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Measuring lifetime redistribution in Dutch collective arrangements

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Abstract in English

This paper assesses how the system of Dutch collective arrangements redistributes between the rich and the poor. Its approach deviates from the way these issues are commonly dealt with by incorporating the full life cycle in the measurements, rather than only the annual effects, and by including a larger part of the arrangements than is usually the case. The measurements on redistribution are carried out using the level of educational attainment to classify the population. For an average, representative person of each level of education we measure, in terms of present values, the average net benefit from government. The results show that the net benefits are positive for the lower levels of education and negative for the higher levels. The figures indicate a sizable redistribution from the rich to the poor and a significant reduction of welfare inequality. The net effect on income inequality is, however, substantially smaller than when it is measured on an annual basis.

Key words: lifetime redistribution, comprehensive measurement

Abstract in Dutch

Deze studie meet in welke mate het Nederlandse stelsel van collectieve arrangementen herverdeelt tussen 'rijk' en 'arm'. De benadering wijkt af van de gebruikelijke door de volledige levensloop in de berekening te betrekken, in plaats van alleen de jaareffecten, en door een groter deel van de arrangementen mee te nemen. Bij de bepaling van de omvang van de herverdeling wordt de bevolking ingedeeld op basis van opleidingsniveau. Vervolgens wordt voor een representatief persoon van elk opleidingsniveau gemeten hoe groot, over de gehele levenscyclus gemeten, het netto profijt van de overheid is in termen van contante waarden. De berekeningen wijzen uit dat het netto profijt bij lage opleidingsniveaus positief is en bij hoge opleidingsniveaus negatief. De uitkomsten duiden op een aanzienlijke herverdeling van 'rijk' naar 'arm' en een substantiële verkleining van welvaartsverschillen. Het netto effect op de inkomensongelijkheid is echter aanzienlijk kleiner dan wanneer deze wordt gemeten op jaarbasis.

Een uitgebreide Nederlandstalige samenvatting is beschikbaar via www.cpb.nl

Steekwoorden: herverdeling over de levenscyclus, omvattende berekening

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Preface

Over the last years, the welfare effects of government policies in the Netherlands have increasingly been analysed by comprehensively determining its effects over the full life cycle of individuals. Until now, these analyses focussed on the implications of policies on the lifetime welfare of generations as a whole and on the often conflicting interests between generations. The issue of equity within generations, however, has not yet been comprehensively addressed on a lifetime basis. This study aims to fill this gap by measuring lifetime redistribution in the system of Dutch collective arrangements and the resulting lifetime distribution of welfare.

This study has been carried out by Harry ter Rele. It benefited from the contribution of many people. Adriaan van Hien developed the model that was required to carry out the calculations. Peter Eering carried out part of the calculations and Edwin van Gameren provided some of the necessary data. In addition, this study benefited significantly from the comments of Casper van Ewijk, Cees Jansen, Marcel Lever, Ruud de Mooij, Jan Nelissen, Rocus van Opstal, and Ed Westerhout on earlier drafts. Valuable suggestions were also made by Frits Bos, Peter Kooiman, Richard Nahuis, Evert Pommer and Michiel Ras.

Henk Don
Director CPB

Summary

This paper assesses how the current system of Dutch collective arrangements redistributes between the rich to the poor. Its approach deviates from the way this issue is commonly dealt with by being more comprehensive. It is so in three ways: a) it covers the effects of collective arrangements over the full life cycle of individuals rather than only the annual effects; b) it covers a larger part of these arrangements than is usually the case and c) it estimates the full redistributive effect of the system of arrangements rather than only the effect of a policy change.

The main innovative contribution of this paper lies in the extension of the measurements to the full life cycle. Measured over the full life cycle, the distribution of welfare and the size of the redistribution between individuals carried out by government may differ substantially from their annual counterparts. There are two reasons for this. The first is that burdens and benefits from government change in the course of life due to the life cycle dependencies ingrained in the system of public arrangements. Due to this pattern net contributors to the public coffers in one stage of life are likely to be net beneficiaries in another stage of life, entailing that the redistribution that takes place through collective arrangements contains an intra-personal component which blurs the picture regarding lifetime interpersonal redistribution. The second reason why life cycle calculations lead to deviating outcomes is that labour incomes show substantial changes during one's career. For these reasons the more comprehensive lifetime measurements may be considered to provide a better indication of the overall welfare situation of individuals and how it is affected by collective arrangements.

On a lifetime basis, the size of redistribution depends on the net effect of the separate arrangements. The influences of these arrangements occur at different stages of the life cycle and are to some extent counterbalancing. As shown in this paper, high lifetime income earners typically feature high lifetime tax burdens and low benefits from health care relative to low lifetime income earners. On the other hand, they are relatively large beneficiaries from government expenditure on education, cultural facilities, housing subsidies and tax favoured saving through the second pillar pension system. The purpose of this paper is to assess how all these factors work out on balance. It does so by determining the present values of the balance of taxes paid and benefits received from public expenditure 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 them we calculate the lifetime primary income of an average person of that level as well as the resulting lifetime welfare after taking account of the impact of taxes and benefits from government expenditure. The size of the redistribution is measured by the differences between the distribution of lifetime primary incomes and the distribution of lifetime welfare.

Because the classification is not based on lifetime income itself but on educational attainment the results of the measurements are not a direct measure of redistribution between the rich and poor. However, as educational attainment is the major determinant of career patterns, this categorisation serves well to construct a spectrum of lifetime incomes which is representative for that in society.

The results in this study show that government arrangements lead to a substantial redistribution in welfare from groups with a high lifetime income to groups with a low lifetime income. Whereas the lifetime taxes roughly rise in line with lifetime earnings, showing a slight rate of progression, lifetime benefits from expenditure turn out to be roughly constant, resulting in a ratio of lifetime benefits to earnings that decreases sharply with income. As a result, welfare inequalities become substantially smaller. An indication for the size of the redistribution is that the ratio that expresses the relative lifetime welfare position between average persons of the highest and the lowest level of education is reduced from 3.5 to less than 2. The Gini-coefficient of inequality which is 0.187 for the before-tax, or primary, lifetime incomes is reduced to 0.106 due to the combined effects of taxation and benefits from government expenditure. A comparison of these with the Gini-coefficients, which can be derived from measurements of inequality which were conducted by SCP (2003) on annual data, shows that the inequality of incomes as well as the redistribution by government, when measured over the full life cycle, are significantly smaller than their annual counterparts.

To some extent the lifetime redistribution is a consequence of differences in labour participation and the use of collective arrangements. In part however, it is also a direct result of the system of arrangements (tax rates, rights on social security) itself.

Our measurements also show that the lifetime marginal tax burdens are high throughout the whole range of income levels. Over the largest part of the income spectrum the lifetime marginal tax rates on wage income amount to around 55% to 60%. These figures include the effect of indirect taxes. These rates are increased at the lower end of the spectrum if the measurements include the impact of the system of rental subsidisation, which is negatively related to income. At the upper end, in contrast, these rates are slightly lowered if the impact of the deductibility of mortgage interest payments is included. The high marginal tax rates indicate a significant disincentive to participate on the labour market.

1 Introduction

The aim of this paper is to assess how the current Dutch system of collective arrangements 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 way these issues are dealt with in the policy debate in the Netherlands. It is so in three ways: a) it covers the effects of government policies over the whole life cycle; b) it covers a larger part of the arrangements and c) it estimates the full redistributive effect of the system of arrangements. Generally, studies on the redistributive effects of government policies follow a more partial approach by focussing on the annual rather than on the lifetime effects, by including only the effects of a part of the arrangements such as income taxation or certain expenditure items and by focussing 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 collective arrangements or measure the effects of policy changes only[1]. Nelissen (1998) for instance restricts his analysis of lifetime redistribution in the Netherlands to the social security system. Studies on other countries, *e.g.* Coronado *et al.* (2000) on the United States and Falkingham and Harding (1993) on Australia and the United Kingdom, respectively include only the public retirement scheme and direct taxes and transfers. Other studies, *e.g.* Fullerton and Rogers (1996) and Altig *et al.* (2001), do not measure the full redistributive effect of arrangements but focus their analysis on how the lifetime distribution of income *changes* in case of adjustments in the tax system.

Annual redistribution by government is misleading as an indicator of redistribution on a lifetime basis because an individual's income and social economic position and his or her net benefit from collective arrangements does not remain constant throughout life. This follows especially from the fact that burdens and benefits from government change in the course of life due to the life cycle dependencies ingrained in the system of public arrangements and the fact that labour incomes show substantial changes during one's career.

This study measures lifetime redistribution by 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. This variable serves as an indicator for lifetime primary income. The size of the redistribution is measured by the differences between the distribution of lifetime primary incomes and the distribution of lifetime welfare after the impact of taxes and benefits from government have been taken account of.

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[1] These studies are discussed in detail in section 8.

As mentioned above this study is broad in scope in comparison to most other studies that follow a lifetime approach. Another difference is that is uses a more direct and less time consuming technique. Other studies generally use micro-simulation techniques, combined with transition probabilities derived from micro-databases, to construct lifetime histories of earnings, taxes paid and benefits received from government expenditure. This study works with age-specific values for these variables which are constructed on the basis of cross section data, thereby using a technique which is derived from that of Generational Accounting. It starts by constructing several stylised lifetime patterns for earnings which 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. However, as educational attainment is the major determinant of career patterns this categorisation serves well to construct a spectrum of career patterns that is representative to that in society.

The lifetime paths of annual tax payments that correspond to each of these income patterns are generated by using the CPB tax model MICROTAX. The lifetime paths of benefits from government expenditure that are typical for these stylised 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.

As a sort of an extra, this study also includes measurements of lifetime marginal wedges on wage income. Annual measures of incentives to participate on the labour market, such as the marginal tax rate, are limited to the effects within one year. They do not include the effects on future incomes, such as those on second pillar pension rights, housing costs and the level of possible future disability and unemployment benefits. Moreover, several subsidy schemes depend on income. This study includes some of these features in the measurements.

The rest of this paper is structured as follows. The next section discusses the reasons for analysing the distributional effects of collective arrangements on a lifetime basis. It also goes into the methodology of the calculations. Sections 3 till 6 work out the redistributive aspect of the arrangements. 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 government as well as the resulting distribution of welfare. After that, section 6 performs a sensitivity analysis. Section 7 treats the efficiency aspect of the arrangements by calculating the marginal lifetime tax rates on labour income. These calculations include the effect on future pensions and the effects through housing subsidisation. Section 8 compares the methodology of this study with that of other ones and section 9 concludes.

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2 Methodology

The distributional effects of public arrangements in the Netherlands and other countries are usually presented by comparing the effects of policy measures on annual net incomes over a range of income levels and social economic groups. This section discusses why a lifetime approach may be a valuable extension to this kind of analysis.

2.1 Why a lifetime approach to measure redistribution?

2.1.1 The measure of (re)distribution in this study

As mentioned in the introduction this study calculates lifetime redistribution by 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 after the impact of taxes and benefits from government have been taken account of.

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 collective arrangements. 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 health care at old age. Individuals who are net payers to the public sector in one stage of their life, usually the middle stage, are thus net receivers in another stage and ignoring this, as annual calculations do, would entail that the measured redistribution would be an overestimation of the inter-personal redistribution that the system of collective arrangements brings about. To solve this problem a lifetime approach is required. The second reason why a lifetime approach leads to a different result is that it takes account of the fact that labour incomes of individuals show major changes during the course of one's life. People with relatively high lifetime incomes generally feature only average annual incomes during the early stages of their careers and, 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 arrangements. The influences of these arrangements 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 health care and long term care. On the other hand, they are relatively large beneficiaries from

government expenditure on education, cultural facilities, housing subsidies and tax favoured saving through the second pillar pension system. This paper's aim is to assess how all these factors work out on balance. Moreover, by presenting the full distributional effect of current arrangements, rather than only the effects involved in changes of policies, it provides policy makers with the relevant information to form an opinion on the size of redistribution by government, and on the desired direction of equity policies.

2.1.2 Current measures of (re)distribution

The distributional consequences of government policies in the Netherlands are currently presented in two ways which are both annual in their approach. The first of these, and the one that 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)). These effects are calculated for households across the range of before-tax income levels from low until high, and in the various social and economic positions such as wage earners, the unemployed and the retired. This presentation thus focuses on accurately measuring changes in annual net incomes and its distribution. It is less comprehensive than this study's measure of redistribution in the three ways which were mentioned in the introduction. However, by distinguishing social and economic positions it also provides information on other issues than only the distributional one, such as on replacement rates.

The other way the distributional consequences of policies are currently presented, which is conducted by the SCP (see SCP (2003)), is by comparing three measures of annual income distribution, *i.e.* the before-tax distribution of income, the after-tax distribution of income (or the distribution of net disposable income) and the distribution of after-tax income plus the benefits from certain government programs[2]. The third measure shows the eventual distribution of welfare after the effects of collective arrangements have been taken account of. Moreover, by comparing it to the before-tax distribution measure it also shows to what extent the government changes the distribution of welfare. This way of presentation is more comprehensive than the first by including the benefits from a part of government programs in the measure of welfare and by showing the full distributional effect of public arrangements and not only the changes in these variables that a specific policy measure brings about. However, it does not follow a lifetime approach.

2.1.3 Qualifications of the lifetime methodology followed in this study

This paper measures the distributional effects of policies on newborns who are faced with the current system of collective arrangements over the rest of their lives. Therefore, the lifetime coverage of the measurements also involves the disadvantage that it inevitably requires assumptions on future developments. This applies especially to the assumptions with respect to labour participation rates, wage levels and benefits from government programs. This study

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[2] These programs involve a part of income transfers and benefits in kind.

imputes present behaviour (see hereafter). A further source of uncertainty involves the discount rate.

A second qualification is that this study, as most other studies on lifetime redistribution, does not include behavioural feedbacks in its analysis. Levels of labour participation and wages are assumed not to be affected by the system of collective arrangements. Moreover, the welfare concept excludes leisure time. Ideally, these features would be included by using a model with households of heterogeneous skills which incorporates leisure time in its definition of welfare and allows each type of household to find its welfare optimising response to the system of arrangements[3]. The effect of arrangements would then be defined in terms of their effect on the lifetime welfare of households and their 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 because household types may respond differently to the system of arrangements[4].

A third qualification is that the implemented 2002 system of collective arrangements with which the calculations have been carried out is probably unsustainable. The rising costs for government due to the ageing of society require an adjustment of policies at some point in time. As our coverage of collective arrangements is not comprehensive (see hereafter), this means that it is implicitly assumed that these adjustments are found in those arrangements that are not included in the calculations. However, also if the required adjustment would be found in the covered items this omission may be of only minor importance for the determination of the redistributive aspect of policies because the costs of the adjustment will be borne by the population at large and thus not gravely affect the differences between the groups.

A fourth qualification involves the fact that the measurements of redistribution only include single person households. However, as is explained in section 5.1, this restriction is of minor importance for our main purpose which is establishing the redistribution from the lifetime rich to the lifetime poor.

2.1.4   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 make the latter redundant. This would only be the case in a world in which there are no credit restrictions, 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 policy makers to base equity policies on would then be the overall redistribution by government and the resulting

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[3] These behavioural responses would most particularly involve the rate of labour participation. Other responses would involve saving rates and the use of government programs.

[4] There may be two reasons for this. The first is that the changes in trade-offs caused by the system of arrangements may differ between households of different skills due to the fact that these households are for instance faced with different marginal tax rates and replacement rates. The second reason is that household types may differ in their behavioural characteristics.

distribution of welfare as measured over the full course of the life cycle. Its distribution over the life cycle would not be relevant as it could be trusted to be allocated optimally. However, the less 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 the 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, it seems that the lifetime measures are more suitable to base equity policies on as these provide a more comprehensive insight in how government policies work out. Note however that lifetime and annual measures are not separate issues. Political preferences on the lifetime distribution of income obviously require translation into annual policies in order to enable implementation. Moreover, annual concepts of a decent income or poverty are not fixed and unchangeable. They may well be influenced by the more comprehensive lifetime measures 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.

2.2   Classifying the population into groups

Ideally, the lifetime redistribution carried out by government would be expressed by comparing how the various groups, classified on the basis of their lifetime incomes, benefit from collective arrangements. However, data limitations prevent us from ranking lifetime incomes from low to high in a direct way as information on lifetime incomes is not readily available. Constructing these would involve a laborious process of developing a micro-simulation model (see below). To avoid this, we will use the level of educational attainment as a 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 labour participation are related to the level of education and age[5]. As the level of education is strongly related to lifetime income this enables us to construct a range of career patterns and lifetime incomes on the basis of this variable, one for each level of education, which is 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 health care, long term care, government transfers and obviously education itself.

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[5] These cross-section data are provided by the LSO 1997 (see CBS 2000). A similar breakdown for participation rates is provided by the EBB 2002.

However, education is only an indicator for lifetime income. Therefore, using average lifetime earnings for the various levels of education to classify groups from low to high with involves a certain inaccuracy in the determination of the range of lifetime incomes. This applies especially to both extremes of the spectrum as the 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.

We will classify society into six groups of educational attainment: basic education (in Dutch: 'basisonderwijs', which currently covers 7% of the population between the age of 30 and 34[6]), lower secondary education (MAVO/VBO, 18%), higher secondary education (VWO/HAVO, 5%), lower vocational education (MBO, 39%), higher vocational education (HBO, 20%) and university education (WO, 11%). 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, both in terms of range and incidence.

2.3   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 8) in the way it constructs the lifetime paths of incomes, taxes paid and benefits received. Other studies generally use a micro-simulation procedure that starts from a micro-database which contains a breakdown of the population in terms of demography, labour 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 on the labour market and the use of government programs, are used to construct lifetime paths.

This study constructs lifetime paths by elaborating on cross-section data. Careers of labour incomes are based on cross-section data that show how *current* wage levels and rates of labour participation depend on the level of educational attainment and age. These annual data are subsequently translated into virtual lifetime paths of labour income for an average person of each of the six educational levels which were mentioned above. The related levels of taxation are calculated by using the current income tax schedule which is modelled in the CPB tax model MICROTAX for 2002. This serves our purpose well as it is our intention to measure the overall redistributive and incentive impact of the system of public arrangements of that year if

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[6] The shares in this age group are chosen to be used as the weights for the levels of educational attainment in this study. The choice for 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 future levels of it would be underestimated.

effective over one's whole lifetime. 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.

The lifetime paths of benefits from government expenditure are calculated in a two stage process. The first of these constructs age specific benefits for the average citizen by using data provided by SCP (1994). It does this for each of the expenditure items that are included in the calculations. In the second stage we establish the benefits that can be attributed to the six groups we are distinguishing by using available additional information on the relation between the level of educational attainment and the relative use of the expenditure item involved. 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. Using this growth factor seems the best possible representation of the Dutch system of public arrangements as this generally links expenditure to market incomes.

The methodology which is applied in this paper has the advantage of requiring a less laborious and time consuming technique than a micro-simulation procedure. Moreover, by constructing lifetime paths by using current (or recent) cross-section data on government arrangements and projections of future behaviour, such as on participation rates (see hereafter), it also provides information on how the *current* system of public arrangements works out on redistribution. This corresponds to the purpose of this paper. Transition probabilities, as used in micro-simulation models, may be based on measurements over too long a time span and thus contain the impact of past circumstances. The same applies to lifetime paths that are based on longitudinal data acquired by following households characteristics over a number of years. Transition probabilities which are based on a short period of time may have the disadvantage of containing temporary influences such as that of the business cycle.

There are, however, two drawbacks. The first is that using selected representative lifetime paths, as is done in this study, does not lead to a classification of the population that is directly based on lifetime incomes. Therefore, it does not render a representation of the population that exactly corresponds to the actual spectrum of lifetime incomes. This would require the use of a micro-database that represents the whole population rather than the averages of groups, as is for instance done by Nelissen (1993, 1998) and Falkingham and Harding (1993). These studies classify the population into deciles on the basis of lifetime primary incomes.

The second drawback of the methodology of this paper is that it ignores transitional issues. Our analysis does not include the fact that older generations may have histories behind them that may well deviate from the lifetime paths generated by our exercise. This follows from the focus on the effects of current arrangements and, related to this, the restriction of the exercise to newborns. The lifetime position of older generations can therefore not be determined

accurately. This prevents the inclusion of all relevant elements when considering a policy change based on a lifetime view. However, many micro-simulation models have the same sort of limitations in their coverage.

2.4   Further assumptions

As mentioned above this paper aims to provide a broad picture of redistribution as well as of incentives, 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. This set of objectives of the study also translates into the requirement for many assumptions and for a simplification of the methodology. One simplification is that the measurements will focus on only one type of household rather than the whole range of possibilities: a single person household with no children. Extending the coverage of the analysis to other kinds of households would not significantly affect our outcomes. This is explained in section 5. Moreover, it would be time consuming and require many additional assumptions on partner incomes and the assignment of the effects of government arrangements that are related to 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 home ownership depends strongly on lifetime income and age. All owners finance their homes by the combination of a mortgage and a capital insurance ('spaarhypotheek') which is, for tax purposes, the most attractive way[7].

Outside the accumulation of funds in the 'spaarhypotheek' the only other form of savings is through the second pillar pension funds. Here, we assume that that the pension level after retirement at the age of 65, including both the public and the mandatory occupational pension, corresponds to 70% of the average wage during one's career. 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 PAYG-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 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 institutionalised saving.

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[7] 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. This period of 30 years corresponds to the maximum period over which mortgage interest payments are tax deductible.

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%. This rate is calculated by assuming that all indirect taxes are effectively levied on consumption.

2.5 Why a lifetime approach to measure marginal wedges?

As an extra, this study also measures how collective arrangements distort incentives to participate on the labour market. The most commonly used measures for this purpose are the marginal tax rates on annual incomes. Here too however, this annual approach has the drawback of not fully capturing all financial consequences involved. Particularly, it ignores the effects that such changes in labour income can bring about on net incomes in future years. These consist of the effects on second pillar pensions at retirement and the rights on several income dependent public arrangements. Moreover, focussing on the tax side of collective arrangements does not take account of the income dependency of some of the benefits from public arrangements such as housing subsidies (both rental and owner-occupied). Section 7 of this study provides measurements which include some of these additional features.

3 The tax side of collective arrangements

This section treats the burden from taxation that single person households face under the assumptions outlined above. It includes income taxes, social security contributions, private health insurance payments as well as indirect taxes. It also includes the pension system, both in terms of how it defers income and how it affects taxation. However, as in our stylised analysis households are assumed not to accumulate personal savings, it excludes the taxation of non-institutionalised savings as well as the effects of the corporation tax. The tax favoured treatment of owner-occupied housing is treated 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 3.1 presents the average tax rates on labour income for a wide range of income levels[8]. They are defined here as the ratio of taxes, social security contributions and private health care insurance payments in annual income[9], and calculated by using MICROTAX. Figure 3.1 presents the tax rates for individuals under and over the age of 65. For those over 65 the ratios are lower. This is a result of the fact that this group is exempt from paying most of the social security contributions. For those under 65, the tax rate includes the social security contributions that are imposed on the employer[10]. Correspondingly, the tax rate is expressed as a percentage of the total costs of labour for the employer. This reflects the way they are treated in this study. Including these contributions corresponds to the notion that their economic effects do not deviate from the effects of the taxes and social security contributions that are paid by the employees themselves. In other words, it is assumed 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 labour will eventually lead to an (equilibrium) outcome, in terms of employment, total costs of labour for the employer and net incomes of the employee, that is independent of the (initial) division of the liability. The effective wedge faced by the employee therefore includes both the employee's and the employer's tax liability.

Pension contributions to pension funds paid by those under 65 are not included in the definition of taxation because pension funds are classified as private institutions. They are,

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[8] These involve the average rates in box 1 of the Dutch tax system. Taxation under box 1 roughly applies to income from labour, pensions and owner-occupied housing.

[9] Private health care 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 euros, from publicly provided health care insurance to private health care insurance.

[10] This entails that both the numerator (taxes and social security contributions) and the denominator (labour 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.

however, included in the definition of the total costs of labour 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 hereafter).

Figure 3.1 shows that, at low levels of income, the tax rate for the under 65 year olds rises sharply. From around 15% at an income of 10,000 euros it rises to 37% at 22,000 euros. 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 euros. Above the income level of 22,000 euros however, the tax rate shows only a small rise and stabilises at a rate of around 40%. Progressively rising pension premiums, which are tax deductible, and the maximisation of the contribution levels to the social security schemes 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 3.1.

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, transites 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. To some extent measuring lifetime taxation involves the addition of both tax regimes.

Figure 3.1   **Average tax rates on wages and pensions (see definition in text)**

total wage (until 65)/pension (over 65)

—— until 65   – – – over 65
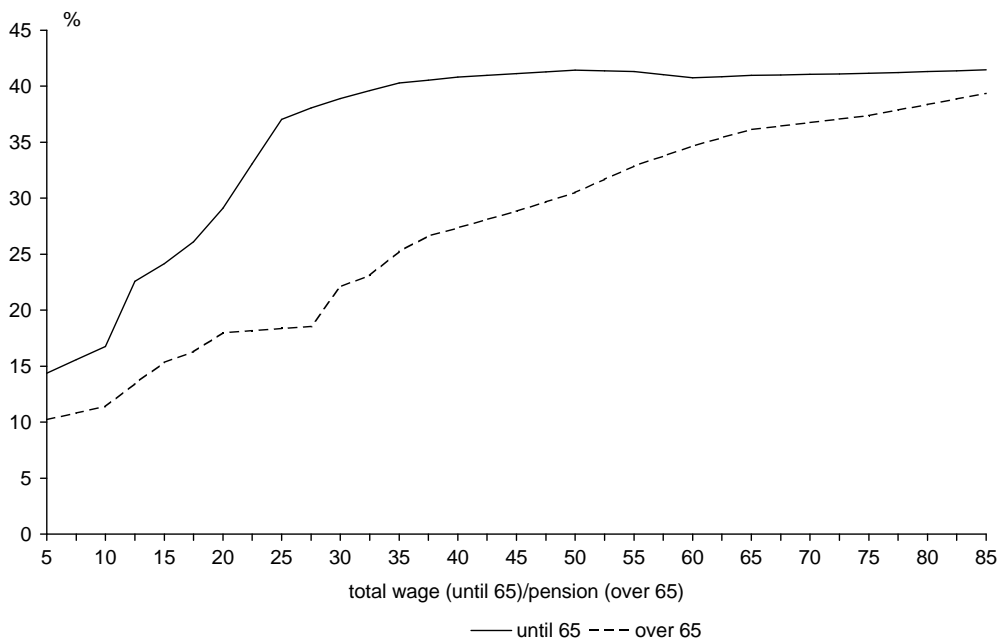
3.2   Some important characteristics

The extent of redistribution that takes place through the public sector does not only depend on the system of collective arrangements itself. Differences in characteristics between the groups also play an important role. With respect to the tax side of collective arrangements, the two major differences concern the size and age pattern of labour participation and the wage level. Figure 3.2 shows the age profile of labour participation that is imputed for the six groups we distinguish. It reveals that high levels of education are accompanied with 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 labour survey[11]. However, these observed rates of participation are adjusted to take account of the fact that future workers are expected to retire at a higher age[12]. The imputed lengthening of the stay in the workforce is two years for each of the educational levels.

Figure 3.2   **Lifetime participation profiles for the six levels of education**
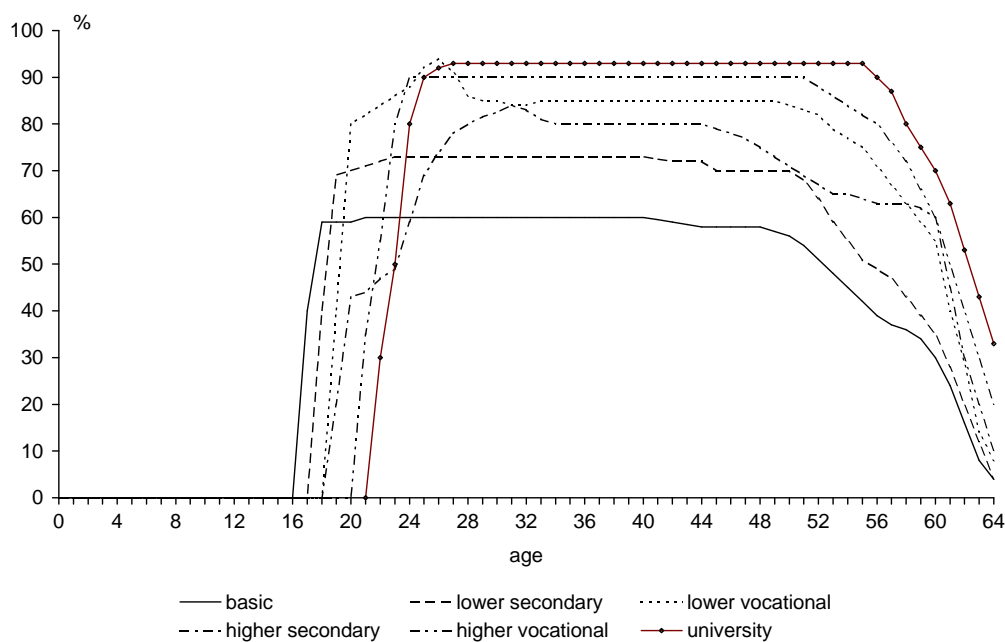
[11] This is the EBB 2002 of Statistics Netherlands, of which the data are available through the Scientific Statistical Agency. Individuals are counted as participants in this survey if they work 12 hours or more per week.

[12] Another trend which 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 whole current workforce. This is discussed above.

Figure 3.3   **Lifetime profiles of labour costs for the six levels of education**
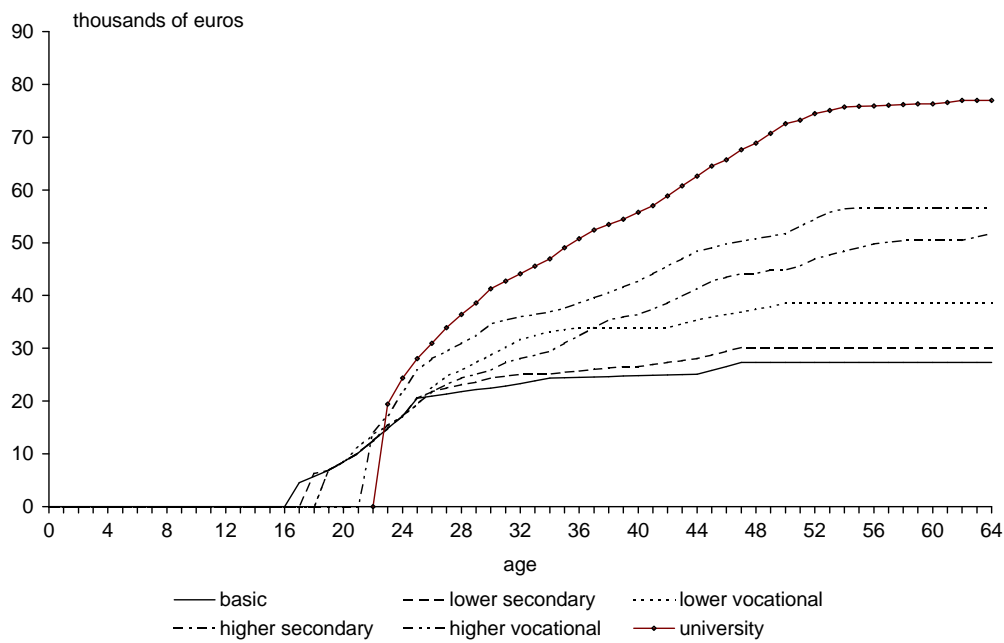
Figure 3.3 shows the current age profiles of labour costs for an average wage earner in each of the six groups[13]. It reveals that high levels of education lead to higher wages as well as a steeper career pattern. Both characteristics contribute to relatively high lifetime incomes in the groups with high levels of education. Table 3.1 presents the present values of the lifetime labour incomes that are the result of the combined effect of the data contained in figures 3.2 and 3.3.

Table 3.1   **Lifetime labour 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	1043.7
Weighted average (see section 2.3 for the weights)	608.5

[13] The labour costs are defined as averages per participant. Individuals are counted as a participant if their working week exceeds 12 hours per week.

3.3   Lifetime taxation

Table 3.2 presents the present values of the lifetime tax burdens for the six typical cases we distinguish in this study[14]. Table 3.3 presents the lifetime tax rates, *i.e.* the lifetime tax burdens as a percentage of lifetime labour income. They 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 of it that is imposed over the age of 65. Table 3.3 shows that the total tax rate turns out to rise only 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 degressive 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. Over the age of 65 the Dutch pension system leads to a declining share of pension income, and taxes paid on that income, relative to previously earned labour income[15]. This outweighs the progression in the tax rates for this age group[16] (see figure 3.1).

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[14] The baseline calculations in this study assume a discount rate of 3% and an age-specific productivity growth rate of 1.5%. The rates of survival for the various groups of educational attainment are derived from data provided by TNO Preventie and Gezondheid (2002). These data distinguish four levels of education.

[15] 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 add up to 70% of the average wage in one'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 labour participation, their larger reliance on the income independent public pension results in a pension level relative to previous labour income that is higher than it is for the groups with higher levels of education.

[16] Note that the tax burdens that are presented in Tables 3.2 and 3.3 are also affected by pension contributions and pension incomes. As the combined effect of these, in terms of present values, are not necessarily neutral the tax rates may also be affected by redistribution of wealth within pension funds.

Table 3.2   **Lifetime tax burdens[a] for the six typical single person households (in thousands of euros)**

	Direct taxes		Indirect taxes		Total taxation
	Until 65	Over 65	Until 65	Over 65	
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 3.3   **Lifetime tax rates[a] for the six typical single person households (in per cents)**

	Direct taxes		Indirect taxes		Total taxation
	Until 65	Over 65	Until 65	Over 65	
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 3.2) relative to the present values of lifetime labour incomes (presented in Table 3.1).

4   The benefits from collective arrangements

The six groups we distinguish differ also significantly in the way in which they benefit from government arrangements. This section assesses these differences. However, the coverage of expenditure is restricted to the expenditure items that can be readily attributed to beneficiaries, such as transfers. Expenditure items that can not 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% of government expenditure.

Table 4.1 reveals the differences in the benefits from government transfers by presenting the lifetime benefits from public pensions, disability payments, unemployment benefits and social assistance[17]. They are presented in terms of present values over the entire life cycle. It shows that the highly educated groups are relatively large beneficiaries from 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 scheme[18] show a discontinuous shape as a result of the combined effect of an inflow into these schemes that decreases with rising levels of education[19] 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 4.1   Lifetime benefits from 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

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

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

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

Table 3.2 presents the costs for government involved in the benefits in kind that are included in this paper. It shows that the costs of health care and long term care can be attributed in a more than proportional way to the groups with a low level of education[20]. Benefits from the subsidisation of cultural and recreation facilities rise strongly with the level of education. The same (obviously) applies to the benefits from government expenditure on education[21]. Total costs for government for these in kind 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 4.2	Lifetime benefits in kind (present values, thousands of euros)				
	Health care	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

Table 4.3 presents the (present values of the) net benefits from public arrangements on both rental and owner-occupied housing for a single person household[22]. The calculations are carried out for stylised cases. The calculations on rental housing take account of the effects of housing allowances (in Dutch: *individuele huursubsidie*), which is negatively related to income, and the users part of the local property tax. The tax treatment of owner-occupied housing is treated in this section because it involves a tax favoured arrangement which leads to a net benefit for the owner. Moreover, it allows a closer comparison to rental subsidisation.

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% buys a house at the age of 30. For households with lower

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[20] The relative sizes of these benefits are derived from data which were provided by the SCP and which in turn are based on an investigation of the use of public arrangements (AVO'99). The age pattern of the benefits is based on information provided by iMTA.

[21] 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 on 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.

[22] The definition of benefits from housing arrangements that is used in this paper differs from the definition of housing subsidisation which is commonly used in literature. In this paper it includes the tax savings on indirect taxes that result from the 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 subsidisation is that this paper does not include in it the avoided tax on alternative investments. It only takes account of the 'direct' net tax savings.

vocational and higher secondary levels of education these figures are assumed to be 60% and in the cases of the highest two levels of education, higher vocational and university, all households become owner-occupiers at 30. The prices of the purchased houses rise with the level of education[23].

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 arrangements 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[24]; and a higher share of owner-occupiers. On balance benefits from housing arrangements turn out to decrease at the lower levels of education and to rise significantly at the higher levels.

Table 4.3	Net lifetime benefits from housing arrangements (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

Table 4.4 adds up the data in tables 4.1 till 4.3 and presents the present values of lifetime costs for government. It shows a relatively flat pattern of these costs across the range of educational levels. The only exception is formed by the highest level for which the costs are somewhat higher. Table 4.5 expresses these data relative to the present values of lifetime labour 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 therefore, in contrast to the tax side of collective arrangements, the benefit side works out in a highly progressive way.

[23] These prices are respectively100 thousand euros for lower secondary education, 150 thousand for both higher secondary and lower vocational, 200 thousand for higher vocational and 250 thousand 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% 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 (in Dutch: 'eigen woningforfait'), 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.

[24] Mortgage interest payments are deductible from personal income and therefore the progressive personal income tax system applies.

Table 4.4   Total benefits from collective arrangements (in present values, thousands of euros)

	Transfers	Benefits in kind	Housing arrangements	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 4.5   Total benefit ratios[a] from collective arrangements

	Transfers	Benefits in kind	Housing arrangements	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	30.7

[a] Defined as the present value of benefits (presented in Table 4.4) relative to the present value of lifetime labour incomes (presented in table 3.1).

5 Lifetime redistribution

5.1 Establishing lifetime redistribution

Table 5.1 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 which were presented in sections 3 and 4 respectively. Note that the coverage of tax side of the government budget exceeds that of the expenditure side by a large margin. The presented net results therefore overestimate the overall net tax burden. In table 5.1 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 5.1 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 −116.6 thousand euros. At the higher levels of education the burden is positive and reaches a level of 247.8 thousand euros 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 collective arrangements features a high level of progression. Whereas the welfare of the lowest two groups is increased by government by 39.6% and 14.0% respectively, it is *reduced* for the higher groups and at a rate of 23.7% for the highest of them.

Table 5.1   Net lifetime tax burdens

	In present values	As % of own lifetime wages
	thousands of euros	
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 5.2 shows how redistribution by government changes the lifetime welfare of the six groups, both in absolute terms 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 benefits in kind. However, it does not include leisure time and does not take into account that the benefits from health care 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 by government raises the lifetime welfare of the group with basic education from 294.1 thousand euros to 410.7 thousand euros. Their welfare position

relative to that of the average of the population is raised from 48.3% to 73.9%. At the other extreme of the spectrum, those with a university education, welfare is reduced from 1043.7 thousand euros to 795.9 thousand euros, entailing that a 71.5% above average position is reduced to 43.2%. The system of collective arrangements 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 as a result of the collective arrangements[25]. The difference in absolute terms, equalling 0.081, can be considered to be a measure of the reduction in inequality brought about by government. The size of the reduction depends on the combined effect of the initial inequality and the levelling power of the system of collective arrangements. The latter of these two factors may be best measured by the reduction in the Gini in *relative* terms. This turns out to be around 43%.

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 due to the fact that the taxation of non-institutionalised, personal, wealth is also not included[26].

Table 5.2	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	1043.7	(171.5)	247.8		795.9	(143.2)
Weighted average	608.5	(100)			555.7	(100)
Gini-coefficient	0.187				0.106	

As mentioned above, these measurements are restricted to the case of a single person household with no children. They may however be considered representative for the size of the redistribution from rich to poor in society as a whole 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

[25] 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.

[26] This is especially so for the exclusion of the impact of the taxation of personal wealth that is acquired through saving from labour 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.

from government expenditure remain relatively constant. This can be derived from an inspection of the system of income taxation and the information on the benefits. Moreover, the transfers to households that are related to children are not sizable enough to change the picture. However, the restriction to single person households with no children does have the, relatively minor, disadvantage that other redistributive aspects of collective arrangements can not be explored. These involve the redistribution *between* the types of households which result from some differentiation on cohabitation or marital status and the presence of children.

5.2 A comparison with an annual measurement of redistribution

As mentioned in section 2.1, the SCP presents information on the annual distribution of before-tax incomes, after-tax incomes and welfare (see SCP (2003), page 157). The groups are classified into deciles on the basis of these variables. Table 5.3 summarises 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 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 versus 0.081). These findings correspond to the insight, which was 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 collective arrangements. The size of *relative* redistribution turns out to be larger in the lifetime case (43% versus 34%).

These differences in outcome, however, can not be attributed solely to the difference between a lifetime and annual approach. This study includes only single person households whereas the SCP includes all households, and both calculations differ to some extent in their coverage of collective arrangements and in their measure of income. Moreover, both calculations of the Gini-coefficient do not include within-group inequality. This leads to a downward bias in the outcomes which may be larger in the lifetime calculations as these are carried out with a smaller number of groups (six versus 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.

Table 5.3   **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).

6 Sensitivity analysis

6.1 Does the discount rate have a sizable impact upon the numerical results?

As the lifetime patterns of wage incomes and net benefits from government differ significantly, the size of the discount rate with which the lifetime calculations are carried out may well affect the measured redistributive impact by government. The question then arises by how much. This section explores this issue by carrying out the above exercise with a 0.5% higher discount rate, *i.e.* a real discount rate of 3.5%. The first column of Table 6.1 shows by how much overall lifetime tax rates (the equivalent of the last column of Table 3.3) change. It reveals that higher discount rates slightly reduce lifetime tax rates. This is due to fact that pension incomes are taxed and therefore lead to a life cycle pattern of taxable incomes which is on average at a higher age than the age at which wages are earned. This leads to a downward effect on the lifetime tax rate due to the higher discount rate. The second column of Table 6.2 shows how the ratio of the present values of benefits relative to the present value of wages (the equivalent of the last column of Table 4.5) changes. It reveals a decrease for the low education (and income) groups due to fact that the benefits from government for these groups occur generally in a later stage of the life cycle than wages earned and are thus affected more by the higher discount rate. The opposite, however, is the case for the groups with a high level of education (and income). This results from the higher costs on early-in-life education. Moreover, the discount rate effect on the benefits late in the life cycle weighs less heavily due to fact that their significance relative to lifetime wages is smaller. On balance, the net lifetime tax rate is increased for the lowest groups and decreased for the highest groups.

Table 6.1	Effects of a 0.5% higher discount rate (in %-points)		
	Effect on lifetime tax rate	Effect on lifetime benefit ratio	Effect on net lifetime tax rate (column 1 minus column 2)
Basic	− 1.2	− 4.6	3.4
Lower secondary	− 1.1	− 2.2	1.1
Higher secondary	− 0.9	− 0.2	− 0.7
Lower vocational	− 0.8	− 0.3	− 0.5
Higher vocational	− 0.7	0.9	− 1.6
University	− 0.7	1.5	− 2.2

Table 6.2 shows how this change of assumption affects the distribution of welfare. It compares the relative positions from this exercise with those from the base case. The first and second columns present the relative positions in lifetime wages and lifetime consumption under the assumption of a 0.5% higher discount rate. The third and fourth columns repeat the results presented in the base case (see Table 5.2). The table shows that the measured redistributive impact of collective arrangements is indeed reduced to some extent. However, this change is

small. The Gini-coefficient is now reduced from 0.183 to 0.103 and thus by 0.080 in absolute terms and 44% in relative terms. This compares to 0.081 and 43% respectively in the base case. Note that this exercise would show the opposite effects if a lower discount rate were imputed.

Table 6.2	Effect of a 0.5% higher discount rate on the distribution of wages and welfare			
	Higher discount rate		Base case	
	Lifetime wages	Lifetime welfare	Lifetime wages	Lifetime welfare
Basic	49.1	73.4	48.3	73.9
Lower secondary	63.9	79.3	63.2	78.9
Higher secondary	90.6	91.5	91.0	90.6
Lower vocational	94.1	97.8	93.7	96.5
Higher vocational	125.8	109.0	126.5	113.5
University	169.6	146.1	171.5	143.2
Weighted average	100	100	100	100
Gini-coefficient	0.183	0.103	0.187	0.106

6.2 To what extent do differences in behaviour influence the results?

The results presented above are a result of the combined effect of the system of collective arrangements and differences between the groups which can, somewhat roughly, be characterised as differences in behaviour. Decomposing the results into these two factors is relevant as it reveals to what extent the distributional effects from 'the rich' to 'the poor' are not ingrained in the system of collective arrangements but, in contrast, originate from differences in labour participation and the use of government facilities. To perform this decomposition, this section measures the resulting distribution of lifetime wages and welfare, and the size of the redistribution by government, if all groups would behave in conformity with the average of the population. This exercise is carried out by imputing the average inputs for labour participation and the use of government programs. The actual (base case) inputs are only imputed for the wage levels, the benefits from the disability and unemployment schemes as far as these result from differences in previous income, housing subsidies and benefits from education. The first column of Table 6.3 shows that tax rates would only change marginally. On the benefit side, in contrast, there are substantial changes. Among the low income groups benefits are much smaller and at the high income groups they are larger.

Table 6.4 presents how the distribution of lifetime wages and welfare would be under these assumptions. The first two columns of Table 6.4 reveal the distribution of lifetime wages and lifetime welfare and show that the Gini-coefficients for these variables are now respectively 0.128 and 0.093. This means that collective arrangements bring about a reduction in inequality of 27%. A comparison of these outcomes with those of the base case (see the third and fourth

column), which shows a reduction of 43%, may serve as an indication that a substantial part of the reduction of welfare inequality results from the system of collective arrangements.

Table 6.3   Effects of eliminating differences in behaviour between the groups (in %-points)

	Effect on lifetime tax rate	Effect on lifetime benefit ratio	Effect on net lifetime tax rate (column 1 minus column 2)
Basic	− 0.9	− 38.0	37.1
Lower secondary	− 0.7	− 11.1	10.4
Higher secondary	− 0.3	2.3	− 2.6
Lower vocational	0.1	3.1	− 3.0
Higher vocational	0.3	9.5	− 9.2
University	0.2	9.9	− 9.7

Table 6.4   Effect of eliminating differences in behaviour on the distribution of wages and welfare

	With average behaviour		Base case (actual behaviour)	
	Lifetime wages	Lifetime welfare	Lifetime wages	Lifetime welfare
Basic	70.7	76.6	48.3	73.9
Lower secondary	76.0	83.1	63.2	78.9
Higher secondary	100.7	99.3	91.0	90.6
Lower vocational	92.9	95.1	93.7	96.5
Higher vocational	117.8	113.4	126.5	113.5
University	150.5	136.2	171.5	143.2
Weighted average	100	100	100	100
Gini-coefficient	0.128	0.093	0.187	0.106

7 Measuring incentive distortions on a lifetime basis

This section measures the incentives provided through the system of collective arrangements to supply labour. As stated above it deviates from the conventional way of doing this by including the effects of the arrangements on future net incomes. The measurements apply to a single person household. They measure the incentive for a worker to seek a pay rise by calculating the marginal tax rates on a lifetime basis and by subsequently correcting these for the effects of some income dependent government arrangements. These calculations measure what share of a pay rise, in terms of lifetime present values, is absorbed by the system of public arrangements. As such it measures the disincentive of working longer hours or of investing in human capital. The forward looking approach is consistent with the rational expectations hypothesis.

The calculations compare a career with a constant wage level with a career in which the wage level is increased permanently by 25%[27]. These calculations are carried out at various wage levels and various ages at which the pay rise takes place. Table 7.1 presents the results for the tax side and includes the effects of direct and indirect taxes. It shows that, overall, the marginal lifetime tax rates can be considered to be high. This applies especially to individuals with a wage level of around 15,800 euros for whom a pay rise is taxed at a rate of 67.9% at the age of 25 and even 68.8 at the age of 50. This high tax rate is the result of the (sudden) discontinuation of the wage subsidies for the low skilled at an income level of 18,000 euros. At higher wage levels the marginal lifetime tax rates still turn out to be high, ranging from around 55% to 60%. At these higher wages, the table shows that the marginal rates are relatively independent of the wage level and the age at which the pay rise occurs.

Table 7.1   **Marginal lifetime tax rates at various income levels and ages of the pay rise**

	Age at pay rise		
	25	35	50
Gross wage level (in 1000 euros)			
15.8 (minimum wage level)	67.9	68.3	68.8
20.0	57.0	57.4	58.1
30.0	55.3	55.9	57.1
50.0	56.7	57.5	58.8
70.0	56.6	57.4	58.7
100.0	57.6	58.6	60.1

[27] The reason for imputing the relatively high jump of 25% is to prevent that the small changes in the average tax rates that occur at certain income levels due to discontinuities in the tax system can lead to extremely high or low measured marginal tax rates and thus provide an unrepresentative outcome.

The lifetime marginal tax rates obviously differ from their annual counterparts by including the rest of life effects in the measurements. This enables the correct specification of tax favoured saving through pension funds in the Netherlands. This typically features a high tax rate at which pension contribution can be deducted relative to the tax rate at which future pension benefits are taxed. As in the measurements on redistribution in the previous sections, this study excludes the pension contributions and includes the taxes on pensions. The annual marginal tax rates as it is currently effective in MIMIC (see Graafland *et al.* (2001)), the CPB model that is generally used to analyse the effects of tax policies with, include the full pension premium.

Table 7.2 assesses the effects of two of the income dependent government programs, namely subsidisation of rental housing and subsidisation of owner-occupied housing. The table expresses the individual benefits from a pay rise, in terms of a higher present value of benefits from these schemes, relative to the present value of the pay rise. These calculations apply to a 25 year old and represent stylised cases. They therefore only provide an indication of the size of the effects. As in section 4, it is assumed that all individuals rent a house until the age of 30, above which all individuals with a minimum wage continue to be a renter for the rest of their lives. However, from those with a gross income of 20 thousand euros 30% buys a house. These figures are 50% for an income of 30 thousand euros, 70% for 50 thousand euros and 100% for the highest two levels. The prices of the houses purchased at these five levels of income are respectively 100, 150, 200, 300 and 400 thousand euros. It is assumed that the pay rise of 25% also leads to a correspondingly higher price of the purchased house. Table 7.2 shows that the pay rise reduces rental subsidies among the lower incomes and thus increases the tax wedge and thereby the disincentive. These effects amount to 6.2% of the rise in labour costs for a minimum wager and 2.5% for an individual with an income of 20 thousand euros. In contrast, benefits from owner-occupied housing are increased by the pay rise, reducing the overall tax wedge. For the middle income levels the increase in benefit originates from the combined effect of the higher price of the house and the higher tax rate at which mortgage interest payments can be deducted. The highest three income levels only benefit from the first of these effects.

   Disability and unemployment benefits are also income dependent government programs. Their impact on incentives is ignored in this paper.

Table 7.2   Change in lifetime benefits from housing arrangements due to pay rise[a] (as % of the pay rise)

	Rental subsidy	Owners subsidy	Total
Gross wage level (in 1000 euros)			
15.8 (minimum wage level)	− 6.2	0.0	− 6.2
20.0	− 2.5	0.7	− 1.8
30.0	0.0	3.3	3.3
50.0	0.0	3.0	3.0
70.0	0.0	3.1	3.1
100.0	0.0	3.0	3.0

[a] Expressed as the present value of additional housing benefits relative to the present value of the rise in labour costs.

Table 7.3 combines the data of tables 7.1 and 7.2 for the 25 year old. It reveals that marginal rates turn out to be extremely high for those with a minimum wage. This results from the accumulation of the wage subsidy and the rental subsidy. At the higher levels of income, where these arrangements are no longer effective and the owner-occupiers subsidy even reduces the tax burden, the overall marginal wedge ranges from 52% to 55%.

Table 7.3   Lifetime marginal wedge on a 25% pay rise (as % of the pay rise)

	Effect through taxation	Effect through housing subsidies	Total
Gross wage level (in 1000 euros)			
15.8 (minimum wage level)	67.9	6.2	74.1
20.0	57.0	1.8	58.8
30.0	55.3	− 3.3	52.0
50.0	56.7	− 3.0	53.7
70.0	56.6	− 3.1	53.5
100.0	57.6	− 3.0	54.6

It should be noted, however, that these calculations only provide an indication of incentive distortions. The measurements involve stylised cases and apply only to one of the distortions by the system of collective arrangements, *i.e.* the effects on labour supply. Moreover, it does not take into account that the actual behavioural response on labour supply depends on whether the tax is levied on wage income, consumption or pension income. It also does not take account of the fact that people may be short sighted and could ignore future effects in decision making.

8   Comparison with other studies

As stated in the introduction this study principally offers a more comprehensive way of establishing the redistributive and incentive effects of collective arrangements than is usually the case. Compared to the other ways inequality of income and redistribution of government is measured in the Netherlands, and presented to policy makers, it offers several extensions. These are discussed in section 2.1. The major extension that this study offers is that it establishes the distributional and incentive effects on a lifetime basis. Currently, such measurements do not play a role in the policy debate.

There are, however, academic studies that follow a lifetime approach. Most of these, however, are less comprehensive in that they cover a smaller part of collective arrangements and incorporate only either the redistributive or the incentive effects. However, this study follows a simpler technique by constructing a number of typical life patterns for incomes, taxes paid and benefits from government which are each representative for that of a certain level of educational attainment. This is done for the full range of levels of education, and the differences in lifetime net benefits from government between these groups serve as the measure of redistribution. Other studies use a micro-simulation technique. They draw their life patterns from a database which 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) measures how a lifetime approach compares to an annual approach in determining the size of redistribution in the Netherlands. He uses a dynamic micro-simulation model and restricts the coverage of his analysis to the social security system. He concludes that, for the reasons outlined above, the lifetime measurement shows a smaller amount of redistribution than the annual one.

For the United States, several studies have followed a similar methodology to measure lifetime redistribution, both in terms of technique and coverage. Liebman (2001), Coronado *et al.* (2000) and Gustman and Steimeier (2000) measure whether the social security system is progressive or not. Both 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. have compared lifetime and annual measurements and concluded that the size of the progression are similar. However, their measurements included only the tax side of government.

Fullerton and Rogers (1994,1996) focus their analysis on the tax side of collective arrangements and explore how changing the composition of taxation affects lifetime distribution. They restrict their analysis to policy *changes* and do not measure the full distributional effect of the current system. Their approach deviates from those above by

measuring the effects in terms of utilities and the corresponding equivalent variations. Altig *et al.* (2001) follow a similar approach.

Falkingham and Harding (1993) measured lifetime redistribution for Australia and the United Kingdom. They cover all households and include direct taxes, social security payments and transfers. As the other authors do, they conclude that the government system results in a redistribution from high (lifetime) income groups to low income groups. For Australia the Gini-coefficient of market (before-tax) incomes and disposable incomes are respectively 0.370 and 0.273. For Great Britain these numbers are respectively 0.327 and 0.245.

For Sweden Petterson and Petterson (2003) carried out a similar analysis and arrive at the same conclusion. The latter study offers a coverage of arrangements that is similar to this study. They arrive 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 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 the Dutch.

On measuring *incentives* on a lifetime basis there is only one study. Gokhale and Kotlikoff (2002) conclude that the US features high marginal tax rates when these are measured on a lifetime basis and, moreover, income dependent government programs are taken into account.

9 Conclusions

This study aims to establish how collective arrangements redistribute between the rich and the poor in a way that is as comprehensively as possible. This makes it necessary that the measurements comprise the full life cycle of individuals and that all arrangements that have a redistributive effect are included in the measurements.

The study concludes that collective arrangements lead 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 roughly rise in line with lifetime incomes, whereas lifetime benefits from expenditure turn out to be roughly constant across the range of income levels. This results from benefits from education and subsidies on housing and cultural facilities that rise with lifetime incomes and benefits from health care 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 degressive effect of indirect taxation. Benefits from public arrangements sharply decline 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 by the collective arrangements 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 by 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 which are averaged out in the lifetime measurements. The reduction in inequality by collective arrangements is also smaller in the lifetime calculations. This follows from the fact that the collective arrangements tend to reallocate income over one's life cycle, mainly though the social security system. This, effectively intrapersonal, element in annual redistribution is eliminated in the lifetime measurements.

An analysis points out that the lifetime redistribution is to some extent a consequence of differences in labour participation and the use of collective arrangements. In part however, it is also a direct result of the system of arrangements (tax rates, rights on social security) itself.

Our measurements also point out that the lifetime marginal tax burdens are high throughout the whole range of income levels. Over the largest part of the income spectrum the lifetime marginal tax rates on wage income amount to around 55% to 60%. These figures include the impact of indirect taxes.

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Appendix 1 The system of taxing labour and pension income

Table A.1 provides a broad and stylised explanation of the Dutch system of taxing labour income by presenting the wedge between labour costs and net disposable income for a number of wage levels. From rows 1 till 8 the wedge is expressed in terms of monetary values and in terms of a percentage of labour costs. Row 9, of which the percentages correspond to the 'until 65' tax burden presented in figure 3.1 of the main text, shows that at low wage levels the total tax rate is low, rises sharply to around 40% 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 social security premiums and personal taxes) remains at a fairly constant rate of around 40% of labour 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 labour costs) lies in the maximisation of the employers social security contribution (see row 3) 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 will be abolished in 2006, the taxation of labour income therefore shows only a very small rate of progression.

Table A.1   Decomposition of total wage at various wage levels (as % of labour costs)

Gross wage level	Minimum wage		1.6 x Minimum wage		3.2 x Minimum wage		5 x Minimum wage	
1) Labour costs	16739	(100)	31290	(100)	61943	(100)	96635	(100)
2) Employers pension premium	0	(0)	1400	(4.5)	5205	(8.4)	9771	(10.1)
3) Employers social security contr.	2950	(17.6)	4890	(15.6)	6738	(10.9)	6864	(7.1)
4) Wage subsidy (–)	– 2011	(– 12.0)	0	(0)	0	(0)	0	(0)
5) Gross wage	15800	(94.4)	25000	(79.9)	50000	(80.7)	80000	(82.8)
6) Employees pension premium	0	(0)	414	(1.3)	1539	(2.5)	2889	(3.0)
7) Personal tax	3428	(20.5)	7392	(23.6)	18502	(29.9)	33427	(34.6)
8) Net disposable income	12372	(73.9)	17194	(55.0)	29960	(48.4)	43685	(45.2)
9) Total taxation (3 + 4 + 7)	4367	(26.1)	12282	(39.2)	25240	(40.8)	50549	(41.7)
10) Idem, excl. wage subsidy (3 + 7)	6378	(38.1)	12282	(39.2)	25240	(40.8)	50549	(41.7)
11) Total pension premiums (2 + 6)	0	(0)	1814	(5.8)	6744	(10.9)	12668	(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 only personal taxation that matters because these payments can be deducted from the tax base that determines the personal tax burden. As these payments are deducted from taxable income, it is the marginal personal tax rate (row 13 of Table A.1) that is the relevant concept in determining the part of the costs covered by the government.

Table A.2 presents the gap between total income and net disposable 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 exemption for a number of social security contributions.

Table A.2   Decomposition of total wage at various wage levels (as % of labour costs)

Gross pension level	Minimum wage		1.6 x Minimum wage		3.2 x Minimum wage		5 x Minimum wage	
1) Gross pension	15800	(100)	25000	(100)	50000	(100)	80000	(100)
2) Personal taxation	2464	(15.6)	4605	(18.4)	15248	(30.5)	30848	(38.6)
3) Net disposable income	13336	(84.4)	20395	(81.6)	36495	(69.5)	49152	(61.4)

Appendix 2   The benefits from public expenditure

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 11020 euros in 2002.

In the case of the other transfers the procedure is more complicated. The benefits are in these cases depend on a number of aspects. In the case of 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 CBS 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 declining with income, this indicates that also the stock of beneficiaries of various (previous) income levels is roughly constant in relative terms and declining 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 arrangement of the scheme itself which links the individuals benefit to (previous) gross income up until the level of around 42000 euros 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 42000 euros for a substantial part of ones 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 arrangement 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.

Health care

The use of health care 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 only available 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. For the rest of this sector there was no information on differences between the groups and therefore its use is assumed 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 health care. 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 nursery 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 A.2.1 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 Ministerie van Financien (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 A.2.1 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 A.1   Age specific costs of education