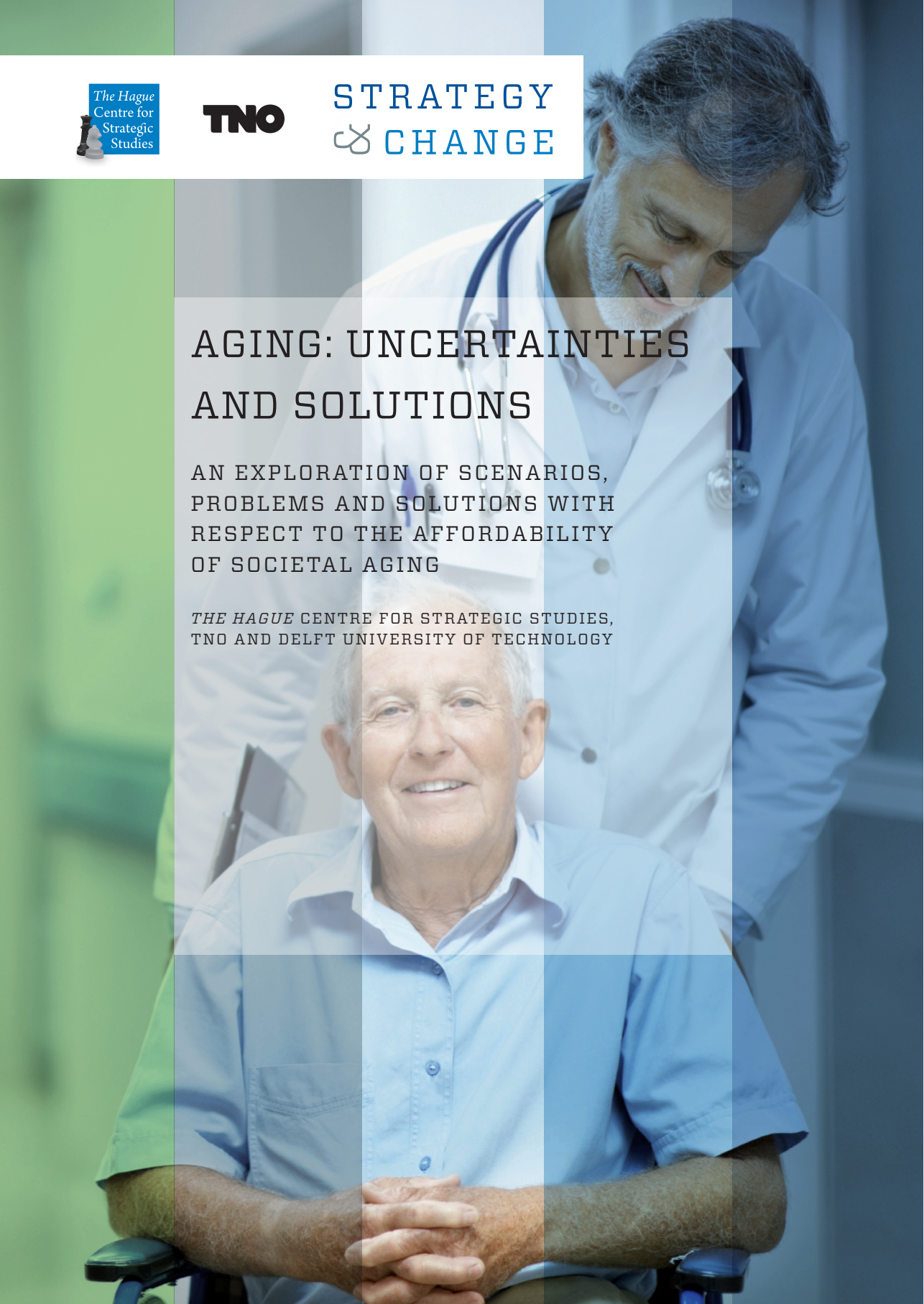

The Hague Centre for Strategic Studies

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STRATEGY & CHANGE

AGING: UNCERTAINTIES AND SOLUTIONS

AN EXPLORATION OF SCENARIOS, PROBLEMS AND SOLUTIONS WITH RESPECT TO THE AFFORDABILITY OF SOCIETAL AGING

THE HAGUE CENTRE FOR STRATEGIC STUDIES,
TNO AND DELFT UNIVERSITY OF TECHNOLOGY

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TU Delft

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The TNO and *The Hague* Centre for Strategic Studies (HCSS) programme Strategy & Change analyzes global trends in a dynamic world affecting the foundations of our security, welfare and well-being.

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CONTENTS

SUMMARY 7

1 INTRODUCTION 11

2 UNAFFORDABLE SOCIETAL AGING 17
2.1 Government contribution to AOW 19
2.2 Health expenditure and GDP 20
2.3 Total costs of societal aging 21

3 AFFORDABLE AGING 23
3.1 Policy options 23
3.2 Government contribution to AOW 28
3.3 Health expenditure and GDP 32
3.4 Total costs of societal aging 34

4 CONCLUSIONS 37

REFERENCES 41

ENDNOTES 45

SUMMARY

In Dutch society, a situation of 'double societal aging' exists: an increasing proportion of the population is becoming retired, whilst average life expectancy is increasing. This can lead to an undesirable situation for public finances, because health care costs and the government's contribution to AOW (the Dutch general seniority law, *Algemene Ouderdoms Wet*) as a proportion of gross domestic product (GDP) could further increase.

The challenges posed by an aging population are highly complex and surrounded by deep uncertainties, such as developments in labor productivity and the thereto linked GDP, life expectancy, the proportion of the population that lives unhealthily, and the health care demand of older people. The result of this is a wide array of future scenarios for the financial sustainability of the Dutch social model.

The methodology Exploratory System Dynamics Modeling and Analysis (ESDMA) generates thousands of plausible scenarios in order to explore the uncertain effects of complex future issues. Within these scenarios, undesirable situations and their causes are identified. Then, policies that can mitigate these undesirable situations are tested for their robustness across the range of uncertainties, i.e. over all of the scenarios.

This study demonstrates that health care costs and the government's contribution to AOW as a portion of GDP can lead to highly undesirable situations. The key trends that contribute to this are:

The main factors that lead to unaffordable situations with regard to the costs of aging are:

- *A declining or unchanged level of labor productivity in the Dutch workforce:* The future labor productivity determines the GDP of the future. If GDP falls or remains unchanged by such a trend in labor

productivity, then the sum of health care costs and the government's contribution of AOW will soon lead to highly undesirable levels relative to GDP.

- *Strong growth in the costs of (long-term) care as a share of GDP*: Older people in the final stages of life account for the largest share of long-term care. As the share of older people in the total population increases, the cost of providing long-term care will rise faster than GDP.
- *An increase in unhealthy behavior*: Unhealthy behavior, such as smoking, alcohol consumption, and unhealthy eating habits and inactivity, increase the risk of diseases. As a result, unhealthy life expectancy increases and overall life expectancy decreases. The first two effects are particularly important in increasing the costs of care.
- *Low levels of labor participation of older people*: Although the average age at which older people stop working is increasing, many older workers stop working several years before the pensionable retirement age. This results in a decline of the total labor force, which, in the case of labor shortage, will lead to a decrease in GDP.
- *A further increase in life expectancy*: Due to improved care and a healthier lifestyle, life expectancy may further increase. This leads to an increase in state pension (AOW) payments, resulting in an increase in the government's contribution to AOW.

A number of policy options can be introduced to achieve affordable aging. This study demonstrates that no policy option reduces costs sufficiently to keep the cost of aging at a sustainable level across all scenarios. Therefore, a combination of measures should be implemented that together will result in a sustainable situation, regardless of which scenario ultimately manifests itself. This robust set of measures and strategies should take into account the following:

- The most important strategy to maintain the affordability of societal aging is to *increase the labor productivity of the Dutch workforce*. This will lead to the increase in GDP that is sufficient to absorb the increasing costs of aging.
- Increasing the retirement age mainly has an impact on the affordability of the state pension (AOW). Therefore, it is important to *link the retirement age to life expectancy*, as proposed in the pension agreement of 2011 and the Dutch stability programme of 2012. In cases where life

expectancy strongly increases or decreases, these proposals are inadequate. On several points these can, therefore, be improved to ensure greater sustainability of public finances:

1. The retirement age should be raised by more than 1 year every 5 years; so, the current proposed increases in the retirement age are insufficient in the short and medium term.
2. The delay between the decision to raise the retirement age and the introduction of the increase (as proposed in the stability programme and pension agreement respectively), is too large to respond adequately to developing changes.
3. Life expectancy in the current proposals is always assessed at 65, even if the retirement age has increased. Adjusting this assessment to the life expectancy at the existing retirement age for the proposed increase makes the calculation simpler and more accurate.
4. The government's strategy should also take into account the possibility that life expectancy decreases in the next 50 years.

- The efficacy of increasing the retirement age is greatest when combined with measures that *increase employment of older workers* and *reduce part-time work by older people*.
- *Increasing productivity in long-term care* is important to maintain its affordability. This has the additional effect that the potential labor shortages in health care as a result of the aging population will be smaller than without these measures. Indeed, higher productivity means that fewer people are needed to do the increased amount of work.

Finally, a major reason for the escalation of the costs of societal aging is the exponential growth of healthcare costs towards the end of life. This development will in time undoubtedly lead to emotionally-charged discussions of medical ethics and the purpose and meaningfulness of treatment and its consequences for individuals and society. At this point the focus of both medical and long-term care will shift from longevity (long life) to quality of life (human dignity). From the perspective of costs, this question is not urgent. Right now is, therefore, a good time to discuss in detail the medical-ethical side of shorter treatment of terminally ill patients, and to take the outcome of this discussion into account in decision making.

1 INTRODUCTION

In many developed societies, especially Japan and Western European countries, two demographic trends can be observed. First, the percentage of older people in society is increasing. This is referred to as societal aging. Furthermore, the life expectancy of these older people is increasing. Combined, these two trends are sometimes referred to as 'double societal aging'. These developments will put significant pressure on healthcare budgets and lead to increased pension costs.

Societal aging combines several important and deeply uncertain[1] elements. Deep uncertainty exists when analysts do not know, or the parties to a decision cannot agree on:

1 The appropriate conceptual models that describe the relationships among the key driving forces that will shape the long-term future;
2 The probability distributions used to represent uncertainty about key variables and parameters in the mathematical representations of these conceptual models, and/or;
3 How to value the desirability of alternative outcomes.[2]

Examples of uncertainties surrounding societal aging are the current and future composition of the population, the development of gross domestic product (GDP), the development of labor productivity, the productivity in curative and long-term care, developments regarding unhealthy behavior (e.g. smoking, drinking, and unhealthy eating habits), and the development of unemployment.

It is important to gain insight into the consequences of these uncertainties for the sustainability of the costs of aging, in particular the total health care costs and the required government contribution to the Dutch state retirement pension (AOW),[3] both as part of the (also uncertain) GDP. This

also includes a study of the effects of the current proposed increases in the retirement age and other policy options, both for government and industry. For a brief explanation of the Dutch pension system, see Box I.

BOX I BRIEF EXPLANATION OF DUTCH PENSION SYSTEM

The Netherlands has a pension system consisting of three pillars:[4]

1 A basic pension for each person over 65 (AOW);
2 A supplementary pension via the employer;
3 Individual pension schemes.

Together these pillars determine the amount of pension that a person receives after reaching the pension age. The system is characterized by collectivism, risk sharing, and efficient implementation.

The first pillar – **the basic state pension** (AOW) – is financed from contributions and from the general funds of the government. This 'pay-as-you-go' system entails that the working population pays for the costs of the retirement of those aged 65+. These costs are levied through contributions on wages or benefits. In 2011 this premium amounted to 17.9%. The portion of the retirement benefits that cannot be covered via these premiums alone are funded from general funds. This government contribution to AOW is the type of pension funding considered in this study.

The second and third pillars are privately organized employers' pensions and private savings. Compared to other countries, the Dutch basic state pension constitutes a limited part of total retirement income. The largest part of retirement income comes from the supplementary pension via employers. These supplementary pensions are arrangements agreed upon by the industry, professional associations, and businesses. More than 8.5 million people have a pension or pension benefits. Their total pension assets amounted to Ð745 billion in 2007.[5]

Supplementary pension is primarily a matter for employers and employees. Many companies have a pension plan that is linked to the employment contract of the employee. The employer usually pays most of the premium for this supplementary pension. The subsequent pension payment is in fact deferred pay for the employee. The employer must levy pension contributions and transfer these premiums to a pension provider. The Netherlands has no mandatory pension obligations. The social partners are free to agree to a pension arrangement in their employment relationships. The government makes a pension plan compulsory for an entire industry or profession if there is sufficient support.

If there are no collective arrangements and there is no compulsory requirement for participation in an industry-wide pension fund, it is up to the employer whether or not to include a pension arrangement. If a plan is agreed, then this scheme must meet the requirements of the Pensions Act. More than 90% of employers have a pension arrangement for employees. In most cases this refers to an arrangement with a an industry-wide pension mandated by collective arrangements. In other cases it concerns a private company or a private pension scheme administered by an insurer.

The third pillar consists of **individual pension schemes** covered by capital. The self-employed, who cannot usually participate in a second pillar pension scheme, are designated entirely to the third pillar. In this way people can build additional pension through fiscal subsidy with an insurer, for example via life annuity, life insurance or since January 2008 via a bank (bank savings).

For this purpose, a fixed monthly or annual premium or a lump sum (single premium) is paid. Later, the insurer or bank pays out the annuity. This may be for a certain period or for life. Employees can thus supplement their pensions. This can be to repair a pension gap (e.g. if the person came to the Netherlands late in his career, through a job in another country) or for early retirement. People can also put aside money through savings, investment, or by building capital via their homes.

To obtain this insight, an Exploratory System Dynamics Modeling & Analysis (ESDMA) study has been performed.[6] ESDMA is a combination of the quantitative modeling technique System Dynamics (SD)[7] and the computational Exploratory Modeling & Analysis (EMA) methodology.[8] ESDMA is currently under development at the Technical University Delft9. It enables the exploration of dynamic developments in complex systems with deep uncertainties, such as the aging problem in Dutch society.

Precise predictions are not possible given the nature of deep uncertainties. Each generated (dynamic) future scenario in this study, therefore, represents a future that will occur if all assumptions and future trends of this scenario come true. Policy options that do not yield undesirable effects in these future scenarios are considered 'robust'. In this report, therefore, various policies are independently and jointly tested for their robustness across all scenarios. A brief explanation about the use of ESDMA for this report can be found in Box II.

There are several advantages to the use of this approach. Compared with more qualitative methods, ESDMA makes it possible to examine behavior that is not obvious but may be a consequence of the interaction of various uncertainties. There are two advantages compared with traditional quantitative research methods. First, this approach makes it possible to examine the effects of uncertainties for which the probability distribution is unknown. Second, no expectation is created about the future: because of the presence of deep uncertainties, it is clear from the outset that there are several possible futures, whereby it cannot be said how likely it is that one of these scenarios will take place.

This report is primarily concerned with the affordability of societal aging. To be able to make statements about this both the costs of care and the required government contribution to the state pension (AOW) – both as a portion of GDP – are taken into consideration. Combining these two values creates a picture of the overall affordability of aging.

It is important to develop and test policy options to prevent a situation from arising where the costs of societal aging become unaffordable. The effectiveness of the policy options can vary greatly among the scenarios. In this study, the options are, therefore, tested across all scenarios that have

been generated on the basis of the present (deep) uncertainties. Furthermore this approach considers how robust the policy is in the uncertain future. As such, this study offers starting points for the possible problems that societal aging brings, as well as solutions.

BOX II EXPLORATORY MODELING & ANALYSIS
IN COMBINATION WITH SYSTEM DYNAMICS (ESDMA)

Financial and other consequences of societal aging are closely connected to combinations of different developments, which are themselves uncertain. An ESDMA approach emphasizes deep uncertainty, the exploration of the 'space' of future scenarios that this creates, and the effectiveness of various policies in mitigating undesirable futures. To map these dynamics and uncertainties, a System Dynamics model has been made as a scenario generator for EMA.10 This box briefly describes how this methodology is applied and how its results are presented in the images.

The uncertainties increase the 'space' of possible outcomes, such as population size or GDP. To explore the impact of such deep uncertainty, a large number (1000) of runs are performed with the model. Each outcome is a graph over time relating to one outcome indicator for one specification of the uncertainties. For example, for the outcome indicator 'Dutch population' the runs lead to the set of outcomes shown in Figure 1.

Most of the runs produce results that fall within a bandwidth that is to be expected and are also considered by other studies (such as by the CBS, Central Bureau of Statistics), see Figure 2. With the ESDMA approach the point is however to further analyze specifically those runs in an undesirable range (see Box III). This report does not focus on a 'most likely' future scenario, but rather on scenarios where the costs of societal aging become unaffordable. The policies discussed in this report therefore aim to prevent such a situation from occurring. This is also the essence of robust measures: measures that prevent undesirable effects, regardless of the future, without causing negative side effects.

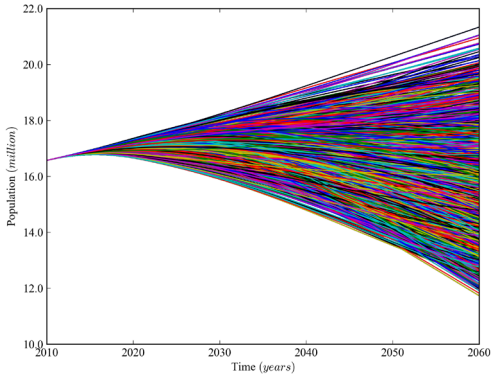

FIGURE 1: ALL THE RUNS IN THE ENSEMBLE FOR THE DUTCH POPULATION TO 2060 WITHOUT IMMIGRATION.

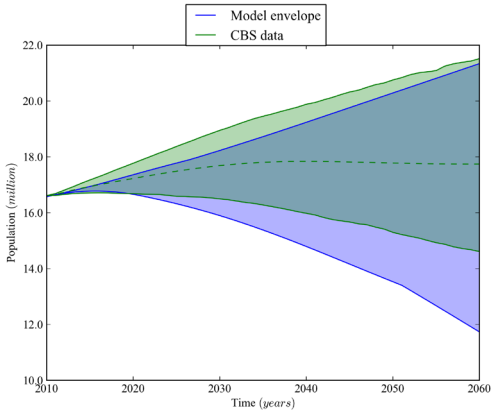

FIGURE 2: THE ENSEMBLE FOR THE DUTCH POPULATION TO 2060 WITH THE CBS FORECASTS OVER THE SAME PERIOD.[11] THE DIFFERENCES BETWEEN THE RESULTS CAN BE EXPLAINED BY NOT INCLUDING THE EFFECTS OF MIGRATION IN THIS STUDY.

2 UNAFFORDABLE SOCIETAL AGING

The affordability of aging is determined by several factors that together constitute a balance. This balance consists on the one hand of the development of the cost of care and government contribution to AOW, and on the other hand the level of GDP. A rise in healthcare costs or an increase in the proportion of the population drawing a state pension (AOW) will have a negative impact on the affordability of aging. Meanwhile, an increase in GDP improves affordability. In order to make the limits of sustainability for public finances explicit, Table 1 below defines somewhat abstract categories of desirability, which are further explained in Box III.

In the figures in this report the boundaries between the desired, sustainable and undesirable categories are indicated by green and orange dashed lines respectively, while the limit of public expenditure is shown with a red dotted line. The graphs are truncated at the boundary of GDP. In the figures percentages are shown as fractions, whereby for example 0.1 is equal to 10% and 1.0 to 100%.

TABLE 1: VALUES FOR THE COSTS OF AGING AS PART OF GDP AND AFFORDABILITY.

RELATIVE COSTS SOCIETAL AGING	AFFORDABILITY
≤ 10%	Affordable, but not realistic
> 10%, ≤ 25%	Affordable
> 25%, ≤ 50%	Undesired; potentially unaffordable
Approximately 50%	Unaffordable; limit of public expenditure
100%	Unaffordable; limit of GDP

BOX III LIMITS IN STATE FUNDING

EXPLANATION OF THE AFFORDABILITY BOUNDARIES FOR THE RELATIVE COSTS OF AGING

ABSOLUTE LIMITS

The affordability boundaries in Table 1 indicate different levels at which the costs of aging can develop. The Dutch economy and society will not be able to bear every cost level. For example, the current limit of public expenditure is approximately 50% of GDP (a political choice),[12] whereas 100% is equivalent to the entire GDP. Simply put, it is impossible for our society to spend more than 100% of GDP on health care and pensions. The actual limit is probably much lower, given that, for example, food, housing, education, and culture also account for a large proportion of public expenditure. Since most of the costs of aging are collectively funded, this is also a clear boundary. Expenditure on health care and government funding of the state pension above 50% of GDP is, thus, effectively impossible from a contemporary perspective.

OTHER DESIRABILITY LIMITS

The question that remains is within which limits expenditure on aging-related costs as a proportion of GDP find themselves, and the desirability of such a situation. In recent years, public spending on health care has grown faster than economic growth. In the long-term, this will lead to an undesirable situation for public finances, because the cost of care will supplant other government expenditure (much like a cuckoo's egg). It is therefore important to establish sustainable limits within which health care costs as a proportion of GDP should remain.

This report is based on three cost levels. First, a scenario in which care costs decrease relative to current costs is viewed as highly desirable. A situation where the costs increase between 10% and 25% is regarded as acceptable, as the costs then remain comparable with current levels. Cost increases of 25% to 50% of GDP will require that additional measures be implemented. It is advisable to determine an acceptable limit for the costs of societal aging (as part of GDP) before the issue becomes acute and unaffordable.

2.1 GOVERNMENT CONTRIBUTION TO AOW

Since the Dutch tax reform in 2001, premiums for the state pension (AOW) no longer provide full coverage. The principle reason for this is that the tax credits in 'tax box 1'* are also deducted from the AOW premiums, thus leaving the actual income from the premiums considerably lower. Hence, since 2001 a government contribution to AOW exists[13] As a part of GDP, this grant is currently not very high (less than 1% in 2008).[14] This can significantly increase however as a result of societal aging, although a decrease is also possible. Compared to the total AOW expenditure (Figure 3) current government contributions cover approximately one-third of the cost. Figure 4 shows the limits within which the government contribution to AOW develops in the model study. The affordability boundaries as defined in Table 1 are also displayed as dashed lines in the figures.

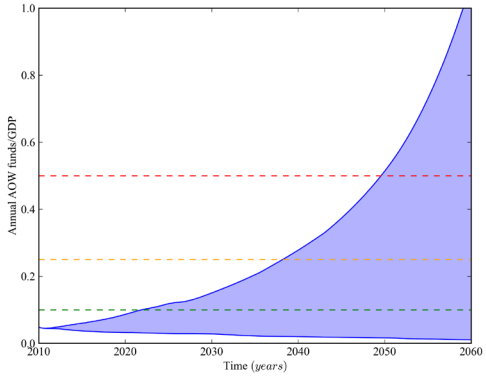

FIGURE 3: POSSIBLE DEVELOPMENTS OF TOTAL AOW EXPENDITURE AS PART OF GDP.

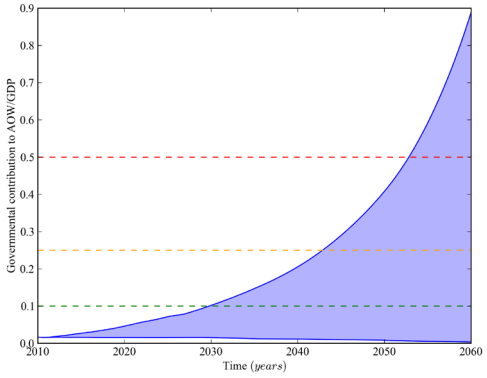

FIGURE 4: POSSIBLE DEVELOPMENTS OF GOVERNMENT CONTRIBUTION TO AOW AS PART OF GDP.

* The Dutch tax system is split into three so-called 'boxes' each related to three different types of taxable income. Each box has its own rules and rates and your income or assets will be taxed in one, two or possibly all three of these boxes. Box 1 concerns income from work and the value of your principal residence; Box 2 concerns income from a substantial business interest; Box 3 concerns savings and investments.

Given that AOW premiums are limited and only paid for by the workforce, a greater proportion of pensioners will result in an increased share of the government's contribution to AOW as a proportion of total AOW expenditure. In the worst case scenario, this government share will reach four-fifths of total expenditures by 2060, as represented by the upper line in the shaded area in the figures.

In the ensemble of the model study the government contribution to AOW as a proportion of GDP shows a large spread. In fact, the value for this indicator can end up in the untenable area above the limit of public spending (50% of GDP). The main reason for the increased government contribution to AOW reaching the undesirable or impossible region is a further increase in life expectancy and decreasing or constant labor productivity.

2.2 HEALTH EXPENDITURE AND GDP

Another frequently mentioned consequence of aging is that healthcare costs will rise. The amount of health expenditures as a percentage of GDP in 2009 was 14.7%.[15] Figure 5 displays the total spread of ESDMA outcomes for this indicator up to 2060.

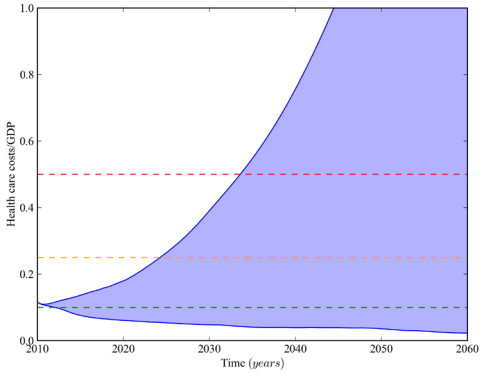

FIGURE 5: HEALTH EXPENDITURE AS A PROPORTION OF GDP.

The figure clearly shows that the cost of care as part of GDP may increase considerably in the coming decades. In the worst cases, the health care costs rise above the limit of public expenditure or GDP and become

untenable. In reality, it is obviously not possible that the costs of care exceed GDP or maximum public expenditure. The graphs are truncated at 100% of GDP to emphasize the impossibility of values beyond this level. In the simulation model, this impossibility is not explicitly built in, because doing so would implicitly incorporate the system's responses, which are in fact policy options. These high, 'impossible' values exceeding 100% of GDP thus represent the *impossibility* to *not* solve this problem.

Values in the clearly unaffordable region (Table 1 and Box III), with values above 50% or even 100% of GDP, are mainly caused by a number of specific, deeply uncertain trends. The most important uncertainty is future Dutch labor productivity. In all situations with a calculated value for health spending exceeding GDP, there is a decrease in labor productivity. A constant level of labor productivity often leads to situations in which health care spending exceeds public spending. The development of unhealthy behaviors, such as smoking, drinking, unhealthy eating habits, and inactivity, also play an important role in this. These lead to higher health care costs and a shorter healthy life. As such they have a negative impact on the sustainability of health care expenditure. Finally, a low labor participation of older people has a negative impact on the desirability of the costs of aging, because of the negative effect that this factor has on the economy in times of labor shortage.

2.3 TOTAL COST OF SOCIETAL AGING

In the preceding sections, two aging indicators have been discussed that, at high values, may lead to an unaffordable situation. Because both indicators can be linked to the burden they impose on the GDP, it is also possible to add them to a potential total value for the costs of aging for each scenario. The size of this composite indicator for the ensemble is shown in Figure 6, which also includes the desirability boundaries as dashed lines (Table 1 and Box III).

To ultimately reach an affordable total cost of aging, it is important that the boundaries of the ensemble of outcomes shown in Figure 6 remain below 50% (0.5), and preferably lower. This figure also shows that scenarios exist in which government finances end up in the affordable domain. However, it is important to ensure that the other, more negative futures also remain within these acceptable limits. Therefore it is important to develop a robust

and adaptive policy that comes into operation when it is needed. The purpose of this policy is to keep all conceivable scenarios within desirable limits. Various policy options and strategies that can achieve this purpose will now be discussed.

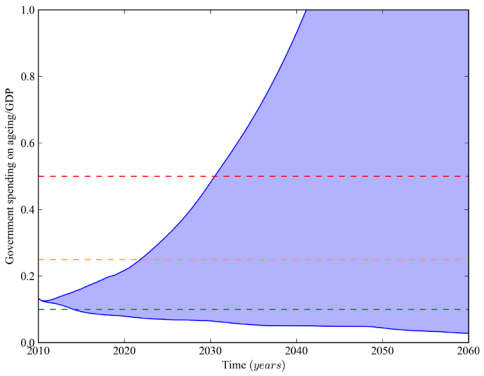

FIGURE 6: TOTAL GOVERNMENT COST OF AGING POPULATION AS PART OF GDP.

3 AFFORDABLE AGING

There are several possible strategies and measures to keep aging affordable. The most often heard is undoubtedly raising the retirement age to 67 years (and perhaps higher in the future), but more is certainly possible in this area. Therefore, policy options and strategies have been designed that may impact on the previously discussed indicators for the affordability of aging. These options are then tested over the entire ensemble of plausible futures, to see how they function under all simulated conditions. A summary explanation of all the tested policy options can be found in Box IV.

3.1 POLICY OPTIONS

The designed policy options have an impact on several factors that are either often linked with the aging population, or related to factors that during the pilot study were found to have an influence on the degree of desirability of some aging indicators. An overview of the options tested in this study can be found in Table 2.

TABLE 2: POLICY OPTIONS TO COUNTERACT THE UNDESIRED EFFECTS OF DEMOGRAPHIC AGING. ALL POLICY OPTIONS ARE IMPLEMENTED IN THE MODEL FROM 2015, EXCEPT FOR THE RETIREMENT AGE PROPOSALS.

POLICY OPTION	GOAL
RETIREMENT AGE	
Retirement age according to pension agreement	In 2020 to 66 years, in 2025 to 67 years. Thereafter coupling with life expectancy according to the formula V = (L - 18.26) - (P - 65).[16]
Retirement age according to Dutch stability programme 2012	Between 2013 and 2019 the retirement age will gradually be raised to 66, and thereafter gradually to 67 by 2023. From 2024 onwards it is assumed that the increase will proceed as planned in the pension agreement, but with a delay of 10 years instead of 11 years.
Robust retirement age	Periodically adjusted, adaptive retirement age at 85% of life expectancy
PREVENTION OF UNHEALTHY BEHAVIOR	
	0,5%/year reduction in the proportion of the population with unhealthy habits
OPTIONS EMPLOYERS	
Equalize age-preference employers	10%/year improvement in the relative age-preference of employers
Increase relative number of hours per older employee	2%/year reduction of portion not worked full time for workers over 45 years
Increase labor participation	2%/year reduction in portion not in full employment for workers over 45 years
LABOR PRODUCTIVITY	
Increase productivity Dutch workforce	2%/year increase in average labor productivity relative to reference
Increase productivity in curative care	2%/year increase of productivity in curative care compared to reference
Increase productivity in long-term care	2%/year increase in productivity in long-term care compared to reference

BOX IV POLICY OPTIONS
MOTIVATION AND IMPLEMENTATION

RETIREMENT AGE

Retirement age according to pension agreement

The pension agreement (2011) proposed raising the retirement age to 66 in 2020 and to 67 years in 2025. This is followed by a coupling with life expectancy, which the legislative proposal defines as follows: 'using the following formula: V = (L - 18.26) - (P - 65); V is the number of years that the retirement age respectively commencement age is increased, L stands for the estimated macro-average remaining life expectancy at age 65 in the calendar year of increase; P stands for the retirement age in the calendar year preceding the calendar year of increase. Where V is negative, or before rounding is less than 1, it is set at 0. If V is 1 or more before rounding, this is set at 1. The increase takes place 11 years after the final date of legal binding.[17] The motivation for this measure is that the current retirement age was introduced at a time when life-expectancy was much lower than now.

Retirement age according to Dutch stability programme 2012

The Dutch stability programme 2012 (also called spring or Kunduz agreement) proposes to accelerate an increase in the retirement age, in order to achieve additional savings with respect to the change in retirement age as proposed in the pension agreement. In this proposal, the retirement age will be increased gradually to 66 years between 2013 and 2019, and then gradually to 67 in 2023.[18] In this study it is assumed that from 2024 the increase proceeds as planned in the pension agreement, but with a delay of 10 years instead of 11 years.

Robust retirement age

Even with the proposals in the spring or pension agreement, the government contribution to AOW can continue to rise relative to GDP, particularly as life expectancy increases faster than the retirement age. It is also possible that over time life expectancy decreases, as happened in Russia after the collapse of the Soviet Union. Both the proposal from the pension agreement and the proposal in the stability programme does not allow the retirement to be lowered too much. In both cases, the current proposals are not sufficiently robust given these situations.

In this policy option the retirement age is also coupled with life expectancy. In this study an arbitrary and illustrative limit of 85% of life expectancy has been chosen. This percentage indicates the approximate ratio of the current life expectancy at birth for a Dutch man (79 years)[19] and the proposed increase in retirement age of 67 years.

In this model this measure is directly implemented from 2015. Every ten years the retirement age is re-evaluated, so in the time frame to 2060, in 2025, 2035, 2045 and 2055. This policy option differs in some aspects with current proposals. First, this option is based on a relative limit with respect to life expectancy. The plans of the pension- and spring agreement assume a constant difference with life expectancy. Furthermore, this policy option responds more quickly to changes in life expectancy, while a decrease in the retirement age as a result of a decrease in the life expectancy is also possible.

PREVENTION OF UNHEALTHY BEHAVIOR

Unhealthy behavior results in people living shorter lives and living unhealthily for longer. The latter causes an increase in health care costs. If average unhealthy life expectancy (the number of years a person lives unhealthy to the end of their life) decreases by successful prevention of unhealthy behaviors, health care costs can be curtailed.

The model uses current trends for the proportion of the population that smokes, drinks too much, is obese or inactive, and from 2015 reduces this by 0.5% per year until a bottom value of one percent – of the population who have an unhealthy lifestyle – is reached.

OPTIONS EMPLOYERS

Equalize age-preference employers

One possible brake on the effect of increasing the retirement age is the age-preference that employers have when hiring or retaining employees. Due to employers' preference for younger workers, older people only acquire (new) work in periods of labor shortage. By equalizing this age-preference in the coming years the economic effect of raising the retirement age can be amplified.

One method to achieve this would be introducing wage restraints for older, less productive employees. In the model this measure is implemented by slowly increasing the age-preference for all working ages to a point of maximum preference. The measure is effective from 2015 and applies to all age categories that can at one point be counted as part of the working population.

Number of hours per older employee

Another factor that reduces the effectiveness of increasing the retirement age for the Dutch economy, is the fact that older workers often do not work fulltime. Encouraging older employees to work longer hours increases the effect of raising the retirement age. This measure is also effective from 2015 and applies to employees above 45 years. The difference between the current number of hours of work per week by age and the full-time equivalent is reduced by two percent annually.

Adjust labor force population among older people

As older people can work part time for their pension, they can retire earlier. This led to an average retirement age of 62.7 years in 2010.[20] Here too, raising the retirement age has little effect if many older workers have stopped working.

This was also one of the conclusions of the Bakker report.[21] In the model this measure is implemented by reducing the difference between employment rates by age and the maximum participation rate by two percent per year.

LABOR PRODUCTIVITY

Labor productivity working population

The labor productivity of Dutch employees is one of the determinants of future GDP. With a decline in productivity, the relative pressure of aging on the national economy will increase further than in a situation of constant or increasing productivity. Increasing labor productivity can be achieved by developing new technology and encouraging innovation. In the model this measure is implemented as a 2% growth in labor productivity per year relative to the uncertainty (exogenous) trend.

Labor productivity in curative care
For all life stages curative care is a major cost item and the total costs of this care as part of GDP have been growing for years.[22] Increasing labor productivity in curative care can limit the development of these costs. This measure will be implemented from 2015 and ensures that the productivity of curative care increases by two percent compared to the uncertainty (exogenous) trend.[23]

Labor productivity in long-term care
The cost of long-term care increases significantly for ages above 80 years.[24] With an aging population chances are high that these costs will remain significant. This measure is implemented in the same way as the increase in labor productivity in curative care.

3.2 GOVERNMENT CONTRIBUTION TO AOW

Since the increase in government funding of AOW is strongly correlated with the increase in life expectancy, the chance of successful policy to limit this government contribution is greatest if policy can adapt to life expectancy. This type of policy, which in terms of implementation is made dependent upon the development of predetermined performance indicators of the system, is called an adaptive policy. This is in contrast to static policy, which remains unchanged regardless of the specific developments in the system. The old retirement age, fixed at 65, is a typical example of static policy. After implementation it is assumed that the goal is reached and that the precise operationalization of the policy in the long-term will not need to be adjusted.

Considering that the average life expectancy of the Dutch population has developed strongly[25] since the introduction of AOW in 1956,[26] a choice can be made for a retirement age that adapts to life expectancy. Depending on the life expectancy (see ensemble of outcomes in Figure 7) several specific values can be examined for the retirement ages (Figure 8) as defined in the previously discussed policy options.

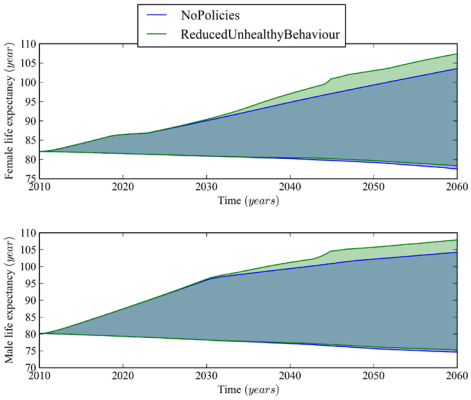

FIGURE 7: ENSEMBLE FOR LIFE EXPECTANCY, WITH AND WITHOUT POLICY PREVENTING UNHEALTHY BEHAVIOR.

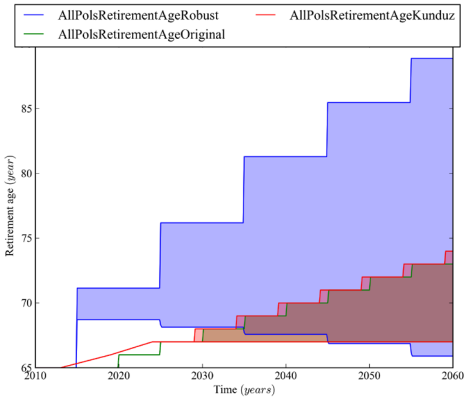

FIGURE 8: DEVELOPMENTS FOR THE RETIREMENT AGE WITH A COMBINATION OF ALL POLICY OPTIONS.

The retirement ages in Figure 8 demonstrate that with rapid advances in life expectancy, retirement age options from the pension and spring agreement will increase at maximum speed. The retirement age proposals in the pension and stability program 2012 cannot keep up with this rapid increase. In the robust adaptive policy, the retirement age is set at 71 years in 2025 and at 74 in 2035.

The difference between the policy options of the pension agreement and the stability program are minimal: the option from the stability program is only an accelerated implementation of the pension agreement. Both options, therefore, have the same shortcomings. The robust policy option shows a much stronger increase in the retirement age in order to reach affordable public finances and deal with situations where life expectancy rises rapidly. Furthermore, in the long-term it is possible to reduce the retirement age if the life expectancy trend permits. Before that happens, however, the long-overdue increase in the retirement age needs to be rectified. Hence, in any case, the retirement age must be increased in the short term to at least 68 years and maybe even higher.

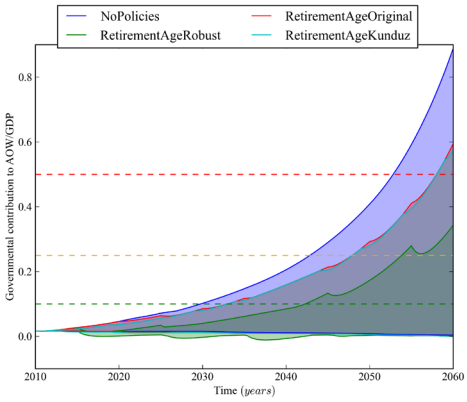

FIGURE 9: GOVERNMENT CONTRIBUTION TO AOW AS PART OF GDP WITH POLICY OPTIONS FOR INCREASING THE RETIREMENT AGE.

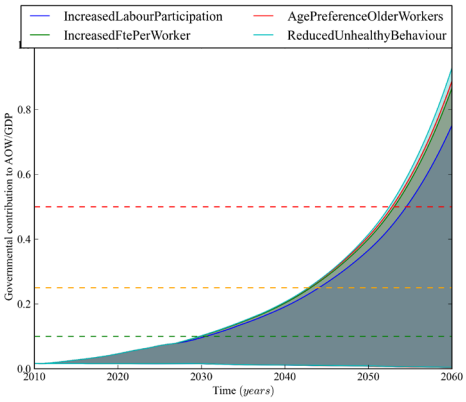

FIGURE 10: GOVERNMENT CONTRIBUTION TO AOW AS PART OF GDP WITH POLICIES FOR LABOR PARTICIPATION, THE RELATIVE NUMBER OF HOURS PER WORKER, INCREASING THE AGE PREFERENCE FOR OLDER WORKERS AND REDUCING UNHEALTHY BEHAVIOR.

The effect of these different measures on the government contribution to AOW as part of GDP is shown in Figure 9. It is clear that in adverse scenarios the current proposals for increasing the retirement age will not be sufficient. This is caused by the restrictions in the policy. The first limitation is that the retirement age in both proposals will be raised by a maximum of 1 year every 5 years, with a delay of 11 or 10 years respectively for the pension agreement and stability program 2012. Due to this limitation and the large delay, it is not possible for the retirement age to follow a sharp increase in life expectancy.**

The increase in the labor participation of older workers is likely to have a beneficial economic impact (Figure 10). Adjusting the age-preference and full-time work of (older) employees has little effect in this simulation if all

** The calculation as indicated in the legislative proposal is more complicated than is strictly necessary. For example, an increase in the retirement age is always – even after raising the retirement age – based on the life expectancy at 65 years, after which, to correct this, the value of 65 is deducted from the retirement age at that moment. It would be more logical to determine the life expectancy at the age at which the pension commences and to change the formula to: = V (LP - 18.26), where LP is the life expectancy at retirement age at the moment just before the increase (previous increases which then take place, are thus included).

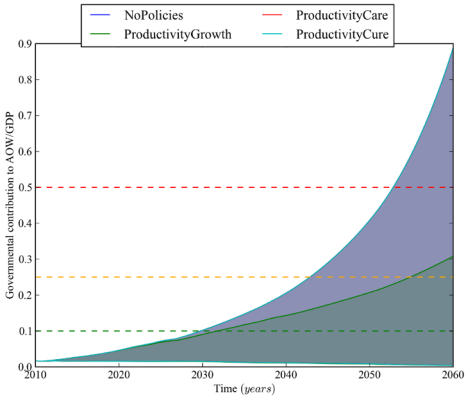

FIGURE 11: POSSIBLE GOVERNMENT CONTRIBUTION TO AOW AS PART OF GDP WITH POLICY OPTIONS THAT INCREASE THE LABOR PRODUCTIVITY OF THE WORKFORCE AND IN THE HEALTH CARE SECTOR.

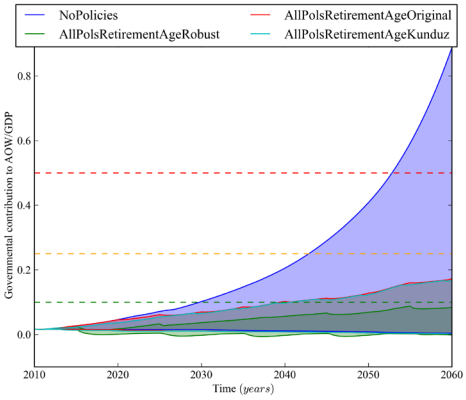

FIGURE 12: POSSIBLE GOVERNMENT CONTRIBUTION TO AOW AS PART OF GDP WITH DIFFERENT RETIREMENT OPTIONS.

these measures are introduced by themselves. By reducing unhealthy behavior, life expectancy increases, as could already be seen in Figure 7. This reduces the possible need for government contribution to AOW. For the affordability of the AOW, this measure, therefore, has a negative effect. Investing in the productivity of the Dutch workforce is a strategy that will have a huge impact on the development of GDP and can, thereby, also greatly reduce government funding of AOW as part of GDP. In itself, this strategy is thus the most effective of all possible policy options (Figure 11). A disadvantage is that this is not easy to achieve and will require continued commitment and focus on the future by both the Dutch government and private sector. Productivity increases in health care have no effect on this indicator, as would be expected.

When all measures are combined with the different retirement age options (Figure 12), we see that the government contribution to AOW can be restricted when a (gradual) adaptive retirement age is chosen. In that case, the whole ensemble of outcomes is reduced to below 10% of GDP. In a number of scenarios the two other variants lead to a government AOW contribution approaching 20% of GDP.

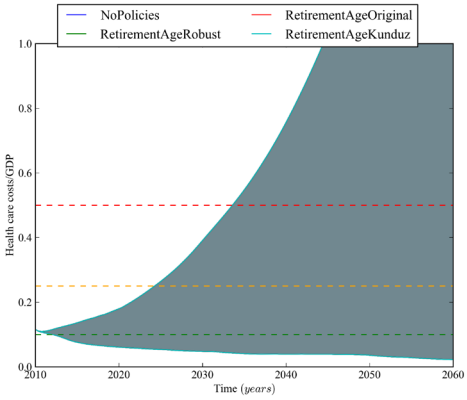

FIGURE 13: CARE COSTS AS A PROPORTION OF GDP WITH POLICY OPTIONS FOR INCREASING THE RETIREMENT AGE. THE FIGURE SHOWS THAT THE DIFFERENT POLICY OPTIONS HAVE NO EFFECT ON THE COST.

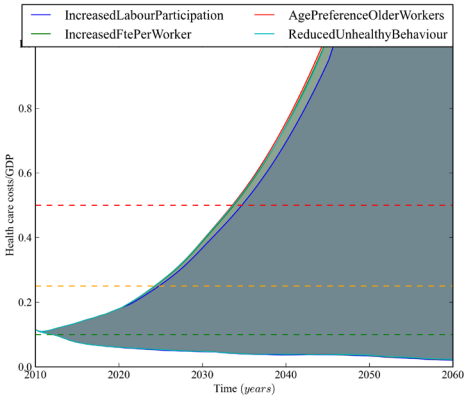

FIGURE 14: CARE COSTS AS A PROPORTION OF GDP WITH POLICY FOR LABOR PARTICIPATION, THE RELATIVE NUMBER OF HOURS PER WORKER, INCREASING THE AGE PREFERENCE FOR OLDER WORKERS AND REDUCING UNHEALTHY BEHAVIOR.

3.3 HEALTH CARE COSTS AND GDP

There are two ways to restrict an increase in the proportion of GDP spent on health care costs: limit health care costs or ensure that GDP increases more than would have happened in the absence of any policy measures. Figures 13, 14 and 15 show the effects of various policy options if no other policies are introduced. Figure 16 shows the effect of the simultaneous implementation of the various options.

It is noticeable that raising the retirement age alone does not lead to lowering the cost of care as part of GDP. This can be explained in several ways. First, an increase in the retirement age does not mean that labor force participation (more older persons working) increases or that the number of hours that the average older persons works increases. Further, an increase in the retirement age does not necessarily lead to new jobs and thus also not to a higher GDP. Moreover, this study assumes that the demand for care is not correlated with the age of retirement. It is also true that, in times of labor shortages, an increase in the retirement age will lead to economic growth, because more jobs can be filled. An increase in the employment of older workers can thus also lead to higher GDP, whereby the costs as a share of GDP become lower. This effect is dependent on the

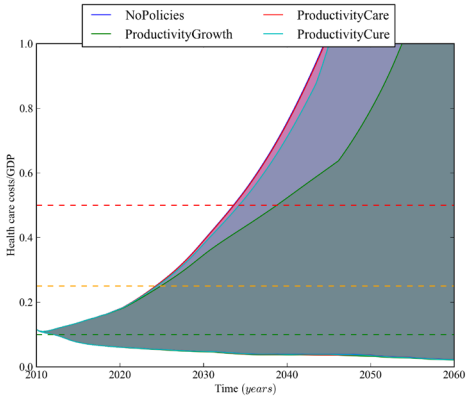

FIGURE 15: CARE COSTS AS A PROPORTION OF GDP WITH POLICY OPTIONS THAT INCREASE THE PRODUCTIVITY OF THE WORKFORCE AND THAT IN HEALTH CARE.

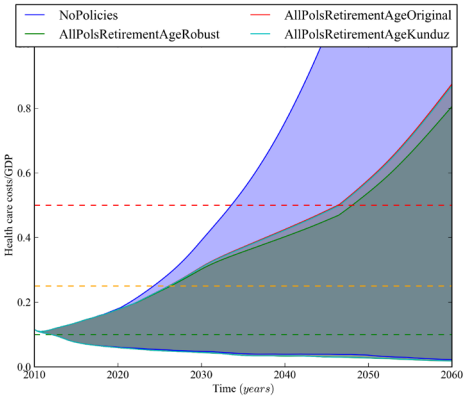

FIGURE 16: CARE COSTS AS A PROPORTION OF GDP WITH ALL COMBINATIONS OF POLICY OPTIONS WITH DIFFERENT RETIREMENT OPTIONS.

availability of suitable work for older people. The same applies to the relative number of hours that older employees work, but this effect is much smaller.

As with the government contribution to AOW as part of GDP, increased productivity of the Dutch workforce has a strong positive effect on the cost of care as part of GDP (Figure 15). Productivity in long-term care can have a similar but smaller effect. This effect mainly works in the long term, because it has the greatest visibility when the costs of long-term care exceed the costs of curative care. This moment is not visible in the figure, because by this time and in the worst case scenario the cost of care will already be too high. With this measure however – that, as with labor productivity, is not easy to achieve – health care costs are directly limited, because high productivity makes care less labor intensive. Productivity in curative care seems to have almost no effect. The cause for this is that, in the most undesirable situations, the cost of curative care is relatively limited with respect to the costs of long-term care.

Combining different policy options (Figure 16) reveals that the cumulative effect can be very strong, so much so that in this simulation no situations

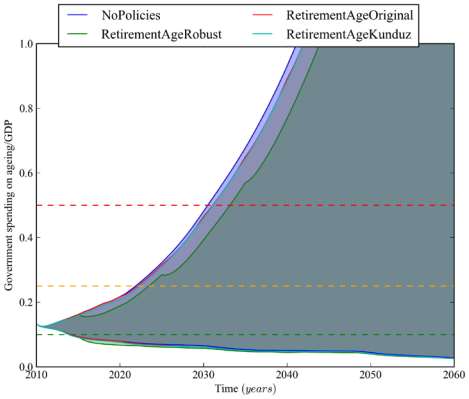

FIGURE 17: EFFECTS OF ONLY AN INCREASE IN THE RETIREMENT AGE TO THE TOTAL COST OF AGING AS PART OF GDP.

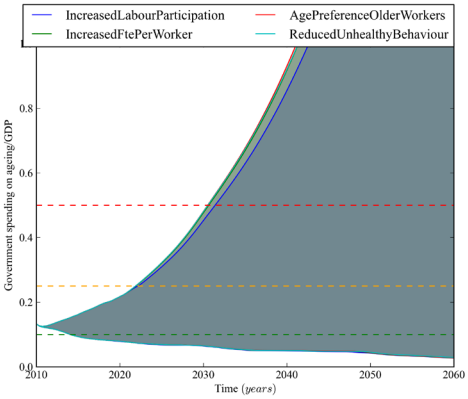

FIGURE 18: EFFECTS OF POLICIES ON EMPLOYMENT, THE RELATIVE NUMBER OF HOURS PER WORKER, INCREASING THE AGE PREFERENCE FOR OLDER WORKERS AND REDUCING UNHEALTHY BEHAVIOR ON THE TOTAL COST OF AGING AS PART OF GDP.

with costs exceeding GDP recur. The specific effects of increasing the labor participation of older workers and increasing the productivity of the workforce and in long term-care combine to yield a more sustainable situation for the development of health care costs. Hereby the exact retirement age has little effect, since a higher retirement age leads to more labor supply, but not to more demand. Raising the retirement age does, therefore, not lead directly to economic growth, unless there is labor shortage. The retirement age, thus, has little to no effect on health care costs as part of GDP, whilst this is indispensable for the government contribution to AOW.

3.4 TOTAL COST OF SOCIETAL AGING

Lastly, it is important to see if the total cost of societal aging is sufficiently reduced by the policies. The potential pressure on GDP from health care costs is greater than the pressure of the government contribution to AOW. As a result, adjusting the retirement age has a relatively small effect on the sustainability of societal aging (Figure 17). Above all, measures will have to be taken that keep the cost of care within acceptable and affordable limits.

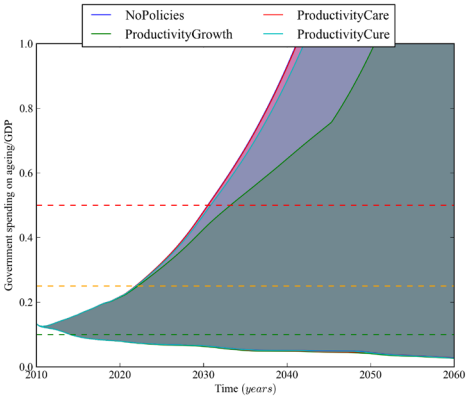

FIGURE 19: EFFECTS OF INCREASING PRODUCTIVITIES ON THE TOTAL COST OF AGING AS PART OF GDP.

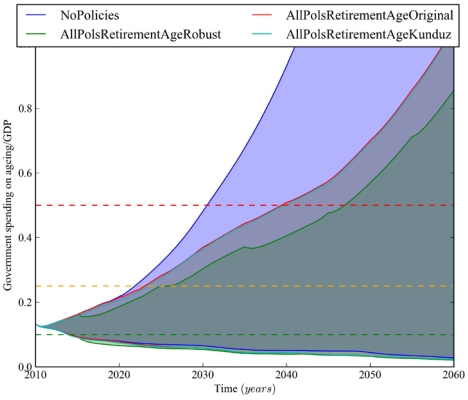

FIGURE 20: EFFECTS OF THE COMBINED POLICY OPTIONS WITH DIFFERENT RETIREMENT AGES ON THE TOTAL COST OF AGING AS PART OF GDP.

The increase of labor participation amongst older workers has a positive economic impact, and therefore also on the restriction of health care costs and the state AOW contribution (Figure 18). But this effect is limited. Reducing unhealthy behavior, however, has a possible negative net effect, because the additional costs due to increased longevity could be greater than the benefits of reduced demand for care.

Increasing the labor productivity of the Dutch population has, as might be expected from the above, a strong influence on the affordability of aging (Figure 19). It is, therefore, interesting to see that regardless of deeply uncertain future trends, the combination of the above measures with a robust retirement age that can absorb a sharp increase in life expectancy has a strong positive effect on the sustainability of aging.

4 CONCLUSIONS

This report demonstrates that the cost of aging for Dutch society can, in some situations, become unaffordable because of the interplay of various deep uncertainties. In that case, the sum of the cost of care and AOW as part of GDP can reach undesirable, or even impossible, levels. These undesirable situations can be prevented by timely identification of the causes of the rise in costs and by implementing measures that eliminate these effects.

The main factors that lead to unaffordable situations with regard to the costs of aging are:

- *A declining or unchanged level of labor productivity in the Dutch workforce*: The future labor productivity determines the GDP of the future. If GDP falls or remains unchanged by such a trend in labor productivity, then the sum of health care costs and the government's contribution of AOW will soon lead to highly undesirable levels relative to GDP.
- *Strong growth in the costs of (long-term) care as a share of GDP*: Older people in the final stages of life account for the largest share of long-term care. As the share of older people in the total population increases, the cost of providing long-term care will rise faster than GDP.
- *An increase in unhealthy behavior*: Unhealthy behavior, such as smoking, alcohol consumption, and unhealthy eating habits and inactivity, increase the risk of diseases. As a result, unhealthy life expectancy increases and overall life expectancy decreases. The first two effects are particularly important in increasing the costs of care.
- *Low levels of labor participation of older people*: Although the average age at which older people stop working is increasing, many older workers stop working several years before the pensionable retirement age. This results in a decline of the total labor force, which, in the case of labor shortage, will lead to a decrease in GDP.

- *A further increase in life expectancy*: Due to improved care and a healthier lifestyle, life expectancy may further increase. This leads to an increase in state pension (AOW) payments, resulting in an increase in the government's contribution to AOW.

A number of policy options can be introduced to achieve affordable aging. This study demonstrates that no policy option reduces costs sufficiently to keep the cost of aging at a sustainable level across all scenarios. Therefore, a combination of measures should be implemented that together will result in a sustainable situation, regardless of which scenario ultimately manifests itself. This robust set of measures and strategies should take into account the following:

- The most important strategy to maintain the affordability of societal aging is to *increase the labor productivity of the Dutch workforce*. This will lead to the increase in GDP that is sufficient to absorb the increasing costs of aging.
- Increasing the retirement age mainly has an impact on the affordability of the state pension (AOW). Therefore, it is important to *link the retirement age to life expectancy*, as proposed in the pension agreement of 2011 and the Dutch stability programme of 2012. In cases where life expectancy strongly increases or decreases, these proposals are inadequate. On several points these can, therefore, be improved to ensure greater sustainability of public finances:
  1. The retirement age should be raised by more than 1 year every 5 years; so, the current proposed increases in the retirement age are insufficient in the short and medium term.
  2. The delay between the decision to raise the retirement age and the introduction of the increase (as proposed in the stability programme and pension agreement respectively), is too large to respond adequately to developing changes.
  3. Life expectancy in the current proposals is always assessed at 65, even if the retirement age has increased. Adjusting this assessment to the life expectancy at the existing retirement age for the proposed increase makes the calculation simpler and more accurate.
  4. The government's strategy should also take into account the possibility that life expectancy decreases in the next 50 years.

- The efficacy of increasing the retirement age is greatest when combined with measures that *increase employment of older workers* and *reduce part-time work by older people*.
- *Increasing productivity in long-term care* is important to maintain its affordability. This has the additional effect that the potential labor shortages in health care as a result of the aging population will be smaller than without these measures. Indeed, higher productivity means that fewer people are needed to do the increased amount of work.

This study is only a first step towards an exploration of the potential costs of aging and solutions to restrict those costs. More research is needed to determine which policy combinations will lead to desirable results. Furthermore, the research should look at measures that could lead to the results envisaged in relation to the labor productivity of the workforce and in care.

In this study, the effects of immigration are not included. Due to an increasing demand for care, the risk of labor shortages in care are very plausible, whereby the demand for care cannot be met. Immigration could be a solution to this, as shown in the study of Logtens.[27] This requires the Netherlands to remain attractive to migrants, which amongst others is related to Dutch competitiveness, which depends on productivity and Dutch prosperity.

In this study, the effect that increasing the retirement age will have on GDP is not included, whilst such an effect may very well exist. This may, for instance, include the effects that the knowledge of older workers, which is then available for longer, will have on the productivity of younger workers. An opposite effect would be that older workers, because they retire later, make more use of unemployment benefits, thereby having less money available and spending less, causing a negative effect on the economy. Therefore, more research is needed into the different effects of raising the retirement age, so that the consequences of this can be explored.

Finally, a major reason for the escalation of the costs of societal aging is the exponential growth of healthcare costs towards the end of life. This development will in time undoubtedly lead to emotionally-charged discussions of medical ethics and the purpose and meaningfulness of

treatment and the consequences this has for individuals and society. At this point the focus of both medical and long-term care will shift from longevity (long life) to quality of life (human dignity). From the perspective of costs, this question is not urgent. Right now is therefore a good time to discuss in detail the medical-ethical side of shorter treatment of terminally ill patients, and to take the outcome of this discussion into account in decision making.

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