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MEASURING THE LIFETIME REDISTRIBUTION ACHIEVED BY DUTCH TAXATION, CASH TRANSFER AND NON-CASH BENEFITS PROGRAMS

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This paper assesses how the Dutch system of taxation, cash transfers and non-cash benefits redistributes between the rich and the poor. The approach in this paper deviates from the usual approach by incorporating the full life cycle in the measurements, rather than only the annual effects. Moreover, the coverage is larger than is usually the case: the paper takes account of both direct and indirect taxes and direct and indirect benefits. In order to obtain the measurements on redistribution, we use the level of educational attainment to classify the population. We therefore measure, in terms of present values, the average net benefit from government policies for an average representative person of each level of education. The results indicate a sizable redistribution from the rich to the poor and a significant reduction of welfare inequality. The net effect on welfare inequality is, however, substantially smaller than when measured on an annual basis.

1. Introduction

This paper assesses how the current Dutch system of taxation,[1] cash transfers and non-cash benefits redistributes between the rich and the poor. Its main objective is to provide a balanced and comprehensive picture of this issue, and to identify the main factors that shape the results. The approach taken is more comprehensive than the usual approach to these issues in the policy debate in the Netherlands, in three ways: (a) it covers the effects of government policies over the entire life cycle; (b) it covers a larger part of taxes and outlays; and (c) it estimates the full redistributive effect of the system of taxation and transfers. Generally, studies on the redistributive effects of government policies follow a more partial approach by focusing on the annual rather than on the lifetime effects, by including only the effects of a part of the system of taxation and transfers (such as income taxation or certain expenditure items), and by focusing on the effects of policy changes alone.

Some academic studies, both on the Netherlands and other countries, do measure redistribution on a lifetime basis. Most of these, however, have a narrower scope. They either cover a smaller part of the system of taxation and transfers or measure only the effects of policy changes.[2] Nelissen (1996, 1998), for instance, restricted his analysis of lifetime redistribution in the Netherlands to the

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[1]Throughout this paper the term "taxation" or "taxes" includes social security contributions.

[2]These studies are discussed in more detail in Section 6.

social security system. Studies on other countries, such as Coronado *et al.* (2000) on the United States, and Falkingham and Harding (1996) on Australia and the United Kingdom, respectively, included only the public retirement scheme and direct taxes and transfers. Other studies, such as Fullerton and Rogers (1994, 1996) and Altig *et al.* (2001), did not measure the full redistributive effect but focused their analysis on how the lifetime distribution of income *changes* in case of adjustments in the tax system.

As several authors have pointed out, annual redistribution by the government is misleading as an indicator of redistribution on a lifetime basis because an individual's income and socioeconomic position, and his or her net benefit from cash transfers and non-cash benefit programs, do not remain constant throughout life. This follows especially from the substantial changes in labor incomes during an individual's career and the fact that burdens and benefits from the government change in the course of life due to the life-cycle dependencies ingrained in the system of taxes and transfers.

This study measures lifetime redistribution by the government by determining the present values of the balance of taxes paid and benefits received from public expenditure (net taxation) for various groups in society. These groups are ranked on the basis of their level of educational attainment. We distinguish six levels. For each of these we calculate both the lifetime primary income of an average person of that level, and his or her lifetime welfare. The latter concept takes account of taxes paid and cash and non-cash benefits received. For both concepts we measure the distribution by calculating the Gini-coefficient of inequality. The redistribution by the government is then measured by the difference between the two.

As mentioned above, this study is broad in scope in comparison to most other studies that follow a lifetime approach. However, it also uses a simpler and less time-consuming technique. Other studies generally use dynamic micro-simulation techniques. Using transition probabilities derived from micro-databases, these studies construct lifetime histories of earnings, taxes paid and benefits received from government expenditure. This study works with age-specific values for these variables that are constructed on the basis of cross-section data, thereby using a technique that is derived from Generational Accounting. It starts by constructing several stylized lifetime patterns for earnings that are typical for those of individuals at the various levels of (lifetime) income. These patterns are based on cross-section data on earnings of individuals at various levels of educational attainment and age. The cross-section data are translated into lifetime profiles. Because the classification is not based on lifetime income itself, as in the case of the studies that use a micro-simulation technique, but on educational attainment, the results of the measurements are not a direct measure of redistribution. The measurements in this paper are therefore less accurate than would be the case if a dynamic micro-simulation model were used. However, the methodology also has the advantage that it is less time consuming, and offers a way to carry out a low-cost assessment on this issue of which the outcome is highly uncertain beforehand. In this way, this paper may serve a methodological purpose. Note that there are relatively few publications that measure lifetime redistribution and this may be due to the substantial investment that is required to construct a dynamic micro-simulation model.

This paper uses the CPB[3] tax model MICROTAX[4] to generate the lifetime paths of annual tax payments that correspond to each of the income patterns. The lifetime paths of benefits from government expenditure that are typical for these stylized and representative individuals are estimated on the basis of various data sources. These provide a link between income or educational attainment and the (relative) benefit from public provisions.

The rest of the paper is structured as follows. The next section discusses the reasons for analyzing the distributional effects of taxes and transfers on a lifetime basis. It also goes into the methodology of the calculations. Sections 3 through 5 work out the redistributive aspect of taxes and transfers. Section 3 deals with the distributional effects of taxation and Section 4 does the same for the benefits from government expenditure. Section 5 combines the data on taxation and government expenditure and presents the total redistribution by the government as well as the resulting distribution of welfare. Section 6 then compares the methodology of this study with that of other studies. Section 7 concludes.

2. Methodology

2.1. *Why a Lifetime Approach to Measure Redistribution?*

As mentioned in the introduction, this study calculates lifetime redistribution by the government by determining the present values of the balance of taxes paid and benefits received from public expenditure for various groups in society. The calculations comprise the full life cycle. The size of the redistribution is measured by the differences between the distribution of lifetime primary incomes and the distribution of lifetime welfare. The latter concept is defined as lifetime primary income minus lifetime taxation plus lifetime cash transfers and non-cash benefits.

As was previously pointed out by Davies *et al.* (1984), Falkingham and Harding (1996), Nelissen (1998), Salas and Rabadán (1998) and Petterson and Petterson (2003), there are two reasons why a lifetime approach leads to different outcomes on these issues. The first is that annual calculations ignore the intra-personal element of redistribution that results from the life-cycle dependencies that are ingrained in the system of taxes and transfers. For most individuals this pattern typically features benefits from education during childhood, a net burden from taxation during the working middle stage of life and benefits from public pensions and healthcare during old age. Individuals who are net contributors to the public sector in one stage of their life (usually the middle stage) are thus net receivers in another stage. Ignoring this, as annual calculations do, would cause the measured redistribution to be an overestimation of the inter-personal redistribution. Solving this problem calls for a lifetime approach. The second reason why a lifetime approach leads to a different result is that it takes account of the fact that labor incomes of individuals show major changes during the life course. People with

[3]CPB, CPB Netherlands Bureau for Economic Policy Analysis, is a government institution that carries out forecasts and economic analyses, mainly for the purpose of underpinning government decision-making.

[4]MICROTAX is a static micro-simulation model for the Dutch system of personal income taxation. Using before-tax incomes as an input, it calculates the tax levels for various types of households and the whole range of income levels.

relatively high lifetime incomes generally feature only average annual incomes during the early stages of their careers. Likewise, individuals with relatively low lifetime incomes may have close to average annual incomes in the middle stages of their careers. The lifetime distribution of income is thus less skewed than the annual distribution. Moreover, working with lifetime histories of incomes strongly reduces the impact of temporary fluctuations in the incomes of individuals.

On a lifetime basis, the size of redistribution depends on the net effect of the separate schemes. The influences of these schemes occur at different stages of the life cycle and are to some extent counterbalancing. As shown later in this paper, high lifetime income earners typically feature relatively high lifetime tax burdens and relatively low benefits from healthcare and long-term care. On the other hand, they are relatively large beneficiaries of government expenditure on education, cultural facilities, housing subsidies and tax-favored saving through the second-pillar pension system. This paper's aim is to assess how all these factors work out on balance. By presenting the full distributional effect of taxes and transfers, rather than only the effects involved in changes of policies, the paper provides policy-makers with the necessary information to form an opinion on the size of the overall redistribution resulting from taxation and transfers. This may provide the relevant background information for the desired direction of equity policies.

2.2. *Current Measures of (Re)Distribution*

The distributional consequences of government policies in the Netherlands are currently presented in two ways, both of which are annual in their approach. The first way, which is most commonly used in the policy debate, is by comparing the effects of policies on annual net disposable incomes (see, for instance, CPB, 2004). CPB presents the net incomes for households across the range of before-tax income levels from low until high, and distinguishes between wage earners and people receiving cash transfers from the government such as the unemployed and the retired. This way of presentation thus focuses on accurately measuring and analyzing changes in annual net incomes and their distribution. It includes only the effects of income taxes and cash transfers. It is less comprehensive than this study's measure of redistribution because this study covers the effect of government policies over the entire life cycle and also takes account of indirect taxes and non-cash benefits.

The other way the distributional consequences of policies are currently presented, which is used by the SCP[5] (see SCP, 2003), is by comparing three measures of annual income distribution: (a) the distribution of primary income; (b) the distribution of secondary income (i.e. primary income minus direct taxes plus cash transfers; and (c) the resulting distribution if certain non-cash benefits from government programs[6] are also included. The third measure shows the eventual distribution of welfare. Comparison of the third measure with the distribution of primary income shows to what extent the government changes the distribution of

[5]SCP, the "Sociaal en Cultureel Planbureau," explores the social and cultural developments and trends in Dutch society.

[6]These programs involve education, provision of certain healthcare services and subsidization of public transport and social and cultural facilities.

welfare. This way of presentation is more comprehensive than the first because it includes the benefits from non-cash programs in the measure of welfare and because it shows the full distributional effect of the system of taxes and transfers—and not only the changes in these variables brought about by a specific policy measure. It does not, however, follow a lifetime approach.

2.3. *The Role of Lifetime and Annual Measures of (Re)Distribution*

The fact that the lifetime measure of redistribution is more comprehensive than its annual counterpart does not render annual measurement redundant. This would only be the case in a world in which there are no credit restrictions, in which individuals are forward looking and have perfect foresight over future incomes and needs, and in which there would be no need for the government to intervene paternalistically in private spending decisions. The only relevant measure for policymakers to base equity policies on would then be the overall redistribution by the government and the resulting distribution of welfare as measured over the full course of the life cycle. Its distribution over the life cycle would not be relevant as one could expect it to be allocated optimally. However, the less the extent to which individuals satisfy these conditions, the more annual measures will have to play a role in political decision-making—as in this case individuals may, during certain phases of their lives, face undesired situations of scarcity and a fall below the poverty line. This entails that redistribution policies would always have to be based on a balanced view that combines the information of both lifetime and annual measures of distribution.

In the low-income groups in society the circumstances, as outlined above, are generally not present and it would therefore seem reasonable that annual measures weigh heavily in redistributive issues such as the determination of the level of social security benefits. In the average to upper ranges of society however, where the chances of falling below the poverty line are smaller, credit restrictions may be less binding and individuals may be more informed and forward looking, lifetime measures may be more suitable to base equity policies on, as these provide a more comprehensive insight in how government policies work out.

Lifetime and annual measures are, however, inseparable. Implementation of political preferences on the lifetime distribution of income obviously requires translation into annual policies. Moreover, annual concepts of a decent income, or of poverty, are neither fixed nor unchangeable. They may well be influenced by the more comprehensive lifetime measurements of relative welfare. In this way they may affect political preferences on annual policies such as the progression of the tax system and the level of social security benefits.

2.4. *Classifying the Population into Groups*

Ideally, the lifetime redistribution carried out by the government would be expressed by comparing how the various groups, classified on the basis of their lifetime incomes, benefit from government policies in net terms. Data limitations prevent us from ranking lifetime incomes from low to high in a direct way, however, as information on lifetime incomes is not readily available. Since constructing these would involve a laborious process of developing a micro-simulation

model (see below), we will use the level of educational attainment as an indicator for lifetime income and rank the groups from low to high on the basis of this variable. This is possible due to the availability of cross-section data on how average wage incomes and rates of labor participation are related to the level of education and age.[7] As the level of education is strongly related to lifetime income, we are thus able to construct a range of career patterns and lifetime incomes on the basis of this variable, one for each level of education, which is roughly representative for that in society. The same reasoning applies to the use of several government programs. There are data on the relation between education and the benefits of various government programs, such as healthcare, long-term care, government transfers and obviously education itself.

We classify society into six groups of educational attainment: basic education (which currently covers 7 percent of the population between the age of 30 and 34[8]), lower secondary education (in the Dutch classification: MAVO/VBO, which covers 18 percent), higher secondary education (VWO/HAVO, 5 percent), lower vocational education (MBO, 39 percent), higher vocational education (HBO, 20 percent) and university education (WO, 11 percent). By attributing these weights to the six groups we construct a spectrum of lifetime paths that may to some extent be considered representative for society, in terms of both range and incidence.

2.5. *The Construction of Representative Lifetime Paths*

This study constructs lifetime paths by elaborating on cross-section data. Careers of labor incomes are essentially based on cross-section data that show how *current* wage levels and rates of labor participation depend on the level of educational attainment and age. These annual data were subsequently translated into virtual lifetime paths of labor income for an average person of each of the six educational levels that were mentioned above. The related levels of taxation were calculated by using the current income tax schedule which is modeled in the CPB tax model MICROTAX for 2002. This serves our purpose well, as we intend to measure the overall redistributive impact of the system of that year as if it were effective over the entire lifetime of each of the average persons. As cross-section data obviously ignore annual productivity increases, this element is additionally imputed through an across-the-board productivity growth factor, thereby leading to personal annual wage rises that consist of a (personal) career element and a general element. This procedure is similar to that in Generational Accounting. Tax brackets are adjusted annually for this growth factor.

[7]These cross-section data were provided by the LSO 1997 (see CBS, 2000). LSO ("Loonstructuur onderzoek") is a study on the wage levels and their relation with educational levels, age, gender, etc. A similar breakdown for participation rates is provided by the EBB 2002. EBB ("Enquete Beroepsbevolking") is a survey on participation rates across the population carried out by Statistics Netherlands. It also provides a breakdown of these rates.

[8]We designated the shares in this age group to be used as weights for the levels of educational attainment in this study. Choosing a younger group would involve the risk that not all individuals have completed their education. Including the groups with a higher age in the weighting would entail that not all recent rises in educational attainment would be taken into account and that future levels of educational attainment would be underestimated.

The lifetime paths of benefits from government expenditure are calculated in a two-stage process. During the first stage, we used data provided by SCP (1994) to construct age-specific benefits for the average citizen. This was done for each of the expenditure items that were included in the calculations. In the second stage we used available additional information on the relation between the level of educational attainment and the relative use of the expenditure item involved in order to establish the benefits that could be attributed to the six groups we distinguished. As is the case with the construction of lifetime tax paths the translation into lifetime histories of benefits is carried out by the addition of an across-the-board productivity growth factor. Use of this growth factor seems to yield the best possible representation of the Dutch system of taxes and transfers, as this generally links expenditure to market incomes.

2.6. *Comparing the Age Profile Methodology with Dynamic Micro-Simulation*

This study deviates from most of the other studies that use a lifetime approach (see Section 6) in the way it constructs the lifetime paths of incomes, taxes paid and benefits received. Other studies generally use a dynamic micro-simulation procedure that starts from a micro-database which contains a breakdown of the population in terms of demography, labor force and other characteristics. The individuals in the database are subsequently moved forward through time by using data on transition probabilities. Changes in their lives—for instance regarding education, participation in the labor market and the use of government programs—are used to construct lifetime paths.

A drawback of the methodology used in this paper is that the use of selected representative lifetime paths does not lead to a classification of the population that is directly based on lifetime incomes. It does not render a representation of the population that exactly corresponds to the actual spectrum of lifetime incomes. Moreover, the restriction of the measurement of redistribution to typical cases of single-person households does not fully take account of the heterogeneity in society and the redistribution that results from differences in family composition. This would require the use of a micro-database that represents the entire population rather than the averages of groups—as is for instance done by Nelissen (1996, 1998) and Falkingham and Harding (1996). These studies classified the population into deciles on the basis of lifetime primary incomes.

Education is only an indicator for lifetime income. Therefore, using the average lifetime incomes for the various levels of education to classify groups from low to high involves a certain inaccuracy in the determination of the range of lifetime incomes. This applies particularly to both extremes of the spectrum, as classification on the basis of averages for each group ignores the lifetime incomes that are below that of the average of the lowest level of education, as well as lifetime incomes that are higher than that of the average of the highest level of education. The range of lifetime incomes is thus underestimated. In the middle range of the spectrum the use of averages involves a smaller misrepresentation of the actual distribution because atypical career patterns roughly cancel out.

However, as pointed out in the introduction, the methodology presented in this paper has the advantage that the construction of the model it uses is far less

laborious and time-consuming than the development of a dynamic micro-simulation model. This enables a low-cost assessment of the size of lifetime redistribution. Note that this size is completely unknown beforehand because it depends on the net effect of many separate and partly counteracting influences.

2.7. *Other Qualifications of the Lifetime Methodology Followed in this Study*

This paper measures the distributional effects of policies on newborns that are faced with the current system of taxes and transfers over the rest of their lives. The lifetime coverage of the measurements therefore also involves the disadvantage that it inevitably requires assumptions on future developments. This applies especially to the assumptions with respect to labor participation rates, wage levels and benefits from government programs. With some modifications (see below), this study imputes the present values for these variables. A further source of uncertainty involves the discount rate with which the present values are calculated.

A second qualification is that this study, like most other studies on lifetime redistribution, does not include behavioral feedbacks in its analysis. Levels of labor participation and wages are assumed to be unaffected by the system of taxes and transfers. Moreover, the welfare concept excludes leisure time. Ideally, these features would be included by using a model with households of heterogeneous skills that incorporates leisure time in its definition of welfare and allows each type of household to find its welfare-optimizing response to the system of taxes and transfers.[9] The effect of the system would then be defined in terms of its effect on the lifetime welfare of households, and its distributional effect would then be measured by the differences between the households in these welfare effects. This omission of this study may to some extent distort the measurements in this study because household types may respond differently to the system.

A third qualification is that the implemented 2002 system of taxes and transfers, which was used to carry out the calculations, is probably unsustainable. The rising costs for the government due to the ageing of society require an adjustment of policies at some point in time. As our coverage of taxes and government expenditure is not comprehensive (see below), it must be implicitly assumed that these adjustments are found outside the taxes and transfers that are included in the calculations.

A fourth qualification involves the fact that the measurements of redistribution include only single-person households. Redistribution between types of households is therefore not included in the analysis. This issue is further discussed in Section 5.1.

A fifth qualification of the methodology of this paper is that it ignores the fact that older generations may have histories that may well deviate from the lifetime paths generated by our exercise. This follows from the focus on the effects of the current system of taxes and transfers and (related to this) the restriction of the exercise to newborns. The lifetime position of older generations cannot, therefore, be determined accurately.

[9]These behavioral responses would most particularly involve the rate of labor participation. Other responses would involve saving rates and the use of government programs.

2.8. *Further Assumptions*

As mentioned above, this paper aims to provide a broad picture of redistribution and of the main factors that shape the results. The measurements apply to 2002. Our main ambition is not to be accurate in determining the exact effects of all of the elements that contribute to the results. This would require a far more laborious technique as well as a more elaborate way of dealing with the whole range of government programs and tax rules. Our objective, rather, is to be comprehensive and to provide a balanced overall picture. To keep this exercise feasible, this objective translates into the requirement for a simplified methodology.

One simplification is that, as mentioned above, the measurements will focus on only one type of household rather than the whole range of possibilities: a single-person household with no children.

It is further assumed that none of the individuals inherits wealth or leaves a bequest. Housing decisions across the levels of education and age are imputed in line with the pattern found in the population. This means that the imputed share of homeownership depends strongly on lifetime income and age. All owners finance their homes by the combination of a mortgage and a capital insurance, which is, for tax purposes, the most attractive way.[10]

Outside the accumulation of funds in the capital insurance the only other form of private saving is through the second-pillar pension funds. Here, we assume that the pension level after retirement at the age of 65, including both the public and the mandatory occupational pension, corresponds to 70 percent of the average wage during a person's career.[11] This applies to a full-time career. Careers that are shorter than 40 years are reflected in a proportionally lower income from second-pillar pensions. As the public pension (which is financed on a pay-as-you-go basis) provides a basic provision and does not depend on previous income (only on marital status), the difference between the total pension and the public pension is fully reflected in the occupational pension. Accordingly, pension contributions are levied only above a threshold level of income that equals the minimum wage level. The calculations assume that there is no "free" personal saving and thus that net personal income is fully consumed. This omission is of minor importance as this form of saving is relatively small in the Netherlands due to the importance of institutionalized saving.

Indirect taxes are also included in our calculations. The taxes per unit of consumption are assumed to be equal for all groups and to correspond to the aggregate rate of indirect taxation, i.e. 17.8 percent. This rate is calculated by assuming that all indirect taxes are effectively levied on consumption.

3. The Impact of Taxation

This section treats the burden from taxation that single-person households face under the assumptions outlined above. It includes income taxes, private health

[10]Annual insurance payments are set at a level that leads to an accumulation of funds after 30 years that exactly suffices to redeem the mortgage. The accumulation of funds is tax exempt. Moreover, mortgage interest payments are tax deductible for a period of 30 years.

[11]Career patterns of wages are constructed by combining age-specific wage levels by age-specific participation rates (see Section 3.2).

insurance payments as well as indirect taxes. It also includes the pension system—in terms of both how it defers income and how it affects taxation. However, as in our stylized analysis households are assumed not to accumulate personal savings, the burden excludes the taxation of non-institutionalized savings as well as the effects of the corporation tax. The tax-favored treatment of owner-occupied housing is described in Section 4. The excluded items nonetheless form only a relatively small part of the revenue side of government finances.

3.1. *The Annual Taxation of Wages and Pensions*

Figure 1 presents the average tax rates on labor income for a wide range of income levels.[12] They are defined here as the ratio of taxes and private healthcare insurance payments in annual income,[13] and calculated by using MICROTAX. Figure 1 presents the tax rates for individuals under and above the age of 65. The ratios are lower for those over the age of 65, since this group faces lower tax rates in the first two tax brackets. For those under the age of 65, the tax rate includes the taxes that are imposed on the employer.[14] Correspondingly, the tax rate is

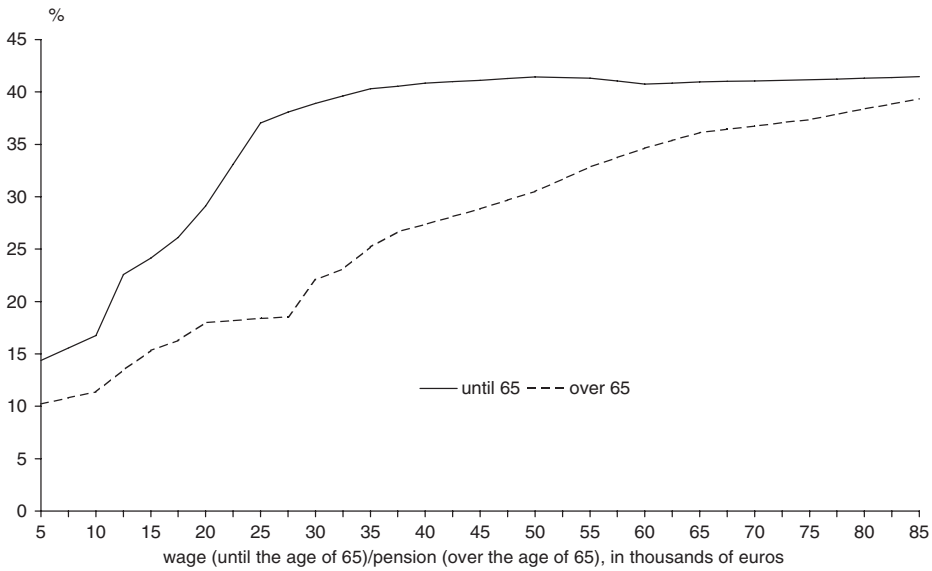

Figure 1. Average Tax Rates on Wages and Pensions (see definition in text)

[12]These involve the average rates on income from labor, pensions and the imputed income from owner-occupied housing.

[13]Private healthcare insurance payments are included here to ensure comparability across all levels of income. This is relevant because of the switch, at an income level of €35,000, from publicly provided healthcare insurance to private healthcare insurance.

[14]This entails that both the numerator (taxes) and the denominator (labor income) include these payments. The denominator also includes the pension premiums paid to pension funds, both the employee's and the employer's part of it, that are required to enable the payment of occupational pensions in the future. These issues are not relevant for the age group of those over 65, as these people are assumed not to be employed and not to pay pension contributions.

expressed as a percentage of the total costs of labor for the employer. This reflects the way these taxes are treated in this study. Including these taxes corresponds to the notion that their economic effects do not deviate from the effects of the taxes that are paid by the employees themselves. In other words, we assume that the way in which these tax liabilities are institutionally divided between employers and employees is not relevant. This follows from the view that responses in the supply of and demand for labor will eventually lead to an (equilibrium) outcome (in terms of employment, total costs of labor for the employer and net incomes of the employee) that is independent of the institutional division of the liability. The effective wedge faced by the employee therefore includes the tax liability of both the employee and the employer.

Pension contributions to pension funds paid by those under the age of 65 are not included in the definition of taxation because pension funds are classified as private institutions. They are, however, included in the definition of the total costs of labor for the employer (the denominator). The pensions that are generated by these contributions are taxed and these taxes are captured in the part of our lifetime calculations that covers the 65-plus stage of the life cycle (see below).

Figure 1 shows that, at low levels of income, the tax rate for the under 65 year-olds rises sharply. From around 15 percent at an income of €10,000 it rises to 37 percent at €22,000. This rise results from the combined effect of the progression of the tax system and the (abrupt) discontinuation of the wage subsidy at a wage level of €18,000. Above the income level of €22,000 however, the tax rate shows only a small rise and stabilizes at a rate of around 40 percent. Progressively rising pension premiums, which are tax deductible, and the maximization of taxes paid by the employer almost offset the progression in the tax rates of the personal income tax system. Appendix 1 provides a more detailed explanation of the course of the average tax rates, which are presented in Figure 1.

The tax rate for those over the age of 65 rises more or less continuously due to the progression in the system of personal income taxation. It shows a marked increase in progression at the income level where second tax bracket (where tax rates are low for the old-aged) transits into the third tax bracket. The smaller progression at low-income (pension) levels is also a result of the absence of the wage subsidies (see above). The higher progression at the higher income levels is due to the absence of the tax-deductible contributions to pension funds.

Note that individuals face both tax regimes in the course of their lifetimes.

3.2. *Some Important Data*

The extent of redistribution that takes place through the public sector does not depend solely on the system of taxes and transfers. Differences in characteristics between the groups also play an important role. With respect to the tax side of the system, the two major differences concern the size and age pattern of labor participation and the wage level. Figure 2 shows the age profile of labor participation that is imputed for the six groups we distinguish. It reveals that high levels

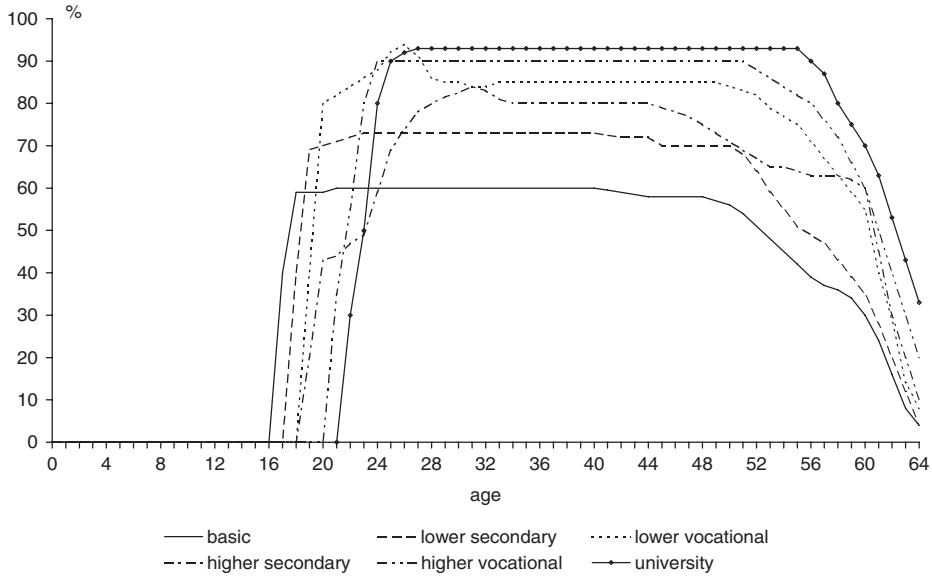

Figure 2. Lifetime Participation Profiles for the Six Levels of Education

of education are accompanied by high levels of participation, as well as later participation in the course of life. The imputed rates of participation are based on a cross-section labor survey.[15] These observed rates of participation are adjusted, however, to take account of the fact that future workers are expected to retire at a higher age.[16] Based on a recent study on long-term developments in labor supply the imputed lengthening of the stay in the workforce is two years for each of the educational levels.[17]

Figure 3 shows the current age profiles of labor costs for an average wage earner in each of the six groups.[18] It reveals that high levels of education lead to higher wages as well as a steeper career pattern. Both characteristics contribute to relatively high lifetime incomes in the groups with high levels of education. Table 1 reports the present values of the lifetime labor incomes that are the result of the combined effect of the data contained in Figures 2 and 3.

[15]This is the EBB 2002 of Statistics Netherlands, of which the data are available through the Scientific Statistical Agency. Individuals are counted as participants in this survey if they work 12 hours or more per week.

[16]Another trend that leads to higher participation rates in the future is the increasing level of education. This trend is implicitly imputed by using the weights of the (young) group between 30 and 34, rather than the participation rates of the entire current workforce. This is discussed above.

[17]See Roodenburg and van Vuuren (2005). The imputed lengthening by two years is roughly in accordance with the average of the four long-term scenarios worked out in that paper. The paper does not distinguish levels of education.

[18]The labor costs are defined as averages per participant. An individual is counted as a participant if his or her working week exceeds 12 hours per week.

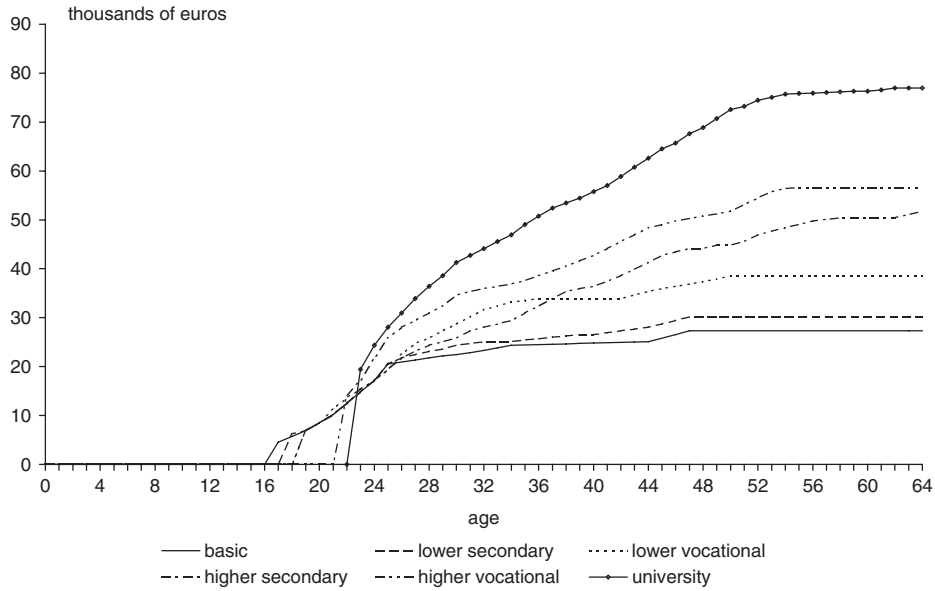

Figure 3. Lifetime Profiles of Labor Costs for the Six Levels of Education

TABLE 1

Lifetime Labor Incomes for the Six Households (present values at birth in thousands of euros)

Basic	294.1
Lower secondary	384.5
Higher secondary	554.0
Lower vocational	569.9
Higher vocational	769.6
University	1,043.7
Weighted average (see Section 2.4 for the weights)	608.5

3.3. *Lifetime Taxation*

Table 2 reports the present values of the lifetime tax burdens for the six typical cases we distinguish in this study.[19] Table 3 presents the lifetime tax rates (i.e. the lifetime tax burdens as a percentage of lifetime labor income), which apply to a single person household. The calculations do not include any form of tax expenditure (such as the deductibility of mortgage interest payments). The total tax burden (see the last column) is decomposed into direct and indirect taxes, and into the part of these taxes that are imposed up to the age of 65 years and the part that is imposed over the age of 65. Table 3 shows that the total tax rate rises only

[19]The baseline calculations in this study assume a discount rate of 3 percent and an age-specific productivity growth rate of 1.5 percent. The rates of survival for the various groups of educational attainment are derived from data provided by TNO Preventie en Gezondheid (2002). These data distinguish four levels of education. These data imply that life expectancy rises from 76.3 years for those with only basic education to 80.1 years for those with higher vocational or university education.

TABLE 2

LIFETIME TAX BURDENS[a] FOR THE SIX TYPICAL SINGLE-PERSON HOUSEHOLDS (IN THOUSANDS OF EUROS)

	Direct Taxes		Indirect Taxes		
	Until 65	Over 65	Until 65	Over 65	Total Taxation
Basic	102.3	7.7	35.8	8.8	154.6
Lower secondary	138.7	9.7	45.5	10.6	204.5
Higher secondary	216.8	14.2	57.9	13.1	302.0
Lower vocational	218.1	12.8	61.6	12.5	305.0
Higher vocational	310.4	19.8	75.1	16.0	421.3
University	426.6	26.5	95.5	20.8	569.4

[a]Defined as the present value at birth of lifetime income taxes, soc. sec. contributions and private health insurance payments (in the case of direct taxes), and as the present value of lifetime indirect taxes (in the case of indirect taxes).

TABLE 3

LIFETIME TAX RATES[a] FOR THE SIX TYPICAL SINGLE-PERSON HOUSEHOLDS (IN %)

	Direct Taxes		Indirect Taxes		
	Until 65	Over 65	Until 65	Over 65	Total Taxation
Basic	34.7	2.6	12.2	3.0	52.6
Lower secondary	36.1	2.5	11.8	2.8	53.2
Higher secondary	39.1	2.5	10.4	2.4	54.5
Lower vocational	38.3	2.2	10.8	2.2	53.5
Higher vocational	40.3	2.6	9.8	2.1	54.7
University	40.9	2.5	9.2	2.0	54.6

[a]Defined as the present values of direct and indirect taxes (presented in Table 2) relative to the present values of lifetime labor incomes (presented in Table 1).

slightly with lifetime income (or level of educational attainment), reflecting a low lifetime progression of the tax system. This low progression can be explained by the fact that the moderate progression in direct taxation until the age of 65 (see the first column) is almost offset by the regressive effect of indirect taxation. The latter is mainly caused by the (slight) progression in direct taxation until the age of 65, primarily among the low levels of educational attainment (and lifetime income), and the progression in pension premiums (see Appendix 1). Both take an increasing share out of net income and consumer spending. For the over-65 age group, the Dutch pension system leads to a declining share of pension income, and taxes paid on that income, relative to previously earned labor income.[20] This outweighs the progression in the tax rates for this age group[21] (see Figure 1).

[20]This results from the Dutch pension system. This system combines a public pension system, which provides an equal pension to all citizens (apart from a differentiation on marital status), with a supplementary private occupational pension which depends on previous income. Combined, the pensions amount to 70 percent of the average wage in a person's career in the case of a full time career. The occupational, income dependent, part of the pension thus increases with (lifetime) wage. As the groups with lower levels of education tend to have lower rates of labor participation, their larger reliance on the income-independent public pension results in a pension level relative to previous labor income that is higher than that for the groups with higher levels of education.

[21]Note that the tax burdens that are presented in Tables 2 and 3 are also affected by pension contributions and pension incomes. As the combined effect of these, in terms of present values, is not necessarily neutral the tax rates may also be affected by redistribution of wealth within pension funds.

As far as direct taxation is concerned the results can be compared to those of other countries. The overall lifetime progression of the system of direct taxation shows a rise from 37.3 percent (for the under and over 65 year-olds combined) for the lowest group to 43.4 percent for the highest group. This rise of 6.1 percentage-points is lower than in two other countries for which there are relatively recent measurements available. Falkingham and Harding (1996) show that lifetime rates of direct taxation in the U.K. rise from around 14 percent for the lowest decile of lifetime income to around 28 percent for the highest decile, or by 14 percentage-points. In Australia these rates even rise by around 26 percentage-points (from 12 to 38 percent).

4. The Benefits from Government Expenditure

The six groups we distinguish also differ significantly in the way in which they benefit from government programs. This section assesses these differences. The coverage of expenditure is, however, restricted to the expenditure items that can be readily attributed to beneficiaries, such as transfers. Expenditure items that cannot be directly attributed, such as general government and infrastructure, are ignored. In contrast to the tax side of the budget, the excluded items are sizable and amount to about 40 percent of government expenditure.

Table 4 reveals the differences in the benefits from government transfers by presenting the lifetime benefits from public pensions, disability payments, unemployment benefits and social assistance.[22] They are presented in terms of present values over the entire life cycle. The table shows that the highly educated groups are relatively large beneficiaries of public pensions. This is purely the result of their longer life expectancy as the public pension system in the Netherlands is a flat-rate scheme. The benefits (in net terms) from the disability and unemployment schemes[23] show a discontinuous shape as a result of the combined effect of an inflow into these

TABLE 4

Lifetime Benefits from Cash Transfers (present values, thousands of euros)

	Public Pensions	Disability (net)	Unemployment (net)	Social Assistance (net)	Total
Basic	51.5	11.0	4.7	19.5	86.7
Lower secondary	58.7	14.2	4.2	8.0	85.1
Higher secondary	58.7	15.5	5.6	5.7	85.5
Lower vocational	58.7	16.2	6.2	4.5	85.6
Higher vocational	61.4	15.6	8.6	2.9	88.5
University	61.4	15.6	8.6	2.9	88.5

[22]Appendix 2 discusses the details of this exercise. Data limitations prevented us from distinguishing between the two highest levels of educational attainment.

[23]These benefits are expressed here net of direct and indirect taxes. An across-the-board tax rate of 30 percent is imputed for direct taxation, and 17.8 percent for indirect taxation, entailing an accumulated rate of 42 percent. In the case of social assistance (see below), these figures are 16, 17.8 and 31 percent, respectively. Public pensions are expressed in before-tax terms, as the taxes on them are already taken into account of in the previous section.

TABLE 5

LIFETIME BENEFITS FROM NON-CASH TRANSFERS (PRESENT VALUES, THOUSANDS OF EUROS)

	Healthcare	Long-Term Care	Culture/Recreation	Education	Total
Basic	80.5	58.0	3.7	25.0	167.2
Lower secondary	72.1	38.3	5.1	43.3	158.8
Higher secondary	58.2	30.7	7.3	54.3	150.5
Lower vocational	71.9	34.1	6.3	58.9	171.2
Higher vocational	68.1	21.6	8.1	68.4	166.2
University	68.1	21.3	8.1	100.4	197.9

schemes that decreases with rising levels of education[24] and benefit levels that are related to previous income, but only up to a level of previous income that roughly equals average wages. Social assistance is a flat-rate scheme of which the inflow is strongly, and negatively, related with education. Overall, the benefits from transfers are very evenly distributed across the levels of educational attainment.

Table 5 presents the costs for the government that are involved in the non-cash transfers included in this paper. The benefits from these transfers are assumed to be equal to the costs for the government. The table shows that, in spite of lower life expectancies, the costs of healthcare and long-term care can be attributed in a more than proportional way to the groups with a low level of education.[25] Benefits from the subsidization of cultural and recreational facilities rise strongly with the level of education. The same (obviously) applies to the benefits from government expenditure on education.[26] Total costs for the government for these non-cash programs show a roughly flat pattern up until the higher vocational level of education. A steep rise of these benefits can be observed for the university level, due to the high cost of this form of education (see Appendix 2).

Table 6 shows the (present values of the) net benefits from public housing schemes that are related to both rental and owner-occupied housing for a single-person household.[27] The calculations are carried out for stylized cases. The

[24]The relative sizes of the inflows into the disability scheme are provided by Statistics Netherlands. The relative sizes of benefits from the unemployment scheme and social assistance are based on data provided by the SCP and the AVO'99. The age profiles of these three schemes are derived from SCP (1994).

[25]The relative sizes of these benefits are derived from data provided by the SCP. The age pattern of the benefits is based on information provided by iMTA (a research institute on healthcare and long-term care issues). Long-term care provision is an income- and wealth-tested provision.

[26]Appendix 2 provides more detailed information on the benefits from education for the six groups. It should be noted that the individual's benefit from education is defined here as the government's cost of education. These benefits do not include the increase in (future) wages that result from the education. In this interpretation, the level of education of individuals is assumed to be independent of the government's provision of it. The government's provision is thus considered solely to replace private funding.

[27]The definition of benefits from housing schemes that is used in this paper differs from the definition of housing subsidization that is commonly used in the literature. The definition here includes the tax savings on indirect taxes that result from a household's expenditure on housing. This is necessary because our calculations on the tax burden also include indirect taxes (see the previous section), and thereby assume that net income is totally consumed. Expenditure on housing reduces the part of the household's spending that is subject to indirect taxation (hence the correction for indirect taxation).

Another difference with the usual definition of housing subsidization is that this paper does not include, in its definition, the tax avoided on alternative investments. It takes account only of the "direct" net tax savings.

TABLE 6
NET LIFETIME BENEFITS FROM HOUSING SCHEMES (PRESENT VALUES, THOUSANDS OF EUROS)

	On Rental Housing	On Owner-Occupied Housing	Total
Basic	17.8	0.0	17.8
Lower secondary	10.3	4.3	14.6
Higher secondary	3.1	12.6	15.7
Lower vocational	2.5	12.1	14.6
Higher vocational	–0.2	27.7	27.5
University	–0.4	35.6	35.2

calculations on rental housing take account of the effects of housing allowances, which are negatively related to income, and the user's part of the local property tax. The tax treatment of owner-occupied housing is covered in this section because it involves a tax-favored scheme that leads to a net benefit for the owner. Moreover, it allows a closer comparison to rental subsidization.

It is assumed that all households are renters from the age at which they leave the educational system until the age of 30. After the age of 30, the households with only basic education all continue to be renters for the rest of their lives. For the households with a lower secondary level of education, we assume that 30 percent become homeowners at the age of 30. These figures are assumed to be 60 percent for households with lower vocational and higher secondary levels of education. In the cases of the highest two levels of education (higher vocational and university) all households become owner-occupiers at the age of 30. The prices of the purchased houses rise with the level of education.[28]

The table shows that the benefits from rental housing decrease with education (income). This results from the system of housing allowances. In contrast, net benefits from the scheme on owner-occupied housing increase with education due to the combined effect of higher house prices (involving higher mortgages), higher levels of income entailing a higher tax rate at which mortgage interest payments can be deducted,[29] and a higher share of owner-occupiers. On balance, benefits from housing schemes decrease at the lower levels of education and tend to rise significantly at the higher levels.

Table 7 compiles the data in Tables 4–6 and presents the present values of lifetime costs for the government. It shows a relatively flat pattern of these costs across the range of educational levels. The only exception is formed by the highest

[28]These prices are respectively €100,000 for lower secondary education, €150,000 for both higher secondary and lower vocational, €200,000 for higher vocational and €250,000 for university. It is assumed that the people remain living in a house of this price for the rest of their lives and move, in line with the national average, every 15 years. The house is fully financed by a combination of a mortgage and a capital insurance. The latter is designed in such a way that the accumulated sum exactly suffices to redeem the mortgage after 30 years. The interest rate on the mortgage is 5 percent in nominal terms. The tax advantage on the deduction of interest payments is therefore nominally constant throughout the 30 years. The taxes on owner-occupied housing, in contrast, are assumed to rise with inflation because these taxes (the imputed rent for income taxation, the local property tax and the transfer tax) are all based on the current house price. It is assumed that house prices rise in line with inflation.

[29]Since mortgage interest payments are deductible from personal income, the progressive personal income tax system applies (see Appendix 1).

TABLE 7

TOTAL BENEFITS FROM PUBLIC SCHEMES (IN PRESENT VALUES, THOUSANDS OF EUROS)

	Cash Transfers	Non-Cash Transfers	Housing Schemes	Total
Basic	86.7	167.7	17.8	272.2
Lower secondary	85.1	158.8	14.6	258.5
Higher secondary	85.5	150.5	15.7	251.7
Lower vocational	85.6	171.2	14.6	271.4
Higher vocational	88.5	166.2	27.5	282.2
University	88.5	197.9	35.2	321.6

TABLE 8

TOTAL BENEFIT RATIOS[a] FROM PUBLIC SCHEMES (IN %)

	Cash Transfers	Non-Cash Transfers	Housing Schemes	Total
Basic	29.1	57.0	6.0	92.2
Lower secondary	22.0	41.3	3.8	67.1
Higher secondary	15.3	27.2	2.8	45.3
Lower vocational	14.9	30.0	2.6	47.5
Higher vocational	11.4	21.6	3.6	36.6
University	8.4	19.0	3.4	30.8

[a]Defined as the present value of transfers (presented in Table 4) relative to the present value of lifetime labor incomes (presented in Table 1).

level (for which the costs are somewhat higher). Table 8 expresses these data relative to the present values of lifetime labor income. It shows that the share of total benefits from government expenditure in lifetime income (see the last column) strongly declines with the level of educational attainment (or lifetime income), and that the benefit side, therefore, in contrast to the tax side, works out in a highly progressive way.

The first column of Table 8 focuses on cash transfers. This makes it possible to compare measurements of the redistributive effect of cash transfers in the U.K. and Australia (see Falkingham and Harding, 1996). Table 8 reveals a drop of the ratio of cash transfers to lifetime income by 20.7 percentage-points between the lowest and the highest groups. In the U.K. and Australia these figures are around 27 percentage-points and 22 percentage-points respectively. The Dutch system of cash transfers thus shows a progression that is roughly similar to that in Australia and is less progressive than that in the U.K.

5. LIFETIME REDISTRIBUTION

5.1. *Lifetime Outcomes*

Table 9 presents the net lifetime burdens from government for the six groups in the case of the single-person household. They are calculated as the balance of the burden from taxation and the benefits from government expenditure that were presented in Sections 3 and 4, respectively. Note that the coverage of the tax side of the government budget exceeds that of the expenditure side by a large margin. The net results presented here therefore overestimate the overall net tax burden. In

TABLE 9

NET LIFETIME TAX BURDENS

	In Present Values (thousands of euros)	As % of Own Lifetime Wages
Basic	–116.6	–39.6
Lower secondary	–54.0	–14.0
Higher secondary	50.3	9.1
Lower vocational	33.6	5.9
Higher vocational	139.1	18.0
University	247.8	23.7

TABLE 10

LIFETIME DISTRIBUTION OF WEALTH, BEFORE AND AFTER GOVERNMENT INTERVENTION, IN PRESENT VALUES (RELATIVE TO WEIGHTED AVERAGE)

	Lifetime Wages	Net Lifetime Tax Burden	Lifetime Welfare
Basic	294.1 (48.3)	–116.6	410.7 (73.9)
Lower secondary	384.5 (63.2)	–54.0	438.5 (78.9)
Higher secondary	554.0 (91.0)	50.3	503.7 (90.6)
Lower vocational	569.9 (93.7)	33.6	536.3 (96.5)
Higher vocational	769.6 (126.5)	139.1	630.8 (113.5)
University	1,043.7 (171.5)	247.8	795.9 (143.2)
Weighted average	608.5 (100)		555.7 (100)
Gini-coefficient	0.187		0.106

Table 9, therefore, it is the differences in the net lifetime burdens rather than their levels that should be interpreted as the measure of redistribution.

The first column of Table 9 expresses the net lifetime tax burdens in thousands of euros. It shows that, even with the incomplete coverage of expenditure, the net burdens for the low-educated groups are negative. For the group with only basic education it amounts to €–116,600. At the higher levels of education the burden is positive and reaches a level of €247,800 for those with university training. The second column presents these figures relative to lifetime earnings. It points out that the composite effect of the system of taxes and transfers features a high level of progression. Whereas the welfare of the lowest two groups is increased by the government by 39.6 percent and 14.0 percent respectively, it is *reduced* for the higher groups—and at a rate of 23.7 percent for the highest of them.

Table 10 shows how redistribution by the government changes the lifetime welfare of the six groups, both in absolute terms as well as in terms of their relative positions with respect to the (weighted) average. Note that the term "welfare" may be misleading. In these calculations, it includes the sum of after-tax incomes from wages, pensions and government transfers as well as non-cash transfers. However, it does not include leisure time and does not take into account the fact that the benefits from healthcare and long-term care may only be a compensation for bad health. For these reasons, the measured differences in welfare may also be misleading.

It turns out that the redistribution raises the lifetime welfare of the group with basic education from €294,100 to €410,700. Their welfare position relative to that

of the average of the population is raised from 48.3 to 73.9 percent. At the other end of the spectrum, welfare for those with a university education is reduced from €1,043,700 to €795,900, which means that a 71.5 percent above-average position is reduced to 43.2 percent. The system of taxes and transfers thus reduces the relative wage position between these two groups, which is 3.5, to a relative welfare position of less than 2. The Gini-coefficient measure of inequality, which is 0.187 for lifetime wages, becomes 0.106.[30] The difference in absolute terms, equaling 0.081, can be considered to be a measure of the reduction in inequality brought about by the government. The size of the reduction depends on the combined effect of the initial inequality and the leveling power of the system of taxes and transfers. The latter of these two factors may best be measured by the reduction in the Gini in *relative* terms. This turns out to be around 43 percent.[31]

It should be noted, however, that these calculations of the Gini-coefficient involve an underestimation of the actual values because the measurements ignore within-group inequality. Moreover, inheritances, which mainly accrue to high-income groups, are not included in these measurements. The underestimation of inequality in lifetime welfare, however, is mitigated to some extent, since the taxation of non-institutionalized, personal wealth is also not included.[32]

As mentioned above, these measurements are restricted to the case of a single-person household with no children. This has the disadvantage that redistribution between types of households, which occurs as a result of the fact that the tax and transfer schemes do actually depend on family situation, is not covered by the measurements. Examples of these are the public pension scheme (where benefits per person are lower in case of a couple than in case of a single), the public healthcare system and certain aspects of taxation.

The restriction to a single person household does not significantly affect the size of redistribution between those with a high lifetime income and those with a low lifetime income, however, because its major determining factors apply to other types of households as well. Also, in the case of couples with either double or single incomes, the tax burden rises with income in a roughly proportional way whereas benefits from government expenditure remain relatively constant. This can be derived from an inspection of the system of income taxation and the system of cash and non-cash transfers.

5.2. *A Comparison with an Annual Measurement of (Re)Distribution*

As mentioned in Section 2.2, SCP presents information on the annual distribution of before-tax incomes, after-tax incomes and welfare (see SCP, 2003, p. 157). The groups are classified into deciles on the basis of these variables.

[30]The calculation of the Gini-coefficient had to be adjusted here in order to take account of the fact that the groups differ in size. This is done by weighing the data accordingly.

[31]A sensitivity analysis, which is not presented in this study, points out that the results are not sensitive for changes in the discount rate. This analysis is presented in ter Rele (2005, Section 6.1; see www.cpb.nl).

[32]This is especially so for the exclusion of the impact of the taxation of personal wealth that is acquired through saving from labor income. This exclusion does not change the distribution of lifetime wages but does, in contrast, lead to an underestimation of the tax burden of the saving part of society, which consists mainly of individuals with high levels of education. This exclusion thus upwardly biases the Gini-coefficient for lifetime welfare.

TABLE 11
Distribution of Before-Tax Incomes and Welfare on an Annual Basis

Decile	Before-Tax Incomes	Relative Position	Welfare	Relative Position
1	0.0	(0%)	0.5	(5%)
2	0.0	(0%)	3.7	(37%)
3	0.5	(5%)	5.4	(54%)
4	2.5	(25%)	6.7	(67%)
5	6.2	(62%)	8.0	(80%)
6	9.1	(91%)	9.5	(95%)
7	11.7	(117%)	11.1	(111%)
8	15.2	(152%)	13.1	(131%)
9	20.0	(200%)	16.1	(161%)
10	34.8	(348%)	26.0	(260%)
Gini-coefficient	0.556		0.369	

Source: SCP (2003).

Table 11 summarizes these results by presenting the before-tax distribution of income as well as the distribution of welfare after taking account of taxes paid and benefits from government programs. It shows that both distributions are substantially more unequal than their lifetime counterparts, which were measured above. Ignoring within-group inequality, it can be calculated from these data that the Gini-coefficients are now 0.556 for before-tax income and 0.369 for welfare (see the last row), compared to respectively 0.187 and 0.106 in the lifetime calculations. Moreover, the size of the redistribution carried out by the government, as measured by the difference between these numbers, turns out to be substantially larger in the annual measurement than it is in the lifetime calculations (0.187 vs. 0.081). These findings correspond to the insight, discussed in Section 2.1, that lifetime calculations undo income measures of temporary effects and also undo the measure of redistribution from the intrapersonal element ingrained in the system of taxes and transfers.

These differences in outcome, however, cannot be attributed solely to the difference between lifetime and annual approaches. This study includes only single-person households whereas the SCP includes all households—and both calculations differ to some extent in their coverage of taxes and transfers and in their measure of income. Moreover, neither of the calculations of the Gini-coefficient include within-group inequality. This leads to a downward bias in the outcomes that may be larger in the lifetime calculations as these are carried out with a smaller number of groups (six vs. ten). However, the measured differences in inequality are so large that the difference in approach probably plays a major role. This point can be illustrated by the first two deciles of households in the annual calculations, which feature zero before-tax (primary) incomes. These deciles typically contain students and the retired and unemployed, which are only temporary situations in the course of a lifetime.

6. A Comparison with Other Studies on Lifetime Redistribution

As stated in the introduction this study principally offers a more comprehensive way of establishing the redistributive effects of the system of taxes and

transfers than is usually the case. Compared to the other ways that inequality of income and redistribution of the government is measured in the Netherlands, and presented to policymakers, this study offers several extensions. These are discussed in Section 2.1. The major extension offered here is that it establishes the distributional effects on a lifetime basis. Currently, such measurements do not play a role in the policy debate.

Although several academic studies follow a lifetime approach, most are less comprehensive in that they cover a smaller part of the system of taxes and transfers. This study follows a simpler technique, however: it constructs a number of typical life patterns for incomes, taxes paid and benefits from the government that are each representative for that particular level of educational attainment. This is done for the full range of levels of education, and the differences in lifetime net benefits from the government between these groups serve as the measure of redistribution. Other studies use a dynamic micro-simulation technique. They draw their life patterns from a database that enables them to classify households directly on the basis of (lifetime) income, and do not have to rely on an indicator for it.

Nelissen (1998) measured how a lifetime approach compares to an annual approach in determining the size of redistribution in the Netherlands. He used a dynamic micro-simulation model and restricted the coverage of his analysis to the social security system. He concluded that, for the reasons outlined above, the lifetime measurement shows a smaller amount of redistribution than the annual one.

Several studies followed a similar methodology for the United States, both in terms of technique and coverage. Liebman (2001), Coronado *et al.* (2000) and Gustman and Steinmeier (2000) explored whether or not the social security system is progressive. All three studies conclude that it is progressive. The latter also conclude that a large part of redistribution involves transfers from men to women and, within families, from primary to secondary earners.

Davies *et al.* (1984) compared lifetime and annual measurements and concluded that the size of the progression is similar. Their measurements, however, included only the tax side of the government.

Fullerton and Rogers (1994, 1996) focused their analysis on taxation and explore how changing the composition of taxation affects lifetime distribution. They restricted their analysis to policy *changes* and did not measure the full distributional effect of the current system. Their approach deviated from those above by measuring the effects in terms of utilities and the corresponding equivalent variations. Altig *et al.* (2001) followed a similar approach.

Falkingham and Harding (1996) measured lifetime redistribution for Australia and the United Kingdom. They covered all households and included direct taxes, social security payments and cash transfers. As the other authors did, they concluded that the government system results in a redistribution from high-income groups to low-income groups. For Australia the Gini-coefficient of market (before-tax) incomes and disposable incomes were, respectively, 0.370 and 0.273. For the U.K., these numbers were respectively 0.327 and 0.245.

For Sweden, Petterson and Petterson (2003) carried out a similar analysis and arrived at the same conclusion. The latter study offered coverage of the system of taxes and transfers that is similar to that of this study. They arrived at Gini-

coefficients for lifetime "market income" and lifetime "total income" of respectively 0.111 and 0.084. As our measurements of the Gini (respectively 0.187 and 0.106) are biased downwards (due to the fact that within-group inequality is not taken account of), this may indicate that the Swedish distribution of lifetime income and welfare is substantially more egalitarian than that of the Dutch.

Finally, Salas and Rabadán (1998) measured the effects of inequality on social welfare in Spain, and explored how this is affected by the Spanish system of personal income taxation. They used convex inequality indices to measure the welfare loss due to inequality. The measurements distinguished the inequality resulting from differences in lifetime income between households and the inequality due to fluctuations in income during a household's lifetime.

7. Conclusions

This study aims to establish, as comprehensively as possible, how the Dutch system of taxation, cash transfers and non-cash transfers redistributes between the rich and the poor. Such a level of comprehensiveness implies that the measurements must comprise the full life cycle of individuals, and that all taxes and transfers that have a redistributive effect must be included in the measurements.

The study concludes that the system of taxes and transfers leads to a substantial redistribution of welfare from individuals with a high lifetime income to individuals with a low lifetime income. This follows from the fact that lifetime tax liabilities rise roughly in line with lifetime incomes, whereas lifetime benefits from expenditure turn out to be roughly constant across the range of income levels. The latter finding is the result of benefits from education and subsidies on housing and cultural facilities that rise with lifetime incomes and benefits from healthcare and long-term care that show an almost as large decline with income.

When expressed relative to lifetime primary earnings, the overall tax system shows a very small rate of progression. This is the net result of a modestly progressive system of direct taxation and the regressive effect of indirect taxation. Benefits from transfers decline sharply as a ratio of lifetime income.

As a result, welfare inequalities become substantially smaller. An indication for this is that the ratio that expresses the relative welfare position between average persons of the highest and lowest levels of education is reduced from 3.5 to less than 2. The measurements in this study also show that the Gini measure of inequality, which is 0.187 for lifetime primary incomes, is reduced to 0.106, or by 0.081. Both measures are smaller than when inequality is measured on an annual basis. It can be calculated on the basis of SCP data that the annual equivalents of both numbers are respectively 0.556 and 0.369, implying a reduction in inequality of 0.187. The smaller inequality in the lifetime outcomes results from the fact that, over their life cycles, the earnings of individuals show large fluctuations that are averaged out in the lifetime measurements. The reduction in inequality by taxes and transfers is also smaller in the lifetime calculations. This follows from the fact that they tend to reallocate income over an individual's life cycle, mainly though the social security system, healthcare and long-term care. This effectively intrapersonal element in annual redistribution is eliminated in the lifetime measurements.

Appendix 1: The System of Taxing Labor and Pension Income

Table A1 provides a broad and stylized explanation of the Dutch system of taxing labor income by presenting the wedge between labor costs and net disposable income for a number of wage levels. In rows 1–8, the wedge is expressed in terms of monetary values and in terms of a percentage of labor costs. Row 9, of which the percentages correspond to the "until 65" tax burden presented in Figure 3, shows that at low wage levels the total tax rate is low, rises sharply to around 40 percent at somewhat higher wage levels and remains roughly constant after that. Row 10 shows that the progression at the low wage levels is almost fully due to the wage subsidy that is provided at low wage levels. Corrected for the wage subsidy, the rate of taxation (consisting of both employers taxes and personal taxes) remains at a fairly constant rate of around 40 percent of labor costs across the whole range of wage levels. This is in spite of the fact that the system of *personal* income taxation is progressive as is pointed out in row 12, which expresses personal taxes as a percentage of taxable income (gross wages minus the employees pension premium). The reason for this relative constancy in the rate of total taxation (as a percentage of labor costs) lies in the maximization of the employer's social security contribution (see row 3), which was included in taxes in the main text, and in the fact that the percentage of total pension premiums, which are tax deductible, rises with income (see row 11). These factors turn out to almost fully offset the progression at the personal level. Apart from the effect of the wage subsidy, which was abolished in 2006, the taxation of labor income therefore shows only a very small rate of progression.

TABLE A1

Decomposition of Total Wage at Various Wage Levels (as % of labor costs)

Gross Wage Level	Minimum Wage		1.6 × Min. Wage		3.2 × Min. Wage		5 × Min. Wage	
(1) Labor costs	16,739	(100)	31,290	(100)	61,943	(100)	96,635	(100)
(2) Employer's pension premium	0	(0)	1,400	(4.5)	5,205	(8.4)	9,771	(10.1)
(3) Employer's taxes	2,950	(17.6)	4,890	(15.6)	6,738	(10.9)	6,864	(7.1)
(4) Wage subsidy (–)	–2,011	(–12.0)	0	(0)	0	(0)	0	(0)
(5) Gross wage	15,800	(94.4)	25,000	(79.9)	50,000	(80.7)	80,000	(82.8)
(6) Employee's pension premium	0	(0)	414	(1.3)	1,539	(2.5)	2,889	(3.0)
(7) Personal tax	3,428	(20.5)	7,392	(23.6)	18,502	(29.9)	33,427	(34.6)
(8) Net disposable income	12,372	(73.9)	17,194	(55.0)	29,960	(48.4)	43,685	(45.2)
(9) Total taxation (3 + 4 + 7)	4,367	(26.1)	12,282	(39.2)	25,240	(40.8)	50,549	(41.7)
(10) Idem, excl. wage subsidy (3 + 7)	6,378	(38.1)	12,282	(39.2)	25,240	(40.8)	50,549	(41.7)
(11) Total pension premiums (2 + 6)	0	(0)	1,814	(5.8)	6,744	(10.9)	12,668	(13.1)
(12) Personal tax rate (7/(5 – 6))	21.7%		30.0%		38.2%		43.3%	
(13) Marginal personal tax rate	37.85%		42%		42%		52%	

For the purpose of deducting mortgage interest payments, however, it is only personal taxation that matters because these payments can be deducted from the tax base, which determines the personal tax burden. As these payments are deducted from taxable income, it is the marginal personal tax rate (row 13 of Table A1) that is the relevant concept in determining the part of the costs covered by the government.

Table A2 presents the gap between total pension income and net disposable pension income for the same levels of gross income as in Table A1. The system is simpler than the system for the under-65 age group because pension premiums, the employers' wage contributions and wage subsidies are absent. The rate of personal taxation is now lower than it is for those under the age of 65, due to the tax rates in the first two tax brackets.

TABLE A2

Decomposition of Total Pension at Various Pension Levels (as % of labor costs)

Gross Pension Level	Minimum Wage		1.6 × Min. Wage		3.2 × Min. Wage		5 × Min. Wage	
(1) Gross pension	15,800	(100)	25,000	(100)	50,000	(100)	80,000	(100)
(2) Personal taxation	2,464	(15.6)	4,605	(18.4)	15,248	(30.5)	30,848	(38.6)
(3) Net disposable pension	13,336	(84.4)	20,395	(81.6)	36,495	(69.5)	49,152	(61.4)

Appendix 2: The Benefits from Public Expenditure

Cash Transfers

The benefits from public pensions are constructed by simply attributing the annual transfer for all singles from the age of 65 until death. This amounts to €11,020 per person in 2002.

In the case of the other transfers the procedure is more complicated. The benefits in these cases depend on a number of aspects. For the disability and unemployment schemes it involves the impact of differences in the probabilities of flowing into these schemes and differences in benefit levels. In the case of social assistance, benefits are unrelated to previous income and therefore only the probability matters. The overall age profile of expenditure on these schemes is derived from SCP (1994) and only indexed to correspond to the 2002 aggregate data. The next stage differentiates between the groups by using data on the relative probabilities of being a beneficiary. In the case of the disability scheme, the available data on these probabilities are provided by Statistics Netherlands. They show the probabilities of flowing into the scheme across wage levels and ages. As these flow probabilities are roughly constant across ages in relative terms, and decline with income, this also indicates that the stock of beneficiaries of various (previous) income levels is roughly constant in relative terms and declines with income. This can be translated into the relative use of this scheme (the relative stock of beneficiaries) for the educational levels we distinguish and subsequently combined with the construction of the scheme itself which links an individual's benefit to (previous) gross income up to the level of around €42,000 on an annual basis. Above this

level it is constant. Combined, the increasing benefit level with a rising level of education turns out to outweigh the declining probability factor for the lower levels of education. At the higher levels, where (previous) incomes are over €42,000 for a substantial part of an individual's career, the probability factor is slightly dominant.

In the case of the unemployment scheme, the data on the probability of unemployment are provided by the SCP. These data directly link these probabilities to educational levels and show a declining use of the scheme with rising education. However, this decline is smaller than it is in the disability scheme. The benefit scheme is similar. Combined, this leads to a more constant rise of the overall benefit.

In the case of social assistance the probability data are also provided by the SCP. They show a sharp declining relation with the level of education, which directly translates into the relation for the overall benefit from this scheme.

Healthcare

The use of healthcare provisions is based on age profiles of the components of this sector, provided by iMTA, and information of the SCP on the (relative) use by the groups of the various educational levels. The latter information is available only for visits to general practitioners and medical specialists, visits to dentists and nights in hospitals. Age profiles on these components for each educational group are constructed by adjusting the overall age profile of it (from iMTA) with a factor that is derived from the SCP information. Since for the rest of this sector there was no information on differences between the groups, we therefore assumed its use to be equal for all groups.

As these data on components were based on information in past years the results had to be indexed by an across-the-board factor, which is derived by comparing the aggregate that results from this exercise by the actual aggregate for 2002.

Long-Term Care

This procedure is similar to that of healthcare. It also involves combining information of iMTA on overall age profiles for the various components of this sector with information on the (relative) use of these components provided by the SCP. For the nursing homes there was direct information available on the use of the various groups. The relative use of these provisions is used to construct the age profiles for the various educational levels. For the other components within long-term care the relative use was approximated on the basis of information in SCP (2003) which presents a breakdown of their use on income rankings.

Cultural and Recreational Facilities

The overall age profile here is assumed to be zero until the age of 20 and flat thereafter, implying an equal benefit for everybody over the age of 20. The aggregate expenditure on this item, as well as its relative use, is (again) provided by the SCP.

Education

Figure A1 presents the age-specific benefits from education for the six groups. They are derived from aggregate data on the various forms of education that are presented in the government budget (see Ministry of Finance, 2001), and transformed into these age-specific expenditure patterns by dividing the aggregates by the number of students in each of these levels of education. Figure A1 shows that higher levels of education involve a longer stay in the educational system and thus a higher cost to the government. The increase in cost is especially marked for the individuals with a university level of education because this form of education is expensive, even in annual terms. Note that expenditure on university education does not contain the part of the costs of universities that involves research.

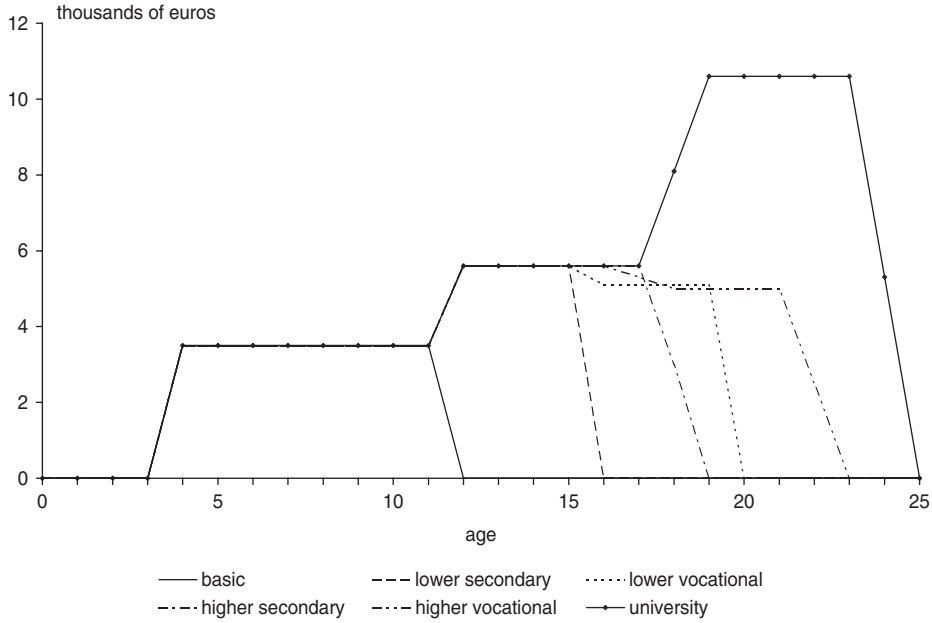

Figure A1. Age-Specific Costs of Education

References

Altig, David, Alan J. Auerbach, Laurence J. Kotlikoff, Kent A. Smetters, and Jan Walliser, "Simulating Tax Reform in the United States," *American Economic Review*, 91, 574–95, June 2001.

CBS, *Sociaal-economische maandstatistiek 2000|04, Loon naar opleidingsniveau en beroep (The dependency of wage levels on educational attainment and profession), 1997*, Voorburg, 2000.

CPB, *Macro Economische Verkenning 2005 (Macro Economic Outlook 2005)*, Sdu Publishers, The Hague, 2004.

Coronado, Julia L., Don Fullerton, and Thomas Glass, "The Progressivity of Social Security," NBER Working Paper 7520, Cambridge, MA, 2000.

Davies, James, France St-Hilaire, and John Whalley, "Some Calculations of Lifetime Tax Incidence," *American Economic Review*, 74, 633–49, September 1984.

Falkingham, Jane and Anne Harding, "Poverty Alleviation Versus Social Insurance Systems: A Comparison of Lifetime Redistribution," in A. Harding (ed.), *Microsimulation and Public Policy*, North Holland, Amsterdam, 1996.

Fullerton, Don and Diane L. Rogers, "Distributional Effects on a Lifetime Basis," NBER Working Paper 4862, Cambridge, MA, 1994.
———, "Lifetime Effects of Fundamental Tax Reform," in Henry Aaron and William Gale (eds), *Economic Effects of Fundamental Tax Reform*, Brookings Institution Press, Washington, DC, 1996.
Gustman, Alan L. and Thomas L. Steinmeier, "How Effective Is Redistribution Under the Social Security Benefit Formula?" NBER Working Paper 7597, Cambridge, MA, 2000.
Liebman, Jeffrey B., "Redistribution in the Current U.S. Social Security System," NBER Working Paper 8625, Cambridge, MA, 2001.
Ministry of Finance, *Begroting Onderwijs Cultuur en Wetenschappen 2002 (Budget for Education, Culture and Sciences 2002)*, Sdu Publishers, The Hague, 2001.
Nelissen, Jan H. M., "Social Security and Lifetime Income Redistribution: A Microsimulation Approach," in A. Harding (ed.), *Microsimulation and Public Policy*, North Holland, Amsterdam, 1996.
———, "Annual Versus Lifetime Redistribution by Social Security," *Journal of Public Economics*, 68, 223–49, 1998.
Petterson, Thomas and Tomas Petterson, "Lifetime Redistribution through Taxes, Transfers and Non-cash Benefits," Paper presented at the International Microsimulation Conference on Population, Ageing and Health in Canberra, December 2003.
Roodenburg, H. and D. van Vuuren, *Arbeidsaanbod in de lange termijn scenarios voor Nederland (Labour supply in long term scenarios for the Netherlands)*, CPB Document 71, The Hague, 2005.
Salas, Rafael and Isabel Rabadán, "Lifetime and Vertical Intertemporal Inequality, Income Smoothing, and Redistribution: A Social Welfare Approach," *Review of Income and Wealth*, 44, 63–79, March 1998.
SCP, *Sociaal en Cultureel Rapport 1994 (Social and Cultural Report 1994)*, The Hague, 1994.
———, *Profijt van de overheid, De personele verdeling van gebonden overheidsuitgaven en -inkomsten in 1999 (Benefits from the government, The personal distribution of assigned government expenditure and revenues in 1999)*, The Hague, 2003.
ter Rele, Harry, "Measuring Lifetime Redistribution in Dutch Collective Arrangements," CPB Document 79, The Hague, 2005.
TNO Preventie En Gezondheid, *Gezonde levensverwachting naar sociaal economische status (The dependency of healthy life expectancy on social economic position)*, Leiden, 2002.