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Marie-Louise Leroux, Pierre Pestieau,
Gregory Ponthiere

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Fair long-term care insurance

Marie-Louise Leroux[1] · Pierre Pestieau[2] · Gregory Ponthiere[3]

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Abstract

The study of optimal long-term care (LTC) social insurance is generally carried out under the utilitarian social criterion, which penalizes individuals who have a lower capacity to convert resources into well-being, such as dependent elderly individuals or prematurely dead individuals. This paper revisits the design of optimal LTC insurance while adopting two egalitarian social criteria—ex ante and ex post egalitarianism—which give priority to the worst-off either in expected or in realized terms. Using a lifecycle model with risk about the duration of life and risk about old-age dependence, it is shown that the optimal second-best insurance under the ex ante egalitarian criterion involves, in comparison to utilitarianism, higher LTC and pension benefits and higher tax rates on savings and on labor earnings. In comparison to ex ante egalitarianism, ex post egalitarianism involves lower LTC and pension benefits, a higher tax on savings and a lower tax rate on labor earnings, in order to increase consumption of the young, who include persons who will turn out to be short-lived.

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✉ Gregory Ponthiere
gregory.ponthiere@uclouvain.be

[1] Département des Sciences Economiques, ESG-UQAM, Montreal, Canada

[2] Université de Liège, CORE and Toulouse School of Economics, Liège, Belgium

[3] UCLouvain, Chaire Hoover, Collège Dupriez, 3 Place Montesquieu, 1348 Louvain-la-Neuve, Belgium

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1 Introduction

The rise of long-term care constitutes a major challenge for advanced economies. Due to ageing, an increasingly large proportion of the population falls into dependency, that is, is unable to carry out basic daily activities such as eating, washing, etc., and, hence, needs to receive long-term care (LTC). The provision of LTC, either formal (i.e. supplied by private firms on the market, or by a public transfer) or informal (i.e. provided by family and friends), is extremely costly, which raises the question of the funding of LTC.[1]

Given the high probability to fall into dependency and the high costs of LTC, one would expect, from the perspective of rational choice theory, that individuals purchase private LTC insurance, in such a way as to insure themselves and their family against the high costs of LTC. However, as shown by Brown and Finkelstein (2007, 2011), only a small fraction of the population at risk purchases private LTC insurance. Indeed, the private share of LTC spending in OECD countries is about 15% (OECD 2011). This is the well-known LTC private insurance puzzle. This puzzle can be explained by various factors, on both the supply side (e.g. high loading factors, adverse selection) and the demand side (e.g. myopia or denial of dependency) of the private LTC insurance market.[2]

The rise of LTC needs and the low coverage rate provided by the LTC private insurance market motivate the involvement of another economic agent, i.e. the State, which could intervene and construct a social—instead of private - LTC insurance. In Europe, there is indeed a will to build progressively what could be regarded as the "fifth pillar" of the Welfare State: besides insuring individuals against unemployment, diseases, accidents and old age, the State could also provide a social insurance against the risk of LTC.[3]

The design of an optimal social LTC insurance raises lots of problems, since many dimensions are present, both in terms of efficiency and equity (see Jousten et al. 2005; Pestieau and Sato 2008; Cremer and Roeder 2013; Cremer and Pestieau 2014). In particular, when examining the design of an optimal social LTC insurance, a key question that arises concerns the *fairness* of that social insurance. What would be a fair social LTC insurance?

The goal of this paper is to concentrate on redistribution issues implied by the design of a social LTC insurance. That question is complex, and there are at least two traps to be avoided when designing a fair social LTC insurance. This paper will pay a particular attention to avoiding those traps.

[1] According to Norton (2000), about 2/3 of LTC is provided informally. However, the share of the informal care may decrease over time, and various scenarios exist regarding the extent of the decrease of informal care with respect to formal care.

[2] On the various possible explanations of that puzzle, see Brown and Finkelstein (2011), Pestieau and Ponthiere (2011), Boyer et al. (2020) and Ameriks et al. (2018).

[3] Some European countries, like France and Germany, already have implemented a public LTC transfer in case of old-age dependency. However, it remains quite small compared to the amount of LTC spending that agents may have to pay in case of dependency.

The first trap concerns the treatment of preferences under old-age dependency. Once a person falls into dependency, his preferences are affected, and do not remain the same as the preferences of a person who is autonomous. As shown by Finkelstein et al. (2013), a deterioration of the health status contributes to reducing the marginal utility of consumption in comparison with situations of good health. The presence of state-dependent utility raises difficulties at the normative level: if dependent individuals have, at the margin, a lower capacity to convert resources into well-being, how should we treat them in comparison with autonomous individuals? The classical utilitarian criterion provides a counterintuitive answer: it assigns *fewer* resources to the dependent elderly than to the autonomous elderly, on the grounds of the lower capacity of the former to produce, at the margin, well-being. This is the first trap, which concerns the treatment of state-dependent preferences when designing LTC insurance.[4]

A second trap raised by the construction of a fair social LTC insurance concerns the definition of the population under study. When considering the design of social LTC insurance, it is tempting to focus only on the elderly population, which is the one that is subject to the risk of dependency. The problem with this approach is that it ignores a sizeable part of the population, which dies prematurely *before* being subject to the risk of dependency. In Western Europe, about 10 percent of the male population does not reach the age of 60, and, hence, are not subject to LTC risk. Whereas one may regard this fact as irrelevant for the design of a social LTC insurance, it matters, since the fairness of a social LTC insurance must be evaluated while taking into account the distribution of well-being along the *entire* population. One cannot ignore the short-lived, since doing so may lead to regressive social insurance, i.e. transferring resources from worse off (short-lived) individuals to better off (long-lived) individuals.

The design of a fair social LTC insurance must provide an answer to the question: what would be a fair treatment of individuals with unequal health and longevity outcomes? The answer depends on the postulated conception of social justice. In this paper, we propose to go beyond utilitarianism, and to consider two alternative conceptions of social justice, which are both egalitarian, but differ regarding what is to be equalized (i.e. the *equalisandum*): on the one hand, ex ante egalitarianism, which aims at equalizing expected lifetime well-being across individuals; on the other hand, ex post egalitarianism, which aims at equalizing realized lifetime well-being (that is, well-being once the duration of life and dependency/autonomy at old age are revealed).

Ex ante and ex post egalitarianism differ regarding their treatment of risk. In a seminal paper on the social evaluation of risky situations, Fleurbaey (2010) argued that, from a normative perspective, one should give priority to the comparison of ex post well-being levels over the comparison of ex ante well-being levels. Fleurbaey's

[4] Note that this limitation of utilitarianism is not specific to an economy with LTC needs. Actually, as stressed in Sen and Williams (1982), utilitarianism also faces problems in its treatment of handicapped persons, who have also a different capacity to convert resources into well-being in comparison with non-handicapped persons.

argument goes as follows. He distinguishes between, on the one hand, uninformed preferences (i.e. preferences on lotteries, i.e. before the state of the world is revealed) and, on the other hand, informed preferences (i.e. preferences on degenerate lotteries, i.e. after the state of the world is revealed). According to Fleurbaey, normative evaluation should give priority to informed preferences over uninformed preferences, and, hence should focus on ex post well-being. This motivates us to compare optimal LTC social insurance under ex ante and ex post egalitarian criteria.

In order to examine the design of a fair social LTC insurance, this paper develops a lifecycle model where a population differing in labor earnings faces risk about the duration of life, as well as risk of old-age dependency. Our analysis proceeds as follows. First, we characterize the laissez-faire equilibrium. Then, for each of the three social welfare criteria under study—utilitarianism, ex ante egalitarianism, ex post egalitarianism—we characterize the social optimum, and then examine its decentralization. Decentralization is studied in a second-best setting where only four (uniform) policy instruments are available: a linear tax on labor earnings, a linear tax on private aggregate savings (annuities and LTC private insurance), a pension benefit and a LTC allowance.

Anticipating on our results, we first show that the precise form of the social optimum is not robust to the postulated social welfare criterion. Whereas elderly dependent individuals receive, at the utilitarian and the ex ante egalitarian optima, fewer resources than autonomous elderly ones, this is not the case under the ex post egalitarian optimum, in which the dependent elderly receives *more* resources than the autonomous one. Secondly, whereas, under utilitarianism and ex ante egalitarianism, the optimal consumption profile is flat for autonomous individuals and decreasing with the age for individuals who become dependent, the optimal consumption profile is, under the ex post egalitarian optimum, decreasing with the age, with a stronger decline for the autonomous elderly, in such a way as to equalize lifetime well-being between the long-lived and the short-lived. Those differences have major implications on policy design. Our theoretical analysis of the second-best problem—and the associated numerical simulations—point to several important differences between the optimal LTC insurance under the three social criteria. In comparison to utilitarianism, ex ante egalitarianism involves higher LTC and pension benefits, as well as higher tax rates on savings and on labor earnings. In comparison to ex ante egalitarianism, ex post egalitarianism involves lower LTC and pension benefits, a higher tax on savings and a lower tax rate on labor earnings, in order to increase consumption of the young, who include persons who will turn out to die prematurely.

As such, this paper casts original light on a major policy challenge of our times—the design of an optimal LTC social insurance -, by highlighting how the postulated social criterion affects the design of the optimal social LTC insurance. Our analysis shows that not only does the level of LTC benefits vary with the underlying social criterion, but, also, the distribution of the financial burden of LTC along the life cycle. In the light of this, the design of the "fifth pillar" of the Welfare state could hardly avoid a discussion on the ethical foundations behind the construction of that pillar, and, in particular, about the ethical treatment of the interests of the dependent elderly and of the prematurely dead. Although the weight assigned to the interests

of the latter may seem, at first glance, irrelevant for the design of a fair LTC social insurance, it matters actually quite a lot, especially concerning the distribution of the financial burden of LTC social insurance. Assigning a higher weight to the interests of the prematurely dead leads to a lower taxation of labor earnings during the active life.

This paper is related to several branches of the literature. First, it is linked to the literature on the design of the optimal LTC social insurance (see Jousten et al. 2005; Pestieau and Sato 2008; Cremer and Roeder 2013; Cremer and Pestieau 2014). In comparison to those papers, the specificity of this study is to lay a strong emphasis on the fairness dimension of LTC social insurance in the context of unequal lifetime. Second, this paper is also related to papers on optimal policies under unequal longevity, such as Fleurbaey and Ponthiere (2013), Fleurbaey et al. (2014, 2016) and Leroux and Ponthiere (2018). The extra value of this paper is to include an intermediate status between life and death—i.e. dependency at the old age -, which allows us to examine the sensitivity of the optimal LTC insurance to the postulated social criterion.

The rest of the paper is organized as follows. Section 2 presents the model. The laissez-faire equilibrium is characterized in Sect. 3. Section 4 studies the utilitarian social optimum and its decentralization. The ex ante egalitarian optimum is studied in Sect. 5, which also explores how this can be decentralized. Then, Sect. 6 characterizes the ex post egalitarian optimum, and studies its decentralization. Section 7 provides some numerical simulations. Conclusions are drawn in Sect. 8.

2 The model

Let us consider a two-period economy. Period 1 is young adulthood, during which individuals are autonomous, supply labor, consume and save for their old days. Period 2 is old adulthood. That period is reached with a probability $0 < \pi < 1$. During the old age, individuals do not work and consume their savings. Moreover, individuals reaching the old age become dependent with a probability $0 < p < 1$. In case of dependency, individuals bear additional exogenous LTC expenditures equal to an amount $S > 0$.

2.1 Heterogeneity

Ex ante (i.e. before the duration of life and the old-age health status are revealed), individuals differ on a single dimension, which is the wage rate w. For simplicity, we assume two wage levels: type-H individuals have a high wage rate, whereas type-L individuals have a low wage rate, i.e. $w_H > w_L$. Individuals of type $i \in \{L, H\}$ are in proportion n_i, with $n_H + n_L = 1$.

Following the literature on the health/wage gradient, we assume that individuals with a higher wage rate have also a higher probability to reach the old age, that

is $\pi_H > \pi_L$, as well as a lower unconditional probability of old-age dependency, $\pi_H p_H < \pi_L p_L$.[5]

2.2 Preferences

Preferences of individuals are represented by a standard expected utility function. Lifetime welfare is time-additive, and the utility of being dead is normalized to 0.[6] We also assume that temporal utility is state-dependent, in the sense that the transformation of resources into welfare is not the same when the individual is autonomous and when he is dependent. Expected lifetime utility for an individual of type $i \in \{L, H\}$ is:[7]

$$EU_i = u(c_i) + \pi_i(1 - p_i)u(d_i) + \pi_i p_i v(b_i) \tag{1}$$

where c_i is consumption at young age, d_i is old-age consumption in case of autonomy, while b_i denotes old-age consumption in case of dependency (excluding LTC expenditure S). Hence, b_i accounts for the net resources left for consumption in case of dependency, and $z_i \equiv b_i + S$ for the gross resources (including LTC expenditure) needed in case of dependency.

Regarding the disutility of working at the young age, it is assumed, for simplicy, that working a period ℓ_i creates a disutility measured in consumption units, equal to $e(\ell_i)$ with $e(0) = 0$, $e'(\ell_i) > 0$ and $e''(\ell_i) > 0$. That assumption is formally similar to assuming quasi-linear utility in the young age.[8]

As usual, it is assumed that $u'(\cdot) > 0$, $u''(\cdot) < 0$, and that there exists a critical consumption level $\bar{c} > 0$ that makes a person indifferent between, on the one hand, an autonomous life with consumption $\bar{c}$, and, on the other hand, death, i.e. $u(\bar{c}) = 0$.[9] That assumption is standard in the literature on life and death (see Becker et al. 2005): assuming, on the contrary, that such a critical consumption level did *not* exist would amount to assume either that being alive (even with a zero consumption) is always better for individuals than being dead, or, alternatively, that being alive (even with a high consumption) is always worse for individuals than being dead, which are implausible assumptions.

[5] Data are obtained from SHARE (waves 2, 4 and 6). See Lefebvre et al. (2018). Note also that the above inequalities imply that $p_H < p_L$.

[6] Assuming time-additive preferences is made for the sake of analytical simplicity. Relying on more general preferences does not prevent the compensation for unequal lifetimes, as long as there exist positive critical consumption levels (i.e. the thresholds $\bar{c}$ and $\tilde{c}$ defined in this section) making individuals indifferent between life and death (see Fleurbaey et al. 2014).

[7] For simplicity, we abstract here from time preferences. Note, however, that the survival probability π_i acts as a biological discount factor, so that introducing pure time preferences would be somewhat redundant in this framework.

[8] That assumption is made for simplicity. It enables us to eliminate income effects and to have a simple expression for the labor supply as a function of the wage only.

[9] This normalisation of the utility of death to zero is standard in the literature. Assuming instead that it is equal to a (finite) constant would not change our results.

Regarding individual utility under old-age dependency, it is assumed that $v'(\cdot) > 0$, $v''(\cdot) < 0$, and that there exists a critical consumption level $\tilde{c} > 0$ such that $v(\tilde{c}) = 0$. That critical level of consumption in case of dependency has the same justification as in the case of an autonomous old-age. Without such a critical consumption level, being dead would always be either worse or better than being alive and dependent, which would be quite implausible.

Whereas the state-dependent temporal utility functions $u(\cdot)$ and $v(\cdot)$ share some properties—both are increasing, concave, with a negative intercept -, these differ nonetheless on two important aspects (see Figure 1).

First, being dependent causes a utility loss with respect to being autonomous, so that, for a given level of consumption, being dependent brings less welfare:

$$u\left(d_i\right) > v\left(d_i\right) \ \forall d_i. \tag{2}$$

This inequality implies that the two critical consumption levels satisfy $\tilde{c} > \bar{c}$.

Second, as shown by Finkelstein et al. (2013), being dependent reduces the marginal utility of consumption in comparison with being autonomous:

$$u'\left(d_i\right) > v'\left(d_i\right) \ \forall d_i. \tag{3}$$

This is consistent with the LTC insurance puzzle, i.e. the stylized fact that a small fraction of population purchases private LTC insurance.[10]

Without additional assumptions, one could not exclude, in theory, that, in a poor economy (i.e. with a very low wage), individuals may prefer being dead to being old and dependent (i.e. case where $b_i < \tilde{c}$), or, also, may prefer being dead to being old and autonomous (i.e. case where $d_i < \bar{c}$).

Given that we focus on the design of optimal LTC social insurance in advanced economies, we will, throughout this paper, exclude those extreme cases, and assume that the economy is productive enough, so that there are always enough resources so as to guarantee that old-age consumption is above the critical levels $\tilde{c}$ and $\bar{c}$, which implies that individuals are better off alive than dead. Concretely, we assume, in the rest of the paper, that the wage level w_L is large enough, so that, both at the laissez-faire equilibrium and at the first-best and second-best optima, consumption levels of low-wage (and therefore of high-wage) individuals are always above thresholds $\bar{c}$ and $\tilde{c}$.

[10] It should be stressed that this assumption involves a simplification of reality. In real life, there are many consumption goods and services, and one cannot exclude that the marginal utility of consumption of *some* goods or services may be higher under dependency than under autonomy. However, our model is a one-good economy and, in that simplified context, assuming that dependency reduces the marginal utility of consumption is a plausible proxy.

3 The laissez-faire equilibrium

Let us first characterize the equilibrium in the absence of governmental intervention. We assume a perfect annuity market, which yields actuarially fair returns on savings.[11] Assuming that the interest rate is zero, the return on savings for an individual of type i in case of survival to the old age is thus $1/\pi_i$. There is also an actuarially fair private LTC insurance market (yielding a return $1/\pi_i p_i$).

Individuals choose labor $\ell_i \geq 0$, savings $s_i \geq 0$ and private LTC insurance $a_i \geq 0$ in order to maximize their expected lifetime welfare subject to their budget constraint:

$$\max_{\ell_i, s_i, a_i} u\left(w_i \ell_i - e\left(\ell_i\right) - s_i - a_i\right) + \pi_i(1-p_i)u\left(\frac{s_i}{\pi_i}\right) + \pi_i p_i v\left(\frac{s_i}{\pi_i} + \frac{a_i}{\pi_i p_i} - S\right).$$

Solving this problem, we obtain that the optimal labor supply equalizes, at the margin, the wage and the marginal disutility of labor, $w_i = e'\left(\ell_i\right)$. Since $w_H > w_L$, and given the convexity of $e(\cdot)$, we have that $\ell_H > \ell_L$, that is, type-H individuals work more than type-L individuals. We also obtain the following consumption-saving trade-off: $u'(c_i) = u'\left(d_i\right) = v'\left(b_i\right)$, implying that $c_i = d_i > b_i \, \forall i$, which also implies that $a_i/(\pi_i p_i) < S$ in equilibrium. Individuals choose to partially insure themselves so as cover some of the additional LTC expenditures S that they would have to bear in case of dependency.

Concerning well-being inequalities prevailing at the laissez-faire, two distinct perspectives can be adopted: on the one hand, we can compare well-being ex ante (i.e. before the outcomes of lotteries are revealed); on the other hand, we can compare well-being ex post (i.e. after the outcomes of lotteries are revealed). The former approach compares *expected* lifetime well-being across individuals, whereas the latter approach compares *realized* lifetime well-being levels.

From an ex ante perspective, only two groups can be compared: types H and L. Assuming that the gap in survival probabilities is small in comparison with the wage gap, we obtain that individuals with a higher wage are, in expected terms, better off than individuals with a lower wage (i.e. $EU_H > EU_L$).[12]

Ex post, realized lifetime well-being levels for type $i = \{L, H\}$ are:

[11] This assumption is standard in models where longevity is risky. Without annuities, there would be accidental bequests, which would have to be dealt with within an intergenerational model. Introducing this would lead us far beyond the scope of this paper.

[12] In our framework, a higher hourly wage not only extends consumption possibilities *ceteris paribus*, but is also associated with a higher survival probability, which decreases the return of savings under perfect annuities, and, hence, consumption possibilities *ceteris paribus*. A sufficient condition for having the intuitive case where type-H individuals are, *ceteris paribus*, better off ex ante than type-L individuals, is that the gap in survival probabilities π_H and π_L is relatively small in comparison with the gap in w_H and w_L.

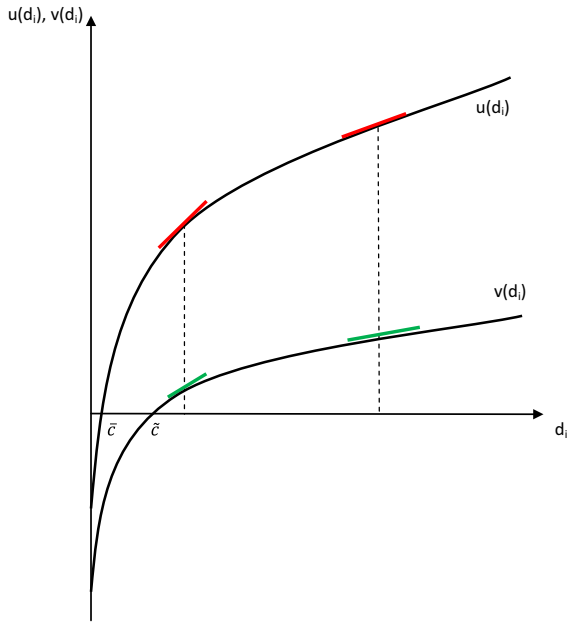


Fig. 1 State-dependent utility

$$\begin{aligned} U^{i,SL} &= u\big(c_i\big), \\ U^{i,LL,D} &= u\big(c_i\big) + v\big(b_i\big), \\ U^{i,LL,A} &= u\big(c_i\big) + u\big(d_i\big), \end{aligned}$$

where $\{A, D\}$ stand for being autonomous (A) or dependent (D), and $\{SL, LL\}$ stand for being short-lived (SL) or long-lived (LL). Under the assumptions $d_i > \bar{c}$ and $b_i > \tilde{c}$ (Sect. 2), we obtain:

$$U^{H,SL} < U^{H,LL,D} < U^{H,LL,A} \text{ and } U^{L,SL} < U^{L,LL,D} < U^{L,LL,A}.$$

The long-lived who is autonomous at the old age is, ex post, better off than the short-lived of the same type. The long-lived who is dependent is also, ex post, better off than the short-lived of the same type.

Assuming that the gap in survival probabilities is sufficiently small in comparison with the wage gap, we obtain that type-H individuals are, ex post, better off than type-L individuals with the same longevity and old-age health status:[13]

[13] Without that assumption, it could be the case that type-L individuals could turn out to be better off ex post than type-H individuals with the same longevity and old-age health status, a counterintuitive case.

$$U^{H,SL} > U^{L,SL},\ U^{H,LL,D} > U^{L,LL,D} \text{ and } U^{H,LL,A} > U^{L,LL,A}.$$

Proposition 1 summarizes our results.

Proposition 1 *At the laissez-faire equilibrium,*

- *Consumption is constant in the first two ages of life if the individual is autonomous, but falls in the old age if he becomes dependent. Moreover, type-H individuals work more than type-L individuals.*
- *If the gap in survival probabilities is sufficiently small with respect to the wage gap, type-H individuals are, ex ante, better off than type-L ones.*
- *The autonomous long-lived is, ex post, better off than the dependent long-lived and the short-lived of the same type* $i \in \{L, H\}$.
- *The dependent long-lived is, ex post, better off than the short-lived of the same type* $i \in \{L, H\}$.
- *If the gap in survival probabilities is sufficiently small with respect to the wage gap, type-H individuals are, for a given longevity and health status, better off ex post than type-L individuals.*

Proof See above. □

4 The utilitarian optimum

The utilitarian social criterion is a normative benchmark in public economics. Based on the pioneer works of Beccaria (1764), Bentham (1789) and Mill (1861), utilitarianism is an ethical doctrine based on a single principle, the Principle of Utility, also known as the Principle of "the largest happiness for the largest number". That principle recommends to design institutions and policies such that the sum of all individual utilities in the society is maximized.

More formally, utilitarianism relies on three ethical premises: (1) consequentialism (i.e. only outcomes matter for social evaluations); (2) welfarism (i.e. the relevant informational basis is individual's well-being or utility); (3) sum-ranking (each person should count as one, and thus everyone receives equal weight in the utilitarian calculus).[14] This section explores the implications of utilitarianism for the design of a LTC social insurance.

[14] Some ethical doctrines assume consequentialism and welfarism, but give up sum-ranking. This is the case for the criterion proposed by Atkinson and Stiglitz (1980), which includes some degree of inequality aversion across individual utilities. One could also sum up utilities *renormalized* in such a way as to give priority to some (disadvantaged) members of the population. This section focuses on the standard version of utilitarianism, based on postulates (1) to (3), which is the most widespread one.

4.1 First-best optimum

Assuming perfect information, the problem of the utilitarian social planner is:

$$\max_{\ell_i, x_i, d_i, b_i} \sum n_i\left[u\left(x_i - e(\ell_i)\right) + \pi_i(1-p_i)u\left(d_i\right) + \pi_i p_i v\left(b_i\right)\right]$$
$$\text{s.t. } \sum n_i \ell_i w_i = \sum n_i\left(x_i + \pi_i(1-p_i)d_i + \pi_i p_i(b_i + S)\right)$$

Focusing on an interior optimum, the FOCs of this problem yield:

$$e'(\ell_i) = w_i, \tag{4}$$

$$u'(c_i) = u'\left(d_i\right) = v'(b_i). \tag{5}$$

Condition (4) implies that type-H individuals should work *more* than type-L individuals, $\ell_H^u > \ell_L^u$. Condition (5) implies, under $u'(.) > v'(.)$, that $c^u = d^u > b^u$, where $c^i = c^u$, $d^i = d^u$ and $b^i = b^u \, \forall i$. Hence, individuals of types H and L should be treated equally in terms of consumption. Also, we find that the dependent elderly should enjoy *less* consumption (equivalently, once LTC expenditures are paid, they are left with fewer resources) than the autonomous elderly. The reason behind that counter-intuitive result is that the utilitarian criterion favors individuals who are more able to transform, at the margin, resources into well-being, i.e. the autonomous elderly. The lower capacity of the dependent elderly to convert resources into well-being explains why they are penalized under utilitarianism.

Regarding well-being comparisons, we have:

$$U^{H,SL} = U^{L,SL} < U^{H,LL,D} = U^{L,LL,D} < U^{H,LL,A} = U^{L,LL,A}.$$

As a consequence, type-H individuals are, from an ex ante perspective, still better off than type-L individuals (i.e. $EU_H > EU_L$), but those inequalities in expected lifetime well-being are reduced with respect to the laissez-faire.

Let us now consider ex post well-being inequalities. The utilitarian optimum, by equalizing consumptions for types H and L, abolishes ex post well-being inequalities between individuals who differ in wage, but enjoy the same longevity and old-age health status.[15] However, well-being inequalities due to unequal longevity or old-age health status are still present ex post. Given that $c^u = d^u \geq \bar{c}$ and $b^u \geq \tilde{c}$, short-lived individuals are worse off than long-lived ones (either in dependency or autonomous), and the dependent elderly are worse off than the autonomous elderly.

[15] This result is related to the use of quasi-linear first-period utility. Other preferences, including a separate term for the disutility from labor, would lead, for a given longevity/health status type, to unequal ex post well-being under utilitarianism.

Proposition 2 *At the utilitarian optimum,*

- *Consumption is constant in the first two ages of life if the individual is autonomous, but falls in the old age if he becomes dependent.*
- *Ex ante, type-H individuals are better off than type-L individuals.*
- *For a given longevity/health status, type-H individuals are, ex post, as well off as type-L individuals.*
- *The autonomous long-lived is, ex post, better off than the dependent long-lived and the short-lived of the same type* $i \in \{L, H\}$.
- *The dependent long-lived is, ex post, better off than the short-lived of the same type* $i \in \{L, H\}$.

Proof See above. □

4.2 Second-best optimum

Up to now, we considered a State that had access to all possible policy instruments and had complete information on individuals' types: wage and probability of survival and dependency. In that case, only differentiated lump-sum transfers at each period are needed to decentralize the utilitarian optimum.

Such a system of differentiated lump sum transfers being hardly available in real-world economies, this section considers a more realistic second-best setting, where the government has access only to a restricted number of uniform fiscal instruments, as in Sheshinski (1972). These instruments are a flat tax on earnings τ, a flat tax on aggregate saving (i.e. actuarially fair private annuities and private LTC insurance) σ, a flat pension benefit ψ and a flat LTC benefit g. Taken together, those policy instruments $\{\tau, \sigma, \psi, g\}$ can be regarded as a reduced form—a four-dimensional—social insurance system.[16]

The timing of the problem is the following one. In the first stage, the government announces the optimal policy. In a second stage, individuals make optimal decisions regarding private savings and LTC insurance, for given policy instruments. As usual, we proceed backwards, by first deriving the individuals' problem and second, by deriving the optimal policy instruments levels, taking into account that they affect individuals' decisions.

From the individual's problem, we obtain that optimal saving, LTC insurance and working time are given by, respectively, $s_i^* = s(\psi, g, \tau, \sigma; w_i)$, $a_i^* = a(\psi, g, \tau, \sigma; w_i)$ and $\ell_i^*(\tau; w_i)$, and are determined by the FOCs:[17]

[16] Since pension/LTC benefits are flat, we have a pure Beveridgian insurance system. On the contrary, we could have introduced a link between past contributions and pension/LTC benefits and have a Bismarkian system. This would not change qualitatively our results. Only the size of the redistribution towards type-L agents would be smaller.

[17] Since private and public insurance are substitutes, interior solutions for s_i^* and a_i^* will only be observed for low levels of public benefits, ψ and g. In the following, we assume that this is the case. This is a strong assumption particularly for low-income individuals, but it allows us to obtain intuitive results. Assuming otherwise would not qualitatively change our results.

$$-u'(c_i)(1+\sigma)+(1-p_i)u'(d_i)+p_iv'(b_i)=0 \tag{6}$$

$$-u'(c_i)(1+\sigma)+v'(b_i)=0 \tag{7}$$

$$u'(c_i)[w_i(1-\tau)-e'(\ell_i)]=0 \tag{8}$$

with $c_i=w_i\ell_i^*(1-\tau)-(1+\sigma)(s_i^*+a_i^*)-e(\ell_i^*)$, $d_i=s_i^*/\pi+\psi$ and $b_i=s_i^*/\pi_i+a_i^*/\pi_ip_i+\psi+g-S$. Combining these conditions, we obtain that:

$$u'(c_i)(1+\sigma)=u'(d_i)=v'(b_i).$$

The social planner then chooses policy instruments τ, σ ψ and g in order to maximize the following Lagrangian:

$$\max_{\tau,\sigma,\psi,g}\mathcal{L}=\sum n_i\left[\begin{array}{l}u\left(\ell_i^*w_i(1-\tau)-\left(a_i^*+s_i^*\right)(1+\sigma)-e(\ell_i^*)\right)+\pi_i\left(1-p_i\right)u\left(\frac{s_i^*}{\pi_i}+\psi\right)\\ \quad+\pi_ip_iv\left(\frac{s_i^*}{\pi_i}+\frac{a_i^*}{\pi_ip_i}+\psi+g-S\right)\\ \quad+\mu\left[\tau w_i\ell_i^*+\sigma\left(a_i^*+s_i^*\right)-\pi_i\psi-\pi_ip_ig\right]\end{array}\right]$$

where μ is the Lagrange multiplier associated with the government's budget constraint. Using the Envelop Theorem for s_i^* a_i^* and ℓ_i^* and replacing $\sum n_i$ by the expectation operator $E(\cdot)$, we obtain the following FOCs:

$$\begin{aligned}\frac{\partial\mathcal{L}}{\partial\tau}&=-Eu'(c)w\ell+\mu\left[Ew\ell+\tau Ew\frac{\partial\ell}{\partial\tau}\right]\\ \frac{\partial\mathcal{L}}{\partial\sigma}&=-Eu'(c)(s+a)+\mu\left[E(s+a)+\sigma E\frac{\partial(a+s)}{\partial\sigma}\right]\\ \frac{\partial\mathcal{L}}{\partial\psi}&=E\pi u'(d)-\mu\left[\bar{\pi}-\sigma E\frac{\partial(a+s)}{\partial\psi}\right]\\ \frac{\partial\mathcal{L}}{\partial g}&=Ev'(b)\pi p-\mu\left[E\pi p-\sigma E\frac{\partial(a+s)}{\partial g}\right]\end{aligned}$$

where the first terms account for the direct effects of policy instruments on social welfare and the second terms account for the indirect effect of these instruments on individuals' private savings and insurance decisions. Combining the last 2 FOCs, we can write the derivative of the Lagrangian with respect to the LTC benefit in compensated terms, that is, we calculate the effect of a marginal change of g on the Lagrangian when that change is compensated by a variation of ψ so as to maintain the government's budget balanced:

$$\begin{aligned}\frac{\partial\tilde{\mathcal{L}}}{\partial g}=\frac{\partial\mathcal{L}}{\partial g}+\frac{\partial\mathcal{L}}{\partial\psi}\frac{d\psi}{dg}&=E\pi\ cov(u'(d),\pi p)-E\pi p\ cov(u'(d),\pi)\\ &+\mu\sigma\left[E\frac{\partial(a+s)}{\partial g}-\frac{E\pi p}{\bar{\pi}}E\frac{\partial(a+s)}{\partial\psi}\right],\end{aligned} \tag{9}$$

where $d\psi/dg = -E\pi p/\bar{\pi}$. To sign the above expression, we use our stylized facts pertaining to the relations between w, πp and π. They imply that the correlation between π and w is positive, and that the correlation between w and πp is negative, which, in turn, imply that $cov(u'(d), \pi p) > 0$ and $cov(u'(d), \pi) < 0$.

Let us assume, for simplicity, that $\sigma = 0$. In that situation, the above expression would be unambiguously positive. This means that, from a utilitarian perspective, a rise in LTC benefit g compensated by a fall in the pension allowance ψ contributes to increasing social welfare. So, if the government had to choose between LTC benefits and pension benefits, for a given level of government resources, it would have interest in giving priority to the financing of LTC benefits over pension benefits. The reason is that LTC benefits are an inferior good (which benefit first low-wage/high-dependency individuals), whereas pensions are a superior good (which benefit first high-wage / high-survival individuals). If σ is not too large, this result is preserved.

In the same way, one can compute the compensated Lagrangian of either ψ or g compensated by τ. The derivative of the compensated Lagrangian with respect to ψ is:

$$\frac{\partial \tilde{\mathcal{L}}^{\psi}}{\partial \psi} = \frac{\partial \mathcal{L}}{\partial \psi} + \frac{\partial \mathcal{L}}{\partial \tau}\frac{d\tau}{d\psi} = 0$$

with $d\tau/d\psi = \bar{\pi}/\left[Ew\ell + \tau Ew\frac{\partial \ell}{\partial \tau}\right]$. It yields, after simplifications,

$$\frac{\partial \tilde{\mathcal{L}}^{\psi}}{\partial \psi} = \frac{1}{\Delta}\left[\begin{array}{l} -\bar{\pi}cov(u'(c), w\ell) + cov(u'(d), \pi)Ew\ell + \sigma\bar{\pi}Ew\ell Eu'(c) \\ +\tau Ew\frac{\partial \ell}{\partial \tau}\left[Eu'(d)\pi\right] + \mu\Delta\sigma E\frac{\partial(a+s)}{\partial \psi} \end{array}\right] = 0$$

where $\Delta = \left[Ew\ell + \tau Ew\frac{\partial \ell}{\partial \tau}\right]$. Isolating τ, we obtain the level of τ that would give the optimal level of ψ. It is equal to:

$$\tau^{\psi} = \frac{cov(u'(d), \pi)Ew\ell - \bar{\pi}cov(u'(c), w\ell) + \mu\Delta\sigma E\frac{\partial(a+s)}{\partial \psi} + \sigma\bar{\pi}Ew\ell Eu'(c)}{-Ew\frac{\partial \ell}{\partial \tau}[Eu'(d)\pi]}. \tag{10}$$

The denominator accounts for the efficiency term: increasing taxation causes distortions on labor supply, resulting in lower resources for the government. The first two terms of the numerator account for the redistributive impact of taxation. The last two terms correspond to the total revenue effect of an increase in ψ. τ^{ψ} can thus be positive or negative since $cov(u'(c), wl) < 0$, $cov(u'(d), \pi) < 0$ and $E\frac{\partial(a+s)}{\partial \psi} < 0$ so that $\tau^{\psi} \lesseqgtr 0$ depending on the size of the different effects.

Following the same approach for g, we compute the derivative of the compensated Lagrangian with respect to g. It is equal to

$$\frac{\partial \tilde{\mathcal{L}}^{g}}{\partial g} = \frac{\partial \mathcal{L}}{\partial g} + \frac{\partial \mathcal{L}}{\partial \tau}\frac{d\tau}{dg} = 0$$

where $d\tau/dg = E\pi p/\left[Ew\ell + \tau Ew\frac{\partial \ell}{\partial \tau}\right]$. After rearrangements, we obtain the level of the tax rate necessary to get the optimal level of LTC benefit, g:

$$\tau^g = \frac{cov(v'(b), \pi p)Ew\ell - cov(u'(c), w\ell)E\pi p + \sigma Ew\ell Eu'(c)E\pi p + \mu\Delta\sigma E\frac{\partial(a+s)}{\partial\psi}}{-Ew\frac{\partial \ell}{\partial \tau}Ev'(b)\pi p}. \tag{11}$$

Using our stylized facts, we have that $cov(v'(b), \pi p) > 0$ (since high-wage individuals have a lower unconditional probability to be dependent than low-wage ones) and $cov(u'(c), wl) < 0$, so that τ^g is positive if $\sigma E\frac{\partial(a+s)}{\partial\psi}$ is small enough.

In the light of our results, it follows that a utilitarian government would always prefer to favour the implementation of a LTC benefit g over a pension benefit ψ. This can be shown both from the arbitrage between g and ψ and from the fact that τ^g is likely to be positive, while nothing ensures that τ^ψ would be positive, in a second-best world. Proposition 3 summarizes our results.

Proposition 3 *Let us assume that the government can only impose uniform taxes on labor and on aggregate savings to finance a uniform pension benefit and a uniform LTC benefit. At the second-best utilitarian optimum:*

- *For a given level of government resources, a uniform LTC benefit should be given priority over a uniform pension benefit.*
- *The tax on labor to finance a pension benefit is equal to Eq.* (10)*. It can be positive or negative.*
- The tax on labor to finance a LTC benefit is equal to Eq. (11). *It can be positive or negative.*

Proof See above. □

For a given amount of governmental resources, a utilitarian government gives priority to the LTC benefit over the pension benefit. The intuition behind that result can be derived from the first-best utilitarian problem (Sect. 4.1). Utilitarianism redistributes resources from type-H individuals to type-L ones. In a second-best setting, this is achieved through giving priority to the LTC benefit, which is consumed by the dependent elderly (who include a higher proportion of type-L individuals in comparison to the elderly in general), over the pension benefit (which is consumed by all long-lived individuals). The priority given to the LTC benefit can thus be interpreted as a second-best way to reduce inequalities between high-wage and low-wage individuals.

5 Ex ante egalitarianism

Utilitarianism tends, with respect to the laissez-faire, to reduce inequalities in expected lifetime well-being between high-wage and low-wage individuals. However, it is still the case that type-H individuals are, ex ante, better off than type-L individuals. Are those inequalities ethically defensible?

To answer that question, it is useful to consider the Principle of Compensation (Fleurbaey and Maniquet 2004; Fleurbaey 2008). The Principle of Compensation states that well-being inequalities due to circumstances should be abolished by governments. In our model, the wage rate is not determined by past education efforts, but is outside individual control, i.e. a pure circumstance. Hence, if one applies the Principle of Compensation, the government should intervene to abolish well-being inequalities due to wage differentials.[18]

In order to do justice to the idea of compensating circumstances ex ante, this section adopts an ex ante egalitarian social welfare criterion, which gives priority to the worst-off in ex ante terms (i.e. before outcomes of lotteries in terms of longevity and old-age health status are revealed), i.e., low-wage individuals.

It should be stressed, however, that in our model the wage rate is only one circumstance among many other circumstances. Clearly, being short-lived or long-lived, or autonomous or dependent at the old age, are all pure circumstances in our economy, which also invite some compensation. The compensation of those circumstances will be studied in the next section. On the contrary, the present section will only consider compensation from an ex ante perspective, which is here limited to compensation for wage differentials.

5.1 First-best optimum

The problem of the ex ante egalitarian social planner can be written as:

$$\begin{aligned}\max_{\ell_i, x_i, d_i, b_i} \; & (1-\gamma)[u\big(c_L\big) + \pi_L(1-p_L)u(d_L) + \pi_L p_L v(b_L)] \\ & + \gamma[u(c_H) + \pi_H(1-p_H)u(d_H) + \pi_H p_H v(b_H)] \\ & + \lambda \sum n_i[\ell_i w_i - \big(x_i + \pi_i(1-p_i)d_i + \pi_i p_i(b_i + S)\big)]\end{aligned}$$

where γ is set so as to ensure equality between the expected utility of type-L and type-H individuals. As we showed in Sect. 3, the worst off individual is a type-L, so that we have: $(1-\gamma) > \gamma$. From a formal perspective, the ex ante egalitarian problem is similar to the utilitarian one, but with a higher weight given to low-wage individuals. The FOCs can be summarized as follows:

[18] Note that the objective of equalizing expected lifetime utilities could also be defended without relying on the Principle of Compensation, by defining social justice in terms of equality of well-being prospects (i.e. whatever the nature of the determinants of well-being is).

$$u'(c_H) = u'(d_H) = v'(b_H) = \frac{\lambda}{\gamma} \tag{12}$$

$$u'(c_L) = u'(d_L) = v'(b_L) = \frac{\lambda}{1-\gamma} \tag{13}$$

$$w_i = e'(\ell_i) \forall i \tag{14}$$

Type-H individuals supply more labor: $\ell_H > \ell_L$. We also obtain, under $u'(.) > v'(.)$, that $c_L = d_L = c_L^u > b_L$ and $c_H = d_H = c_H^u > b_H$. Like under utilitarianism, we have $c_i^u > b_i \forall i$. Yet, in comparison to the utilitarian optimum, consumptions are now higher for type L than for type H: under $1-\gamma > \gamma$, $c_L^u > c_H^u$ and $b_L > b_H$.

By construction, the ex ante egalitarian optimum involves perfect equalization of expected lifetime well-being across types, i.e. $EU_L = EU_H$.

From an ex post perspective, we have that some inequalities remain:

$$U^{H,SL} < U^{L,SL}; U^{H,LL,D} < U^{L,LL,D}; U^{H,LL,A} < U^{L,LL,A},$$
$$U^{i,SL} < U^{i,LL,D} < U^{i,LL,A} \forall i.$$

Hence, for any longevity and health-status, a low-wage individual is, ex post, better off than a high-wage one. This is quite different from the utilitarian optimum, where ex post utilities were equalized across wage types. In addition, like at the utilitarian optimum, we still find that, for any wage type, the worst-off individual is always the short-lived and that dependent individuals are also worse-off than autonomous ones. Our results are summarized in Proposition 4.

Proposition 4 *At the ex ante egalitarian optimum,*

- *Consumption is constant in the first two ages of life if the individual is autonomous, but falls in the old age if he becomes dependent.*
- *Consumptions are higher for type-L individuals than for type-H ones.*
- *Ex ante, type-L individuals and type-H individuals are equally well off.*
- *For a given longevity/health status, type-L individuals are, ex post, better off than type-H individuals.*
- *The autonomous long-lived is, ex post, better off than the dependent long-lived and the short-lived of the same type $i \in \{L, H\}$.*
- *The dependent long-lived is, ex post, better off than the short-lived of the same type $i \in \{L, H\}$.*

Proof See above. □

This section therefore illustrates the existence of an ethical dilemma between ex ante and ex post egalitarianism. The neutralization of inequalities in expected

lifetime well-being across types L and H prevents the neutralization of inequalities in realized lifetime well-being across those types.

5.2 Second-best optimum

Let us now assume that the government can only set uniform policy instruments, identical to those we had assumed at the utilitarian second-best optimum. The timing of the problem remains the same, and the problem of the ex ante egalitarian social planner is:

$$\begin{aligned}
&\max_{\tau,\sigma,\psi,g} \begin{bmatrix} u\big(\ell_L^* w_L(1-\tau) - \big(a_L^* + s_L^*\big)\big) + \pi_L(1-p_L)u\Big(\frac{s_L^*}{\pi_L} + \psi\Big) \\ +\pi_L p_L v\Big(\frac{s_L^*}{\pi_L} + \frac{a_L^*}{\pi_L p_L} + \psi + g - S\Big) \end{bmatrix} \\
&\text{s.t.} \quad \sum n_i\big[\tau w_i \ell_i^* + \sigma\big(a_i^* + s_i^*\big) - \pi_i\psi - \pi_i p_i g\big] \geq 0 \\
&\text{s.t.} \quad u\big(\ell_H^* w_H(1-\tau) - \big(a_H^* + s_H^*\big)\big) + \pi_H(1-p_H)u\left(\frac{s_H^*}{\pi_H} + \psi\right) \\
&\qquad + \pi_H p_H v\left(\frac{s_H^*}{\pi_H} + \frac{a_H^*}{\pi_H p_H} + \psi + g - S\right) \\
&\qquad = u\big(\ell_L^* w_L(1-\tau) - \big(a_L^* + s_L^*\big)\big) + \pi_L(1-p_L)u\left(\frac{s_L^*}{\pi_L} + \psi\right) \\
&\qquad + \pi_L p_L v\left(\frac{s_L^*}{\pi_L} + \frac{a_L^*}{\pi_L p_L} + \psi + g - S\right)
\end{aligned}$$

where $s_i^* = s(\psi, g, \tau, \sigma; w_i)$, $a_i^* = a(\psi, g, \tau, \sigma; w_i)$ and $\ell_i^*(\tau; w_i)$ are jointly determined by (6)–(8). Hence, FOCs are now:

$$\begin{aligned}
\frac{\partial \mathcal{L}}{\partial \tau} &= -u'(c_L^*) w_L \ell_L^* + \mu\left[E w \ell + \tau E w \frac{\partial \ell}{\partial \tau}\right] \\
\frac{\partial \mathcal{L}}{\partial \sigma} &= -u'(c_L^*)\big(a_L^* + s_L^*\big) + \mu\left[E(s+a) + \sigma E \frac{\partial (a+s)}{\partial \sigma}\right] \\
\frac{\partial \mathcal{L}}{\partial \psi} &= \pi_L u'(d_L^*) - \mu\left[\bar{\pi} - \sigma E \frac{\partial (a+s)}{\partial \psi}\right] \\
\frac{\partial \mathcal{L}}{\partial g} &= v'(b_L^*)\pi_L p_L - \mu\left[E\pi p - \sigma E \frac{\partial (a+s)}{\partial g}\right]
\end{aligned}$$

where μ is the Lagrange multiplier associated to the resource constraint. Rearranging these FOCs, we obtain the equation defining the optimal level of g compensated by a decrease in ψ:

$$\frac{\partial \tilde{\mathcal{L}}^{EA}}{\partial g} = u'(d_L^*)\left[\frac{\pi_L p_L}{\pi_L} - \frac{E\pi p}{\bar{\pi}}\right] + \mu\sigma\left[E\frac{\partial (a+s)}{\partial g} - \frac{E\pi p}{\bar{\pi}} E\frac{\partial (a+s)}{\partial \psi}\right]$$

where *EA* accounts for ex ante egalitarianism. Comparing this expression with the one we had at the utilitarian optimum (Eq. 9), we find that the first term in the above expression is higher and thus, pushes even more toward a positive level of the LTC benefit, g. From a ex ante egalitarian perspective, a rise in g compensated by a fall in the pension allowance ψ would even be more desirable than at the utilitarian optimum, since it would allow more redistribution toward the type L.

We now compute the level of τ that would give the optimal level of ψ at the second-best ex ante egalitarian optimum:

$$\tau^{\psi,EA} = \frac{\pi_L u'(d_L^*) E w \ell - \bar{\pi} u'(c_L^*) w_L \ell_L + \mu \Delta \sigma E \frac{\partial(a+s)}{\partial \psi}}{-u'(d_L^*) \pi_L E w \frac{\partial \ell}{\partial \tau}}. \tag{15}$$

The tax rate τ^{ψ} can thus be positive or negative depending on the overall sign of $\pi_L u'(d_L^*) E w \ell - \bar{\pi} u'(c_L^*) w_L \ell_L$. As in the utilitarian case, it is not clear whether it would be beneficial to further tax labor in order to increase the pension benefit. To the contrary, computing the level of the tax rate that would be necessary to get the optimal level of LTC benefit, g, we obtain:

$$\tau^{g,EA} = \frac{v'(b_L^*) \pi_L p_L E w \ell - u'(c_L^*) w_L \ell_L^* E \pi p + \mu \Delta \sigma E \frac{\partial(a+s)}{\partial \psi}}{-v'(b_L^*) \pi_L p_L E w \frac{\partial \ell}{\partial \tau}}. \tag{16}$$

For a type-L individual, the sign of first two terms is clearly positive so that for σ small enough, τ^g is positive. Proposition 5 summarizes our results.

Proposition 5 *At the second-best ex ante egalitarian optimum, a uniform LTC benefit should be given priority over a uniform pension benefit and its level should be higher than at the utilitarian second-best optimum.*

Proof See above. □

All in all, shifting from the utilitarian criterion to the ex ante egalitarian criterion reinforces the desire to implement LTC benefit over a pension benefit.

6 Ex post egalitarianism

As shown in Sect. 5, the ex ante egalitarian criterion does justice to the idea of compensating individuals for wage differentials, in line with the Principle of Compensation applied ex ante. One may nonetheless question the adequacy of an ex ante perspective for the social evaluation of individual situations.

Fleurbaey (2010) argued that priority should be given to comparisons of well-being in realized terms (that is, ex post) over the comparison of well-being in expected terms (that is, ex ante). Fleurbaey's argument is based on the distinction between informed and uninformed preferences. Ex ante, individuals do not know which state of nature will prevail, and thus their preferences on lotteries are

uninformed. Ex post, individuals know which state of nature prevails, so that preferences over (now degenerate) lotteries are fully informed. Fleurbaey considers that social evaluations should give priority to informed over uninformed preferences, since the former constitute a more relevant informational basis for welfare comparisons.

Giving priority to well-being comparisons ex post has strong implications in our framework. As shown above, the ex ante egalitarian optimum equalizes expected lifetime well-being across all types of individuals ex ante, but still involves inequalities in realized lifetime well-being, either between low-wage or high-wage individuals, but, also, between short-lived and long-lived individuals, and between the autonomous and the dependent elderly.

If one adopts an ex post perspective, those well-being inequalities are hardly defensible. Actually, from an ex post perspective, circumstances include not only the wage, but, also, the realized longevity.[19] Moreover, circumstances also include, ex post, the realized old-age health status.[20] Hence, from an ex post perspective, the Principle of Compensation requires to compensate individuals for all those circumstances.

In order to do justice to the idea of compensating for all circumstances (including those only revealed ex post), this section adopts the *ex post* egalitarian criterion, which gives priority to the worst-off in realized terms, and explores the implications of ex post egalitarianism for the design of LTC social insurance.[21]

6.1 First-best optimum

The problem of the ex post egalitarian social planner can be written as the maximization of the well-being of the short-lived of type L subject to the resource constraint and subject to several egalitarian constraints:

[19] About 1/4 to 1/3 of longevity inequalities within a cohort are due to the genetic background, a pure circumstance (see Christensen et al. 2006). Contoyannis and Jones (2004) and Balia and Jones (2008) showed that about 25% of inequalities in lifetime are due to lifestyles (eating behavior, drinking behavior, etc.), but those lifestyles are acquired through a socialization process within the family, which is, again, a pure circumstance.

[20] Regarding the risk of old-age dependence, Farrer et al. (1997) show that there exists a statistical association between apolipoprotein e genotype and the risk of Alzheimer disease.

[21] Note that the social objective of equalizing ex post lifetime utilities could also be defended without relying on the Principle of Compensation, for instance by defining social justice in terms of equality of realized well-being among all individuals (independently of the nature of factors—efforts or circumstances—determining realized well-being levels).

$$\begin{aligned}
&\max_{\ell_i, x_i, d_i, b_i} u(x_L - e(\ell_L)) \\
&\quad \text{s.t.} \sum n_i \ell_i w_i = \sum n_i \big(x_i + \pi_i (1 - p_i) d_i + \pi_i p_i (b_i + S)\big) \\
&\quad \text{s.t. } u(c_L) = u(c_H) \\
&\quad \text{s.t. } u(c_i) + u(d_i) = u(c_i) \ \ \forall i \\
&\quad \text{s.t. } u(c_i) + v(b_i) = u(c_i) \ \ \forall i
\end{aligned}$$

The first egalitarian constraint states that individuals of type H who are short-lived should be exactly as well off as individuals of type L who are short-lived. The second egalitarian constraint states that, for a given type $i = H, L$, individuals who are autonomous at the old age should be exactly as well off as individuals who are short-lived. The third egalitarian constraint states that, for a given type $i = H, L$, individuals who are dependent at the old age should be exactly as well off as individuals who are short-lived.

Focusing on an interior optimum, we obtain:

$$\begin{aligned}
e'(\ell_i) = w_i \implies \ell_H > \ell_L, \\
c_L = x_L - e(\ell_L) = c_H = x_H - e(\ell_L) \implies x_H > x_L, \\
d_L = d_H = \bar{c} > b_L = b_H = \tilde{c},
\end{aligned}$$

where the LHS and RHS of the third line are obtained by setting $u(d_i) = 0 \ \forall i$ and $v(b_i) = 0 \ \forall i$, so as to leave no well-being inequality between short-lived and long-lived individuals. Moreover, consumptions are, for each age of life and each health status, equalized across types H and L: $c_L = c_H = c^e$, $d_L = d_H = d^e = \bar{c}$ and $b_L = b_H = b^e = \tilde{c}$.

A first important difference with the previous sections is that consumptions at the young age and at the autonomous old age are not equal. Actually, individuals who reach the old age and are autonomous should here have a consumption equal to the threshold $\bar{c}$. The underlying intuition is that reducing old-age consumption allows to free resources, which are transferred to the young age. This contributes to increase the realized lifetime well-being of the unlucky short-lived individuals. This rationale explains why the ex post egalitarian optimum involves a consumption profile *decreasing* with age.[22]

Moreover, the ex post egalitarian optimum involves a higher consumption for the dependent elderly than for the autonomous elderly, that is, $b^e = \tilde{c} > d^e = \bar{c}$.[23] This is different from what prevailed under utilitarianism and ex ante egalitarianism, where dependent individuals received fewer resources than the autonomous elderly, because of a lower capacity to convert them into well-being. On the contrary, from an ex post egalitarian perspective, having a lower capacity to convert resources into well-being justifies to receive, as a compensation, more resources.

[22] On this result, see also Fleurbaey et al. (2014).

[23] Indeed, the egalitarian constraint is such that $u(d^e) = v(b^e) = 0$, and, given that $u(d) > v(d) \, \forall d$, it implies that $b^e > d^e$.

Regarding the comparison with young age consumption, old-age consumption in case of dependency is below young-age consumption ($c^e > b^e = \tilde{c}$).

In the light of all this, we have:

$$U^{H,SL} = U^{L,SL} = U^{H,LL,D} = U^{L,LL,D} = U^{H,LL,A} = U^{L,LL,A}.$$

Type-H individuals are, ex ante, better off than type-L individuals (i.e. $EU_H > EU_L$). However, from an ex post perspective, realized well-being levels are equalized across all individuals. Proposition 6 summarizes our results.

Proposition 6 *At the ex post egalitarian optimum,*

- *Consumption is higher at the young age than at the old age (independently of the health status).*
- *Old-age consumption is higher for dependent individuals than for autonomous ones.*
- *Consumptions are equal for type-L and type-H individuals.*
- *Ex ante, type-H individuals are better off than type-L individuals.*
- *For a given longevity/health status, type-H individuals are, ex post, as well off as type-L individuals.*
- *The autonomous long-lived is, ex post, as well off as the dependent long-lived, and as well off as the short-lived.*

Proof See above. □

The ex post egalitarian optimum neutralizes inequalities due to circumstances, whatever these are caused by unequal wage, lifetimes or health status at the old age. This perfect equalization of realized lifetime well-being across all types is achieved by designing a particular lifetime consumption profile, independent of the wage, which is decreasing with the age, but less decreasing for those individuals who turn out to become dependent at the old age (since old-age consumption is larger under dependency than under good health).

Achieving a perfect equalization of well-being ex post seems surprising, since, ex ante, the social planner does not know who will reach the old age or not, and who will fall into dependency or not. However, lifetime well-being equalization is achieved by constructing a consumption profile that neutralizes the impact of longevity or health inequalities on well-being. Thus, there is perfect compensation of individuals for either premature death or for falling into dependency, since there is no welfare loss associated with these events.

This equalization of all ex post lifetime well-being levels has a cost: it leads to a quite low consumption for the autonomous elderly, which can be regarded as an extreme solution. However, this feature is the price to pay to transfer more resources towards individuals with higher needs ex post: on the one hand, the dependent elderly and, on the other hand, the short-lived. The situation of the

prematurely dead is improved by transferring resources towards the young, who include individuals who will turn out to be short-lived.

Note also that ex post egalitarianism prevents the equalization of *expected* lifetime well-being across types H and L. We are thus in presence of an ethical dilemma between ex ante and ex post egalitarianism. It is not possible here to equalize well-being across all individuals *both* in expected terms and in realized terms. A choice is to be made between the ex ante and the ex post ethical views.

6.2 Second-best optimum

The social planner chooses policy instruments τ, σ, ψ and g so as to solve the following problem:

$$\begin{aligned}
&\max_{\tau,\sigma,\psi,g} u\left(\ell_L^* w_L(1-\tau) - (a_L^* + s_L^*)(1+\sigma) - e(\ell_L^*)\right) \\
&\quad \text{s.t. } \sum_i n_i \left[\tau w_i \ell_i^* + \sigma\left(a_i^* + s_i^*\right) - \pi_i \psi - \pi_i p_i g\right] \geq 0 \\
&\quad \text{s.t. } \frac{s_i^*}{\pi_i} + \psi = \bar{c} \ \forall i \\
&\quad \text{s.t. } \frac{s_i^*}{\pi_i} + \frac{a_i^*}{\pi_i p_i} + \psi + g - S = \tilde{c} \ \forall i
\end{aligned}$$

where the first constraint is the government's budget constraint and the last two constraints are egalitarian constraints. Since both $s_i^* = s(\psi, g, \tau, \sigma; w_i)$ and $a_i^* = a(\psi, g, \tau, \sigma; w_i)$ depend on w_i, the only way to satisfy the above egalitarian constraints for both types H and L consists in taxing away both private savings and private LTC insurance benefits (i.e. setting $\sigma = 100\%$) and to give $\psi = \bar{c}$ to the autonomous elderly and $g + \psi = \tilde{c} + S$ to the dependent elderly, independently of their type $\{H, L\}$. In that way, no inequality in realized lifetime well-being remains between individuals of a given wage type, w_i.[24] As to the optimal level of τ, it is given by the budget constraint of the government and it is such that:[25]

$$\tau E w \ell = \psi \bar{\pi} + g E \pi p.$$

However, since individuals in the first-period of their life have $c_i = \ell_i^* w_i (1-\tau) - e(\ell_i^*)$, there remain ex post inequalities between short-lived and long-lived individuals of different wage types:

[24] It is possible to show that, at the second-best optimum, the egalitarian constraints are binding. We can prove this by contradiction. Assume instead that the egalitarian constraints are not binding. For given levels of ψ and g, in order to increase the welfare of the short-lived, it is optimal to increase σ so as to tax away private savings and LTC insurance, as well as to decrease τ. From the resource constraint of the government, the decrease in τ stops when ψ and g are fixed at their minimum, that is when the egalitarian constraints are binding. This is true as long as $\bar{c}$ and $\tilde{c}$ are not too large (a weak assumption).

[25] Since savings and private LTC insurance are taxed away, individuals choose neither to save not to invest in a private insurance so that taxation of aggregate savings does not appear in the government budget constraint.

$$U^{i,SL} = u(\ell_i^* w_i(1-\tau) - e(\ell_i^*)),$$
$$U^{i,LL,D} = u(\ell_i^* w_i(1-\tau) - e(\ell_i^*)) + v(\tilde{c}),$$
$$U^{i,LL,A} = u(\ell_i^* w_i(1-\tau) - e(\ell_i^*)) + u(\bar{c}).$$

Yet, no inequality remains between individuals with different length of life or health status at the old age, for a given wage type i (since $u(\bar{c}) = v(\tilde{c}) = 0$).

Proposition 7 summarizes our results.

Proposition 7 *Let us assume that the government can only impose a uniform tax on labor and on aggregate savings to finance a uniform pension benefit and a uniform LTC benefit. In the second-best ex post egalitarian optimum:*

- *It is optimal to set LTC and pension benefits such that* $g = \tilde{c} - \bar{c} + S$ *and* $\psi = \bar{c}$.
- *No ex post inequality remains between long-lived and short-lived as well as between autonomous and dependent individuals of a given wage type* w_i.
- *There remain ex post inequalities across individuals with unequal wages.*

Proof See above. □

Proposition 7 can be interpreted by relying on the first-best ex post egalitarian optimum characterized in Sect. 6.1. From an ex post egalitarian perspective, the allocation of resources should be such that inequalities due to outcomes of lotteries—either in terms of life duration or health status at the old age—are neutralized. This explains also the results obtained at the second-best. Indeed, the levels of the pension allowance and of the LTC benefit shown in Proposition 7 are exactly those that neutralize inequalities caused by unequal durations of life or unequal health status among the elderly.

Let us now compare our second-best results with what we obtain under other social criteria. Under utilitarianism and ex ante egalitarianism, priority is given to type-L individuals (who become more often dependent at the old age), at the expense of type-H individuals (who remain more often autonomous), through a positive LTC benefit. Under ex post egalitarianism, priority is given to the prematurely dead, and both the autonomous and the dependent elderly are given just enough resources to be as well-off as the unlucky short-lived. Hence, fiscal resources necessary to finance $g + \psi$ at the *ex post* egalitarian optimum are lower than those needed under other social criteria. The reasons are twofold. First, at the ex post egalitarian optimum, consumptions in the old-age (whether the individual is autonomous or dependent) are set at their minimum, $\tilde{c}$ and $\bar{c}$ while at the utilitarian optimum and the ex ante egalitarian optimum, old-age consumptions are higher. Second, the compensation of the short-lived for their early death is made by increasing welfare in the first-period, which is lived by *all* individuals (including those who will turn out to be

short-lived). High taxation levels would go against compensation of the short-lived, since they decrease first-period consumption, and, hence, first-period well-being (equal to lifetime well-being for the short-lived).

7 Numerical illustration

This section proposes to impose specific functional forms for the representation of preferences and to calibrate our model, in order to examine quantitatively the robustness of optimal LTC insurance to the underlying social criterion. For that purpose, we use French data on wages, on LTC expenditures, on survival probabilities and on probabilities to become dependent.

Using INSEE (2015) data on wages, we partition the French population into two categories with monthly wages, $w_H = 3176€$ and $w_L = 1681€$, with $n_H = 0.4$ and $n_L = 0.6$.[26] This leads to an average monthly wage of 2279€.

Regarding the calibration of LTC expenditures S, we use data on the monthly median price of a nursing home in France (CNSA 2017), and we set $S = 1949€$.

In order to calibrate survival probabilities and (unconditional) probabilities to become dependent, we use the study by Cambois et al. (2011). We assume that, in our 2-period model, young adulthood lasts from 25 to 65 years, and old adulthood lasts from 65 years until 105 years, we use data on the life expectancy and on healthy life expectancy at age 65.[27] This yields the following probabilities: $\pi_H = 0.46 > \pi_L = 0.41$ and $p_H = 0.60 < p_L = 0.67$.

Regarding preferences, we assume that functions $u(\cdot)$ and $v(\cdot)$ are given by:

$$\begin{aligned} u(x) &= \log(x) + \alpha \\ v(x) &= \delta \log(x) + \beta \end{aligned}$$

To calibrate parameters $\{\alpha, \beta, \delta\}$, we proceed in three steps. First, following Becker et al. (2005), we assume that $\bar{c} = 300/12$ €, where 300€ is the critical annual consumption that would make individuals indifferent between survival and death. Normalizing the utility of being dead to zero, this allows us to derive α from the equation $\log(\bar{c}) + \alpha = 0$. This leads to $\alpha = -3.218$.

Second, we use Finkelstein et al. (2013) to calibrate the marginal utility of consumption under dependency. Finkelstein et al. (2013) shows that marginal utility of consumption under bad health (chronic diseases) is evaluated to be between 75 and

[26] See Tables 1 and 6, in INSEE (2015). We consider that high-qualification and intermediary occupations as type-H individuals, and clerks and manual workers as type-L individuals.

[27] See Table 2 (male column) of Cambois et al. (2011). Using the weights for the different socio-demographic categories used in the previous step, we aggregate life expectancy at 65 and life expectancy at 65 without daily-life restrictions for each type H and L, and obtain probabilities by dividing these by the length of the period (i.e. 40 years).

90% of the marginal utility under good health. Using this as a proxy for the marginal utility under dependency, we assume that $\delta = 0.9$.

Third, regarding the calibration of β, which captures the reduction of well-being due to loss of autonomy, we use the study by Ferrer-i-Carbonell and van Praag (2002). That study shows that heart diseases are, from a welfare perspective, equivalent to a decrease in income equal to 47%. Using this as a proxy for the welfare loss due to becoming dependent, we obtain $\beta = -3.180$.[28]

Finally, we obtain the monthly minimum level of consumption under dependency $\tilde{c}$ by solving the following equation: $\delta \log(\tilde{c}) + \beta = 0$ (Table 1).

Our calibrated model is then used to derive the second-best optimal social insurance system $\{\tau, \sigma, \psi, g\}$ under, successively, the utilitarian, the ex ante egalitarian and the ex post egalitarian criteria. Our results are summarized in Table 2, which shows the optimal values of policy instruments, as well as the associated levels of realized lifetime well-being for the 6 types ex post.[29]

Table 2 shows that relying on the utilitarian criterion, the ex ante or the ex post egalitarian criterion has strong quantitative effects on the design of the optimal social insurance.[30] Some of those results could already be anticipated from our theoretical analysis of the second-best problem, but our calculations allow us to go beyond qualitative observations, and to quantify the lack of robustness of the optimal policy to the postulated social criterion.

Ex ante egalitarianism involves, in comparison to utilitarianism, higher pensions, higher LTC benefits, as well as higher overall taxation (total fiscal revenue is higher). Quite logically, low-wage individuals obtain higher *ex post* utility in case of dependency and autonomy (while ex post utility of a short-lived is smaller) under *ex ante* egalitarianism than under utilitarianism.

Consider now ex post egalitarianism. A first major difference with respect to utilitarianism and ex ante egalitarianism concerns the global level of taxation: fiscal revenues are lower under ex post egalitarianism than under utilitarianism and ex ante egalitarianism, since in these cases more resources are spent on the long-lived (both autonomous and dependent). There is also a substantial difference in the structure of taxation. The ex post egalitarian second-best involves, in comparison to other social optima, a much lower tax rate on the young adults's labor earnings (24% against 42% and 45%), as well as a higher tax rate on savings and private LTC insurance (100% against 9% and 29%).

As a consequence, consumption at the young age is higher under ex post egalitarianism than under utilitarianism and ex ante egalitarianism (independently of types $i = \{H, L\}$). Favoring high consumption at the young age improves the situation of the young, including those who will turn out to be short-lived. Higher consumption

[28] β solves: $\beta = \alpha - \delta \log(d) + \log(0.53d)$ with α and δ already obtained in previous steps and where $d = w_L/2$ (i.e. half of the income of the low wage individual).

[29] For simplicity, our calculations assume that individual labor supply is fixed. This implies some minor changes on the government budget constraints and on the first-order condition with respect to τ at the second-best utilitarian optimum. Relaxing that assumption would not modify our results substantially.

[30] Note that, at the utilitarian and the ex ante egalitarian second-best optima, we have corner solutions: $s_H^* > 0$ while $s_L^* = 0$ and $a_i^* = 0 \; \forall i$.

Table 1 Calibration of parameters

Parameters	w_L	w_H	n_L	n_H	S	α	β	δ	$\bar{c}$	$\tilde{c}$
Value	1681	3176	0.6	0.4	1949	-3.218	-3.180	0.900	25	34.251

Table 2 Numerical results

	SB utilitarian	SB ex ante egalit.	SB ex post egalit.
τ^*	42.43%	44.8%	24.12%
σ^*	9.24%	28.71%	100.00%
ψ^*	1060.82	1108.1	25.00
g^*	1883.09	2015.35	1958.25
total revenue	974.42	1031.15	549.70
$U^{L,SL}$	3.66	3.61	3.93
$U^{H,SL}$	4.16	4.18	4.57
$U^{L,LL,D}$	6.69	6.84	3.93
$U^{H,LL,D}$	7.52	7.51	4.57
$U^{L,LL,A}$	7.40	7.45	3.93
$U^{H,LL,A}$	8.26	8.14	4.57

at the young age allows short-lived individuals to be better off at the ex post egalitarian optimum than at the other social optima**.**

Another important difference concerns pensions and LTC benefits. Under utilitarianism and ex ante egalitarianism, more resources are devoted to long-lived individuals (both autonomous and dependent), through the level of the pension benefit ψ: $\psi^{EA} > \psi^{U} > \psi^{E}$ and $\psi^{EA} + g^{EA} > \psi^{U} + g^{U} > \psi^{E} + g^{E}$.[31] Overall, long-lived individuals (either autonomous or dependent) have higher lifetime well-being at the utilitarian and the ex ante egalitarian optima than at the ex post egalitarian optimum. The reason why the ex post egalitarian solution involves fewer resources spent on the elderly follows from the underlying goal of compensating the unlucky short-lived. Dedicating fewer resources to the old makes these worse off than under utilitarianism and ex ante egalitarianism, but this allows to improve the situation of young individuals, and, hence, the situation of the unlucky individuals who turn out to be short-lived.

The utilitarian, the ex ante egalitarian and the ex post egalitarian optimal second-best policies have also different effects concerning well-being inequalities among the long-lived. At the utilitarian and ex ante egalitarian optima, individuals who are autonomous at the old age are better off than those who fall into dependency. On the contrary, at the ex post egalitarian solution, the low old-age consumption for the autonomous elderly (with respect to the LTC benefit) leads to equalize the

[31] Note also that, in line with our theoretical results, utilitarianism and ex ante egalitarianism give priority to the LTC benefit over the pension benefit.

well-being levels of the autonomous and the dependent elderly (for a given wage level). Thus the ex post egalitarian criterion leads to fully compensate the dependent elderly.

All in all, our numerical simulations confirm that the design of the optimal social insurance is not robust to the postulated social criterion. The LTC benefit is, under ex post egalitarianism, lower than under *ex ante* egalitarianism, but higher than under utilitarianism. Moreover, the *ex post* egalitarian second-best involves, in comparison to utilitarianism and ex ante utilitarianism: (1) a lower tax rate on labor earnings; (2) a higher tax rate on aggregate savings; (3) lower pension benefits. Adopting one specific social welfare criterion has sizeable quantitative effects on the design of the LTC social insurance.

8 Conclusions

What would be a fair LTC social insurance? That question is complex, since the construction of a fair LTC social insurance raises several difficulties. Among those difficulties, a crucial issue concerns the fact that individuals in situation of dependency do not have the same preferences as autonomous individuals. Moreover, another difficulty is that the fairness of a LTC social insurance should be valued not only by comparing the situations of autonomous and dependent elderly individuals, but, also, by taking into account the situation of the unlucky prematurely dead individuals who do not face the risk of being dependent at the old age, simply because they do not reach the old age.

In order to address that issue, this paper developed a lifecycle model with risk about the duration of life and about the health status at the old age, while allowing for state-dependent preferences. In order to examine the robustness of the optimal LTC social insurance to the underlying social welfare criterion, we contrasted three social optima: the utilitarian optimum, the ex ante egalitarian optimum and the ex post egalitarian optimum.

Our results show that the optimal LTC social insurance is not robust to the adopted social welfare criterion. At the first-best optimum, if one adopts the utilitarian or the ex ante egalitarian criterion, the dependent elderly should receive fewer resources than the autonomous elderly, since the latter exhibits a higher capacity to convert resources into well-being. On the contrary, under the ex post egalitarian social criterion, more resources should be allocated to the dependent elderly than to the autonomous elderly, so as to compensate him for dependency.

The postulated normative criterion has also crucial consequences for the overall shape of consumption profiles. Whereas the optimal consumption age profile should be, under utilitarianism and ex ante egalitarianism, flat in the absence of old-age dependency and decreasing under old-age dependency, it would be, under the ex post egalitarian criterion, decreasing with the age (with a stronger decline for the

autonomous elderly). The underlying intuition is that a consumption profile decreasing with the age pushes towards more resources being allocated to the young, who include unlucky individuals who will turn out to be short-lived. Hence, compensating individuals for arbitrarily short lives justifies more decreasing consumption profiles with the age.

We also carried out a second-best analysis with uniform policy instruments. The second-best policy was shown to vary with the postulated social objective. The optimal social insurance under the ex ante egalitarian criterion involves, in comparison to utilitarianism, higher LTC and pension benefits and higher tax rates on savings and on labor earnings. In comparison to ex ante egalitarianism, ex post egalitarianism involves lower LTC and pension benefits, a higher tax on savings and a lower tax rate on labor earnings, in order to increase consumption of the young, who include persons who will turn out to be short-lived.

Those findings have strong policy implications for the design of the fifth "pillar" of the Welfare State. From a quantitative perspective, the paper suggests that the strongest ethical dilemma is not between utilitarianism and egalitarianism, but, rather, between ex ante and ex post egalitarianism. The ethical treatment of risks plays a key role in the design of optimal LTC social insurance. Ex ante egalitarianism involves higher LTC and pension benefits, but at the cost of a larger fiscal burden on the young. On the contrary, ex post egalitarianism implies lower pension and LTC benefits, which allow to reduce the fiscal burden of the young, in order to compensate those who die prematurely.

All in all, this paper suggests that the construction of a fair LTC social insurance depends strongly on the postulated normative foundations. The relative size of the optimal LTC social benefit - as well as the overall burden of the funding of LTC—is not invariant at all to the social objective that is pursued. A corollary of this is that public debates on the future of LTC social insurance should not only focus on behavioral and technical issues, but should also discuss normative foundations. If one wants to treat the dependent elderly in a fair way, one can hardly leave these normative foundations aside. At the end of the day, how a society treats its elderly dependent members is a matter of social choice.

Finally, it should be stressed that none of the three social welfare criteria studied in this paper has fully satisfactory policy implications. Both utilitarianism and ex ante egalitarianism disfavor the unlucky short-lived and the dependent elderly in comparison to the autonomous elderly, an unattractive implication. Ex post egalitarianism leads to very low consumption levels at the old age, a rather extreme corollary. Those negative results may invite further research towards an alternative social welfare criterion, which would avoid all those unsatisfactory implications. The quest for a new social criterion with more satisfactory policy implications is left for future research.

References

Ameriks J, Briggs J, Caplin A, Shapiro M, Tonetti C (2018) The long-term-care insurance puzzle: modeling and measurement. NBER working paper 22726

Atkinson A, Stiglitz J (1980) Lectures on public economics. MacGraw Hill International, New-York

Balia S, Jones A (2008) Mortality, lifestyle and socioeconomic status. J Health Econ 27:1–26

Beccaria C (1764) Des délits et des peines. Version française (2015). Flammarion, Paris

Becker G, Philipson T, Soares R (2005) The quantity and quality of life and the evolution of world inequality. Am Econ Rev 95(1):277–291

Bentham J (1789) An introduction into the principles of morals and legislation. In: Mill JS, Warnock M (eds) Utilitarianism. Fontana Press, London

Boyer MM, De Donder P, Fluet C, Leroux ML, Michaud PC (2020) Long-term care insurance: information frictions and selection. Am Econ J Econ Policy 12(3):134–169

Brown J, Finkelstein A (2007) Why is the market for LTC insurance so small? J Public Econ 91:1967–1991

Brown J, Finkelstein A (2011) Insuring long term care in the US. J Econ Perspect 25(4):119–142

Cambois E, Laborde C, Romieu I, Robine J-M (2011) Occupational inequalities in health expectancies in France in the early 2000s: unequal chances of reaching and living retirement in good health. Demogr Res 25(12):407–436

CNSA—Caisse Nationale de Solidarité pour l'Autonomie (2017) Analyse des tarifs des EPHAD en 2016, numéro 4, Juin 2017

Christensen K, Johnson T, Vaupel J (2006) The quest for genetic determinants of human longevity: challenges and insights. Nat Rev Genet 7:436–448

Contoyannis P, Jones A (2004) Socio-economic status, health and lifestyle. J Health Econ 23:965–995

Cremer H, Pestieau P (2014) Long term care social insurance and redistribution. Int Tax Public Finance 21:955–974

Cremer H, Roeder K (2013) Long-term care policy, myopia and redistribution. J Public Econ 108:33–43

Farrer L, Cupples L, Haines J, Hyman B, Kukull W, Mayeux R et al (1997) Effects of age, sex, and ethnicity on the association between apolipoprotein e genotype and Alzheimer disease: a meta analysis. JAMA 278(16):1349–1356

Ferrer-i-Carbonell A, van Praag B (2002) The subjective costs of health losses due to chronic diseases. An alternative model for monetary appraisal. Health Econ 11(8):709–722

Finkelstein A, Luttmer E, Notowidigdo M (2013) What good is wealth without health. The effect of health on the marginal utility of consumption. J Eur Econ Assoc 11:221–258

Fleurbaey M (2008) Fairness, Responsibility and Welfare. Oxford University Press, Oxford

Fleurbaey M (2010) Assessing risky social situations. J Polit Econ 118:649–680

Fleurbaey M, Maniquet F (2004) Compensation and responsibility. In: Arrow KJ, Sen AK, Suzumura K (eds) Handbook of social choice and welfare, 1st edn, vol 2, chapt 22. North-Holland, pp 507–604

Fleurbaey M, Ponthiere G (2013) Prevention against equality? J Public Econ 103(1):68–84

Fleurbaey M, Leroux ML, Ponthiere G (2014) Compensating the dead. J Math Econ 51(C):28–41

Fleurbaey M, Leroux ML, Pestieau P, Ponthiere G (2016) Fair retirement under risky lifetime. Int Econ Rev 57(1):177–210

INSEE (2015) Les niveaux de vie en France. INSEE Premiè re 1665

Jousten A, Lipszyc B, Marchand M, Pestieau P (2005) Long term care insurance and optimal taxation for altruistic children. Finanz Arch 61:1–18

Lefebvre M, Perelman S, Schoenmaeckers J (2018) Iné galités face à la mort et au risque de dépendance. Revue Française d'Economie 33(2):75–112

Leroux ML, Ponthiere G (2018) Working time regulation, unequal lifetimes and fairness. Soc Choice Welf 51:437–464

Mill JS (1861) Utilitarianism. New version edited by Mary Warnock. Fontana Press, London

Norton E (2000) Long term care. In: Cuyler A, Newhouse J (eds) Handbook of health economics, vol 1b, chapt 17. North-Holland
OECD (2011) Help wanted? Providing and paying for long-term care. http://www.oecd.org/health/health-systems/help-wanted-9789264097759-en.htm. Accessed Sept 2018
Pestieau P, Ponthiere G (2011) The long term care insurance puzzle. In: Costa-Font J, Courbage C (eds) Financing long term care in Europe: institutions, markets and models. Palgrave Macmillan, London, pp 41–52
Pestieau P, Sato M (2008) Long term care: the state, the market and the family. Economica 75:435–454
Sen AK, Williams B (1982) Utilitarianism and beyond. Cambridge University Press, Cambridge
Sheshinski E (1972) The optimal linear income-tax. Rev Econ Stud 39(3):297–302

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