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Time to smell the roses?
Risk aversion, the timing of inheritance receipt, and retirement

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Abstract

Understanding when workers choose to retire is key for the design of public pensions and labor market policies. Private wealth may play a substantial role in retirement decisions, but little is still known on the link between the two. In this paper, we explore a new way to leverage the receipt of an inheritance as a plausible exogenous wealth shock, by relying on the precise timing of receipt. Using retrospective calendars from the French wealth survey, we find that, at any age between 55 and 65, chances of current labor market exit are 40% higher among individuals who inherit at that age than among those who inherit in the next few years. To go further in understanding the effect of inheritance receipt on labor force participation, we develop a model of retirement choice with risk aversion and an endogenous replacement rate and we test its predictions. We find that inheritance receipt triggers current labor force exit because risk averse individuals plan their retirement date according to the certainty equivalent of their bequest, not its expected value.

Keywords: Retirement, inheritance, labor supply, risk aversion

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L'effet de l'héritage sur le départ à la retraite

Résumé

Pourquoi et quand part-on à la retraite ? Les réformes du système de retraite reposent souvent sur des réponses implicites à cette question. S'il est clair que les paramètres du système (durée de cotisation, taux de remplacement, décote, …) ont un fort effet sur la décision de départ à la retraite, les connaissances sur le lien entre retrait de la vie active et patrimoine privé sont faibles.

Notre travail tente d'éclairer ce lien en utilisant le fait de recevoir un héritage et le moment exact où l'héritage est reçu comme sources de variation du patrimoine des individus. Nous utilisons plusieurs millésimes de l'enquête Patrimoine de l'Insee (1992, 1998, 2003 et 2009) en mettant à profit la description chronologique précise tant du parcours professionnel des individus que de leurs héritages.

En centrant notre analyse sur les personnes de 55 à 65 ans qui ont reçu un héritage, nous montrons que la probabilité de départ à la retraite augmente de 40 % l'année de réception de l'héritage, comparée à une réception plus tardive. Afin de mieux comprendre les mécanismes sous-jacents, nous développons et testons les prédictions d'un modèle théorique de choix de départ à la retraite qui prend en compte l'aversion au risque et le fait que le taux de remplacement dépend de la date de départ. Nous montrons que l'effet de l'héritage sur le départ à la retraite peut s'expliquer par le fait que les individus averses au risque se basent sur l' « équivalent certain » et non pas la valeur anticipée de leur héritage.

Mots-clés : Retraite, héritage, offre de travail, aversion au risque

Classification JEL : J14, J26

1   Introduction

Understanding when people choose to retire is key for the design of public pensions and labor market policies. It has been the focus of an extensive literature investigating the effect of factors as diverse as health status, longevity, private and public pensions, or health insurance.[1] While there has been much theoretical work on the retirement effect of individual wealth, be it in the form of private assets or Social Security entitlements,[2] empirical work has often failed to provide causal evidence of this link, or found contradictory results.[3] Wealthy individuals typically have distinct preferences, for example regarding leisure or time, both of which can in turn influence labor market participation. Finding truly exogenous sources of variation of private wealth is difficult, particularly if one requires these variations to take place around ages where individuals might prefer to completely withdraw from the labor market rather than to make adjustments at the intensive margin. In this paper, we explore a new way to leverage the receipt of an inheritance as a plausible exogenous wealth shock, by relying on the precise timing of receipt. We build on the fact that, conditionally on receiving an inheritance within a few years, the exact moment of receipt is largely random.[4] Using retrospective calendars from the French Wealth Survey, we find that, for any age between 55 and 65, chances of current labor market exit are 40% higher among individuals who inherit at that age than among individuals who inherit in the next few years. To go further in understanding the effect of inheritance receipt on labor force participation, we develop a model of retirement choice with risk aversion and an endogenous replacement rate. We find that inheritance receipt triggers current labor force exit because risk averse individuals plan their retirement date according to the certainty equivalent of their bequest, not its expected value.

As in many countries, public pensions make up most of retirees' financial resources in France, providing them with 75% of their pre-retirement income on average (COR (2013)). In order to unlock their pension, individuals must work until the legal retirement age. In addition, they must contribute to the pension system for a given number of years in order to retire with full benefits. In case of early retirement, an individual's pension is scaled down in proportion of the number of

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[1]See among many others Bloom, Canning, Mansfield, and Moore (2007), Bloom, Canning, and Moore (2014), Burtless (1986), Gruber and Madrian (1995), Bloemen (2011).

[2]Examples include Kingston (2000) or Stock and Wise (1990).

[3]See for example Samwick (1998) for a survey of the literature on the effects of Social Security, and a re-examination of some of the evidence.

[4]There are some reasons to doubt that the receipt of an inheritance itself is completely exogenous and independent of workers' characteristics (see e.g. Hurst and Lusardi (2004)). Our strategy enables us to overcome the usual issue that inheritors and other individuals are not comparable due to unobservable characteristics (cf. section 2).

missing years. Considering the importance of public pensions in France, we investigate whether the effect of inheritance receipt on retirement depends on an individual's pension entitlement status. We find that the increase in exit rates among individuals who happen to inherit before or after the legal retirement age is very comparable. This increase is also very similar among individuals who happen to inherit before or after having reached the necessary contribution length. The main effect of inheritance receipt seems to be instantaneous rather than delayed labor market exit, regardless of whether individuals face a high cost of exit or not. This suggests that some individuals are willing to give up a substantial part of their benefits in order to exit the labor market a few years earlier, when they can afford to do so.

Previous work has highlighted the fact that, when individuals anticipate the receipt of an inheritance, adjustments of their labor force participation might have already occurred at the date of receipt. In this scenario, only inheritances representing a higher amount than expected can have an impact on current retirement probability. We explore an alternative interpretation of our results. Building on a simple model of retirement decision under uncertainty, we show that, when individuals are risk averse and bear the risk associated with their own inheritance, the receipt of an inheritance can have labor supply effects even when the amount received was perfectly anticipated. This is because individuals make their lifetime labor supply decisions with respect to the certainty equivalent of the inheritance rather than its expected value.[5] Using multiple measures of risk aversion available in our data, we are able to test the validity of this framework. Consistent with our model, we show that the receipt of an inheritance has a particularly large effect on current retirement rates for the most risk averse individuals.

Despite the existence of an important literature investigating the effects of private wealth on labor supply decisions, direct evidence of an impact on retirement behavior is still scarce. Kaplan (1987) and Imbens, Rubin, and Sacerdote (2001) studied lottery players, and both showed that lottery winners' labor earnings were significantly reduced, all the more so as they were close to the retirement age. Using the bull market of the 1990s, Coronado and Perozek (2003) and Sevak (2002) both found that households who benefited from unanticipated capital gains ended up retiring earlier than others. However, with the same strategy, Coile and Levine (2006) found no evidence of changes in labor supply due to variations in stock market. Earlier studies also leveraged the receipt of an inheritance as a credible exogenous wealth shock, but with similarly ambiguous conclusions. Holtz-Eakin, Joulfaian, and Rosen (1992) showed that a single person who inherits about $150,000 is four times more likely to leave the labor market than one who

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[5]This was one of the interpretation suggested by Brown, Coile, and Weisbenner (2010).

inherits less than \$25,000. Joulfaian (2006) and Bo, Halvorsen, and Thoresen (2013) also both found significant effects, but much smaller in magnitude. On the other hand, Joulfaian and Wilhelm (1994) found inconclusive results on older workers in the Panel Study of Income Dynamics. The papers closest to ours are Brown, Coile, and Weisbenner (2010) and Blau and Goodstein (2015), who concentrate exclusively on retirement decisions following the receipt of an inheritance. Using data from the Health and Retirement Survey (HRS), Brown, Coile, and Weisbenner (2010) show that individuals who inherit between two waves of the survey are also more likely to exit the labor market during that time. Using information on inheritance expectations, they are also able to test whether the effect is entirely concentrated on workers receiving more than they expected, but find effects of similar magnitudes for individuals receiving more than expected and exactly what they anticipated. While Brown, Coile, and Weisbenner (2010) study households behavior, Blau and Goodstein (2015) focus on married individuals. They show that the receipt of an inheritance has a negative effect on own labor force participation, but no effect on that of the spouse.

Our study differs from previous work in a number of ways. We explore a new source of randomness associated with inheritance by focusing on the precise timing of receipt among heirs, namely by comparing individuals who receive an inheritance at a given age with individuals who receive one in the next few years rather than with all individuals. We also clarify the theoretical status of risk aversion using a simple lifecycle model. Empirically, we find that individuals behave in a way that is consistent with our model, where the most risk averse individuals are also those for whom the labor market response of inheritance receipt is the strongest. This sheds new light on why workers might adjust their labor supply after the receipt of an inheritance, including in the case where they perfectly anticipated it. The rest of the paper is organized as follows. Section 2 describe our empirical strategy more in details, section 3 presents the data used in the analysis, sections 4 to 6 present our results, and section 7 concludes.

2 Empirical strategy

Multiple studies have used the receipt of an inheritance as a plausible exogenous wealth shock. However, there are some reasons to doubt that receiving an inheritance is actually a clear random event. Individuals who inherit may differ from those who do not, be it in their education, occupation, personal wealth, or other characteristics (sometimes unobservable and so hardly possible to control for), in particular because of important intergenerational correlations in all

those variables. For instance, in their study of entrepreneurship, Hurst and Lusardi (2004) found that both past and future inheritances predict current business entry, suggesting that individuals who inherit at some point are just fundamentally different than those who do not.[6] In this paper, we attempt to go beyond this limit by leveraging the precise timing of inheritance receipt. Concentrating on individuals who do receive an inheritance over their life, we propose to use the timing of inheritance receipt as a more exogenous wealth shock. Specifically, at any age, we propose to compare individuals who receive an inheritance at that age with individuals who receive an inheritance in the next few years. The assumption behind this strategy is that, conditionally on inheriting within a restricted time range, the exact time at which individuals receive that inheritance is essentially random.

Econometrically, we build on the tools of duration analysis. We consider the standard Cox proportional hazard model:

$$h_i(t) = h_0(t) \exp(\alpha \text{Inh}_{it} + X_{it}\beta) \tag{1}$$

where $h_i(t)$ denotes the hazard rate for individual i at age t, i.e. the instantaneous retirement probability of i conditional on still being employed at t. Inh_{it} is a dummy with value 1 if i receives an inheritance at t, and 0 if i receives an inheritance in a given time interval after t, say $]t, t+T[$. If we denote t_i^b the time at which i inherits, Inh_{it} takes value 1 when $t = t_i^b$ and 0 when t is in $]t_i^b - T; t_i^b[$. X_{it} is a vector of individual and potentially time-varying covariates. In this model, the parameter of interest is α: the probability of labor market exit at t is multiplied by $\exp(\alpha)$ when an inheritance is received at t.

The estimation of model (1) requires information in continuous time, which is not available in our data. Instead, we observe events grouped in 1-year intervals. In this context, it can be shown that model (1) can be rewritten as a binary model with a complementary log-log link function to accommodate interval data.[7] We use this model to estimate the parameters α and β.

In practice, we estimate the parameters of model (1) using the following specification:

$$y_{it}^* = \mu_t + \alpha \text{Inh}_{it} + X_{it}\beta + \epsilon_{it} \tag{2}$$

where y_{it}^* is the latent variable such that $y_{it} = \mathbb{1}_{\{y_{it}^* \geq 0\}}$ with y_{it} a dummy indicating that

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[6]They do not control for parents' characteristics.
[7]See for example Garbinti (2014)

individual i retired during interval $[t, t+1[$. μ_t is an age-specific effect,[8] and the error term ϵ_{it} follows a complementary extreme value type I distribution (specifically, $P(\epsilon > x) = 1 - \exp(-\exp(-x))$). Inh_{it} is a dummy with value 1 if individual i received an inheritance between $[t, t+1[$, and 0 if she receives an inheritance between $[t+1, t+T[$. The parameters α and β identified by model (2) are the same as those in model (1).

Before continuing, we should make it clear that, even though we use tools from duration analysis, our approach differs slightly from traditional survival models. In these models, all individuals are followed until they either retire, or exit the sample for possibly unknown reasons (censorship). Here, we do not follow individuals until their exit from the labor market as this would be fundamentally incompatible with our empirical strategy. We want to compare inheritors with similar characteristics who differ only by the timing of their inheritance. A natural way of doing so is to compare the behavior of the individuals who receive their inheritance between $[t, t+1[$ with the one of those who receive their inheritance slightly latter. For this purpose, we only keep observations corresponding to individuals who either receive an inheritance between $[t, t+1[$ or do not receive their inheritance between $[t, t+1[$ but receive it between $[t+1, t+T[$. Had we used a standard survival model set up, all non-retired individuals would have been kept in the sample at every time t, even when they have not received an inheritance between t and $t+T$. However, there is no reason why individuals who have already received an inheritance at $t_0 < t$ should be compared with people who have not yet received any inheritance. In a policy evaluation setup, the first group of individuals would be considered as already treated, and would thus not be eligible to be part of the control group.[9] In addition, those individuals are non-compliers since they stayed in the labor force even after having received the "treatment". Put differently, they probably constitute a selected subsample of the individuals who inherited at t_0. They potentially have a stronger attachment to the labor market. Including them in the control group at t would lead to an underestimation of the baseline retirement probability of individuals at t, and an overestimation of the effect of inheritance on retirement.[10] Therefore, for each age, we do not include observations corresponding to these situations. This approach is essentially similar to assuming a frailty model, except that we only care about obtaining unbiased estimates of the treatment variable, not about recovering the parameters associated with the frailty distribution.

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[8]The legal retirement age is constant over our period of analysis.

[9]Later in the paper, we investigate the lagged effect of inheritance receipt. When we do so, we also keep observations corresponding to individuals who have received an inheritance in the previous few years, i.e. between $]t-T, t-1]$.

[10]We confirm this point in section 4.2.

7

3   Data

We use data from the *Enquête Patrimoine* (EP), the French wealth survey. The EP is conducted by the French statistical office every 6 years on a sample of about 15,000 households in which wealthier households are overrepresented. We pool data from the years 1998, 2004 and 2010. Those surveys provide detailed information on the main socio-economic characteristics of the households, and on the composition of their assets. For the 2004 and 2010 waves, a fraction of the individuals were also asked specific questions on their attitude towards risk. Specifically, individuals had to rank themselves on a scale from 0 (very careful) to 10 (likes to take risks), and were proposed a simple lottery detailed in Appendix C. In all waves, respondents are asked to report their main career changes over their life, such as any interruption of activity, change of labor force status (e.g. from employed to self-employed), or retirement decision, along with the year at which these changes occurred. Individuals are also asked whether they received any inheritance at some point in their lives. For each inheritance received, they are then asked the year at which they received it, as well as who they received it from (parents, distant relatives, . . .), the amount and the nature of the inheritance (cash, real estate, . . .).

From these retrospective calendars, we build a database containing one observation for each year lived by each individual (i.e. for each individual, years between the reported birth year and the year of the interview). This new database contains time-invariant variables (e.g. household socio-demographic variables at the time of the interview) as well as time-varying variables such as the labor force status of each individual at each year, a dummy variable indicating inheritance receipt in that year, and the number of years left to reach full pension rights.[11] Since most workers exit the labor market between 55 and 65, we concentrate on individuals aged within this bracket at the time of the interview. In line with our empirical strategy, for each age a between 55 and 65, we keep observations corresponding to individuals employed or actively looking for a job between $[a - 1, a[$.[12] Active job seekers might be expected to respond to the receipt of an inheritance in much the same way as employed individuals. Receiving an inheritance might push them to exit the labor market completely rather than to keep looking for a job.[13] We consider that an individual has exited the labor market when she self-defines as either inactive or retired.[14] In the rest of the paper, we use the term *retirement* as a synonym for labor market

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[11]See Appendix B for a description of French pension regulations and of how we build this variable.

[12]In particular, the self-employed are excluded from our sample.

[13]The unemployed make up slightly less than 10% of our sample. We tested that our results do not change much when they are excluded. The basic results are reported in Table 6 in appendix D.

[14]In 2008, the possibility was introduced for employers and employees to mutually agree on a conventional termination of the work contract between them. For employees, this can be an alternative to submitting their

exit.

4 Inheritance receipt and retirement

4.1 Graphical Evidence

Before moving on to the econometric analysis, we provide simple graphical evidence on the effect of inheritance receipt on labor market withdrawal. We compute for each age $a \in [55, 65]$ the proportion of individuals who leave the labor market at any time between $[a, a + 1[$ among those still employed at a. Figure 1 reports this proportion computed separately for individuals who happen to receive an inheritance between $[a, a + 1[$ (dashed line), and for individuals who have not yet received an inheritance but will receive one within the next two years, i.e. between $[a + 1, a + 3[$.

The figure first shows that the probability to leave the labor market varies significantly across ages. Individuals who are still employed at ages 60 and 65 have a 50% to 60% chance to retire at that age when no inheritance is received, whereas this conditional probability is quite stable outside those ages, around 10% between $[55, 60[$ and 20% between $]60, 65[$. As described in appendix B, 60 is the age at which most workers can start to cash out their pension and 65 is the age at which discounts are canceled, and consequently, many individuals wait until those ages to retire. This pattern is roughly unchanged when the proportion of labor market exits is computed among those who receive an inheritance at the age under consideration.

Figure 1 also shows that at most ages a, the proportion of individuals who withdraw from the labor market is higher among those who receive an inheritance at exactly a than among those who have not yet received an inheritance. The degree to which this is the case varies substantially with age. For example, the probability to retire doubles when an inheritance is received at ages 55 and 64, but it is roughly unchanged at ages 58 and 60. Overall, these results are indicative that receiving an inheritance at any age between 55 and 65 is associated with an increase in the probability to retire at that age.

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resignation (which does not give rights to unemployment insurance), while for employers it is cheaper and easier than a normal layoff. As workers who benefit from such a contractual termination are entitled to unemployment insurance, it is unclear whether they would self-declare as unemployed, retired or inactive. This could be a source of bias if individuals choose this particular channel to exit the labor market after the receipt of an inheritance. To be sure, we tested that restricting our sample to observations made before 2008, when contractual termination was not possible, does not change our results.

4.2 Econometric results

To go one step further, we turn to the econometric analysis described in section 2, which builds on the intuitions from Figure 1. The first two columns of Table 1 show the results of the estimation of model 2 on our sample. For any age a between 55 and 65, we detect a very significant impact of receiving an inheritance at that age on the instantaneous probability to retire. Specifically, column (1) reveals that individuals who receive an inheritance at a are 39% (exp(.326)) more likely to exit the labor market at a than those who have not yet received an inheritance, but who will receive one in the next 2 years. Column (2) of Table 1 shows that this estimate is virtually unchanged by the introduction of a full set of controls for individual characteristics, including socio-economic status, gender, and education. This suggests that timing of inheritance receipt over a short period of time is indeed only weakly correlated with workers' characteristics, including those affecting retirement age. In Table 3, we estimate the same model for several socio-demographic subgroups. We find that the effects are generally larger for individuals of lower SES or lower education.

Columns (3) and (4) of Table 1 report the results of the estimation of the same model as in columns (1) and (2), but comparing individuals who receive an inheritance at t with all other individuals employed at t. If inheritance receipt is correlated with unobserved workers' characteristics influencing retirement age, this strategy should yield biased results. Those results may then also depend on the extent to which individual heterogeneity can be accounted for in the model. When excluding all controls, we find that individuals who receive an inheritance at t are 32% more likely to retire that year than any other individual still employed at t. This figure is slightly less than the result from column (1). However, when controls are included, we find results that are very similar to the ones obtained with our previous strategy. Specifically, when controlling for basic socio-economic characteristics of the individuals, we find that workers who receive an inheritance at t are 38% (exp(.333)) more likely to retire that year than other workers. Overall, this indicates that comparing inheritors with other individuals may lead to a small downward bias in the estimation of the effect of inheritance receipt of retirement. It also suggests that this bias can be largely eliminated by controlling for the basic socio-demographic characteristics of individuals.

These results are in line with those of previous American studies, although not directly comparable. Previous works have reported estimates based on logit or linear probability specifications, whereas our model directly estimates multiplicative effects. When we rescale our estimates taking

into account the mean retirement probability in our sample, we get a marginal effect equivalent to a 5 percentage point decline in labor force participation following inheritance receipt.[15] This figure is slightly higher than Brown, Coile, and Weisbenner (2010) (2.3 percentage point decline) but clearly in line with Blau and Goodstein (2015), with effects ranging from a 3.8 to a 6.5 percentage point decline (depending on whether men or women are considered). The main difference with Blau and Goodstein (2015) turns out to be that they find a lower effect for women while our estimates are of the same order of magnitude whatever the gender.

As it has been pointed out by a number of studies (e.g. Brown, Coile, and Weisbenner (2010)), the results from Table 1 could be driven by the fact that the death of a relative has a direct effect on the labor market participation of an individual. For instance, some individuals might stop working after the death of one of their parents to have more time to take care of their surviving parent. In that case, our results would overestimate the effect of inheritance receipt on retirement. Since inheritance is by essence associated with the death of an individual, these two effects are hard to disentangle.[16] A way to shed some light on this issue is to explore whether the labor market response of individuals who inherit a given year varies whether they receive their inheritance from their parents or from more distant relatives or friends. Under the assumption that the death of a parent has a direct negative effect on labor market participation, we would expect inheritances received from parents to be associated with a higher probability to withdraw from the labor market. To test this, column (2) of Table 2 reports the results obtained for the estimation of model (2), distinguishing between bequests[17] received from parents or grandparents and bequests received from other family members of friends. Those results first confirm that workers who inherit in a given year from a close parent are more likely to exit the labor force that year than individuals who inherit in the next couple of years. As it turns out, this effect is not less important and not statistically different when the inheritance comes from a more distant relative or from a friend. Overall this result is suggestive that labor market responses to the death of a parent cannot be entirely driving the estimates of Table 1.

A related concern is that some individuals might exit the labor force a few years *before* the death of a parent. This could happen for example when some individuals take time off work to care for a parent suffering from a severe illness. If this is the case, at any given age a, the

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[15]The mean retirement probability in our sample is 13%. We multiply our multiplicative effect (39%) by this sample mean in order to get closer to the way Blau and Goodstein (2015) compare results across studies. To take into account the fact that the probability of exit is increasing with age, our multiplicative effect is relative to the time changing baseline retirement probability of non-inheritors and not to the sample mean of the dependent variable. It explains an important part of the difference in the comparison.

[16]We do not have information on the death of parents in our data.

[17]To avoid repetitions, we use "bequest" as a synonym for "inheritance".

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retirement probability of individuals who will inherit in the next few years will overestimate the baseline retirement probability at a, and our results will be biased towards 0. A way to test whether these effects are substantial is to compare our results with those obtained when considering a control group composed of individuals who receive an inheritance over a longer time horizon. Workers who inherit at $a + 5$ should be less likely to exit the labor market at a to take care of their parent than workers who inherit at $a + 2$. If these effects are large, we should find that the impact of inheritance on current retirement increases when we consider an extended time horizon. In columns (3) to (5) of Table 2, we investigate how the results of Table 1 change when we consider inheritances received over a longer period of time. We estimate the same model as for column of Table 1, but this time comparing the retirement probability in a given year for individuals who inherit that year and for those who inherit in the next 3 years (column 3), in the next 5 years (column 4), or in the next 10 year (column 5). The estimates do not increase, and actually change very little when we extend the time horizon considered. Our results are not driven by our choice to consider inheritances received in a two-year window.

5 Retirement and the timing of inheritance

Receiving an inheritance at any age between 55 and 65 is associated with a substantial increase in the probability of retiring at that age. However, the costs of leaving the labor market vary significantly across those ages.[18] In order to get their full benefits, individuals must work until they reach the necessary contribution length. In addition, most workers need to wait until they turn 60 to be able to unlock their public pension. At this stage, it could well be that receiving an inheritance leads an individual to leave the labor market only when he has the possibility to do so at very little costs. The opposite would indicate that individuals are ready to sacrifice a substantial part of their pension to retire earlier when they can afford to do so, which could have deep implication for the design of public pensions.

To investigate this, Table 4 shows the results of estimating model (2) when the inheritance dummy is interacted with an indicator that the individual under consideration is older than 60 (column 1), or with an indicator that she has fulfilled the necessary contribution length (column 2). First, column (1) reveals that the effect of inheritance receipt on labor force participation is not lower when individuals happen to inherit before 60. Receiving an inheritance after 60 increases the probability of instantaneous labor market exit by about 22% with respect to receiving

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[18]French pensions are explained in more details in Appendix B.

an inheritance in the following couple of years, but it is not significant. As it happens, this figure actually almost triples, to a 65% increase, when the inheritance is received before 60. This result suggests that the labor market impact of inheritance receipt is not lower when individuals cannot yet cash out their public pension. Column (2) of Table 4 then shows that this also holds true when considering pension rights rather than the possibility to unlock the pension. Specifically, individuals who happen to inherit when they have already reached their full contribution length, and have therefore earned their full benefits, are 44% more likely to exit the labor market at that point than those who receive their inheritance in the next couple of years. This effect is only slightly smaller (30%) when individuals happen to receive their inheritance when they have not yet worked enough to earn their full pension rights.

As described in Appendix B, the entitlement cost of an early labor market exit can be quite large, even with just a few missing years of contribution. When workers are too far away from earning their full benefits, receiving an inheritance might not be enough to compensate the loss of pension money associated with an early exit, even if an individual has a strong disutility for work. To test this idea, we investigate whether the effect of inheritance receipt on retirement decreases when individuals are missing more than a certain number of years of contribution. Specifically, we estimate the same type of model as for column (2) of Table 4, but distinguishing whether individuals are missing more or less than 2 years of contribution. Column (3) reports the results of this estimation. As it turns out, individuals who have not yet earned their rights to full benefits but who are close to having done so are also those for whom receiving an inheritance is associated with the strongest probability to retire. When an individual happens to receive an inheritance while he is less than two years away from earning full retirement rights, his probability of exiting the labor market increases by 53%. By contrast, if he happens to receive an inheritance while being more than two years away from earning full benefits, he is not more likely to exit the labor market than a comparable individual who did not yet receive any inheritance. Some individuals suffer from a strong disutility from work. For them, receiving an inheritance is a way to finance their early retirement, as long as the cost of doing so is not too high.

So far we have only considered the possibility of instantaneous exit. The next question is whether the conclusions of this section hold true when also considering the possibility of delayed exit. It could very well be that some individuals who receive an inheritance when exit is costly wait until they have acquired their full rights to retire, or until they can unlock their pension. We therefore investigate whether inheritance receipt has a lagged effect on retirement. To do so, at any age a between 55 and 65, we compare the probability of labor market withdrawal

for individuals who inherited in the last two years and for those who will inherit in the next two years. The results of this regression are reported in column (4) of Table 4. As it happens, among individuals still employed at a certain age, the likelihood of exiting the labor market is similar for those who inherited in the past couple of years and for those who have not yet inherited. This suggests that inheritance receipt only has an instantaneous effect on retirement: if an individual chooses to keep on working during the year the inheritance is received, she will not be more likely to retire at any point in the future than if she had not received that inheritance. An interpretation of this could be that workers differ greatly in their attachment to the labor market. Some workers wish to cease their activity as soon as possible, and receiving an inheritance enables them to do so right away. Other workers have stronger ties to the labor market, and care little about whether they suddenly have the possibility to leave their job. A few year after the receipt of an inheritance, all workers of the first type have exited, leaving only workers of the second type in the sample.

6 Inheritance, retirement, and risk aversion

The previous sections have shown that the receipt of an inheritance has a substantial effect on labor market participation. At this stage, it is not entirely clear why that should be the case. Previous studies have highlighted the fact that, in a classical framework, inheritance receipt should have an impact on labor supply decisions only to the extent that inheritances are not anticipated. Intuitively, agents integrate the receipt of an inheritance in their intertemporal budget constraint, and choose their lifetime supply of labor, and in particular their date of retirement, accordingly. In the case where an individual receives exactly the amount that she expected to receive, her labor supply decisions should not be affected. In this context, only the part of an inheritance that exceeds individuals' expectations can be taken as an exogenous wealth shock, not the receipt of an inheritance in general.

However, in a related contribution, Brown, Coile, and Weisbenner (2010) found that this was not entirely true.[19] According to their estimates, individuals who receive an inheritance in line with their expectations are not less likely to exit the labor market than those who receive more than they expected. An interpretation of this result could be that individuals face some uncertainty about the amount that they will inherit, and therefore plan their lifetime labor supply according to the certainty equivalent of their inheritance rather than according to their

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[19]This point was also confirmed by Blau and Goodstein (2015).

14

expectations.[20] In this section, we take this idea one step further by building on a simple model of intertemporal labor supply, where agents are risk averse and bear the risk associated with their own inheritance. We show that, in this context, the receipt of an inheritance can have an impact on their date of retirement, even in the case where individuals receive exactly the amount that they expected, and that this impact is all the more important as individuals are risk averse. We then test and confirm this prediction using multiple measures of risk aversion available in our data.

6.1   A model of lifetime labor supply with inheritance and risk aversion

We present here intuitions and main results from the model developed in Appendix A. There exists several models that take into account optimal consumption and endogenous decision to withdraw from the labor market. Here, we introduce the dependence of the replacement rate of pension to the date of retirement to take into account the fact that pensions depend on the number of years of contribution. As far as we know, no theoretical model has been developed to analyze the effect of realized bequest (versus anticipated one) and how risk aversion shapes this effect on the decision of withdrawal. A model close to ours is Bloom, Canning, Mansfield, and Moore (2007) and Ljungqvist and Sargent (2012) (chapter 29, pp 1203-1208). We add pensions with an endogenous replacement rate, bequests, and we focus on the role of bequest and risk aversion.

The basic set up is the one of an agent who plans her optimal consumption path and withdrawal from the labor market. To do so, she maximizes her lifetime utility from the beginning of her working life t_0 to the age of death T:

$$\mathcal{U} = \int_{t_0}^{T} e^{-\delta(t-t_0)} u(c_t, R) dt$$

under the budget constraint

$$\int_{t_0}^{T} e^{-r(t-t_0)} c_t dt = \int_{t_0}^{R} e^{-r(t-t_0)} w dt + \int_{R}^{T} e^{-r(t-t_0)} \lambda(R) w dt + \tilde{B} + W_{t_0} \tag{3}$$

u is the instantaneous utility function. It depends on c_t, the level of consumption at time t, and on the date of retirement R. The date of retirement plays a direct role because of the disutility from working that is taken into account (cf. appendix A). δ is the discount factor, r the interest

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[20]Although this is mentioned by Brown, Coile, and Weisbenner (2010), it is not detailed in their paper.

rate, w is the wage and $\lambda(R)$ the replacement rate applied to wages to compute pensions. It depends on the age of retirement R. W_{t_0} stands for the non inherited assets at time t_0. $\tilde{B}$ is the actualized bequest that the agent expects to receive. It is uncertain because of uncertainty on the exact amount that will be received.[21] Since consumption and retirement date both depend on the uncertain amount of inheritance, the agent indeed maximizes $\mathbf{E}_{\tilde{B}}[\mathcal{U}(\tilde{B})]$.

We assume that the agent bears the risk of not receiving the exact expected amount. Risk aversion then plays an important role in the way she plans her future consumption path and retirement date. Facing uncertainty (and without liquidity constraints), risk-neutral agents base their budget constraint on the expected amount of bequest $\mathbf{E}(\tilde{B})$. Risk averse ones don't. Intuitively, the more risk averse an agent is, the smaller the amount taken into account in her budget constraint. In the extreme case of infinite risk aversion, an agent is expected to draw her plan as if she would not plan to receive any inheritance. By contrast, the less risk averse and the more risk neutral the agent is, the closer to the expectation of bequest the amount taken into account in her budget constraint. Under uncertainty, the expected lifetime utility of an agent $\mathbf{E}_{\tilde{B}}[\mathcal{U}(\tilde{B})]$ is lower than the one she would reach if she receives the guarantee bequest expectation $\mathcal{U}(\mathbf{E}(\tilde{B}))$. Indeed this expected lifetime utility corresponds to the utility of the so-called "certainty equivalent" of the expected amount B^{CE}.[22] Under uncertainty, the agent solves:

$$\max_{c,R} \mathbf{E}_{\tilde{B}}[\mathcal{U}(\tilde{B})] = \max_{c,R} \mathcal{U}(B^{CE}) \tag{4}$$

Let's recall that, for a risk averse agent, $B^{CE} < \mathbf{E}(\tilde{B})$, which means that the budget constraint is lower with risk aversion than what it would be for risk neutral agents.[23] When the received bequest is higher than the certainty equivalent, we show in appendix A that the agent adjusts her plan on consumption and labor force exit. Specifically, when the received amount is higher than the certainty equivalent, the agent decides to withdraw earlier than initially scheduled.

A first consequence of this simple set up concerns the receipt of the exact expected amount of bequest. Since for risk averse agents it is necessarily higher than the certainty equivalent

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[21]The uncertainty on the date of receipt may also play a role and be related to the uncertainty on amount. Several factors may be here at stake. If there are some liquidity constraints, an earlier bequest will unbind them and a later one maintain them longer than expected. The timing may also be related to the exact amount received: if parents consume their wealth, the sooner the date of receipt, the higher the amount received.

[22]By definition, B^{CE} is the guarantee value of bequest that equalizes the agent's utility with her utility under uncertainty (cf. for instance Laffont (1989)). The difference between $\mathcal{U}(\mathbf{E}(\tilde{B}))$ and $\mathcal{U}(B^{CE})$ depends on the level of risk aversion.

[23]Furthermore, using a bequest in an intertemporal budget constraint may imply some liquidity constraints. In this case, the agent would borrow less then her certainty equivalent amount, and we would still have that the bequest amount taken into account in the budget constraint is lower than the bequest expectation.

amount, it will bring forward the date of retirement. This result may shed a light on results by Brown, Coile, and Weisbenner (2010) and Blau and Goodstein (2015). They find that the receipt of the exact expected amount of bequest has a non-significant but positive effect on retirement. Their point estimate, though imprecise, turns out to have the same order of magnitude (even a bit higher) than the one obtained for the effect of an amount higher than expected. Our model may explain both this effect and the imprecision. This imprecision may then come from the heterogeneity of answers due to non-risk averse agents. For risk-neutral agents, there would be no effect and for risk-lover ones, there would be a negative effect.

A second consequence is that the more risk averse an agent is, the later she forecasts her retirement date. This is due to the fact that the amount of bequest taken into account in her budget constraint is lower than the one of a less risk averse agent (cf. appendix A). A third consequence is that the effect of the receipt of a bequest whose amount differs from the certainty equivalent will be higher for the most risk averse agents. It means for instance that when they receive an amount of bequest higher than the certainty equivalent amount, all agents will retire earlier, but the most risk averse ones are those who will advance the most their retirement date. We test and confirm empirically these last two predictions in the next section.

6.2 Risk aversion and the impact of inheritance receipt on retirement

In the context of the model presented in section 6.1, the impact of inheritance on labor market withdrawal should be more important for agents who are more risk averse, assuming that agents are bearing the risk associated with their own inheritance. We now test this prediction using multiple measures of risk aversion. In the EP waves that took place in 2004 and 2010, about half of the individuals were asked questions about their attitude towards risk. Individuals had to position themselves on a scale from 0 (very carefull individual) to 10 (person who likes to take risks), and were also presented with a simple lottery that we detail in Appendix C. These questions provide us with two measures of risk aversion, which we label respectively subjective risk aversion and lottery risk aversion. In addition, we use stock market participation as a third measure of risk aversion. We estimate a model similar to model (2), in which the inheritance indicator is interacted with an indicator of low or high risk aversion constructed from one of our three measures. The results of these estimations are reported in Table 5.

The Table first reveals that, for all three measures, inheritance receipt does not have a statistically significant impact on labor market exit for individuals with a low risk aversion. These individuals do not seem to be more likely to exit the labor market when they receive an

inheritance than individuals who inherit in the next few years. In contrast, for individuals with a high risk aversion, the impact of inheritance receipt on labor market withdrawal is significant, at least for the lottery and stock market participation measures. For each of these measures respectively, those individuals are about 68% and 73% more likely to exit the labor market when they receive an inheritance than individuals who will receive an inheritance in the next couple of years. Generally, for all three risk aversion measures, the point estimates reported in Table 5 are always lower for individuals with low risk aversion than for those with a high risk aversion.

A possible interpretation of these findings is that individuals plan their retirement according to the certainty equivalent of their inheritance rather than its expected value, as explained in section 6.1. In this context, the receipt of an inheritance is always associated with an exogenous wealth shock for risk averse individuals, even when they make perfect predictions on the size of their inheritance. This exogenous wealth shock leads individuals to exit the labor market earlier than they planed to.

7   Conclusion

In this paper, we take advantage of the fact that the timing of inheritance receipt generates an exogenous shift of the intertemporal budget constraint of the recipient. Comparing individuals who inherit in a given year with those who inherit in the next couple of years, we find that the receipt of an inheritance is associated with a strong increase in the probability of current labor market exit. This increase is higher when an individual happens to inherit in the few years before reaching full pension entitlement, when an early labor market exit is moderately costly. This suggests that many agents have a strong disutility for work, and contemplate leaving the labor market as soon as they can afford to do so, even when it is costly. Social security reforms that modify pension wealth induce changes in workers' assets that are very similar to the variations we use in this paper. Our results suggest that reforms affecting social security wealth may quickly influence individuals' retirement decisions, although the magnitude of these shifts might not be similar to our estimates based on private wealth, as there is evidence that individuals are sensitive to the type of wealth they hold (see e.g. Blau (2015)).

The receipt of an inheritance may alleviate an individual's intertemporal budget constraint for multiple reasons. Agents may face liquidity constraints and might not be able to borrow against a future inheritance, or they could be reluctant to draw future plans on their parents' death. An alternative explanation is that they face some uncertainty on when and how much they will

18

inherit. We build on a simple model of intertemporal labor supply in which agents bear the risk associated with their own inheritance to explore this specific channel. Risk averse individuals plan their retirement according to the certainty equivalent of their inheritance rather than its expected value. As a result, the receipt of an inheritance can have an impact on individuals' date of retirement, even when they received exactly the anticipated amounts. We find support for this explanation in our data.

Figures and Tables

Figure 1: Retirement probability by age and inheritance receipt
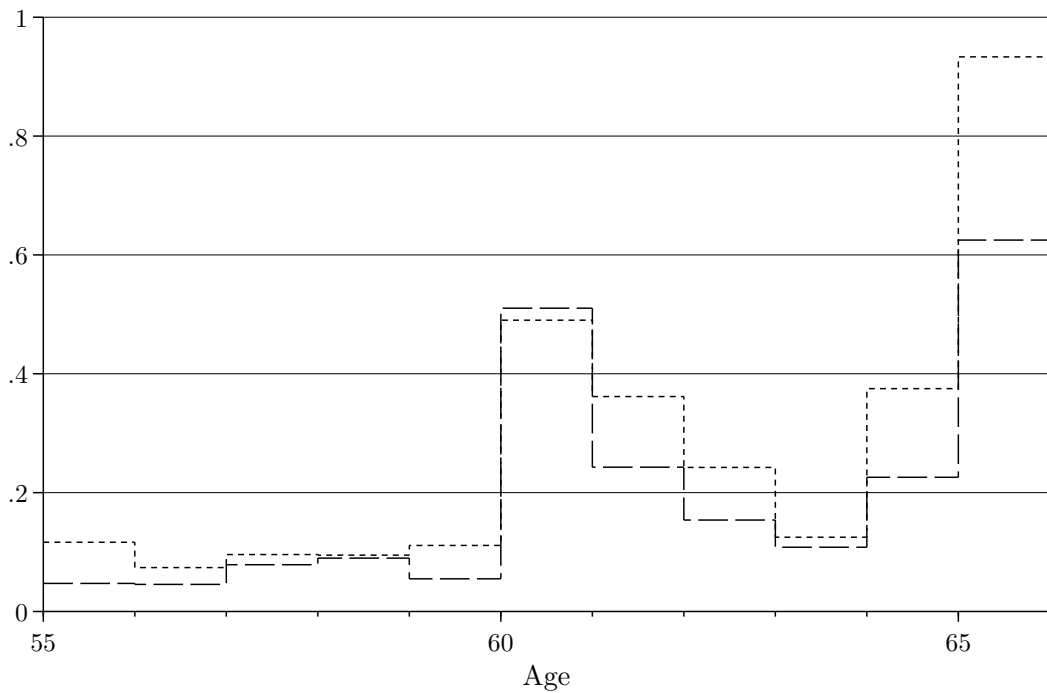
Table 1: Effect of inheritance receipt on instantaneous retirement

	2 years		Non heirs	
	(1)	(2)	(3)	(4)
Inheritance received at t	0.326***	0.328***	0.278***	0.333***
	(0.102)	(0.103)	(0.0785)	(0.0784)
Additional controls	No	Yes	No	Yes
Observations	2783	2783	72708	72708
Individuals	1225	1225	14337	14337

Note: the table shows the results of the estimation of a complementary log-log model, where a indicator of current labor force exit is regressed on an indicator of current inheritance receipt, and a full set of age dummies (11 levels, for ages 55 to 65). Controls in columns (2) and (4) include 3 SES levels, 3 relative diploma levels, a gender dummy, and an indicator of public / private sector. In columns (1) and (2), the sample is defined by keeping, at each age a, individuals who receive an inheritance between $[a, a+3[$. In columns (3) and (4), we keep all individuals. Standard errors clustered at the individual level are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels respectively.
Source: Enquête Patrimoine, Insee, 1998-2010.

Table 2: Effect of inheritance receipt on instantaneous retirement: some robustness checks

	2 years		Other controls		
	(1)	(2)	(3) 3 years	(4) 5 years	(5) 10 years
Inheritance received at t	0.328*** (0.103)		0.287*** (0.0979)	0.241*** (0.0915)	0.274*** (0.0876)
Received from parents		0.274** (0.112)			
Other		0.523** (0.244)			
Additional controls	Yes	Yes	Yes	Yes	Yes
Observations	2783	2783	3538	4901	7236
Individuals	1225	1225	1321	1528	1796

Note: the table shows the results of the estimation of a complementary log-log model, where a indicator of current labor force exit is regressed on an indicator of current inheritance receipt (columns 1, 3, 4 and 5) or an indicator that the individual is receiving the inheritance from (i) his parents or (ii) other individuals (column 2). All regressions include a full set of age dummies (11 levels, for ages 55 to 65), and controls for 3 SES levels, 3 relative diploma levels, a gender dummy, and an indicator of public / private sector. We also control for individuals' net worth in column (2). In columns (1) and (2), the sample is defined by keeping, at each age a, individuals who either receive an inheritance between $[a, a + 3[$. In columns (3), (4) and (5), we keep at each age individuals who receive and inheritance respectively between $[a, a+4[, [a, a+6[$, and $[a, a+11[$. Standard errors clustered at the individual level are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels respectively.
Source: Enquête Patrimoine, Insee, 1998-2010.

Table 3: Effect of inheritance receipt on instantaneous retirement for various demographic subgroups

	Education		Sex		SES	
	(1) Low	(2) High	(3) Men	(4) Women	(5) Low	(6) High
Inheritance received at t	0.547***	0.0846	0.344**	0.338**	0.413***	0.175
	(0.137)	(0.164)	(0.141)	(0.153)	(0.129)	(0.184)
Additional controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1502	1281	1489	1294	1680	1103
Individuals	674	551	658	567	749	476

Note: the table shows the results of the same regression as in the column (2) of Table 1 for various demographic subgroups. Specifically, columns (1) and (2) respectively investigate individuals below and above the median relative diploma, and colummns (3) and (4) concentrate on men / women. Columns (5) and (6) study respectively blue collar to middle-level workers, and executives. Standard errors clustered at the individual level are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels respectively.
Source: Enquête Patrimoine, Insee, 1998-2010.

Table 4: Retirement rights and the effect of inheritance receipt

	(1)	(2)	(3)	(4)
*Inheritance * age at t*				
Below 60	0.502***			
	(0.157)			
60 or above	0.200			
	(0.138)			
*Inheritance * contribution duration at t*				
Incomplete		0.256		
		(0.168)		
More than 2 years missing			-0.0454	
			(0.248)	
Less than 2 years missing			0.424**	
			(0.197)	
Complete		0.368***	0.368***	
		(0.132)	(0.132)	
Inheritance received before *t*				0.0192
				(0.0910)
Additional controls	Yes	Yes	Yes	Yes
Observations	2783	2783	2783	3714
Individuals	1225	1225	1225	1537

Note: columns (1) to (3) estimate the same model as in column (2) of Table 1. In column (1), the inheritance indicator is replaced by two dummies indicating current inheritance receipt while an individual is aged below / above 60. In column (2), the inheritance dummy is replaced by two indicators of current inheritance receipt while having (resp. not having) earned full retirement benefits (see appendix B for details). In column (3), the indicator for inheritance receipt while not having earned full benefits is further broken down in two separate indicators for current inheritance receipt while being more / less than two years away from full benefits. Colums (2) and (3) also include respectively 1 and 2 controls for contribution status. Column (4) reports the estimation of a similar model, where a retirement indicator is regressed on an indicator of inheritance receipt in the last two years (excluding the year of observation). For this regression, the sample comprises individuals who either inherited in the last two years, or in the next two years (but not in the year under consideration). Standard errors clustered at the individual level are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels respectively.
Source: Enquête Patrimoine, Insee, 1998-2010.

24

Table 5: Risk aversion and the effect of inheritance receipt on retirement

	(1) Subjective scale	(2) Lottery	(3) Owns stocks
*Inheritance * risk aversion*			
High	0.417	0.519**	0.546***
	(0.276)	(0.262)	(0.140)
Low	0.259	-0.0655	0.0929
	(0.362)	(0.501)	(0.152)
Additional controls	Yes	Yes	Yes
Observations	635	597	2783
Individuals	276	262	1225

Note: the table shows the results of the estimation of the same model as in Table 1, where the inheritance indicator is replaced by two dummies indicating current inheritance receipt for individuals with high / low risk aversion. In column (1), risk aversion is defined using a subjective scale from 0 to 10, in column (2) it is defined using a simple lottery described in appendix C, and in column (3) low risk aversion is proxied by an indicator for whether an individual own stocks. All regressions include a control for high risk aversion, and the individual's net worth. Standard errors clustered at the individual level are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels respectively.
Source: Enquête Patrimoine, Insee, 1998-2010.

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A A model with endogenous retirement, inheritance and risk aversion

Here we develop a simple model with endogenous retirement, inheritance and risk aversion. Conclusions from this model directly derives from the fact that the more risk-averse the agent is, the less amount of inheritance she takes into account in her budget contraint. The amount taken into account in the budget contraint is the uncertainty equivalent (*cf. infra.*). For a risk averse agent, it is always lower than the expect value. It is all the lower as the agent is risk averse. A first result is then that the more risk averse an agent is, the later she forecasts her retirement date. A second result is that, once the inheritance received, the difference between what she receives and the uncertainty equivalent she based her plan on, represents a windfall gain that modifies her budget contraint. This windfall gain is then all the larger as the agent is risk averse.

A.1 Set up

There exists several models that take into account optimal consumption and endogenous decision to withdraw for the labor market. We introduce the dependence of the replacement rate of pension to the date of retirement to take into account the fact that pensions depend on the number of years of contribution. Some models use a CRRA function but, as far a we know, none has been used to study the effect of realized bequest (versus anticipated one) and how risk aversion shapes this effect on the decision of withdrawal. A model close to ours is Bloom, Canning, Mansfield, and Moore (2007) and Ljungqvist and Sargent (2012) (chapter 29, pp 1203-1208). Computations for the Hamiltonian are directly derived from their models. We add pensions with an endogenous replacement rate, bequests and focus on the role of bequest and risk aversion. The agent utility fonction is given by:

$$\mathcal{U} = \int_{t_0}^{T} e^{-\delta(t-t_0)} u(c_t) dt \tag{5}$$

The beginning of the observation period is t_0. T stands for the age at death. We take into account disutility from work thanks to a constant term γ that does not depend on age. The instantaneous utility function is given by a standard CRRA utility function with $\alpha > 0$. I_t^w is an indicator whose value is 1 if the agent is working in time t and 0 otherwise (ie $I_t^w = \mathbb{1}_{(t<R)}$

where R stands for the time of withdrawal or retirement) .

$$u(c) \quad = \quad \frac{c^{1-\alpha}}{1-\alpha} - \gamma I_t^w$$

Such as

$$u(c) \quad = \quad \begin{cases} \frac{c^{1-\alpha}}{1-\alpha} - \gamma & \text{if she is working (with } \gamma > 0) \\ \frac{c^{1-\alpha}}{1-\alpha} & \text{if she is retired} \end{cases}$$

So:

$$\mathcal{U} \quad = \quad \int_{t_0}^T e^{-\delta(t-t_0)} \left(\frac{c_t^{1-\alpha}}{1-\alpha} - \gamma I_t^w \right) dt$$

Her budget constraint is:

$$\int_{t_0}^T e^{-r(t-t_0)} c_t dt \quad = \quad \int_{t_0}^T e^{-r(t-t_0)} w_t dt + \tilde{B} + W_{t_0}$$

$$= \quad \int_{t_0}^R e^{-r(t-t_0)} w dt + \int_R^T e^{-r(t-t_0)} \lambda(R) w dt + \tilde{B} + W_{t_0}$$

where W_{t_0} stands for the non inherited assets at time t_0, $w_t = w$ if the agent is working (w stands for the annual wage) while $w_t = \lambda(R)w$ if she is retired with $\lambda(R)$ is the replacement rate used to compute the pension. $\lambda(R)$ depends on the date when the retirement occurs.

$\tilde{B}$ is the present value of the expected bequest. It is uncertain because of uncertainty on the exact amount that will be received[24]. Since consumption and retirement date both depend on the amount of bequest through the budget constraint, the agent maximizes indeed $\mathbf{E}_{\tilde{B}}[\mathcal{U}(\tilde{B})]$.

We assume that the agent bears the risk of not receiving the exact expected amount. Risk aversion plays then an important role in the way she plans her future consumption path and retirement date. Facing uncertainty (and without liquidity constraints), risk-neutral agents base their budget constraint on the expected amount of bequest $\mathbf{E}_{\tilde{B}}$. Risk averse ones don't. Intuitively, the more risk averse an agent is, the smaller the amount taken into account in her budget constraint. In the extreme case of infinite risk aversion, an agent is expected to draw her plan

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[24]If the date of receipt t_B and the amount B received were perfectly known, the budget constraint would be: $\int_{t_0}^T e^{-r(t-t_0)} c_t dt = \int_{t_0}^T e^{-r(t-t_0)} w_t dt + e^{-r(t_B-t_0)} B + W_{t_0}$. We note $\tilde{B}$ the present value of the uncertain amount that takes into account both uncertainty on date and on amount. The uncertainty on the date of receipt may play a role and be related to the uncertainty on amount. Several factors may be here at stake. If there are some liquidity constraints, an earlier bequest will unbind them and a later one maintain them longer than expected. The timing may also be related with the exact amount received: if parents consume their wealth, the sooner the date of receipt, the higher the amount received.

as if she would not plan to received any bequest. On contrast, the less risk averse and the more risk neutral the agent is, the closer to the expectation of bequest the amount taken into account in her budget constraint.

Under uncertainty, the expected lifetime utility of an agent $\mathbf{E}_{\tilde{B}}[\mathcal{U}(\tilde{B})]$ is lower than the one she would reach if she receives the guarantee bequest expectation $\mathcal{U}(\mathbf{E}(\tilde{B}))$. Indeed this expected lifetime utility corresponds to the utility of the so-called "certainty equivalent" of the expected amount B^{CE}[25].

Under uncertainty, the agent solves:

$$\max_{c,R} \mathbf{E}_{\tilde{B}}[\mathcal{U}(\tilde{B})] = \max_{c,R} \mathcal{U}(B^{CE}) \tag{6}$$

Let's recall that, for a risk averse agent, $B^{CE} < \mathbf{E}(\tilde{B})$, which means that the budget constraint is lower with risk aversion than what it would be for risk neutral agents [26]. The budget constraint for this maximisation program thus writes:

$$
\begin{aligned}
\int_{t_0}^{T} e^{-r(t-t_0)} c_t dt &= \int_{t_0}^{T} e^{-r(t-t_0)} w_t dt + \tilde{B} + W_{t_0} \\
&= \int_{t_0}^{R} e^{-r(t-t_0)} w dt + \int_{R}^{T} e^{-r(t-t_0)} \lambda(R) w dt + B^{CE} + W_{t_0} \tag{7} \\
&= \int_{t_0}^{R} e^{-r(t-t_0)} w dt + \int_{R}^{T} e^{-r(t-t_0)} \lambda(R) w dt + A_{t_0} \tag{8}
\end{aligned}
$$

where A_t stands for assets at time t.

To write the Hamiltonian of the problem, we re-write the budget constraint as:

$$
\begin{aligned}
\frac{dA_t}{dt} &= w_t + rA_t - c_t \\
&= I_t^w w + (1 - I_t^w)\lambda(R)w + rA_t - c_t \\
&= I_t^w w(1 - \lambda(R)) + \lambda(R)w + rA_t - c_t
\end{aligned}
$$

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[25]By definition, B^{CE} is the guarantee value of bequest that equalizes the agent's utility with her utility under uncertainty. *Cf.* for instance Laffont (1989).

[26]Furthermore, using a bequest in an intertemporal budget constraint may imply some liquidity constraints. In this case, the agent would borrow less then her certainty equivalent amount, and we would still have that the bequest amount taken into account in the budget constraint is lower than the bequest expectation.

The Hamiltonian writes:

$$\mathcal{H}_t = e^{-\delta(t-t_0)}\big[\frac{c_t^{1-\alpha}}{1-\alpha} - I_t^w \gamma\big] + \mu_t[I_t^w(1-\lambda(R))w + \lambda(R)w + rA_t - c_t]$$

The first order conditions are:

$$\dot{\mu}_t = -\frac{\partial \mathcal{H}_t}{\partial A}$$
$$= -r\mu_t$$
$$\frac{\partial \mathcal{H}_t}{\partial c_t} = e^{-\delta(t-t_0)}u'(c_t) - \mu_t \qquad (9)$$
$$= 0$$

$$-e^{-\delta(t-t_0)}\gamma + \mu_t(1-\lambda(R))w \begin{cases} > 0 \text{ if } I_t^w = 1 \\ = 0 \text{ if indifferent to } I_t^w \in \{0;1\} \\ -e^{-\delta(t-t_0)}\gamma + \mu_t(1-\lambda(R))w < 0 \text{ if } I_t^w = 0 \end{cases} \qquad (10)$$

then we get the Euler equation[27]

$$\frac{\dot{c}_t}{c_t} = \frac{r-\delta}{\alpha}$$

To compute the level of consumption in c_t, we use the budget constraint 8.

---

[27]

$$\mu_t = e^{-\delta(t-t_0)}u'(c_t)$$
$$\dot{\mu}_t = -\delta\mu_t + \dot{c}_t e^{-\delta(t-t_0)}u''(c_t)$$
$$-r\mu_t = -\delta\mu_t + \dot{c}_t e^{-\delta(t-t_0)}u''(c_t)$$
$$(\delta - r)\mu_t = \dot{c}_t e^{-\delta(t-t_0)}u''(c_t)$$
$$(\delta - r)e^{-\delta(t-t_0)}u'(c_t) = \dot{c}_t e^{-\delta(t-t_0)}u''(c_t)$$
$$(\delta - r)u'(c_t) = \dot{c}_t u''(c_t)$$
$$\dot{c}_t = (\delta - r)\frac{u'(c_t)}{u''(c_t)}$$
$$\dot{c}_t = (\delta - r)\frac{c_t}{-\alpha}$$

$$\int_{t_0}^{T} e^{-r(t-t_0)} c_t dt = \frac{w}{r}[1 - e^{-r(R-t_0)}] + \lambda(R)\frac{w}{r}[e^{-r(R-t_0)} - e^{-r(T-t_0)}] + A_0 + B^{CE}$$

$$\frac{\alpha c_0}{r(1-\alpha) - \delta}[e^{\frac{r(1-\alpha)-\delta}{\alpha}(T-t_0)} - 1] = \frac{w}{r}([1 - e^{-r(R-t_0)}] + \lambda(R)[e^{-r(R-t_0)} - e^{-r(T-t_0)}]) + A_0 + B^{CE}$$

$$\frac{\alpha c_0}{r(1-\alpha) - \delta}[e^{\frac{r(1-\alpha)-\delta}{\alpha}(T-t_0)} - 1] = \Phi(A_0, B^{CE})$$

with $\Phi(A_0, B^{CE}) = \frac{w}{r}([1 - e^{-r(R-t_0)}] + \lambda(R)[e^{-r(R-t_0)} - e^{-r(T-t_0)}]) + A_0 + B^{CE}$.

Thus

$$c_0 = \frac{\delta - r(1-\alpha)}{\alpha[1 - e^{\frac{r(1-\alpha)-\delta}{\alpha}(T-t_0)}]}\Phi(A_0, B^{CE}) \tag{11}$$

It then implies $\delta - r(1-\alpha) > 0$.

From equation 10, the optimal age of retirement R is given by:

$$e^{-\delta(R-t_0)}u'(c_R)[1 - \lambda(R)]w = \gamma e^{-r(R-t_0)}$$

$$u'(c_R)[1 - \lambda(R)]w = \gamma e^{(\delta-r)(R-t_0)}$$

$$c_R^{-\alpha}[1 - \lambda(R)] = \frac{\gamma}{w}e^{(\delta-r)(R-t_0)}$$

$$e^{(\delta-r)(R-t_0)}c_0^{-\alpha}[1 - \lambda(R)] = \frac{\gamma}{w}e^{(\delta-r)(R-t_0)}$$

$$c_0^{-\alpha}[1 - \lambda(R)] = \frac{\gamma}{w}$$

$$c_0 = [\frac{1 - \lambda(R)}{\frac{\gamma}{w}}]^{\frac{1}{\alpha}} \tag{12}$$

And

$$c_t = e^{\frac{r-\delta}{\alpha}(t-t_0)}[\frac{1 - \lambda(R)}{\frac{\gamma}{w}}]^{\frac{1}{\alpha}} \tag{13}$$

A.2 How risk aversion plays a role

For the sake of clarity, from now we assume $r = \delta$. It leads to $c_t = c_0 = [\frac{1-\lambda(R)}{\frac{\gamma}{w}}]^{\frac{1}{\alpha}}\ \forall t \geq 0$. To get simple closed forms from our model, we set $r = 0$. At time t, equation 11 re-writes, using the superscript to explict the dependancy to B^{CE}:

$$(T-t)c_0^{CE} = w(R^{CE}-t)[1-\lambda(R^{CE})] + w(T-t)\lambda(R^{CE}) + A_t^{CE} \tag{14}$$

$$(T-t)c_0^{CE} = w(R^{CE}-t)[1-\lambda(R^{CE})] + w(T-t)\lambda(R^{CE}) + W_t^{CE} + B^{CE}$$

$$B^{CE} = (T-t)c_0^{CE} - w(R^{CE}-t)[1-\lambda(R^{CE})] - w(T-t)\lambda(R^{CE}) - W_t^{CE}$$

$$B^{CE} = (T-t)[\frac{1-\lambda(R^{CE})}{\frac{\gamma}{w}}]^{\frac{1}{\alpha}} - w(R^{CE}-t)[1-\lambda(R^{CE})] - w(T-t)\lambda(R^{CE}) - W_t^{CE}$$

$$B^{CE} = f(R^{CE})$$

The budget constraint above is the one consistent with a bequest B^{CE} and determines W_t^{CE}, the amount of non-inherited assets accumulated up to time t.

If at time t, the amount received turns out to be B, then the budget contraint moves to:

$$(T-t)c_0^B = w(R^B-t)[1-\lambda(R^B)] + w(T-t)\lambda(R^B) + A_t^{CE} \tag{15}$$

$$(T-t)c_0^B = w(R^B-t)[1-\lambda(R^B)] + w(T-t)\lambda(R^B) + W_t^{CE} + B$$

$$B = (T-t)[\frac{1-\lambda(R^B)}{\frac{\gamma}{w}}]^{\frac{1}{\alpha}} - w(R^B-t)[1-\lambda(R^B)] - w(T-t)\lambda(R^B) - W_t^{CE}$$

$$B = f(R^B)$$

and the agent can modify her consumption and date of retirement according to the windfall gain (or loss) $B - B^{CE}$.

f is a strictly decreasing function[28] and so is f^{-1}. Then, for any $B \geq B^{CE}$, $f^{-1}(B) \leq f^{-1}(B^{CE})$. It means that for any bequest received higher than the certainty equivalent amount, the agent will decide to withdraw earlier from the labor market.

Taking into account risk aversion leads to interesting results. If agent 1 si more risk averse than agent 2, by definition, $\mathcal{U}_1(\tilde{B}) \leq \mathcal{U}_2(\tilde{B})$, thus $\mathbf{E}\mathcal{U}_1(\tilde{B}) \leq \mathbf{E}\mathcal{U}_2(\tilde{B})$ and $B_{CE}^1 \leq B_{CE}^2$. Using the fact that f is decreasing: $R_{CE}^1 \geq R_{CE}^2$. This results has two strong implications. First, facing the same uncertainty, a risk averse agent will plan a later retirement. Second, since for any received bequest B, $R_{CE}^1 - R^B \geq R_{CE}^2 - R^B$. It means that the effect of a received inheritance will be higher for the most risk averse agents.

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[28]We model $\lambda(R) = \dot{\lambda}(R-R_0) + \lambda_0$. It is consistent with the French retirement system described in appendix B and with the fact that, in our age-window, individuals are old enough to be close to the age of retirement R_0 (generally 60) that enables to expect a replacement rate λ_0. $f'(R) = -\frac{w(T-t)\dot{\lambda}}{\alpha\gamma}[\frac{1-\lambda(R)}{\frac{\gamma}{w}}]^{\frac{1}{\alpha}-1} - w[1-\lambda(R)] - w\dot{\lambda}(T-R)$, so $f'(R) < 0$ because $\lambda(R) < 1$, $\dot{\lambda} > 0$ and $T \geq R$.

B Retirement in France

We describe here the main features of the French retirement system which we build on in the paper. In France, contributing to a public pension fund is mandatory, and in turn public pensions constitute most of the pension income of retired individuals.[29] For our period of analysis, the legal retirement age, that is the age at which it becomes possible for one to cash out her pension, is set at 60. The monthly pension for retired workers is then computed on the basis of both past wages and years contributed to the system. Specifically, it obeys the following formula:

$$p = \bar{w} \times \tau \times \rho$$
$$\tau = min(1, \frac{n}{n_0})$$
$$\lambda = \lambda_0 + d(n, n_0, a, a_0)$$

where $\bar{w}$ represents the base wage, τ represents the *pro rata* coefficient, and λ is the replacement rate that encompasses possible discounts or premiums. n is the number of years contributed to the system, and n_0 is fixed by the law.[30] λ_0 is the base replacement rate applicable to the individual, which is usually 50% (75% for public sector employees). d is a discount or premium term that depends on how the number of contributed years n compares to the legally set threshold n_0, and also on how the age a of the individual compares to the legally fixed age threshold a_0. It is increasing in n, positive if $n \geq n_0$ and negative if $n \leq n_0$, but cannot be negative if $a \geq a_0$ (in other words, discounts do not apply after a_0, but potential premiums still apply). For example the current law specifies that $d(n, n_0) = 0.05 * (n - n_0)$ with $|d| \leq 0.25$, that is a 5% discount per year missing limited to 25% off, or a 5% premium per additional year limited to a 25% increase. This makes discounts and premiums far from negligible, since retiring 5 years earlier than the legal threshold n_0 cuts one's pension by at least half. Of particular interest is the legal number of contribution years n_0, and in particular whether the number of contributed years n of an individual is above or below that threshold. When $n \geq n_0$, $\tau = 1$ so the pension gains of working one additional year only work through λ. On the other hand when $n \leq n_0$, the pension gains of working one additional year can be substantial because the additional year increases both τ

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[29]In addition, private sector employees must contribute to complementary pension funds, which rules are different from that of main public funds. However they follow the same patterns of premiums and discounts as public pensions, so that the conclusions of this paragraph still apply.

[30]The number of years contributed is technically different from the number of years worked. For example dispositions exist which enable women who stopped working to raise children to have a part of this time lapse counted as contribution years even though they were not working nor paying retirement contributions. Using all available information, we do our best to account for these special cases in the data.

and λ. Overall, an individual has more to lose if she retires before having completed the legal number of contribution years n_0.[31] In the data, we are able to reconstitute the number of years an individual has contributed to the pension system using retrospective calendars. The calendars contain information on periods of activity, as well as on periods of unemployment and military service, both of which are taken into account when computing the total number of contribution years.

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[31]This all the more significant as the premium was only progressively introduced in 2003, and therefore only concerns a small part of our sample. Most of the time, there is very little incentive to work past the legal number of contribution years, whereas there are considerable incentives to work up to having contributed n_0 years.

C   Measures of risk aversion

In the EP waves of 2004 and 2010, a fraction of the respondents were asked questions relative to their perception of risk. In particular, they were successively made to choose between to of the following contracts, ordered from safer to riskier:

- Contract A: yields w with certainty

- Contract B: yields $2w$ with a 50% chance, and $\frac{4}{5}w$ with a 50% chance

- Contract C: yields $2w$ with a 50% chance, and $\frac{2}{3}w$ with a 50% chance

- Contract D: yields $2w$ with a 50% chance, and $\frac{1}{2}w$ with a 50% chance

First, respondents were asked to choose between A and C. If they chose A, then they were asked to choose between A and B; otherwise, they were asked to choose between A and D. This experiment allows us to classify individuals among four levels of risk aversion, from most risk averse to least risk averse:

- $A \succ B$: 70% of individuals

- $B \succ A \succ C$: 16% of individuals

- $C \succ A \succ D$: 9% of individuals

- $D \succ A$: 5% of individuals

Individuals with a high risk aversion are those from the first category, and individuals with a low risk aversion are those from any of the other three categories.

D Further results

Table 6: Effect of inheritance receipt on instantaneous retirement, without the unemployed

	2 years		Non heirs	
	(1)	(2)	(3)	(4)
Inheritance received at t	0.373***	0.369***	0.280***	0.342***
	(0.107)	(0.107)	(0.0805)	(0.0805)
Additional controls	No	Yes	No	Yes
Observations	2576	2576	65978	65978
Individuals	1143	1143	13459	13459

Note: the table replicates Table 1, but excluding unemployed individuals from the sample. Standard errors clustered at the individual level are reported in parentheses. *, **, *** denote significance at the 10%, 5%, and 1% levels respectively.
Source: Enquête Patrimoine, Insee, 1998-2010.

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