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Welfare losses of non-participation in employment
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Abstract

This paper aims at measuring the individual and national welfare losses due to non-participation in employment. The calculations are made from a micro-economic point of view and based on assumptions of the human capital theory. We measure welfare losses as the hypothetical loss of production resulting from one additional year of interruption or postponement of the working career. Depreciation of human capital due to non-use in the interruption period and foregone experience are taken into account.

We estimate the welfare losses for individual cases with specific characteristics with respect to age, educational level and length of interruption spell and use multiplication factors to calculate the national welfare losses.
1. The problem

The employment participation rate, i.e. the ratio of the number of persons with a paid job in the Netherlands and the total population between the age of 15-65, is low in comparison to other industrialized countries. The three main elements of this low participation rate are the high number of unemployed persons, the huge number of recipients of public disablement benefits and the low number of women participating in employment.

In the Netherlands in 1987, 36.7% of the total female population aged between 15 and 65 years had a paid job. This is low when compared with the 47.2% participation rate in Germany and very low compared with the 71.0% participation rate in Denmark. In the same year employment participation rate of men in the Netherlands amounted to 68.8% which is again below Germany with 73.9% and far below Denmark with 83.0%.

Chart 1 shows the development in unemployment and disablement. Unemployment has fallen since 1984, whereas disablement has been increasing over the reference period. Since 1986 the number of recipients of public disablement benefits is higher than the number of unemployed persons1.

Obviously, this low employment participation incurs costs both for the individual non-participant and for the society as a whole. These costs are associated with income transfers from participants to non-participants, loss of production and depreciation of human capital. With respect to unemployment, Feldstein (1978) and Okun (1981) provide a classification of the various costs, whilst Junankar (1989), the European Trade Union Institute (1984) and Mittelstadt and Roberti (1984) give estimates of total costs of unemployment under alternative assumptions.

Junankar presents a low and a high costs scenario for several European countries using estimates based on Okun's law. The results show that in 1983 the costs of unemployment vary from 13 to 21 percent of the Gross Domestic Product (GDP). Using a different calculation method, the European Trade Union Institute estimates the potential production from Gross National Product and unemployment. The results of 1982 vary from 9.4 to 25 percent of the GNP in the Netherlands, depending on whether or not an Okun factor is used. In the lower benchmark estimate of Mittelstadt and Roberti, the total loss of production due to unemployment in the OECD-area amounts to about 6 percent of OECD output.

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1 According to recent estimates, registration problems result in actual unemployment being some 40 per cent lower than the level of unemployed persons registered at the public employment offices. The main problem is that the public employment offices are not notified in time that unemployed workers have found jobs.
This paper presents calculations of welfare losses due to non-participation in employment both on the individual and on the national level. We base these calculations on assumptions derived from the human capital theory. The human capital theory has been applied in calculating the value of household production by calculating opportunity costs. We basically use the same principles, but the new elements in our analysis of estimating the welfare losses of non-participation in employment are that we account for depreciation of human capital and foregone work experience. Although our calculations refer to the Netherlands and are inspired by the low employment participation rate, the methodology is generally applicable.

In section 2 we define our concept of individual welfare losses and specify the assumptions underlying our calculations. Section 3 explains the method by which we calculate welfare losses of non-participation. In section 4 we illustrate this method by calculating the welfare losses for some specific cases. In section 5 the national welfare losses of a low employment participation rate are calculated. In section 6 we investigate the sensitivity of our calculation method. Section 7 concludes.

2. Definitions

We define welfare losses of non-employment participation as the economic costs for the society as a whole and identify the welfare losses as the hypothetical loss of production due to non-participation.

However, as a basis for actual calculations of welfare losses the above intuitive notion of this concept is much too vague. Therefore, this section provides an operational definition and lists a number of assumptions underlying the calculations.

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2 We are not concerned with possible social or political costs. Social costs may occur because of a possible relation between non-participation and criminal behaviour. Political costs may occur because of civil disobedience and a low tax moral due to the large transfer payments from workers to non-participants. Moreover growing racism and political extremism may lead to political costs.
Moreover, welfare losses should be clearly distinguished from collective costs. The latter are, for a large part, actual costs, which incur directly from low employment participation. Social security transfers to non-participants are an easily quantifiable part of these collective costs. Some collective costs are hypothetical as well, such as tax payments and social security contributions which cannot be collected because of the low level of income and expenditure as a result of the low employment participation.

The literature considers welfare losses as potential losses of both present and future production. This study defines the welfare loss at the individual level as the costs incurred by that individual from one extra year of non-participation. We therefore calculate the size of the loss of production when individual non-participant enters employment at year t+1 instead of year t. In the calculations of the potential production we account for the depreciation of human capital and forgone work experience incurred during this extra year of non-participation.

We distinguish between primary and secondary welfare losses. Primary welfare losses are potential production losses of non-participants in year t, including their actual depreciation of human capital in that year. Secondary welfare losses occur because of future losses of production. These costs relate to the depreciation of human capital itself, as a consequence of being out of employment for one additional year. We define these costs in year t as the difference between potential production of that person over the remaining part of his working life when re-entry to employment occurs in year t, and the potential production with re-entry in year t+1. This loss of human capital is not only determined by the difference in number of years which remain for production, but also by the depreciation of human capital during the extra year of non-participation.

Primary welfare losses are flow figures and are expressed in guilders a year. Secondary welfare losses are stock figures, expressed in guilders over the remaining working life. However, if we define the secondary welfare losses as the difference between the human capital of an individual measured at two moments in time, secondary welfare losses are flow figures as well and can be added consistently to the primary welfare losses in order to obtain total welfare losses.

Clearly collective costs and welfare losses are not completely independent. Not only will non-participants pay less taxes during their spell of non-participation but also afterwards, since they will earn less after their re-entrance to employment than persons with the same characteristics who have remained in employment. Chart 2 illustrates the main relationships between welfare losses, collective costs and their component parts defined in this section.

This study calculates individual welfare losses as potential production losses that depend on the individual's characteristics with respect to education, work experience, age and the duration of non-participation. Therefore, each case considered relates to a group of people who are homogeneous with respect to the above characteristics. The yardstick for the calculation of potential production is a person with the same characteristics with full working hours who has never left employment.
Chart 2. Relation between collective costs and welfare losses of non-participation.

The calculation of welfare losses of non-participation obviously requires a number of firm, or even heroic, assumptions concerning potential production and the depreciation of human capital of the non-participant. Firstly, we assume that wage costs fully and correctly reflect labour productivity, as implied by the neo-classical theory in the case of perfect competition. Secondly, we take the actual wage costs as a basis for our calculation. Hence we assume that a mass entrance of non-participants to employment will not lead to a general fall of labour productivity. Moreover we assume that there is no selectivity bias and hence that the least productive will not be the first to loose their job and become non-participants.

Thirdly, we assume that there will be no demand constraints (and hence no surpluses of supply) when all non-participants, up to some normative level of participation, become productive. Hence we do not consider the costs involved in creating jobs for the non-participants. We are obliged to make this assumption because we look at individual welfare losses, and do not compute feedback effects on a macro level by, for instance, using a macroeconomic model. Therefore, our calculation of the individual welfare losses can, when aggregated over all relevant non-participants, be regarded as gross welfare losses. They may constitute an upper limit for the macroeconomic costs of non-participation.

Our fourth assumption is that all non-participants up to a specific level would accept an offered job. This assumption especially relates to the female non-participants, and becomes relevant when aggregating individual welfare losses. Yet, this assumption is implicit when calculating individual welfare losses. The same holds for the fifth (and related) assumption: work within the home and voluntary work are considered to be non-productive.

The sixth and last assumption relates to the fact that we use estimates of age-wage costs profiles from available earnings data. When using these data with respect to
different levels of education, we implicitly assume that all participants are employed exactly in accordance to their specific level of education and capabilities, and that nobody has a job which requires a higher education or has a job which could be held by somebody with less capabilities.


Age-income profiles can be specified in several functional forms. Among the variety of variables postulated to explain earnings during the life cycle, years of education and work experience, or age are the variables which are nearly always used. In most of the empirical studies the natural logarithm of earnings is specified as the dependent variable. For the independent variables the literature distinguishes two functional forms: a natural logarithmic experience term and a combination of a linear and a quadratic work experience term. In a comparative study Heckman and Polachek (1974) conclude that there is ambiguity across data sets in preferring one or the other specification. The number of years of schooling is mostly specified as a level. In our calculations the natural logarithm of work experience is used:

\[ \ln y_T = (a + b \ln(x+c)) \]

where \( y_T \) = income at age \( T \)
\( x \) = work experience

Note that if this person enters his first job, his work experience is equal to zero and his income will be \( \exp(a + b \ln(c)) \). Coefficient \( c \) may be interpreted as 'pseudo' work experience which is acquired during the educational career. Chart 3 summarizes the main theoretical arguments with respect to the disruption of a working career using age-income profiles. (See e.g. Groot, Schippers and Siegers, 1988; Mincer and Ofek, 1982). For the sake of simplicity, income is drawn as a linear function of age; however actual age-income profiles usually show diminishing increases of income with age.

Chart 3. Linear age-income profile for a continuous and an interrupted working career.
Line ABL of chart 3 represents the profile of a worker who has a paid job from leaving school until retirement. The profile ABCDEFG mirrors the income of an individual person who disrupts his working career at age V. In this disrupted working career case we may distinguish four stages: the period before interruption (AB), the interruption period (CD), the restoration period (EF) and the post-restoration period (FG). The presence of these theoretical stages has been tested in several empirical studies, the results of which will be summarized below. Assumptions are then made concerning these different stages, on the basis of these results.

When the non-participant returns to employment his wage will be lower than when he left employment, due to the depreciation of the stock of his human capital. The theory of human capital provides a number of arguments for this depreciation, some of which are summarized under the heading atrophy (see Groot et al., 1988, p.220). There are several empirical studies on the yearly depreciation rate during the interruption period and there appears to be much divergence between the results. They vary between zero percent (Corcoran, 1979) and 9 percent per year (Mineer and Ofek, 1982). We will assume that human capital depreciates during the period of non-participation by five percent per year.

In the period immediately following re-entry, human capital will be restored rapidly because of the new work experience. In this restoration period wages rise quickly. Mineer and Ofek (1982) pay specific attention to this so called rebound effect and estimate it to be 5.8 to 6.4 percent in the first year after re-entry. In our study we will abstract from a rapid recuperation.

In the post-restoration period we assume that the growth rates of income of the two types of workers are equal. Both persons spend part of their time investing in human capital so that their investment ratio (the ratio of investment expenditures to gross income) will be equal, which is in line with various empirical studies (Mineer and Polachek, 1974; Mineer and Ofek, 1982; Corcoran, 1979).

Additionally we assume that the actual depreciation of human capital does not continue indefinitely: There is a minimum level of human capital. We assume that actual depreciation only lasts for two years. After two years the earning capacity of the non-participant remains constant (Möller, 1990).

Our calculation method for individual welfare losses of non-participation is based on assumptions derived from human capital theory. The income and depreciation profiles for a (non-)participant are depicted in chart 4. The chart graphically illustrates our calculation method. In the case of a continuous working career the worker of chart 4 has a lifetime income equal to the area ABCD. We assume that he enters employment at age F and retires at age Z.

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3 The broken line ABCDEFG (chart 3) is the profile of an involuntary interrupted working career. In the literature (Mineer and Polachek, 1974; Mineer and Ofek, 1982; Cox, 1984) it is often mentioned that an individual who anticipates an interruption of his career accumulate less human capital in the period before interruption (AB) than a worker who expects a continuous career of paid work. The slope of the line AB will be less steep in the case of an expected interruption than in the case no interruption is expected.
Now suppose that this person interrupts his working career at age T-h. Hereafter investment in human capital stops and instead depreciation takes place. If this person never finds a job his earning capacity is indicated in chart 4 by the broken line MNO. The horizontal part of this broken line is a result of the assumption that depreciation is bounded by some minimum level. This assumption can be formalized for the depreciation factor \( \rho \) as follows:

\[
\begin{align*}
\rho &= 1 - h \delta, & \text{for } (1-h\delta) > \rho^* \text{ (line MN)} \\
\text{and} \\
\rho &= \rho^*, & \text{for } (1-h\delta) \leq \rho^* \text{ (line NO)}
\end{align*}
\]

where

- \( \rho \) = total depreciation ratio of human capital
- \( = 1 - h \delta \)
- \( \rho^* \) = maximum depreciation ratio
- \( h \) = length of interruption period in years
- \( \delta \) = annual depreciation rate of the stock of human capital

If this person finds a job his lifetime earnings over the post-interruption period will be equal to area EGHD. If this worker postpones his re-entry for a further year, commencing work at time T+1 rather than T, his lifetime income over the post-interruption period will be the area JKLD.

We calculate the individual welfare losses as losses resulting from the delay of one year in re-entering employment. These losses are equal to the difference of the area EGHD and the area JKLD. This is the shaded area in chart 4.

The calculation method can be formalized as follows. When no interruption takes place the earnings of a representative worker at age T, are equal to

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4 This minimum level and hence the period during which actual depreciation takes place, may differ according to the educational level of the representative worker.
(3) \[ y_T = \exp(a + b \ln(x+c)) \]

where \[ y_T \] = income at age \( T \)
\[ x \] = work experience

The above formulation of the income profile implies a decreasing investment ratio of human capital with growing age. Next we calculate the potential wage at age \( T \) of the person who has left employment at age \( T-h \) as:

(4) \[ y_{T,h}^P = \exp(a - \ln \phi + b \ln(x+c)) \]

where \( y_{T,h}^P \) = potential income at age \( T \) with length of the interruption period \( h \)
\[ \phi = y_T / (y_{T+h} \cdot \rho) \]
\[ y_{T+h} \] = income at moment of interruption

The ratio \( \phi \) in this equation represents both the lack of work experience (\( y_T / y_{T+h} \)) during the period of interruption and the depreciation of human capital (\( y_{T+h} \cdot \rho \)). It calculates the income difference between a worker with a continuous and an interrupted career at the moment of re-entry in employment.

When this representative non-participant does not enter employment again at moment \( T \) but at moment \( T+1 \), his potential income will be:

(5) \[ y_{T+1,h+1}^P = \exp(a - \ln \eta + b \ln(x+c)) \]

where \[ \eta = y_{T+1} / (y_{T+1+h} \cdot \rho) \]

Note that not only income at moment \( T \) or at moment \( T+1 \) is relevant for calculating the individual welfare losses, but also the income earned over the rest of the working life. In order to calculate this remaining lifetime income (indicated by the areas EGHD or JKLD in chart 4), we calculate the discounted value of these future earnings at period \( T \). (With \( T \) the base year for our calculation of the welfare losses of one additional year of non-participation). The discounted value of the remaining lifetime income in the case of re-entry at moment \( T \) is equal to

(6) \[ \pi_{T,h} = \int_T^Z y_{T,h}^P \cdot e^{(T-t)r} \, dt \]

where \( \pi_{T,h} \) = discounted value at \( T \) of potential remaining lifetime income in the case of re-entry at \( T \)
\[ Z \] = age of retirement
\[ r \] = discount rate (= long term interest rate)

The discounted value of the remaining lifetime earnings in the case of re-entry at moment \( T+1 \) is equal to

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5 By including the loss of skills in \( \phi \) we do not have to include correction factors in the term \( \ln x \) in the above earnings equation. Thus these two terms are equal for workers with continuous and interrupted working careers when both belong to the same homogeneous group with respect to education and age.
\[(7) \quad \pi_{T+1,h} = \sum_{T+1}^{T} y_{i,h} e^{(T-t)} dt \]

where \( \pi_{T+1,h} \) = discounted value at T of potential remaining lifetime earnings in the case of re-entry at moment \( T+1 \).

Now total individual welfare losses of one additional year of non-employment is equal to the difference of these two discounted values for the remaining lifetime earnings:

\[(8) \quad y_{T,h}^* = \pi_{T,h} - \pi_{T+1,h} \]

where \( y_{T,h}^* \) = total individual welfare losses because of one additional year of non-participation at \( T \) in case of an interruption period of length \( h \).

The total welfare losses defined above can be segregated into primary and secondary welfare losses in the following manner:

\[(9) \quad y_{T,h}^{pl} = \int_{T}^{T+1} y_{i,h} e^{(T-t)} dt \]

where \( y_{T,h}^{pl} \) = primary welfare losses of one additional year of non-participation at age \( T \) with interruption of \( h \) years.

and

\[(10) \quad y_{T,h}^{sl} = y_{T,h}^* - y_{T,h}^{pl} \]

where \( y_{T,h}^{sl} \) = secondary welfare losses of one additional year of non-participation at age \( T \) with interruption of \( h \) years.

The profile of the income- and depreciation curves depicted in chart 4 has the following implications for primary and secondary individual welfare losses:

- The cumulated investment in human capital increases with age. Hence the primary welfare losses concerning non-participants who have left employment at a relatively high age are larger than those concerning younger workers with the same educational level;
- Secondary welfare losses decrease with increasing age of the non-participant, because the remaining working life becomes shorter with rising age;
- Primary welfare losses increase with the level of education;
- The influence of the level of education on secondary welfare losses is ambiguous. These losses depend, amongst others, on the shape and characteristics of the age-income profile;
- When measuring the influence of the length of the interruption period on primary welfare losses we should distinguish between two cases:
  a) the non-participant who is situated at the decreasing part of the depreciation curve: in that case primary losses will become lower when the interruption period has lasted longer;
  b) the non-participant who is situated at the horizontal part of the depreciation curve: in this case primary welfare losses are dependent on the shape of the income profile;
- The influence of the length of the interruption period on secondary welfare losses is also ambiguous.
4. Case-studies of welfare losses.

In section 2 we assumed that wage costs fully and correctly reflect labour productivity. Therefore, the theoretical framework of age-income profiles and the calculation method as explained in the previous section will be applied on wage costs instead of income.

Using the methodology of section 3 and the estimates of the age-wage costs profiles presented in appendix 1 we are able to calculate the individual welfare losses for representative non-participants. These representative non-participants are classified by three characteristics: level of education, age, and start of interruption period (or alternatively number of years of non-participation). As illustration of the calculation method and of the order of magnitude of individual welfare losses, this section discusses five hypothetical non-participants. All examples use the following assumptions:
- depreciation rate of human capital is 5% a year;
- lifetime earnings are discounted at a real long term interest rate of 5%.
- work experience is measured as age minus years of fulltime education minus 6
- actual depreciation of human capital lasts 2 years; after 2 years earning capacity of the non-participant remains constant;
- every child is obliged to attend school until the age of 17;
- it is not possible to earn less than the minimum wage and thus produce less than the minimum wage costs.

Table 1. Individual welfare losses for hypothetical non-participants (guilders, 1985)

<table>
<thead>
<tr>
<th>Cases</th>
<th>primary welfare losses</th>
<th>secondary welfare losses</th>
<th>total welfare losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case 1. 30 years old; extended primary education; out of employment at 29</td>
<td>36,600</td>
<td>54,500</td>
<td>91,100</td>
</tr>
<tr>
<td>Case 2. 30 years old; completed academic education; out of employment at 29</td>
<td>79,500</td>
<td>118,200</td>
<td>197,700</td>
</tr>
<tr>
<td>Case 3. 26 years old; completed academic education; did not enter employment at 24</td>
<td>45,000</td>
<td>64,400</td>
<td>109,400</td>
</tr>
<tr>
<td>Case 4. 50 years old; primary education; out of employment at 50</td>
<td>47,900</td>
<td>30,600</td>
<td>78,500</td>
</tr>
<tr>
<td>Case 5. 50 years old; primary education; out of employment at 44</td>
<td>39,900</td>
<td>4,800</td>
<td>44,700</td>
</tr>
</tbody>
</table>

Table 1 gives the results for these cases. The first case considers a 30 year old non-participant who has left employment at the age of 29 and has an extended
primary education. At T=30 human capital of this non-participant has depreciated by 5 percent; and in the case where he is still not in paid employment at T=31, his human capital would have depreciated at that moment with 10 percent. However, when calculating the potential earnings of this non-participant we should not only reckon with the depreciation of human capital, but also with the loss of work experience during the period of non-participation by the use of equations (4) and (5), which makes the total depreciation percentages equal to 7.7 for T=30 and 15.7 for T=31. By subtracting potential lifetime earnings at T=31 from potential lifetime earnings at T=30 we obtain the individual welfare loss for this non-participant. (See case 1 in table 1).

Our second example is a non-participant who is also 30 years old and has left employment at the age of 29, but has a completed academic education instead of an extended primary education. According to table 1 the welfare losses of this second non-participant appears to be much higher than that of the first one. It is especially valid for the secondary welfare losses. The difference can be completely ascribed to the difference in level of education since both non-participants are equal with respect to all other relevant characteristics.

Chart 5. Age-wage costs profile of an university graduate who postpones the entry to the employment with two years.

The third example considers a non-participant of 26 years with a completed academic education who has delayed the start of his working career: at T=24 he finished his education, but did not get a paid job. As we assume for all individuals that the depreciation of human capital only lasts for two years, he is on the horizontal section of the potential earnings profile at re-entry (line NO in chart 4). Chart 5 reproduces the stylized age-wage costs profile for this particular non-participant. In this case the total depreciation of human capital at T=27 is equal to that at T=26. However, the loss of work experience is larger at T=27 than at T=26, because the reference worker who did start his working career at T=24 will have had an additional year of work experience. Table 1 shows that the welfare loss of this university graduate who did not find a job after the completion of his study, is less than that of the non-participant of Case 2. Two causes are responsible for this effect: compared with the individual in Case 2 the university graduate with the delayed start of his career has accumulated less human capital through work experience and his interruption spell has been longer.

In the fourth case we calculate the welfare loss for a non-participant of 50 years who has left employment in the same year and who has a primary education only.
Table 1 illustrates that this relatively old non-participant incurs much smaller secondary welfare losses than a young non-participant. When we combine the old age with a long interruption spell (Case 5) we see that the secondary welfare loss becomes particularly small.

5. National welfare losses

The welfare loss of low employment participation on a national level is estimated using individual welfare losses of n groups of persons, which are homogeneous with respect to education, age and length of the interruption spell. Besides these data, we need multiplication factors for the three subgroups mentioned in section 1: the unemployed, the disabled and the voluntarily non-participating people. For this we use CBS data from the Labour Force Survey of 1985.

In order to determine the multiplication factor of unemployment we assume that frictional unemployment is a necessary condition for a well-functioning labour market and will therefore be excluded from the calculation of the welfare losses. The welfare losses of unemployment are calculated for about 400 thousand persons. Among disabled people in the Netherlands, a numerous amount have earning capacity. Due to labour market factors, like unemployment and technological development, persons were declared disabled although they still had the capacity to fulfill paid jobs. We assume that this hidden unemployment in disability is 14 percent (Vrooman and de Kemp, 1990) of the total number of disabled people, and amounts to about 100 thousand persons. Most of these people are assumed to be between the ages of 50 to 65 years and have a primary or extended primary education. This assumption implies that the national welfare losses of disability are relatively small compared to unemployment and voluntary non-participation.

Voluntary non-participants in employment are assumed to be female. We take an adjusted labour force participation rate of men as a benchmark for women and we calculate the total welfare losses of non-participating women up to this point. In doing so our calculations comprise 1.7 million women, who would be in employment when the benchmark participation rate is reached.

Table 2 presents the estimates of the total, primary and secondary welfare losses for the economy as a whole. All estimates are based on the same assumptions as in the case-studies (section 4).

<table>
<thead>
<tr>
<th></th>
<th>primary welfare losses</th>
<th>secondary welfare losses</th>
<th>total welfare losses</th>
<th>% of GNP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployment</td>
<td>18.8</td>
<td>9.0</td>
<td>27.8</td>
<td>6.6</td>
</tr>
<tr>
<td>Disability</td>
<td>4.9</td>
<td>0.3</td>
<td>5.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Voluntary non-participation</td>
<td>71.7</td>
<td>12.7</td>
<td>71.7</td>
<td>17.1</td>
</tr>
<tr>
<td>Total</td>
<td>95.4</td>
<td>22.0</td>
<td>104.7</td>
<td>25.0</td>
</tr>
</tbody>
</table>

6 The labour force participation of men is adjusted in order to account for the male disabled individuals who have earning capacity and related to the total male population in the age of 15-65.
The total welfare loss due to a low employment participation rate is about 25 percent of GNP in 1985. The share of secondary welfare losses is not as large as most case studies in section 4 suggest. The reason for this is the distribution of the subgroups over the relevant characteristics. Numerous voluntary non-participants and disabled people have interrupted their career for a long period. Moreover, the working capacity of the disabled is assumed to be among the older people. As the fifth case study shows, secondary welfare costs are relatively low for those subgroups.

For unemployment the total welfare losses in 1985 are about 7 percent of the GNP. The latter percentage is in line with the percentage Mittelstadt and Roberti estimated for the OECD-area (6.1%) and the 9.4 percent of The European Trade Union Institute. The estimates of Jumankar for unemployment are somewhat higher than the estimates in this paper.

The national welfare losses in table 2 look like huge golden mountains, which should be digged off as soon as possible. However, we must realize that our definition of welfare losses results in calculated costs, which are not totally avoidable. They can be viewed as the opportunity costs of non-participation in employment.

6. Sensitivity analysis

Our estimates of welfare losses of non-participation in employment are based on a number of assumptions concerning the different stages in the career of a worker (section 3). In this section we investigate the sensitivity of our calculation method with respect to the following assumptions: the yearly depreciation rate of human capital, the long term interest rate and the wage costs related to the minimum wage as the lower benchmark of productivity. In each alternative calculation we vary one assumption and compare the results with the central calculation. The results are summarized in table 3.

Table 3. Macro-economic welfare losses in the Netherlands under different assumptions, in billions of guilders, 1985

<table>
<thead>
<tr>
<th></th>
<th>disabled</th>
<th>unemployed non-participants</th>
<th>total</th>
<th>% of GNP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central 1)</td>
<td>5.2</td>
<td>27.8</td>
<td>71.7</td>
<td>104.7</td>
</tr>
<tr>
<td>of which primary</td>
<td>4.9</td>
<td>18.8</td>
<td>59.0</td>
<td>82.7</td>
</tr>
<tr>
<td>of which secondary</td>
<td>0.3</td>
<td>9.0</td>
<td>12.7</td>
<td>22.0</td>
</tr>
<tr>
<td>I: depreciation 0.5%</td>
<td>5.7</td>
<td>25.7</td>
<td>73.7</td>
<td>105.1</td>
</tr>
<tr>
<td>of which primary</td>
<td>5.4</td>
<td>20.0</td>
<td>60.7</td>
<td>86.1</td>
</tr>
<tr>
<td>of which secondary</td>
<td>0.3</td>
<td>5.7</td>
<td>13.0</td>
<td>19.1</td>
</tr>
<tr>
<td>II: long term interest 2%</td>
<td>5.3</td>
<td>32.7</td>
<td>79.1</td>
<td>117.1</td>
</tr>
<tr>
<td>of which primary</td>
<td>5.0</td>
<td>19.1</td>
<td>59.9</td>
<td>84.0</td>
</tr>
<tr>
<td>of which secondary</td>
<td>0.3</td>
<td>13.6</td>
<td>19.2</td>
<td>33.1</td>
</tr>
<tr>
<td>III: no minimum wage</td>
<td>5.2</td>
<td>29.6</td>
<td>56.6</td>
<td>91.4</td>
</tr>
<tr>
<td>of which primary</td>
<td>4.9</td>
<td>18.4</td>
<td>45.4</td>
<td>68.7</td>
</tr>
<tr>
<td>of which secondary</td>
<td>0.3</td>
<td>11.2</td>
<td>11.2</td>
<td>22.7</td>
</tr>
</tbody>
</table>

1) Depreciation of human capital is 5% a year, long term interest rate is 5% a year, productivity is bounded below.
Lowering the yearly depreciation rate of human capital has a relatively small impact on the total welfare losses. Although we would expect increasing primary and decreasing secondary losses, the primary losses become only slightly more important. The small magnitude of this impact is caused by a combination of two effects: the minimum wage costs and the length of the interruption period. Labour productivity is bounded below by the minimum wage costs, which is particularly relevant for the estimation of welfare losses of voluntary non-participation. Because a large part of the voluntary non-participants experience long interruption periods, this minimum level is reached in the case of both depreciation rates.

Lowering the long term interest rate has an increasing effect on the total welfare losses and especially on the secondary losses. The long term interest rate determines the weight of the future losses of production in the total losses. A low discount rate implies a relatively high share of secondary losses, while a high discount rate implies a low impact of secondary losses. These expectations are verified by our calculations.

Table 3 shows that although the minimum wage costs, which bound productivity below, have an increasing effect on the total welfare losses, we see different effects for the subgroups distinguished. The third sensitivity analysis shows us the effect of a release of the the minimum wage level ($p^* = 0$ in equation 2). The direction in which secondary losses are altered are dependent of the length of the period out of employment. There is no effect on the welfare losses of disability, because most earning capacity is among the age category 50-65 and they earn, even if we account for depreciation of human capital and forgone experience, more than the minimum wage level because of their age. After two years of non-participation the earning capacity of this group, does not fall below the minimum level so releasing this productivity restriction does not alter the welfare losses. For the unemployed we see an increase in the secondary welfare losses. Instead of reaching the minimum level after one year of non-participation, human capital depreciates for an additional year. The decrease of secondary losses for voluntary non-participation result from the long period of interruption. These non-participants are positioned on the horizontal part of the depreciation curve (line NO in chart 4). The release of the minimum wage level means a decrease of production at re-entry at T or at T+1. This results in a lower nominal growth of production caused by the assumption of equal investment ratio’s of individuals with the same age and educational level.

7. Conclusion

Employment participation rate in the Netherlands is low. This paper defines a framework and a methodology for computation of individual welfare losses through non-participation in employment. The method is based on the human capital theory. In order to construct flow data we define the individual welfare losses of non-participation as the loss of potential productivity of a non-participant in the case of one additional year of non-participation. Thus we distinguish between primary losses due to the loss of potential production during one year and secondary losses which relate to the additional loss of potential earnings of the non-participant because of the depreciation of his human capital and the loss of additional work experience (no further investment in human capital).

In order to illustrate this method we calculated the welfare losses for hypothetical individual cases. These calculations are based on estimates of age-wage costs profiles for five levels of education in the Netherlands using data for 1985. Of course, the value of these losses depends on a number of assumptions which we have made explicit. Therefore the main aim of this paper is to clarify how welfare losses can be calculated, and what assumptions are relevant in that respect. It is shown that the calculation of welfare losses requires empirical evidence on the
speed and time shape of the depreciation of human capital, and on the investments in human capital after the interruption period. Finally we have aggregated the individual welfare losses up to national welfare losses by multiplication of the individual losses for homogeneous groups of non-participants by the number of people belonging to these groups. We estimate the national welfare loss of non-participation in employment as 26 percent of the Gross National Product in 1985. About 70 percent of this loss originates from voluntary non-participating women, 25 percent is caused by unemployment and 5 percent by disablement.

We tested the sensitivity of our calculations by varying assumptions. It appears that the calculated welfare loss is sensitive to the assumptions concerning the minimum level of productivity and the discount rate. Variation in the yearly depreciation rate of human capital has only a small effect on the total welfare losses.

The welfare loss calculated should be considered as a gross welfare loss, since we do not account for the costs, productivity decline and the demand constraints associated with the new jobs for the non-participants. In future research we intend to analyze the effect of these macro-economic feedback mechanisms.

List of symbols

- $r$ = discount rate (= long term interest rate)
- $DHBO$ = dummy for extended secondary and technical education
- $DM$ = dummy for secondary education
- $DUL$ = dummy for extended primary education
- $DWO$ = dummy for academic education
- $h$ = length of interruption period in years
- $s$ = years of education
- $x$ = work experience ($T-s-6$)
- $y_T$ = income at age: $T$
- $y_T^h$ = income at moment of interruption
- $y_T^{h,T}$ = potential income at age $T$ with $h$ the length of the interruption period
- $y_T^{h,T}$ = total individual welfare losses because of one additional year of non-participation at $T$ in the case of an interruption period of length $h$
- $y_T^{h,T}$ = primary welfare losses of one additional year of non-participation at age $T$ with interruption during $h$ years
- $Z$ = age of retirement
- $\delta$ = annual depreciation rate of the stock of human capital
- $\phi$ = $y_T/(u_T^h + \rho)$
- $\eta$ = $y_T^{h+1}/(y_T^{h+1} + \rho)$
- $\pi_T,h$ = discounted value at $T$ of potential remaining lifetime income in the case of re-entry at $T$
- $\pi_T^{h+1}$ = discounted value at $T$ of potential remaining lifetime in the case of re-entry at $T+1$
- $\rho$ = total depreciation ratio of human capital = $1-h\delta$
- $\rho^*$ = maximum depreciation ratio

References


**Appendix 1. Estimation of age-wage costs profiles for the Netherlands.**

In order to calculate welfare losses for individual non-participants using the methodology of section 3, we need, amongst others things, values for the constant term \(a\) and the parameters \(b\) and \(c\) of the age-wage costs profile of formula (3) for each level of education. In order to measure these parameters we estimate equation (3) using CBS-data on gross wages in 1985 in the Netherlands which are available for 5 levels of education and for 9 age-groups. These gross wages are transformed to wage costs by multiplication factors for specified gross income categories provided by the Central Planning Bureau. Table A1 gives the data on gross wages and shows how they rise with age and with the level of education.
As only 45 observations are available, estimation of equation (3) for each level of education separately would incur too big a loss of degrees of freedom. Therefore we have performed a joint regression with a dummy variable for each level of education. We assume that only the constant term in equation (3) is different for each level of education, whereas the influence of the number of years of work experience on wage costs is assumed to be the same for all levels of education. The outcome for this regression equation with t-values in parentheses is as follows:

\[(11) \ln y = 0.19 + 0.44 \ln (x + 5.16) + 0.13 \text{DUL} + 0.32 \text{DM} + 0.52 \text{DHBO} + 0.90 \text{DWO}\]

\[
\begin{array}{cccccc}
 & \text{37.6} & \text{7.0} & \text{3.0} & \text{2.7} & \text{6.5} & \text{8.4} \\
(11) & (17.7) & & & & & \\
R^2 & = & 0.96
\end{array}
\]

Explanation of symbols:
- \(y\) = wage costs in 1985
- \(x\) = years of work experience (T-5)
- \(s\) = years of education
- \(T\) = age
- \(\text{DUL}\) = dummy for extended primary education
- \(\text{DM}\) = dummy for secondary education
- \(\text{DHBO}\) = dummy for extended secondary and technical education
- \(\text{DWO}\) = dummy for academic education

The outcome of this regression is most satisfactory: all coefficient values differ significantly from zero and both coefficients with respect to work experience obtain the correct sign. Moreover the coefficient of the dummy variables get plausible values, as they indicate how much higher the earnings of the respective levels of education are as compared to the first level of education (primary school only) given the same number of years of work experience. Hence this estimation result shows that the people with an academic education earn almost twice as much as people with primary schooling only.

Chart A1 gives the age-wage costs profiles calculated by means of this equation.

\[\text{In fact even less than 45 observations are available as some cells of the data matrix are empty.}\]

Table A1. Average gross monthly wages on a full time basis of workers in the manufacturing and service sectors in the Netherlands in 1985.

<table>
<thead>
<tr>
<th>Level of education</th>
<th>Primary</th>
<th>Extended primary</th>
<th>Secondary</th>
<th>Higher vocational</th>
<th>Academic</th>
</tr>
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<tbody>
<tr>
<td>Age in years</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16-19</td>
<td>(1298)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-24</td>
<td>2124</td>
<td>2220</td>
<td>2444</td>
<td>3206</td>
<td></td>
</tr>
<tr>
<td>25-29</td>
<td>3099</td>
<td>2906</td>
<td>(3054)</td>
<td>3739</td>
<td></td>
</tr>
<tr>
<td>30-34</td>
<td>3045</td>
<td>3436</td>
<td>(3093)</td>
<td>4817</td>
<td></td>
</tr>
<tr>
<td>35-39</td>
<td>(3870)</td>
<td>3255</td>
<td>3695</td>
<td>(4394)</td>
<td>5925</td>
</tr>
<tr>
<td>40-44</td>
<td>(3916)</td>
<td>3416</td>
<td>4099</td>
<td>6699</td>
<td></td>
</tr>
<tr>
<td>45-49</td>
<td>(3031)</td>
<td>3464</td>
<td>(4234)</td>
<td></td>
<td>7212</td>
</tr>
<tr>
<td>50-54</td>
<td>(3057)</td>
<td>3526</td>
<td>(4134)</td>
<td></td>
<td>7529</td>
</tr>
<tr>
<td>55-64</td>
<td>(3630)</td>
<td></td>
<td>(4562)</td>
<td></td>
<td>7924</td>
</tr>
</tbody>
</table>

1) Wages in parentheses are based on 100-150 observations, those without parentheses on more than 150 observations.