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Life Cycle Option Value

The value of consumer flexibility
in planning for retirement

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Abstract

Recent policy shifts in many of the advanced economies worldwide confront individuals with a greater personal responsibility in planning for their retirement. In this review paper, we build on the life cycle model and address how individuals should consider the importance of flexibility when planning for their retirement, taking an options-based view. We first address the notion of personal decision flexibility and outline its usefulness by providing an overview of the key research areas where option value has been investigated. We then apply an options-based view to personal life cycle planning. This general view is followed by a discussion of the three key capital components in a person's life cycle: financial capital, human capital, and health capital. For each of these components we provide examples of relevant consumer trade-off decisions and of the impact these decisions may have on life cycle option value. Next, we present an overview of behavioral considerations that can play a role in the evaluation of option value in retirement life cycle decisions. We conclude with a more practice-oriented discussion of an example of option value and mid-career retraining, including a presentation of general social challenges related to differences in option value between individuals.

Samenvatting

Optiewaarde in de levenscyclus: De waarde van flexibiliteit voor individuen bij het plannen van hun pensioen

Door beleidswijzigingen in de afgelopen jaren in veel landen met moderne economische systemen hebben individuen steeds meer verantwoordelijkheden gekregen in het plannen van hun pensioen. In dit overzichtsartikel wordt op basis van het levenscyclusmodel besproken hoe belangrijk flexibiliteit is bij het plannen van het pensioen. We bespreken eerst het concept van persoonlijke flexibele besluitvorming en laten de voordelen zien van het redeneren vanuit opties voor de toekomst aan de hand van een overzicht van de belangrijkste onderzoeksgebieden waarbinnen optiewaarde is onderzocht. Vervolgens passen we de optiegebaseerde benadering toe op het plannen van een persoonlijke levenscyclus. Hierna volgt een uiteenzetting over de drie belangrijkste vermogenscomponenten in een mensenleven: financieel kapitaal, menselijk kapitaal en gezondheidskapitaal. We geven voor elk van deze componenten voorbeelden van relevante beslissingen die individuen moeten nemen en de mogelijke invloed van deze beslissingen op de optiewaarde van het individu in de levenscyclus. Daarna geven we een overzicht van de gedragsmatige overwegingen die een rol kunnen spelen bij het beoordelen van optiewaarde bij pensioenvoorbereidingen en levenscyclusbeslissingen. We besluiten met een praktijkgerichte bespreking, namelijk herscholing halverwege iemands loopbaan. Algemene maatschappelijke uitdagingen die naar voren komen bij het faciliteren van verschillen in levenscyclusoptiewaarde tussen individuen komen ook aan bod.

1. Introduction

Growing financial pressures on collective pension systems in many of the advanced economies around the world lead to lower projections of retirement income and a move away from uniform collective pension agreements (Bodie and Prast, 2012; Lapperre, Oerlemans, and Dellaert, 2016). The resulting policy shifts confront individuals with greater responsibility in planning for their personal retirement. However, in order to make normatively optimal retirement planning decisions, they need to consider many important components and apply complex decision and optimization rules (Wendel et al., 2016). Key elements of this life cycle model¹ include decisions on education, consumption, health, savings, and retirement age (de Nardi et al., 2010; Hai and Heckman, 2015, 2017).

The fact that individuals face considerable inherent uncertainty regarding each and every component in the life cycle optimization model makes preparing for retirement an even more challenging task. For instance, people may be uncertain about their future health and therefore about how much money to set aside for unforeseen medical expenses. Also, potential policy shifts such as changes in the endorsed retirement age confront individuals with uncertainty as to whether they will be able to perform their current job until retirement age. Such uncertainty about future events motivates the main question addressed in this paper, namely, how do consumers consider and value flexibility when preparing and planning for retirement?

To understand the relevance of this question, consider the value of flexibility associated with one's human capital and its connection to the uncertainty regarding the ability to perform one's current job until retirement. The degree of flexibility in human capital can be thought of as the option value of human capital. It can increase, for example, through retraining² or even by changing one's career path around the age of 40 or 50. Retraining and switching jobs can offer more flexibility because it provides a person with more options to switch jobs later on. Thus, a person who retrains or switches jobs has a greater human capital option value than a person who sticks with the same job or does not retrain throughout his or her career. Increasing one's human capital option value is particularly interesting for persons

1 Note: 'life cycle investing' in the Dutch pension sector refers to moving from a riskier asset investment to one that is less risky in trying to achieve a personal investment objective. In the context of this paper, we use the life cycle concept from economics, which refers to individual consumption and savings behavior over the entire life span.

2 In line with Bolhaar et al. (2017), retraining refers to post-initial education, including courses and training sessions.

who perform highly physically demanding jobs, such as nurses or construction workers. Individuals in these professions have a greater chance of not being able to carry out their current jobs until their retirement age. Technological advancements can also produce uncertainty for individuals, which can be a reason why human capital option value is important. One can think of many jobs becoming obsolete due to advancements in technology, such as the introduction of self-driving vehicles, which can make truck drivers redundant. These examples illustrate that in response to future uncertainties, retraining programs can open up new opportunities for individuals. Consequently, individuals need to consider the impact of uncertain future information *now* when preparing for their retirement in the future.

Another example of option value relates to a person's decision to take out a mortgage loan when buying a house; this leads to lower liquidity now versus renting a house, which offers more flexible investment opportunities. Moreover, renting a house offers more flexibility in terms of mobility, plus it increases the possibilities to take on a job at a more distant location, which means greater labor market flexibility. In Table 1 we provide more examples of such trade-off decisions and how they can impact a person's life cycle option value.

In this paper we take an option-based view as we discuss how a person should value flexibility when preparing for retirement.³ Specifically, the focus is on different options that a person can take when preparing for retirement by incorporating flexibility in the decision-making process. We first address the notion of decision flexibility and describe its usefulness, with an overview of key research areas where option value has been explored. Second, we apply the concept of option value to personal life cycle preparation. To do so, we identify three key capital components in the life cycle model (financial capital, human capital, and health capital), arguing for the importance of decision flexibility, thus option thinking. We provide examples of consumer trade-off decisions related to these components, illustrating how decision flexibility can be a valuable tool to deal with uncertain future events. Third, to illustrate our analysis, we provide a detailed discussion of option value in the specific context of retraining. Lastly, we complement the normative view of option value with a discussion of behavioral and social concerns that may impact the effectiveness of such an approach in understanding consumer evaluation of flexibility when preparing for retirement. Note that this paper includes a conceptual analysis of option theory in the life cycle model. We leave computational methods that provide consumers with

3 Note that we adopt the American style options approach, contrary to the European style option approach, since a person's decision *when* to make a specific decision is not an objective of this paper.

advice regarding optimal trade-off decisions, based on their individual preferences, and with empirical analysis hereof for future research.

2. Flexibility in decision-making

The importance of the concept of decision flexibility has been highlighted by various researchers (e.g., Benjaafar, Morin, and Talavage, 1995; Chávez and Shachter, 1995; Marshak and Nelson, 1962), but Marshak and Nelson (1962) were the first to formalize the relationship between the concept of flexibility and its application to general decision-making. The authors argue that flexibility should be seen as a way for decision-makers to take advantage of future information. Moreover, the more one experiences current uncertainty about the future, the more one should and can value flexibility. To summarize, the greater the future uncertainty, the greater the value that decision flexibility offers.

Underlying the notion of decision flexibility is the question how a person's decision *now* either restrains or extends the future decision opportunities of that person (Chávez and Shachter, 1995). We therefore argue that thinking in terms of options reflects at its core the flexibility to deal with future uncertainty.

2.1 Decision flexibility and the theoretical concept of option value

In this section we provide an overview of key research areas that address option value and highlight the importance and value of decision flexibility in these research streams. The first three research streams, originating from the finance literature, identify option thinking as an important tool for strategic investment decisions that deal with future uncertainty. Specifically, option value has been addressed in finance literature, management and organizational literature, and in environmental economics literature. A fourth research stream addresses flexibility and option thinking in consumer decision-making in the field of marketing.

Option value in strategic investment decisions

The basic concept of option thinking originates from finance literature. It refers to call and put options that give the holder the right, but not the obligation, to buy or sell a specific asset. These options are nowadays an important investment category of global capital markets, but they were already used by the Romans and Phoenicians, who also wrote option contracts. In 17th century Holland, 'option thinking' occurred in the contracting of tulip bulbs (Smit and Trigeorgis, 2004). Options theory was initially mainly used to value financial options (e.g., Black and Scholes, 1973). The Black-Scholes model is a well-known pricing model in the financial field, where it is used to determine the fair price or theoretical value of an option, based on six variables (volatility, type of option, underlying stock price, time, strike price, and risk-free interest

rate), and it laid the foundation for options. Building on the Black–Scholes model, the term 'real options' was first used by Myers in 1977, who referred to it as a way to assign value to non–financial investments (or 'real' investments). This approach can be regarded as an extension of the option theory for purely financial instruments to strategic 'real investments', and it refers to 'choices whether and how to proceed with corporate investments', thus incorporating decision flexibility in its valuation (e.g., Smit and Trigeorgis, 2004; Trigeorgis, 1996). Almost all company investment decisions, such as in an R&D project, inherently contain some future uncertainty. Take, for example, a company that wants to expand its operations to another location, that is faced with a real–option decision with an uncertain future. This company may decide to invest tomorrow or to wait a year with the investment. This implies that it has the right, but not the obligation, to invest in expansion at a time that it chooses itself. This provides the company with the flexibility to wait and to accumulate more information over time on market circumstances and react to changing future situations. In the finance literature, Han Smit and Lenos Trigeorgis are leading authors who highlight the concept of decision flexibility and real–option thinking. Smit and Trigeorgis (2004) present an overview of common corporate real options, with two overall categories, namely operational and financial flexibility. An example of an operational flexibility real option is the option to expand (as in the example above), in particular when an investment project is built with capacity that exceeds the expected level of output. Doing so allows the company to produce at a higher level if it wants or needs to, and it provides management the option to expand in case the circumstances are positive. However, it also requires more capital, the additional amount being the option premium that the company is willing to pay. In return, the additional investment provides management with the option and decision flexibility to expand in the future. An example of a financial flexibility real option is staged financing, which implies investing in stages instead of in one go. This option provides the venture capitalist the opportunity to exit at a specific stage of a development project if the company does not perform as well as expected. Smit and Trigeorgis (2004) furthermore argue that flexibility in investment decisions is particularly crucial when markets are volatile and competitive, because these conditions imply that it is more difficult to judge future cash flow so that more uncertainty is involved.

The success of real–option thinking for addressing strategic investment financial decisions also led to its application in the management and organizational literature, where this addresses the challenge of putting a value on decision flexibility in managerial decision–making (e.g., McGrath and Nerkar, 2004). Here also, analogous to the argumentation in the finance literature, researchers argue that thinking of real

options as part of corporate strategy generates value through learning and capabilities and that this can serve as a competitive advantage (Rozsa, 2015). Kogut and Kulatilaka (2001) formulated an even broader perspective on real options: "A real option is the investment in physical and human assets that provides the opportunity to respond to future contingent events" (p.3). For instance, for managers in the pharmaceutical industry who have to make decisions regarding growth options such as innovation in new technological fields, the real-option approach is a useful valuation method (MGrath and Nerkar, 2004). This industry is characterized as being uncertain, with long-term decision-making, which makes thinking in terms of real options applicable. Moreover, these are often multi-staged decisions, where at each step of an R&D trajectory a decision has to be made as to whether to continue with the project or to pull out of it (Copeland and Tufano, 2004). There is a clear overlap with the finance literature that highlights decision flexibility in staged financing.

In a recent literature stream about entrepreneurial decisions, analogies can be made to strategic investment decisions in projects (in time and money) and to the option value that they generate. Early research has shown how entrepreneurs allocate their money to various investment projects over their lifetime (Hakansson, 1971) and how they divide their time between leisure and work activities (Levesque et al., 2002). However, this has been expanded to address optimal time allocation decisions by entrepreneurs, such as how entrepreneurs should allocate given amounts of time to different investment projects (Yoo et al., 2016). These authors note that future research should investigate how entrepreneurs invest in projects or activities that save time in the future and how that relates to NPV methods (i.e., present value of time streams). Another crucial decision that an entrepreneur may be confronted with is when to hire a first employee. This can be seen as an investment decision involving option value; the upfront investment in capital can be compared to the entrepreneur's investment in recruitment setup cost and time, which then impacts the time and money that the entrepreneur has available in the future to potentially grow or to spend his or her time more effectively (Yoo et al., 2016).

Finally, another relevant field of research, that of cost benefit analysis and social welfare economics, also investigates option value. In this field the term 'option value' refers to the value that is placed on private willingness to pay for maintaining or preserving a public asset (e.g., a park) or a service (e.g., public transportation services) for future use, even if there is little or no likelihood of the individual ever actually using it (e.g., Hanemann, 1989; Weisbrod, 1964). In this context, option value is mostly used from a public policy perspective to justify continuing to invest in public assets and services. It is therefore slightly different compared to the strategic

investment decisions discussed above. For example, Geurs et al. (2006) investigated the option value of public transportation in the Netherlands; they argued that option value can be seen as a form of 'use value' in the total economic value of an environmental research evaluation and that it should therefore be included in strategy formulation as a benefit. The inherent uncertainty of consumers in this context refers, for example, to a situation where a consumer might change his or her job location, or experience car problems or unavailability of gas, and is therefore willing to pay a risk premium (in addition to the expected user benefit) for the option of using public transportation in the future. This underlying idea is also in line with Weisbrod (1964), who stated that entrepreneurs and managers should understand that there are consumers who anticipate using a certain service or buying certain products in the future (and valuing this future potential use), but who will actually never do so. He argued that, if these consumers act as 'economic men', then they would be willing to pay for the opportunity (i.e., option) to use the service or product at some future point in time. Therefore, in considering whether to invest or not in a project, this 'option value' should be taken into consideration.

In summary, understanding the value that flexibility offers to managers is what real-option thinking is about, and managers can lessen the strategic risk related to an investment by applying real option thinking. Since project investments are often uncertain and can only be solved by waiting and obtaining new information about the available options, real options provide managers with the possibility but not the obligation to choose from different options. This way managers can lower the risk of losing money on investments while at the same time benefiting from an upside risk. Thinking in terms of options is thus a helpful strategic managerial tool to steer investment decisions.

Option value in consumer consumption and purchasing decisions

Lastly, flexibility and option thinking in consumer decision-making also applies in the field of marketing, particularly in relation to consumer consumption and purchasing situations (e.g., Walsh, 1995; Salisbury and Feinberg, 2010). Despite the fact that the term option value has not been used in this research area, the underlying reasoning is in our view analogous. For instance, Walsh (1995) argued that purchase and consumption decisions typically are separated. Also, consumer tastes change over time (e.g., from purchase to consumption); consequently, consumers may not know in a specific product purchase situation which alternatives they will prefer in the future when they actually consume the product. Therefore, it is in the consumer's interest to have a varied choice set (e.g., different types of snacks), thus different options, to

choose from in the future. This offers them flexibility regarding their future choice. Consequently, the decision someone takes now impacts the person's flexibility in the future, which is in line with the option-based view. Simonson (1990) supported this view, arguing that greater observed variety (among chosen items) reflects increased uncertainty about future preferences. Consumers are unable to judge *now* what products they will prefer in the future; so in order to deal with this future uncertainty, they select a variety of products.

2.2 Option value and life cycle preparation

In line with the option-based thinking that we discussed in the previous section, we plead for an analogous approach in our discussion of personal retirement planning decisions.⁴ In this paragraph we therefore apply the concept of option value in the context of a person's life cycle preparation. Normatively speaking, preparing and planning for retirement is a life-long optimization problem (Scholz et al., 2004; Skinner, 2007). Solving one's retirement planning problem implies making a series of financial, human, and health capital decisions to eventually achieve adequate pension wealth for retirement. These decisions in turn impact not only the actual pension wealth that a person achieves, but also the person's option value to flexibly respond to life and external (economic and other) changes along the way. It is the latter aspect, namely the person's option value to flexibly respond, that we focus on in this paper.

As an example, an important decision in life related to financial capital is that of buying or renting a house. This decision not only affects the financial capital that someone will have accumulated by the end of his or her life, but also the option value over that person's life span. Buying a home can reduce a person's option value in several ways. When purchasing a house, an individual incurs the obligation to pay off the related mortgage loan. This obligation may cause short-term liquidity problems so that there is less money to spend now on other investments (e.g., a training program or saving money). When renting a house, a person will most likely retain more liquid financial capital (e.g., savings) and thus have more flexibility regarding alternative investment opportunities. Moreover, compared to buying a house, renting provides greater flexibility with respect to finding a place to work. Home owners face

4 Kocken (2006) relies on real-option thinking, similar to us. In his book Kocken explores embedded options in pension funds, specifically options (e.g., indexation) between the corporate employer and the beneficiaries. He furthermore discusses risk management strategies for pension funds.

higher transaction costs when moving from one home to another, which can make it more costly to accept a new job offer at a distant location.

Individuals face much inherent uncertainty in terms of life cycle decisions, for instance whether a financial crisis will occur in the future, whether housing prices will drop, or whether the return on investment of a training program will be high enough to offset the costs. Therefore, uncertainty about one's future makes flexibility a necessary and beneficial asset. This underlines the importance of thinking in terms of options in the context of retirement planning. Flexibility implies that people have multiple options to choose from in the future. For instance, a truck driver who has decided to follow a retraining program early in his life cycle so as to be able take on another job in case he loses his job – thus valuing the flexibility that a retraining program may offer in the future – has the option value of taking on another job. Therefore, the concept of options is particularly relevant in the context of retirement planning. It is even more important in the face of growing uncertainty about the future, as many people face greater pressures about life time employment. They can thus benefit from option values being assigned to different potential pathways depending on their preferences, and that will have an effect on their retirement income. As a basis for more precisely conceptualizing option value in the life cycle model, the following section provides a more detailed overview of the key components of the life cycle model.

3. Key components of the life cycle model: a normative framework

Achieving adequate wealth at retirement does not imply that one should save as much money as possible for retirement. Instead, it requires an optimal balance between pre-retirement expenditures and the accumulated retirement wealth that facilitates post-retirement expenditures. For example, if one expects to live to a high age, which means a long period of consumption and possibly high medical costs, it is best to save more before retirement. Likewise, the amount of retirement savings should depend on one's desired living standard after retirement (Skinner, 2007): the more a person intends to consume, the more wealth such person should allocate for retirement. To enable optimal planning, one should be aware of these trade-offs, balancing the benefits of immediate consumption today against the benefits of saving for future consumption after retirement.

Planning to ensure adequate pension wealth for retirement cannot be done properly without considering a number of other events that may take place during one's life. We call these "life events". They occur at some point in a person's life before retirement and have potential influence on retirement income. Some of these life events will be driven largely by exogenous factors, while others are important personal decisions. Also exogenous shocks (such as a heart attack or involuntary loss of one's job) are considered "life events" that are relevant in the context of retirement savings decisions. Therefore, we take these exogenous shocks and life event decisions into account on our review of key components for an optimal retirement plan from a normative perspective.

We review trade-off decisions of individuals related to the three types of capital that are relevant to life cycle decision-making, namely, (1) financial capital, (2) human capital, and (3) health capital. In doing so, we build on Wendel et al.'s (2016) review of the literature from various streams of economics, investigating aspects that have been found to have impact on financial pension outcomes. More specifically, we identify trade-off decisions related to savings, housing, retirement age, training and retraining, labor supply, and healthy lifestyle, and we assign each to one of the three capital components. In addition, we highlight how these decisions impact a person's option value, thus decision flexibility. Table 1 provides an overview of the three capital components, of the related trade-off decisions of consumers, and of how these decisions can impact a person's life cycle option value.

Compared to the traditional life cycle model over a person's entire life cycle, we impose one restriction, in line with our focus on supporting retirement planning decisions: we start our review at the point in the life cycle at which the individual

Table 1: Overview of capital components, related trade-off decisions, and impact on option value

Capital component	Related trade-off decisions	Illustrations of option value per decision
Financial	Buying or renting a house	Taking out a mortgage loan when buying a house lowers so as to have liquidity now, versus renting a house, which offers more flexibility in investment opportunities. Renting a house offers more flexibility in mobility (lower moving costs) and increases possibilities to accept a job offer at a more distant location, thus greater labor market flexibility.
	Savings in annuities or shares	An annuity at retirement offers steady and certain income (with tax benefits), versus self-managed investment in shares, which offers more flexibility in terms of when to buy and sell and more variation in investment.
Human	Full-time versus part-time work Participating in the labor market: yes / no	Full-time versus part-time work affects flexibility in different ways. The possibility of flexible or partial pension schemes provides people with the option to follow a path of gradual decrease of labor market participation. More generally, having the option between income generation and leisure/consumption benefits can increase a person's welfare.
	Retiring earlier or later	Being able to adjust one's retirement date offers flexibility. Value arises from the option to choose one's retirement age based on realized pension wealth.
	Participating in training and retraining: yes / no	Training creates flexibility in career path, such as switching jobs more easily. By retraining, a person can also hold onto a full-time job more easily, perhaps even at a higher wage, instead of being forced to reduce working hours due to physical limitations or low demand.
Health	Healthy Lifestyle Adopting healthy behavior: yes / no	A healthy lifestyle creates greater flexibility in career path, such as working longer hours, working in a variety of jobs, or working to a higher age.

starts his or her professional career path, after having completed an initial education trajectory (e.g., at the age of around 25 years in case of a university graduate). This point of departure is practical for most pension-related decisions and avoids the need to make assumptions on how children (and their parents) should choose early life and education paths to achieve adequate wealth at retirement.

3.1 Financial capital

Housing

The housing asset is a large capital component in retirement planning (Knoef et al., 2012). By purchasing a house, an individual can lower the cost of housing in the long run, but there is in turn the obligation to pay off the mortgage loan. This obligation can lead to short-term liquidity problems, but in the long run, after retirement, the house will be a financial asset owned by the individual, which lowers the need for

higher retirement savings. Furthermore, as argued by Knoef et al. (2012) in their paper on Dutch retirement savings adequacy, housing decisions can have a strong impact on pension wealth and pension wealth requirements. To illustrate, taking out a mortgage loan lowers the ability to save for retirement due to the increased spending on housing compared to renting a house. At the same time, however, real estate assets accumulate and provide a significant part of total wealth upon retirement. In fact, housing assets are the biggest assets for most households in many advanced economies. The home can be used as a means of supporting retirement, by home reversion or equity release products. Home reversion, which is not an option in the Netherlands yet, implies that a person can sell his house fully or partly and in return receive a lump sum or periodic income. The underlying idea is that one can continue to live at home until death. Such a product implies that a person's loss of option value, which the illiquidity of home ownership currently causes, can be lowered.

The purchase of a house also affects pension wealth indirectly. Compared to individuals who do not own a house during their retirement, those who own a house can rent "for free", which strongly reduces their living costs during retirement. This double role of housing assets – as both a durable consumption good and an asset – makes it a complex but high-impact factor in pension planning.

Savings

In the Dutch setting, as in many other countries around the world, the first and second pillars in the pension saving system are tall and the main source of income for most persons after retirement. The first pillar is the state pension, which provides a fixed basic level income amount for people who retire at the legal retirement age. The second pillar is provided via one's employer and is built up throughout the employee's working life. The amount that is saved depends on the average income of the employee over the entire working career until retirement. The first pillar offers very little flexibility, and thus little option value, whereas the second pillar increasingly integrates some elements of individual choice (Dellaert and Ponds 2015), thus leading to higher option value.

Also a third pillar pension system is in place in the Netherlands. This pillar refers to pension products that are offered by, for instance, insurance companies and banks. These have to be purchased by the individuals themselves. As a consequence, they offer the highest option value. For instance, one can decide to invest in annuities, which are relatively restrictive and commonly represent a long-term contract with an insurance company or an annuity provider to set aside money that is paid out in periodic instalments after retirement. This type of investment offers a fixed and steady

income amount after retirement. However, flexibility with respect to the amount or timing of the money that can be withdrawn is limited. Individuals can also decide to invest their money differently, such as by buying shares and managing these shares themselves. This option provides much more flexibility, as it offers the person more freedom to buy or sell the acquired shares at specific future moments, for instance when more or less money is needed. Moreover, deciding against taking out an annuity opens up the opportunity to set aside money for investment elsewhere, such as in training or retraining activities.

This clearly highlights the trade-off that people are often confronted with in life cycle decision-making: between increasing the stability and predictability of their income and expenses, especially in the short term, versus increasing the flexibility and option value of their life cycle decision paths, which may be more beneficial for their income and expenses in the long term.

3.2 Human capital

Labor market participation

The decision to actively participate in the labor market, and to what degree, represents another example of a pre-retirement decision that has large impact on pension wealth, both in terms of expected retirement wealth and of income option value before and after retirement. Labor market status is partly endogenous, meaning that one largely has the choice to take on a paid position or not. This perspective is common in the labor economics literature, where researchers are interested in the interaction between labor market participation and other variables. For example, Fortin (1995) showed that individuals will adjust their labor supply to potential changes in wealth. When people decide to join the job market or to quit their job, it will affect their income for an extended period, which in turn affects their pension income. Option value arises here because individuals can benefit from having a greater number of options to choose from. For instance, the option to participate fulltime or part-time in the labor market can increase the number of job market opportunities that a person has. Here for example, the possibility of flexible or partial pension schemes provides employees with the option to follow a path of gradual decrease of their labor market participation while at the same time building up more pension. It thus provides them with more flexibility regarding the decision to retire, from which they can benefit depending on how much income they need to generate near retirement. Also, a decrease in working hours may offer employees the opportunity to perform their current job for a longer period of time instead of having to retire.

Retirement age

In our focal context of retirement, individuals also face an important decision regarding their retirement age. Most countries have implemented a legal retirement age. In the past this was 65 in the Netherlands, but it is being raised to 67 over the next few years. After 2021 the retirement age will be linked to the average life expectancy. However, individuals may also retire before the legal retirement age. In that case the pension that one will receive will be substantially lower. Individuals also have the choice of either working longer in order to build up higher pension savings or of stopping with work earlier and consequently receiving considerably less pension income. The flexibility provided by the decision at what age to retire creates option value because it allows a person to compensate for poor returns or to benefit from good returns on human, financial, and health capital.

Training and Retraining

Human capital is described in the Oxford English Dictionary as 'the skills the labor force possesses and is regarded as a resource or asset.' This description encompasses the notion of investments in people (e.g., education, training, health) and that these investments increase a person's productivity (Goldin, 2016). Various human capital theories and models have been discussed in the field of labor economics, with the model described by Mincer (1958), Schultz (1963), and Becker (1964) being the conventional framework when examining education as well as training-related decisions (Jacobs, 2007). Normatively, according to human capital theory, individuals will reach their highest life-time utility when making the most optimal education and training investment decisions.

In addition to these factors that increase human capital value, decisions on training or retraining activities can have a strong impact on pension wealth and retirement income option value. Training or retraining activities influence future real income and labor value in later life through the resources (e.g., capabilities and skills) that are acquired (Becker, 1962). Additionally, training and retraining investment decisions provide workers with the flexibility to transfer to another sector or to stay in the workforce if additional training enables a person to perform a job that would not have been possible without the training. For instance, a 40-year-old nurse who performs heavy physical labor and knows that she will not be able to perform her job until her retirement age might consider participating in a training program to prepare her to perform a management function supervising younger nurses. Moreover, successfully finishing a particular training will offer an individual other options, namely to build further on that training or even to change one's career path. A growth in

option value thus arises, where the individual has the possibility, but not the obligation, to continue (Jacobs, 2007).

3.3 Health capital

Lifestyle behavior

Finally, health is an important component in the life cycle decision-making model. Due to rising medical expenditures and longer life expectancy, the costs of maintaining the health status of the population has become a major concern in many economies, also in relation to retirement income. For example, de Nardi et al. (2010) found that rising medical expenses are a more important driver of old age savings than bequest motives. When asked about their motives for saving, more individuals answered that preparing for unexpected health expenses was an important motive for them than those that mentioned preparing for retirement (Mastrogiacomo and Alessie, 2011). In addition, poor health not only leads to higher medical expenses but also lowers productivity standards (Galama and Van Kippersluis, 2010). This second impact can also affect retirement planning as it influences one's ability to generate income. For instance, Hai and Heckman (2015) investigated the interplay between health, education, and wealth in a dynamic life cycle model. They argued that health can affect a person's choices on education and wealth in various ways. One of these relates to retraining decisions because health impacts a person's discount rate, meaning that the way a person regards the future is altered depending on his or her state of health. This in turn impacts the person's investment decision regarding retraining activities that improve human capital and thus labor market wages and wealth.

Staying healthy (i.e., preventing getting sick) thus opens up more opportunities in the job market as well as in the type of education or retraining program that one chooses or can choose. In line with this analysis we argue that investing in one's health has a direct impact on one's life cycle option value. More specifically, investing in one's health implies adopting health promoting or lifestyle behavior (e.g., exercising, nutrition, stress management), leading to better health and getting sick less often.

4. Behavioral concerns in retirement planning decisions

The normative life cycle model implies that individuals make fully rational decisions to maximize utility, by systematically reviewing the different capital components and their implications, including option value implications, and finding an optimal solution. It is clear that this is a very complex problem for individuals to solve. Therefore, in this section we provide a review of a number of behavioral effects that can influence a person's option value considerations of such complex tasks in planning for retirement.

Limited forward-looking behavior

Looking ahead is of crucial importance to individuals, yet it is difficult to actually do. For instance, the literature on intertemporal discounting addresses exactly this problem and discusses the decisions by people that involve a trade-off between the benefits and costs they face in the present versus the future. This can cause a person to make suboptimal retirement planning decisions. One reason that leads to limited forward-looking behavior is hyperbolic discounting, which refers to a person's preference changes over time. That is, when making decisions, individuals seem to discount future rewards at a higher rate when the delay occurs sooner in time (Laibson, 1997). Also saving for retirement involves a trade-off between having money available for spending now, and using the money after retirement to enjoy a more pleasant and luxurious life then. This is also why people delay making a decision and do not exercise the will power that is necessary in retirement planning. For instance, Choi et al. (2002) state that, despite the fact that most people indicate that they want to increase their saving rate, the majority do not do so. A consequence of limited forward-looking is that it lowers the value of future possible actions and requires much more self-control on part of the individual, as it provides the opportunity to consume now instead of investing in future option value.

Uncertainty-related effects

Another well-known behavioral limitation that individuals face is that they typically are not fully informed about all alternatives that are available in the market and thus do not know all options that they have. Individuals face great information search cost if they wish to overcome this lack of information, and they are prone to using decision and search heuristics to cope with this information challenge (Gigerenzer and Todd, 1999; Hey, 1982; Payne, 1976). As a consequence, the concept of ambiguity aversion is also relevant in applying option value. Ambiguity aversion refers to the fact that

people prefer not to choose an alternative when they do not have information about the risks involved, or if they feel that they are not knowledgeable about a specific domain. A concept closely related to ambiguity aversion is comparative ignorance (Fox and Tversky, 1995; Fox and Weber, 2002), which implies that consumers first compare their knowledge of one alternative (i.e., a decision path) to their knowledge of other alternatives, or to the knowledge of other consumers in a specific field. In the latter case, consumers evaluate whether they know less or more than others (Trautmann et al., 2008). If a consumer believes that he knows less than others, a feeling of ignorance arises, whereas a feeling of competence arises if a consumer thinks that he knows more than others in the field. Both ambiguity aversion and feelings of ignorance cause people to avoid making a decision. They may be more likely to stick with the current situation and less likely to select new option-value-increasing alternatives due to the fact that these new alternatives are more uncertain than well-known alternatives that they currently experience.

Heuristics-related effects

Consumers who are not knowledgeable of a specific domain may prefer not having to make a choice and instead holding on to the status quo option (status quo bias). For example, when analyzing the savings contribution rate and the asset allocation of the retirement savings portfolio, researchers observed that many individuals do not reallocate their investment funds throughout their working lives (Beshears et al., 2016). This illustrates that these individuals implicitly prefer doing nothing. This may also imply not wanting to follow retraining. Individuals currently feel safe in their present job, and limited forward-looking behavior may play a role.

Choosing to accept the default option is another example of a simple decision rule that can lead to potentially suboptimal retirement planning decisions. Just as with status quo bias, this approach implies that consumers make a decision in a structural way through their reliance on heuristics. These default effects can also be observed in the retirement investment domain. There are a couple of reasons for people to stick with default options, which can be explained by the following fundamental motives. First, individuals may think that this is the option chosen by experts; therefore, it must be the best available option. Second, the default option may be seen as indicating what is perceived to be the social norm, and deviating from this norm will require effort on part of the individual in terms of thinking and time. Third, individuals may fear experiencing more regret when the self-chosen option turns out to be a wrong decision (Bodie and Prast, 2012). Consequently, to avoid this negative emotion of anticipated regret, they may decide not to choose or not to decide at all, which is

known as regret aversion (e.g., Zeelenberg, 1999). Moreover, the way a particular decision is communicated or framed to people can have an impact on their decisions and choices (e.g., Tversky and Kahneman 1981). For instance, research has shown that the way the default retirement age options (65 or 68) were presented in an experiment (either in gains or in losses) had an impact on a person's preferred retirement age. The results of the experiment illustrated that when the option to receive benefits at age 68 was communicated as resulting in a financial gain (taking the age of 65 as reference point), 38% of the respondents chose 68 as their preferred retirement age; but when receiving benefits at age 65 was framed as resulting in a financial loss (taking an age of 68 as reference point) 57% chose 68 as the preferred retirement age (Knoll, 2011). This is also in line with research on loss aversion, which puts forward that individuals experience a loss as more detrimental than a gain feeling valuable. Consequently, people go for the option that feels less harmful (Knoll, 2011).

5. Discussion

From a social and political standpoint, it is challenging to construct a system and policy options that address the issue described in the introduction, namely that individuals need to take a more active role in the planning for their retirement and to consider option thinking with its potential trade-offs. How can society best be prepared to support people in taking on that role and in consciously considering the options (decisions paths) that are available?

One area of attention that is highlighted in the literature and is a major concern in society is the role of *education*. Bolhaar et al. (2017) show in their article that, on average, individuals with lower education are much less involved in retraining next to their regular work than individuals with higher education. Of employees with lower education between the ages of 50 and 67, 38% followed a course in the most recent year reported, compared to 64% of employees with higher education.

A second area of attention when discussing retirement planning decisions and their connection to option value is the role of *age*. Older people, who are currently close to retirement age, have little time left to adjust or to decide on a different decision path compared to younger people. This difference implies, from a social point of view, that the elderly, who are close to retirement, have far fewer options to respond to policy shifts, such as in the official retirement age, compared to younger individuals. Moreover, possible health issues and a lack of work-related flexibility put the elderly at a disadvantage that is hard to overcome in the time they have left. Thus, an increase of the official retirement age confronts them with the fact that they have few options.

A third area of attention is *income*. Especially low income individuals have little financial buffer and hence options to compensate a sudden drop in employment by consuming less (Bolhaar et al., 2017). This illustrates how important it is to consider income when investigating the option value of different capital components.

A detailed illustration: Life cycle option value and personal retraining decisions

As a detailed illustration of life cycle option value we discuss personal retraining decisions. The very timely topic of mid-career retraining has recently received national and international media attention. Andries de Grip, director of the Research Centre for Education and the Labour Market (ROA), argues that it would be ideal for people to think about their reschooling options at the age of about 45. The reason underlying this view is that people of this age are still attractive for the labor market after retraining (Stellinga, 2017). In addition, especially for people who perform heavy

physical work such as construction workers or nurses, retraining is particularly important. This group of people, who are now expected to work a lot longer than before, are not able to work until the official retirement age and are also confronted with more health-related issues. Occupational physicians (company doctors) recognize this problem across various labor market sectors, especially for employees with lower education (NVAB 2017). It is exactly this group of people who would benefit the most from reschooling, which should therefore be introduced and offered by their employers.

In the Netherlands, the Ministry of Social Affairs and Employment has put aside €12.5 million for projects that keep employees healthy and vital at their workplace longer. The term "sustainable employment" consists of two key words, stressing the importance of employees and employers to invest together by providing retraining options and career advice (Rijksoverheid, 2017). However, recent research by *Wijzer in Geldzaken*, which surveyed 1,000 Dutch employees between the ages of 55 and 67, found that this employee category is not interested in retraining (*Wijzer in Geldzaken*, 2017). About 75% of the respondents expect their employer to help them in being able to work longer; yet this topic is hardly discussed between employees and employers. This seems to be different, however, in the sector where retraining takes place. According to Statistics Netherlands, 1.5 million Dutch people participate in training programs. Almost one out of five Dutch people between the ages of 25 and 65 state that they participated in a course or training program (Verhoef, 2016). Most of the employees who follow a course or training program have a job in the financial sector (31%), education (29%), and healthcare or welfare and government (26%). This partly reflects the fact that in some sectors participation in training programs is mandatory. Looking at what individual employees believe about the value of retraining, we see that the statement that employees between the age of 40 and 50 should consider whether they can actually perform their job until they reach their retirement age triggered mixed responses on various online platforms. The quotes below (translated from Dutch to English) illustrate how individuals think in terms of option value (positive as well as negative) when discussing this topic.

The concept of flexicurity

In assessing these social and political challenges further in supporting individuals in their pension planning decisions, we have looked beyond the Dutch borders at the Danish Flexicurity model, as this model seems to offer interesting ideas that address some of these challenges (e.g., Wilthagen and Tros, 2004).

Flexicurity is a portmanteau of the words 'flexibility' and 'security'. Flexibility refers to the rules related to the hiring and firing of employees. Specifically, employers

Anonymous quote 1

Who is going to absorb your income drop? At 45, you're usually at the end of your wage scale and starting in a new sector means going back to square one.

I was retrained at the age of 30 myself and found it quite challenging. You're not really used to life at school, your income drops because you're given a student wage, and you cannot work full-time because you also have to go to school for a day (which isn't always paid).

Nonetheless, I'm glad I did it, because I have more opportunities now than if I hadn't.

However, recently I was offered a traineeship, which I absolutely rejected. I wouldn't want to start all over again. Besides, I think I'll be able to make it to retirement age in my profession.

https://forum.viva.nl/werk-studie/quot-oudere-werknemer-moet-zich-laten-omscholen-quot/list_messages/373065 (March 18, 2017)

Anonymous quote 2

It isn't always easy to learn new things when you get older. In addition, many employees, particularly those working in physically demanding jobs, really aren't inclined to sit down and study. They were glad to be able to leave school and start in a job. I don't see how you can retrain them. And after you've been retrained, you have to move to where your new job is, often with a new employer, assuming that you can even find a new job at an older age. The big problem is that people go from a permanent job to a temporary contract. This is a considerable risk if you've been in permanent employment for a while. How on earth are you going to motivate those employees to retrain? You can provide as many facilities as you like, but it's not going to help.

https://forum.viva.nl/werk-studie/quot-oudere-werknemer-moet-zich-laten-omscholen-quot/list_messages/373065 (March 18, 2017)

Anonymous quote 3

I retrained at thirty, and two people in my vicinity are retraining in their forties, so I don't think it's that unusual.

Many people want to do something different after twenty years and with more than twenty years to go. Preferably something they enjoy. I also think that studying keeps you mentally young and flexible.

https://forum.viva.nl/werk-studie/quot-oudere-werknemer-moet-zich-laten-omscholen-quot/list_messages/373065 (March 18, 2017)

Anonymous quote 4

Martin Duinmeijer is from a family engaged in the paving business. His company, Meijer & Duinmeijer Bestratingen, works for municipalities and now employs more machines than personnel. But regarding the question of continuing to work longer, now that the retirement age is going up, he is quite resolute: 'That is absolutely impossible.' His father kept going for 51 years. 'A miracle. He ran semi-marathons and is incredibly fit.' What to do with his older employees? He really doesn't know. 'I let the young guys do the heavy work and give them tasks I think they can handle. But all of our jobs are heavy. I also cannot imagine continuing till I'm 65 – let alone till I'm 70.' Of course, Duinmeijer has considered retraining his older personnel, for example to become maintenance engineers for the street paving machines. 'But that was setting the bar too high. Should you tell someone who's 50 that he must go back to school to study?

<https://www.nrc.nl/nieuws/2017/01/03/langer-werken-kan-iedereen-dat-6008279-a1539595>

Anonymous quote 5

But what should people with physically demanding jobs – and there are quite a few – be trained for? Many “light” jobs, such as administrative work, are disappearing, due to the computerization and robotization of the job market, or they require higher professional training.

And what kind of new jobs will take the place of the computerized or robotized jobs? You never hear anything tangible about that. And are they suitable for everyone?

https://forum.viva.nl/werk-studie/quot-oudere-werknemer-moet-zich-laten-omscholen-quot/list_messages/373065 (March 18, 2017)

have the flexibility to fire employees in case of bad times and to hire employees during good times. Security refers to unemployment compensation, which can be as high as 90% of the employee's income from his or her previous job. A final feature of this system is its active labor market policy, offering coaching, training and learning to those unemployed. One key difference between the Danish and Dutch models is the fact that the Danish model is aimed at work security through creating option value in the labor market instead of creating greater security in an existing specific job. Under Danish law, people can get fired more easily, but the system also helps people to find a new job more quickly when unemployed. Mobility and lifelong learning are key aspects of the system. These active labor market policy instruments can therefore create tremendous advantages as they increase a person's life cycle option value. Still, both employers and labor unions play a crucial role in this system. Creating a mindset that focuses on work security instead of job security is one of the many challenges in establishing such a model.

6. Conclusion

Concluding, we can safely assert that it is important to stimulate individuals in society to look ahead by creating awareness of the three capital components (financial capital, human capital, and health capital) and of the related available decision trade-offs and options. With the current trends and shifts in society, it is necessary for people to constantly consider and reconsider their options regarding each of these capital components. In this paper we have reviewed the literature on option value by building on the concept of decision flexibility, and have applied it to life cycle decision-making by individuals. We have also highlighted the considerable behavioral challenges that people face in doing so. In the discussion part, we have illustrated how at society level the roles of education, age, and income can constrain a person's option value and are thus of considerable concern, and how a look to the Danish flexicurity model and its implementation of option value may offer worthwhile ideas.

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