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Economic Policy Analysis

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Inequality and Redistribution in the Netherlands*

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Abstract

This paper combines detailed administrative records on the universe of the Dutch population with national accounts aggregates to provide a thorough description of income inequality before and after taxation and government spending. Accounting for domestic and foreign retained earnings has a substantial impact on inequality, raising the top 10% share of pre-tax national income from 29% to 31%. Overall, the tax system is regressive due to high consumption taxes and a low tax burden on capital income. The entire reduction in inequality - the top 10% income share falls to 26% - comes from government spending that is targeted at the bottom of the distribution.

JEL codes: D3, H2, H3, H5
Keywords: inequality, redistribution, taxes, transfers, Netherlands

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1 Introduction

Ever since the publication of Piketty (2014), the study of inequality has made enormous progress. A frequent shortcoming of traditional inequality research is that its income concepts do not cover all of the national income, as constructed by national accounts statisticians. At the same time, the national accounts which include the most used aggregate income concepts such as net national income and gross domestic product lack a distributional dimension. This gap was already identified by the Stiglitz-Sen-Fitoussi commission (Stiglitz, Sen and Fitoussi, 2009). It is now most ambitiously addressed by two research programs, the OECD's Expert Group on Disparities in a National Accounts framework (EGDNA),[1] and the World Inequality Lab's (WIL) Distributional National Accounts (DINA).[2] Both approaches differs in a number of ways (Zwijnenburg, 2019), but share the goal of bridging the gap between micro studies on the inequality of income and wealth and the corresponding macro aggregates.

This paper constructs distributional national accounts for the Netherlands for the year 2016 according to the methodology outlined in Blanchet et al. (2021) and is the result of a collaboration between national statisticians, research institutes and academics. We are the first to provide income inequality statistics for the Netherlands that are consistent with national income. We build on Bruil (2022), who constructs distributional national accounts for the household sector, by extending our analysis to income earned in the corporate and government sectors as well as exploiting new data sources for the household sector. Most of our income concepts, as well as different types of taxes and government spending are based on microdata on the full universe of the Dutch population. Our distributional results consequently rely on fewer assumptions than in most of the existing DINA projects for many components of taxation and government spending.

When assigning all of national income to households, we find that the top 10% of the income distribution accounts for 31% of pre-tax national income. This share lies below that found for the United States and Italy (Guzzardi et al., 2022; Piketty, Saez and Zucman, 2018) and is comparable to the levels found in France and Austria (Bozio et al., 2022; Jestl and List, 2020). While labour income and pension benefits make up more than half of the bottom 99%'s pre-tax income, capital income and retained earnings dominate the incomes of the top 1%. Accounting for retained earnings matters for inequality: the top 10% share of pre-tax national income before allocating corporate income is only 29%.

When comparing pre-tax and post-tax income, we find a substantial reduction of overall inequality: the bottom 50%'s share of income increases from 21 to 29%, while the top 10%'s income share falls by 5 percentage points to 26%. The reduction of inequality can be attributed entirely to the redistributive nature of government spending, rather than to taxation. While the corporate tax and taxes on personal income and wealth are progressive (up until the top 0.1%), the tax system as a whole is regressive due to social security contributions which are

[1] See Fesseaui and Mattonetti (2013) and Zwijnenburg et al. (2021) for a review of this approach and Bruil (2022) for an application to the Netherlands.

[2] See Piketty, Saez and Zucman (2018) and Garbinti, Goupille-Lebret and Piketty (2018) for the first applications and Blanchet et al. (2021) for an extensive description of the methodology.

mostly flat in income and consumption taxes, the burden of which falls as a share of income. The regressivity is particularly pronounced for the top 1%: whereas the tax burden lies between 40 and 50% for the bottom 99%, there is a sharp drop within the top 1%, ultimately to only 21% for the top 0.01%. Conversely, the spending side is not only directed to low incomes, but the slope of government spending expressed in terms of income is considerably steeper than that of the tax burden. The lowest income groups receive government spending that is at least as large as their pre-tax income. For the highest income groups on the other hand, government spending amounts to less than 7% of pre-tax income.

We make the following contributions to the literature. We first add to the quickly developing literature on distributional national accounts by providing a complete assessment of income inequality in the Netherlands. We present the most complete analysis of the Dutch tax system and government spending to date. We show that income inequality is higher and the tax system is less progressive than previously thought. While the Dutch literature on redistribution (e.g. Caminada and Goudswaard (2001); Caminada et al. (2021); De Kam et al. (1996); Trimp and De Kam (2011)) focused entirely on the tax system and the cash benefits, we show the redistributive impact from in-kind benefits and collective expenditures as well. Moreover, we include more taxes in the analysis, such as the corporate income tax and the inheritance tax.

Aside from increasing the scope of international comparisons by adding a new country to the list of DINA countries, the Netherlands is an interesting case study for at least two reasons. First, it combines some features of other European countries – a large welfare state and high levels of public expenditure – with a large semi-private pension system which shares similarities with the United States. The investment income associated with collective pension funds is the largest among European countries, even in absolute amounts. Households at the bottom of the income distribution have non-negligible amounts of pension wealth and thereby indirectly earn capital income. Second, the Netherlands records unusually large inward and outward foreign direct investment stocks, a result of its role as a conduit country for multinational corporations (Lejour, 2021; Weyzig, 2013). This makes the assumptions regarding the distribution of corporate income and taxes both more complex and more consequential. Guvenen et al. (Forthcoming) documents how corporate profit shifting affects macroeconomic aggregates such as gross domestic product and the balance of payments. In this paper we show its importance for income inequality and tax progressivity.

Our second contribution consists of bringing a set of methodological insights to the DINA literature, leveraging the high quality of the Dutch data. First, we provide new insights on an important component of income at the top of the distribution, namely retained earnings from corporations. Accounting for retained earnings, in particular in closely held businesses, is essential for the measurement of income inequality (Alstadsæter et al., 2016; Fairfield and Jorratt De Luis, 2016; Kopczuk and Zwick, 2020; Smith et al., 2019; Wolfson et al., 2016). Data from the tax authority allows us to link owners to their closely held businesses, even in cases of complex ownership links. We assign these firms' retained earnings to their ultimate owners. An important aspect of corporations in the Netherlands, is that a substantial part of their equity is

owned by pension funds. As a result, the (indirect) ownership of equity is spread more broadly across the population and so is the income that is derived from this equity ownership.

Second, we are able to assign the majority of in-kind transfers directly to the beneficiaries. The majority of in-kind transfers in the Netherlands are received as education, health care and long-term care. Using data on the actual use of these services, we show that the distribution can differ markedly from those obtained when assigning such transfers proportionally, lump-sum or according to a small number of demographic variables. Given the size of in-kind transfers in modern welfare states, this is an issue of first-order importance. The large amounts of transfers received by individuals also raises the question of the appropriate treatment of actual consumption of care in the definition of post-tax income.

Our third main contribution is to produce a thorough sensitivity analysis to alternative assumptions for the construction of our main results. Distributional accounts are based on many assumptions of different kinds. Despite a praiseworthy level transparency on assumptions made in most papers, a full assessment of the sensitivity of the results to alternative possible approaches is not often provided. A recent exception is given by Bozio et al. (2022), who presents a number of robustness results to distributional assumptions. We go one step further in that direction by explicitly comparing our main results to a wide set of alternative assumptions, and by analysing the important differences as well as the underlying mechanisms behind these differences. We believe that this exercise is necessary to provide an explicit assessment of the uncertainty embedded in the construction of distributional national accounts.

The rest of the paper proceeds as follows. First, we present the main features of the Dutch tax system and government spending in section 2. Section 3 presents the main conceptual and methodological choices we have made for the analyses and construction of our data set. Section 4 presents our main results and section 5 presents a sensitivity analysis. Section 6 concludes and discusses next steps for future research.

2 Background on taxation and government spending

2.1 Taxation of personal income and wealth

In 2016, households paid a total of €56.8 billion (9.8% of national income) in taxes on income and wealth.[3] The taxation of personal income and wealth in the Netherlands is governed by the 2001 Income Tax Law, which divides income into three separate "boxes".[4] Each box taxes a different type of income according to different tax rules. *Box 1* taxes labour income, self-employment income, pension benefits, transfer income and imputed rental income from owner-occupied housing at progressive rates varying from 36.55% to 52% in 2016. Mortgage interest payments related to the owner-occupied house can be deducted from taxable income in *Box 1*. Pension contributions can be deducted from taxable income in *Box 1* and pension

[3]The statistics on government revenue and spending in this section are taken from Current transactions by sectors; National Accounts 2016; CBS Statline

[4]This section is partly taken from Leenders et al. (2022).

benefits - which reflect initial contributions and the return on these contributions - are taxed at reduced rates in *Box 1* when paid out during retirement.[5]

Box 2 taxes profits distributed to and capital gains realised by taxpayers who own at least 5% of a corporation at a 25% rate, which is called a "substantial ownership". As long as no dividends are paid out and capital gains are not realised, no income tax is due. *Box 3* covers all wealth with the exception of owner-occupied housing, substantial ownership and pension wealth. Among other types of wealth, the *Box 3* tax base thus includes bank deposits, bonds, non-substantial ownership of shares, and second homes. Effectively, the taxation in *Box 3* corresponds to a 1.2% wealth tax. The value of real estate is also taxed by a municipal tax.

Households' inheritance and gift taxes amounted to €1.9 billion (0.3% of national income) in 2016. These taxes have exemptions and increasing marginal tax rates that depend on the relationship between the donor and recipient. Marginal rates range from 10% to 40%.[6] Figure 1 breaks down the tax revenue of all taxes and contributions in terms of their share in national income.[7]

2.2 Corporate income tax

In 2016, corporations paid a total of €23 billion (4.0% of national income) in corporate and dividend taxes. Corporate profits are subject to the corporate income tax with a 20% rate for profits until 200 thousand euro and 25% above. Income derived from R&D is taxed at a reduced effective tax rate of 5%. Dividends received by Dutch companies are exempt from the corporate income tax under some conditions ("participation exemption"). The Dutch tax authority may provide advance rulings on the specific application of the corporate income tax. The Netherlands has concluded tax treaties with over 90 countries. As a result, the Netherlands has become an important conduit country used for multinational profit shifting (Lejour, 2021; Weyzig, 2013).

2.3 Production taxes

Production taxes amounted to €84.7 billion (14.6% of national income) in 2016. The most important indirect tax is the value added tax (VAT). It accounts for about 30% of all tax revenues. The normal rate is 21% and the reduced rate is 6% in 2016. The tariff on exports is 0%. Many services are VAT-exempt, which implies that the sellers do not levy a VAT, but also cannot subtract the costs of paid VAT on their purchases. There is a special tax on insurance products with a rate of 21%. The Dutch government levies excise taxes on alcohol, tobacco and petrol. Tariffs depend on the specific type of the product. There are also taxes on the purchase of cars and motors and on the use of these vehicles amounting to around 1% of national income.

[5] A substantial part of taxes in *Box 1* consist of social security contributions. Individuals above the statutory retirement age do not pay social security contributions and therefore face lower rates in the lower brackets.

[6] In addition to general thresholds below which tax-free donations can be made (such as €20.148 for inheritances and €5.304 for donations to children in 2016), one-off exemptions exist for donations intended for purchases of owner-occupied homes and for business successions.

[7] For more details on the Dutch tax system, see Bovenberg and Cnossen (2001) and Cnossen and Jacobs (2021).

Environmental taxes are mainly levied by municipalities and paid by households. In the national accounts all these taxes are defined as production taxes.

2.4 Social insurance contributions

Social insurance contributions amount to €107.5 billion in 2016, nearly 39% of all taxes and contributions. Social contributions consist mainly of contributions to health care and long-term care spending. This amounts to 8.8% of national income. Most of these contributions are paid by households and employees and a smaller part is paid by employers. Total government expenditures on health care exceed contributions: the remaining share is financed from general tax revenues. Another large share of the social insurance contributions, paid by households, is used to finance pay-as-you-go old-age pensions. Finally, there are insurance contributions for disability, illness, unemployment and some other social risks. These latter risks are mainly covered by employer contributions. Other social expenditures, like social benefits, and labour market activation policies are covered by the general government budget. Most contributions are fixed rates on income and the contributions are maximised at an income of about €52 thousand.

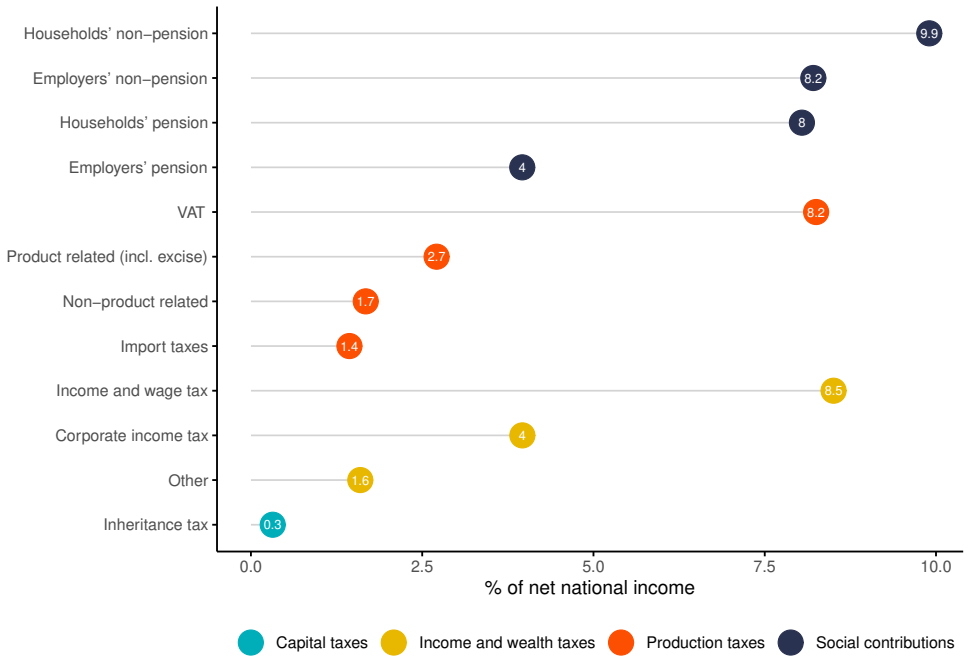
These social insurance contributions do not include pension premiums paid to pension funds and insurance companies. The Dutch pension system consists of three pillars. The first pillar are pensions provided by the government to every old-age person in the Netherlands. These benefits are financed by social security contributions mentioned above and by overall tax revenues. The second pillar are the benefits for employees on top of the government pension. These benefits are related to the average wage over an employee's lifetime and are paid out by pension funds and financed by compulsory contributions of employees. These compulsory contributions amount to about €69 billion in 2016. This leads to a total of €177 billion in social contributions, or 30% of national income. The third pillar consists of private pensions offered by insurance institutions. Under certain conditions the premiums can be deducted from taxable income. This pillar is meant for non-employees which are not eligible for a second-pillar pension and employees saving for additional pension benefits.

2.5 Government spending

Redistribution mostly takes place via social schemes run by the government, financed by taxes and social contributions described in the previous paragraphs. Following national accounting, we make the distinction between benefits in-cash and in-kind, and collective expenditures: a distinction based primarily on whether it benefits the individual or society as a whole. Both in-cash and in-kind benefits are about equal in terms of national income in the Netherlands, with 21.6% and 21.2% respectively.[8] Figure 2 shows all types of spending in terms of their share in national income. Social security and insurance benefits are the most important ones, followed by pension benefits and social assistance benefits. The largest in-kind transfers are health care and education as in most Western countries. Together they make up 21.2% of total

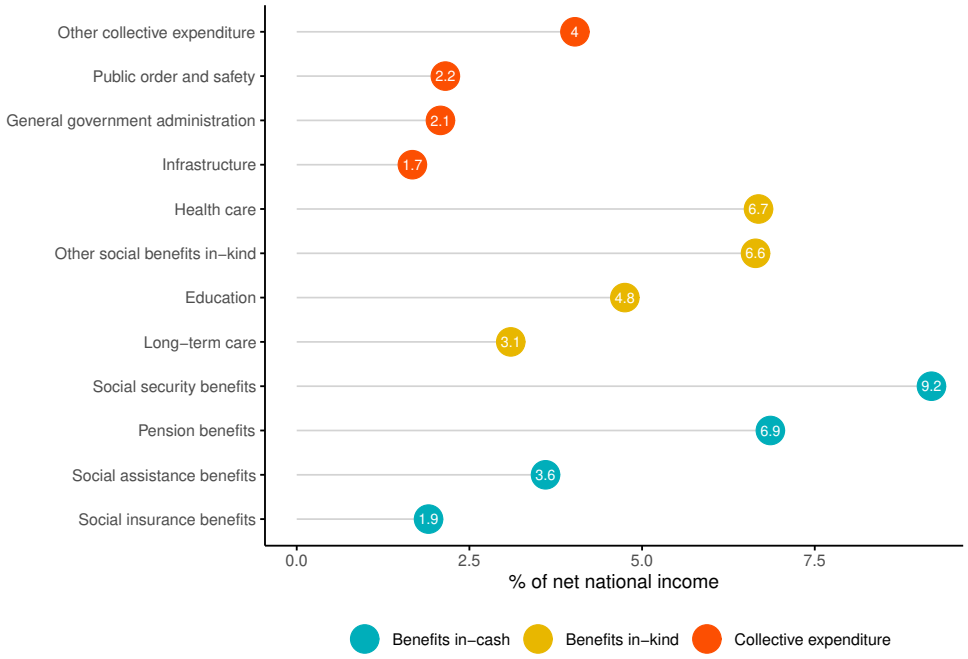
[8]Current transactions by sectors; National Accounts, 2016; CBS Statline.

Figure 1: Taxes and social contributions



Source: CBS Statline and Bruil (2022)

Figure 2: Social benefits and collective expenditure



Source: CBS Statline and Bruil (2022)

government expenditure, which represents 11.4% of national income. Collective expenditure accounts for nearly 19% of total public spending (10% of national income) and is mostly spent on public order and safety, general government administration and infrastructure.

3 Methodology and data

3.1 Methodological choices

Unit of observation We analyse income distribution and the effect of redistribution at the level of the individual. We apply the equal-split approach, where all income, taxes and government spending are shared equally between adult members of the household. The adult-individual approach, advocated by Blanchet et al. (2021), is more relevant for the analysis of income inequality, which is what we are ultimately interested in. We also construct alternative scenarios with different units of analysis, such as the household approach, preferred by national statistical agencies (Bruil, 2022; Germain, André and Blanchet, 2021), which relates more closely to the standard of living, hence to individual consumption and welfare. Section 5 compares the results obtained in our main specification to alternative scenarios.

Income concepts To ensure comparability and consistency with the literature, the income concepts we use correspond to the ones developed and used in the DINA literature (Blanchet et al., 2021; Piketty, Saez and Zucman, 2018). The two polar income definitions are pre-tax factor income and post-tax income. The former includes all types of primary income, i.e. of the household sector as well as that of the government and corporate sectors, before taxes and government spending. The latter corresponds to income after the operation of the pension system and redistribution through taxes and government spending. They are both equal to total national income in the economy.[9] The DINA framework also uses an intermediate concept of income between the first two: pre-tax national income corresponds to pre-tax income after the operation of the pension system (narrow definition) or the overall social security system, also including unemployment and disability insurance (broad definition). In the main results of our analysis, we use the narrow definition of pre-tax national income. In practice, pre-tax national income amounts to pre-tax factor income plus social security benefits and minus social security contributions. The main justification for incorporating social security in pre-tax income is that the highly redistributive effects are largely driven by a country's demographic characteristics. For instance, a large share of pensioners in the population mechanically translates in large factor income inequality, since factor income of pensioners is close to zero. The important drawback of pre-tax national income is that it ignores the redistributive nature of the pension system.[10] While we can look at the difference between factor income and pre-tax national income to isolate

[9] Note that these income concepts differ slightly from national income measured in the national accounts. The difference is that retained earnings are attributed to their owners, so that retained earnings in a Dutch firm owned by foreign shareholders are assigned to those foreign shareholders while retained earnings in a foreign firm owned by Dutch shareholders are assigned to those Dutch shareholders. See section 3.3.

[10] See for example, Haan, Kemptner and Lüthen (2020) for the German pension system or Caminada et al. (2021) for the Dutch pension system.

the effect of the pension system, its redistributive features often have a strong intertemporal component and these are imperfectly captured in a static analysis.

In our empirical analyses, we focus on pre-tax national income and post-tax income to measure the redistribution of income. This requires a further discussion of the first pillar in the pension system and its inclusion in pre-tax income. The first-pillar pension (*Algemene Ouderdomswet*, AOW) is a non-contributive scheme: eligibility and benefits are unrelated to contributions.[11] AOW contributions are largely perceived as a tax and AOW benefits as a transfer instead of as replacement income. In line with this, we could refrain from removing AOW contributions and adding AOW benefits to pre-tax national income. However, doing so is problematic on two grounds. First, since AOW pension are the main income component for a significant number of pensioners, the inequality indicators would be very sensitive to the age-structure of the population. Second, nearly all pension systems have a contributive and non-contributive component, and often less explicitly separated than in the Dutch system. Treating these two components separately would undermine the international comparison with countries for which this distinction is not explicit (e.g. in Piketty, Saez and Zucman (2018) or Garbinti, Goupille-Lebret and Piketty (2018)). We thus decide to include the AOW scheme in pre-tax income in our main results. We compute an alternative scenario where we leave it out in section 5.

Ordering of individuals When analysing the distribution of income, taxes and government spending by income group, one needs to choose the income concept for ranking individuals/households and for constructing the income groups. Different options are used for ordering household or individuals in the literature. In most papers (e.g. Bozio et al. (2022); Piketty, Saez and Zucman (2018)), the ranking variable depends on the income concept considered (e.g. computing income share of pre-tax income by ranking individuals by pre-tax income). Therefore, we also use this method as our main approach. However, one shortcoming is that the composition of the income group changes from one income concept to another. This can be problematic when one wants to compute what everybody contributes in taxes and receives in government spending and it understates the amount of redistribution. We therefore also consider an alternative approach, where we use pre-tax income variable to rank individuals for pre-tax and post-tax income when assessing the overall redistribution of the system (Figure 9 in section 4).

3.2 Data sources

Our analyses combine national accounts aggregates with administrative microdata as well as survey data to compute income, taxes and government spending for all households in the Netherlands in 2016. The ideal data set for this exercise would contain the following information at the individual level: all earned incomes, all taxes paid directly or indirectly through con-

[11] The amount received only depends on the years of residency in the Netherlands (a full AOW is given after 50 years).

sumption taxes, and all cash and in kind transfers that are actually received from government expenditures. The total of all those individual components would sum-up to the aggregates of the national accounts. The reality of the available data sources does not match this ideal, as some incomes and transfers are not directly recorded (e.g. VAT) or observable (e.g. collective expenditure) at the individual level. Even for incomes and transfers for which we observe data at the individual level, some inconsistencies – or data gaps – can remain when comparing with the national accounts aggregates. These two departures from the ideal setting require distributional assumptions to fill those gaps. We describe these assumptions and methods in the next subsection.

In spite of some limitations, the data sources available in the Dutch context are not very far from the ideal data, in particular for recent years, including 2016. We are indeed able to observe (i) a very large set of incomes, taxes as well as in-cash and in-kind transfers (ii) for the whole Dutch population.

Microdata The detailed description of the different data sources used in our analyses can be found in Bruil (2022) and the data Appendix A. We hereby present the main features of the data. We combine different administrative records containing the full universe of the Dutch residents in 2016, through a unique individual identifier. Registers at the municipality level provide information on basic demographic variables (date of birth, gender) as well as household composition. Employers-employees linked data provide information on wages and social security contributions. Different types of individual incomes are combined from different sources (tax and social security data). We also have information on household wealth and education attainment. We have information on in-kind transfers received from the most important schemes (health care, long term care or social assistance), for which we observe transfers in terms of cost or consumption (e.g. hours of a given type of care received). We combine these different data sources to construct a master file containing all Dutch households with all the *available* microdata on earned income, paid taxes and received transfers in 2016. Aside from the administrative records on the whole population, we also use survey data (e.g. Budget survey for the computation of consumption taxes), and data linking firms to individuals owners that we use to distribute corporate income for a subset of the population (see details below).

National accounts aggregates National accounts aggregates are constructed and made publicly available by Statistics Netherlands.[12] The Dutch national accounts are very detailed and contain most of the items mentioned in Eurostat (2013). In addition to the officially published national accounts, we have access to more disaggregated measures of in-kind transfers expenditures.[13]

[12]The accounts by sectors can be found here https://opendata.cbs.nl/#/CBS/nl/dataset/84098NED/table?searchKeywords=collectieve%20regelingen

[13]Statistics Netherlands provided a decomposition of the D.63 item, into around 50 sub-items, regrouped by schemes or policies.

3.3 Distribution of national income

The final product of the data creation process is a data set containing all Dutch individuals/households, with *all* information on their income, paid taxes and received benefits. All the variables in the final data set correspond to national accounts aggregate items, and the aggregated amounts over the population match the national accounts aggregates. Consequently, the total amounts of income, taxes and benefits also match their national accounts aggregates. In particular, we want that the totals of pre- and post-tax income are equal to national income as measured in the national accounts.

Income and transfers variables are computed as follows. We first gather the available microdata corresponding to the national accounts variable. Then we usually find a gap between the total of the microdata and the national accounts aggregate, which we distribute using distributional assumptions (e.g. proportional to the observed amounts). For parts of the national income for which we do not have microdata (or only for a limited scope), we distribute the national accounts aggregates based on assumptions, ideally based on estimations made on external datasets like survey data.

We start from the data set constructed in Bruil (2022), which contains the targeted information for a large subset of the national economy, namely the household sector. Using social security and tax data, he is able to attribute a large part of households' income, tax and benefits, and distribute the remaining data gaps to obtain income distributions that are consistent with the national accounts. We extend this work in two broad directions. First, we improve the analysis of the household sector by incorporating additional available data sources. Second, we distribute the entire national income by adding the following components: corporate income tax and retained earnings and remaining components of the government sector (production taxes, collective expenditure and surplus). To do so, we largely follow the DINA guidelines provided by Blanchet et al. (2021). In the rest of this section, we discuss the approaches we follow for those computations.

Household sector

Regarding income, taxes and transfers that can be directly attributable to households, we improve the data construction of Bruil (2022) in different ways. Our main additions concern the distribution of in-kind transfers. Although in-kind transfers tend to be non-monetary, individuals do benefit from the fact that they need not pay market prices for, say, education. In an ideal setting, we would observe the costs that are made for each individual in order to determine the exact in-kind transfer per individual or household. We do not observe such individualised costs. However, we do try to simulate these by exploiting microdata in which all users for the majority of in-kind transfers are registered. Bruil (2022) already made use of several administrative records of in-kind benefits, for example for education or health. We complement this approach by using newly available microdata containing information on the use of childcare, social care, youth care and long-term care. For each transfer we observe which individuals have received which type of care - and in some cases information about the intensity

of care received (e.g. hours of care). Using this data, we can distribute the in-kind transfers to actual beneficiaries taking into account the fact that *within* schemes, costs differ. For each transfer, the difference with the national accounts aggregate is proportionally allocated.

Appendix B.2 gives a more detailed description of the allocation method for each transfer. In the appendix we also compare our data-driven method with the proportional and lump-sum allocation methods of these in kind benefits, which can be seen as the under- and upper-bound of the distribution respectively (Blanchet et al. (2021)). Figure C.2 shows for example that our method causes a substantial different distribution than the proportional method, which strongly underestimates (overestimates) the average transfer for lower (higher) incomes. Section 5 discusses this comparison in more detail. Clearly the most appropriate assumption depends on the type of welfare system countries have, as is also pointed out by Jestl and List (2020) who deviate from the proposed method in Blanchet et al. (2021) and suggest allocating all government expenditure equally is a more accurate method for the Austrian case.

There are some obvious advantages to exploiting the microdata for the allocation of in-kind transfers, since it requires fewer distributional assumptions compared to the proportional (transfers increase by income) or lump-sum (equal transfers) methods. One limitation of our analysis that particularly affects the distribution of in-kind transfers is the focus on a single year, while households' income and circumstances change over time. The distribution in turn might alter when reviewing it over longer time series. This could be in particular the effect for in-kind transfers with demographic characteristics, as in-kind transfers like education, health and long-term care are strongly related to age. Ultimately, a life-cycle approach would allow us to disentangle demographic from income effects. However, the microdata on in-kind transfers are only available for a few years.

We also improve on Bruil (2022) by using newly available microdata on inheritance and gift taxes. These taxes amount to 1.8 billion euro, 0.3% of NNI in 2016, which we allocate using the observed distribution. We observe all inheritances and gifts that have been filed by Dutch citizens including the tax paid, which means that donations under general tax free thresholds[14] do not appear in the data. All other donations must be reported, also if the tax due is zero because of other special exemptions, most importantly tax expenditures for business successions.

Finally, we also add a sensitivity analysis regarding the distribution of dividends by Bruil (2022). The data gap between the total found in the microdata and the national accounts aggregate is very large for dividends distributed to Dutch households: 5.8 billion euro from the tax records versus 12.8 billion euro according to the national accounts. The reasons behind this large gap are not clear yet. Bruil (2022) distributes the data gap proportionally to observed dividends, which is the most natural approach since we expect dividends to be concentrated at the top of the income distribution. However, there is no corresponding data gap for the taxes paid on capital, so that distributing according to observed dividend mechanically decreases the tax burden at the top of the income distribution. In section 5, we compare this approach with an alternative approach where we distribute the dividends' data gap according to pre-tax income.

[14]The general threshold depends on the relationship between donor and recipient. In 2016 a yearly tax-free donation to children was maximised at €5.304

Corporate sector

Corporate income can be paid out as dividends or kept in the firm as retained earnings. In 2016, households received €12.8 billion euro in dividends, while the corporate sector retained over €70 billion of its earnings and paid €23 billion in corporate taxes. After accounting for the fact that part of these earnings and taxes are associated to foreign shareholders, as well as the fact that Dutch households own equity in foreign firms, we are left with €64 billion euro in retained earnings and €16 billion in corporate taxes (see Appendix B.3 for an elaborate explanation of how we account for these facts). For dividends we follow the assignment to households of Bruil (2022). In this approach, dividends are partly observed and the data gap is assigned to households based on the observed dividend distribution (cf above). This section explains how we assign the retained corporate income and corporate taxes to individual households.

Previous studies have used different methods for assigning corporate income and taxes to households. Piketty, Saez and Zucman (2018) allocates corporate income proportional to the equity holdings of households. This assumes a constant return to equity across all firms. Alternatively, Saez and Zucman (2019) allocates retained earnings proportional to the distribution of dividends. This approach assumes firms have a uniform pay-out rate. The disadvantage of this approach is that in practice firms choose not to pay out any dividends in a particular year or pay out the profits of multiple years at once. This is quite common for smaller firms that are not publicly traded. This leads to a stronger concentration of dividends in comparison to profits. A third approach is to use data on firm ownership and directly linking retained earnings of individual firms to their owners. This approach has been used for Norway by Alstadsæter et al. (2016). In this paper, we follow the latter methodology for closely-held businesses. For these firms, we use ownership data to directly allocate the retained earnings to the owners. The remaining retained earnings are distributed proportional to equity holdings. Appendix B.3 presents the methodology we follow in details.

Statistics Netherlands publishes sectoral balance sheets of equity holdings. These balance sheets allow us to distribute corporate income and taxes to households, pension funds and the government. We then use households' equity and pension wealth to assign corporate income and taxes to individual households, while the government's share in corporate income and taxes are assigned to households based on their income, consistent with the DINA guidelines (Blanchet et al. (2021)). We provide further details in Appendix B.3.

Collective expenditure

To obtain post-tax national income we add both in-kind transfers and collective expenditure to post-tax disposable income. Collective expenditure is allocated lump-sum assuming everyone benefits equally. The other polar option is to consider that collective expenditure should be distributed proportionally to income, in order to reflect the idea that richer individuals benefit more from general infrastructure. We test the sensitivity of this assumption in section 5.

While these two methods are convenient in case no information is available about which individuals benefit (most) from collective goods, much room for improvement is left in this

regard. The allocation could be improved using different distributional assumptions that exploit the nature of the type of collective expenditures. One possible direction is to allocation proportional to wealth, which might be justifiable for expenditures such as police and defence spending (Piketty, Saez and Zucman (2018)). One other direction is to use additional microdata or surveys on the use of specific public goods as is done by Olsthoorn et al. (2017), who allocate public expenditure on passenger transport based on passenger kilometres travelled in public transport[15] and show that the benefits from public spending on transport largely falls to households with a high income, partly because of the greater car ownership in these households.

Government sector

Following the DINA guidelines, we distinguish between the distribution of production taxes in pre-tax and post-tax income. In pre-tax income, we distribute production taxes proportionally to factor income, in order to align with the national income aggregate but without affecting the distribution of factor income.[16] In post-tax series, production taxes are removed proportionally to consumption. We first estimate the average VAT and excise duties paid using a detailed survey on household expenditure among 15,000 households, combined with the tariffs that apply to each households' consumption basket. Since we observe household income, we then impute the average production tax rate by income decile. A detailed description of the method and survey can be found in Appendix B.1. As section 4 shows, production taxes appear to be regressive as the effective VAT and excise burden decreases with income.[17] This is due to households with higher incomes having lower consumption rates (and higher savings rates) on average. Bettendorf and Cnossen (2014) already have shown that higher income groups spend similar proportions of their budget on goods and services subject to a lower VAT tariff, suggesting the lower VAT rate is an ineffective measure to lower the tax burden of lower income groups.

Finally, we allocate social security deficit (in pre-tax income) and government deficit (in post-tax income) proportionally to pre-tax factor income.

[15] Based on data from the Research on Movements in the Netherlands (OViN) by Statistics Netherlands.

[16] Production taxes are already included in the standard level of national income since prices reflect purchasers' prices. Factor income, being the sum of all flows to labour and capital, excludes production taxes. Hence, to obtain pre-tax income series in line with the national income level, we need to *add* production taxes to factor income. A thorough explanation of the ratio behind these distributional assumptions can be found in the DINA guidelines.

[17] In this study, we measure the progressivity of the tax system by the extent to which the effective tax burden increases by income. Some studies however advocate for expressing the tax burden in terms of its tax base, which in this context means expressing the effective VAT rate in terms of total expenditures. By doing that, Bettendorf and Cnossen (2014) show that the VAT instead is slightly progressive.

4 Income inequality and redistribution in the Netherlands

4.1 Inequality in pre-tax income

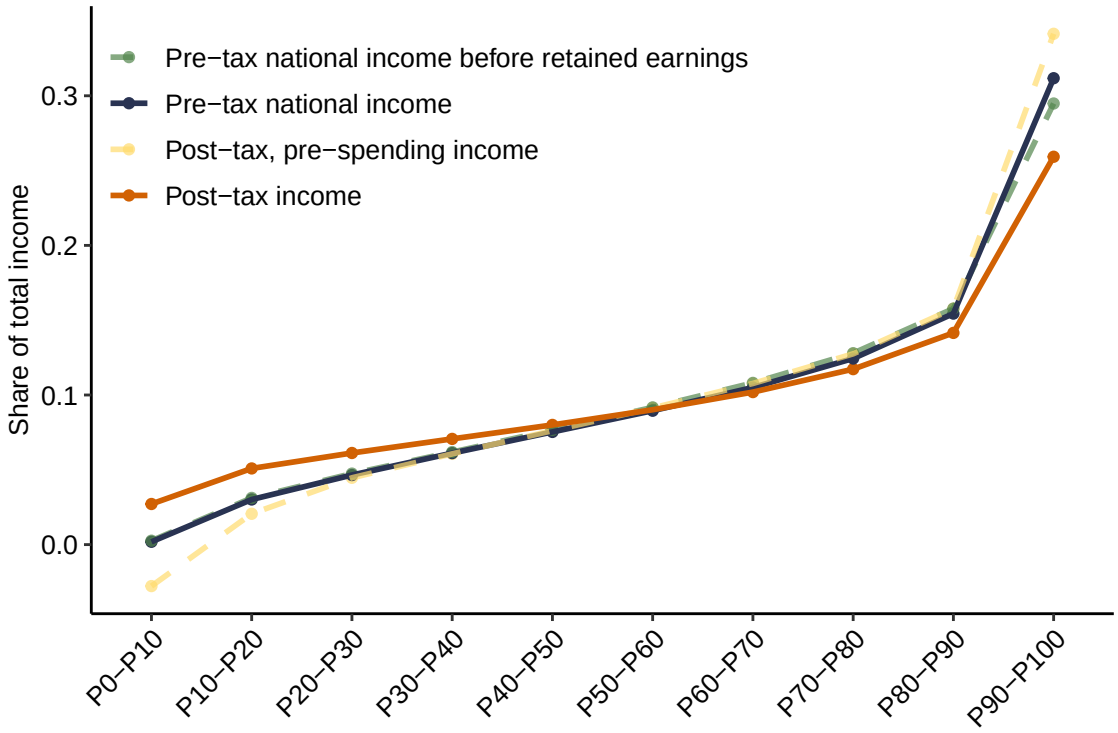
The main focus of our analysis lies on pre-tax national income and post-tax income. Pre-tax national income refers to individuals' income after the operation of the pension system, but before government redistribution in the form of taxation and government spending (Blanchet et al., 2021).[18] Pre-tax national income consists of labour income (minus pension contributions), pension benefits, income of self-employed (mixed income), imputed rent, capital income, retained earnings from domestic and foreign corporations, and imputed production taxes (see previous section).

Figure 3 shows the distribution of pre-tax national income (as well as other types of income) by income decile. The top 10% has an average income of €117,297 and accounts for 31% of pre-tax national income, less than the share found in the US (around 45%) and Italy (around 38%) and close to the levels found for France (around 32%) and for Austria (around 33%) (Bozio et al., 2022; Guzzardi et al., 2022; Jestl and List, 2020; Piketty, Saez and Zucman, 2018). An important contribution of this paper is the inclusion of retained earnings in our income statistics. To isolate the effect of retained earnings on inequality, we also show the distribution of pre-tax national income before the allocation of retained earnings. The top 10% income share before allocation of retained earnings is almost 2 percentage points lower at 29%. In section 5 we explore how different assumptions on the allocation of retained earnings affects top 10% and bottom 50% income shares.

Figure 4 presents income shares for all percentiles of pre-tax national income. The top 1% income share is equal to 9.7%. Note that we observe that the income share is negative for the first two income percentiles. This is partly driven by negative income for the self-employed or by negative retained earnings allocated to owners of firms with negative profits. This is related to looking at the income distribution of a single year rather than to the distribution of life-time income. Households that have negative profits this year may find themselves in the top of the income distribution in another year and vice versa for households that are in the top this year.

[18] The income concept we use corresponds to "narrow" pre-tax national income in Blanchet et al. (2021)

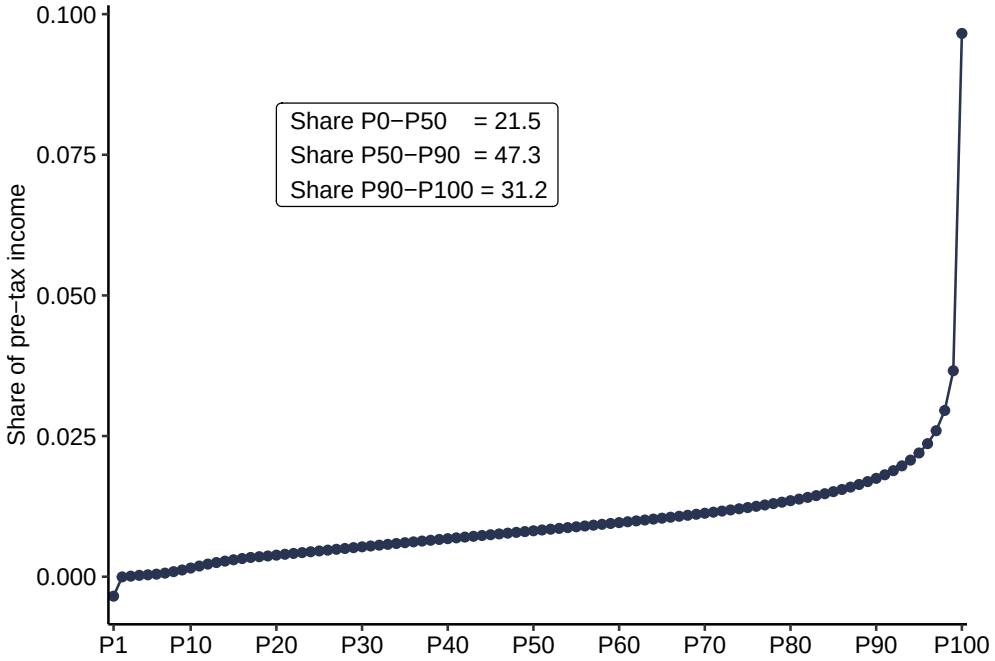
Figure 3: Distribution of income



NOTE: This Figure shows the share of income for each decile of the distribution of different income concepts: 1) pre-tax national income before the allocation of retained earnings, 2) pre-tax national income, 3) national income after taxes, before the allocation of government spending, and 4) post-tax national income. The ranking of individuals is done separately for each of the income concepts.

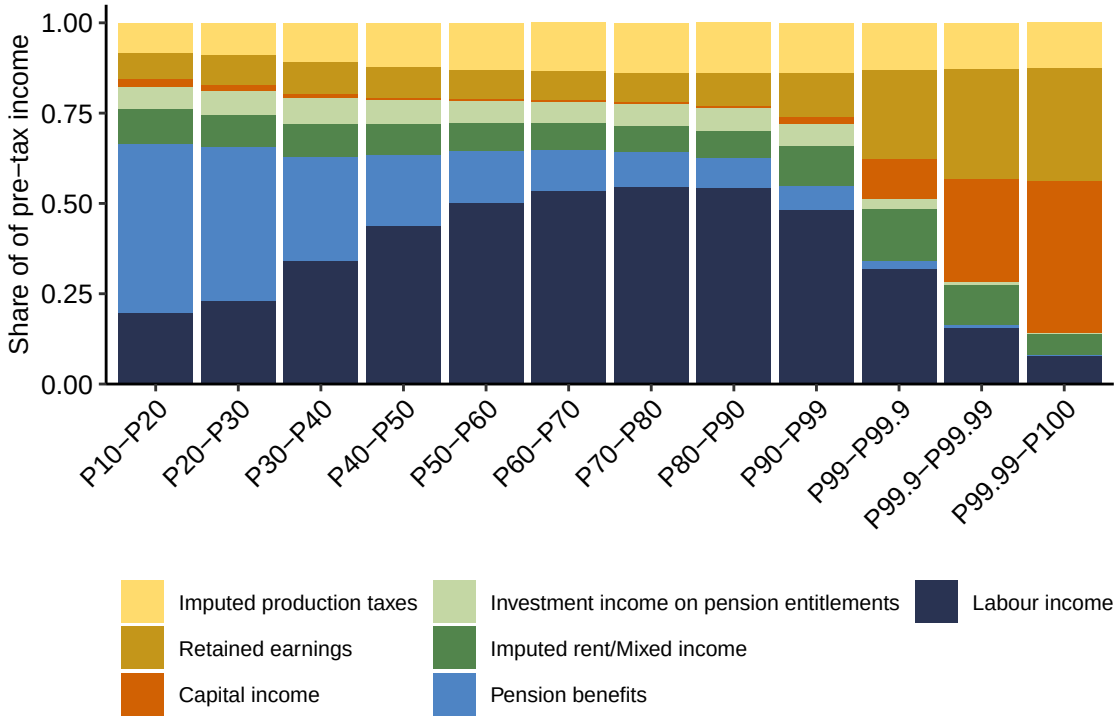
The bottom and the top of the income distribution differ radically in terms of income composition, as illustrated in Figure 5. It presents the share of the different components of the pre-tax income by income group, with a focus at the very top of the income distribution. We observe that labour income is the main source of income for the first 99 percentiles of the income distribution, and is hardly relevant for the P99.99-P100 income group. For this latter group, retained earnings (domestic and foreign) and capital income are the main components of pre-tax income. A distinctive feature of the Dutch income composition is that all income groups earn a substantial amount of capital income in the form of investment income on pension entitlements, which reflects the unusually large funded pension schemes in the Netherlands. For all income groups, we observe a significant share of retained earnings. This is due to the fact that we allocate a significant part of the corresponding national accounts aggregate to households through pension funds and government, based on pension wealth and factor income respectively (cf. section 3.3). Also note that retirees are mainly concentrated in the second and third income decile. This explain the low (high) share of labour (pension) income.

Figure 4: Distribution of pre-tax national income



NOTE: This Figure shows the share of pre-tax national income for each percentile of the distribution of pre-tax national income.

Figure 5: Composition of pre-tax income by income group



NOTE: This Figure present the composition of pre-tax income, by group of pre-tax income. See section 3.3 for a description of the difference components of income and the approach used to distribute them to individuals.

4.2 Redistribution from the taxation and government spending

We now turn to the comparison between pre-tax and post-tax income. By comparing household income with and without all the taxes paid and the benefits received, we can assess how the public tax and benefit system overall changes the income distribution and inequality.

Figure 3 presents the income shares for pre-tax and post-tax income by income decile (panel a) and percentile (panel b). As expected, we can see that post-tax income is less concentrated than pre-tax income. When moving from the former to the latter, the income share at the top of the distribution (from percentile 60) decreases, while the share at the bottom of the distribution increases. The share of total income owned by the upper decile reduces from 31 to 26%. The shares of the first two deciles increase from virtually zero to around 5%. Table 1 provides additional information regarding the inequality reduction generated by taxation and government spending. It presents the income of the bottom (bottom 50%), middle (from P60 to P90) and top (last decile) of the income distributions for pre-tax (national) income and post-tax income, next to the ratios between the average income of these groups. We re-rank households based on the definition for which we compute the average, but the results are not very sensitive to this ranking approach. We also compute the Gini index for the different income distributions. Total inequality[19] is reduced by 38%, implying the taxes and government spending cause 38% reduction in pre-tax inequality. This reduction is driven by a reduction in bottom-end inequality, rather than upper inequality. As is often found, the income share of the middle 40 hardly changes when moving from pre-tax to post-tax income. Second, the reduction in total inequality is a lot smaller based on the Reynolds-Smolensky index[20], partly because this indicator is more sensitive to changes in the middle of the income distribution. In Table C.1 the sensitivity of the income shares and inequality indicators to alternative approaches is tested, which is discussed in section 5. It appears that a lump-sum allocation of in-kind transfers and changing to the individual as the unit of analysis provide the lower and upper bound in terms of redistribution respectively.

Inequality reduction between the pre-tax and and post-tax income implies that taxation and government spending benefits the bottom of the distribution of pre-transfer income relatively more. We verify this in Figure 6, which presents the ratio between the total of taxes paid (Figure 6a) and benefits received (Figure 6b), as a function of pre-tax income, by decile of pre-tax income. The profile of tax rate by decile is rather flat, slightly decreasing at from decile 2 to decile 6, and lower for the last income decile. Transfers are, on the other hand, very concentrated at the bottom of the distribution. In terms of amounts, transfers received by the top of the income distribution are not negligible (see for example the case of in-kind transfers in Figure C.2). However, transfers only represent a small share of their total income. Overall, the combination of a rather flat but large tax system, with benefits that increase mainly the incomes at the bottom of the pre-tax distribution generates the large inequality reduction we observe.

[19] Expressed as the ratio between the average income of the top 10% income group and the average income of the bottom 50% income group, in line with Bozio et al. (2022).

[20] The difference between the Gini for pre-tax and post-tax income/)

Table 1: Inequality indicators

	Pre-tax	Post-tax	Δ
Income shares			
Top 10%	31%	26%	-5 p.p.
Middle 40%	47%	45%	-2 p.p.
Bottom 50%	22%	29%	+7 p.p.
Inequality indicators			
Total inequality (T10/B50)	7.2	4.5	-38%
Upper inequality (T10/M40)	2.6	2.3	-12%
Lower inequality (M40/B50)	2.8	1.9	-32 %
Gini	43.2	32.0	11.2 p.p.

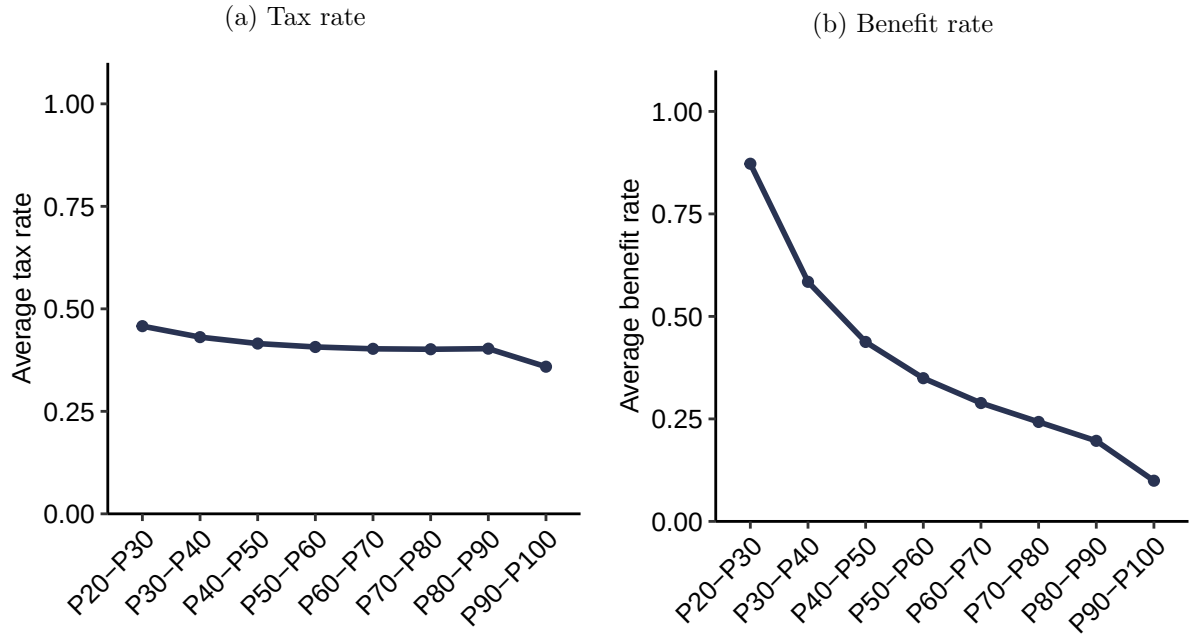
NOTE: The inequality indicators are calculated as ratios between average income for different income groups in 2016. In table C.1 the income shares and indicators using alternative scenarios are shown.

This implies that the entire tax system cannot be very progressive. This is confirmed if we look at the distribution of national income after taxes, but before the allocation of government spending in Figure 3: incomes after taxes are in fact more unequally distributed than incomes before taxes. Figure 7 present the tax rate by income group with a focus on the very top of the distribution. It appears that the slight drop we observe in Figure 6a for the top decile is almost entirely driven by the last percentile of the income distribution. For this group, the tax rate is about two times lower than for the rest of the population. The very low tax rate at the top of the income distribution can largely be explained by the type of income those individuals earn. As shown in Figure 5 before, top income individuals mostly earn capital and corporate income, which are taxed at a lower rate than the top marginal tax rate of the income tax schedule. The very low rate can also be explained by the high share of retained earnings in income at the top. Retained earnings are not taxed by the personal income tax until they are distributed or when the shares are sold.

Comparison with previous Dutch literature on inequality There is a large body of literature studying inequality and redistribution in the Netherlands (Caminada and Goudswaard (2001), Caminada et al. (2021), De Kam et al. (1996), Trimp and De Kam (2011), considering the household sector (70-80% of national income). However, these studies are less extensive than the DINA papers. De Kam et al. (1996) and Trimp and De Kam (2011) focus on the tax burden and present hardly any information on income inequality, while Caminada and Goudswaard (2001) and Caminada et al. (2021) just focus on income inequality and use Gini-coefficients in their analysis. Also some of the studies use data from the 1990s (De Kam et al. (1996), Caminada and Goudswaard (2001)) in which the current tax and healthcare system was not implemented.These differences makes it hard to compare the outcomes of these studies. Having said this, the main findings are that primary income is more concentrated than disposable income and inequality in disposable income is stable over time (Caminada and Goudswaard (2001), Caminada et al. (2021)). Whereas the pre-tax (factor) inequality levels we find are comparable to those found in micro studies, inequality in disposable income appears

to be much larger, as many DINA papers find. One of the reasons is that most Dutch studies compare pre-tax factor income with disposable income which introduces the pension system in the comparison. From the decomposition in Caminada et al. (2021) it appears that the AOW and pension system are highly redistributive and the main drivers of lower inequality at disposable income levels. Previous Dutch studies have also shown the tax system is much less progressive if premiums for social security and consumption taxes are taken into account (De Kam et al. (1996); Trimp and De Kam (2011)), but an exhaustive approach including all types of income, taxes and transfers, has not yet been implemented. This paper aims to contribute to this strand of literature by doing that.

Figure 6: Average taxes and benefits rate by income group



NOTE: These Figures show the average tax rate and average benefit rate by decile of the pre-tax income distribution. These rates are calculated by dividing total taxes paid or total benefits received by the total pre-tax income for each decile.

Comparison with previous DINA literature Our findings are roughly in line with the results of Blanchet, Chancel and Gethin (Forthcoming) for the Netherlands in 2017. In our estimates, the top 10 pre-tax income share is 2 percentage points higher, while the income share of the bottom 50% is 2 percentage points smaller. In addition to allocating income components differently (see section 3.3) this can be explained by using different pre-tax income definitions. As section 3.1 discussed, we use the narrow definition of pre-tax national income, whereas Blanchet, Chancel and Gethin (Forthcoming) apply the broad definition. The latter approach is used in most studies, partly because the distinction between different components of the social security system cannot always be made. In practice, this means that we account for benefits and contributions such as those for unemployment in post-tax income rather than

pre-tax income, which results in slightly smaller pre-tax income shares of lower income groups opposed to the common approach.

Compared to other similar countries studies in the DINA literature, unsurprisingly the Dutch pre-tax income levels are much smaller than found for the US (Piketty, Saez and Zucman (2018)). In the US the average income of the top 10% is nearly 16 times as large as the average income of the bottom 50, which is 7.2 for Dutch top earners (see Table 1). Also compared to West-Europe as a whole (Blanchet, Chancel and Gethin (Forthcoming)), the Netherlands appears more equal in pre-tax income, although such a comparison conceals some heterogeneity between Western-European countries. Zooming in on country-specifics shows that the income share of the top 10% is highest in Italy with 38% in 2015 (Guzzardi et al. (2022)), around 33% in Austria in 2016 (Jestl and List (2020)) and on average 32% in France (Bozio et al. (2022)) over the 2010-2018 period. In France, Austria and the Netherlands, the top 10 earns about 7.1-7.2 times more than the bottom 50. In addition, with the exception of 15% for Italy and 14% for the US case, the bottom 50 shares lie between 22% and 24%. Note that the papers mentioned here use a broad pre-tax income definition, hence the bigger the social security systems in place, the smaller pre-tax inequality levels tend to be.

Whereas most studies rely on the adult equal-split approach, the Italian study uses the individual approach as a baseline. In an alternative scenario (scenario 3a, section 5) we do the same and both Figure 11 and Table C.1 show the big impact of the individual approach on pre-tax income levels. In this context, Guzzardi et al. (2022) already point out the positive role of households in reducing inequalities for individuals at the bottom of the income distribution, while they find the effect vanishes for the highest part, suggesting assortative mating.

Since it represents a large share of public expenditure, the allocation of in-kind transfers strongly impacts the size of redistribution found. Nearly all studies distribute health care spending as a lump sum transfer and allocate the rest proportional to post-tax disposable income, as advocated for in Blanchet et al. (2021). Jestl and List (2020) deviate from this benchmark in their baseline and allocate all in-kind transfers lump sum, relying on the assumption that Austrian social in-kind transfers tend to be equally distributed across the distribution. In our baseline, we are able to assign the majority of in-kind transfers directly to the beneficiaries. We find that the lowest income groups receive government spending that is at least as large as their pre-tax income. For the highest income groups on the other hand, government spending amounts to less than 7% of pre-tax income. Comparing our baseline to other studies, income shares turn out to be still in line with the Dutch results found in Blanchet, Chancel and Gethin (Forthcoming) although we do find slightly more redistribution from the top to the bottom.[21] When moving from pre-tax to post-tax income, we find overall inequality reduces by 38%. Interestingly this is considerably smaller than redistribution found for France (on average 44%), but also the US (43%). Note that our results for redistribution incorporate the effect of both social security benefits and the allocation of in-kind transfers. To disentangle the effect of the latter we use the benchmark from Blanchet et al. (2021) instead, and end up with an even

[21] Specifically, our top 10 (bottom 50) decreases (increases) by 5 (7) percentage points, compared to a reduction of about 4 and an increase of 5 percentage points found in Blanchet, Chancel and Gethin (Forthcoming).

smaller reduction in inequality of 28% (see Table C.1, scenario 3d).

Conceptually this is the logical result from allocating most in-kind transfers proportional to income and thereby rendering much less redistribution. The results do suggest however that the benchmark underestimates the level of redistribution when taking into account who actually benefited from government spending. Naturally, this is the case at one point in time and neglects the fact that the use of some in-kind transfers can be much more related to demographics rather than income levels. From a lifetime perspective, taking into account the possibility that every citizen makes use of, say, long-term care at a certain age, a lump-sum allocation might more closely mimic the redistribution over age rather than income.

In terms of redistribution, we find the reduction of inequality can be attributed entirely to the redistributive nature of government spending rather than to taxation. Where Blanchet, Chancel and Gethin (Forthcoming) already pointed out the regressivity of the Dutch tax system for the top 1%, we are able to zoom in and show that there is a sharp drop within the top 1%, ultimately to only 21% for the top 0.01%. For the bottom 99%, the tax burden lies between 40 and 50%. In comparison, the French tax system appears more progressive, albeit Bozio et al. (2022) still report a small regressivity in French tax rates at the very top, but not as pronounced as we find. Guzzardi et al. (2022) also find regressivity at the top, specifically for the top 5, with a tax rate falling from a peak of 50% to 35%. Similarly to the Italian study, our results are driven by a progressive personal income tax that is insufficiently compensating for the regressive character of consumption taxes and social security contributions.[22]

4.3 Decomposition of the redistributive effects

We finally decompose the redistributive effect of the tax and benefit system between the different types of transfers, which were presented in section 2. We firstly break down the analysis of redistribution presented in the previous section by type of taxes. Secondly, we use an alternative approach in which we keep the ranking variable fixed (pre-tax income) in order to assess redistribution at the individual level without the effect of reranking.

Decomposition of taxes and transfers Figure 7 breaks down the total tax of Figure 6a by types of tax. Figure 8 presents the average amount of transfers received by broad types of transfers.

Figure 7 confirms that production taxes and social security contributions are the two most important types of taxes for many income deciles. As those taxes are not progressive – social security contributions are mostly flat, and consumption taxes are more concentrated at the bottom of the income distribution –, they are essentially shaping the flat pattern of the effective tax rate. Taxes on income and wealth and corporate income tax are slightly more progressive, but represent only a small share of the total.

[22] As in our study, Guzzardi et al. (2022) is able to include more information on consumption instead of using the difference between income and savings as is commonly done, thereby only including consumption effectively subject to VAT.

In terms of benefits, the most important source of redistribution are in-kind transfers, as they represent a very large share of disposable income of households at the bottom of the distribution. Education and healthcare are important benefits for all incomes, but the other in-kind benefits mainly for low incomes such as long-term care. Social security in-cash benefits are the second largest transfers. Other in-cash transfers are important for lower deciles only, such as welfare and social care. Finally, collective expenditures are also important and more concentrated at the bottom of the distribution. This is a direct consequence of the choice made to distribute collective expenditures as a lump-sum transfers.

Overall redistribution Following Germain, André and Blanchet (2021), we summarise the overall effect of the tax and benefit system on income inequality in Figure 9. It presents, for each decile of pre-tax income, the average pre-tax and post-tax income (red lines), along with all the components we need to add (benefits) or remove (taxes) to the pre-tax to obtain the post-tax income. The difference with the previous graphs and in particular Figure 3 is that we keep the same ranking for the pre-tax and post-tax income. We can then measure at the individual level the amount of redistribution, and the difference between taxes paid and benefits received.

We first observe that the relative shape of pre-tax and post-tax income is similar in Figure 9 compared to the results obtained with re-ranking. The gap between the two lines is only slightly more important without reranking, which shows that our analyses of redistribution is not very sensitive to the ranking approach. The two lines cross at decile 6, which implies that net beneficiaries from the whole tax and benefit system are in deciles 1 to 5 and the net contributors in income deciles 7 to 10. This verifies that the benefits received largely exceed the taxes paid at the bottom of the distribution, and that the opposite is true for the top of the distribution.

Looking at amounts rather than shares also gives us also some insights on tax progressivity, compared to the tax rate presented in Figure 7. We can indeed observe that, in spite of the overall regressivity of the system, the top decile pays much more taxes (especially social security contribution and corporate and personal income taxes) than the rest of the population. This is due to their relatively large pre-tax incomes.

Note that the redistribution depicted in Figure 9 presents average taxes and transfers by decile. Figure 10 presents, for each decile of pre-tax income, the distribution of net transfers, that is the difference between the benefits received and the taxes paid. The corresponding average is given by the difference between the dotted and plain line in Figure 9. It appears that the average by decile hides substantial within deciles variations. In particular for deciles 2 to 5, who are net beneficiaries from redistribution on average, we observe a substantial share of individuals with negative net transfers (net contributors). This reminds us that our results aggregate potentially very heterogeneous individual situations.

Figure 7: Tax rate by income group and type of taxes

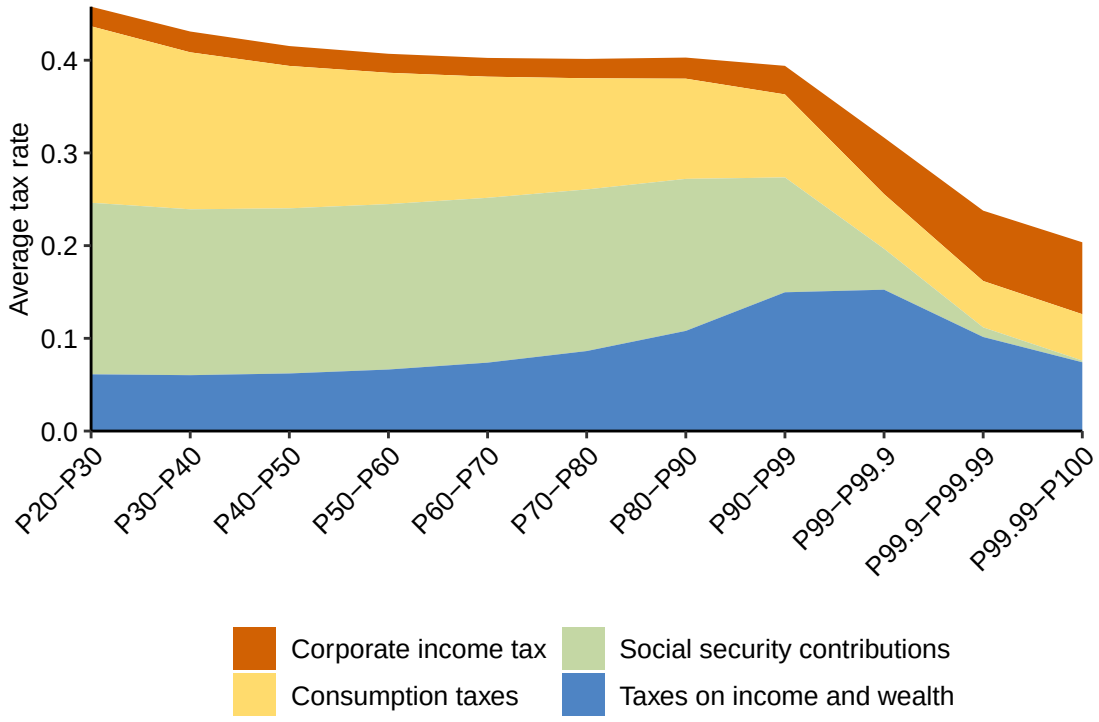


Figure 8: Transfer amounts by income group and type of transfer

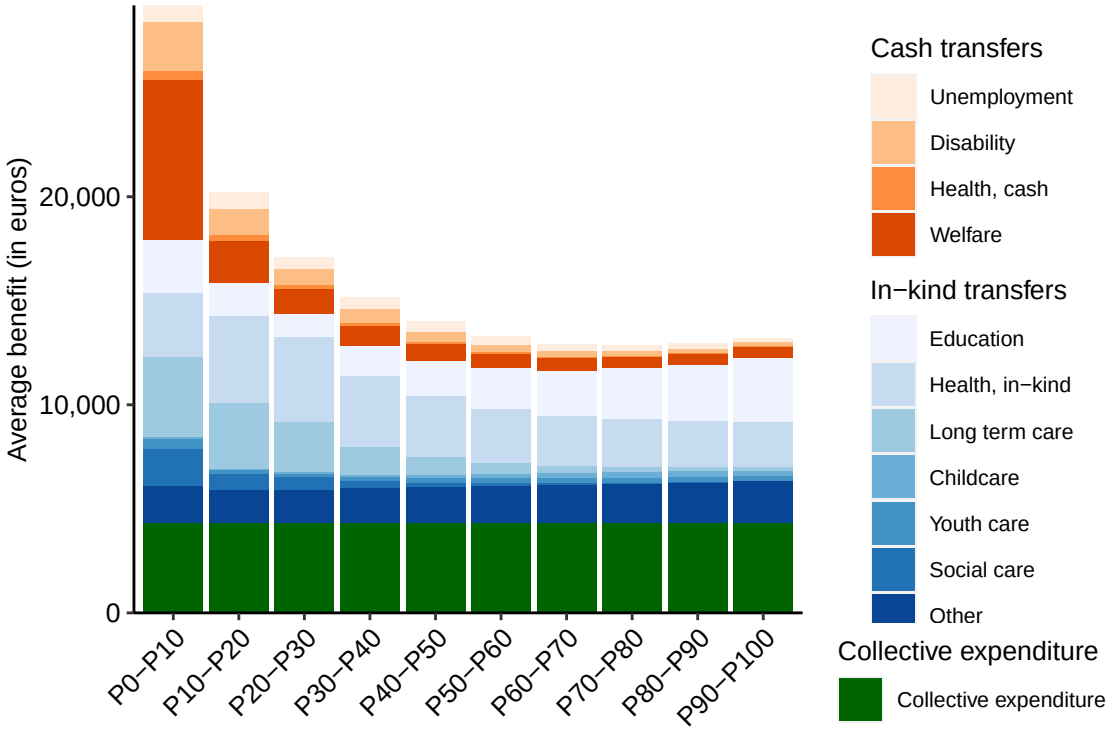
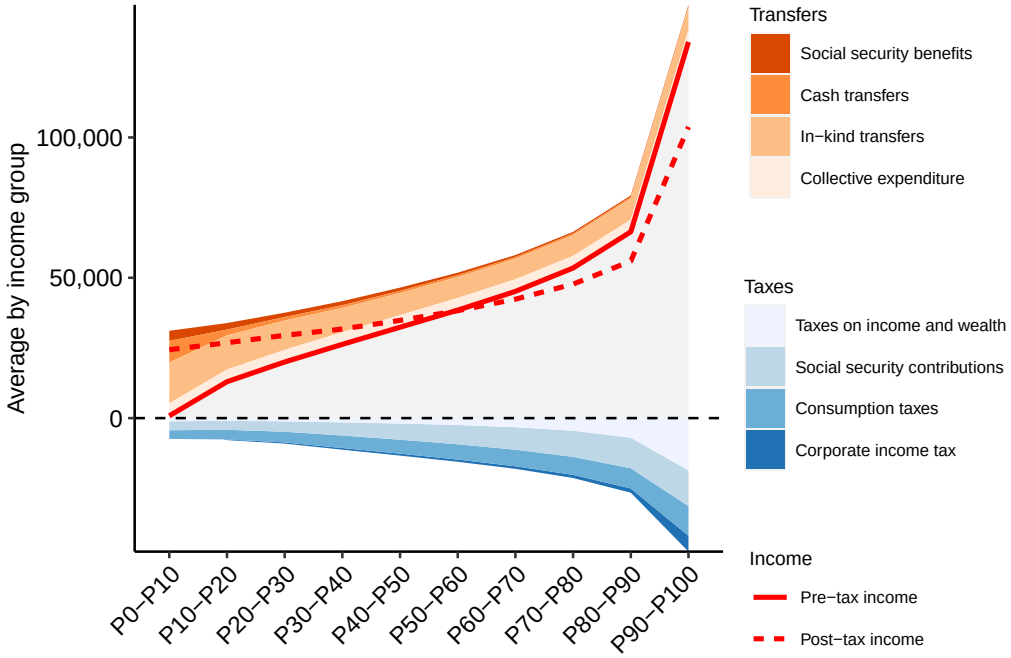
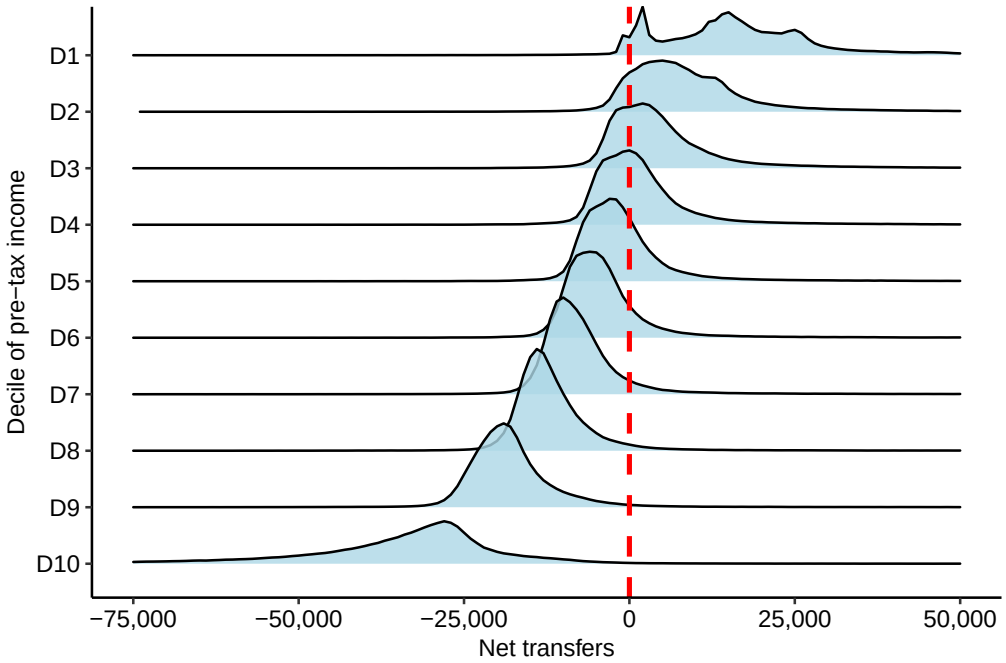


Figure 9: Pre- and post-tax income, taxes and transfers, by income decile



NOTE: These Figures present, for each decile of pretax income, the following average amounts: pre- and post-tax income (plain and dotted red lines respectively), transfers received as positive values above the pretax line and taxes paid as negative values below the 0 axis. Amounts are related as follows: pre-tax + benefits - taxes - deficit = post-tax.

Figure 10: Distribution of net transfers, by decile of pre-tax income



NOTE: This Figure presents the distribution of net transfers (total benefits received - total taxes paid) by deciles of pre-tax income. See text and Figure 9 for a description of the taxes and benefits included in the computation of net transfers.

5 Sensitivity analysis

As mentioned in section 3.1, our assessment of the level of inequality and redistribution relies on a set of conceptual choices and distributional assumptions. In this section, we compare the results obtained in our baseline specification to alternative scenarios. The objective of this exercise is twofold. First, we test the sensitivity of our results to the underlying assumptions. Second, we shed some lights on the mechanisms and drivers of the pre-tax and post-tax inequality levels.

Table 2: Alternative scenarios

Distributional assumptions for pre-tax income	
1a	Aggregate for households' retained earnings taken from microdata
1b	Distribution of retained earnings as equity wealth
1c	Distribution of retained earnings as dividends
1d	Dividends' data gap distributed as income
Distributional assumptions for in-kind benefits	
2a	Proportional in-kind transfers
2b	Flat in-kind transfers
2c	Proportional collective expenditure
2d	Flat health-care and proportional other in-kind transfers
Unit of analysis and income concepts	
3a	Individual income without splitting
3b	Household level
3c	Household level with equivalence scale
3d	Alternative pre-tax income definition

Alternative scenarios The set of conceptual and distributional choices that underlie the results presented in section 4 form our baseline specification. We hereby construct alternative scenarios in which we change one parameter of the baseline scenario[23], as presented in Table 2. A first set of scenarios (1a, 1b, 1c, 1d) concerns assumptions related to the distribution of pre-tax income. In the baseline scenario, we use macroeconomic balance sheets to determine how much retained earnings should be assigned to households, pension funds and the government, respectively. We then allocate households' retained earnings and corporate taxes according to the observed distribution using the SZOAB+ dataset (cf. section 3.3). In scenario 1a, we replace the macro aggregate for retained earnings attributed to households by the sum of retained earnings in the SZOAB+ dataset. The remainder is attributed to the state and pension funds. In scenario 1b, we distribute retained earnings and corporate taxes according to equity wealth (as in Piketty, Saez and Zucman (2018) or Garbinti, Goupille-Lebret and Piketty (2018)); in 1c

[23]In theory, different assumptions could interact with one another so we could have as many scenarios as possible combination of parameters. For the sake of simplicity we compute only marginal changes in the set of assumption compared to the baseline.

according to dividends (as in Saez and Zucman (2019)). Finally, scenario 2d uses an alternative assumption for the distribution of the dividend data gaps compared to Bruil (2022), which may underestimate the tax burden at the top as discussed in section 3.3, and distributes it according to pre-tax income instead of actually observed dividends.

The next sets of scenarios we use alternative assumptions for the allocation of in-kind benefits. We first compare our baseline scenarios for in-kind transfers (based on actual consumption of care as much as possible) to the two polar assumptions of flat and proportional distribution (scenarios 2a and 2b), and use a proportional allocation of collective expenditure instead of a flat one (scenario 2c). Finally, in scenario 2d we use the DINA benchmark as suggested in Blanchet et al. (2021) and allocate health-care lump sum, while distributing other in-kind transfers proportional to post-tax disposable income.

The final set of scenarios concerns conceptual choices for the definition of the unit of analysis and the income concepts we consider. Instead of the equal-split approach – all income, taxes and benefits are equally shared among adult members of the household –, we consider the individual income approach in scenario 3a.[24] We then consider inequality in household income, with and without equivalence of scales[25] (scenarios 3b and 3c respectively). Finally, in scenario 3d we use a more narrow definition of pre-tax income, that does not incorporate the first-pillar pension (AOW benefits). As discussed in section 3.1, their inclusion in the pre-tax income is not straightforward given the non-contributive nature of the scheme.

In the rest of this section, we compare the difference between alternative scenarios in terms of the distributions of pre-tax income, before analysing post-tax income and the associated level of inequality reduction measured. Figure 11 presents the Gini index for pre-tax and post-tax income, for the different scenarios of Table 2. Inequality reduction is represented by the difference between the two points. Appendix Table C.1 presents the exact percentage number, along with alternative measures of inequality reductions (e.g. income ratios), and Figure C.1 presents the income share for the top 10 and bottom 50 income groups for pre- and post-tax income. In order to explain the difference in inequality reductions between scenarios, we also compute tax rates and transfer rates for the different scenarios in Figures 12a and 12b.

Pre-tax income inequality Pre-tax inequality levels are somewhat sensitive to the alternative distributional assumptions we consider (1a, 1b, 1c, 1d). This is particularly the case for scenario 1a, where a larger amount of retained earnings is assigned to households using the SZOAB+ dataset instead of to households through pension funds. Since ownership in the SZOAB+ dataset is more concentrated than the more evenly distributed pension wealth, pre-tax income inequality is higher. Inequality is almost equal when using equity wealth instead of the more granular ownership data when distributing retained earnings to households (scenario 1b). This is due to the fact that financial wealth and retained earnings are highly correlated at the individual level. Distribution according to dividends, as done in scenario 2c and Piketty,

[24] We keep the equal-split approach for the items that are by essence defined at the household level, e.g. childcare benefits.

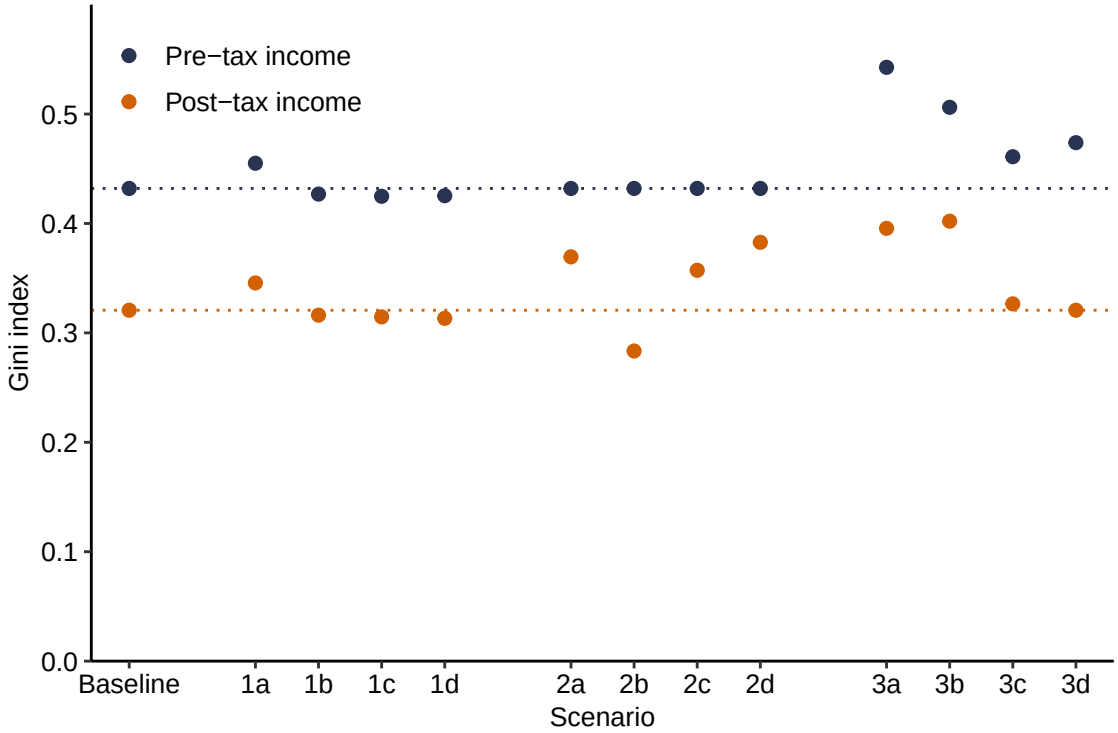
[25] We use the OECD scale, as done in Bruil (2022).

Saez and Zucman (2018), does not substantially alter pre-tax income inequality, suggesting that the dividend assumption commonly used in the literature for retained earnings is a sensible approximation. Finally, pre-tax inequality logically decreases somewhat when distributing the dividends data gaps according to pre-tax income rather than observed dividends (scenario 1d), which reflects the fact that the former is less concentrated than the latter.

In scenarios 2a, 2b, 2c and 2d, we only change how we assign in-kind transfers and collective expenditure and so pre-tax income inequality remains unaffected.

Turning to different units of analysis, pre-tax income inequality is much higher when considering individual income instead of splitting household income equally among adults members (scenario 3a). This reflects the effect of intra-household income differences, stemming from income differences between spouses or adult children living in the household. Income is also more concentrated when considering total household income (scenario 3b), which can be explained by a combination of size effect (high income household have more income earners) and assortative mating in terms of income level. Income inequality is slightly lower when including equivalences of scale (scenario 3c), which reflects the positive correlation between income level and family size, but remains slightly higher than in the equal split approach. Finally, pre-tax income inequality increases significantly if we do not include the operation of the first-pillar pension in pre-tax income (scenario 3d). This comes from the fact that first-pillar pension represents a significant fraction of income for a substantial number of pensioners, who end up with very low income level under this scenario, pushing upward the level of inequality.

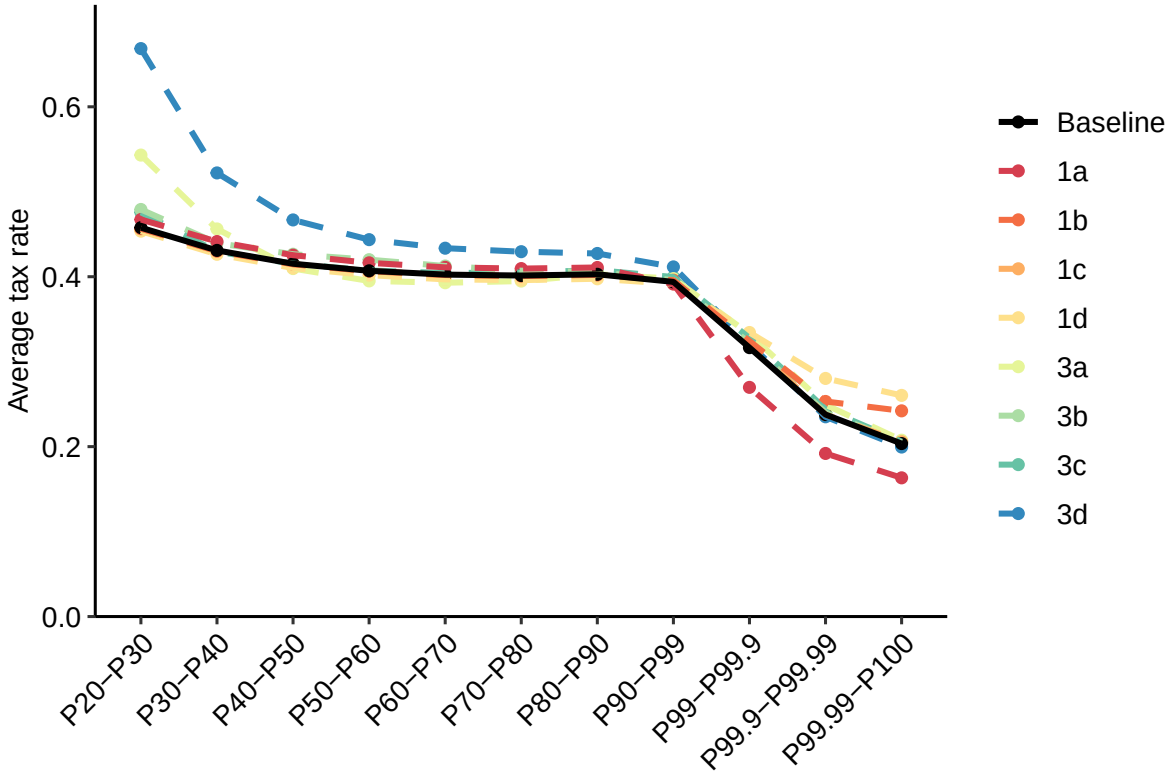
Figure 11: pre-tax and post-tax inequality, for different scenarios



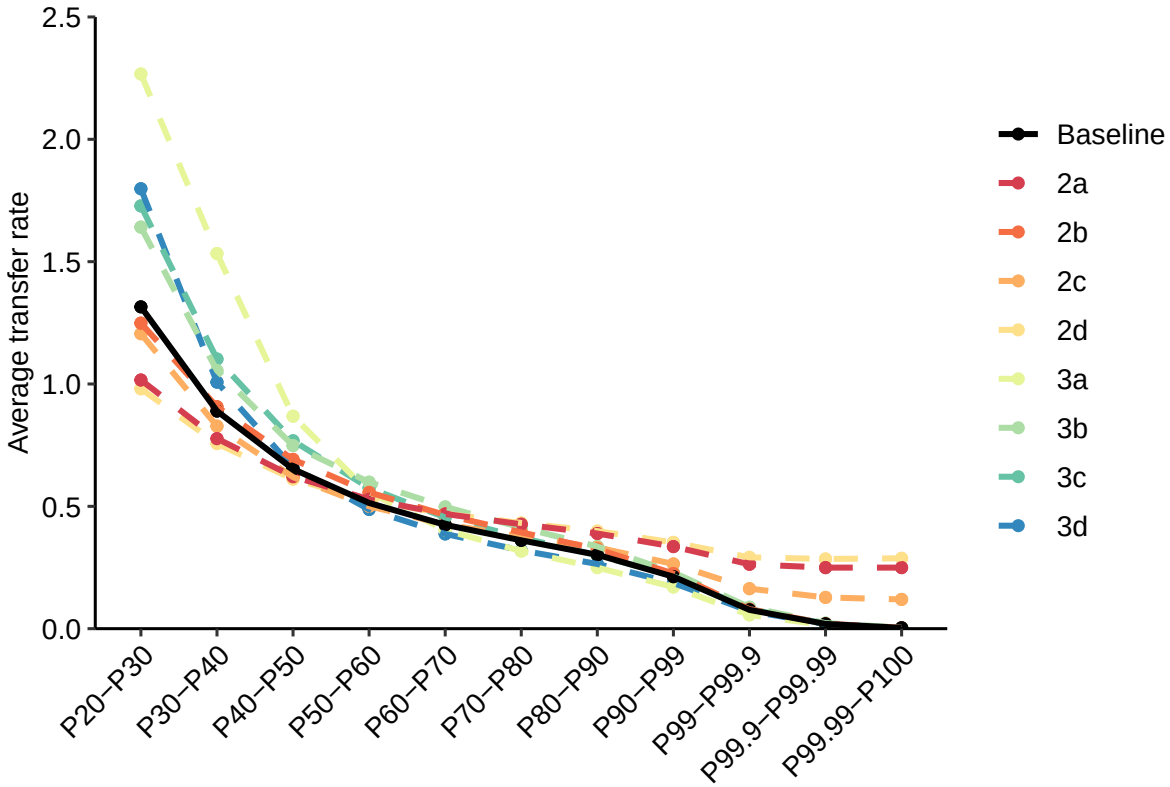
NOTE: This Figure present the Gini index for the pre- and post-tax income distribution, under different set of assumptions. See Table 2 for the description of the different scenarios.

Figure 12: Tax rate and benefit rate, for different scenarios

(a) Tax rate by scenario



(b) Benefits rate by scenario



NOTE: These Figures present the average tax rate (panel a) and benefit rate (panel b) by group of pre-tax income, for different scenarios for computation of the results. See text of section 5 for a description of the different scenarios.

Inequality reduction The gap between the Gini indices for pre- and post-tax income distributions is relatively stable across the different scenarios. This is also illustrated in Figures 12a and 12b which exhibit similar patterns for the tax burden and the receipt of government spending by income groups across different scenarios.

In particular, the inequality reduction – in terms of the change in the Gini coefficient – we find in the main scenario (-11 p.p.) is quite similar to the alternative scenarios when considering the household level with equivalence of scale (scenario 3c), and the different assumptions for pre-tax income (1a-1d), hovering between -11 and 13 percentage points. Hence, while the different assumptions do impact pre-tax and post-tax inequality levels, they leave the magnitude of redistribution roughly unchanged. The same holds for inequality in terms of the T10/B50 ratio. This ratio decreases by about 38% in the baseline scenario, similar to scenarios 1a-1d. Redistribution is much larger when considering individual income (3a) instead of equal splitting, when first-pillar pension (resp. contributions) are not added (resp. removed) from pre-tax income (3d), or when we distribute in-kind transfers as lump-sum transfers (2b). In these scenarios, inequality in terms of the T10/B50 decreases by about 47% up to 55%. For scenario 3a, the reduction in inequality is mainly driven by a higher concentration of transfers at the bottom of the distribution (see Figure 12b), resulting in a change in overall inequality similar to scenario 2b, as measured by the T10/B50 ratio. This may be driven by transfers targeted to poorer members within households that do not show up in the equal split approach. Similarly, inequality reduction is stronger in scenario 3d through the operation of first-pillar pension, which is largely redistributive since it is a transfer from workers to lower income pensioners. The T10/B50 decreases by 50%.

The stronger inequality reduction associated with the flat in-kind transfers is rather counter-intuitive, given that in-kind transfers are largely concentrated at the bottom of the distribution of the pre-tax income distribution, as previously shown in Figure 8. This is due to the fact that some individuals at the bottom of the pre-tax income distribution that receive very high in-kind transfers end up higher up on the post-tax income distribution, while some others do not receive much. As a result, the lump-sum distribution reduces inequality more when ranking individuals according to post-tax income. This is illustrated in Appendix Figure C.2, which shows that the lump-sum distribution of in-kind transfers is less redistributive than the baseline when ranking individuals according to pre-tax income, but more redistributive when using the post-tax income ranking. Lastly and logically, inequality reduction is reduced compared to the baseline when distributing in-kind transfers (scenario 2a) and collective expenditure (2c) proportional to disposable income, or when applying the DINA benchmark (2d). These proportional allocations are much less redistributive than the one used in the baseline, namely actual consumption for in-kind transfers and lump-sum for collective expenditure. As was pointed out by Bozio et al. (2022), these results confirm the sensitivity of the inequality reduction to distributional assumptions concerning in-kind benefits. At the same time the results reveal the importance of using individual data for the distribution of in-kind transfers if the goal is to determine which income groups actually benefit from government spending.

Note that through our approach of the empirical distribution of in-kind transfers, individuals receiving large health care spending through e.g. heavy treatment for diseases could end up at the top of the post-tax income distribution. This could be conceptually disputed, and one could prefer to rely on more *ad hoc* assumptions, e.g. lump sum distribution. However, this would ignore available information about the actual consumption of care.

6 Conclusion and perspectives

In this paper, we study the income distribution of the Netherlands using a large set of administrative records on the full universe of the Dutch population on income, taxes and government spending. We combine these microdata sources with national accounts aggregates to provide a full assessment of income inequality in the Netherlands and the role of taxation and government spending. We find that the top 10% of the income distribution accounts for 31% of total pre-tax income and 26% of post-tax income, a fall in inequality which is confirmed by other inequality metrics. Inequality reduction is largely driven by government spending, which are targeted at the bottom of the distribution, and much less so by the tax system, which is rather flat and even largely regressive at the very top of the income distribution.

Future research could extend the analyses conducted in this paper in different directions. First, collective expenditure are an important part of public expenditure and their distribution relies on *ad hoc* assumptions (lump sum or proportional allocation). This could be improved using additional macro and micro data sources. A first step would be to use the detailed decomposition available in the national accounts to apply different assumptions for different types of expenditure (e.g. proportional to wealth for police and defence expenditure). An second option would be to use available microdata to measure the access to collective expenditure, from geographical data or consumption surveys for example. Related, our data allows for a geographical analysis of inequality that we can implement. Finally, we will use the estimated distribution of hidden wealth from Leenders et al. (2022) to distribute evaded income to individuals, which is likely to lower even further the effective tax rate at the top.

Second, we intend to construct distributional national accounts for a longer time period. This would be a crucial element necessary to understand the Netherlands' recent economic development and the role of the state in shaping pre- and post-tax incomes. However, the task of providing an accurate and consistent picture of the long run evolution of inequality in the Netherlands is seriously hampered by the paucity of microdata on income and taxes before 1999. Ideally, we would also like to streamline the process of constructing distributional national accounts so that the lag between distributional and non-distributional national accounts is shortened, in line with the newly developed "real-time distributional national accounts" (Blanchet, Saez and Zucman, 2022).

Third and lastly, a key limitation of the inequality and redistribution measured in the DINA approach is that it poorly accounts for the life-cycle redistribution generated by taxes, government spending as well as the pension system, which are likely to be important in countries where social security systems are large such as the Netherlands. One of the limitations of our

current approach is that we look at a snapshot of a single year. This means that the moment of taxation can be disconnected from when the income is earned. This applies for example to consumption taxes, since consumption does not have to take place in the same year the income was earned. Another example is the taxation of profits of closely held businesses, which does not happen in the same year the profits are earned in case of retained earnings. More research is needed to see how essential lifetime redistribution can be taken into account in the assessment of the income distribution and of the overall progressivity of the tax and benefit system.

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A Data appendix

In this appendix we describe the different data-sources used in the paper. Table A.1 lists all the sources, and we provide more detailed information about each of the data sets.

Table A.1: Description of the datasets used in the analyses

Data set	Years	Content
Special datasets provided CBS		
Household data from Bruil (2022)	2015-2016	Households income and taxes
SZOAB+ dataset	2007-2019	Ownership data
Other datasets provided by CBS		
Budget survey	2015-2016	Consumption expenditure
Gebwlztab	2015-2016	Long-term care
Gebwmotab	2015-2016	Social support facilities
Jgdhulpbus	2015-2016	Youth care trajectories
Kinderopvang	2015-2016	Child care allowance
Vehtab	2015-2016	Wealth data
Vrktab	2015-2016	Inheritance data
Schtab	2015-2016	Gifts data

A.1 Special datasets provided by Statistics Netherlands

Household dataset from Bruil (2022)

We have access to the data sets used in Bruil (2022). It contains all income that are actually received, along with taxes paid and in-cash and in-kind benefits received., for each individual of the Dutch population in 2015 and 2016. The totals of the individuals are consistent with the national accounts. Details on the data sources and the distributional assumptions used to construct this data set are in the appendix section of Bruil (2022) and in Bruil and Koymans (2014).

SZOAB+ dataset

We obtain the ownership data for all Dutch firms with a Dutch substantial owner (an owner with more than 5% ownership) from the SZO AB+ data set from Statistics Netherlands (CBS). This data set was made available specifically for this project. The data contain the ownership shares of all Dutch owners that own at least 5%. [26] Besides the ownership shares, the dataset also includes financial data, like the balance sheet and profit and loss statements. For mother-daughter relations, firms are allowed to file a joint tax report as a fiscal unit. In these cases,

[26] In some cases the total ownership adds up to more than 100%. In these cases we reduced all shares proportionally to obtain a total to 100%.

we treat the group of firms as a single firm, by using their consolidated financial data. The fiscal profit is available at the level of the firm. Dividends are not available at the level of the firm, but they are available at the level of individuals based on data from the personal income taxation. We determine retained earnings by first allocating all fiscal profits to individuals and then subtracting their received dividends.

A.2 Other datasets provided by Statistics Netherlands

Information about the administrative microdata can be found online.[27] The datasets that are used for allocating health care, education and the other (miscellaneous) in-kind transfers are described in Bruil (2022).

Budget survey dataset The Budget Survey is a survey on household expenditure among 15 thousand households in 2015. Data on income are linked from registrations held by Statistics Netherlands. During four weeks, participants record all expenditure on articles and services of 20 euro. During one of those weeks, participants also record expenses on goods and services below 20 euro. The survey distinguishes between 135 types of goods.

Gebwlztab This dataset contains registries of all persons of 18 years and up who have made use of long-term care for which a personal contribution must be paid.

Gebwmotab This dataset contains registries of all individuals aged 18 and up who have made use of social support facilities for which a personal contribution must be paid.

Jgdhulpbus This dataset contains all provided trajectories for youth care in a given year, excluding youth protection and juvenile probation.

Kinderopvang This dataset contains all the beneficiaries of childcare allowance, along with the corresponding amount received.

Vrktab This dataset contains for all inheritances for which tax returns have been filed, the inheritance amount, the inheritance tax and the relation between the testator and the recipient.

Schtab This dataset contains for all donations for which tax returns have been filed, the donation amount, the gift tax and the relation between the donor and the recipient.

[27] https://www.cbs.nl/nl-nl/onze-diensten/maatwerk-en-microdata/microdata-zelf-onderzoek-doen/catalogus-microdata (available in Dutch only).

B Methodological appendix

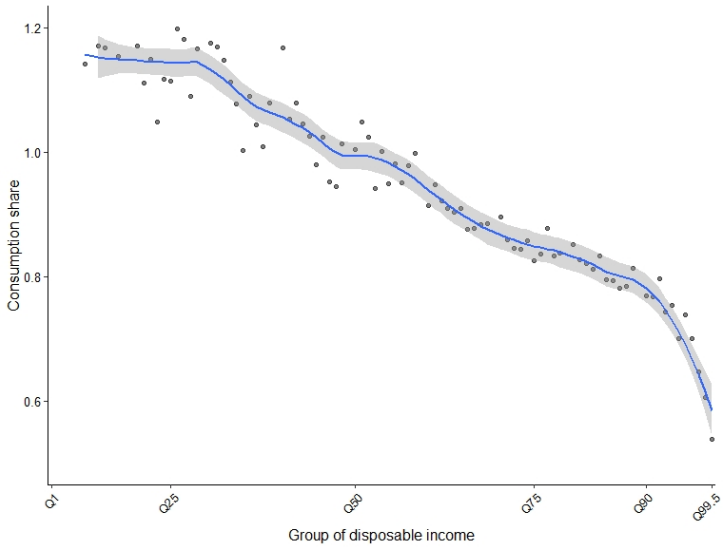
B.1 Computation of production taxes

Taxes on products (D.21 in national accounts) mainly consist of VAT and excise taxes, and some smaller ones like property taxes. In the Netherlands, the VAT is a percentage of the price and can be 21%, 6% or 0%, as explained in section 2. Excise duties are levied on alcoholic beverages, fuels and tobacco and are in general levied as a fixed amount per unit of product. In terms of national accounts, excise duties are the majority of 'Other product taxes' (table B.1).

Table B.1: National accounts aggregates D.21 (billion euro)

Tax	**NA total**
VAT	47.8
Taxes on import	8.3
Other product taxes	15.7
Taxes on products	**71.9**

Figure B.1: Consumption share by disposable income



NOTE: This Figure presents the average consumption by income group, expressed as a share of disposable income. Those shares are estimated using the Dutch Budget Survey for year 2015.

To calculate the VAT and excise paid by households, we make use of the Budget Survey from Statistics Netherlands (see appendix A for a detailed description). First, we assign the applicable tariff to each good in the Budget Survey. This assignment is imperfect in a few cases, for example if the use of the good determines the relevant tariff. In these cases, we assign either the tariff that is most commonly applied or an average. Second, we estimate the amount of VAT and excise paid based on each households' consumption basket and the relevant tariffs. Since the excise tax is levied as a fixed amount per unit, we must infer the quantity consumed

by means of average prices of the goods subject to excise.[28] At last, we link observed household income in the Budget Survey to the consumption taxes paid and impute the average VAT and excise paid per income quantile for the whole population. Specifically, we impute the tax rate per income percentile, except for the top 1 percentile where the tax rate is imputed using smaller income bins. This is motivated by the relatively large differences in the share of income spent on consumption (hence consumption tax rate) *within* the top 1 percentile with respect to the rest of the income distribution, as can be seen in Figure B.1. The difference with the national accounts aggregate is proportionally allocated. The Budget Survey is only available in 2015, so we assume consumption patterns remain unchanged in 2016.

B.2 Computation of in-kind transfers

Methodology

In-kind transfers (D.63 in national accounts) in the Netherlands consist for the most part of health care, education and long-term care, followed by social support, youth care and child care, shown in table B.2. For each of these transfers, a short description of the scheme itself and the allocation method is given below.

Transfer	**NA total**
Health care	38,8
Education	27,6
Long-term care	18,0
Social support	5,3
Youth care	3,5
Child care	2,1
Miscellaneous	27,5
Total	**122,8**

Table B.2: National accounts aggregates D.63 (billion euro)

Health care The Health Care Insurance Act (Zvw) requires almost all Dutch residents to take out basic health insurance. The national government determines what is covered by the basic insurance. For the distribution of health care, we follow the method proposed by Bruil (2022). The dataset *Zvwzorgkostentab* contains per individual resident who is insured through the basic insurance, his or her costs per year for the care received. The costs are those costs that are actually reimbursed by the health insurers. The difference with the national accounts aggregate is proportionally allocated.

Education All levels of education are funded by the government. Primary and (general) secondary education is free, secondary vocational and tertiary education institutions do require

[28] These prices are based on data from Statistics Netherlands and the EC Excise Duty Tables III.

tuition fees from students. In distributing education, we follow Bruil (2022) as well, using administrative data from The Education Administration (DUO) that contains a unique student number, the type of education enrolled in and the institution where education is followed. Enrollment is used as a proxy for the distribution of the national macro total, per type of education (primary, secondary, tertiary). This implies that every student makes the same costs within the type of education.

Long-term care The LTC system in the Netherlands is targeted at people who constantly need (intensive) care, such as the chronically ill, vulnerable elderly or people with a severe mental or physical disability. *Gebwlztab* contains data of all persons of 18 years and up who have made use of care for which the costs are borne by the Long-term care Act (Wlz) and for which a personal contribution must be paid. The national accounts aggregate is allocated among all registered users, taking into account average cost of the care type based on open data on the costs of several long-term care packages.[29][30]

Social support The Social Support Act (Wmo) requires municipalities to assist people who are unable to independently arrange the care and support they need.[31] This includes services like companionship, day activities and sheltered accommodation for people with psychiatric disorders. In the dataset *Gebwmotab* individuals aged 18 and up who have made use of such facilities are observed.[32] The amount of social support transfers are calculated as follows. Open data[33] on social support expenditure at the national level are linked to all registered individuals who have received some kind of social support. By doing so we obtain an estimation of average cost per type of support, per four weeks. This estimation is used to calculate the costs per individual. The difference with the national accounts aggregate is proportionally allocated.

Youth care Various forms of youth care exist for individuals up to 18 years old. The Youth Act requires municipalities to ensure access to youth care and for granting it to young people and their parents. The data set *Jgdhulpbus* contains all provided trajectories for youth care in a given year, excluding youth protection and juvenile probation. We group all forms of youth

[29] CBS, 2022

[30] As explained in section 2, the long-term care premium is one of the mandatory social contributions for all Dutch residents. Long-term care is financed by both these premiums and via co-payments of long-term care users. Currently we do not consider these co-payments. Our allocation method could be improved in the future by doing just that, particularly as those co-payments are strongly income-dependent and thus might affect the income distribution considerably.

[31] We do not take local differences into account, since we aim to show the redistributive effects of in-kind transfers at the national level. In practice however, important redistributive effects at the local level might arise when in-kind transfers differ strongly between municipalities. Since municipalities to some extent are free to shape their social policy, it is likely such local effects do exist.

[32] Only the facilities for which a personal contribution must be paid are registered. In 2016, municipalities could determine the height of personal contribution themselves, but were also free to grant exemptions, for example for low incomes. As a result, those individuals do not show up in the microdata. We do not know at which scale such exemptions are given. One possible consequence is that we underestimate the average in-kind transfer for lower incomes, since unregistered individuals that did receive support are more likely to be at the lower end of the income distribution.

[33] CBS, 2022

care into care with and without residence, after which the average costs for each care type are estimated. Due to lack of expenditure data at the national level, we make use of open data on youth care expenditure of municipalities.[34] Selecting only those municipalities that have registered their expenditure on the two types of care leaves us with data of 52 municipalities, out of 393. By linking these data to registered users of youth care in those municipalities, we estimate the average cost per day for each care type, which we impute to all observed individuals - hence assuming equal average costs for the missing municipalities.[35] The difference with the national accounts aggregate is proportionally allocated.

Child care The childcare allowance depends on income, the number of children, the type of childcare and the number of hours worked. In the microdata we directly observe the childcare allowance received for all beneficiaries, on which we allocate the national accounts aggregate.

Miscellaneous We follow the method as described in Bruil (2022) when it comes to allocating the rest of the social transfers in-kind. Rent subsidies are allocated based on microdata, whereas other transfers, which consist of a variety of smaller schemes, are allocated either through a proxy or by evenly distributing them over an age group of eligible individuals.

B.3 Computation of corporate income and taxes

B.3.1 Separation between foreign and domestic income and taxes

In 2016, primary income of the corporate sector (B.5n of S.11 and S.12) amounted to €70.3 billion, while corporations paid a total of €23 billion in corporate taxes. Corporate primary income is made up of six different components:

A.1 Earnings retained by Dutch corporations owned by Dutch households
A.2 Earnings retained by Dutch corporations owned by foreign households through foreign portfolio investment (FPI)
A.3 Earnings retained by foreign corporations owned by Dutch households through foreign direct investment (FDI)
A.4 Corporate taxes paid by Dutch corporations owned by Dutch households
A.5 Corporate taxes paid by Dutch corporations owned by foreign households through FPI
A.6 Corporate taxes paid by Dutch corporations owned by foreign households through FDI

This implies that the following income categories are not included:

B.1 Earnings retained by foreign corporations owned by Dutch households through FPI
B.2 Corporate taxes paid by foreign corporations owned by Dutch households through FPI
B.3 Corporate taxes paid by foreign corporations owned by Dutch households through FDI
B.4 Earnings retained by Dutch corporations owned by foreign households through FDI

[34] CBS, 2022

[35] The data gap between the total of the calculated in-kind transfers and the NA aggregate suggests this is unlikely to hold in practice, although data gaps may also arise due to other factors, as discussed in section 3.2.

We only want to distribute corporate income and taxes to Dutch households to the extent that the associated corporations are owned by Dutch households, that is A.1+A.3+A.4+B.1+B.2+B.3. The national accounts provide estimates of A.3 and B.4, while the Dutch central bank has previously estimated A.2 and B.1.

Estimating the other components is complicated by enormous in- and outflows of foreign direct investment and the associated income streams. A substantial part of these in- and outflows are associated with the corporate subsector "Captive financial institutions and money lenders" [S.127]. Detailed data from Statistics Netherlands on corporate subsectors allows us to distinguish between retained earnings by S.127 and all other corporate subsectors.

NA category	**S.127**	**Non-S.127**	**Total**
B.5n	3,836	66,458	70,294
D.43b	37,864	20,171	58,035
D.43m	3,963	-3,298	665
D.5b	1,032	21,948	22,980

Table B.3: Retained earnings and corporate taxes by corporate subsectors

Our procedure starts with estimating A.6 separately for corporations in the S.127 subsector and those in other subsectors. In each case, we assume that the ratio between corporate taxes and gross retained earnings is the same for Dutch corporations owned by either Dutch households and foreign households through FPI (B.5n – D.43m) or by foreign households through FDI (D.43b). For S.127, this ratio equals 2.7% since corporate taxes equal €1,032 million and earnings retained by Dutch S.127-corporations equal €37,737.[36] We apply this ratio to D.43b and find that the S.127 part of A.6 amounts to €1,065 million.[37] For the non-S.127 subsectors, this procedure returns €6,512 million as the amount paid in corporate taxes by foreign households who own Dutch corporations through direct investment. In total, A.6 thus amounts to €7,577 million.

After accounting for taxes paid by foreign households through direct investment, we are left with €62,052 million in earnings retained and €15,403 million in corporate taxes paid by Dutch corporations owned by either Dutch households or by foreign households through portfolio investment. We assume that the ratio between taxes and earnings is the same for both types of ownership, which implies that foreign households paid an additional €8,102 million in corporate taxes with Dutch households accounting for the remaining €7,301 million [A.4]. Earnings retained by Dutch corporations owned by Dutch shareholders then amounts to €22,113 million [A.1].

Finally, we need to estimate the value of corporate taxes paid by foreign corporations owned by Dutch households [B.2+B.3]. We assume that the ratio of foreign corporate taxes to earnings retained by foreign corporations owned by Dutch households is the same as that of the domestic

[36]Earnings retained by Dutch corporations corresponds to B.5n – D.43m + D.43b. We need to subtract D.43m because these are earnings retained by foreign corporations.

[37]Since D.43b is expressed net of tax, the formula to obtain A.6 is 2.7%*D.43b/(1-2.7%).

equivalents, that is (B.2 / B.1) = (A.5 / A.2) and (B.3 / A.3) = (A.6 / B.4). This results in estimates of €8,289 million and €87 million for corporate taxes paid by foreign corporations owned by Dutch households through FDI or FPI.

All combined, we assign to Dutch households a total of €63.6 billion in retained earnings and €15.7 billion in corporate taxes.

B.3.2 Separation between income and taxes attributed to households, pension funds, and government

After establishing how much retained earnings and corporate taxes need to be assigned to Dutch households, we need to determine how. Corporations that are not foreign-owned are owned by households, pension funds or the government. We use detailed macroeconomic financial balance sheets from Statistics Netherlands to determine what share of corporate retained earnings and taxes should be assigned to each of these sectors. For example, pension funds own 56% of equity of corporations, with households and the government accounting for 35% and 9% respectively. We therefore assign 56% of earnings retained and taxes paid by corporations according to households' pension wealth, 35% according to their equity wealth, while 9% gets added to the government's capital income.

For earnings retained and taxes paid by foreign corporations owned by Dutch households through portfolio investment, we need to take one additional step. The same macroeconomic balance sheets show that foreign portfolio investment if owned by corporations (61%), pension funds (32%), and households (7%). Thus, 61% of income and taxes follows the 56-36-9 division described above. Then 32% gets assigned to households based on their pension wealth, while 7% gets assigned according to households' equity wealth.

B.3.3 Allocation of income and taxes to household using individual data

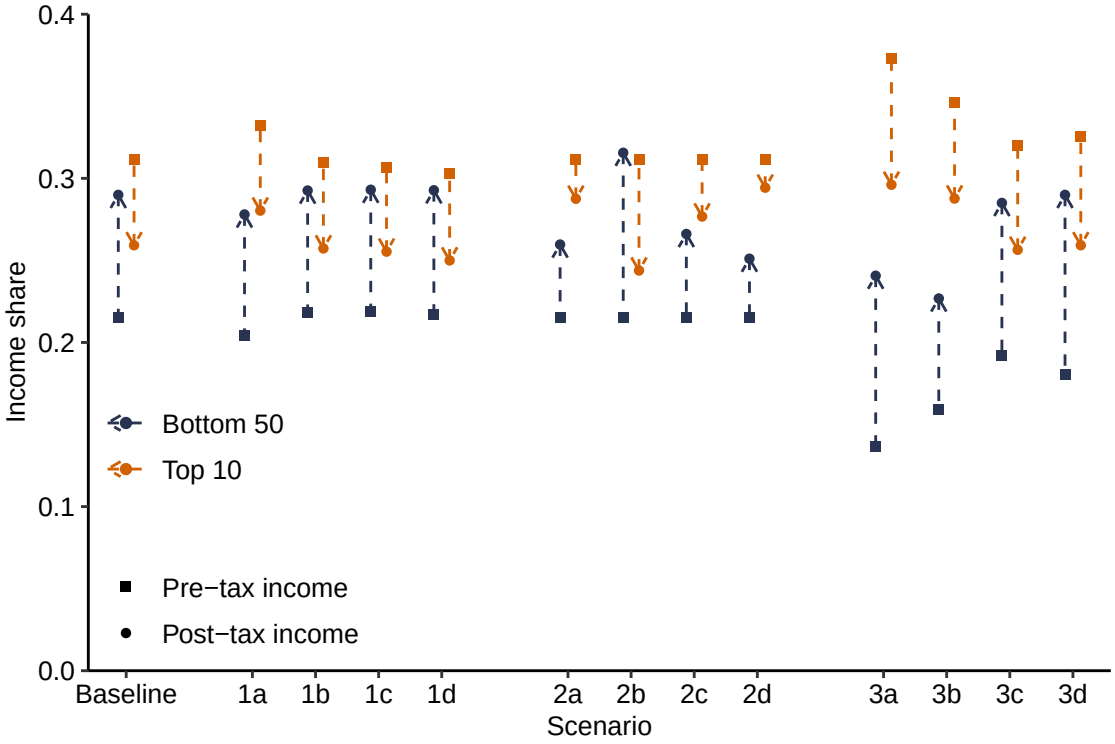
This section describes the approach used for the distribution of retained earnings and corporate income tax, based on the ownership dataset we have access to (see appendix A).

We observe, for each firm owned by at least one substantial owner (above 5% of ownership), the ownership shares as well as the fiscal profit. We proportionally assign all fiscal profits to their direct owners, which can either be individuals or firms. Since individuals can own multiple firms, we sum all assigned profits for each individual. Next, we subtract from these profits the total amount of dividends that the individual received from their closely-held businesses. These dividends are available from the data on personal income taxes. The retained earnings are equal to the difference between the total profits that are assigned to an individual and the received dividends. There can be complex networks of ownership, where firms (A) owned by individuals can also have shares in other firms (B). When these latter firms (B) make profits, they can either retain them or pay them out as dividends to their owners (A). Our approach works conditional on the assumption that in both cases, A correctly includes the total profits of B in their own profit statement. This generally does not lead to double taxation, since the Netherlands has an exemption for profits of affiliated firms.

The retained earnings from the national accounts that could not be allocated to owners of closely-held businesses are allocated proportional to equity holdings (other than equity in closely-held businesses). Next, corporate income taxes from the national accounts are assigned proportionally to the retained earnings. We could not directly assign corporate income taxes based on the ownership structure, since the firm data in this dataset do not include taxes.

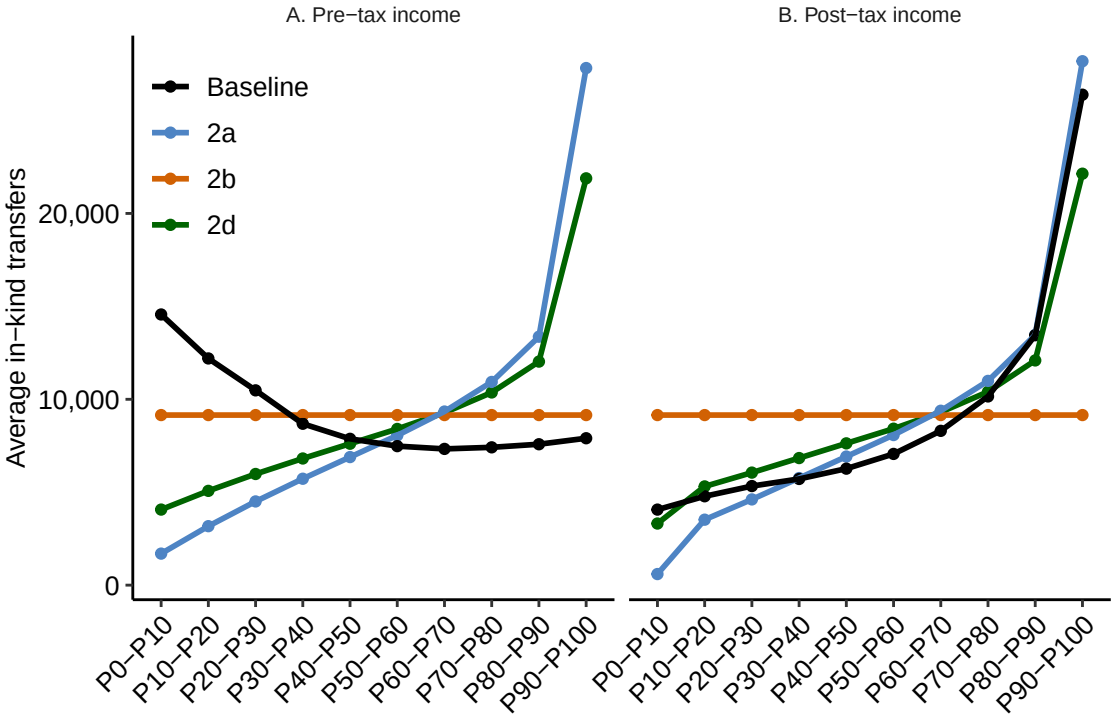
C Additional Tables and Figures

Figure C.1: Average amount of in-kind transfers, by scenarios and ranking variable



NOTE: This Figure presents the income shares of the top 10 and bottom 50 groups, for the pre- and post- tax income and for different scenarios for computing them. The exact values can be found in Table C.1.

Figure C.2: Average amount of in-kind transfers, by scenarios and ranking variable



NOTE: This Figure presents the average amount of in-kind transfers received by group of income, when ranking individuals by pre-tax income (panel A) and post-tax income (panel B), and for different assumptions for the distribution of in-kind transfers. Baseline (black line) distribution is based on the actual consumption of in-kind transfers as much as possible (see appendix B.2 for details). Alternative scenarios presents a proportional (scenario 3a, in blue), lump-sum (scenario 3b, in orange), or the baseline wid (scenario 3c, in green) allocation. See section 5 for a motivation and discussion around these alternative scenarios.

Table C.1: Inequality reduction for different scenarios

Scenario		Bottom 50	Mid 40	Top 10	$\frac{T10}{B50}$	Gini
1a	Pre-tax income	0.20	0.46	0.33	8.13	0.46
	Post-tax income	0.28	0.44	0.28	5.04	0.35
	$\Delta_{absolute}$	0.07	-0.02	-0.05	-3.08	-0.11
	$\Delta_{relative}$	0.36	-0.05	-0.16	-0.38	-0.24
1b	Pre-tax income	0.22	0.47	0.31	7.09	0.43
	Post-tax income	0.29	0.45	0.26	4.40	0.32
	$\Delta_{absolute}$	0.07	-0.02	-0.05	-2.70	-0.11
	$\Delta_{relative}$	0.34	-0.05	-0.17	-0.38	-0.26
1c	Pre-tax income	0.22	0.47	0.31	7.02	0.42
	Post-tax income	0.29	0.45	0.26	4.36	0.31
	$\Delta_{absolute}$	0.07	-0.02	-0.05	-2.66	-0.11
	$\Delta_{relative}$	0.34	-0.05	-0.17	-0.38	-0.26
1d	Pre-tax income	0.22	0.48	0.30	6.97	0.43
	Post-tax income	0.29	0.46	0.25	4.27	0.31
	$\Delta_{absolute}$	0.08	-0.02	-0.05	-2.70	-0.11
	$\Delta_{relative}$	0.35	-0.05	-0.17	-0.39	-0.26
2a	Pre-tax income	0.21	0.47	0.31	7.25	0.43
	Post-tax income	0.26	0.45	0.29	5.54	0.37
	$\Delta_{absolute}$	0.04	-0.02	-0.02	-1.71	-0.06
	$\Delta_{relative}$	0.21	-0.04	-0.08	-0.24	-0.14
2b	Pre-tax income	0.21	0.47	0.31	7.25	0.43
	Post-tax income	0.32	0.44	0.24	3.86	0.28
	$\Delta_{absolute}$	0.10	-0.03	-0.07	-3.39	-0.15
	$\Delta_{relative}$	0.47	-0.07	-0.22	-0.47	-0.34
2c	Pre-tax income	0.21	0.47	0.31	7.25	0.43
	Post-tax income	0.25	0.46	0.29	5.86	0.38
	$\Delta_{absolute}$	0.04	-0.02	-0.02	-1.39	-0.05
	$\Delta_{relative}$	0.17	-0.04	-0.06	-0.19	-0.11
2d	Pre-tax income	0.21	0.47	0.31	7.25	0.43
	Post-tax income	0.27	0.46	0.28	5.20	0.36
	$\Delta_{absolute}$	0.05	-0.02	-0.03	-2.05	-0.07
	$\Delta_{relative}$	0.24	-0.03	-0.11	-0.28	-0.17
3a	Pre-tax income	0.14	0.49	0.37	13.66	0.54
	Post-tax income	0.24	0.46	0.30	6.15	0.40
	$\Delta_{absolute}$	0.10	-0.03	-0.08	-7.51	-0.15
	$\Delta_{relative}$	0.76	-0.06	-0.21	-0.55	-0.27
3b	Pre-tax income	0.16	0.49	0.35	10.88	0.51
	Post-tax income	0.23	0.49	0.29	6.34	0.40
	$\Delta_{absolute}$	0.07	-0.01	-0.06	-4.53	-0.10
	$\Delta_{relative}$	0.43	-0.02	-0.17	-0.42	-0.21
3c	Pre-tax income	0.19	0.49	0.32	8.33	0.46
	Post-tax income	0.28	0.46	0.26	4.50	0.33
	$\Delta_{absolute}$	0.09	-0.03	-0.06	-3.83	-0.13
	$\Delta_{relative}$	0.48	-0.06	-0.20	-0.46	-0.29
3d	Pre-tax income	0.18	0.49	0.32	9.01	0.47
	Post-tax income	0.29	0.45	0.26	4.47	0.32
	$\Delta_{absolute}$	0.11	-0.04	-0.07	-4.54	-0.15
	$\Delta_{relative}$	0.60	-0.09	-0.20	-0.50	-0.32
Baseline	Pre-tax income	0.21	0.47	0.31	7.25	0.43
	Post-tax income	0.29	0.45	0.26	4.47	0.32
	$\Delta_{absolute}$	0.07	-0.02	-0.05	-2.78	-0.11
	$\Delta_{relative}$	0.35	-0.05	-0.17	-0.38	-0.26

NOTE: Table 2 presents the coding of the scenarios. The T10/B50 indicator is calculated as the ratio between average income for the top 10% and the bottom 50% in 2016. The Δ's show the absolute and relative change in shares and indicators when moving from pre-tax to post-tax income. $\Delta_{absolute}$ for the Gini corresponds to the Reynolds-Smolensky indicator.