return on participation in foreign investment companies and dividend from designated private equity companies, retrieved 19-4-2023 from: https://www.cbs.nl/nl-nl/onze-diensten/maatwerk-en-microdata/microdata-zelf-onderzoek-doen/microdatabestanden/inpatab-inkomen-van-personen
[139] Retrieved 19-4-2023 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/80262ned/table?dl=31854
[140] Retrieved 19-4-2023 from: https://www.berekenhet.nl/belastingtarieven/belastingtarieven-2016.html

per euro of dividend. Roughly speaking, in the case of large non-financial Dutch companies, one euro of dividend, according to INPATAB variable INPT3120DIV, yields a total of more than one euro in taxes for the Dutch treasury. However, a significant part of the dividend tax etc. will not relate to Dutch companies. In the absence of accurate data and in order to avoid false accuracy, it is assumed that for every euro of dividend the Dutch state receives 50 cents in tax under the names Corporate income tax / dividend tax and Other indirect taxes and non-tax resources from companies. For the aforementioned amount of 1.8 billion, this equates to a macro amount of 0.9 billion euros. That leaves 36.9 billion euros.

For some of the companies, (natural) persons are the direct owners. A distinction must be made here between directors-major shareholders and other entrepreneurs. For directors-major shareholders, the dividend tax paid can be retrieved from INPATAB by means of the INPATAB variable 'dividend substantial interest' (INPT3110DAB). The macro amount for the grossed-up[141] dividends for a substantial interest is EUR 7.0 billion. A quarter of that is dividend tax, about 1.8 billion euros. This has already been settled with the wage and income tax.[142] The taxes that are paid under the names corporate tax (VPB) and Other indirect taxes and non-tax resources (IRN) via companies have not yet been settled. However, it is impossible to deduce this from the dividend tax paid, because data on the relationship between the different types of tax in smaller companies is too scarce. The same applies to taxes received from people with income from business who are not directors-major shareholders. These people have all kinds of operating costs on which VAT, vehicle tax (BPM), excise duties, etc. have to be paid. Calculations for a large part of the Dutch companies[143] show that per euro operating profit, in addition to operating costs for purchasing and personnel, there are also 213 cents 'other operating costs'. The latter item includes costs for means of transport for 22 cents, an item with a substantial total tax liability for, among other things, motor vehicle tax, motor fuels (excise duties), insurance (insurance tax) and vehicle tax (BPM). In addition, there are other taxes such as energy tax and environmental taxes and levies. Based on the available information, it is impossible to really calculate how much tax under the headings corporate tax (VPB) and Other indirect taxes and non-tax resources (IRN) is received via companies from director-major shareholders and other entrepreneurs, especially since there can be major differences between, for example, a self-employed person and a director-major shareholder. That is why a diffuse prior has been assumed: for every euro of profit from a company and every euro of dividend or wages of directors-major shareholders, 10 cents in tax is paid that relates to operating costs. Based on the INPATAB variables INPT3110DAB (dividends from substantial interest, 7.0 billion), INPT1030DGN (directors-major shareholders' wages, 13.7 billion) and INPT2070WIN (own enterprise income, 34.7 billion), an estimate is made of taxes through this channel. The above-mentioned sources of income amount to 55.3 billion euros; 10% of that is 5.5 billion euros. The remaining amount is 31.4 billion euros.

The remaining amount of the corporate tax (VPB), Dividend tax, and Other indirect taxes and non-tax resources (IRN) via companies is made up of the indirect ownership of companies via the pension

[141] "The treatment of the dividend tax results from the gross registration of dividend, i.e., including dividend tax. This means that the dividend tax must be booked with the sector that receives the dividend. As a result, dividend tax is also paid abroad and received from abroad."

[142] This has been checked with a regression over more than half a million directors-major shareholders: every euro of dividend yields 24.9 cents in extra wage and income tax.

[143] SBI 2008 classification, branches B to J and N, retrieved 19-4-2023 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/81156NED/table?dl=3617E.

assets. For the calculation of the pension assets, the variable PENSAANSPRBedragOpbouwPensioen from the Statistics Netherlands microdata file PAS (PENSIOENAANSPRAAK2016ANA) has been recalculated to the present value associated with the age and retirement age of the person concerned. This has been done for various discount rates, whereby the discount rate in this specific case refers to the return on shares. The starting point was the tables with factors from the pension federation for 2018 and 2020 for the nine retirement ages from 60 to 68 years. These factors are separately (unweighted) averages for men and women for each combination of age and retirement age. The factors were then analysed as follows.

1. First, the ratio between the factors of successive ages was calculated separately for each of the 9 retirement ages. The discount rate for the relevant year (1.648% for 2018 and 0.290% for 2020 respectively) has been deducted from this. The resulting profile is called 'residual profile'. This results in nine times a vector with the aforementioned differences for all ages from 16 to 60-68 years (the highest age depends on the retirement age). These residual profiles are almost identical for all retirement ages (insofar as they have values in common, which is not always the case from the age of 60). The average of these is then taken, which his called the average residual profile.
2. Subsequently, a comparable estimated average residual profile was made by interpolation and extrapolation for 0, 1, 2, 3 and 4%. A fourth-degree polynomial was estimated using Excel for each residual profile. As a check: by adding this fourth-degree polynomial with the discount rate, the ratios of life-year to life-year of the conversion factors are obtained very accurately for the two interest rates for which tables are available (i.e., 1.648% for 2018 and 0.290% for 2020).
3. By starting from the factor in the life year that the retirement age is reached, called the final factor, for a certain retirement age, the factor can also be calculated for all years of life prior to the retirement age by successively dividing by the aforementioned ratios.
4. The final factors themselves are obtained for the discount rates 0, 1, 2, 3 and 4% by linear extrapolation and interpolation from the end factors associated with the discount rates for 2018 and 2020 (for 2018 1.648% and for 2020 0.290%). Next, for each discount rate, the value of the end factors as a function of retirement age was estimated using linear regression.

The four steps allow automatic generation of the factors. Based on step 4, the final factor for a certain discount rate and a certain retirement age is calculated. Based on steps 2 and 3, all factors are calculated for the years prior to retirement age. The calculation was ultimately carried out in two ways, once based on the age on the reference date and once on the age at the end of 2016.

Based on the above system, the pension accrual has been estimated for ages up to 64 years. The current study assumes an average real return on equities of 2% (a conservative estimate). The calculated profile was used up to age 60. From the age of 60, the pension accrual is fictitious. This is because when sampling groups with less data, sampling was often done for the age category 60-63 years, the average over that age, called $M_{60\text{-}63}$, was used for the ages 60 to 65 years. The profile of the pension accrual was then synthesised. For the ages 60 and 61, the pension accrual based on observation for the entire population has been set at 100% and 102% of $M_{60\text{-}63}$ respectively. Based on the observations, pension capital decreases from 62, but that would almost certainly be biased, due to the rising retirement age. That is why for 62, 63 and 64 years the pension accrual has been set at 103.5%, 105.0 and 106.0% of $M_{60\text{-}63}$ respectively.

A decrease in pension assets has been estimated for ages 65 and older, again based on a return on shares of 2%. This was done by estimating, based on the Statistics Netherlands table population for 2016, a factor for the starting capital required to pay one euro per year in pension benefits from the age of 66 over the remaining life course. This factor is calculated at 16.3228. For this factor, there is a residual capital of zero euros for 105-year-olds.[144] This supplements the rest of the synthetic pension capital.

All in all, this results in the development of the pension assets for the average Dutch person, which is shown in Figure 5.8. The pension assets are zero until the age of 16. From 16 to 60 years, the course has been estimated on the basis of the PAS file. For 60 to 66 years, it has been synthetically supplemented based on the average $M_{60\text{-}63}$ over the ages 60-63 years. From the age of 66, a steady decrease is assumed until the pension assets at the end of the 105th year of life are equal to 0.

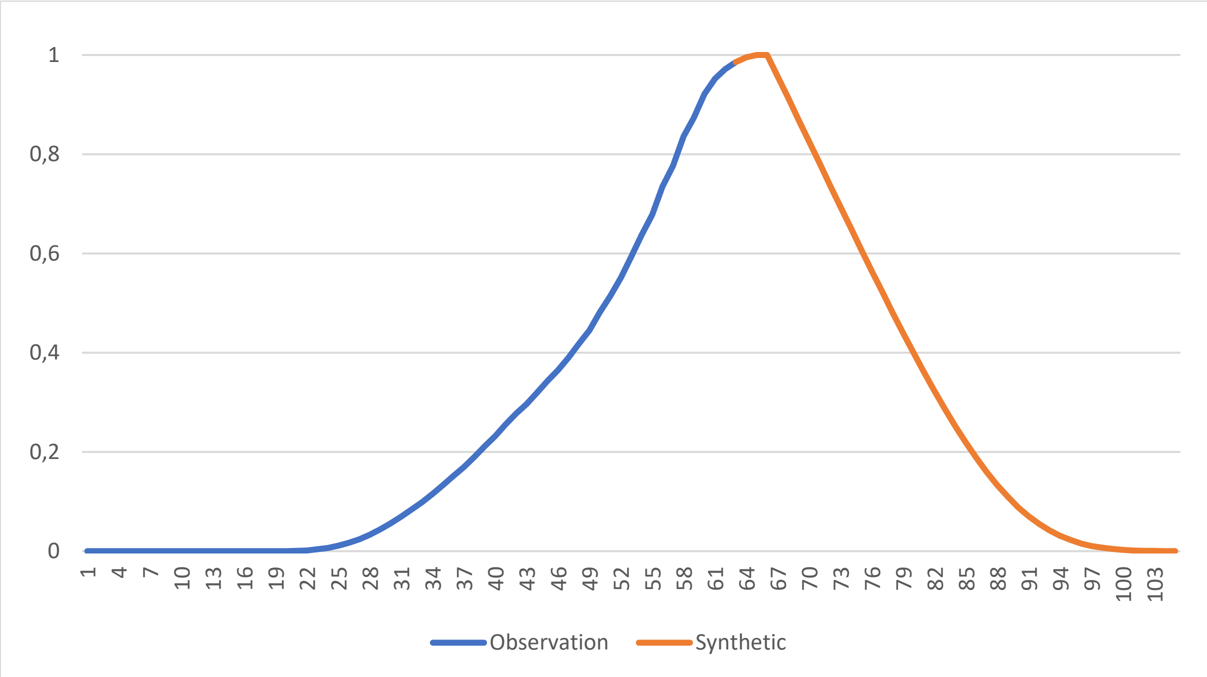

Figure 5.8 Operationalisation of pension accrual and pension decrease in the Dutch population by age, synthetic profile.

The age profiles for direct equity, tax payments from entrepreneurs and pension assets were then added up to form a total profile that is referred to in the rest of this section as the 'asset profile'. This asset profile was used as the basis for the corporate income tax/dividend tax and IRN items of companies, by weighing it against the age structure of the entire study population and then calibrating it against the relevant CPB macro amounts from Table 5.1.

A slightly different operationalisation has been chosen for the inheritance tax. With regard to the age distribution, in line with the CBP, in principle the CPB profile for the item 'Inheritance tax' from Table 5.1 has been used. This profile was then weighted according to group differences in income, wealth and home ownership. Three operationalisations are averaged for this. The first operationalisation is

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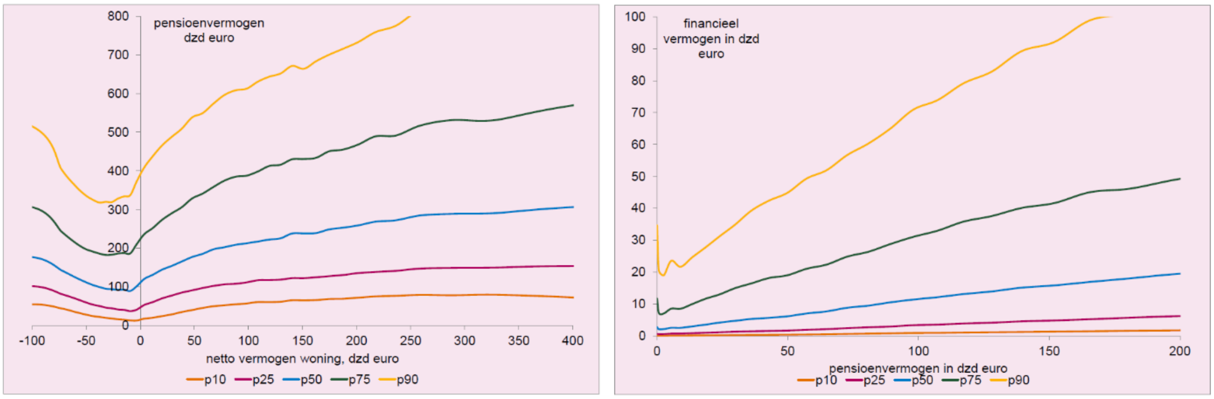
[144] The table population has been synthetically supplemented for this on the basis of Statistics Netherlands StatLine data for 2014-2018 for numbers of people aged 99-105, retrieved 19-4-2023 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/37325/table?dl=2F6F2.

based on the age profile for wealth defined in the previous section, in which the amounts are summed over the ages of 28 to 48 years (for the second generation, due to a lack of data for higher ages) or 28 to 68 years (for the other groups). Subsequently, with regard to this sum, the ratio between the relevant group and the population as a whole was determined. In the second and third operationalisation, ratios were also determined on the basis of Personal Gross Income (variable INPPERSBRUT from INPATAB) and the interest paid on mortgage debts (variable INPT3170RBW from INPATAB). The ratios of these three operationalisations are then averaged. The aforementioned CPB profile 'Inheritance tax' from Table 5.1 was then multiplied by this average. Finally, the resulting profile was calibrated against the CPB macro amount for inheritance tax from Table 5.1, by weighing against the age structure of the entire study population.

The rationale behind these three operationalisations is that in general there seems to be a reasonable correlation between financial assets and net assets in the owner-occupied home (both important assets in inheritances) and pension assets (see Figure 5.9) and furthermore that income is strongly correlated with the wealth of different groups of origin. The limitation to ages from 28 to 48 years for the second generation is due to the lack of data for some groups for people from 48 years of age for the second generation.

Figure 5.9 Correlation between pension assets (employees), home equity (left) and financial assets (right) respectively, 2014. Facsimile of Figure 3.4 and 3.5 respectively from CPB, De verscheidenheid van de vermogens van huishoudens*, retrieved 12-12-2020 from:* [*https://www.cpb.nl/publicatie/de-verscheidenheid-van-vermogens-van-huishoudens*](https://www.cpb.nl/publicatie/de-verscheidenheid-van-vermogens-van-huishoudens)



6 Start-up costs and costs after remigration

6.1 Asylum reception and residence permit issuance

In addition to costs and benefits that apply to all citizens over the entire life course, there are some cost items that only apply to first-generation immigrants. First of all, there are the start-up costs of immigration. The reception of asylum seekers, the issuing of residence permits and the integration of non-Western immigrants entail government costs, which can be included in the calculation for the groups concerned.

Tentative calculations – based on the 2013-2018 national budgets[145] – have been made for this in the current report, which indicate an order of magnitude[146]. For integration costs and the issuing of residence permits, a distinction has been made between asylum immigrants and other immigrants. First of all, the IND costs are divided between residence permits for asylum and regular immigration. Based on the 2017[147] budgetary framework, it has been estimated that the costs for asylum are approximately 2.4 times higher than the costs for regular immigration. By dividing the regular part of the IND costs for the period 2013-2018 (after inflation adjustment[148]) by the total number of regular residence permits for the period 2013-2018, the costs for a regular permit are estimated at approximately €3,100. This is based on the amounts stated for IND costs in the 2013-2018 national budgets.

The reception costs for asylum immigrants are calculated as follows. First, the largest items were added up to arrive at a total amount per year. Included in this calculation are the costs from the 2013-2018 national budgets for COA, Nidos (youth protection, guardianship, etc. for underage asylum seekers) and a lump sum of 30 million per year for the items Vluchtelingenwerk[149] and the Repatriation and Departure Service (*Dienst Terugkeer en Vertrek*). In addition, the costs of the IND have been included insofar as they are attributable to asylum. The costs per permit are calculated by expressing the total costs for the period 2013-2018 (after inflation adjustment[150]) in euros for 2016 and then dividing by the total number of residence permits for asylum immigrants in the period 2013-2018.[151] The costs per permit thus come to approximately €53,700.

The final amount therefore does not express the costs of receiving one asylum seeker, but the costs associated with admitting one asylum immigrant, including the costs of the selection mechanism that

[145] See the following budget documents, retrieved 19-4-2023 from:
http://www.rijksbegroting.nl/2013/voorbereiding/begroting,kst173859_15.html
http://www.rijksbegroting.nl/2014/voorbereiding/begroting,kst186612_12.html
http://www.rijksbegroting.nl/2015/voorbereiding/begroting,kst199430_12.html
http://www.rijksbegroting.nl/2016/voorbereiding/begroting,kst212222_11.html
http://www.rijksbegroting.nl/2017/voorbereiding/begroting,kst225850_17.html
http://www.rijksbegroting.nl/2018/voorbereiding/begroting,kst236777_17.html

[146] It is not difficult to adjust the totals with your own calculation based on the set of tables in this report.

[147] TK 34 550 VI, No. 2 Table 37.4.

[148] Government wage rate, CEP2018, retrieved 19-4-2023 from: https://www.cpb.nl/sites/default/files/omnidownload/Verzamelde_bijlagen_CEP_2018.xlsx

[149] A subsidised organisation providing a wide range of services for and to asylum seekers.

[150] Government wage rate, CEP2018, retrieved 19-4-2023 from: https://www.cpb.nl/sites/default/files/omnidownload/Verzamelde_bijlagen_CEP_2018.xlsx

[151] The number of asylum residence permits for the period 2013-2018 is: 131,760, see Statistics Netherlands StatLine *Verblijfsvergunningen voor bepaalde tijd; verblijfsgrond en nationaliteit*, retrieved 18-12-2020 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/82027NED/table?dl=2D47B.

is the basis of the UN Refugee Convention. For the period 2013-2018, the difference is minimal because the number of asylum seekers does not differ much from the number of asylum residence permits issued.[152]

The amount for the asylum reception is quite high, mainly because of the considerable costs for the COA. According to the national budgets 2008-2018, these amounted to 5.1 billion euros for 132,000 residence permits (€39,000 per residence permit) for the period 2013-2018 and 7.4 billion euros for the period 2008-2018 for 169,000 permits (€43,000 per permit). In addition, the costs for, among others, the IND, Vluchtelingenwerk, Nidos and the Repatriation and Departure Service are added.

6.2 Civic integration

In this section a tentative calculation is given for the costs of integration. In 1998 the Newcomers Integration Act (WIN) came into force. Since then, immigrants have been formally obliged to become proficient in the Dutch language and to acquire knowledge about Dutch society. Initially, the costs were borne by the government. The CPB study from 2003 mentions an amount of €7,000 in 2001 for the integration costs without further explanation.[153] In 2016 prices, this amount – depending on the price index used – is approximately €10,000. Because the content of the integration courses has remained roughly the same since 2001, this figure also gives an indication of the magnitude of the current costs. Since then, however, the funding system has changed.

With the Civic Integration Act of 2006 (introduced in 2007), personal responsibility became more important. In addition to fines, residence law sanctions were also included in the law for failing to pass the civic integration exam in time. In 2013, another funding system followed in the form of a loan system:

> "For asylum immigrants, the maximum amount that can be borrowed is equal to €10,000. For family immigrants, the maximum amount to be borrowed is income-related, but never exceeds €10,000. Only from asylum immigrants, so not from family immigrants, can the loan be waived under certain conditions after meeting the civic integration obligation."[154]

The course offerings were left to the market. Partly because the residence law sanctions, which could form a strong incentive for the integrating person to make an effort, were rarely applied in practice, the results intended by this law did not materialise.

All this was the reason to once again overhaul the integration process in the coalition agreement for the Rutte III cabinet. The residence sanctions remain – on paper at least:

> "Imputable failure to integrate has consequences, such as losing residence status for regular immigrants and not obtaining a stronger residence status [read: permanent residence permit] for asylum permit holders."[155]

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152 The number of 1st asylum applications over the period 2013-2018 is virtually equal to the number of asylum residence permits: 130,770, see *Asielverzoeken en nareizigers; nationaliteit, geslacht en leeftijd,* retrieved 18-12-2020 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83102NED/table?dl=2370E

153 Roodenburg et al. (2003) *Immigration and the Dutch Economy, pg. 67*

154 Blom, Michiel et al. (2018) Inburgering: systeemwereld versus leefwereld, Evaluatie Wet Inburgering 2018, pg. 18

155 (2017) Vertrouwen in de toekomst, Regeerakkoord 2017-2021, pg. 55

The funding will be drastically changed. The loan system is abolished and funding is once again provided by the government. Implementation is left to the municipalities. In terms of content, the program is more demanding, because "[t]he language requirement is being tightened from A2 to B1. To this end, language lessons at level B1 are also financed by the national government."[156] The government intends to implement the changes in the year 2020.[157]

The following general considerations have been made when estimating the integration costs per immigrant insofar as these are borne by the government. According to the methodology of the current study, the consequences of immigration for collective finances are calculated on the basis of existing institutions. In practice, this means that the situation in 2016 is the starting point. This is the most recent year for which all or at least the most important data is available. For the integration costs, however, the policy changes that are foreseen from 2020 are taken into account (see the above). Amounts after 2016 are expressed in prices of 2016. This means that two estimates have to be made, namely for the years 2016-2019 and for 2020 and later years.

The following considerations have been made for the 2016-2019 period. Under the current loan system, a maximum of €10,000 can be borrowed. Family immigrants have to make do with an income-dependent maximum. Unless they fall into the lowest income category, this is lower than the aforementioned €10,000. However, this is not so much an indication that lower costs apply to this category, but rather the lower amount stems from the idea that they can make a contribution of their own.

The costs borne by the government are determined by three factors:

- The average amount borrowed (= total amount of loans divided by the number of immigrants including non-borrowers);
- The percentage of remissions for meeting the integration obligation (only asylum immigrants);
- The percentage of irrecoverable debts on non-remitted loans.

With regard to points 1 (amount borrowed) and 2 (remissions), the evaluation report by Blom et al.[158] offers some starting points:

> "Of the integrators who became obliged to participate in a civic integration program in 2013, it appears from this evaluation that, on the reference date 1 September 2017, approximately three quarters had complied with the obligations arising from the Civic Integration Act. This group consists of: those who pass the exam, people with an exemption and people relieved of the obligation. Of the integrators who became subject to an integration obligation in 2013, approximately 60% had passed the civic integration exam (or State Exam NT2) on the reference date. An exemption has been granted to 5% of the integrators. Integrators can receive an exemption if they have completed a Dutch education with a basic qualification (MBO-2 level or higher). Integrators can be relieved of the integration obligation on medical grounds, on the basis of demonstrable efforts or because they have demonstrably been sufficiently integrated (see chapter 7).[159] More than one in ten people integrating (11%) from the first cohort has received an exemption. The remaining quarter has received an extension of the regular

[156] See note III pg. 54
[157] Rijksoverheid (2018) Inburgering op de schop
[158] See note II pg. 5 and pg. 19
[159] This exemption is granted retrospectively if the person integrating has fulfilled his best-efforts obligation.

integration period of three years and is still integrating. Half of these extensions are the result of a so-called culpable delay. The civic integrators involved have been fined for failing to comply with the civic integration obligation on time and a new civic integration period of two years. … If the person integrating has culpably failed to comply with the obligations under the law on time, DUO [= the relevant government agency] will impose a fine and a new term of two years will start. The right to remission of the loan lapses."

The aforementioned evaluation report also provides information about the loans granted:

> "The data from DUO shows that the vast majority (94%) of the asylum immigrants from the 2013 cohorts who are subject to an integration requirement have a loan (see Figure 5-9). Only a third of family immigrants have a loan. The average loan amount of family immigrants is much lower than that of asylum immigrants (Figure 5-10). Family immigrants who have passed the (integration or state) exam borrow an average of €2,200 compared to asylum immigrants who pass who borrow an average of €6,000. Figure 5-11 provides insight into the distribution of the amounts borrowed for the various groups of immigrants. This shows that almost half of the asylum immigrants borrow more than €7,000, and a quarter borrow the maximum amount of €9,000 - €10,000. The majority of family immigrants borrow between €1,000 and €3,000."[160]

From the Figure referred to in the quote above, it can be seen that those who do not pass the exam among both asylum and family immigrants borrow approximately €1,400 more than those who pass the exam. The pass/fail ratio is approximately 60/35 (for both categories combined).[161]

The average amount borrowed can be calculated as follows:

- Asylum immigrants: ((6,000 × 60 + 7,400 × 35) / 95) × 0.94 = approx. €6,100
- Family immigrants: ((2,200 × 60 + 3,600 × 35) / 95) × 0.33 = approx. €900

The remitted part of these amounts (point 2) is relevant for public finances. This only applies to asylum immigrants. It is known that a quarter of all civic integration obligations (unfortunately, not only asylum immigrants) do not pass within the prescribed period, and that in half (12.5%) of these cases there is 'culpable delay', with the result that the remission is cancelled. On average per asylum immigrant subject to the integration requirement, this amounts to 7,400 × 0.125 = rounded up to €900.

Finally, we come to point 3 (irrecoverable debts). In view of the low income of many immigrants subject to integration requirements, not all (non-remitted) loans will eventually be paid off. In the absence of hard figures, a 'diffuse prior' is used, i.e., half-payment. Table 6.1 summarises the findings:

Table 6.1 Civic integration costs 2016-2019 per year per immigrant (in €)

	[1] Loan	[2] Remission	[3] = [1] – [2] Remaining loan	[4] = [3] × 0.5 Uncollectable	[2] + [4] Government costs
Asylum immigrant	6,100	5,200	900	450	5,650
Family immigrant	900	0	900	450	450

[160] See note II pg. 58
[161] See note II pg. 4, diagram

The following considerations have been made for the cost development from 2020 onwards. As provided for in the coalition agreement, the level for the language component will be raised in the system that is to come into effect in 2020. It is not yet clear what this increase in the language level means for the costs. The following cryptic sentence in the coalition agreement does not provide much clarity: "The current financial frameworks, together with the resources made available in the coalition agreement for raising the language level, apply as hard preconditions."[162] In the financial appendix to the coalition agreement, there is item number 93, from which one could conclude that this concerns an increase from 60 to 70 million (= 17%) for the language component. In the absence of clarity, an increase of half of this percentage has been assumed and is subsequently rounded to multiples of €50. This gives the following amounts:

Asylum immigrant:	€5,650	× (1 + 0,17 / 2) = (afgerond):	€6,150
Family immigrant:	€450	× (1 + 0,17 / 2) = (afgerond):	€500

These amounts are used to calculate the integration costs. For each group, an estimate was made of the fraction of people with an integration obligation, which depends on variables such as age and immigration background. Based on this fraction and the immigration profile, the average amount per person was then calculated for each group. Finally, the age profile for the Public administration item has been increased by this amount. To compensate for this, the initial age profile for the Public administration item was lowered prior to the calculation in such a way that for the population as a whole the macro amount for 2016 is again in line with the amount in Table 5.1.

6.3 State pension rights

In addition to costs that occur around immigration, there are also costs that continue after possible remigration. A (re)migrant usually retains the right to (part of) the accrued state pension and those costs for the treasury in that case therefore partly continue after departure from the Netherlands. A tentative calculation has also been made for this. For this purpose, the share of so-called treaty countries for including state pension rights has been calculated per origin group, immigration motive or combination of origin and motive.[163] Subsequently, on the basis of the remigration probabilities and the immigration profile, it was calculated how much state pension right immigrants had built up at the time of remigration.

Subsequently, the present value of the claimable state pension rights was determined against the discount rate and mortality probabilities associated with the scenario concerned. Two lump sum amounts were used for this: one for people from treaty countries and one for people from non-treaty countries, who have fewer rights to 'carry over the state pension' in the event of remigration.[164] In both cases it

[162] See note III, pg. 2
[163] See the following sources, retrieved 19-4-2023 from:
https://www.svb.nl/int/nl/algemeen/eu_eer.jsp
https://www.svb.nl/int/nl/algemeen/verdragslanden.jsp
https://www.uwv.nl/particulieren/overige-onderwerpen/internationaal/handhavingsverdrag-naar-welke-landen-kan-uitkering-mee/detail/uitzonderingen-wajong-uitkering-ww-uitkering
https://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=71093ned&D1=1&D2=0&D3=0&D4=a&D5=a&D6=l&HDR=T&STB=G1,G2,G3,G4,G5&VW=T
https://www.belastingtips.nl/kennisbank/fiscaaladvies_dossier/emigratie/recht_op_aow_na_emigratie/
[164] SVB, *Overzicht verdragslanden,* retrieved 12-12-2020 from: https://www.svb.nl/nl/aow/verdragslanden

is assumed that 18.65% tax is paid in the Netherlands on the gross amount and this tax has been deducted.

The amount for treaty countries was calculated by taking the weighted average of the amounts paid out for the state pension in 2016, weighted according to the Statistics Netherlands table population 2016, based on age 68 (weight 1.0). Weighing is done to compensate for the fact that the cohabitant / single person ratio changes with age and with it the state pension amount. The amount for 67 years is half counted, to compensate for the fact that on average the amount in the year that the state pension starts will be lower.[165] After deduction of the aforementioned tax, this yields an amount of €9,331 per year.

The amount from the non-treaty countries is based on 50% of the minimum wage, including holiday pay allowance. The amounts for the minimum wage up to 1 July 2016 and from 1 July 2016 are averaged.[166] It has been assumed that the amount in the year in which the entitlement takes effect is half of the amount in the following years. After deduction of a tax to be paid in the Netherlands of 18.65%, this yields an amount of €7,817 per year.

Subsequently, the net present value of the state pension rights for treaty countries and non-treaty countries was calculated, against the discount rate and death probabilities applicable in the scenario concerned. Incidentally, these are not very large amounts *per immigrant on average* (usually less than €10,000), because many immigrants come young (on average around 25 years of age) and stay for a short period (a large number leave within 10 years). In the case of remigration, the accrued rights are therefore still limited and because the state pension for young people is still far in the future, the amounts are even lower due to the discounting and interim mortality rates. At a growth rate of 1% and a discount rate of 2.5% – as used by the CPB in its latest ageing study (2019) – after discounting the mortality probabilities, the present value of the state pension of young immigrants – people in their twenties and (early) thirties, for example – is in the order of magnitude of €100,000. An immigrant who has five years of residence that count towards the state pension accrual is entitled to 10% of the state pension and the present value of this at the time of immigration is therefore only in the order of magnitude of €10,000.

These calculations are tentative and intended to indicate an order of magnitude. The actual amounts of the costs after remigration are probably different. It is possible that by no means all state pension rights will be claimed and due to all sorts of legal and practical objections, the average claimable state pension right in non-treaty countries will be even lower. On the other hand, the costs after emigration could also be higher than assumed here. For example, remigrants are partly entitled to Dutch healthcare, which is not included here.

[165] It is all a bit more complicated because the state pension age is shifting, but this is sufficient for a tentative calculation.
[166] Staatscourant, stcrt-2015-10678 stcrt-2016-24815.

7 Demographics and ageing

7.1 Birth and death

The age-specific fertility is based on Statistics Netherlands StatLine data for the years 2014-2018 of the number of live births per thousand of the average female population per age. These data have been summed over the years 2014-2018 for each of the following 35 age categories separately: 'younger than 16 years', the individual ages from 16 to 49 years and the age category '49 years or older'. Based on these data, an age profile was made for the age-specific fertility. This profile has a value of 0 for ages from 0 to 15 years and for ages from 50 to 100 years. The value for the other ages (15 to 50 years) is determined as follows. The value for 15 years is equated to the sum (described above) for the category 'younger than 16 years'. The values for 16 to 49 years are equated with the separate sums (described above) for 16 to 49 years. The value for 49 years is equated to the sum (described above) for the category '49 years or older'. Finally, the resulting age profile was multiplied by a normalisation factor in such a way that a probability distribution emerged (i.e., such that the sum is equal to 1) over all ages.

The number of children per woman is based on Statistics Netherlands[167] data for the number of children in the first generation. However, these data are only available for fairly broad geographical categories. That is why data from the United Nations for the Total Fertility Rate in regions of origin has also been used[168]. The weighted average (⅔ CBS, ⅓ UN) of both figures was then used. Fertility is dynamic, but for simplicity it has been assumed to remain constant. This, of course, creates bias, especially for births further in the future. However, because the peak in the distribution of entry ages (usually around age 25) roughly coincides with the peak in age-specific fertility (around age 30), a large proportion of the second generation will be children of fairly recently arrived first-generation immigrants, so this bias is expected to be limited.

To simplify the calculation, no distinction is made between men and women. The number of births is determined for each group as follows. The number of children in the group concerned is halved first. The outcome was then multiplied by the age profile for the age-specific fertility. From the resulting vector and the vector for the age structure of the relevant group in the relevant year, the number of births for the relevant year was determined by matrix multiplication.

In addition, account has been taken of the fact that children of first-generation immigrants born abroad also belong to the first generation. It has also been taken into account that some of the immigrants immigrate during or after childbearing age. It is assumed here that children up to the age of 18 always emigrate with their parents and children from 18 years of age always stay in the Netherlands. This may lead to bias if self-selection would occur with regard to whether or not to have children. If people with children remigrate less often, this could, for example, lead to an underestimation of the net contribution (positive or negative).

The mortality probabilities are based on data from Statistics Netherlands StatLine. The standard scenario is based on the Statistics Netherlands mortality probabilities up to 2060. The mortality

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[167] Statistics Netherlands StatLine, *Geboorte; vruchtbaarheid, migratieachtergrond en generatie moeder*, retrieved 12-5-2020 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83307NED/table?dl=39911

[168] United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019, Online Edition.

probabilities were then kept constant from 2060 onwards. In the model used, ages from 0 to 100 years are used. De facto, the mortality rate for 99-year-olds is therefore 100% (there are no 100-year-olds in the model, so in the model, all 99-year-olds completely disappear from the model after one year). That is not realistic, because a growing group of people are living to be 100 years or older. Based on Statistics Netherlands StatLine data, it has therefore been estimated that the number of people over 100 is 2.4 times the number of 99-year-olds. This factor increases the costs and benefits of 99-year-olds in order to include the costs for people over 100 in the calculation. This is based on an effective discount factor of 1% and the assumption that the costs and benefits for 99-year-olds are equal to the costs and benefits for people over 100. This is a relatively small part of the total amount, so this approximation is sufficient.

In order to investigate the effect if the mortality probabilities are not kept constant from 2060, an exponential curve has been fitted for each age on the basis of the Statistics Netherlands projections for mortality probabilities for 2017-2060 with SPSS, which has been extrapolated to the years from 2060. For older ages, the data for the first years are not included, for people in their seventies the first 5 years, for people in their eighties the first 10 years, and for people in their nineties the first 15 years.[169] The net contribution will become more negative if the mortality probabilities continue to fall after 2060. The difference is in the order of magnitude of €10,000.

For the different levels of education, differences in mortality have been taken into account on the basis of Statistics Netherlands StatLine data.[170] The mortality probabilities are lower for people with a higher education level and vice versa. The ratio in mortality probabilities per age (group) between the education level on the SEC 3-part division (low, intermediate and high) is taken as the starting point. The reference group used for this was upper secondary education (HAVO, VWO and MBO2, 3 and 4). Because, especially for children and young people, the mortality probabilities are close to the smallest unit, i.e., 0.0001, so that deviations due to rounding can play a major role, the denominators/numerators in the ratios have been increased/decreased by 0.00005 in such a way that an effect of rounding is excluded. The ratios between high/low education on the one hand and secondary education on the other hand were set at 0 if they were above/below 1 for high/low education. Finally, the results are smoothed.[171]

The lower the education level is, the greater the effect on the net contribution over the life course of differentiating mortality probabilities by education. Compared to this reference group, the difference is greatest for people with the highest education at primary school, with a net contribution over the life course that is approximately €18,000 higher if mortality probabilities are taken into account. For people with lower secondary education (VMBO b/k, MBO1 or VMBO g/t, HAVO, VWO-onderbouw) as the highest level of education, the net contribution is €17,000 and €14,000 higher, respectively, if differentiated by level of education. Taking into account differences in mortality probabilities actually yields a net contribution that is €8,000 lower for people with a (HBO- or WO-) bachelor's degree as the

[169] For the reason that these deviated from the otherwise almost perfect log-linear model.
[170] Retrieved 19-4-2023 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83780NED/table?dl=3CF9C
[171] By applying the function $(f(L-1)+2\times f(L)+f(L+1))/4$ five times in succession for ages $0<L<99$ where $f(L)$ is the function to be smoothed.

highest level of education attained. The difference is negligible at the (HBO- or WO-) masters and doctorate levels.

Differences in mortality probabilities by motive or origin have not been taken into account, because no suitable data could be found for this. We considered using differences in mortality probabilities by income as a proxy, but this was not done because it was not clear how good this approach would be. However, the previous results do give an indication of the expected differences, which will probably be in the order of magnitude of €10,000.

7.2 Immigration

This section discusses the operationalisation of the immigration profiles and remigration probabilities. Because the immigration profiles are rather decisive for the net contribution (over the life course), an immigration profile has been made as much as possible for each group separately. In total, immigration profiles were made for 139 different groups. This concerns groups of origin, groups classified according to immigration motive (asylum, labour, study, etc.) and combinations of both. Probabilities of remigration are also very decisive for the net contribution and are therefore determined individually as much as possible for each group. In total, 407 different remigration profiles were calculated for 76 different groups for different entry age intervals.

For the operationalisation, based on GBAMIGRATIEBUS 2017, all migration movements from 1995 have been used for the first generation (regular and other arrivals and departures). In the case of several migration movements of the same person per year, inward and outward movements that neutralise each other are removed. For the immigration profiles, the migration movements are aggregated by age at the end of 2016 and the relevant origin group (region and/or immigration motive). For the remigration probabilities, the emigration movements are aggregated by entry age, length of stay and the relevant origin group (region and/or immigration motive) and divided by the number of people of the relevant origin group residing in the Netherlands on 1 January of the relevant year.

When determining the remigration probabilities, several profiles were made for each group because the remigration probabilities depend strongly on the entry age. In principle, separate remigration profiles have been made for entry ages up to 60 years for the age groups 0 to 20 years, 20 to 30 years, 30 to 40 years and 40 to 60 years and 60 to 70 years, for motive, region (maximum refinement up to the 18-part division) and the motive and region combination (maximum refinement to the 12-part division). If the data allowed this, remigration profiles were also made for the intermediate 10-year (entry) age groups. In some cases, two of the aforementioned age groups have actually been merged. Also, for the older ages, the combination of motive and region is often limited to only the distinction between Western and non-Western. For the age group 70 to 80 years, there is only a breakdown by motive and the Statistics Netherlands 12-part division of regions of origin. For the age group 80 to 90 years, there is only a breakdown into Western and non-Western. For the age group 90 to 100 years only a repatriation profile has been made for all first-generation immigrants together. In total, 407 different remigration profiles were created.

The remigration profiles have been made up to and including 23 years of residence, insofar as the data permits. The profiles were extrapolated from 23 years to 50 years. That is done as follows. The course of the remigration probabilities by year of residence is approximately exponential (with a negative exponent: the probabilities decrease). The factor of the decline has been estimated for eight 10-year entry age groups for the remigration probabilities of all first-generation immigrants combined.[172] This was done by calculating the decline for 11 different 10-year periods (1-10 years of residence, 2-11 years of residence, … , 11-20 years of residence)[173]. Subsequently, the average of this was taken and this was used to extrapolate all 407 profiles (where possible and applicable) to 50 years.

Of course, extrapolating that far ahead is fraught with uncertainty.[174] In order to provide a better estimate for the probabilities of remigration after 23 years of residence, three profiles have also been estimated for the long-term probabilities of remigration: one for Western immigrants, one for non-Western immigrants and one for all immigrants combined. This was done by separately determining both the number of emigrants and the number of people residing in the Netherlands on 1 January of the year in question for these three groups and then dividing the first quantity by the second quantity. For lengths of stay up to 24 years, the empirical data-based profiles have been used. For the length of stay from 24 to 30 years, the extrapolations were used. For lengths of stay of 30 to 50 years, the weighted average was taken of the extrapolations and the applicable long-term remigration profile. The function (*length of stay* – 30) / 20 has been weighted for a gradual transition. Only the applicable long-term remigration profile, i.e., the profile for first-generation immigrants, is used for residence times from 50 years of age, whether or not broken down by the Western or non-Western region of origin.

7.3 Ageing

For the ageing simulation, a demographic model has been built based on the age structure of the Dutch population on 1 January 2020, based on Statistics Netherlands StatLine data. This has been supplemented with data on the age structure of the third generation on 1 January 2020, which is based on Statistics Netherlands microdata. This is based on the Statistics Netherlands definitions of people with a Dutch background and a first, second or third-generation immigration background.

In principle, the operationalisation of birth, death and migration is based on the operationalisation in the previous two paragraphs. The distribution over entry ages – the immigration profile – has been equated with that of the average immigrant. The same has been done for the remigration probabilities. As with the calculation of the net contribution, the second generation is assumed to always accompany their parents up to the age of 18 in the event that they remigrate. The third and subsequent generations are assumed not to migrate. The same has been assumed for the native Dutch group.

An age vector was constructed for the remigration probabilities of the first and second generation. For the first generation, this was done by combining the immigration profile of the average first-generation immigrant with the remigration probabilities of the average immigrant for the 10 age groups 0 to 10 years to 90 to 100 years (see §7.2 of this appendix). Specifically, the (fractional) population created by the influx of 1 immigrant in 2020 (distributed across the entry ages 0 to 100 according to the aforementioned immigration profile) was tracked separately for each entry age from 0 to 100 years until

[172] Extrapolation is not necessary for the groups 80 to 90 and 90 to 100 years, because the model calculates with ages up to 100 years and the remigration probabilities for the first 23 years are already known (insofar as the data permits).

[173] There was little data for the period after 20 years of residence, which is why it was not used for the extrapolation.

[174] It should be noted here that the chances of remigration after 23 years of residence are often already very small, because most remigration takes place in the first 10 years. The effect of extrapolation errors will therefore usually be small, partly because due to discounting amounts carry less weight the further they are in the future.

ages 100. Thus, an immigrant with an entry age of 0 years is tracked until the year 2119 which represents an age of 99 years. An immigrant with an entry age of 99 years is followed only in 2020. This population develops according to the mortality probabilities discussed in §7.1 of this appendix and the remigration probabilities discussed in §7.2 of this appendix. The development over time of this population is thus a 100 × 100 matrix with only zeros under the diagonal running from '*entry age=99 × calendar year=2020*' to '*entry age=0 × calendar year=2119*'. In the rest of this section, a 100 × 100 matrix always refers to a matrix of entry age (0-99 years) and calendar year (2020-2119). Based on this matrix, a second 100 × 100 matrix is calculated, with the (fractional) number of emigrants. By then aggregating both matrices by the age of immigrants, the emigration probability can be calculated for each age. The age can be calculated from the combination of calendar year and entry age in the year 2020. This provides the age profile with remigration probabilities for the first generation.

For the second generation, we first combined the aforementioned 100 × 100 population matrix of the first generation of immigrants with the age profile for age-specific fertility (see §7.1 of this appendix). This yields a 100 × 100 population matrix containing the (fractional) number of children born for each combination of calendar year and entry age (with, by its very nature, again many cells that are zero). The following operation was now successively applied 18 times to this second-generation population for child ages $0 \leq k \leq 17$: (i) first, the population was normalised by scalar multiplication to a population size of 1; (ii) then, in the form of a 100 × 100 remigration matrix based on the first-generation remigration probabilities, the fractional number of second-generation emigrants was determined for child-age k and for each combination of calendar year and entry age; (iii) then, the sum of the aforementioned matrix with remigrating second generation of child-age k was determined and this sum, due to normalisation in step (i), is also directly the remigration probability for child-age k; (iv) finally, the population matrix was adjusted by subtracting the remigration matrix (the mortality probabilities of the second generation were neglected) and a further cycle started from step (i). This provides the age profile with remigration probabilities for the second generation.

The remigration profiles for the first and second generation are based on average emigration behaviour over the period 1995-2017. However, immigration has become more dynamic over time, with higher emigration probabilities. By multiplying the remigration profiles for the first and second generation by a correctly chosen scalar, the steady state remigration probability can be adjusted. By steady state remigration probability is meant the stable ratio of immigrants to emigrants that occurs in the long run when one has constant yearly number of immigrants.

The model follows as closely as possible the United Nations calculations, which is quoted in §10.2 and replicated in §10.3 of the current report. The UN calculations involve additional population growth due to "replacement migration", meant to keep ageing constant. Here, the development of the population in 1995 is set against the development of the group of 'post-1995 immigrants and their descendants'. The model used for §10.3 of the current report compares the development of the Dutch population on 1 January 2020 and their descendants with the development of the post-2020 immigrants (immigrants arriving from 1 January 2020) and their descendants needed. Thereby, the number of post-2020 immigrants is always chosen so that the ratio between the over-70s and the 20-70-year-olds remains constant at the 2020 level.

To keep the model simple, some assumptions have been made:

1) There are equal numbers of men and women.
2) The childbearing rate is constant 1.7 children per woman for all groups.
3) All children born in the Netherlands from 2020 onwards are either offspring of people living in the Netherlands on 1 January 2020 or offspring of post-2020 immigrants.
4) Offspring of post-2020 immigrants are either the child of two post-2020 1st generation immigrants (= post-2020 2nd generation), or the child of two post-2020 2nd generation parents (= post-2020 3rd generation), or the child of two post-2020 3rd generation parents (= post-2020 4th generation).

Point 1) makes the model much simpler, because in terms of mortality and (re)migration probabilities, one can work with averages of men and women. Point 3) needs some explanation. The calculation is only about the additional population growth from 2020 onwards, and because of point 2) – the number of children is always 1.7 per woman for all groups – taking all possible forms of 'mixed relationships' into account has no effect at all on that additional population growth, while it does make the calculation much more complicated. However, it was considered relevant to provide insight into the share of post-2020 1st and 2nd generation. That is why four groups are distinguished in Figure 10.2 of the current report, namely, in addition to 'Residents in 2020 and their descendants' also 'Post-2020 immigrants' (= post-2020 1st generation), 'Children of post-2020 immigrants' (= post-2020 2nd generation) and '(Great)grandchildren of post-2020 immigrants' (= post-2020 3rd and 4th generation). The latter group includes not only the post-2020 3rd generation and the post-2020 4th generation but also the descendants of the post-2020 4th generation, but the latter is a completely negligible fraction of the total population until the year 2100 and is therefore not distinguished or mentioned separately in the figure. Point 4) serves to keep the calculation for understanding the relative size of 1st and 2nd generation post-2020 immigrants as simple as possible.

In the model, emigration was subtracted first and then mortality. Then ageing was applied and birth was calculated. The resulting total population was then calculated. As a final step, immigration was calculated and then the resulting population was recalculated. This approach has the advantage that it is relatively easy to calculate how many immigrants are needed to keep ageing constant (or for other purposes such as a constant migration balance or a stationary population).

7.4 Demographics

In this section, some demographic passages are explained from Chapter 1 (population growth in the 21st century with different net migration), Chapter 2 (estimation of the current population size if there had been no immigration) and Chapter 11 (estimation of additional population growth upon the admission of so-called high potentials to absorb the costs of an ageing population) of the current report.

The demographic model from the previous section has also been used for the population growth estimates given in §1.1 of the current report. In the model, an annual net migration that is 10 thousand higher in 2100 results in 1.23 million extra inhabitants. In §1.1 of the current report, it is stated that the difference in population size in the year 2100 with a migration balance of 0 persons versus a migration balance of 80,000 persons is equal to about 10 million. That is a rounding of 8 × 1.23 = 9.84 million. Compare the population numbers and the population increase per 10 thousand increase in the annual net migration given in this section with the Medium Variant and the Zero-Migration scenario of the United Nations.[175] In the Medium Variant, the average net migration weighted against population size is 1.19 immigrants per 1000 inhabitants, which equates to a net migration of 20.0 thousand people per year.[176] The difference in population size in 2100 between the Medium Variant and the Zero-Migration scenario amounts to 2.37 million people and that also amounts to 1.19 million extra inhabitants per 10,000 net migration in 2100, so close to the model used in the current report.

The population estimate without immigration (§2.2) is based on the population on 1 December 2022. The total population then was 17.81 million.[177] Of this, the first generation (2.64 million) is obviously the direct result of immigration. The same goes for the second generation with two foreign-born parents (0.93 million). The second generation with one foreign-born parent (1.13 million) is included by weight 0.5 (=0.56 million) as a contribution to population growth due to immigration. The effect of the third generation up to 50 years of age (size on 1 January 2020: 0.88 million) on population growth is estimated at 0.32 million, based on CBS-data[178], on 1 January 2020 and at 0.36 million by the end of 2022. This calculation uses the observation that around ⅕ of the population with a western second-generation migration background has two foreign-born parents and around ⅔ of the population with a non-western second-generation migration background has two foreign-born parents. Altogether, this gives 2.64 + 0.93 + 0.56 + 0.36 = 4.49 million population growth attributable to immigration, rounded up to 4.5 million.

The estimate of the additional population growth if so-called high potentials are admitted to absorb the costs of an ageing population (§11.3) is based on the amounts for 2016, the reference year of the current study. For ease of comparison, we have assumed a period that is as long as in the calculation exercise based on *Immigration and the Dutch Economy* given in the main text (60 years), hence the calculation from 2020 to 2080. Because all amounts in the current report are expressed in 2016 euros, it is based on the GDP in 2016, which was 708 billion euros.[179] 2.5% of 708 billion is 17.7 billion. At the assumed €100,000 net contribution per high potential, this yields that 177,000 high potentials are needed annually to cover 2.5% GDP ageing costs. Simulation using the same demographic model outlined in the previous section yields that this leads to additional population growth of 5.7 million people.

It was further assumed that 'for every 3.4 additional labour migrants, one additional family migrant comes to the Netherlands'.[180] This amounts to about 0.3 family migrant per labour migrant, or 52,000 family migrants per year. Assuming the remigration probabilities of family migrants (§7.2 of this

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[175] United Nations, Department of Economic and Social Affairs, Population Division (2019).

[176] United Nations, *Net migration rate (per 1,000 population).* Retrieved 21-3-2023 from: http://data.un.org/Data.aspx?q=migration&d=PopDiv&f=variableID:85;crID:528;timeID:104,110,116,122,128,134,140,146,152,158,164,170,176,74,80,86,92,98&c=2,4,6,7&s=_crEngNameOrderBy:asc,_timeEngNameOrderBy:desc,_varEngNameOrderBy:asc&v=1

[177] CBS-maatwerk. *Bevolking op eerste van de maand; geslacht, leeftijd, migratieachtergrond,* retrieved 12-1-2023 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83482NED/table?dl=76461

[178] CBS-maatwerk. *Personen met ouders van de tweede generatie,* retrieved 12-1-2023 from: https://www.cbs.nl/nl-nl/maatwerk/2020/46/personen-met-ouders-van-tweede-generatie-1-januari-2020

[179] Statistics Netherlands StatLine, *Opbouw binnenlands product (bbp); nationale rekeningen*, retrieved 12-02-2021 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/84087NED/table?dl=4D597

[180] CBS, *Veronderstellingen Immigratie* bij de bevolkingsprognose 2014-2060, retrieved 7-1-2023 from: https://www.cbs.nl/-/media/imported/documents/2015/17/2015bt06-bevolkingsprognose-2014-2060.pdf?la=nl-nl

appendix), this gives 2.6 million additional inhabitants in the year 2080. In total, this immigration thus gives 8.3 million additional population growth up to the year 2080.

The question, of course, is what the net contribution of these family migrants will be. In part, these are minor family migrants. Based on Statistics Netherlands StatLine data,[181] [182] it is estimated that about ¼ of the family migrants are minors, or 13,000 out of 52,000 family migrants. If minor family migrants are similar to natives, their net contribution will be about €0. So if we assume that, there are still 52,000 - 13,000 = 39,000 adult family migrants whose net contribution has to be discounted. If they contribute negatively, this cancels out part of the net contribution of labour migrants, and more than 177,000 labour migrants need to be admitted annually for the desired effect. Conversely, if family migrants contribute positively then less than 177,000 labour migrants are needed.

A calculation example can clarify the effects. Suppose that the selection on high potentials is such that there is also (implicit) selection on the net contribution of family migrants who therefore have a positive net contribution of €80,000. Then the additional population growth until the year 2080 is over 7 million. Conversely, if there is no (implicit) selection on the net contribution of family migrants and they cost the treasury a net €80,000 over the life cycle – more or less in line with the current situation (see Table 6.1 of the current report) – then the additional population growth up to 2080 is over 10 million persons.

[181] Retrieved 19-4-2023 from: https://opendata.cbs.nl/#/CBS/nl/dataset/84808NED/table?dl=760DC
[182] Retrieved 19-4-2023 from: https://opendata.cbs.nl/#/CBS/nl/dataset/84809NED/table?dl=760DB

8 Anchoring in CPB studies

8.1 Anchoring in CPB ageing study *Minder zorg om morgen* (2014) and the CPB *Update Medium Term Outlook 2018-2021*

The method of generational accounting used in the current report is the same as is used in the CPB ageing studies. Starting point for the calculations are the methods and assumptions[183] from the CPB ageing study *Minder zorg om vergrijzing*[184] (*Less Worries about Ageing*, 2014) and, to the extent possible, the CPB ageing study *Zorgen om morgen*[185] (*Worries about Tomorrow*, 2019). Although *Minder zorg om vergrijzing* (2014) is the starting point for the current report, in practice, a more up-to-date dataset was used, namely a projection[186] to 2060 for the *CPB Update Medium-Term Forecast 2018-2021* (*Actualisatie Middellangetermijnverkenning 2018-2021*)[187].

The CPB ageing studies focus on determining the so-called "sustainability balance" for public finances. With a number of corrections[188], this sustainability balance can be traced back to the concept of "net benefit", that is, the net fiscal benefit an individual has from the government. The concept of net benefit is a mirror image of the concept of net contribution that is central to the current study. For example, a resident who has a net benefit from the government of +€50,000 will have a (negative) net contribution of –€50,000, i.e., the same amount, but with the opposite sign.

The calculations in the current report are based on the base year 2016. At the start of the current study, this was the most recent year for which all data was available. In order to include the development of policy and the economy from 2016 in the calculation, the current report uses the aforementioned projection to 2060 from the CPB *Update Medium Term Outlook 2018-2021*. This concerns a dataset with age profiles (0-99 years) for all government expenditure and income (with the exception of financial income and expenditure and income from abroad) divided over 23 cost and income items (see Table 5.1). This dataset – referred to in the rest of this document as the CPB2018 dataset for short – consists of 6×23×100 nominal amounts. Specifically, these are age profiles (0-99 years) for each of the 6 years 2016, 2021, 2030, 2040, 2050 and 2060 and each of the 23 items in Table 5.1. The development of these amounts over time is based on a number of assumptions made by the CPB. Many of these assumptions are simply adopted, because in the long term they ultimately come to amounts that fit in with the long-term growth path of the economy that the CPB foresaw when writing the *Update Medium Term Outlook 2018-2021*. However, adjustments have been made for two assumptions.

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[183] See Technical Appendix of *Minder zorg om vergrijzing*, retrieved 19-4-2023 from: https://www.cpb.nl/sites/default/files/publicaties/bijlagen/dp170-technische-bijlage.pdf

[184] Smid, B., H. ter Rele, S. Boeters, N. Draper, A. Nibbelink en B. Wouterse (2014), *Minder zorg om vergrijzing*, retrieved 17-1-2022 from: https://www.cpb.nl/sites/default/files/publicaties/download/cpb-boek-12-minder-zorg-om-vergrijzing.pdf

[185] Adema, Y., & I. van Tilburg (2019), *Zorgen om morgen*, retrieved 17-1-2022 from: https://www.cpb.nl/sites/default/files/omnidownload/CPB-Vergrijzingsstudie-2019-Zorgen-om-morgen.pdf

[186] Projectie voor het 'houdbare basispad model', versie 4, 15-8-2017, ISIS-versie 23.8.0.

[187] Retrieved 19-4-2023 from: https://www.cpb.nl/publicatie/actualisatie-middellangetermijnverkenning-2018-2021

[188] Smid, B., H. ter Rele, S. Boeters, N. Draper, A. Nibbelink and B. Wouterse (2014), framework 'EMU-saldo en netto profijt', pg. 41, retrieved 17-1-2022 from: https://www.cpb.nl/sites/default/files/publicaties/download/cpb-boek-12-minder-zorg-om-vergrijzing.pdf

The first adjustment from CPB2018 concerns productivity growth and discount rate. The research proposal for the current report dates from mid-2018 and, following the CPB ageing study *Minder zorg om vergrijzing (2014)*[189] and CPB2018, it assumed a real discount rate of 3% and productivity growth of 1.5% per year.[190] During the current study, the CPB ageing study *Zorgen om morgen* (2019) was published, which assumed a real discount rate 2,5%[191] and productivity growth 1%[192]. To match the CPB as much as possible, these assumptions have been adopted in the current report.

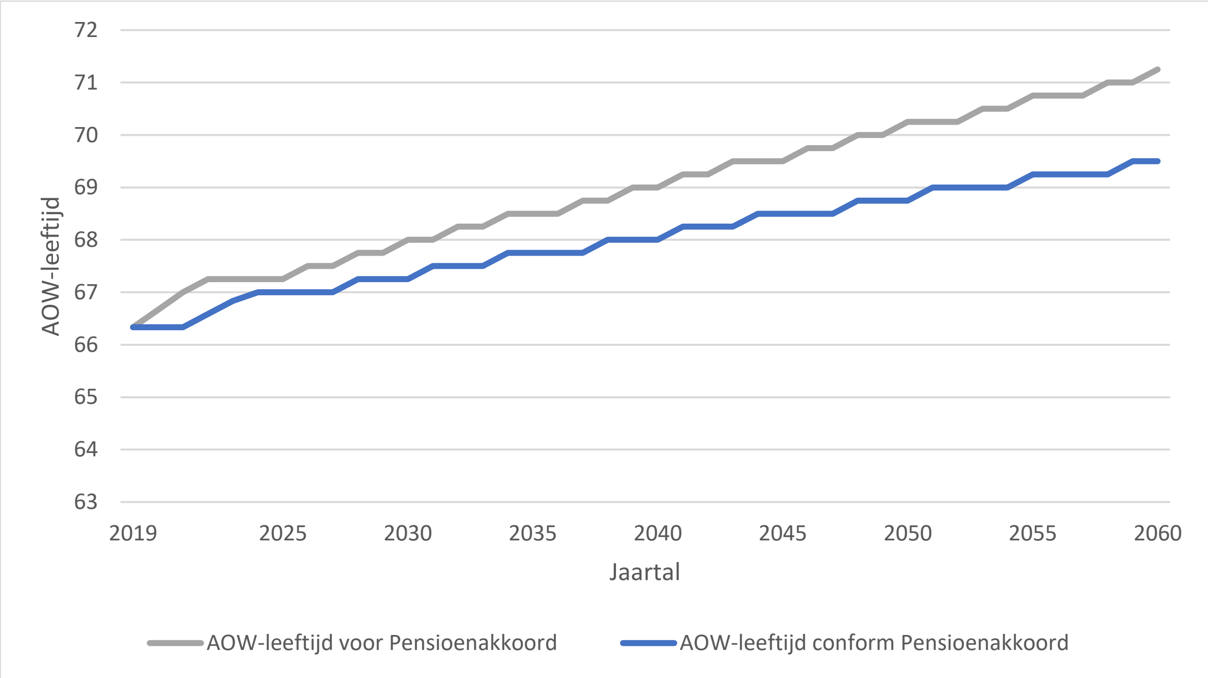

Figure 8.1 Development of the state pension age, originally and in accordance with the pension agreement. Source: Excel worksheet 8.1L from the data set for the CPB (2019) Zorgen om morgen (Worries about tomorrow)*, CPB population ageing study, retrieved 10-2-2021 from: https://www.cpb.nl/sites/default/files/omnidownload/CPB-Vergrijzingsstudie-2019-Data-figuren.xlsx*

The second adjustment from CPB2018 concerns the state pension age, which is rising less rapidly due to the so-called 'pension agreement', see Figure 8.1. The adjustment of the state pension age relates to certain items (such as the state pension itself, but also taxes and benefits) and to certain ages (mainly the ages 65-71). By using the development over time for ages that are not influenced by the adjustment of the state pension age, the adjustment of the state pension age has been completely removed from the CPB2018 dataset. In practice, because of the division into age groups, developments in the age groups 60 to 64 and 72 to 80 have been used in particular. In the resulting dataset, the development over time of the relevant items for the *range* 64 to 72 years is in line with the surrounding higher and lower ages. This revised dataset was used, among other things, for the 'state pension at 65' scenario in the sensitivity analysis in §6.5 of the current report.

[189] Smid, B., H. ter Rele, S. Boeters, N. Draper, A. Nibbelink en B. Wouterse (2014), retrieved 17-1-2022 from: https://www.cpb.nl/sites/default/files/publicaties/download/cpb-boek-12-minder-zorg-om-vergrijzing.pdf
[190] This implied a nominal discount rate of 5% and nominal productivity growth of 3.5% per year, as CPB assumed inflation of 2%, see Smid, B., H. ter Rele, S. Boeters, N. Draper, A. Nibbelink & B. Wouterse (2014), pg. 27
[191] See Adema, Y., & I. van Tilburg (2019), blz. 70-72
[192] See Adema, Y., & I. van Tilburg (2019), blz. 42

The baseline scenario for the current report is formed by the CPB2018 dataset in combination with the adjustments described above; the reduction of the real discount rate (from 3.0% to 2.5%) and productivity growth (from 1.5% to 1%) and the adjustment of the state pension age. As *Minder zorg om vergrijzing* (2014) has a sustainability balance of +0.4% GDP and the pension agreement yields a deterioration of 0.4% GDP (see §8.2), the base scenario for the current report has a sustainability balance of around 0% GDP.

Tabel 2.2 Verschillen in het houdbaarheidssaldo tussen de huidige en de vorige vergrijzingsstudie

	% bbp
Vorige vergrijzingsstudie 2014	+0,4
Ontwikkelingen tijdens Rutte II	-0,2
Beleid Rutte III - regeerakkoord	-0,6
Beleid Rutte III – lastenverlichting en Pensioenakkoord	-0,7
Aanpassingen zorguitgaven	-0,6
Arbeidsaanbod	+0,5
Overig, waaronder revisie van de Nationale rekeningen	-0,4
Lagere discontovoet en productiviteitsgroei	0,0
Modelwijzigingen Gamma	0,0
Huidige vergrijzingsstudie 2019	-1,6

Figure 8.2 Differences between CPB-aging studies Minder zorg om vergrijzing *(2014) and* Zorgen om morgen *(2019). Facsimile of Table 2.2 from Adema, Y., & I. van Tilburg (2019),* Zorgen om morgen*, retrieved 17-1-2022 from: https://www.cpb.nl/sites/default/files/omnidownload/CPB-Vergrijzingsstudie-2019-Zorgen-om-morgen.pdf*

8.2 Calibration of the CPB ageing study *Zorgen om morgen* (2019)

The research proposal for the current report dates from mid-2018, but a new CPB ageing study, *Zorgen om morgen* (*Worries about Tomorrow*, 2019), was published before the current report's publication. In order to further calibrate the calculations as much as possible on CPB-calculations, the data set in the CPB ageing study *Zorgen om morgen* from 2019, from now on simply referred to as the CPB2019 dataset, was used. The CPB mentions the following differences (for a complete overview see Figure 8.2, in Dutch) with the earlier CPB ageing study *Minder zorg om vergrijzing* from 2014:

1) The CPB has lowered the real discount rate from 3.0% to 2.5%;[193]
2) The assumed productivity growth has been reduced by the CPB from 1.5% to 1%;[194]
3) Due to higher healthcare costs, the sustainability balance has deteriorated by 0.6% of GDP compared to 2014;[195]
4) The pension agreement worsens the sustainability balance compared to 2014 by 0.4% of GDP;[196]

[193] See Adema, Y., & I. van Tilburg (2019), pg. 70-72
[194] See Adema, Y., & I. van Tilburg (2019), pg. 42
[195] See Adema, Y., & I. van Tilburg (2019), pg. 17-18
[196] See Adema, Y., & I. van Tilburg (2019), pg. 17

5) In total, the sustainability balance has deteriorated by 2.0% of GDP compared to 2014, of which 0.9% due to the policy of Rutte III, other than the pension agreement, and 0.2% of GDP due to Rutte II.[197]
6) The labour supply increases over the long term.

The starting point for the current study is to follow the CPB as much as possible. The reduction in the real discount rate by half a percentage point to 2.5% and the decrease in productivity growth by half a percentage point to 1% have therefore been adopted. The effects of the pension agreement have also been incorporated into the current report (see §8.1). However, the other differences cannot simply be adopted because the datasets CPB2018 and CPB2019 differ. Among other things, the CPB2019 dataset is aggregated to 8 sub-items, instead of the 23 of CPB2018 (see Table 5.1), and because too little is known about the precise methods, etc., combining the two datasets may lead to inconsistencies.

The CPB2019 dataset[198] was however used to check the calculation in the current report. According to the documentation for *Zorgen om Morgen*, the data set refers to the year 2020. Therefore, the comparison is based on the nominal amounts for 2020 from the CPB2014 data set. The profile for long-term care[199] – i.e., the so-called difference profile from §5.5 of this appendix – has been replaced by the difference profile that arises by summing the profiles Wmo,[200] Wlz[201] and other healthcare in Excel worksheet 2.4 of the 2019 dataset[202]. In the long run, this results in a decline of 0.3% of GDP decline, which is half[203] of the total difference of 0.6% of GDP in point 3) in the above summary. However, over the period 2016-2020 the difference is small (0.02% of GDP) because the size of the effect increases with the grey pressure. The same is true for the labour supply, which is also something that will only have an effect in the long term, and not as early as 2020.[204] From the revision of national accounts, a significant part in the current report may already have been processed through the use of microdata, although that is unsure. This leaves at least a decline of 0.2% of GDP (Rutte II) plus 0.7% – 0.4% = 0.3% of GDP (Rutte III minus the pension agreement) and the Rutte III coalition agreement of at least 0.6% of GDP, because the short-term effect is greater than the long-term effect.[205] In total, that is at least 1.1% of GDP. Because it is not clear exactly what this refers to, this was achieved by adding a constant to the item Public administration which, after weighting against the population on 1 January 2020, yields a macro amount of 1.1% of the GDP forecast for 2020[206], assuming 3.0% growth compared to

[197] See Adema, Y., & I. van Tilburg (2019), pg. 16
[198] Retrieved 19-4-2023 from: https://www.cpb.nl/sites/default/files/omnidownload/CPB-Vergrijzingsstudie-2019-Data-figuren.xlsx
[199] Care under the Social Support Act (Wmo), the Long-term Care Act (Wlz), etc.
[200] Social Support Act (Wmo).
[201] Long-term Care Act (Wlz).
[202] Retrieved 19-4-2023 from: https://www.cpb.nl/sites/default/files/omnidownload/CPB-Vergrijzingsstudie-2019-Data-figuren.xlsx
[203] See Adema, Y., & I. van Tilburg (2019), pg. 17
[204] Figure 4.1 pg. 7, retrieved 19-4-2023 from: https://www.cpb.nl/sites/default/files/omnidownload/CPB-Achtergronddocument-dec2019-Arbeidsparticipatie-en-gewerkte-uren-tot-en-met-2060.pdf
[205] "Direct effect, see pg. 22: The negative sustainability effect will be fully realized within the cabinet term. The policy package has an effect on the EMU balance in 2021 of -1.2% of GDP. After 2021, there will be a positive effect of 0.6% of GDP." Retrieved 19-4-2023 from: https://www.cpb.nl/sites/default/files/omnidownload/CPB-Notitie-4okt2017-Analyse-economische-en-budgettaire-effecten-Regeerakkoord_0.pdf
[206] Due to Corona, GDP for 2020 will be lower, but here a comparison is made with the prediction of the CPB and not with reality.

2019 [207] and a GDP for 2020 of 859 billion euros. This yields almost the same macro amounts. When adding 1.13% of GDP (instead of 1.1% of GDP), the difference between the net contribution profile of the current report for 2020 and the profile based on the CPB2019 dataset, weighted against the population of 2020, is even nil. This indicates that with the assumed adjustments, the results in the current report differ only slightly from the results in the CBP ageing study from 2019.

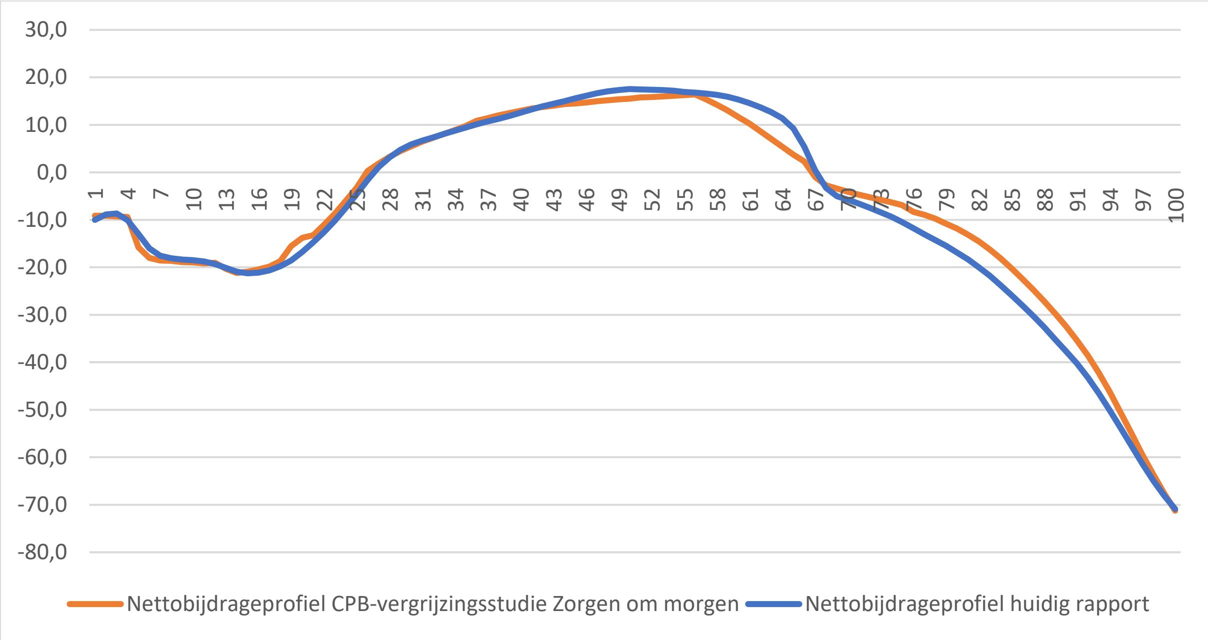

Figure 8.3 Comparison of the net contribution profile of the current report with the net contribution profile from the CPB ageing study Zorgen om morgen *from 2019.*

The resulting profile for 2020 differs from the profile from CPB2019 in terms of course, mainly because microdata was used for the current study, which gives a smoother and more natural course (see Figure 8.3). In addition, for example, the wealth-related taxes in the current report are directly derived from the accrued (and gradually reduced after retirement) pension assets, which gives higher values around the state pension age.

Because the net age profile for 2020 of the current study – after the aforementioned corrections – weighted against the population of 2020 yields almost the same macro amount as the net age profile for 2020 from *Zorgen om morgen* (2019), it is assumed that an uncertain correction about the observed inflation and productivity growth for the years 2016-2021[208] does not yield more reliable results than assuming that productivity growth is the same for all years. That is why, for all years, the nominal productivity growth of 3.5% from the CPB ageing study *Minder zorg om morgen* (2014) has been converted into a real productivity growth of 1.0% from the CPB ageing study *Zorgen om morgen* (2019). This is done by multiplying all nominal amounts by the following correction factors:

$$\left(\frac{1.010}{1.020 * 1.015}\right)^{J-2016} \quad voor\ 2016 \leq J \leq 2.200$$

[207] Retrieved 19-4-2023 from: https://www.cpb.nl/sites/default/files/omnidownload/CPB-Policy-Brief-Decemberraming-2019-vooruitzicht-2020.pdf NB: published 1 day before *Zorgen om morgen*

[208] Compare CPB, *Verzamelde bijlagen bij de raming november 2020*, retrieved 15-12-2020 from: https://www.cpb.nl/sites/default/files/omnidownload/verzamelde-bijlagen-raming-nov-2020-plus-mlt.xlsx

This produces a new dataset containing all assumptions from the 2014 CPB ageing study *Minder zorg om morgen*, supplemented by the adjustment of the state pension age to the pension agreement and recalculated to a real productivity growth of 1%. Calculating in real terms makes it unnecessary to make assumptions about future inflation. This new dataset for the evolution over time of the 23 items from Table 5.1 is used for the base case of the current report. The real discount rate is 2.5% in the base scenario, following the CPB's ageing study *Zorgen om morgen*.

8.3 Comparison with CPB report *Immigration and the Dutch Economy* (2003)

The results of the CPB report and the current report cannot simply be compared because of the inflation that has occurred in the meantime, a different calculation method and a different discount rate and growth rate.

First, we will look at the discount rate and growth rate. The CPB calculated in 2003 with a real growth rate of 1.75% and a discount rate of 4.0% real.[209] This produces an effective discount rate of 2.25%. In the current report – in line with the current CPB standard – calculations are based on a real growth rate of 1.0% and a real discount rate of 2.5%. This produces an effective discount rate of 1.5%. The difference in discount rate has been solved by extracting the information for the first-generation non-Western immigrants from *Figure* 4.4[210] and *Figure* 4.6[211] of the CPB report and converting this to the situation in the current report. In the aforementioned *Figure 4.4*, calculations are made with a discount rate of 4.0% and in the aforementioned *Figure* 4.6 with a discount rate of 3% (the dark blue and orange lines Figure 8.4), which gives an effective discount rate of 1.25%. This information has been converted to the growth rate and discount rate in the current report (the grey line in Figure 8.4).

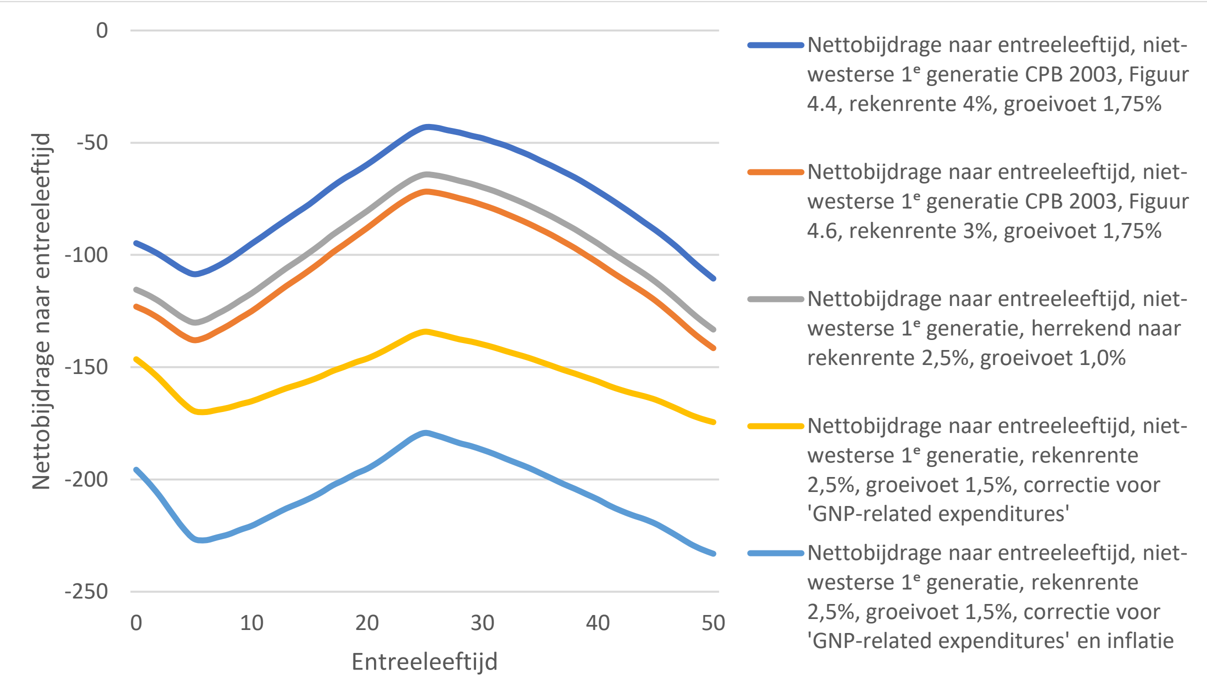

Figure 8.4 Translation of the results for non-Western first-generation immigrants from Roodenburg et al. to the current report.

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209 Roodenburg, H., R. Euwals & H. ter Rele (2003), pg. 68, footnote 12
210 Roodenburg, H., R. Euwals & H. ter Rele (2003), pg. 70
211 Roodenburg, H., R. Euwals & H. ter Rele (2003), pg. 74

Subsequently, the methodological difference of the measurement of public goods described in §4.2 was corrected. To this end, the difference between the two methods has been estimated based on the Personal Primary Income (PPI) per year of age (from the Statistics Netherlands microdata file INPATAB, variable INPPERSPRIM, reporting year 2016). The PPI was chosen because it accurately reflects the contribution to the GDP and, just like in the net contribution profiles of the CPB (see *Figure* 4.3[212]), makes a difference especially for the ages 15-65. Based on the PPI per year of age, a profile *P* has been calculated for the net contribution by entry age for entry ages up to and including 50 years. The calculation of *P* is based on the discount rate and growth rate used by the CPB in 2003. The remigration probabilities are extracted from *Figure* A.3.1.[213] The table population from 2016 has been taken as a proxy for the mortality probabilities. Subsequently, the resulting profile *P* was calibrated using a discount factor as a provisional value and the given reference values for 'GDP-related expenditures' for the group 'non-Western' in *Table* 4.3[214] as benchmarks. According to *Table* 4.2[215], the 'GDP-related expenditures' had already been included in the calculation for 52% by the CPB. The remaining 48% is added by subtracting 12/13th part of profile *P* from the grey line in Figure 8.4. The result is the yellow line in Figure 8.4. Finally, inflation has been adjusted by multiplying it by a factor of 1.336[216] [217], which yields the light blue line in Figure 8.4.

The light blue line was then weighted against the immigration profile used in the current study, resulting in –€188,000 net contribution for the ages up to and including 50 years. Subsequently, based on the ratio between the relevant age groups for non-Western immigrants as observed in the current study, the net contribution for the ages above 50 years is estimated at –€13,000. In total, this results in a net contribution for first-generation non-Western immigrants of approximately –€199,000. That is one fifth higher (in absolute terms) than the result for first-generation non-Western immigrants in the current report.

[212] Roodenburg, H., R. Euwals & H. ter Rele (2003), pg. 68
[213] Roodenburg, H., R. Euwals & H. ter Rele (2003), pg. 120
[214] Roodenburg, H., R. Euwals & H. ter Rele (2003), pg. 71
[215] Roodenburg, H., R. Euwals & H. ter Rele (2003), pg. 66
[216] The base year for the CPB report is 2000, which is taken for GNP (Roodenburg, H., R. Euwals and H. ter Rele (2003), Table 3.3, footnote b, pg. 49) and is further explicitly mentioned on pg. 117 ("base year") and implicitly on pg. 32 "It remains to be seen whether these results still apply to the year 2000". The descriptive statistics are based on reference year 2000 (Figure 2.5, 2.6, 2.7 and 2.8). The datasets used are from the years (footnote Table 4.1) 2001, 2000 and (footnote Table 4.2) 2002, 1999, 2001 and 2001. 2000 is also used for the demographic projections, see Table A.3.1. reference year 2016. The consumer price index of Statistics Netherlands shows a growth of 33.6% over this period, Statistics Netherlands StatLine, *Consumentenprijzen; prijsindex 2015=100*, retrieved 14-12-2020 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83131NED/table?dl=493F7 and the cumulative year-on-year changes over the period 2000-2015, according to the appendices to the Central Economic Plan (CEP) of the CPB, amount to 33.1%, see CPB, *Verzamelde_bijlagen_CEP_2018*, retrieved 15-12-2020 from: https://www.cpb.nl/sites/default/files/omnidownload/Verzamelde_bijlagen_CEP_2018.xlsx
[217] Statistics Netherlands StatLine, *Consumentenprijzen; prijsindex 2015=100*, retrieved 14-12-2020 from: https://opendata.cbs.nl/statline/#/CBS/nl/dataset/83131NED/table?dl=8943

9 Important points for interpreting the results

9.1 Description is not a test, correlation is not a causal relationship

The current research is highly exploratory and descriptive in nature. The net fiscal contribution over the life course of immigrants is mainly described on the basis of all kinds of data, broken down by origin group, immigration motive and generation. During the current study, all kinds of correlations between variables were noted and often reported. However, this too was mainly done in a descriptive way, intended as starting points for further research. Incidentally, the significance of the correlations has been reported or for small *N* the Spearman's rho has also been reported for completeness. It is not intended to carry out testing, nor has any effort been made to demonstrate causal relationships.

9.2 One reference year: repetition is needed

As noted in Box 4.1, in Chapter 4 of the current report, we determine the expected net fiscal contributions of immigrants over their remaining length of stay in the Netherlands (i.e., over their future ages, in future years) from the amounts that apply to an immigrant of the relevant age in 2016. As noted there: 'an immigrant who enters in 2016 as a 30-year-old will be allocated in 2026 the amounts that applied to a 40-year-old in 2016'. The calculation therefore applies to the revenues and expenditures in 2016 of characteristics that we can observe (such as education received and region of origin) and to the characteristics of the immigrant population present in 2016 that we cannot observe (such as ambition, creativity, etc.). We can differentiate the amounts when applied to future years according to the observable characteristics, but not according to the possible change in the revenues and expenditures associated with those characteristics (for example, wage differences according to education level may change). By definition, we cannot say anything about changes associated with unobserved features. Also essential is the assumption that the differences we observe in 2016 *between* the cohorts can be treated as differences *within* cohorts. The difference between immigrants from a certain region, with a certain education, who differ in age by five years, need not be equal to the change an immigrant from the same region, with the same education can expect in five years, if he will indeed be five years older. The first difference applies between different people, the second difference is the age effect of the same person. An immigrant who is five years older in 2016 need not be representative of a statistically comparable immigrant who is five years older in 2021.

Because of the unobservable differences between individuals and the dynamics that are typical of our society, it is important to check to what extent results for a certain reference year are also valid for another reference year. This implies a plea for regular repetition of a calculation like this, as monitoring of the fiscal implications of the development of immigration. We do not expect that the large differences in fiscal effects between regions of origin and immigration motives will prove to be very volatile over time. But such monitoring will continuously provide detailed, well-founded information for policy, and identify shifts in a timely manner. And it will, if necessary, convince sceptics that the base results are robust.

A comparison with the results of the CPB study from 2003 – as done in Chapter 4 of the current report and in §8.3 – already indicates that certain essential conclusions from our study also applied at that time. Also according to that study, the contribution of the non-Western immigrant at any entry age is negative and the most advantageous entry age is shortly after completing an education (25 to 30 years). The disproportionate dependence of non-Western immigrants on social benefits has also often been noted.[218] The participation of students with a non-Western immigration background shows an upward trend[219], which could lead to a smaller negative result for non-Western immigrants.

The method – basing data on one reference year and then extrapolating it to the future based on CPB expectations – requires periodic repetition of the calculations. This could well be done, for example, in the context of the annual 'state of immigration', the integral immigration report that is produced by the government (see also §1.2 of the current report). One could then, for example, move the reporting year in the Statistics Netherlands microdata files used one year at a time. As in the current report, the CPB expectations could be derived from the CPB ageing studies to be published periodically. This would also create a time series with which the fiscal and economic effects of immigration and integration policies can be further monitored.

[218] Zorlu, A., J. Hartog and M. Beentjes (2010), Uitkeringsgebruik van migranten, Working Paper 10-101, AIAS, Universiteit van Amsterdam.
[219] Retrieved 19-4-2023 from: https://longreads.cbs.nl/integratie-2018/onderwijs/

10 Sampling

10.1 Measurement errors

In the current study, there is a certain tension between the desire to provide a reliable measurement and the desire to provide a detailed picture. Large groups are required for reliability, but with the gradual refinement of regional divisions (see §4.4 of this appendix), the groups are of course smaller. The same happens when combining regional divisions with other variables, such as education or immigration motive.

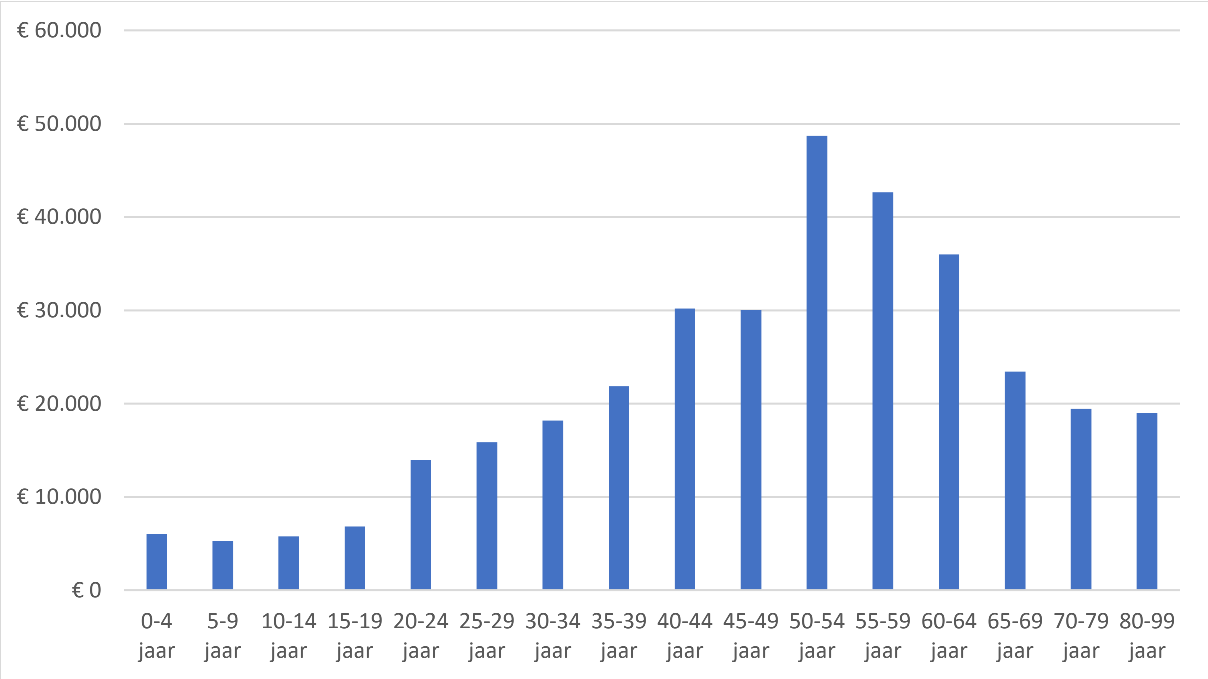

Figure 10.1 Standard deviation of the net contribution based on Statistics Netherlands microdata[220] *per five-year age group.*

In order to be able to assess as objectively as possible how the trade-off between reliability and detailed analysis works out when dividing into regions (and other aggregates), the sampling for the different age groups has been studied. Prior to the regional division, the division into age groups and the like, an estimate was made of the standard deviation of the ultimate net contribution per age group, see Table 10.1. This graph shows that the standard deviations from 0 to 20 years are relatively small. The standard deviation increases from age 20. Between the ages of 40 and 65 – especially for those in

[220] This calculation was performed at the start of the process, prior to the division into regions, with the aim of making an estimate in advance of the effect of the division into regions of origin and age groups. This calculation only includes the items calculated on the basis of Statistics Netherlands microdata, because it is mainly those items that contribute directly to the variance. This also concerns the raw Statistics Netherlands microdata amounts; in the final calculation, these are often weighted by a factor to calibrate on the CPB macro amounts for 2016. Also in this calculation, security costs, gross investments in schools, corporation tax and other indirect taxes and non-tax resources via companies were not yet allocated to persons and the student weights counted for 100%. Ultimately, no division into age groups of 5, 10 and 20 years was applied, but into age groups of 1, 2, 4, 8 and 10 years. However, ex-post checking based on the final calculations gives comparable results with regard to the spread.

their fifties – the standard deviation is highest and then decreases again. This shows that it is important to have many observations per age group for ages from 20 years and especially for ages 40 to 65 years.

This foregoing observation has been used when dividing into regions and in particular when asking how much reliability is compromised if this division makes the number of observations for certain age groups small. The following considerations are involved in answering this question.

For children younger than primary school age (0-3 years), low numbers of observations per age group are not a problem because of the small group differences. In fact, only the healthcare costs differ at that age. Small numbers or merging regions are no problem in this case. The differences are also relatively small during the rest of the compulsory education period. For older people of retirement age, the standard deviation is on average three to four times higher than for ages up to 20 years. In contrast to young people, the elderly pay taxes and have high healthcare costs on average. In addition, the standard error also depends on the group size per age group, which is on average low for older ages due to increasing mortality probabilities. This effect is illustrated in Figure 10.2 using the population as a whole. It can be seen that the standard error initially decreases after a peak around 60 years, but rises sharply again especially for older ages, due to the effect of decreasing numbers of observations for older ages.

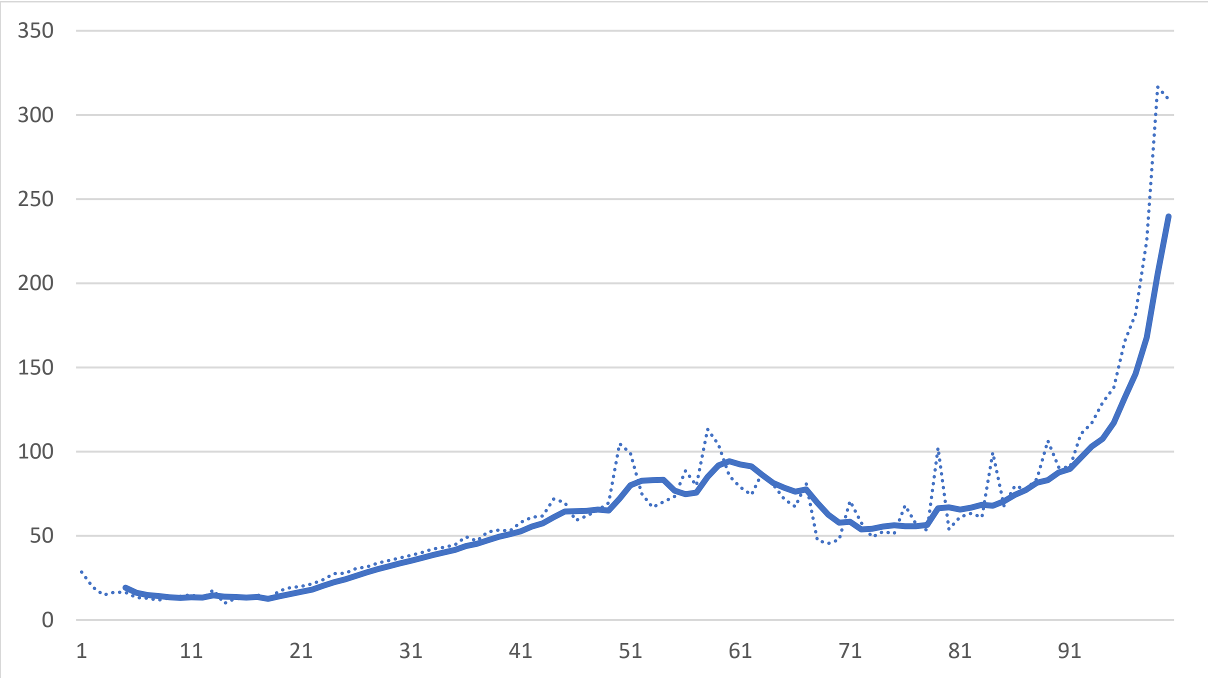

Figure 10.2 Standard error of the net contribution for the entire population and 5-year moving average.

However, there are some reasons why under-sampling is less of a problem in the elderly than it might seem at first glance. The first reason is related to the reason for under-sampling itself: namely that relatively few people actually live to very old age and the net contribution over the last phase of life therefore only counts to a limited extent in the total net contribution. In the case of immigrants, remigration also plays a role.[221] Partly due to emigration, the number of elderly people is small, but for the same reason, the weight of the elderly in the total net contribution of the group as a whole is usually

[221] If applicable in the relevant scenario. In the standard scenario, there is emigration.

also small. Furthermore, most immigrants come when they are young – around 25 years old – and only a small proportion are older than 50 years at the time of immigration. The direct net contribution of the elderly in the first years of residence is therefore limited as a whole of the group's net contribution. Of course, immigrants do get older and automatically fall into the limited sampled age categories. However, due to the discounting and due to death and possible remigration, future amounts weigh less heavily. All this is illustrated in the Figure 10.3, where for the group of all first-generation immigrants in the standard scenario with remigration, for each age year separately, the contribution to the total net contribution over the life course is calculated from an error of +€1,000 in the relevant year of age. It can be seen that the effect for young people is small, increases rapidly from the age of 20 and peaks at around €400 around the age of 40, after which it decreases steadily. Effectively, therefore, a maximum of 40% of a measurement error in a certain year of age ends up in the net contribution over the life course, and usually (much) less.

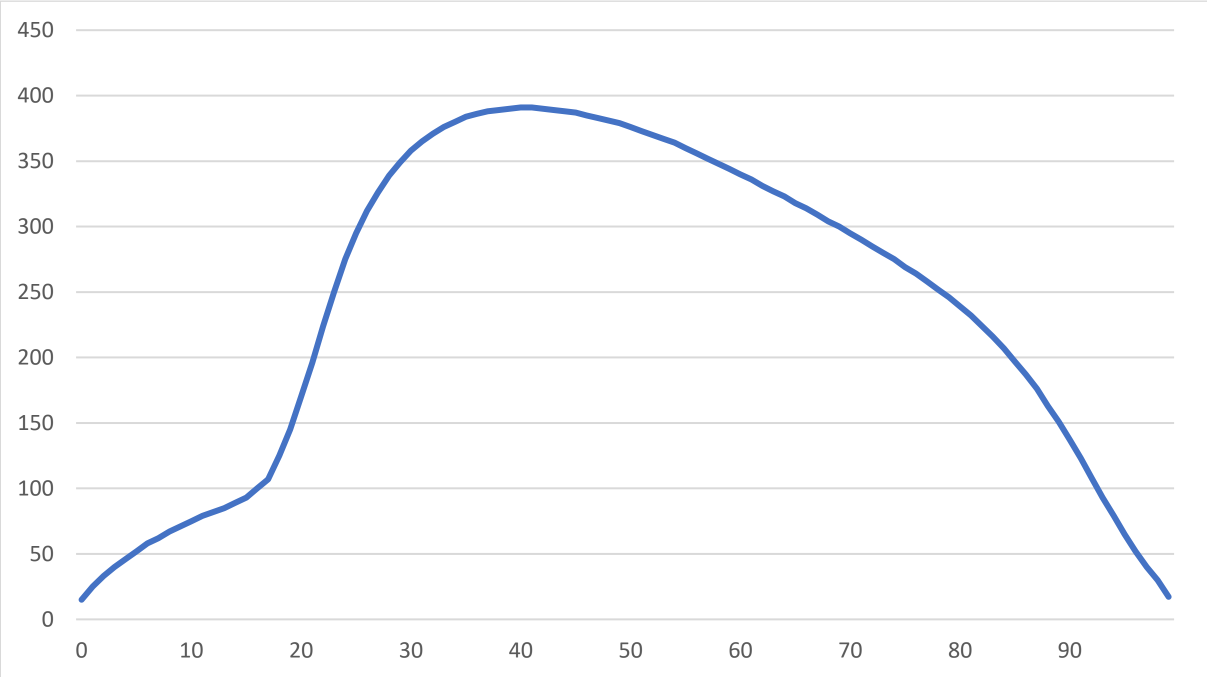

Figure 10.3 Increase in the total <u>*net contribution over the life course*</u> *(vertical axis) as a result of an increase of €1,000 in the* <u>*net contribution in a given year of age*</u> *(horizontal axis), with the immigration and remigration behaviour of the average first-generation immigrant, and mortality and discounting as in the standard scenario.*

To provide insight into how the margins of error affect the calculation, Figure 10.4 shows the net contribution per year of life for persons with a first-generation Moroccan immigration background. The stepped pattern is due to the sampling by age group. The blue line shows the average amounts for reference year 2016. The blue error bars show the effective standard errors. This means the standard error based on the (sample) standard deviations and group size for each specific age group, weighted by the effect on the net contribution over the life course as shown Figure 10.3.

All in all, the sum of the effective standard errors over all age groups is generally relatively small, usually between €5,000 and €10,000 for the Statistics Netherlands 12-part division. The exceptions are Latin America (€16,000) and especially the Other outside Europe region, which includes Japan, North America and Oceania (€47,000). Further analysis shows that labour immigrants in particular sometimes have a very high net contribution, which leads to a larger standard deviation, especially if the age groups are somewhat smaller, as is the case, for example, in the region Other outside Europe. The solution to this problem is set forth in §10.4.

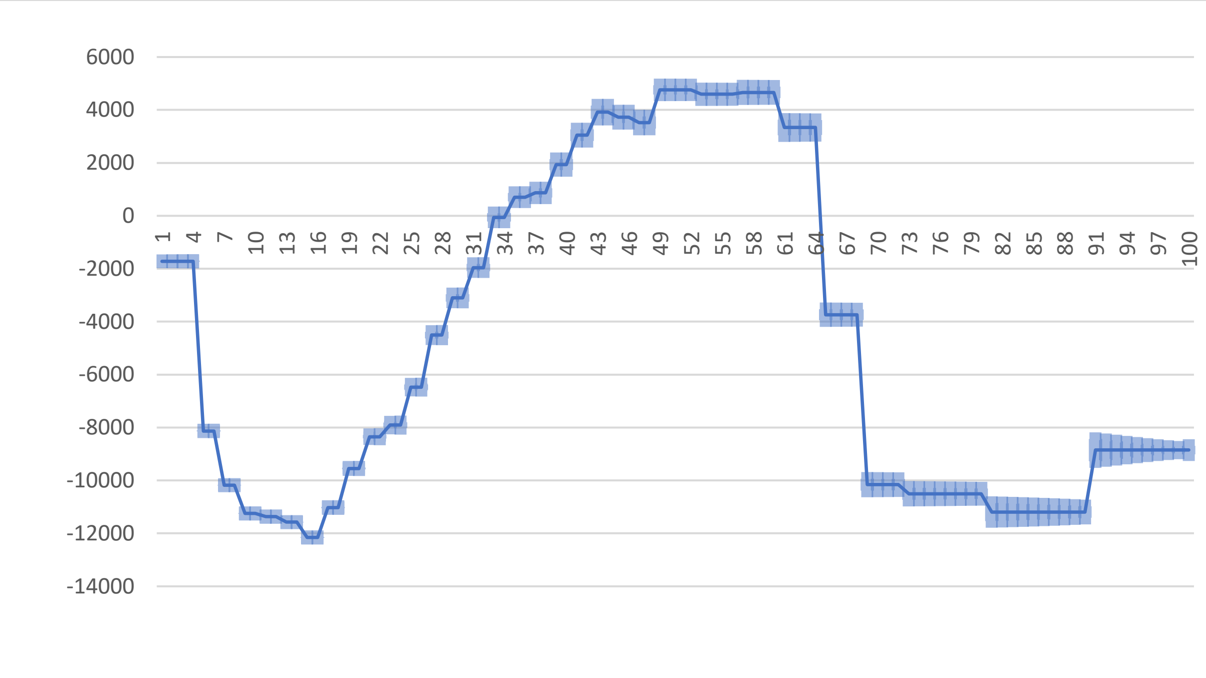

Figure 10.4 Sampling of the net contribution for people with a first-generation Moroccan immigration background, sampled values and effective standard error, i.e., the standard error based on the size and standard deviation of the sample groups and weighted by the effect (see Figure 10.3) of the immigration and remigration behaviour of the average first-generation immigrant, and mortality and discounting as in the standard scenario.

10.2 Distribution across cell-size classes

Furthermore, it was investigated which distribution over different cell size classes the sampling led to. By cell size is meant the number of observations per cell by age, region of origin, generation, immigration motive and other relevant variables. The cell size matters because the standard error halves with every quadrupling of the cell size. Due to the skewed distribution, a quasi-logarithmic class division has been used for the division into cell-size classes, see Table 10.1.

The frequencies shown in Table 10.1 concern the most important datasets in which sampling played a role. In order to be able to represent the whole in a somewhat compact way, three layers with column headings are shown. The first row of headings indicates whether it is aggregated by immigration motives or education. N/A here means that there is no aggregation according to education or motive. The second row of headings indicates whether it is aggregated by generation. N/A means there is no aggregation by generation. A single number indicates that selection has occurred on that generation only. Multiple numbers indicate that aggregated to the mentioned generations. Generation 0 equals native Dutch (Dutch background). The third row of headings shows which origin has been aggregated for. N/A again indicates that there is no aggregation by origin.

Finally, the Cito column indicates, for each second-generation group according to the 42-part division, for how many people there are available Cito scores. This is the only column for which age is not also aggregated, because Cito tests are administered around the age of 11 or 12 and age distinction is not relevant in the context of the current study. All other groups are aggregated according to age groups. In principle (for example for the 42-part division) the following age groups have been created: from 0 to 72 years per four years, from 72 to 80 years per four years, from 80 to 100 years per 10 years. In some cases, this has been deviated from, if this was necessary in connection with the sampling or the data allowed for further refinement, such as with very large groups such as Western and non-Western first-generation immigrants or with young second-generation immigrants.

Table 10.1 Number of observations per age group. The modal class is in bold.

Breakdown by	Motive, Education, Cito	N/A						Motive			Education		Cito[a]
	Generation[b]	N/A	0, 1, 2	1			2[c]	1			N/A	0,1,2	1,2
	Origin[d]	N/A	N/A	Country type	12-part	42-part	42-part[e]	N/A	Country type	12-part	N/A	Country type	42-part
Cell size class	10-30	0	0	0	0	10	6	1	5	60	0	10	0
	31-100	0	1	0	9	42	74	4	13	144	3	55	1
	101-300	0	5	2	24	139	326	7	18	213	14	130	4
	301-1,000	0	8	10	61	**320**	**646**	8	38	**276**	18	308	25
	1,001-3,000	0	15	25	73	297	289	18	45	183	36	623	26
	3,001-10,000	4	45	72	**120**	213	73	34	**75**	93	60	855	**19**
	10,001-30,000	5	76	**80**	64	77	12	**35**	31	8	126	938	4
	30,001-100,000	11	72	1	1	1	0	10	5	2	**215**	**1,021**	3
	> 100,000	**80**	**78**	0	0	0	0	0	0	0	15	9	0
Total		100	300	190	352	1,099	1,426	117	230	979	487	3,949	82
10-100 as % total		0%	0%	0%	3%	5%	6%	4%	8%	21%	1%	2%	0%

[a] This concerns the total number of persons of the second generation whose Cito score is known; this is the only variable that is not also aggregated by age. [b] Generation 0 stands for native Dutch. [c] Up to 48 years, see §4.2 for more details. [d] Country type is the Statistics Netherlands designation for the Western, non-Western classification. [e] Whereby for origin Indonesia, Turkey, Morocco, Suriname and Aruba and the (former) Dutch Antilles is further broken down by the number of parents born abroad.

For each cell size class, the table shows the observed number of groups that fall within the relevant cell size class, in other words, how many combinations of age and/or origin and/or generation and/or education, Cito or motive fall into the relevant class. These combinations are underlined below for the sake of readability.

The modal class (in bold in the table) is class 301-1,000 or higher in all cases. When discussing the table, we take as a starting point the percentage of cell sizes that fall into the classes 10-30 or 31-100, referred to simply as the class 10-100 (for those percentages, see the row '10-100 as % total ' in the table).

Four combinations have (rounded up) 0% observations in the class 10-100, namely: N/A × N/A × N/A (this is the entire population), N/A × Generation 0, 1, 2 × N/A (this is the population broken down by generation), N/A × Generation 1 × Country type (these are first-generation immigrants broken down into Western and non-Western) and Cito × Generation 2 × 42-part division. We leave these combinations out of consideration.

For the classification Generation 2 × 42-part division, §2.4 already describes how the lack of data has been overcome. This classification is not considered further here. For the combinations Education × N/A × N/A and Education × Generation 0, 1, 2 × Country type, §4.2 describes how a synthetic net contribution profile was created for each education level of the SEC 8-part division based on the relevant net contribution profiles for active educational participants and people who no longer participate in education. The weighted average of students and non-students is taken for ages up to 38 years in upper secondary vocational education (MBO2, MBO3 and MBO4), and higher (tertiary) education (bachelors and masters). A large part of the small cell sizes concerns people who study at an older age. Few people in their thirties follow an MBO training, for example. If there were small numbers of observations in these groups, this was initially solved by increasing the age groups. Of course, this leads to a distortion for these groups, but it hardly affects the total net contribution over the life course. After all, if the proportion of people in their thirties following an MBO training is so small (to stick with the aforementioned example), the effect of any measurement errors on the total calculation is also negligible. The combinations with education are also not considered further.

The discussion focuses on the five remaining groups. This concerns first-generation immigrants broken down into 12 or 42-part division (N/A × Generation 1 × 12-part division and N/A × Generation 1 × 42-part division). In addition, it concerns the combinations for first-generation immigrants with immigration motive and region, namely Motive × Generation 1 × N/A (broken down by motive only), Motive × Generation 1 × Country type (broken down by combinations of motive and Western/non-Western) and Motive × Generation 1 × 12-part division (broken down by motive and region according to the 12-part division). For the latter combination, the proportion of cell sizes is greatest in the class 10-100 at 21%.

The problem of small cell sizes consists of two issues. The first issue is how best to replenish cells with few or no observations. This is discussed in §10.3. The second issue is how best to deal with large spikes that can result from few observations. The solution to that problem is explained in §10.4. Before we discuss that, some notes on the problem of small cell sizes.

First of all, based on the exploration in §10.1, the regions in the 42-part division have been classified in such a way that there are many observations for the first generation for ages between 20 and 72 years. In the region divisions, the relatively small cell size therefore largely relates to groups for which the consequences of measurement errors are relatively small. This usually concerns young people (often the age group 0-3 years) and the elderly (often the age groups 80-89 and 90-99 years). As explained in §10.1, the effect of measurement errors for very young and old people on the total net contribution is small. There are, however, some somewhat exceptional groups. Due to existing Statistics Netherlands classifications, Japan (nearly 2,000 observations) is more or less forced to be classified separately in the 42-part division. Israel (more than 4,000 observations) has also been classified separately, despite few observations, because of the large differences with neighbouring countries. For the other groups in the 42-part division, the group size varies from 6,000 to 260,000 people.

In the case of motive, the small cell sizes partly concern very young study and labour immigrants. However, this is not a problem at all for the final calculation of the net contribution. By weighing against the immigration profile, the effect on the total net contribution over the life course is negligible for the same reason: few very young study and labour immigrants come, so their share as a percentage of all study and labour immigrants respectively in the weighted average is negligible.

A bigger problem is that there are also few observations for higher ages for study and labour immigrants, because that complicates the calculation of the remaining life course, although the relativising observations of §10.1 also apply here (measurement errors for higher ages do not significantly affect the total net contribution). Especially in the sampling of combinations of immigration motive with the Statistics Netherlands 12-part division into regions of origin, there are a few groups with a low total number of observations, in particular this concerns labour immigrants from Suriname and Indonesia and immigrants with other motives from Indonesia. The total number of observations of these three groups is between 700 and 900. On average, the number of observations per age group for these three groups is 67 and per age year is 16. As will be explained in §10.3 for these groups, the net contribution profile used for much of the life course is synthetic. This means that the observations for a relatively large number of age groups have been supplemented with data from the parent group and/or a profile that is fitted to the observations that do exist. This should be taken into account when interpreting the results for these groups. At the same time, an important remark must be made in this regard. The breakdown according to the combinations of motive with the Statistics Netherlands 12-part division into regions was mainly done to determine the total net contribution of recent and future immigration (see Chapter 7 of the current report) and to align with the Statistics Netherlands forecasts performed according to the 12-part division. Any bias has a negligible influence on the calculation of the total net contribution, precisely because the problem of the low numbers for the aforementioned combinations of immigration motive and region of origin arises because so few immigrants come for those combinations. Any measurement errors therefore only count for a very small part in the total calculation. For most combinations of motive and origin, the number of observations is more than sufficient, see Table 10.2.

Table 10.2 Number of observations for 1st generation immigrants, for combinations of migration motive and region of origin according to the 12-part division.

Region/Motive	**Asylum**	**Family**	**Study**	**Work**	**Other**	**Unknown**	**Total**
Western	10.532						**10.532**
Other non-western	5.106						**5.106**
West Asia	69.345						**69.345**
Africa	31.884	42.996	7.884	9.086	13.427	12.783	**118.060**
Asia		84.206	27.323	26.279	21.739	14.562	**174.109**
Latin America		20.977	7.381	6.491	3.003	11.440	**49.292**
European Union		91.247	24.253	186.223	41.859	30.280	**373.862**
Other Europe		30.040	9.079	11.682	16.118	4.424	**71.343**
Other outside Europe		12.068	4.894	9.373	3.219	5.566	**35.120**
Indonesia		7.247	3.529	713	917	5.227	**17.633**
Morocco		43.847	1.861	2.382	1.938	13.523	**63.550**
Suriname		19.806	3.143	794	1.767	25.227	**50.737**
Turkey		52.154	2.424	3.719	1.960	10.908	**71.164**
(Former) Antilles						53.606	**53.606**
Total	**116.867**	**404.588**	**91.769**	**256.742**	**105.946**	**187.546**	**1.163.458**

10.3 Treatment of age groups with few observations

Insofar as there were small numbers of elderly and young people in the regional divisions, this was remedied in the first generation [222] by using the data from the higher-level region. Two different hierarchies are hereby distinguished for the higher level. The division All Origins [223] > Country type > Statistics Netherlands 12-part division > 19-part division > 42-part division > 87-part division (see §4.4) has been used for the regions. For combinations of region with motive, the division All Motives × All Regions [224] > Motive × All Regions > Motive × Country type > Motive × Statistics Netherlands 12-part division > Motive × Statistics Netherlands 19-part is used.[225]

A layered solution was therefore chosen with regard to the regions, in which data from the 'higher level' was used if necessary. To make this concrete, the following is an elaboration for the combinations of motive and region. First, the best possible estimate was made for motive (for all regions together), then for motive in combination with country type (Western/non-Western), then for motive in combination with the Statistics Netherlands 12-part division into world regions and finally for motive in combination with the 19-part division (if necessary, see the explanation about the different levels of regional division). Here, motive is thus the higher level for motive × country type, then motif × country type is again the higher level for motive × 12-part division and finally motive × 12-part division is again the higher level for motif × 19-part division.[226] For motive and region combinations, the profile for the higher level was used, if necessary, to supplement the age groups with few observations.

Supplementing too little or missing data from the higher level is done in two ways: manually and with an algorithm. The algorithm is described later in this section. This and the following paragraphs provide a description of the manual supplementation from the higher region.

In the 19-part division, for the age group 90-99 years data from the higher region was used in two cases.[227] For the 42-part division, data from the higher region was also used in a number of cases for the age groups 0-3 years,[228] 80-89 years[229] and 90-99 years[230]. These profiles are therefore synthetic, in the sense that they are made up of profiles for different groups.

Also in the case of immigration motive, in a number of cases missing data was manually filled in from the higher level. When calculating the net contribution per immigration motive, the problem of small numbers mainly arises among study and labour immigrants. There are – naturally – few very young study and labour immigrants. In particular, the number of observations in the age groups up to 16 years is small or zero. In addition, the number of people over 68 among study immigrants is low and there is no sample for the group 90 years and older. The lack of data is solved in this case as follows.

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[222] A different solution has been chosen for the second generation, see §2.4.
[223] In this, 'All Origins' is equal to all first-generation immigrants.
[224] Only for the motives of labour and family immigration.
[225] Here, 'All Motives × All Regions' is equal to all first-generation immigrants.
[226] In concrete terms: for Western labour immigrants, Labour is the higher level; for labour immigrants from the European Union, Labour x Western is the higher level; for labour immigrants from the GIPS countries, Labour x European Union is the higher level.
[227] For regions of origin North Africa, Sub-Saharan Africa and Indian subcontinent.
[228] For the sub-regions of regions of origin Sub-Saharan Africa, Indian subcontinent, East Asia and Latin America (excluding Suriname, Aruba and Antilles).
[229] For the sub-regions of regions of origin Sub-Saharan Africa, Indian subcontinent and Other outside Europe.
[230] For the sub-regions of regions of origin Sub-Saharan Africa, Indian subcontinent, European Union, Other (outside) Europe, East and West Asia and Latin America (excluding Suriname, Aruba and Antilles).

For study and labour immigrants up to the age of 16, the data for native Dutch people has been used. The rationale behind this is that study and labour immigrants have fairly high average Cito scores and for these ages there is a strong correlation between Cito score and net contribution per year of life. Incidentally, in this specific case the effect of any (reasonable) choice is negligible, because the proportion of study and labour immigrants up to the age of 16 is very small, so that the effect on the total net contribution weighted by entry age is also negligible. Data is also missing for study immigrants from the age of 90, and data from the first generation as a whole have been used for this purpose.

In addition, there is also aggregation according to combinations of immigration motive and region. There is generally sufficient data for combinations of motives with the Western and non-Western classification – except for the problem discussed in the previous paragraph with the young study and labour immigrants and the old study immigrants. However, we also aggregated according to combinations of motive with the Statistics Netherlands 12-part division, with a view to reconciling with the division into regions of origin that Statistics Netherlands uses in, among other things, its population forecasts. By combining motive and region, the number of observations per age group is of course even smaller. Here it was examined on a case-by-case basis how the (synthetic) net contribution profiles should be compiled for the most reliable calculation possible. For the Aruba region of origin and the (former) Dutch Antilles, there were only sufficient observations for the unknown category.[231] There were virtually no observations for all other motive categories and these were therefore not included in the analysis. For asylum immigrants, a division was made into the regions of Africa (excluding Morocco), West Asia, other non-Western and Western regions, because the amount of data did not allow for further refinement.

Particularly in the case of refinements of the regional division – whether or not in combination with motive – there is sometimes too little data even after supplementation from the higher level and/or supplementation from the higher level results in trend breaks in the age profile for the net contribution. An algorithm has been developed to solve this problem and to arrive at a better estimate, especially for the older ages. This algorithm proceeds in three steps: supplementing missing data, estimating a best-fit profile and taking a weighted average of the numbers of observations.

If there are no observations at all, for the first step, the respective data is simply copied from the corresponding data of the higher level. This is done – just like with manual supplementation – according to the two hierarchies described above.

If there is too little data, the approach is slightly more complex. 'Too little data' has been operationalized as '50 observations or less. The approach differs per group of sub-items. A number of items have been calculated semi-manually for each group. This concerns the items Public Administration (including Security costs), Defence, Transfers abroad, Gross investments in buildings and infrastructure, Inheritance tax, Corporate income tax/dividend tax, Other indirect taxes of companies, Net land sales and Non-tax assets remaining (Item 1, 2, 10, 13, 14, 18, 19, 21, 22, 23 in Table 5.1). These items are either the same for each group, or they are semi-manually calculated separately for each group with a

[231] That is to say, motive unknown from 1995, immigrants with unknown motive from before 1995 were not included in the analysis because of the comparability with the other motives that are only available from 1995 onwards.

number of intermediate steps as described in Chapter 6 of this appendix. These items are therefore not considered further here.

The following approach was followed for the other items. Suppose that P_j is an element of age profile $\vec{P}$ for item p for a certain group, for ages $0 \leq j \leq 99$. Suppose further that N_j is an element of age profile $\vec{N}$ of the numbers of observations per year of age[232] for the group concerned, again with $0 \leq j \leq 99$.

As a first step, in the case of few observations, both $\vec{P}$ and $\vec{N}$ are adjusted by replacing the observed amounts or numbers for the higher ages with the average amount for item p or the average number of observations for the group concerned, respectively. 'Few observations' is operationalised as 'less than 100' and 'higher ages' is operationalized as 'from 90 years', 'from 80 years' or 'from 72 years'. The ages 72, 80, 90 were chosen because 72-79, 80-89 and 90-99 are age groups. This is based on the youngest age $j' \in \{72, 80, 90\}$ for which $\sum_{j=j'}^{99} N_j < 100$. If such a j' did not exist, no adjustments were made. If such a j' did exist, a lower bound L was first determined as follows: $L = 68$ if $j' = 72$, $L = 72$ if $j' = 80$ and $L = 80$ if $j' = 90$. Subsequently, the amounts P_j and observations N_j for $L \leq j \leq 99$ are replaced by $\sum_{j=L}^{99} N_j \cdot P_j / \sum_{j=L}^{99} N_j$ and $\sum_{j=L}^{99} N_j/(100 - L)$ respectively.[233] What this step does is take the average of a low number of observations for age groups approaching retirement age, thereby reducing any large spikes on the age profile in question for older ages.

Subsequently, a weighting profile $\vec{W}$ was made based on the original[234] vector $\vec{N}$:

$$W_j = Min\left(1, \frac{N_j}{50}\right) \; if \; N_j > 0 \quad and \quad W_j = 0.5 \; if \; N_j = 0 \quad for \quad 0 \leq j \leq 99$$

Thus, this is a vector that is 1 if there are at least 50 observations, is 0.5 if there are 0 observations, and is $\frac{N_j}{50}$ if the number of observations N_j is greater than 0 and less than the threshold value of 50. The part $W_j = 0.5 \; if \; N_j = 0$ of the above definition provides 'anchoring' in the parent profile in the next step for those values of j (if any) for which there are no observations for P_j at for which $N_j = 0$.

Next, a *brute force* method is used to find the i for which the weighted sum of squares KS below is minimal:

$$KS = \sum_{j=0}^{99} W_j \cdot \left(P_j - \frac{i \times P_j^{Up}}{100}\right)^2 \quad for \quad i = 1, 2, 3, \dots \quad and \quad 0 \leq j \leq 99$$

Here is P_j^{Up} is an element of profile $\vec{P}^{Up}$ for item p for the higher level (see previous explanation of the two hierarchies for the classification of regions and combinations of regions and immigration motive).

[232] The sample sizes are thus divided by the size of the age group in years.

[233] An alternative is to calculate $\sum_{j=L}^{U} N_j/(U + 1 - L)$ with $U > L$ being the smallest integer for which $N_U > 0$. The results then differ marginally, however (for the 77 groups for which there is a difference, the absolute difference is less than €1,000 in 70 cases, in six cases between €1,000 and €2,000, and in one case the difference is approximately €2,200. Another alternative is not to average the numbers of N_j at all and even then the differences are limited.

[234] This is done to ensure that there is always 'anchoring' in the higher profile if there are no observations at all for a particular age group. This often concerns labour immigrants or immigrants with 'other motives'.

The i for which KS is minimal is called i'. This step finds a multiple of the higher profile – i.e., the scalar product $FIT_{i'} = i' \times P^{Up}/100$ of the higher profile with i' – that best fits the profile $\vec{P}$. This takes into account age years with 'few' observations, i.e., fewer than 50 observations. If for a certain age year j there are no observations at all for item p then there is supplementation from the higher profile for that year $P_j = P_j^{Up}$ and w and the square of the difference is taken into account for half.

Finally, the final profile $\vec{P}'$ for item p is calculated as follows:

$$P_j' = W_j \cdot P_j + (1 - W_j) \cdot \frac{i' \times P_j^{Up}}{100} = W_j \cdot P_j + (1 - W_j) \cdot FIT_{i'} \quad for\ 0 \le j \le 99$$

This profile $\vec{P}'$ is equal to the observations for age years for which there are at least 50 observations. For age years for which there are fewer than 50 observations, the profile $\vec{P}'$ is the weighted average of the observations and the fitted profile is $FIT_{i'} = i' \times P^{Up}/100$.

For the supplementation from the higher level, 50 observations per age year have therefore been used as the threshold value. To clarify this, here is a concrete example with fictitious, round numbers. Suppose that for labour immigrants from Indonesia there are 120 observations for the four-year age group 60-63 years. This means 120 / 4 = 30 observations per year of age. That is below the standard of 50 observations per age year. In this case, the higher level is 'Western labour immigrants' (Indonesia is classified as a Western country by Statistics Netherlands). Suppose the tax item LIS for Indonesian labour immigrants aged 60-63 is an average of €40,000 and an average of €30,000 for Western labour immigrants aged 60-63. Then the item LIS_{60} for 60-year-olds is calculated as follows:

$$LIS_{60} = \frac{30}{50} \times €40{,}000 + \frac{20}{50} \times €30{,}000 = €24{,}000 + €12{,}000 = €36{,}000$$

The underlying idea of the algorithm is that the age profiles of costs and benefits that are largely or wholly based on microdata for large groups (such as the entire population or all first-generation immigrants together) have a characteristic and 'smooth' course (for some examples, see §5.3 and §5.5-5.7 of this appendix). In very small groups (such as labour immigrants from Suriname and Indonesia), the profiles are often erratic due to few observations and/or pieces missing (no observations). What the algorithm roughly does is 'smooth' the pieces with no or few observations as they fall into the retirement phase and then fill in from the higher level as well as fill in from a profile that is calibrated to all available observations and has the same shape as the corresponding profile for the higher level. The profiles P_j' are sequentially calculated and stored from the highest level to the lowest level, so that the profile of the higher level is always a calibrated and completed profile when used for a lower level.

The effect of this algorithm depends on the size of the groups and the distribution of the available data over the age groups. This is discussed below for the net contribution for the first generation according to the standard scenario with remigration. The numbers are rounded for readability. For all first-generation immigrants together, the difference between applying and not applying the algorithm is €0. If we look at the 42-part division, the effect for large origin groups such as Morocco (*N* ≈ 220,000) and Indonesia (*N* ≈ 260,000) is negligible. (≈ €250 and ≈ €50 respectively). In origin groups with a median size (*N* ≈ 17,000), such as Spain and India, the differences are comparable or larger (≈ €150 and ≈ €900, respectively). The two smallest origin groups in the 42-part division are Japan and Israel. For Japan (*N* ≈ 2,000) – which is classified separately for the existing Statistics Netherlands classification – the difference between not applying (€197,000) and applying (€180,000) the algorithm is significant at €17,000. Also for Israel (N ≈ 4,000) – which is classified separately because it differs so much from neighbouring countries – the difference is considerable (≈ €2,300). The differences are particularly large with combinations of motive and region of origin, especially for motives such as labour and study, for which data for lower and (more importantly) higher ages are missing.[235] Let us take the motive labour as an example. In the case of labour, the higher level is 'all first-generation immigrants'. Only supplementing from this higher level produces a net contribution of €142,000. Applying the algorithm additionally yields a net contribution of €153,000, so a difference of €11,000. This is because only supplementing from the averages for first-generation immigrants gives an underestimation (labour immigrants perform above average, so supplementing from the average first-generation immigrant yields too low amounts) and the algorithm reduces that underestimation. When estimating, for example, non-Western labour immigrants (N ≈ 85,000), the algorithm yields an estimate that is €9,000 higher, purely because missing data is supplemented for higher ages. In the case of employment, origin is further subdivided into the Statistics Netherlands 12-part division. The largest group is formed by labour immigrants from the EU (N ≈ 190,000), where application of the algorithm causes a decrease of approximately €1,000. For labour there are also two very small groups, namely labour immigrants from Indonesia (N ≈ 700) and Suriname (N ≈ 800). For example, for labour immigrants from Indonesia, application of the algorithm results in an increase from €9,000 to €21,000, or €11,000 higher. Of course, the effects of the algorithm are also sensitive to the choices made. For example, if the threshold value is lowered from 50 to 25, the outcome will differ by approximately €100 for Israel, approximately €1,500 for Japan and approximately €3,000 for labour immigrants from Indonesia.

The approach outlined above is laborious, but there are some advantages in return. Anchoring in the higher level is a safeguard against extreme results for age groups for which there is really very little or even no data. Because the number of observations is included in the sum of squares when fitting the profile FIT_j cohort effects are reduced. After all, recent cohorts with a short stay are more strongly represented in the ages (twenties and early thirties) in which the immigration profile usually peaks (and are therefore weighed more heavily in the fitting process) than earlier cohorts with a length of stay of, for example, 20 years that are much older. For example, for Turkish labour immigrants, this approach leads to significantly higher outcomes than an approach in which the sample size is not taken into account. This reflects the fact that in the cross-section made, Turkish labour immigrants in the relatively large young age groups have a significantly higher net contribution than in the older age groups, which have far fewer observations.

10.4 Treatment of some extreme outliers

The small numbers of observations lead in some cases to another problem: extreme outliers – in practice immigrants with a very large positive net contribution – can have a disproportionate influence on

[235] In the case of aggregation based on motive, there is no real 'higher level'. Data is missing for study and labour immigrants up to the age of 16, and data for native Dutch people has been used for this. The rationale behind this is that study and labour immigrants have fairly high average Cito scores and for these ages there is a strong correlation between Cito score and net contribution per year of life. Incidentally, in this specific case the effect of any (reasonable) choice is negligible, because the proportion of study and labour immigrants up to the age of 16 is very small, so that the effect on the total net contribution weighted by entry age is also negligible. Data is also missing for study immigrants from the age of 90, and the data of the first generation as a whole has been used for this purpose.

the net contribution of the entire group. This is particularly the case for labour immigrants from Latin America and the Other outside Europe region, which includes Japan, North America and Oceania.

For this reason, for combinations of labour and motive, the net contribution per individual was always examined. It was substantial for a limited number of people. It concerned labour immigrants from the European Union, Other outside Europe, and Latin America. The effect was sometimes large, especially in the last two regions, because the numbers of older labour immigrants from those regions are small. There are also quite a few high earners among labour immigrants from the EU, but the age groups there are so large that it does not have much effect on the average.

In the case of labour immigrants from Latin America and Other outside Europe, however, this leads in a number of cases to bias because a small number of extremely high earners fall into a small age group. In this way, the total contribution of the group depends too much on chance: for example, if one were to sample (ceteris paribus) one year earlier or later, the net contribution of the group as a whole could already increase (or decrease) substantially because one high earner falls into a different age group that is significantly smaller (or larger). Consecutive age groups can make a difference in size by a factor of 2 to 3, non-consecutive age groups a multiple of this. Coincidence thus has an unacceptably large effect on the final result.

To make this concrete, here is an example based on fictitious, round numbers for an imaginary group of 10,000 labour immigrants from region X. Suppose someone from this group has a net contribution of 10 million euros. Suppose further that this person falls into an age group with 1000 people and that it concerns a four-year age group (the high earners in question in practice all fall into four-year age groups). The contribution of this one person to the total net contribution profile of the group concerned is then 4 × €10,000,000 / 1000 = €40,000. Effectively, in the standard scenario (with remigration) 30% of this (see Figure 10.3, in practice most high earners are in their forties, fifties or sixties) ends up in the total net contribution over the life course of the group concerned. For convenience, in the rest of this example, assume that the percentage is exactly 30%. In this example, that means that one high earner who falls into an age group of 1000 people single-handedly increases the average net contribution of those 10,000 labour immigrants from region X by €12,000 (30% of €40,000). That in itself is already a significant effect. However, if that same person falls into an age group of 100 people, that increases the total average net contribution of his group by 4 × €10,000,000 / 100 = €400,000. Effectively, that is €120,000 (30% of €400,000). This creates a 'spike' on the net contribution profile that is so large that the average net contribution, calculated over 10,000 people, is over a hundred thousand more, purely because that one high earner falls into a smaller age category.

That is a substantial net contribution (attributable to one individual), but it is apparently an empirical fact that there are sometimes persons with a very high net contribution among certain groups. Deleting these people is therefore not a good option.

The problem was further analysed in order to arrive at a solution. The large difference in age distribution of all labour immigrants from region X (in short, the 'total population') and the Top 100 labour immigrants with the largest net contribution from region X (in short, the 'Top 100') is striking. This is shown schematically in Figure 10.5.[236] The chance that a labour immigrant falls into the age category

[236] This figure is loosely based on the observations for Latin America and the region Other outside Europe.

36-39 is many times greater than the chance that a labour immigrant falls into the age category 68-71. The distribution of the total population is therefore very skewed for the age groups shown.

However, the age distribution of the Top 100 with highest net contributions is (approximately) normally distributed for ages between 36 and 71 with a peak in the 52-55 age group. A normal distribution is symmetric. The chance that a high earner falls in the age group 40-43 is (approximately) the same as the chance that he or she falls in the age group 64-67. The problem now is that within the Top 100 the distribution of net contributions is skewed: there are only a limited number of extremely high net contributions. The chance of an extremely high net contribution is therefore very small, but the potential effect is high. That is why chance – for example: does one person fall into the relatively large age group 40-43 or the relatively small age group 64-67 – will play a major role. This undermines the reliability of the measurement.

Thus, the crux of the problem is that the number of true 'high earners' is so small that a probability event such as 'a person with a net contribution of 5 million or more falls into age category Y' leads to unacceptably large, chance-induced measurement errors.

Several solutions have been considered. As mentioned, removing the (extreme) high earners is not an option because that is denying the empiricism. Another option is to increase the number of reference years in order to reduce the chance of coincidence, but this encountered all sorts of practical objections. It is also possible to considerably increase the age groups, for example to 12, 16 or 20 years. However, that would lead to unacceptable distortions of the net contribution profile, causing all kinds of problems in further analysis.

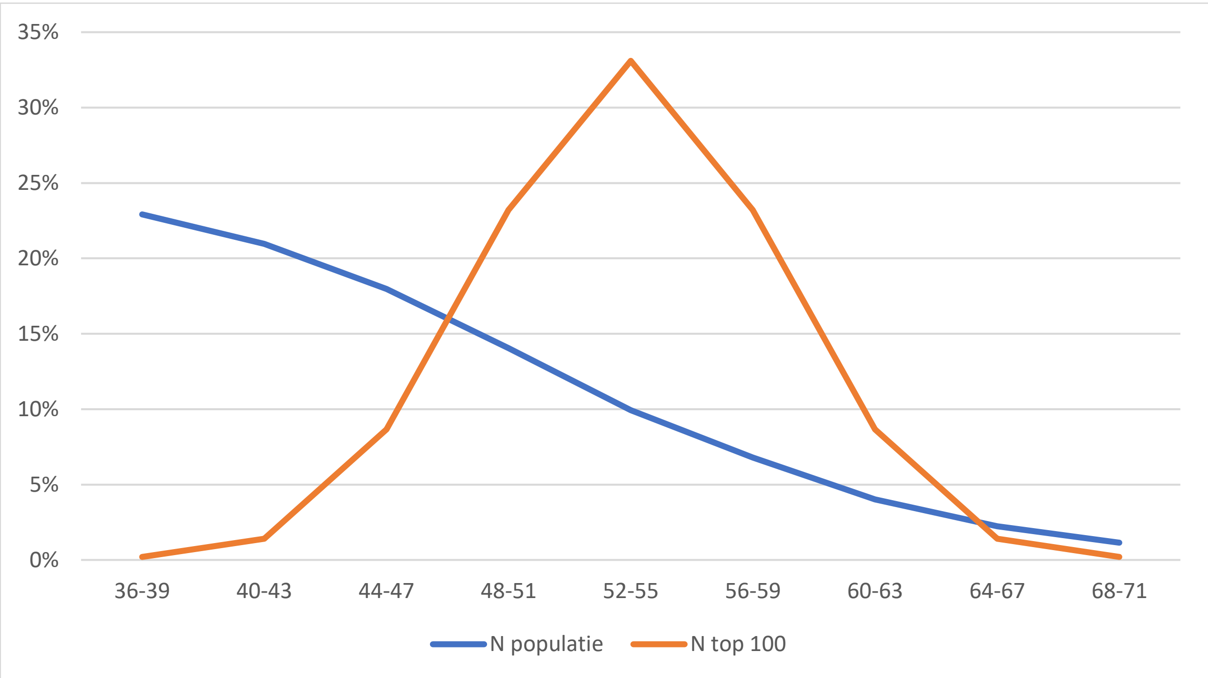

Figure 10.5 Schematic representation of the distribution over age categories for a fictitious population of labour immigrants (blue) and the Top-100 with the highest net contribution within this fictitious population (orange).

Therefore, the solution has been sought in the assumption[237] that the distribution over age categories of the Top 100 (as shown schematically in Figure 10.5) is the actual probability distribution for age of the Top 100. Based on this assumption, extremely high net contributions can be distributed according to this probability distribution among the age groups 36-39 to 68-71. This 'spreads large spikes' across those age categories.

In practical terms, the following solution has been chosen. The solution is explained for labour immigrants from Latin America, but the same has been done for labour immigrants from the Other region outside Europe. For each individual, the dataset contains one record with all variables. For the top 100 high earners among labour immigrants from Latin America, the average amount has been calculated for each variable that has an amount as its value. Subsequently, the amounts in the original records were replaced by those averages, but the age was not changed. In this way, the total net contribution for labour immigrants from Latin America remains the same, but only the distribution of that net contribution across the different age groups changes. This calculation was performed for various Top-X with X between 10 and 100. For Latin America, the changes were limited from Top 20 and in the region Other outside Europe from Top 50. The corrective effect is from Top 50 an estimated €63,000 lower for labour immigrants from Latin America and €28,000 lower for labour immigrants from the region Other outside Europe.

10.5 Main points sampling

In summary: with most classifications there is more than enough data and small groups are rare. With the 42-part division and with combinations of region with immigration motive, little or no data in younger and/or older ages plays a role. In all these groups, the effect on the net contribution over the life course is usually small because any errors (i) remain relatively small due to a low variance, (ii) do not fully factor into the final outcome due to discounting, mortality and remigration and/or (iii) only count for a small part in the final outcome because weighting is performed against a characteristic such as entry age that is associated with the low frequency (in other words: when weighting against entry age, errors arising from low numbers for a certain entry age carry little weight). To solve the problem of small numbers, data has been supplemented from higher regions and algorithms have been developed that reduce the effect of large 'spikes'. In the smallest groups according to the 42-part division (originating in Japan), in a few small groups in combinations of motive with the 12-part division (particularly labour immigration from Indonesia and Suriname) and in small groups in combination with the presence of people with a very large positive net contribution (particularly labour immigration from Latin America and the region Other outside Europe), the uncertainty surrounding the results is greater than for other groups. This must be taken into account in the interpretation.

[237] It is of course possible that the very high net contributions will repeatedly be distributed in a skewed manner towards the higher ages for a large number of reference years (for example, as an effect of career development) and in that case this assumption may be too optimistic, which would be an argument in favour of taking a smaller Top X in order to better approximate that possible skewed distribution or other possible solutions.

11 Strengths, Weaknesses and Suggestions for Further Research

11.1 Strengths

A strength of the current research is that almost all items in Table 5.1 were filled in as much as possible with Statistics Netherlands microdata where this was possible and useful. The level of detail in the breakdown by region of origin and/or immigration motive also provides a great deal of insight.

The same applies to the calculation of the net contribution according to the highest level of education attained and the Cito score. This, together with the demonstrated correlation of Cito scores between the generations, is an excellent example of the long-term effect of the extent to which the admission of immigrants is selective with regard to the level of education. For groups in which the first generation's Cito scores are on average very good or very bad, a moderate advantage, respectively persistent disadvantage can be detected in the second and often even in the third generations.

Another strong point is that the net contribution of the second generation is not based on the assumption that half of the second generation is integrated, as in the CPB study *Immigration and the Dutch Economy* (2003), but that per group in different ways (there is method and data triangulation) an estimate has been made of the degree of integration. For integration policy, this provides a valuable socio-economic integration measure for the second generation – which has not yet been used – and which, if updated regularly, could be used to monitor the progress of integration.

The quantification of the causes of the large differences in net contribution between (particularly) non-Western immigrants and native Dutch people in §9.12 is another strength of this research. This shows that the differences are certainly not to be found in the Dutch education system, but mainly in a lack of absorption in the labour market and a lack of selection based on educational level upon admission to the Netherlands.

The social implications of the results in the current report are significant. The results provide policy-makers with guidelines for a rational immigration policy. It provides insight into how the costs and benefits of immigration are related to the region of origin and the immigration motive. In addition, it makes clear how decisive the education level is for the net tax contribution of the first generation and – via the Cito scores – also for the net contribution of the second and subsequent generations. Selection based on education level is common in classical immigration countries such as Canada and Australia and the effects of such selection are expected to be even greater in the Netherlands, due to the extensive and relatively accessible welfare state.

The recommendation to periodically repeat this generational accounting from now on would also provide insight into the effect of policy measures. In addition, regular updating is also necessary because government policy with regard to income and expenditure is constantly changing and the cost and benefit items change with it. This would also provide more insight into possible systematic and random measurement errors.

11.2 Weaknesses

At the same time, the current report also has a number of weaknesses. Not all items have yet been completely filled in with Statistics Netherlands microdata. In most of those cases – defence, government investments in buildings and infrastructure, transfers abroad, land sales and other non-tax resources – allocation to individuals through operationalization with Statistics Netherlands microdata is not possible and/or not useful (see items 2, 10, 13, 14, 22 and 23 in Table 5.1). However, some of these items could be calculated in proportion to the contribution to GDP. Obvious candidates are Defence and Development Aid whose macro amount is a percentage of GDP (at least, that is the system, but it is not always followed in practice). For other items, such as government investment in buildings, population-based allocation as done in the current report seems more obvious. Items such as infrastructure are likely to grow more progressively in relation to population size as population density increases due to immigration. The same probably applies to other costs that are the result of extra population growth due to immigration, such as all kinds of (difficult to quantify) external costs due to things such as congestion, extra environmental pollution, loss of landscape, nature and open space or extra costs for the achievement of climate goals. It may be possible to further improve the estimation of the net contribution by weighting the items mentioned according to the extent to which they are related to population size or GDP.

In addition, there are three cost items for which it would be useful to investigate whether further implementation with microdata and/or macrodata is possible, namely public administration, healthcare and a part of social security. For example, in the case of public administration, this could be the cost of policies specifically targeting immigrants or the cost of local policies (municipalities, provinces, etc.) that do not fall under any of the other 22 items. In the case of healthcare, this concerns the costs for (special and long-term) healthcare (approx. 15 billion euros) that have not yet been entered with Statistics Netherlands microdata. In the case of social security, this concerns part of the costs for the 'Other social security' item (approx. 11 billion euros). All in all, this represents a significant part of the total government expenditure in 2016 of more than 300 billion.

Furthermore, there are still few data for a number of groups for the second generation, which makes the estimates for those groups more uncertain. The problem of limited data also applies to a number of combinations of immigration motive and region of origin in the 12-part division and 19-part division. Incidentally, this has a negligible effect on the calculations of the total net contribution for historical and future immigration in Chapter 7 of the current report, because small groups are also only included to a limited extent in the total net contribution.

11.3 Suggestions for further research

These observations lead to a number of suggestions for further research. First of all, it is recommended that the Healthcare item be further completed with Statistics Netherlands microdata, for example with expenditure from the AWBZ funds. Incidentally, the amount of data will increase over time for groups – such as the second generation and the immigration motive groups – for which limited data is sometimes available. All this will lead to an (ever) better estimate of the net contribution.

In the field of application, the tables with net contributions broken down by region, immigration motive and/or level of education that are included in the current report can provide guidance for many government agencies. All kinds of policy intentions can be calculated for their budgetary effect by using these amounts.

It would also be good to repeat these calculations periodically. In this way, the sensitivity of the calculations for choices with regard to data, reference year and the like will becoming increasingly clear. It also makes the progress of integration and the effects of policy more visible. As more data becomes available over time, the third generation could also be involved more in the analysis, in order to see to what extent the observed lagging integration in various origin groups is also continuing in the third generation. Relatively low Cito scores for a number of third-generation groups suggest that this is likely, but direct research into the net contribution is currently only possible to a limited extent.

Due to the objective and the resulting descriptive nature of the current report, testing causal relationships has not been an aim in itself. In a number of cases, when describing the costs and benefits, a (possible) relationship was found between two or more variables. A relationship between variables may indicate a causal relationship, but in itself does not constitute evidence of a causal relationship. This would require further investigation.

Further research into self-selection mechanisms in remigration would be very useful to gain a better understanding of the causal mechanisms that perpetuate or even reinforce group differences. For example, further research could be done into the association between benefit dependency and return migration opportunities as shown in §2.2. There seems to be such a thing as a 'reverse wealth magnet effect' where the 'welfare magnet' keeps benefit-dependent immigrants relatively often in the Dutch welfare state, while other groups remigrate relatively often. Something similar applies to the negative self-selection on education level and Cito score that apparently occurs with remigration (§9.12) and possibly related to this the significant differences in Cito score that exist between the immigration motives and between Western and non-Western immigrants (§9.7).

Another important point that deserves further research is the registration of the immigration motive by the IND (see §6.4). This often does not reflect the actual behaviour of immigrants and the benefit dependency among registered study and labour immigrants from Africa and the Middle East, among other places, increases with the years of residence. This requires further investigation into the registration and assessment of residence applications by the IND.

Also notable is the exceptionally high consumption of disability benefits by immigrants with an immigration background from Turkey, Morocco and the former Yugoslavia. It is worth investigating whether there really is such a big difference between the different groups with regard to capacity to work and what illnesses, disabilities, etc. prevent them from working in such large numbers. Something similar applies to the above-average reliance on unemployment benefits by Polish immigrants, which is related to proven fraud (see §8.6-§8.7).

Finally, the results suggest that socio-economic and socio-cultural integration go hand in hand. It is clear that children with one parent born in the Netherlands (in the second generation) and children with one parent with a Dutch background (in the third generation) often have higher net contributions. It is worth further investigation to explain these differences. It is possible that self-selection and partner selection play a role in this, in the sense that people who choose a partner with a Dutch background have different characteristics than people who do not. Other possible explanations are differences according to immigration background in child-related and parent-related factors that determine school success and social position and treatment.

In line with this, the statistical relationship between value preferences and socio-cultural distance prevailing in the country of origin on the one hand and socio-economic integration and Cito scores on the other is worth further investigation. They may provide insights that policy makers can integrate into admissions policies with a view to smooth integration of future immigrants.

12 Model

We start out from observed immigrants' contributions paid to or benefits received from the government in 2016:

$$X_{gac}$$

With:

- c category of contributions or benefits
- a immigrant age, $0 \leq a \leq 99$
- g group defined by generation, source region, immigration motive, education

We distinguish 23 categories of contributions/benefits, following the CPB 2014 study *Minder zorg om vergrijzing* on consequences of ageing. We take observations from Statistics Netherlands microdata, Statistics Netherlands StatLine and the CPB2018-dataset.

The net contribution profile $\overrightarrow{P_g}$ for group g is a profile by age, a vector with elements P_{ga} given by:

$$P_{ga} = \sum_{c} X_{gac} \; for \; 0 \leq a \leq 99$$

P_{ga} is the net contribution for group g and age a.

Future contributions/benefits for year $y \geq 2016$ are obtained from multiplying by W_{yac} taken from the CPB2018-dataset. In its ageing study, the CPB has predicted levels of contributions and benefits up to 2060, based on anticipated economic developments and policy measures. We use these predictions to set values by category relative to their value in 2016. The CPB is an acknowledged authority in the Netherlands on economic policy analysis in political debates, providing a common reference in the debates. Of course, CPB predictions are not beyond doubt or discussion, but using them puts our calculations within the common frame of reference.

As contributions/benefits in category c for group g at age a in year y are given by $W_{yac} \cdot X_{gac}$, the net contribution of group g at age a in year y is given by:

$$NCA_{gay} = \sum_{c} W_{ayc} \cdot X_{gac}$$

The net contribution NCE_{ge} by entry age e and group g is given by:

$$NCE_{ge} = \sum_{a=e}^{99} \left\{ \left(\frac{1+p}{1+i} \right)^{a-e} \cdot NCA_{ga(2016+a-e)} \cdot SURV_{ea} \cdot STAY_{gea} \right\}$$

With:

- p rate of productivity growth (perunage)
- i real rate of interest (perunage)
- $SURV_{ea}$ probability of survival up to age a when arriving at entry age e

- $STAY_{gea}$ probability of staying in the Netherlands up to age *a* when arriving at entry age *e,* for a member of group *g*

Note the implicit assumption that someone belonging to a certain group and arriving at age e will upon arrival be assigned the contributions/benefits of a comparable immigrant of age e, i.e., an arriving immigrant is assumed to have the age profile of the average residing immigrant of the same group and age. This eliminates cohort effects by year of arrival, which is unavoidable as we have no data by year of entry.

The net lifetime contribution LNC_g for group g is given by:

$$LNC_g = \sum_{e=0}^{99} \{NCE_{ge} \cdot I_{ge}\}$$

I_{ge} is the fraction of immigrants in group g immigrating at entry age *e.* The fractions are taken from immigrants arriving between 1-1-1995 and 31-12-2016.

The immigration profile $\overrightarrow{I_g}$ is a profile by age for group g, a vector with elements I_{ge} , $0 \leq e \leq 99$.

The fraction $SURV_{ea}$ is given by:

$$SURV_{ea} \; = \prod_{m=e}^{a} (1 - S_{m(2016+m-e)})$$

S_{ay} is the probability of dying at age a in year y. The probabilities are taken from Statistics Netherlands predictions up to 2060 and kept constant thereafter.

The fraction $STAY_{gea}$ is given as:

$$STAY_{gea} \; = \prod_{m=e}^{a} (1 - R_{ge(m-e)})$$

R_{ged} is the probability of remigration for an immigrant in group g arriving at age e after a stay of duration d for $d + e \leq 99$. The probabilities for $0 \leq d \leq 23$ have been calculated from Statistics Netherlands microdata on emigration of immigrants arriving in the Netherlands since 1-1-1995, as is described in §7.2 of this appendix.

For individuals with a first-generation immigration background, the net contribution is augmented by initial cost of immigration: integration courses, processing of immigration application, cost of housing and monetary allowances for refugees. Present values of entitlement to state pension (AOW) for immigrants who have left the Netherlands are also added, based on anticipated length of stay derived from remigration probabilities and weighted by the entry age distribution (pension entitlements build up by year of presence). For details, see Chapter 6 of this appendix.

For individuals without an immigration background and individuals with second-generation immigration background who will not remigrate, the net lifetime contribution is determined as:

$$LNC_g = \sum_{a=0}^{99} \left\{ \left(\frac{1+p}{1+i} \right)^a \cdot NCA_{ga(2016+a)} \cdot SURV_{0a} \right\}$$

Thus, in this case the calculation for LNC_g equals the calculation for NCE_{ge} for entry age $e = 0$ and $STAY_{gea} = 1$ for all $0 \leq a \leq 99$.

For individuals with a second-generation immigration background, we assume that after age 18 they will never remigrate and before age 18 they will always remigrate with their migrating parents. In the latter case, we assign them the remigration probabilities of their parents. The net lifetime contribution is then calculated as:

$$LNC_g = \sum_{a=0}^{99} \left\{ \left(\frac{1+p}{1+i} \right)^a \cdot NCA_{ga(2016+a)} \cdot SURV_{0a} \cdot STAY_{g0a} \right\}$$

Hence, in this case the calculation of LNC_g equals the calculation of NCE_{ge} for entry age $e = 0$ and and probabilities to stay $STAY_{gea}$ taken as their parents' values. Birth of (by definition of Statistics Netherlands) Dutch-born second-generation immigrants is predicted from age-specific fertility rates of the mother (as described in §7.1 of this appendix) combined with the immigration profiles (as described in §2.3 and §7.2 of this appendix).

Thus, to summarise, our basic data are observations on contributions and benefits observed at individual levels in 2016. They are carried forward by remigration probabilities observed in 2015-2017, mortality rates predicted by Statistics Netherlands and macro-economic developments predicted by the CPB. Differentiation by entry age is obtained by assuming that an immigrant enters the lifetime age profile of contributions and benefits observed in 2016 for a residing immigrant at his age at entry.

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