Discussion Paper Series

RIEB

Kobe University

DP2024-24

The Nexus between Long-term Care Insurance, Formal Care, Informal Care, and Bequests: The Case of Japan

Charles Yuji HORIOKA
Emin GAHRAMANOV
Xueli TANG

July 17, 2024

Research Institute for Economics and Business Administration
Kobe University
2-1 Rokkodai, Nada, Kobe 657-8501 JAPAN

The Nexus between Long-term Care Insurance, Formal Care, Informal Care, and Bequests: The Case of Japan

Charles Yuji Horioka*
(Kobe University, Osaka University, Asian Growth Research Institute, and National Bureau of Economic Research)

Emin Gahramanov
(American University of Sharjah)

Xueli Tang
(Deakin University)

June 2024

Abstract

The purpose of this paper is to conduct a theoretical and empirical analysis of the nexus between long-term care insurance (LTCI), formal care, informal (family) care, and bequests. In our empirical analysis, we use micro data from the Japan Household Panel Survey on Consumer Preferences and Satisfaction (JHPS-CPS), formerly known as the Preference Parameter Study, conducted by Osaka University. Japan is an interesting case to analyze because a public LTCI system was introduced there in 2000. Our analysis shows that, in the case of Japan, if parents are eligible for public LTCI benefits, their children will be less likely to be their primary caregiver and that this, in turn, will reduce their children's perceived likelihood of receiving a bequest from them. This result implies that bequests are selfishly or strategically motivated (i.e., that parents leave bequests to their children in order to elicit care from them) and that the introduction of a public LTCI system will reduce the likelihood of children providing care to their parents and through this channel reduce their perceived likelihood of receiving a bequest from them.

JEL classification codes: D11, D12, D15, D64, E21, I13, J14

Keywords: Altruistic bequests; bequests; caregiving; elderly care; family care; formal care; informal care; long-term care; long-term care insurance; parental care; selfish bequests; strategic bequests

*Corresponding author: Charles Yuji Horioka. Address: Research Institute for Economics and Business Administration, Kobe University, 2-1, Rokkodai-cho, Nada-ku, Kobe, Hyogo 657-8501, JAPAN. E-mail: horioka@rieb.kobe-u.ac.jp

1. Introduction

Population ageing is occurring in many countries in the world due to increases in life expectancy and declines in fertility although its timing and speed varies greatly from country to country. This will greatly increase the burden of long-term care of the elderly, and in fact, this issue is such an urgent and important one that the National Bureau of Economic Research (NBER) recently embarked on a large-scale research project on this topic and will soon publish a book on this topic (Gruber and McGarry, forthcoming). This book compares long-term care in 10 major developed countries and finds that spending on formal long-term care is a large and growing share of GDP in all 10 of the countries they studied, increasing, on average, from 1.4 percent of GDP in 2000 to 2.1 percent of GDP in 2019 (see Gruber, et al., 2023). The increase in spending on long-term care has been even more pronounced in Japan, where the share of formal long-term care in GDP increased from 0.7% in 2000 to 2.1% in 2019, a three-fold increase. This sharp increase is primarily due to the fact that Japan introduced a public long-term care insurance (LTCI) system in 2000. Moreover, these figures would be even higher if informal care by family members were to be included (which Gruber and McGarry (forthcoming) attempt to do in their book). In fact, Gruber, et al. (2023) and Fu, et al. (2023) estimate that the aforementioned figures for Japan would be 75 percent higher if informal long-term care were to be included.

Given how onerous the burden of long-term care of the elderly has become, it has become difficult for the necessary long-term care services to be financed solely by the private sector. Partly in response to this challenge, many countries including Germany, the Republic of Korea, Japan, and Singapore have introduced public LTCI systems. Moreover, many other countries provide public funding for long-term care through other means (for example, by using general tax revenue or incorporating it into their public health insurance systems) (see Li, et al., 2023, for more details). However, despite the growing importance of long-term care spending and government funding for such spending, relatively little research has been conducted on the nexus between LTCI, formal care, informal (family) care, and bequests.

The purpose of this paper is to construct a theoretical model of this nexus and to test this model using micro data from Japan, where, as mentioned earlier, a public LTCI system was introduced in 2000. In particular, we use data from the Japan Household Panel Survey on Consumer Preferences and Satisfaction (JHPS-CPS), formerly known as the Preference Parameter Study, conducted by Osaka University, to analyze the impact of LTCI on informal parental care and through this channel on bequests. Our reasoning is that the introduction of a public LTCI system will lower the price of formal care relative to the price of informal care (at least in a country like Japan where there are no cash benefits for informal care), induce the substitution of formal care for informal care, and reduce the prevalence of bequests (to the extent that bequests are strategically or selfishly motivated—i.e., to the extent that parents leave bequests to their children in order to elicit care from them). Thus, our findings have important implications for the desirability and optimal design of public LTCI programs, for the extent to which wealth disparities are passed on from generation to generation, and for labor force participation, especially of women.

To summarize the main findings of this paper, we find that, if parents are eligible for public LTCI benefits, their children will be less likely to be their primary caregiver and that this, in turn, will reduce their children's perceived likelihood of receiving a bequest from them. This result implies that bequests are selfishly or strategically motivated (i.e., that parents leave bequests to their children in order to elicit care from them) and that the introduction of a public LTCI system will reduce the likelihood of children providing care to their parents and through this channel reduce

their perceived likelihood of receiving a bequest from them. Our findings imply that both parents and children are selfish, at least in the case of Japan.

This paper makes important contributions to the literature both theoretically as well as empirically. Theoretically, it analyzes all four possible cases (the case of an altruistic parent and an altruistic child, that of a selfish parent and a selfish child, that of an altruistic parent and a selfish child, and that of a selfish parent and an altruistic child) and shows how the impact of LTCI and informal parental care on bequests differs among the four cases.

Empirically, there is a large literature on whether LTCI and informal care are substitutes for one another starting with Mellor (2001) and there is an equally large literature on whether providing informal care to one's parents enhances a child's prospects of receiving a bequest starting with Menchik (1988). However, to the best of our knowledge, there are no previous studies that have examined the two issues simultaneously, and the current paper is virtually the first to examine the nexus between LTCI systems, formal care, informal care, and bequests in a unified framework. Moreover, it estimates the impact of LTCI eligibility on informal parental care and bequests using an innovative instrumental variables approach to control for endogeneity (it uses parental eligibility for LTCI benefits as an instrument for informal parental care). Finally, the estimation strategy in our paper enables us to determine which of the four theoretical cases applies in the real world.

The paper is organized as follows: Section 2 conducts a survey of the relevant literature, section 3 discusses Japan's public LTCI system, section 4 presents the theoretical model, section 5 discusses the data source used in this paper and the sample selection criteria, section 6 discusses the estimation model, section 7 presents descriptive statistics, section 8 presents the estimation results, and section 9 summarizes the findings of this paper and discusses the policy implications thereof.

2. Literature Survey

Since this paper examines the nexus between LTCI, formal care, informal care, and bequests, it is related to at least five strands of literature.

First and most obviously, our paper is related to the extensive literature on the interrelationship between bequests and other intergenerational transfers from parents to children and the informal care children provide to their elderly parents. The most well-known hypothesis that explains this connection is the strategic bequest motive of Bernheim et al. (1985). According to this hypothesis, parents leave bequests to their children in order to induce them to provide care and attention during old age, and conversely, children provide care and attention to their parents during old age in order to obtain a larger share of their parents' inheritance (see also Horioka et al. 2018).

Thus, the empirical relevance of the strategic bequest motive can be tested in one of two ways—first, by examining whether or not parents who expect to receive informal care from their children are more likely to leave bequests or to leave larger bequests, and second, by examining whether or not children who expect to receive bequests or who expect to receive larger bequests from their parents are more likely to provide informal care to their parents during old age. There are many studies that attempt to shed light on the validity of the strategic bequest motive, with some of them adopting the first strategy and others adopting the second strategy. For example, Menchik (1988), Sloan et al. (1997), Norton and Taylor (2005), Brown (2006), Norton and van Houtven (2006),

and Groneck (2017) adopt the first strategy. Turning to studies that adopt the second strategy, Bernheim et al. (1985) and Perozek (1998) use data for the United States, while Noguchi et al. (1989), Komamura (1994), Ohtake and Horioka (1994), Horioka et al. (2000), Yamada (2006), Wakabayashi and Horioka (2009), Kohara and Ohtake (2011), and Horioka et al. (2018) use data for Japan, Almas, et al. (2020) use data for China, and Ho (2022) uses data for Singapore (see Laferrère and Wolff 2006, Arrondel and Mason 2006, Horioka et al. 2018, and Horioka 2021a, 2021b for more extensive surveys of this literature). Since direct data on bequest receipts or bequest expectations are usually not available, most of these studies use various proxies therefor such as the bequeathable wealth or educational attainment of parents. As for care-related variables, previous studies use a variety of measures including frequency of visits and phone calls, co-residence, living nearby, help with housework, help with nursing care, help with ADL (Activities of Daily Living) and/or IADL (Instrumental Activities of Daily Living), and financial assistance. Finally, there are some studies such as Cox (1987), Cox and Rank (1992), Henretta et al. (1997), McGarry and Schoeni (1995, 1997), and Norton et al. (2013) that look at the related issue of whether there is a correlation between *inter vivos* transfers from parents to children and informal care of parents by children but it is possible that *inter vivos* transfers and bequests are governed by different considerations.

Another strand of literature to which our paper is related is the literature on the determinants of who provides care to parents requiring care. For example, Stern (1995) and Chechovich and Stern (2002) conduct an econometric analysis of what parent and child characteristics influence the caregiving decision (see Grabowski, et al., 2012, for a useful survey of this literature).

A third strand of literature to which our paper is related is the literature on the substitutability between informal (family) care and formal care and on what impact the availability of public and private LTCI, which reduces the relative price of formal care, has on this substitutability. There will be less need for children to provide informal care to their parents during old age if their parents have access to formal care and/or are covered by LTCI, and conversely, that there will be less need for formal elder care and/or for LTCI if there are children who can provide informal care to their parents during old age. Mellor (2001) examines whether children and other family members are substitutes for LTCI and finds that the availability of informal caregivers does not have a statistically significant impact on the actual or intended purchase of LTCI. Lockwood (2012, 2018) shows that bequest motives (which, in turn, presumably precipitate greater informal care) significantly reduce the demand for LTCI. Mommaerts (2018) examines the extent to which nursing home care and co-residence with adult children are substitutes for one another and finds that changes in eligibility for public LTCI (Medicaid) benefits could have large impacts on the probability of co-residence with adult children. Finally, Sloan and Norton (1997) and Norton (2000) and Bonsang (2009) look at the related issue of the substitutability between public LTCI (Medicaid in the United States) and private LTCI in the United States and Europe, respectively.

A fourth strand of literature to which our paper is related is the literature on the impact of LTCI on children's incentive to provide care to their parents during old age (see, for example, Stern, 1995, and Grabowski et al., 2012). For example, Sloan and Norton (1997) and Courbage and Zweifel (2011) point out that, if the parents have LTCI, their children will be less likely to provide informal care to them during old age because LTCI will protect the parents' bequest from the cost of nursing home care. Conversely, if the parents have no LTCI, their children will be more likely to provide informal care to them during old age because failure to do so may necessitate putting their parents in a nursing home, which means that children will not be able to receive as large a bequest. Thus, parents who want their children to provide informal care to them during old age

may decide not to purchase LTCI because they want to give their children as much of an incentive to provide informal care as they can (see, for example, Pauly, 1990).

A fifth and final strand of literature to which our paper is related is the literature on the determinants of the demand for private LTCI. For example, Braun, et al. (2019) analyze the determinants of the demand for private LTCI in the United States in order to shed light on why the demand for private LTCI is so low in the United States despite the absence of a public LTCI system.

3. An Overview of Japan's Public LTCI System

Before turning to our analysis, we provide a brief overview of Japan's public LTCI system, which was introduced in 2000 (see Fu, et al., 2017; Iwagami and Tamiya, 2019; and Kikuchi, et al. (2024) for more details). In Japan as well as in any other country, care of the elderly can be provided either by family members, in which case it is called "informal care" or by professional care workers, in which case it is called "formal care." Moreover, formal care can be financed either by the individual's own savings or by public or private LTCI.

Almost no Japanese people have purchased private LTCI either before or after the introduction of public LTCI in 2000 even though it is available, but one very important thing to note is that there were means-tested subsidies for nursing home care and at-home care even before 2000 (in fact, since 1963). Thus, low-income people could obtain subsidies for nursing home care and at-home care even before 2000, and in fact, the subsidies they could receive declined after 2000 in some cases. By contrast, middle- to high-income people had to pay almost the full cost of nursing home care before 2000, but they sometimes relied on long-term hospitalization (in which case medical insurance could be used to cover all or part of the cost) although this is no longer possible. The introduction of the LTCI system in 2000 was not as abrupt a change as one might think because similar systems were already in place even before then, but it is true that LTCI benefits became more generous and were expanded to a larger segment of the population (in particular, to middle- to high-income people) after 2000.

The public LTCI system that was introduced in Japan in 2000 covers everyone aged 65 or older as well as younger people with an aging-related disability. If a person meets these eligibility requirements and is certified as needing care, the public LTCI system will cover 90% of the cost of the formal care that he or she is deemed to require, and the person himself/herself needs to pay only 10% of the cost.[1] The system covers formal care that is provided by professional care workers (home helpers) who visit you at home, formal care that is provided by "day service" facilities where the elderly person is dropped off in the morning and picked up in the evening in the same way that a young child is taken care of at a daycare center, and formal care provided by nursing homes but does not cover informal care provided by family members.

The amount of care that is subsidized by the government depends on the person's need level. The person's need level, in turn, depends on the mental and physical condition of the person and is determined by the Long-term Care Approval Board based on the opinion of a regular medical doctor. There are seven need levels (support level 1 is the lowest need level, followed by support level 2, care level 1, care level 2, care level 3, care level 4, and care level 5), and the amount of

[1] Pursuant to the 2015 revision of Japan's LTCI system, the copayment rate was raised from 10% to 20% for those whose income is above a certain level, but since the data we use in this paper pertain to 2011, we did not need to take account of this revision.

required care that the government will subsidize increases with the person's need level (i.e., with the severity of the person's disability).

To enable the reader to better understand Japan's public LTCI system, Table 1 presents information on the requirements, standardized care times, and maximum benefits for each need level. As can be seen from this table, a recipient with the lowest need level (support level 1) is estimated to require 25 to 32 minutes of care per day whereas a recipient with the highest need level (care level 5) is estimated to require 110 or more minutes of care per day, which is about 4 times as much as the amount of care that a recipient with the lowest need level is estimated to require.

Table 1 here

Similarly, Table 1 also shows that the maximum benefit is 50,320 yen per month for a recipient with the lowest need level (support level 1) whereas the maximum benefit is 362,170 yen for a recipient with the highest need level (care level 5), which is more than 7 times as much as the maximum benefit of a recipient with the lowest need level.

Thus, Japan's LTCI system is needs-based, with benefits increasing sharply with the recipient's need level (degree of disability) and is *not* means-tested (i.e., it does not depend on the person's income or wealth).

As noted earlier, Japan's public LTCI system does not pay cash benefits for informal care provided by family members, unlike in the case of, for example, the German system. Thus, the system creates a bias toward formal care, or to put it another way, it lowers the price of formal care relative to the price of informal care. Thus, the person is eligible for benefits equal to 90 percent of the cost of formal care that he/she is deemed to require based on his/her need level but receives no benefits for formal care in excess of the required amount or for informal (family) care.

The introduction of Japan's public LTCI system in 2000 had an enormous impact, with spending on formal long-term care increasing from about 0.7% of GDP in 2000 when the LTCI system was first introduced to 2.1% of GDP in 2019 (see Gruber, et al., 2023, and Fu, et al., 2023), a three-fold increase in less than 20 years, as already noted.

However, it should be noted that, although Japan's public LTCI covers all "required" care, eligibility requirements are very strict, meaning that the system seldom covers all of the recipient's care needs. For example, the public LTCI system may cover the cost of a home helper coming to the recipient's home twice a week even though he/she actually needs the home helper to come every day.

4. The Theoretical Model

In our theoretical model of the nexus between the LTCI system, formal care, informal care, and bequests, we consider the following four cases, which differ with respect to whether parents and children are selfish or altruistic: the case of a selfish parent and a selfish child in Case 1, the case of an altruistic parent and a selfish child in Case 2, the case of an altruistic parent and an altruistic child in Case 3, and the case of a selfish parent and an altruistic child in Case 4.

Assume that, at any point in time, one parent interacts with one child of her own, and we arbitrarily refer to both economic agents as being of feminine gender. A young adult agent (parent) enters the model in the first period of economic life and lives for two periods. In the first period, the young parent decides how much to save for the future and how much care to provide to her own elderly parent. In the second stage of life, the agent becomes elderly and begins an "economic" interaction with her own grown-up child. The elderly parent decides how much care to purchase from outside the family and how much bequest to leave behind to her child (while possibly expecting some care in return).

Let the current period be $t = 0$. In the previous period ($t = -1$), a young parent has already formed expectations about uncertainties regarding her future (time $t = 0$) health status, care needs, the characteristics of her offspring, and so on. As a result, when young in period $t = -1$, the parent has already decided how much to save for old age, and let that saving be s_{-1}^{p}, where hereafter the superscript p denotes the current "parent." We also assume that, in period $t = -1$, the young parent took care of her own parents and possibly received a bequest from them. In any event, the parent has decided with how much saving (s_{-1}^{p}) she would arrive at the old-age stage of life in period $t = 0$. In what follows, we consider four separate cases.

Case 1: Selfish parent and selfish child

Given the saving carried over from the first period of life, s_{-1}^{p}, the elderly parent begins to strategically interact with her child in period $t = 0$. The parent is selfish in the sense that she cares only about her own well-being, and so is the child. One might assume, following Zweifel and Strüwe (1996), that some minimum bequest level ($B_{min} > 0$) is guaranteed to the child. One might think that the parent has some assets that are of no use outside the family. Alternatively, there might be a social norm that requires leaving something behind to one's offspring, and the parent may not desire to be ostracized for not following this tradition. In a simpler setting, one can set $B_{min} = 0$.

The parent will strategically leave part of her saving to her child as a bequest (possibly more than the minimum level B_{min}) to incentivize her child to provide care to the parent. The parent also needs to decide how much extra health and emotional care to acquire from private providers (optional care expenditures). After leaving a bequest and taking care of her health and emotional well-being, the parent would simply consume what is left over until she exits the model at the very end of period $t = 0$.

Hereafter, let superscript ch denote the parent's child. Assume that our elderly parent wants to adhere to some bequest rule by choosing the bequest rule parameter α in the following function:

$$B^{p} = f(B_{min}; \alpha; C^{ch}), \qquad (1)$$

where B^{p} is the amount the parent will leave as a bequest, C^{ch} is the "care level/amount" ultimately received from the child (at time $t = 0$), $\frac{\partial f}{\partial C^{ch}} \geq 0$, $\frac{\partial^2 f}{\partial C^{ch} \partial \alpha} \geq 0$. We make the assumption that the amount of care the child provides to her parent will increase the bequest the parent leaves to her child only for Case 1, where all agents are assumed to be selfish. To ensure that totally selfish children would provide care to their parents, the child must recognize that there will be a reward for her efforts. We do not preclude the theoretical possibility that the amount of care the child provides might have no impact whatsoever on the amount of bequest she receives from her

parent. Furthermore, as will be made clear below, the choice of bequest level (B^p) is endogenous since the parameter α is a choice variable, and B^p could in principle be zero. Thus, we assume that the bequest is a non-decreasing function of care provided by the child as it would be counterintuitive to presume that selfish children will be systematically fooled into providing care for a "negative" reward from their parents. We also note that, if parameter $\alpha > 0$, it reflects the "price" parents are willing to pay to their children (in the form of a bequest) for care received during old age, or to put it another way, this parameter reflects how much parents value receiving care from their children (as opposed to receiving it from outside sources). In this section, we assume that $0 \leq C^{ch} < 1$ is simply the time spent by the child caring for her parent. The total time endowment of an economic agent is normalized to unity.

Let HE^p_{-1} be the parent's health and emotional well-being level at the very end of period $t = -1$. Assume that the parent's health and emotional well-being can be enhanced by increasing the level of TC^p, representing the total amount of care and attention available to the elderly (which might include, among others, nursing care, care from her child, medical attention, and psychological support, to name a few). Following Ariizumi (2008), let there be a production function for the parent's health and emotional well-being that depends on TC^p. Thus, we assume that, in the current period ($t = 0$), the parent's realized health and emotional well-being level is given by

$$HE^p_0 = (1 - d)HE^p_{-1} + \lambda(\beta; TC^p), \qquad (2)$$

where $0 < d < 1$ is the depreciation rate, $\beta > 0$ is the productivity parameter, $\frac{\partial \lambda}{\partial TC^p} > 0$, $\frac{\partial^2 \lambda}{\partial TC^p \partial \beta} > 0$. In other words, we assume that an increase in the total amount of care and attention increases the parent's health and emotional well-being and that the impact of the total amount of care and attention is higher, the higher is the productivity parameter.

Let the parent's total care input from outside sources be summarized by $C^{p,out}$, which can be substituted for care provided by the child, C^{ch}. Thus,

$$TC^p = \theta_1 C^{ch} + \theta_2 C^{p,out}, \qquad (3)$$

where $\theta_1, \theta_2 \geq 0$. Both $C^{p,out}$ and C^{ch} are endogenous, as explained shortly.

In the Japanese LTCI system, the government pays for up to 90 percent of the cost of required care, with the amount of required care being determined by the person's need level. There is usually a cap on the monthly co-payment amount, but to keep things simple, we assume that the co-payment rate ($0 < \varphi \leq 1$) is constant. This will not be an impediment to the focus of our study.

Let RC be the amount of "required" care (which depends on one's health status), a proportion $(1 - \varphi)$ of the cost of which is paid for by the government. Thus, $RC = RC(HE^p_{-1})$, $\frac{dRC(HE^p_{-1})}{dHE^p_{-1}} < 0$. In other words, the amount of required care is higher, the lower is the parent's health and emotional well-being in the previous period. The amount of required care is the minimum care level deemed necessary by the government's Long-term Care Approval Board. We assume that the parent would incur this necessary level of expenditures even in the absence of LTCI (i.e., even if $\varphi = 1$) but that this care level would be considered insufficient by most people, in which case they would opt for additional (optional) care.

Denoting OC^p as the amount of optional care chosen by the parent, the total amount of outside care can be expressed as

$$C^{p,out} = RC(HE^p_{-1}) + OC^p. \quad (4)$$

We normalize the price of optional care services to unity. Let us assume that the elderly parent has no earnings, and let the elderly parent's utility function at time $t = 0$ take the general form

$$U^p = U\left(s^p_{-1} - \varphi RC(HE^p_{-1}) - OC^p - B^p, HE^p_0\right), \quad (5)$$

where the first argument in the utility function, $s^p_{-1} - \varphi RC(HE^p_{-1}) - OC^p - B^p$, denotes the consumption of the elderly parent.[2] We assume that the utility function is increasing in both arguments, and note also that HE^p_0 is a function of $C^{p,out}$ (and thus OC^p) due to (2), (3) and (4). The elderly parent will maximize her utility by choosing OC^p and α.

In the first period of her economic life ($t = 0$), the young adult child of our elderly parent only decides how much to save for old age and how much care time to offer to her parent. However, it is obvious that the child's optimal saving amount and time sacrifice for her parent at time $t = 0$ might depend on how uncertain her own future is. First, the child is not sure about her own health and emotional well-being level at the very end of her young life (at the beginning of her elderly life at time $t = 1$); i.e., HE^{ch}_0 is random. Second, she does not know about the attitude and economic conditions of her own offspring, and therefore is not sure how much care, if any, she will receive from her own child at time $t = 1$. Denoting that care amount by $\bar{C}^{ch}$, we reason that $\bar{C}^{ch}$ is also a random variable at time $t = 0$. Third, the young adult child at time $t = 0$ is not sure what will be the amount of outside care that she will ultimately purchase herself at $t = 1$ (i.e., $C^{ch,out}$ is also random but only because future optional care purchased (OC^{ch}) as well as HE^{ch}_0 are random). Finally, partly due to the aforementioned reasons and partly due to other unforeseen circumstances, the young adult child is not sure about the amount of the bequest that she might end up leaving to her own offspring (i.e., B^{ch} is random). Thus, we have four random variables of immediate interest: HE^{ch}_0, $\bar{C}^{ch}$, OC^{ch}, and B^{ch}, and let us assume that these variables are continuous random variables (that are not necessarily independent) with the following respective realization ranges: $[\underline{he}, \overline{he}]$, $[\underline{c}_1, \bar{c}_1]$, $[\underline{c}_2, \bar{c}_2]$, and $[\underline{b}, \bar{b}]$.

Assume simply that, based on historic evidence and her own intuition, the young person at time $t = 0$ guesses a probability function that in her view describes the "simultaneous behavior" of the four random variables. That is, the adult child guesses the joint probability density function (pdf). Hereafter, we will use lower-case characters to denote the realizations of these respective four random variables. Thus, let the joint pdf be

$$\xi \equiv \xi_{HE^{ch}_0, \bar{C}^{ch}, OC^{ch}, B^{ch}}(he^{ch}_0, \bar{c}^{ch}, oc^{ch}, b^{ch}). \quad (6)$$

[2] Note that we assume that wealth (net of one's healthcare needs) that is not left as a bequest is used for the elderly agent's own consumption. In actual practice, bequests are a function of assets that are left over at death, net of, for example, charitable contributions. One could endogenize charitable contributions and other possible outside options, but doing so would complicate the closed-form derivations. It would be worthwhile to pursue such an extension in future work. We thank an anonymous referee for bringing this issue to our attention.

Next, let us assume that the young adult child at time $t = 0$ inelastically supplies $0 < \varepsilon < 1$ units of time to the labor market, and let her total after-tax income be y_0^{ch}. Hence, the lifetime utility of the child at time $t = 0$ (EU^{ch}) depends on current consumption and leisure ($1 - \varepsilon - C^{ch}$), and an expectation term relating to future consumption and health and emotional well-being. (Note that leisure at old age is unity as $\varepsilon = 0$ when old and as we assume that family care is provided only when one is young, meaning that we do not need to include the old-age leisure term in the utility function). Assuming no discounting and a zero interest rate, expected utility is given by

$$\begin{aligned} EU^{ch} &= Z(y_0^{ch} + B^p - s_0^{ch}, 1 - \varepsilon - C^{ch}) \\ &\quad + \int_{\underline{b}}^{\bar{b}} \int_{\underline{c_2}}^{\bar{c}_2} \int_{\underline{c_1}}^{\bar{c}_1} \int_{\underline{he}}^{\overline{he}} \Omega dhe_0^{ch} d\bar{c}^{ch} doc^{ch} db^{ch}, \end{aligned} \tag{7}$$

where the argument $y_0^{ch} + B^p - s_0^{ch}$ of function Z denotes the young adult's consumption, while the argument $1 - \varepsilon - C^{ch}$ denotes the young adult's leisure. Function Z is increasing in both arguments. Further, let

$$\Omega \equiv \xi V(s_0^{ch} - \varphi RC(he_0^{ch}) - oc^{ch} - b^{ch}, he_1^{ch}). \tag{8}$$

As before, function V on the right-hand-side of (8) denotes utility at old age (which is a random variable at time $t = 0$), where we conventionally use lower-case characters as this term appears in the integrand of (7). Clearly, utility is increasing in both arguments, consumption and health status. Note from (8) that we have multiplied the bracketed term by the joint pdf, ξ.

Note that TC^{ch} is a random variable that denotes the total amount of care that is available to the child in the next period. Clearly, $TC^{ch} = \theta_1 \bar{C}^{ch} + \theta_2 C^{ch,out}$, where $C^{ch,out} = RC(HE_0^{ch}) + OC^{ch}$. Using lower-case characters to denote the realizations of the random variables, and recalling (2)-(4), we can now set he_1^{ch} (the realization of the agent's health and emotional well-being status at the very start of period $t = 1$) in (8) to

$$\begin{aligned} he_1^{ch} &= (1 - d)he_0^{ch} + \lambda(\beta; tc^{ch}) \\ &= (1 - d)he_0^{ch} + \lambda(\beta; \theta_1 \bar{c}^{ch} + \theta_2 c^{ch,out}) \\ &= (1 - d)he_0^{ch} \\ &\quad + \lambda\big(\beta; \theta_1 \bar{c}^{ch} + \theta_2 (RC(he_0^{ch}) + oc^{ch})\big). \end{aligned} \tag{9}$$

The child needs to maximize (7) by choosing s_0^{ch} and C^{ch}. The sequence of events at time $t = 0$ is as follows. First, nature reveals the form of the bequest rule function (1) that then becomes common knowledge. Second, the parent chooses the amount of optional outside care and the bequest rule parameter (α). Finally, after observing the parent's behavior, the child chooses the optimal saving level and the amount of care to provide to the parent. We solve the model backwards, starting from the third and second stages. Thus, for a given value of α, the child uses

the bequest rule in (7) to obtain the optimal care function, C^{ch} (along with s_0^{ch}). Next, the parent observes C^{ch}, and maximizes (5) with respect to OC^p and α.

Clearly, once the optimal α is determined, the actual realized value of C^{ch} (and also the child's optimal saving amount, s_0^{ch}) will be determined. Thus, we can determine the optimal amount of total care that the parent will receive, TC^p,[3] and the actual amount of the bequest that the parent will end up leaving (B^p).

Remark 1. We next proceed to solving the model, and for that purpose, we need to specify functional forms. Unfortunately, due to the presence of random variables and integrals, realistic functional forms do not lead to closed-form solutions, and even somewhat simpler ones lead to extremely cumbersome solutions.

Hence, we proceed by assuming simple functional forms. First, analogous to well-known two-variable joint uniform pdf's commonly used in probability theory and mathematical statistics, we use the following joint pdf for general 4-space:

$$\xi = \frac{1}{(\overline{he} - \underline{he})(\bar{c}_1 - \underline{c}_1)(\bar{c}_2 - \underline{c}_2)(\bar{b} - \underline{b})}. \tag{10}$$

Furthermore, we can safely set $\underline{c}_1 = \underline{c}_2 = \underline{b} = 0$. Next, note that it is not uncommon in the economics literature to consider a utility function that is linear in one argument and concave in another (e.g., Acemoglu and Robinson 2000; Carlstrom and Fuerst 2001; Cremer et al. 2004; Chang 2009), and we do likewise. Specifically, we assume that utility functions are quadratic in consumption, yet linear in leisure and health status. Certainly, we will need to ensure that the optimal consumption level does not exceed a bliss point because otherwise marginal utility will be negative. Thus, let

$$\begin{aligned} U^p = {} & \mu_1\left(s_{-1}^p - \varphi RC(HE_{-1}^p) - OC^p - B^p\right) \\ & - \frac{\mu_1}{2}\left(s_{-1}^p - \varphi RC(HE_{-1}^p) - OC^p - B^p\right)^2 + \rho_1 HE_0^p, \end{aligned} \tag{11}$$

$$Z = \mu_2\left(y_0^{ch} + B^p - s_0^{ch}\right) - \frac{\mu_2}{2}\left(y_0^{ch} + B^p - s_0^{ch}\right)^2 + \gamma(1 - \varepsilon - C^{ch}), \tag{12}$$

[3] We are explicitly assuming that agents uphold verbal commitments and honor intergenerational contracts due to social norms, their desire to maintain their reputation, or other enforcement mechanisms. This is a common assumption in this line of literature (see, e.g., Bernheim et al. 1985; Raut and Tran 2005; and Barczyk and Kredler 2018). Yet strictly speaking, it is optimal for parents to break their promise with their children and to just choose their maximum possible consumption without leaving any bequest to their children. Foreseeing this outcome, it is rational for the child not to provide any care to the parent. The purpose of using perfect Bayesian equilibrium or subgame perfect Nash equilibrium in game theory is exactly to resolve the issue of sequential irrationality that happens at Nash equilibria. We thank Ching-Jen Sun for this comment.

$$\mathrm{V} = \mu_3\left(s_0^{ch} - \varphi RC(he_0^{ch}) - oc^{ch} - b^{ch}\right) - \frac{\mu_3}{2}(s_0^{ch} - \varphi RC(he_0^{ch}) - oc^{ch} - b^{ch})^2 + \rho_2 he_1^{ch}. \quad (13)$$

For simplicity, we set $B_{min} = 0$ and assume that

$$B^p = \alpha C^{ch}, \quad (14)$$

$$\lambda = \beta TC^p, \quad (15)$$

$$RC(HE_{-1}^p) = 1 - q_1 HE_{-1}^p, \quad (16)$$

$$RC(he_0^{ch}) = 1 - q_2 he_0^{ch}. \quad (17)$$

To reduce notational clutter, we set $\rho_1 = \rho_2 = \rho$, $q_1 = q_2 = q$, and $\mu_1 = \mu_2 = \mu_3 = \mu$, while $\gamma > 0$. By using asterisks to denote optimal solutions, we find that the bequest left by the selfish elderly parent is

$$B^{p*} = \frac{-4\theta_2\gamma + \theta_1\mu(4 + \bar{b} + \bar{c}_2 - 2y_0^{ch} + 2\varphi - \underline{he}q\varphi - \overline{he}q\varphi)}{4\theta_1\mu}, \quad (18)$$

while the amount of optional care chosen by the selfish parent is

$$OC^{p*} = \frac{4\theta_2\gamma + \theta_1(4\beta\theta_2\rho - \mu(8 + \bar{b} + \bar{c}_2 - 4s_{-1}^p - 2y_0^{ch} + 6\varphi - \underline{he}q\varphi - \overline{he}q\varphi - 4q\varphi HE_{-1}^p))}{4\theta_1\mu}. \quad (19)$$

The optimal care provided to the parent by her selfish child is given by

$$C^{ch*} = \frac{16\theta_2^2\gamma^2 - \theta_1^2\mu^2(4 + \bar{b} + \bar{c}_2 - 2y_0^{ch} + 2\varphi - \underline{he}q\varphi - \overline{he}q\varphi)^2}{-32\theta_1^2\gamma\mu}, \quad (20)$$

while the optimal saving amount of the adult selfish child is

$$s_0^{ch*} = \frac{-4\theta_2\gamma + \theta_1\mu(4 + 3\bar{b} + 3\bar{c}_2 + 2y_0^{ch} + 6\varphi - 3\underline{he}q\varphi - 3\overline{he}q\varphi)}{8\theta_1\mu}. \quad (21)$$

Note that to obtain B^{p*} in (18), we first need to solve for the optimal value of α (see expression 14). We obtain

$$\alpha^* = \frac{8\gamma\theta_1}{4\theta_2\gamma + \theta_1\mu(4 + \bar{b} + \bar{c}_2 - 2y_0^{ch} + 2\varphi - \underline{he}q\varphi - \overline{he}q\varphi)}. \qquad (22)$$

It is straightforward to show that both α^* and the optimal amount of care from the child, C^{ch*}, are strictly increasing in θ_1, and when $\theta_1 = 0$, α^* is zero, too. That is, when parents do not consider their children's care as being valuable for their health and well-being ($\theta_1 = 0$ means that a parent's health and emotional well-being is unaffected by her child's input), there will be no parental bequest, and as a result, no child will take care of her parent. In that case, an LTCI program will have no impact on the amount of bequests or on the amount of informal care.

We next consider the effect of the introduction of a LTCI program, i.e., we contrast the case of $0 < \varphi < 1$ (i.e., an LTCI system exists) and the case of $\varphi = 1$ (i.e., an LTCI system does not exist).[4]

Remark 2. If the amount of required care is non-negative in value and positive (however small) for at least half of the possible realizations of the health and emotional well-being outcomes, the introduction of a LTCI system will increase the amount of care provided by the child and the amount of the bequest left by the parent in families with selfish children and selfish parents. By contrast, the abolition of a LTCI system will reduce the optional amount of outside care purchased by the parent. Interestingly, the magnitudes of these effects will be larger for cohorts that are relatively less healthy.

To see this, first note that

$$B^{p*}|_{\varphi=1} = \frac{-4\theta_2\gamma + \theta_1\mu(6 + \bar{b} + \bar{c}_2 - 2y_0^{ch} - \underline{he}q - \overline{he}q)}{4\theta_1\mu}, \qquad (23)$$

$$C^{ch*}|_{\varphi=1} = \frac{16\theta_2^2\gamma^2 - \theta_1^2\mu^2(6 + \bar{b} + \bar{c}_2 - 2y_0^{ch} - \underline{he}q - \overline{he}q)^2}{-32\theta_1^2\gamma\mu}, \qquad (24)$$

$$OC^{p*}|_{\varphi=1} = \frac{4\theta_2\gamma + \theta_1(4\beta\theta_2\rho - \mu(14 + \bar{b} + \bar{c}_2 - 4s_{-1}^p - 2y_0^{ch} - \underline{he}q - \overline{he}q - 4qHE_{-1}^p))}{4\theta_1\mu}. \qquad (25)$$

The bequest level given by (23) will be strictly greater than that given by (18) as long as $2 - q\left(\underline{he} + \overline{he}\right) > 0$ (or, equivalently, $1 - q\frac{(\underline{he}+\overline{he})}{2} > 0$), while if $RC(HE_{-1}^p) \geq 0$, under the same condition, the optional care level given by (25) will be strictly less than that given by (19). The

[4] Even though hereafter we consider the two extreme cases (an LTCI system exists or does not exist), our results hold for any increase in the co-payment rate φ, which would indicate a less generous LTCI system.

condition $1 - q\frac{(\underline{he}+\overline{he})}{2} > 0$ means that the amount of required care is positive (however small) at least for those people who have experienced health and emotional well-being levels that are less than or equal to the midpoint value of possible health and well-being outcomes (recall that from the perspective of any young adult, future health status is a random variable). In other words, selfish decision-making agents need to be convinced that requiring some care in the future is a "sufficiently viable" possibility. Similarly, based on (24), it can be shown that the amount of care provided to the parent by her selfish child in the absence of a LTCI will be strictly greater than the care level given by (20) so long as the optimal bequest $B^{p*} > 0$ and optimal care time provided by the child is positive (or, more precisely, $0 < C^{ch*} < 1$), while $1 - q\frac{(\underline{he}+\overline{he})}{2} > 0$ still holds. Intuitively, abolishing the LTCI system will increase the potential care expenses of young people when they become old because they will have to bear the full cost of the required care (unless they are reasonably confident that they will not require any care, in which case the LTCI program is irrelevant to them). Provided that parents (however selfish) recognize that their children's care can positively impact their own well-being—i.e., children's care is worthy of a reward—young people will be incentivized to provide more care to their parents in order to "earn" a larger bequest. Consequently, the amount of optional outside care purchased by their elderly parents will decrease. Thus, eliminating LTCI benefits will induce parents to seek more family care from their children, which has become less expensive relative to outside care. This happens because forward-looking children are more willing to provide such care to their parents as the LTCI program becomes less generous, i.e., as the price of children's care relative to the price of outside care (the optimal value of the α parameter in (14)) decreases. Indeed, recall the optimal price of children's care from (22), and note that

$$\alpha^*|_{\varphi=1} = \frac{8\gamma\theta_1}{4\theta_2\gamma + \theta_1\mu(6 + \bar{b} + \bar{c}_2 - 2y_0^{ch} - \underline{he}q - \overline{he}q)}. \qquad (26)$$

Again, the right-hand side of (26) is strictly less than that of (22) as long as $1 - q\frac{(\underline{he}+\overline{he})}{2} > 0$. That is, because children are more willing to "earn" a bequest when public LTCI is abolished, the price of their care decreases, encouraging their parents to substitute care from their children for outside optional care. The fact that a greater amount of care from children reduces their leisure time and therefore their utility is of no concern to selfish parents. Their interaction with their children is merely a business transaction and nothing more.

If, in addition, we conduct comparative statics to find out how the magnitude of the above choice variables change with the co-payment rate (see earlier remark in footnote 4), it would follow that the magnitude of our comparative statics are larger for a less healthy society. For such a society, the lower $(\underline{he} + \overline{he})/2$ value (the midpoint of the possible health outcome values) will make the term $q(\underline{he} + \overline{he})$ smaller, *ceteris paribus*. Intuitively, for a given distribution of health outcomes, a lower midpoint value of the support of the random variable means that society is relatively less healthy. Thus, young decision-making agents would expect to require more care in the future (thus expecting to pay an even larger amount when the co-payment rate increases), and this possibility magnifies the comparative statics effects.

Case 2: Altruistic parent and selfish child

We assume that an altruistic parent cares about her child through two channels. First, even though the care from her child enhances the parent's health and emotional well-being on the one hand, the parent does derive disutility from the fact that the child cannot consume as much leisure if she provides more care time to the parent. Thus, the parent derives utility from the child's leisure consumption. Second, the parent cares about the child's consumption and recognizes that a bequest left to her child might increase the child's lifetime consumption by some magnitude.

Regarding the second channel, it is possible that the parent assumes that a dollar of bequest given to the child will increase the child's lifetime consumption by exactly one dollar. Yet since the parent and the child essentially live separate lives and will overlap only during the old age stage of the parent's life, it is plausible that the parent will worry about possible uncertainty and assume that one unit of bequest left would increase the child's lifetime consumption by X units, where $\underline{x} \leq X \leq \bar{x}$ is a random variable with a known pdf $f_X(x)$, and $\underline{x} \geq 0$. Let us define

$$\Lambda \equiv \int_{\underline{x}}^{\bar{x}} x f_X(x)\, dx. \tag{27}$$

Drawing an analogy to expression (11), we can state the expected utility of the parent at time $t = 0$ as

$$\begin{aligned} EU^p = {} & \mu_1\left(s_{-1}^p - \varphi RC(HE_{-1}^p) - OC^p - B^p\right) \\ & - \frac{\mu_1}{2}\left(s_{-1}^p - \varphi RC\left(HE_{-1}^p\right) - OC^p - B^p\right)^2 + \rho_1 HE_0^p \\ & + \gamma^p(1 - \varepsilon - C^{ch}) + \sigma B^p \Lambda - \frac{\sigma}{2}(B^p\Lambda)^2, \end{aligned} \tag{28}$$

where $\gamma^p > 0$ is the weight the parent places on the child's leisure consumption and $\sigma > 0$ is the weight the parent places on the child's expected consumption ($B^p\Lambda$). To be consistent with the agent's preferences over her own consumption, we assume that the parent's preferences over the child's consumption possibilities are quadratic (hence, we have two quadratic terms on the right-hand-side of (28)). As for the random variable X, note that the integral on the right-hand side of (27) sums up to some constant value (possibly a positive fraction or unity). Thus, from the parent's viewpoint, one unit of bequest will, on average, increase the lifetime consumption of the child by that constant amount.

The child is as selfish as in Case 1, so her lifetime utility function has the same form as expression (7). The stages of the game are similar to Case 1, and we solve the model starting from the last stage. The optimal solutions for the parent's problem are given as follows:

$$B^{p*} = \frac{-\beta\theta_2\rho + \sigma\Lambda}{\sigma\Lambda^2}, \tag{29}$$

$$OC^{p*} = s_{-1}^p - 1 + \frac{\beta\theta_2\rho}{\mu} - \varphi + HE_{-1}^p q\varphi + \frac{\beta\theta_2\rho}{\sigma\Lambda^2} - \frac{1}{\Lambda}. \tag{30}$$

The optimal solutions for the child's problem are given as follows:

$$C^{ch*} = 0, \tag{31}$$

$$s_0^{ch*} = \frac{-2\beta\theta_2\rho + 2\sigma\Lambda + \sigma(\bar{b} + \bar{c}_2 + 2y_0^{ch} + 2\varphi - \underline{\underline{he}}q\varphi - \overline{\overline{he}}q\varphi)\Lambda^2}{4\sigma\Lambda^2}. \tag{32}$$

These results can be summarized by the following remark:

Remark 3. In the case of an altruistic parent and a selfish child, the parent, being altruistic, will generally leave a positive bequest to her child, which is independent of the presence of the public LTCI system, regardless of whether or not her child provides any care, but her child, being selfish, will not provide any care because she knows that she will be able to receive the same bequest regardless of whether or not she provides care.

In addition, note that

$$OC^{p*}|_{\varphi=1} = s_{-1}^{p} - 2 + \frac{\beta\theta_2\rho}{\mu} + HE_{-1}^{p}q + \frac{\beta\theta_2\rho}{\sigma\Lambda^2} - \frac{1}{\Lambda}. \tag{33}$$

Unless the parent does not require any care, the optional care level given by (33) is strictly less than the one given by (30). Intuitively, abolishing the public LTCI system will reduce the wealth of the altruistic parent, who is committed to a fixed bequest amount, and the parent will have to reduce her expenditure on outside optional care. We thus state the following remark:

Remark 4. If the amount of care required is positive in value (however small), abolishing the public LTCI system for families with selfish children and altruistic parents will reduce the optional amount of outside care purchased by the parent.

Case 3: Altruistic parent and altruistic child

This case is similar to Case 2 except that now we assume that the child is altruistic towards her parent. Namely, the child derives utility from the health and emotional well-being of her parent. The parent's utility is the same as in expression (28). The child's utility is given by

$$EU^{ch} = Z\left(y_0^{ch} + B^p - s_0^{ch}, 1 - \varepsilon - C^{ch}\right)$$

$$+ \int_{\underline{b}}^{\bar{b}} \int_{\underline{c_2}}^{\bar{c}_2} \int_{\underline{c_1}}^{\bar{c}_1} \int_{\underline{he}}^{\overline{he}} \Omega dhe_0^{ch} d\bar{c}^{ch} doc^{ch} db^{ch} + \pi HE_0^p \qquad (34)$$

$$- \frac{\pi}{2}(HE_0^p)^2,$$

where we assume that preferences over the parent's health and emotional well-being are quadratic (as they are over consumption) and that $\pi > 0$. The sequence of interactions and the solution structure resemble those in Case 2. Recalling expressions (2), (3) and (4), we need to bear in mind that the HE_0^p term in (34) depends on the amount of outside optional care purchased by the parent, i.e., OC^p. We thus state the following remark:

Remark 5. The optimal amounts of the bequest and of outside optional care are identical to those given in expressions (29) and (30), respectively. The optimal amount of saving for old age chosen by the child is identical to the one given in expression (32). The optimal amount of care provided by the child is given by

$$C^{ch*} = \frac{\pi\beta\theta_1\left(1 - HE_{-1}^p(1-d)\right) - \gamma - \pi\beta^2\theta_1\theta_2(OC^{p*} + RC(HE_{-1}^p))}{\pi\beta^2\theta_1^2}, \qquad (35)$$

where OC^{p*} in (35) is identical to expression (30). Note that the LTCI co-payment parameter, φ, enters (35) via OC^{p*}. Using (30), we evaluate OC^{p*} at $\varphi = 1$, substitute it into (35) and obtain $C^{ch*}|_{\varphi=1}$. After some algebra, we deduce that so long as $RC\left(HE_{-1}^p\right) > 0$, the following inequality holds:

$$C^{ch*}|_{\varphi=1} > C^{ch*}. \qquad (36)$$

Based on (36), and the results that are identical to those in Case 2, we summarize our findings in the following remark:

Remark 6. If the amount of care required is positive in value (however small), abolishing the LTCI system for families with altruistic children and altruistic parents will reduce the amount of optional outside care purchased by the parent (recall (33)), and will increase the amount of care provided by the child (recall (36)). Parents will leave some bequest, which is independent of the public LTCI system, as can be seen from (29).

Thus, the key difference between Cases 2 and 3 is that, in Case 3, the child, being altruistic, will provide care to her parents even if the parent is altruistic, instead of no care as in Case 2. In addition, in both Cases 1 and 3, parents do leave a positive bequest, and a less generous public LTCI system tends to reduce the amount of optional outside care purchased by the parent. Thus, there is an obvious similarity between Cases 1 and 3. And in fact, many studies admit that even if their results show that the children are proving care to their parents and that their parents are

leaving bequests to their children, this result is consistent with both the selfish strategic bequest motive and the reciprocal altruism model and that the two cases cannot be distinguished from one another. Yet our results show one important difference, which can help distinguish the two scenarios. We thus state the following remark:

Remark 7. Even though parents leave a bequest to their children in both Case 3 (reciprocal altruism) and in Case 1 (the selfish parent-selfish child case), the abolition of the public LTCI system will not affect the amount of the bequest in Case 3 but will increase the amount of bequest in Case 1. In Case 1, the parent, being selfish, will leave a larger bequest to her child when LTCI benefits are reduced or disappear as this would increase the relative price of formal care and induce parents to substitute care from her child for outside care and because the parent will not care even if the greater care provided by her child reduces her child's leisure enjoyment. By contrast, in Case 3, when LTCI benefits are reduced or disappear, this will not cause any change in the amount of the bequest the parent leaves to her child while her child, being altruistic, will provide more care to the parent to compensate her for the drop in the amount of outside care that is caused by the reduction of LTCI benefits. Conversely, the introduction of a public LTCI system will generally decrease the amount of care that children provide to their parents in both Cases 1 and 3, whereas it will generally decrease the amount of the bequest that parents leave to their children in Case 1 but keep the amount of the bequest unchanged in Case 3.

Case 4: Selfish parent and altruistic child

In this case, we assume that the parent is selfish and that the child is altruistic. The child, being altruistic, does not consider the possibility of obtaining an extra reward from the parent by raising the amount of care she provides to her parent. The parent's utility is the same as in (11), and the child's utility is the same as in (34) for a given B^p. We derive the optimal solution to this problem, and summarize the main results in the following remark:

Remark 8. The selfish parent in Case 4 will not leave any bequest. The optimal amount of care provided by the child is the same as in (35). Moreover, the relationship between the care level and the existence of LTCI system follows condition (36).

Thus, the parent will not leave a bequest under any circumstances. She will not leave a bequest out of altruism because she is selfish, and moreover, she will not leave a bequest to induce her child to provide care because she knows that her child, being altruistic, will provide care whether or not the parent leaves a bequest. By contrast, the child, being altruistic, will provide care to her parent regardless of whether or not the parent leaves a bequest. Moreover, the introduction of a LTCI system will not affect parent's bequest behavior because the parent will not leave a bequest whether or not there is an LTCI system, but it will influence the child's care behavior because the change in relative prices brought about by the introduction of the LTCI system will induce the substitution of formal care for informal care.

Summary of the four cases

The predictions of the four cases of the theoretical model are summarized in Table 2, and as can be seen from this table, all four cases make different predictions about whether parents will leave bequests to their children, about whether children provide care to their parents, and about whether the provisions of the LTCI system will affect the bequest behavior of parents and the caregiving behavior of children. Thus, we can infer which case applies in the real world by looking at the

actual behavior of parents and children, and it is to this exercise that we turn in the remainder of this paper.

Table 2 here

5. Data Source and Sample Selection Criteria

The data source we use for our empirical analysis is the 2011 wave of the Japan Household Panel Survey of Consumer Preferences and Satisfaction (JHPS-CPS), formerly called the Preference Parameters Study (*Kurashi no Konomi to Manzokudo ni tsuite no Chousa*), a panel survey that is being conducted by Osaka University in Japan and three other countries (China, India, and the United States). Funding for the survey was provided by the 21st Century Center of Excellence (COE) Program "Behavioral Macrodynamics Based on Surveys and Experiments," the Global COE Project "Human Behavior and Socioeconomic Dynamics" of Osaka University, and the Japan Society for the Promotion of Science (JSPS) KAKENHI Projects "Behavioral-Economic Analysis of Long-Run Stagnation" (15H05728) and "Economic Stagnation and Widening Wealth Inequality: Crises of the World Economy and a Construction of a Unified Macroeconomic Theory."

The survey has been conducted since 2003, but we chose to use data from the 2011 wave of the Japanese survey because the questions about bequest motives and parental care are not asked in every year and 2011 was the most recent year in which all of necessary questions were asked. The survey collects data on a nationwide random sample of both sexes aged 20 to 69, and the 2011 wave had 4934 respondents.

The micro data from this survey are perfectly suited for our purposes because they contain detailed information on bequest expectations, informal care children provide to their parents and parents-in-law, eligibility for public LTCI benefits, and other socioeconomic variables relating to the respondent, his or her spouse, his or her parents, and his or her parents-in-law. The complete survey instrument (questionnaire form) for the survey that we used for our analysis can be found at the following website: https://www.iser.osaka-u.ac.jp/survey_data/doc/japan/questionnaire/english/2011QuestionnaireJAPAN.pdf

Since the data source we used is a panel survey, it would have been preferable to do a panel analysis with fixed effects to control for individual heterogeneity, but unfortunately, we were not able to do so because, as already explained, some of the questions such as the ones pertaining to bequest expectations, informal care, and eligibility for public LTCI benefits were not asked in every wave. Fortunately, however, the survey we used collects information on a multitude of individual and household attributes, so we were able to control for such heterogeneity by including a large number of individual- and household-related control variables.

The sample selection criteria we used are as follows:

We kept only observations for which exactly one of the respondent's parents is still alive (in other words, we dropped all observations for which both of the respondents' parents are still alive or for which both of the respondents' parents are deceased because there is the possibility of one parent taking care of the other parent in the case of respondents with two living parents and because there is no need for parental care if both parents are deceased. This reduced the sample size to 1667.

We also dropped all observations for which there were missing values for at least one of the variables used in the estimations, which further reduced the sample size to 571, and this is the sample that we used for our estimation.

We also considered dropping those with siblings from the estimation sample because our theoretical model assumes that the child has no siblings and because the presence of siblings complicates the analysis, as pointed out by Stern (1995) and Chechovich and Stern (2006), but we were not able to do so because there were only 29 respondents who had no siblings.

6. Estimation Model

The first two objectives of our empirical analysis are (1) to test our theoretical model of the nexus between LTCI, formal care, informal care, and bequests for the case of Japan and (2) to determine which of the four cases applies in the case of Japan. Two additional objectives of our empirical analysis are (1) to examine what impact Japan's LTCI system has had on the amount of informal care provided by children to their parents and (2) to examine what impact Japan's LTCI system has had on bequests from parents to children via its impact on the amount of informal care provided by children to their parents.

Thus, we estimate two equations—one that analyzes the determinants of whether children provide informal care to their parents (more specifically, of whether or not they are their parent's primary caregiver) and another that analyzes the determinants of whether children expect to receive bequests from their parents.

Our analysis is important and interesting because it can shed light on whether or not parents are selfish or altruistic. If parents are selfish, we would expect respondents who are their parent's primary caregiver to have a higher probability of receiving a bequest from his/her parent, whereas if parents are altruistic, we would expect respondents who are their parent's primary caregiver to be no more or less likely to receive a bequest from their parent, as our theoretical analysis showed.

The problem is that we cannot estimate the two equations independently because children's decisions concerning whether or not to provide informal care to their parents are likely to be endogenous. For example, children may provide care to their parents in the belief that their probability of receiving a bequest from their parents will be enhanced by providing care to them. In other words, the direction of causality might be reversed. In order to control for this endogeneity, we will estimate a bivariate probit model in which we use the respondent's parent's eligibility for public LTCI benefits as an instrument for whether or not the respondent provides informal care to his or her parent.

In order for this variable to be a good instrument for providing informal care, it must meet the two conditions for a good instrument. First, it must be correlated with whether or not the respondent provides care to his or her parent. We will shortly test econometrically if this condition is met, but intuitively, if the respondent's own parent is eligible for public LTCI benefits, the parent is likely to rely more on formal care and less on his or her child (the respondent) because eligibility for public LTCI reduces the price of formal care relative to the price of informal care.

The second condition for a good instrument is that it must not have a direct impact on bequest expectations and that its only impact on bequest expectations is through whether or not the respondent provides care to his or her parent. It is quite possible that the parent's eligibility for

public LTCI benefits will affect the amount of the bequest that the parent can afford to leave to his or her child because a person who becomes disabled will incur considerable medical and long-term care expenses and that the parent's financial burden may well increase even if he or she is eligible for public LTCI benefits. However, the bequest expectations variable that we use in our analysis is not the amount of the bequest that the respondent expects to receive from his or her parent but whether or not he or she expects to receive a bequest of any amount from his or her parent. It is plausible that this variable will not be affected by the parent's eligibility for public LTCI benefits and that it will depend more on the parent's degree of altruism towards his or her child and on the parent's preference for being taken care of by his or her own child.

Accordingly, we will estimate a bivariate probit model, in which one dependent variable is a dummy variable for whether or not the respondent or the respondent's spouse is the parent's primary caregiver and the other dependent variable is a dummy variable for whether or not the respondent expects to receive a bequest from his or her parent. In the caregiving equation, we will use the parent's eligibility for public LTCI benefits as an instrument for whether or not the respondent is the parent's primary caregiver.

Thus, the estimation model is as follows:

(First stage)

Prob(Primary caregiver) = a0 + a1*(Eligibility for public LTCI benefits) + a2*X + u, where X = a vector of control variables

(Second stage)

Prob(Bequest) =b0 + b1*Prob(Primary caregiver) + b2*X + v

Note that the dependent variable in the second stage is whether or not the respondent expects to receive a bequest (or inter vivos transfer) from his or her parent, not whether or not the respondent will actually receive a bequest, and furthermore, bequest expectations will not necessarily be accurate. However, we unfortunately do not have information on whether or not the respondent will actually receive a bequest. Moreover, we believe that it is actually preferable to use bequest expectations because it is bequest expectations (whether or not they are accurate), not actual bequests received, that influence the caregiving and other behavior of children.

As discussed in section 3, there are 7 need levels in Japan's public LTCI system, but the survey that we used for our empirical analysis groups the 7 need levels into three groups (support levels 1-2, care levels 1-2, care levels 3-5), where support levels 1-2 are the lowest need levels and care levels 3-5 are the highest need levels. We therefore initially planned to use two instruments--a dummy variable that equals one if the respondent's parent's need level for public LTCI purposes is one of the four lowest levels (support level 1 or 2 or care level 1-2) and a dummy variable that equals one if the respondent's parent's need level for public LTCI purposes is one of the three highest levels (care levels 3-5). However, the first of these was totally insignificant as a determinant of the probability of the respondent being his or her parent's primary caregiver, indicating its weakness as an instrument. Thus, in the end, we used only the second dummy variable (eligibility for the three highest need levels) as an instrument for whether or not the respondent is the parent's primary caregiver.

One other candidate we considered as a possible instrument for whether or not the respondent is the parent's primary caregiver was the parent-in-law's eligibility for public LTCI benefits. If the respondent's parents-in-law are eligible for public LTCI benefits, they would be expected to rely more on formal care and less on the respondent (or the respondent's spouse), leaving the respondent (or the respondent's spouse) with more time to provide informal care to his or her own parent. Moreover, there is no reason to expect that the respondent's parents-in-law's eligibility for public LTCI benefits would influence the bequest behavior of the respondent's own parent. Thus, this variable appears to meet the two conditions for a good instrument, but we found that it was totally insignificant as a determinant of the probability of the respondent being the primary caregiver of the his or her parent. Because of its weakness as an instrument, we ultimately decided not to use this variable as an instrument for whether or not the respondent is his or her parent's primary caregiver.

We also included the following control variables in both our caregiving and bequest expectation equations, learning from previous studies such as Menchik (1988), Sloan et al. (1997), Norton and Taylor (2005), Brown (2006), Norton and van Houtven (2006), and Groneck (2017): the respondent's age, a dummy variable for whether or not the respondent is a college graduate, dummy variables for whether or not the respondent and the respondent's parent are female, a dummy variable for whether or not the respondent is the eldest son, a dummy variable for the number of living siblings the respondent has, a dummy variable for whether or not the respondent is an only child, a dummy variable for whether or not the respondent is married, and a dummy variable for whether or not the respondent has any cohabiting children. Our rationale for including a dummy variable for the respondent being the eldest son is that the social norm in Japan has been for the eldest son to live with, and provide care to, his parents and to receive the parent's entire bequest.

7. Descriptive Statistics

Table 3 shows descriptive statistics for all variables included in the regression analysis, and as can be seen from this table, more than half (59.6%) of respondents expect to receive a bequest from their parents,[5] while 38.7% of respondents or their spouses are their parent's primary caregiver. Thus, it appears that, in Japan, it is quite common for parents to leave bequests to their children and that it is also quite common for respondents (or their spouses) to provide care to their parents.

Table 3 here

Turning to correlations among the explanatory variables, the correlation matrix of the explanatory variables is not shown due to space limitations, but an examination of this matrix shows that all correlations are relatively low (in absolute value). Thus, there does not appear to be any need to worry about multicollinearity among the explanatory variables.

[5] The 59.6% figure may seem low since there are presumably very few people who die penniless and since Japan's postwar civil code states that the parents' bequest will be divided equally among their children unless they leave a will specifying otherwise. However, Japan's prewar civil code stated that the eldest son would receive the parents' entire bequest, and the social norm of the eldest son receiving all or most of the parents' bequest prevails even today to some extent. This social norm can be implemented by the parents leaving a will that specifies that the eldest son will receive more and/or by the other children "voluntarily" relinquishing their right to receive a bequest but note that Japan's civil code also specifies that no child can be totally written out of the will. Another possibility is that bequest expectations are pessimistic and that there are at least some people who do not expect to receive a bequest but end up receiving one unexpectedly.

Table 3 also shows descriptive statistics for those who are primary caregivers and those who are not primary caregivers, and as this table shows, the proportion of respondents who expect to receive a bequest from their parents is much higher for those who are their parent's primary caregiver than it is for those who are not their parent's primary caregiver (61.5% vs. 43.7%). This result is consistent with the case of selfish parents and selfish children or the case of altruistic parents and altruistic children in the theoretical model we developed in section 4. However, we need to do a more formal econometric analysis to ascertain whether these results hold up even after we control for other factors and for the endogeneity of the primary caregiver variable.

As for other differences between caregivers and non-caregivers, college graduates, eldest sons, and only children are more likely to be caregivers, while those whose parents are eligible for public LTCI benefits, who have a larger number of siblings, and are married are less likely to be caregivers. However, we will not know if these differences hold up even after controlling for other factors until we examine the results of our econometric analysis in the next section.

Table 4 shows the impact of LTCI eligibility on caregiving, and as can be seen from this table, the proportion of respondents who are their parent's primary caregiver is much higher in the case of those whose parent is not eligible for LTCI benefits than it is for those whose parent is eligible for LTCI benefits (43.4% vs. 30.6%). Moreover, the proportion of respondents who are the primary caregiver of their surviving parent decreases with their parent's need level, which determines how much subsidized formal care the parent is eligible for. This proportion is 42.5% in the case of those whose parent is eligible for support levels 1-2 (the lowest level), but 25.4% and 23.3%, respectively, in the case of those whose parent is eligible for care levels 1-2 and care levels 3-5. All of these results strongly suggest that there is an inverse relationship between LTCI eligibility and caregiving, with those whose parent is not eligible for LTCI being much more likely to be their parent's primary caregiver and with their likelihood of being their parent's primary caregiver decreasing as their parent's need level increases. These results are consistent with the theoretical model we developed in section 4.

Table 4 here

8. Estimation Results

The estimation results (average marginal effects) are shown in Table 5, and looking first at the determinants of whether or not the respondent is the parent's primary caregiver, eligibility for the three highest levels of public LTCI benefits has a negative and significant impact, as expected. In other words, respondents are less likely to be their parent's primary caregiver if their parents are eligible for the three highest levels of public LTCI benefits. The average marginal effect of the LTCI eligibility variable is -0.203, which implies that being eligible for the three highest levels of public LTCI benefits reduces the respondent's probability of becoming the parent's primary caregiver by a full 20.3 percentage points. The magnitude of this effect is considerable because it implies that the proportion of children serving as their parent's primary caregiver would increase from the current 38.7% to 59.0% if Japan's public LTCI system were to be abolished entirely. This finding establishes that the parent's need level meets one of the two conditions for being a good instrument for whether or not the respondent is the primary caregiver.[6]

[6] It is possible that the probability that the respondent becomes his or her parent's primary caregiver decreases with need level not because the relative price of formal care declines with need level but because parental preferences for formal care increases with need level, but unfortunately, we did not have the data to test this proposition (see Lehnert et al., 2019).

Table 5 here

In addition, being the eldest son also makes it more likely for the respondent to be the parent's primary caregiver, which is also not surprising since the social norm in Japan has been for the eldest son to live with, and take care of, his parents. By contrast, being females also makes it more likely for the respondent to be the parent's primary caregiver, which is consistent with the conventional wisdom that females typically bear a disproportionate share of caregiving responsibilities. A related finding that being married makes it less likely for the respondent to be the parent's primary caregiver is as one might expect since a married respondent may be too busy taking care of his or her own family to take care of his or her parent. These two findings are consistent with the finding of previous studies (e.g., Hanaoka and Norton, 2008, and Niimi, 2016) that, in Japan, the traditional role of daughters-in-law in providing informal care to parents is increasingly being taken over by unmarried children, especially unmarried daughters, in response to significant changes in family structure and social norms. Finally, being an only child makes it more likely for the respondent to be the parent's primary caregiver, which is not surprising because there are fewer potential caregivers in the case of only children. However, this result is inconsistent with Bernheim, et al.'s (1985) strategic bequest motive, which predicts that only children will be less likely provide care to their parents because their parents' threat to disinherit them is not as credible in the case of only children. In any case, most, but not all, of the results, are consistent with the earlier findings from Table 2.

Turning next to the results for the determinants of whether or not the respondent expects to receive a bequest from his or her parent, being the parent's primary caregiver has a positive and significant impact on the probability of receiving a bequest from his or her parent, which implies that parental bequests are motivated by selfish or strategic considerations (i.e., that they are a *quid pro quo* for informal care during old age). The average marginal effect of the primary caregiver variable is 0.444, which implies that being one's parent's primary caregiver increases one's probability of receiving a bequest from one's parent by 44.4 percentage points, which is an enormous amount.

If we consider the estimation results of the two equations collectively, they imply that abolishing Japan's public LTCI program would cause the proportion of people who are their parents' primary caregiver to increase by 20.3 percentage points from 38.7% to 59.0%, which in turn will cause the proportion of people who expect to receive a bequest from their parents to increase by 0.203*44.4=9.0 percentage points from 59.6% to 68.6%.

In addition, being female reduces one's probability of receiving a bequest from one's parent, which is not surprising since the social norm in Japan has been for sons (especially eldest sons) to receive a disproportionate share of parental bequests. Moreover, having more siblings also reduces one's probability of receiving a bequest from one's parent, which is also not surprising since more siblings means more competitors for the parent's bequest. Finally, being a college graduate increases one's probability of receiving a bequest, which is a somewhat puzzling result. It seems to suggest that parents are not altruistic toward their children because we would expect an altruistic parent to be less likely to leave a bequest to a highly educated and presumably affluent child.

It is interesting to note that being the eldest son significantly increases one's probability of being one's parent's primary caregiver but that it does not significantly increase one's probability of receiving a bequest from one's parent. Similarly, being female significantly increases one's probability of being one's parent's primary caregiver but it does not significantly increase one's probability of receiving a bequest from one's parent. This suggests that both eldest sons and

daughters receive an unfair deal, being more likely to be their parent's primary caregiver but not being more likely to receive a bequest from their parents.

These results also suggest that social norms influence people's behavior to some extent even in this day and age. It appears that social norms vary substantially across countries and even within countries and that they change only slowly over time (see, for example, Alesina and Giuliano, 2014).

Looking finally at the estimated value of rho, which indicates the correlation between the residuals of the two equations, it is negative but not significant, which suggests that whether or not the respondent is the primary caregiver may not necessarily be endogenous after all and that a bivariate probit estimation may not have been necessary. We therefore also estimated a single-equation probit model and found that the results are very similar and that being the parent's primary caregiver is still positively and significantly associated with bequest expectations.

Note that our empirical findings are broadly consistent with previous empirical analyses of related topics. For example, our finding that parental eligibility for public LTCI reduces the likelihood of their children becoming the parent's primary caregiver is consistent with the many previous studies of the substitutability between formal care and informal care. Moreover, our finding that being the parent's primary caregiver enhances the child's probability of receiving a bequest is consistent with the many previous studies that find evidence in favor of the strategic bequest motive. It is reassuring that both findings still hold even after controlling for the simultaneity of the caregiving and bequest decisions.

9. Conclusion

The purpose of this paper was to construct a theoretical model of the nexus between LTCI, formal care, informal care, and bequests and to test that model using micro data from Japan, where a public LTCI system was introduced in 2000. In particular, we used data from the Japan Household Panel Survey of Consumer Preferences and Satisfaction (JHPS-CPS) (formerly called the Preference Parameter Study), conducted by Osaka University, to analyze whether or not the introduction of a public LTCI system affected the likelihood of children to provide informal care to their parents and, through this channel, affected the likelihood of children to receive a bequest from their parents.

To summarize the main findings of this paper, we found that, if parents are eligible for public LTCI benefits, their children will be less likely to be their primary caregiver and that this, in turn, will reduce their children's perceived likelihood of receiving a bequest from them. This result implies that bequests are selfishly or strategically motivated (i.e., that parents leave bequests to their children in order to elicit care from them) and that the introduction of a public LTCI system will reduce the likelihood of children providing care to their parents and through this channel reduce their perceived likelihood of receiving a bequest from them.

Turning to the issue of what our findings imply about which model of household behavior applies in Japan, we can rule out Case 2 (the case of an altruistic parent and a selfish child) because it predicts that children will never provide care to their parents whereas we found that a substantial share of Japanese children provide care to their parents, with more than a third serving as their parents' primary caregiver. Similarly, we can rule out Case 4 (the case of a selfish parent and an

altruistic child) because it predicts that parents will never leave a bequest to their children whereas we found that more than half of Japanese children expect to receive a bequest from their parents.

That leaves Case 1 (the case of a selfish parent and a selfish child) and Case 3 (the case of an altruistic parent and an altruistic child). Both cases predict that parents will leave a bequest to their children and that children will provide care to their parents. Since we found that a substantial proportion of Japanese parents leave a bequest to their children and that a substantial proportion of Japanese children provide care to their parents, both cases seem to apply in the case of Japan, suggesting that it is not possible to determine which of the two cases applies in Japan.

However, Cases 1 and 3 yield different predictions regarding the impact of the LTCI system on parents' bequest behavior. Case 1 implies that increasing the generosity of the LTCI system will reduce the amount of the bequest that parents leave to their children, whereas Case 3 implies that increasing the generosity of the LTCI system will have no impact on the amount of the bequest that parents leave to their children. Thus, our finding that a more generous LTCI system will reduce the probability of being one's parent's primary caregiver and thereby reduce the probability of receiving a bequest from one's parent suggests that it is Case 1 (the case of a selfish parent and a selfish child), not Case 3 (the case of an altruistic parent and an altruistic child), that applies in Japan.

Thus, we can conclude from our theoretical analysis and our empirical findings that both Japanese parents and Japanese children are selfish in their interactions with one another. This, in turn, implies that theoreticians should use case 1 (the case of a selfish parent and a selfish child) when they conduct theoretical analyses of Japanese household behavior. This conclusion is consistent with the findings of Noguchi et al. (1989), Komamura (1994), Ohtake and Horioka (1994), Horioka et al. (2000), Horioka (2002, 2014, 2021a, 2021b), Yamada (2006), Wakabayashi and Horioka (2009), Kohara and Ohtake (2011), and Horioka, et al. (2018).

Turning finally to the policy implications of the findings of this paper, which apply not only to Japan but to all countries, our findings imply that public LTCI systems will have important impacts on individuals' formal care, informal care, and bequest behavior and that these impacts should be taken into account when introducing and designing public LTCI systems. In particular, it must be borne in mind that the introduction of a public LTCI system that does not provide cash benefits for informal care will lead to a substitution of formal care for informal care, which in turn may lead to a larger than expected increase in the demand for (and cost of) formal care.

However, one silver lining of introducing a public LTCI system without cash benefits for family care is that it may lead to a decline in the prevalence of bequests, thereby alleviating the extent to which wealth disparities are passed on from generation to generation.

Moreover, another benefit of introducing a public LTCI system without cash benefits for family care is that it will reduce the amount of informal care that is needed and will make it easier for children (especially females) to engage in market work and to realize their full potential in market work. This is a substantial benefit not only for the children themselves but also for the economy as a whole given that population ageing is projected to lead to severe labor shortages.

Acknowledgements

The empirical work undertaken in this paper utilizes micro data from the Japan Household Panel Survey on Consumer Preferences and Satisfaction (JHPS-CPS) (formerly called the Preference Parameters Survey), which has been conducted by the Institute of Social and Economic Research of Osaka University with funding from the 21st Century Center of Excellent Program "Behavioral Macrodynamics based on Surveys and Experiments" (2003-2008), the Global Center of Excellence Program "Human Behavior and Socioeconomic Dynamics" (2008-2013) of Osaka University, and two Grants-in-Aid for Scientific Research (KAKENHI) from the Japan Society for the Promotion of Science: "Behavioral-Economic Analysis of Long-Run Stagnation (15H05728) and "Economic Stagnation and Widening Wealth Inequality: Crises of the World Economy and a Construction of a Unified Macroeconomic Theory" (20H05631). We acknowledge the survey's co-investigators─Yoshiro Tsutsui, Fumio Ohtake, and Shinsuke Ikeda. We are also grateful to the participants of the Family Economics Workshop held at the Faculty of Economics, Keio University; the Annual Meeting of the Society of Economics of the Household; the Applied Economics Seminar of the Graduate School of Economics, Kyoto University; the Virtual Workshop on the Economic Impacts of Demographic Transition: Cases of Asia and Europe, jointly organized by the Asian Development Bank Institute (ADBI), Tokyo, Japan, and the Fulbright School of Public Policy and Management (FSPPM), Hanoi, Vietnam; the International Conference on Changing Family Life in East Asia held at Academia Sinica; the Household Economics Workshop of the Research Institute for Economics and Business Administration, Kobe University; the Singapore Economic Review Conference; Korean Economic Association/Korea University International Conference; Asian Meeting of the Econometric Society in East and Southeast Asia; East Asian Economic Association International Conference; Meeting on the Implications of Elderly Care Provision for Caregivers in Japan (Institut National d'Etudes Demographiques (INED)); seminars held at the University of Hawaii, De La Salle University; New Zealand Treasury, the University of Auckland, and the University of Canterbury; Takanori Adachi, Yuya Aikawa, Mika Akesaka, Christopher Cabuay, Chia Ngee Choon, Jeremy Clark, Dieter Eissel, Zheng Fang, Jesus Felipe, Shoshana Grossbard, Junya Hamaaki, Makoto Hasegawa, John Hillas,Cheng Hsiao, Yoko Ibuka, Ancilla Inocencio, Yumi Ishikawa, Shinya Kajitani, Kamhon Kan, Kyeongbae Kim, Hisaki Kono, Wataru Kureishi, Sumner LaCroix, Sang-Hyop Lee, Steffen Lippert, Andrea Menclova, Joel Kayembe Mpoy, Patrick Nolan, Jan Ondrich, Euston Quah, Ekaterina Sherstyuk, Ching-Jen Sun, Luigi Ventura, Philip Vermeulen, Midori Wakabayashi, Xiangyun Yin, Jongsay Yong, Michio Yuda, and especially R. Anton Braun, Colin McKenzie, Yoko Niimi, Edward Norton, and Ken Yamada for their valuable comments, discussions, and assistance. This work was supported by JSPS (Japan Society for the Promotion of Science) KAKENHI Grant Numbers 18H00870, 20H01513, 20H05633, and 23H00831.

Conflicts of Interest

The first author received funding from JSPS (Japan Society for the Promotion of Science) KAKENHI Grant Numbers 18H00870, 20H01513, 20H05633, and 23H00831 for the research leading to these results. The authors have no competing interests to declare that are relevant to the content of this article.

References

Acemoglu, D., and J. A. Robinson (2000), "Why Did the West Extend the Franchise? Democracy, Inequality, and Growth in Historical Perspective," *Quarterly Journal of Economics*, 115(4): 1167-1199.

Alesina, A., & P. Giuliano, P. (2014), "Family Ties" in P. Aghion and S. N. Durlauf, eds., *Handbook of Economic Growth*, vol. 2 (New York: Elsevier B.V.), pp. 117-215.

Almas, I., E. Freddi, and O. Thogersen (2020), "Saving and Bequest in China: An Analysis of Intergenerational Exchange, *Economia*, 87: 249-281.

Ariizumi, H. (2008), "Effect of public long-term care insurance on consumption, medical care demand, and welfare," *Journal of Health Economics*, 27(6): 1423-35.

Arrondel, L., and A. Masson (2006), "Altruism, Exchange or Indirect Reciprocity: What Do the Data on Family Transfers Show?" in S.-C. Kolm and J. M. Ythier, eds., *Handbook of the Economics of Giving, Altruism and Reciprocity*, vol. 2 (New York: Elsevier Science B.V.), pp. 971-1053.

Barczyk, D., and M. Kredler (2018), "Evaluating long-term-care policy options, taking the family seriously," *Review of Economic Studies*, 85(2): 766-809.

Bernheim, B. D., A. Shleifer, and L. H. Summers (1985), "The Strategic Bequest Motive," *Journal of Political Economy*, 93(6): 1045–1076.

Bonsang, E. (2009), "Does informal care from children to their elderly parents substitute for formal care in Europe?" *Journal of Health Economics*, 28(1): 143–154.

Braun, R. A., K. A Kopecky, and T. Koreshkova (2019), "Old, frail, and uninsured: accounting for features of the US Long-Term care insurance market," *Econometrica*, 87(3): 981-1019.

Brown, M. (2006), "Informal Care and the Division of End-of-Life Transfers," *Journal of Human Resources*, 41(1): 191–219.

Carlstrom C. T., and T. S. Fuerst (2001), "Timing and real indeterminacy in monetary models," *Journal of Monetary Economics*, 47: 285-298.

Chang, Y.-M. (2009), "Strategic Altruistic Transfers and Rent Seeking within the Family," *Journal of Population Economics*, 22: 1081-98.

Chechovich, T. J., and S. Stern (2002), "Shared caregiving responsibilities of adult siblings with elderly parents," *Journal of Human Resources*, 37(3): 441-478.

Courbage, C., and P. Zweifel (2011), "Two-Sided Intergenerational Moral Hazard, Long-Term Care Insurance, and Nursing Home Use," *Journal of Risk and Uncertainty*, 43(1): 65-80.

Cox, D. (1987), "Motives for Private Income Transfers." *Journal of Political Economy*, 95(3): 508–546.

Cox, D., and M. R. Rank (1992), "Inter-vivos Transfers and Intergenerational Exchange," *Review of Economics and Statistics,* 74(2): 305–314.

Cremer H., J. Lozachmeur, and P Pestieau (2004), "Social security, retirement age and optimal income taxation," *Journal of Public Economics,* 88: 2259-2281.

Fu, R., H. Noguchi, A. Kawamura, and H. Takahashi (2017), "Spillover Effect of Japanese Long-Term Care Insurance as an Employment Promotion Policy for Family Caregivers," *Journal of Health Economics,* 56: 103-112.

Fu, R., T. Iizuka, and H. Noguchi (2023), "Long-term Care in Japan," NBER Working Paper No. 31829, National Bureau of Economic Research, Cambridge, Massachusetts, USA.

Grabowski, D., E. C. Norton, and C. H. Can Houtven (2012), "Informal Care," in A. M. Jones, ed., *The Elgar Companion to Health Economics,* 2nd ed. (Northampton, MA: Edward Elgar), pp. 318-328.

Groneck, M. (2017), "Bequests and Informal Long-Term Care: Evidence from HRS Exit Interviews," *Journal of Human Resources,* 52(2): 531-572.

Gruber, J., and K. M. McGarry, eds. (forthcoming), *Long-term Care around the World* (Chicago, Illinois, USA: University of Chicago Press.

Gruber, J., K. M. McGarry, and C. Hanzel (2023), "Long-term Care around the World," NBER Working Paper No. 31882, National Bureau of Economic Research, Cambridge, Massachusetts, USA.

Hanaoka, C. and E. C. Norton (2008), "Informal and formal care for elderly persons: How adult children's characteristics affect the use of formal care in Japan," *Social Science and Medicine*, 67(6): 1002-1008.

Henretta, J. C., M. S. Hill, W. Li, B. J. Soldo, and D. A. Wolf (1997), "Selection of Children to Provide Care: The Effect of Earlier Parental Transfers," *Journals of Gerontology Series B: Psychological Sciences and Social Sciences,* 52 (Special Issue): 110-119.

Ho, C. (2022), "Strategic Parent Meets Detached Child? Parental Intended Bequest Division and Support from Children," *Demography*, 59(4): 1353-1376.

Horioka, C. Y. (2002), "Are the Japanese Selfish, Altruistic, or Dynastic?" *Japanese Economic Review,* 53(1): 26-54.

Horioka, C. Y. (2014), "Are Americans and Indians More Altruistic than the Japanese and Chinese? Evidence from a New International Survey of Bequest Plans," *Review of Economics of the Household,* 12(3): 411-437.

Horioka, C. Y. (2021a), "Does the Selfish Life-Cycle Model Apply in the Case of Japan and, If So, Why? A Literature Survey," *Review of Economics of the Household*, 19(1): 157-187.

Horioka, C. Y. (2021b), "Nihon de Raifu Saikuru Kasetsu ha Naritatteiruka? (Is the Life Cycle Hypothesis Applicable in Japan?)" in T. Ui, T. Kanou, J. Doi, and Y. Nishiyama, eds., *Gendai*

Keizaigaku no Choryuu (*Trends in Contemporary Economics*) (Tokyo, Japan: Toyo Keizai Shinposha), pp. 35-59 (in Japanese).

Horioka, C. Y., H. Fujisaki, W. Watanabe, and T. Kouno (2000), "Are Americans More Altruistic than the Japanese? A U.S.-Japan Comparison of Saving and Bequest Motives," *International Economic Journal,* 14(1): 1-31.

Horioka, C. Y., E. Gahramanov, A. Hayat, and X. Tang (2018), "Why Do Children Take Care of Their Elderly Parents? Are the Japanese Any Different?" *International Economic Review,* 59(1): 113-136.

Iwagami, M., and N. Tamiya (2019), "The Long-Term Care Insurance System in Japan: Past, Present, and Future," *JMA (Japan Medical Association) Journal*, 2(1): 67-69.

Kohara, M., and F. Ohtake (2011), "Altruism and the Care of Elderly Parents," *Japanese Economy*, 38(2): 3-18.

Komamura, K. (1994), "Koureisha Kakei ni okeru Isan Koudou no Keizai Bunseki (An Economic Analysis of Bequest Behavior in Elderly Households)," *Kikan Shakai Hoshou Kenkyuu,* 30(1): 62-74 (in Japanese).

Konishi, T., H. Inokuchi, and H. Yasunaga (2024), "Services in public long-term care insurance in Japan," *Annals of Clinical Epidemiology*, 6(1): 1-4.

Laferrère, A., and F.-C. Wolff (2006), "Microeconomic Models of Family Transfers," in S.-C. Kolm and J. M. Ythier, eds., *Handbook of the Economics of Giving, Altruism and Reciprocity*, vol. 2 (New York: Elsevier Science B.V.), pp. 889–969.

Lehnert, T., M. Heuchert, K. Hussain, and H. König (2019), "Stated preferences for long-term care: A literature review," *Ageing and Society,* 39(9): 1873-1913.

Li, S.-H., Y.Chon, and Y.-Y. Kim (2023), "Comparative Analysis of Long-Term Care in OECD Countries: Focusing on Long-Term Care Financing Type," *Health Care*, 11(206): 1-13.

Lockwood, L. M. (2012), "Bequest Motives and the Annuity Puzzle," *Review of Economic Dynamics*, 15(2): 226-243.

Lockwood, L. M. (2018), "Incidental Bequests and the Choice to Self-Insure Late-Life Risks," *American Economic Review*, 108(9): 2513-2550.

McGarry, K. (1999), "Inter Vivos Transfers and Intended Bequests," *Journal of Public Economics*, 73(3): 321–351.

McGarry, K., and R. F. Schoeni (1995), "Transfer Behavior in the Health and Retirement Study: Measurement and the Redistribution of Resources Within the Family," *Journal of Human Resources*, 30 (Special Issue): S184–S226.

McGarry, K., and R. F. Schoeni (1997), "Transfer Behavior Within the Family: Results from the Asset and Health Dynamics Study," *Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 52 (Special Issue): 82–92.

Mellor, J. M. (2001), "Long-Term Care and Nursing Home Coverage: Are Adult Children Substitutes for Insurance Policies?" *Journal of Health Economics*, 20(4): 527-547.

Menchik, P. L. (1988), "Unequal Estate Division: Is it Altruism, Reverse Altruism, or Simply Noise?" in D. Kessler and A. Masson, eds., *Modeling the Accumulation and Distribution of Wealth*, Oxford: Clarendon Press, pp. 105–116.

Mommaerts, C. (2018), "Are Coresidence and Nursing Homes Substitutes? Evidence from Medicaid Spend-Down Provisions," *Journal of Health Economics*, 59: 125-138.

Niimi, Y. (2016), "The "Costs" of Informal Care: An Analysis of the Impact of Elderly Care on Caregivers' Subjective Well-being in Japan," *Review of Economics of the Households*, 14(4): 779-810.

Noguchi, Y., K. Uemura, and Y. Kitou (1989), "Souzoku ni yoru Sedai-kan Iten no Kouzou: Shutoken ni okeru Jittai Chousa Kekka (The Structure of Intergenerational Transfers via Bequests: Results of a Survey in the Tokyo Metropolitan Area)," *Kikan Shakai Hoshou Kenkyuu (Quarterly of Social Security Research)*, 25(2): 136-144 (in Japanese).

Norton, E. C. (2000), "Long-Term Care," in A. J. Culyer and J. P. Newhouse, eds., *Handbook of Health Economics*, vol. 1 (New York: Elsevier B.V.), pp. 955–994.

Norton, E. C., L. H. Nicholas, and S. S.-H. Huang (2013), "Informal Care and Inter-vivos Transfers: Results from the National Longitudinal Survey of Mature Women," *BE Journal of Economic Analysis and Policy*, 14(2): 1–24.

Norton, E. C., and D. H. Taylor (2005), "Equal Division of Estates and the Exchange Motive," *Journal of Aging and Social Policy*, 17(1): 63–82.

Norton, E. C., and C. H. Van Houtven (2006), "Inter-Vivos Transfers and Exchange," *Southern Economic Journal*, 73(1): 157–172.

Ohtake, F. and C. Y. Horioka (1994), "Chochiku Douki (Saving Motives)," in T. Ishikawa, ed., *Nihon no Shotoku to Tomi no Bunpai (The Distribution of Income and Wealth in Japan)* (Tokyo Daigaku Shuppankai, Tokyo, Japan), pp. 211-244 (in Japanese).

Pauly, M. V. (1990), "The Rational Nonpurchase of Long-term-Care Insurance," *Journal of Political Economy*, 98(1): 153-168.

Perozek, M. G. (1998), "A Reexamination of the Strategic Bequest Motive," *Journal of Political Economy*, 106(2): 423–445.

Raut, L., and L. H. Tran (2005), "Parental human capital investment and old-age transfers from children: Is it a loan contract or reciprocity for Indonesian families?" *Journal of Development Economics*, 77: 389-414.

Sloan, F. A., and E. C. Norton (1997), "Adverse Selection, Bequests, Crowding Out, and Private Demand for Insurance: Evidence from the Long-Term Care Insurance Market," *Journal of Risk and Uncertainty*, 15(3): 201-219.

Sloan, F. A., G. Picone, and T. J. Hoerger (1997), "The Supply of Children's Time to Disabled Elderly Parents." *Economic Inquiry*, 35(2): 295–308.

Stern, S. (1995) "Estimating Family Long-term Care Decisions in the Presence of Endogenous Child Characteristics," *Journal of Human Resources*, 30(3): 551-580.

Wakabayashi, M., and C. Y. Horioka (2009), "Is the Eldest Son Different? The Residential Choice of Siblings in Japan," *Japan and the World Economy*, 21(4): 337-348.

Yamada, K. (2006), "Intra-family Transfers in Japan: Intergenerational Co-residence, Distance, and Contact," *Applied Economics*, 38(16): 1839-1861.

Zweifel, P., and W. Struwe (1996), "Long-Term Care Insurance and Bequests as Instruments for Shaping Intergenerational Relationships," *Journal of Risk and Uncertainty*, 12(1): 65-76.

Table 1: The Structure of Long-Term Care Insurance Benefits in Japan

Support or care level	Requirement for certification	Standardized care times (minutes per day)	Maximum benefits (Japanese yen per month)
Support level 1	The recipient lives independently but requires assistance with IADL	25.0-31.9	50,320
Support level 2	The recipient requires more assistance with IADL than a recipient at support-required level 1 and might deteriorate to care level 1	32.0-49.9	105,310
Care level 1	The recipient requires more assisance wih IADL than a recipient at support-required level 1 or 2	32.0-49.9	167,650
Care level 2	The recipient requires more assistance with IADL than a recipient at care level 1	50.0-69.9	197,050
Care level 3	The recipient requires more assistance than a recipient at care level 2 and thus needs total care	70.0-89.9	270,480
Care level 4	The recipient cannot live without care and functions poorly in terms of ADL	90.0-109.9	309,380
Care level 5	It is impossible for the recipient to live without care and he/she has more substantial ADL needs than a recipient at care level 4	110.0-	362,170

Note: "ADL" denotes "activities of daily living" while "IADL" denotes "instrumental activities of daily living."

Sources: Fu, et al. (2023) and Konishi, et al. (2024).

Table 2: Summary of the Four Theoretical Models

	Informal care	Bequests	Impact of LTCI on informal care	Impact of LTCI on bequests
Case 1: Selfish parent, selfish child	Yes	Yes	Generally negative	Generally negative
Case 2: Altruistic parent, selfish child	No	Yes	None	None
Case 3: Altruistic parent, altruistic child	Yes	Yes	Negative	None
Case 4: Selfish parent, altruistic child	Yes	No	Negative	None

Source: See section 4 of the main text.

Table 3: Descriptive Statistics						
	Full sample		Primary caregivers		Non-primary caregivers	
Variable	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Bequest expectations	0.596	0.500	0.615	0.488	0.437	0.497
Primary caregiver	0.387	0.488	100.000	0.000	0.000	0.000
Parent's eligibility for LTCI	0.128	0.334	0.077	0.267	0.160	0.367
Age of respondent	52.492	9.040	51.208	8.772	53.303	9.125
College graduate	0.350	0.477	0.389	0.489	0.326	0.500
Female respondent	0.545	0.498	0.543	0.499	0.546	0.499
Female parent	0.839	0.368	0.842	0.366	0.837	0.370
Eldest son	0.333	0.472	0.385	0.488	0.300	0.459
Number of siblings	1.734	1.084	1.525	1.021	1.866	1.103
Only child	0.051	0.220	0.086	0.281	0.029	0.167
Married	0.853	0.355	0.801	0.400	0.886	0.319
Presence of cohabiting children	0.599	0.491	0.606	0.490	0.594	0.492

Table 4: The Impact of LTCI Eligibility on Caregiving		
Parent's eligibility for LTCI	Proportion of respondents who are their parent's primary caregiver (%)	No. of obs.
Not eligible for LTCI	43.4	362
Eligible for LTCI	30.6	209
Support levels 1-2	42.5	73
Care levels 1-2	25.4	63
Care levels 3-5	23.3	73
Full sample	38.7	571

Table 5: Bivariate Probit Results						
Explanatory variable	Primary caregiver			Bequest expectations		
	Average marginal effect		Std. error	Average marginal		Std. error
Primary caregiver				0.444	***	0.147
Parent's eligibility for LTCI	-0.203	***	0.051			
Age of respondent	-0.002		0.002	-0.001		0.002
College graduate	0.036		0.046	0.085	*	0.048
Female respondent	0.143	**	0.062	-0.149	***	0.056
Female parent	0.030		0.053	0.000		0.047
Eldest son	0.181	***	0.069	-0.044		0.000
Number of siblings	-0.028		0.022	-0.051	**	0.025
Only child	0.253	**	0.105	-0.105		0.079
Married	-0.168	***	0.065	0.013		0.060
Presence of cohabiting children	0.031		0.046	-0.050		0.040
RHO	-0.576		0.316			
Wald test of RHO=0, chi2(1)	1.924					
Prob>CHI2	0.165					
Log-likelihood	-719.350					
No. of obs.	571					
Wald CHI2(20)	169.800					

Notes: * denotes significant at the 10% level, ** denotes significant at the 5% level, and *** denotes significant at the 1% level.