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The Size and Composition of Wealth Holdings in the United States, Italy, and the Netherlands

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DRU-2767-DOL

March 2002

Prepared for the Department of Labor

Labor & Population Program

Acknowledgements

This report benefited greatly from the expert input of Rob Alessie and Luigi Guiso throughout the course of the conceptualization and analysis. We are also very grateful to Nicholas Souleles for his thoughtful comments and to Francesca Carrieri for her generous help. We thank Delia Bugliari for her excellent research support.

This project was funded by the Department of Labor, Pension and Welfare Benefits Administration, under Contract J-9-P-7-0045. We thank Patricia Willis for her encouragement and support.

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1. Introduction

This document reports on retirement saving and portfolio choice in the United States, Italy, and the Netherlands. In addition to relying on public retirement provisions, households prepare for retirement through tax-sheltered and after-tax savings. They may invest these funds in a wide variety of assets, including housing, stocks, bonds, savings accounts, etc. These asset types differ in their risk, return, and liquidity characteristics as well as in their fiscal treatment. As explained in Section 2, economic theory postulates that households allocate their portfolios according to their risk aversion, time horizon, uncertain out-of-pocket medical expenditures, income risk, informal (family) risk sharing arrangements, etc. While the literature has tested various parts of the theory, both testing and quantification of the theory are hampered by the fact that some of the major variables do not exhibit sufficient variation within a country to establish their relative importance for portfolio choice, or, more generally, for retirement saving and investment.

Portfolio allocation behavior is important for a number of reasons (Bertaut and Starr-McCluer, 2000):

- Returns vary across asset types, so portfolio composition has important implications for the pace of wealth accumulation and the degree of retirement preparedness;
- Risks vary across asset types, so portfolio composition has important implications for the distribution of retirement income;
- Portfolio decisions illuminate how tax policy affects household spending and saving;
- Portfolio decisions illuminate how macro variables (interest rates, stock prices, inflation, unemployment) affect household spending and saving;
- Understanding households' portfolio decisions may provide deeper insight into theories of consumption and saving behavior.

This report is organized as follows. Section 2 reviews the literature on the size and composition of the wealth holdings of the (nearly) retired. Section 3 compares and contrasts the legal and institutional environments of the three countries under study. Section 4 briefly describes the microdata that we use to study saving and allocation decisions. Section 5 draws together the findings from the literature review and the description of institutional arrangements to formulate a number of hypotheses about expected patterns in the micro-data from the different countries. Section 6 presents the empirical analysis with particular emphasis on the evidence in favor or (or against) the hypotheses formulated in Section 5. Section 7 concludes with a brief evaluation of the results and a sketch of possible future work.

2. Literature Review

To discuss the size and composition of wealth holdings of households near and after retirement, it is useful to first sketch a general framework. The dominant economic framework to study retirement savings is the life cycle hypothesis (LCH) formulated by Modigliani and Blumberg (1954). We therefore begin with a very brief sketch of the LCH. We then discuss a number of issues that fit well within the LCH framework or that can be viewed as extensions of or deviations from the underlying theoretical notions.

2.1. The Life Cycle Hypothesis

The basic tenet of the LCH is that rational consumers will try to smooth consumption over the life cycle in such a way that the marginal utility of consumption is equalized across periods. Since individuals usually have a life cycle income pattern that is inversely U-shaped (at young ages, earnings are modest but grow until roughly retirement, after which income declines), the life cycle pattern of wealth is also inversely U-shaped. In its simplest form, sometimes referred to as a 'stripped-down' version (Browning and Lusardi, 1996), the LCH fails to explain several well-known facts. Several extensions have therefore been introduced. These include the incorporation of uncertainty, bequest motives, borrowing constraints, precautionary motives, transaction costs associated with the reshuffling of portfolios, taxes, and lack of financial sophistication.

We discuss several of these extensions below, in so far as they shed light on the portfolios of the retired.

2.2. Income Profiles, Unanticipated Shocks, and Bequest Motives

It is instructive to consider the effect of income paths before and after retirement on wealth accumulation according to the LCH.[1] To illustrate, we take a simple version of the LCH with time preference rates equal to the interest rate, a constant household composition, no uncertainty, no bequest motives, and no liquidity constraints. Consumers live until they are 85 years old (which is also known with certainty). In that case the optimal consumption profile over one's life is flat, i.e., one should plan to spend the same amount of money each period. This amount should be chosen in such a way that wealth is zero at the time of death.

[1] The examples below are similar to illustrations by Bernheim, Skinner, Weinberg (2001).

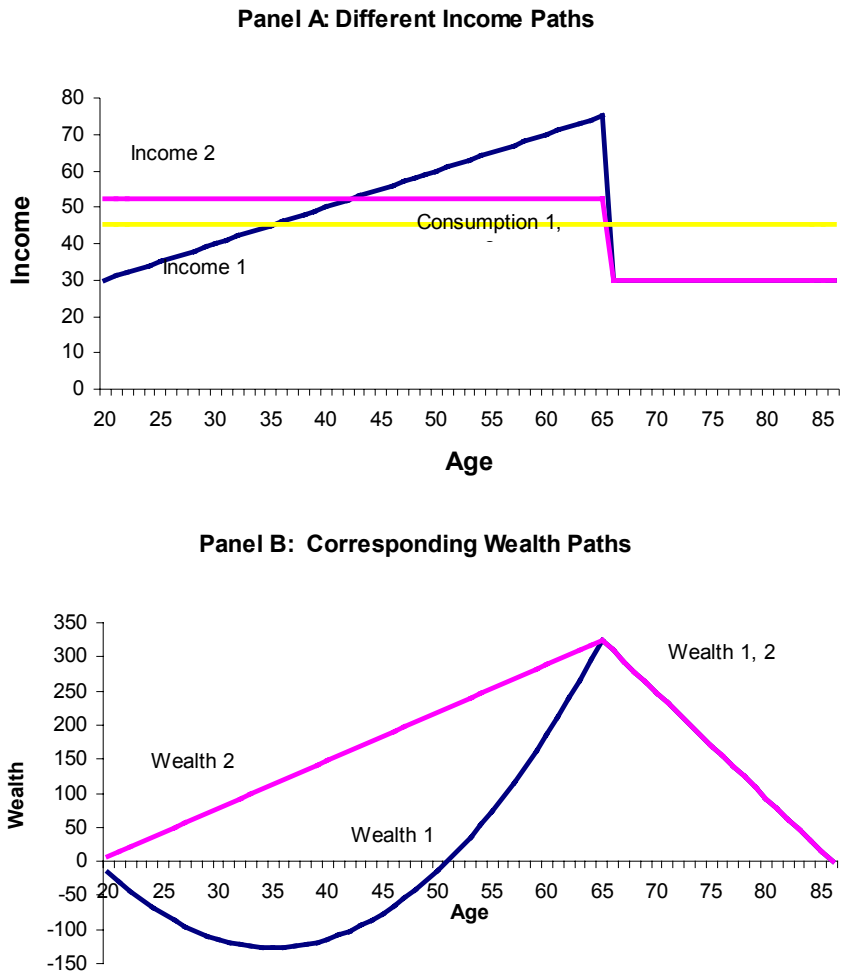

Figure 1. Different Income and Wealth Paths

Figure 1 illustrates the implications for saving and wealth accumulation for the two different income paths. The income paths have been chosen in such a way that lifetime resources are equal, so that they both imply the same consumption level. Figure 1b illustrates that the implications for saving, and hence wealth accumulation, are very different. The first income path ("income 1") starts below the consumption level and increases monotonically until age 65. The individual retires at age 65 and has a constant annuity income thereafter. As a result, wealth ("wealth 1" in Figure 1b) initially falls to negative levels and then increases. After retirement, wealth is drawn down gradually to exactly zero at the end of life. The second income path is always above the consumption level, so under this scenario wealth ("wealth 2" in Figure 1b) is always positive. Thus, before retirement, wealth for the first income path is always lower than for the second income path. Given that we have chosen the same annuity income after retirement for both scenarios, wealth at retirement age is exactly equal in both cases. In general, of course, that does not have to be true.

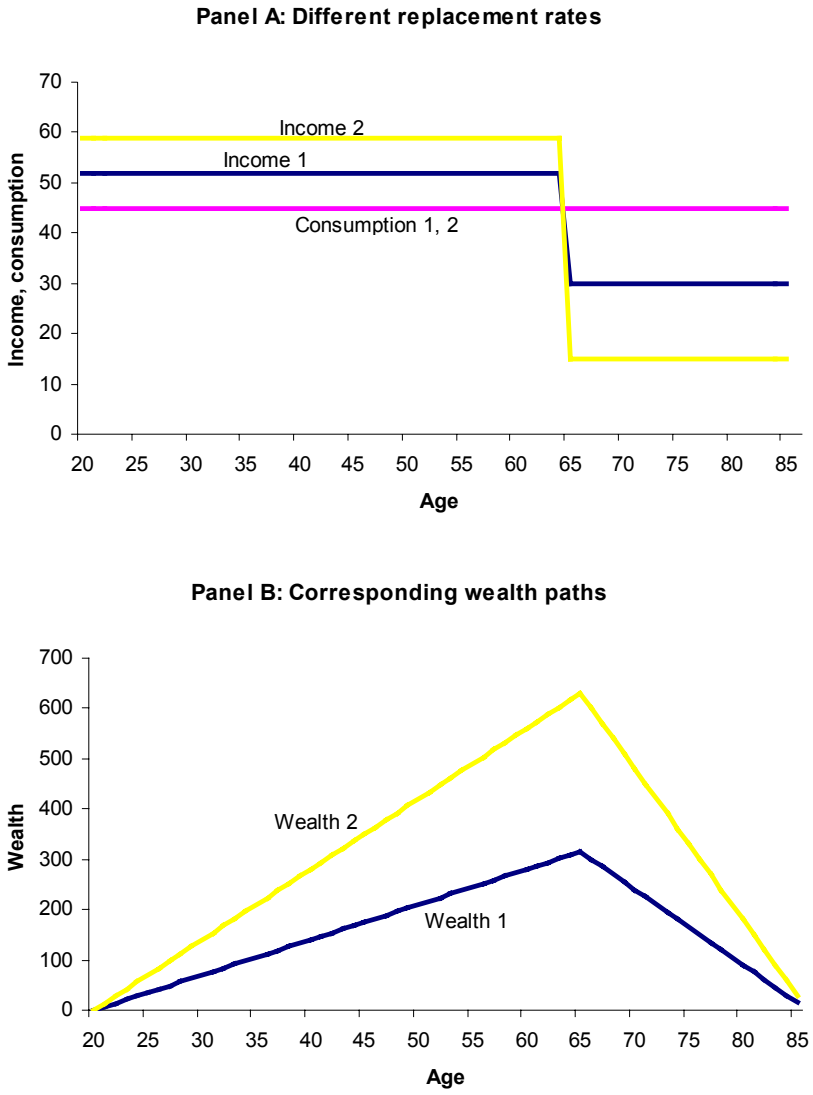

Figure 2. Income and Wealth Paths under Different Replacement Rates

Figure 2 illustrates a case with different levels of retirement annuity incomes. Again, we consider a case where total lifetime resources are identical across two different scenarios, so that consumption is the same for both cases. Clearly, the income path with the less generous retirement income leads to more wealth accumulation. Thus, the theory in its simple form would imply that those households with relatively meager pension provisions would save the most.

In the simple framework considered so far, there is no room for taste differences. All consumers will choose a flat consumption profile. The simplest way to allow for differences in tastes for saving across households is to allow for differences in bequest motives. Figure 3 illustrates the point. The person with the strongest bequest motive saves the most (and consumes the least), even though both have identical income paths.

Figure 3. Income and Wealth Paths under Different Bequest Motives

A somewhat more satisfactory way of introducing heterogeneity of tastes is to allow for differences in patience across consumers. The more patient a consumer is (the lower his time preference rate), the higher the growth of consumption will be. Figure 4 illustrates this for two consumers. The more patient consumer will save more in the beginning of his life and then spend it later. In Figure 4a his consumption ("consumption 1") is below income until retirement; after retirement consumption is higher than income and saving turns negative. For the less patient consumer the converse holds. His saving is negative until age 42 (income is lower than consumption). Saving turns positive after age 42 until retirement age. After retirement age, saving is negative for a short period and then turns positive again. In this example, the wealth of the less patient consumer is always negative ("wealth2" in Figure 4b). The examples in Figure 4 do not only illustrate the role of impatience, but also the joint role of consumption and income in determining the

life cycle path of private wealth. The often cited "stylized fact" that wealth would exhibit a hump-shaped relation with age, is true for the patient consumer, but not for the impatient consumer.

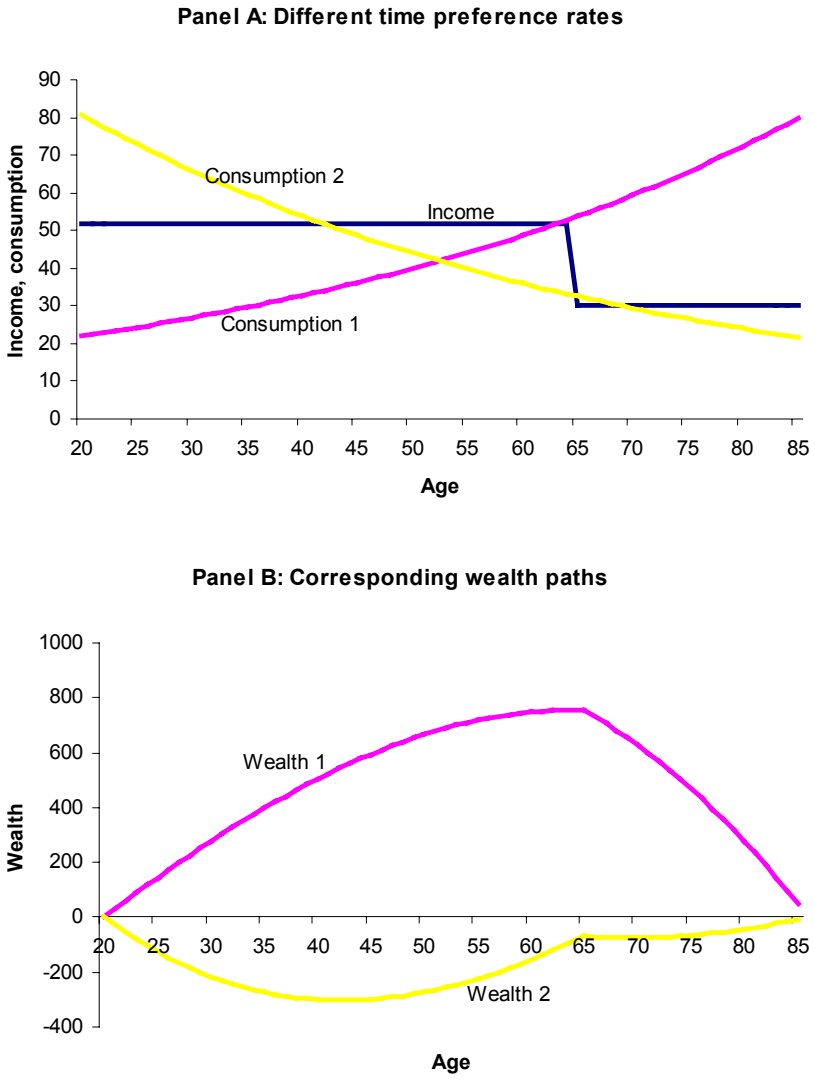

Figure 4. Income and Wealth Paths Under Different Time Preference Rates

Uncertainty will be discussed more extensively below. Here, it is worth noticing the effect of unanticipated adverse (permanent) shocks in income (e.g., due to a lay-off) or in expenditures (e.g., the costs of a serious illness). Figure 5 illustrates how an unanticipated income shock affects both consumption and the amount of wealth one will have accumulated at retirement. In the figure we compare the first income path of Figure 1 with an income path that unexpectedly falls to a lower trajectory at age 35. Due to the fall in income, the consumer has to revise consumption ("consumption 2") downward. Nevertheless, wealth accumulation is affected severely ("wealth 2" in Figure 5b) and as a

result the adverse income shock causes the consumer to arrive at retirement with considerably less wealth than originally planned.

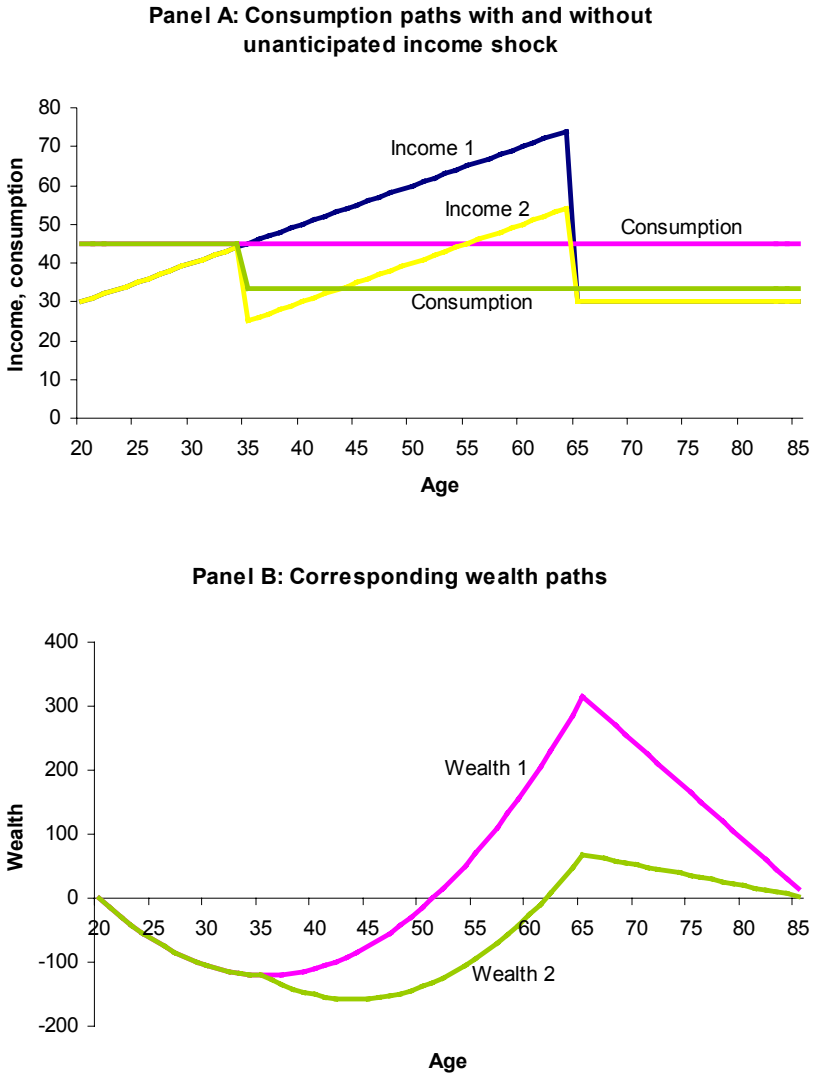

Figure 5. Income and Wealth Paths With and Without Unanticipated Income Shock

In all the scenarios considered so far, consumption is smooth around retirement. That is, we don't see any sharp changes in expenditures around retirement. This is due to the forward-looking nature of the LCH. If one anticipates when to retire, one can plan adequately and hence maintain a smooth consumption path. Empirical research in the U.S. and the U.K. raises serious doubt about the validity of this implication of the LCH. See e.g., Bernheim, Skinner, Weinberg (2001); Hamermesh (1984); Mariger (1987); Robb and Burbridge (1989); Banks, Blundell, Tanner (1998). See also below.

2.3. Retirement Saving Plans

The sketch of the simple LCH in the preceding section rests heavily on consumers being rational and forward looking. Making consumption and saving plans requires efforts on the part of the consumer, including the acquisition and processing of information. Lusardi (2000) uses information from the 1992 wave of the Health and Retirement Study (HRS) to shed some light on the extent to which individuals are informed about their income sources after retirement and the amount of planning they do for retirement. She exploits a question that asks how much respondents have thought about retirement: "a lot", "some", "little", or "hardly at all". It turns out that only about 30 percent of the respondents report to have thought "a lot" about retirement, whereas 32 percent have thought "hardly at all" about retirement. Given the ages of the respondents (between 51 and 61), this is rather remarkable. She finds that people who have not thought a lot about retirement are more likely to have less education and score lower on various cognitive tests. It turns out that, even controlling for a host of other factors, people who have thought less about retirement have lower net wealth and are less likely to own stocks.

Other evidence indicates that many people are poorly informed about their Social Security and pension benefits (Gustman and Steinmeier, 1999). As a result, income in retirement often comes as an unpleasant surprise and may lead to substantial cuts in consumption, as documented above. Lusardi (2000) cross-tabulates for retirees the extent to which people had thought about retirement and how retirement turned out to be. Retirement appears much less likely to be "satisfying" the less people had thought about retirement before actually retiring.

Hurd and Zissimopoulos (2000) consider the planning aspect from a somewhat different angle. They use HRS Wave 3 (1996) and consider questions about saving behavior and saving outcomes. The saving behavior questions ask when one started saving for retirement, whether one has saved enough for retirement (73 percent say "too little" and 26 percent say saving was "about right"), and whether one plans to do more saving for retirement in the future. They also use questions about whether households anticipate being able to maintain their current living standards after retirement (64 percent say "yes"). Asked for the reason why a household did not save enough, the most frequently given answer is low or insufficient income. In the context of the LCH this answer cannot be rationalized, since the model assumes that people will make forward looking plans given the level of resources available, be they low or high. Hurd and Zissimopoulos consider the possibility that rather than income being low, it is income growth that has been disappointing for a number of respondents. Indeed they find that among those who say that their saving was too little, income growth between Waves 1 and 3 of the HRS is considerably less than among those who say that their saving was adequate (10 percent versus 25 percent). They also find that respondents who had experienced considerable losses in the past (associated with health expenses or job loss, for instance) were much more likely to report that their retirement savings had been inadequate (cf. Figure 5).

Altogether, the analysis by Hurd and Zissimopoulos (2000) is more benign to the LCH than Lusardi (2000) in the sense that they are better able to interpret the variation in savings adequacy by factors that would explain lower savings in a LCH framework. However, they also find strong persistence in saving behavior, in that those who have saved more in the past (and have reported to have saved enough for retirement) are considerably more likely to keep saving than those who did not save enough in the past. This persistence is difficult to explain in an LCH context.

Overall, the evidence (partly surveyed by Lusardi, 2000) appears to indicate that there is substantial heterogeneity in the amount of planning consumers do for retirement. The planning effort varies by education and cognitive capabilities. There definitely is room for further informational provision to consumers about their financial retirement options, and for assistance with the design of a coherent plan. Generally, financial education may be expected to contribute to more saving (Bernheim, Garrett, Maki, 2001).

2.4. Precaution and Liquidity Constraints

In its simplest form, the introduction of uncertainty leads to a straightforward extension of the LCH. Consumers still want to equalize the marginal utility of consumption across periods, but since they cannot control or foresee the future perfectly, they can now only equalize marginal utility in expectation. If in each period, the world would turn out to be exactly as expected, the expectation would be realized perfectly and we would be back in the world illustrated by, for instance, Figure 1. However, expectations are generally not realized exactly and on the basis of new information one has to re-optimize. An example was discussed above with respect to Figure 5a, where an unanticipated adverse income shock led to a revision of the consumer's expected income path over the life cycle, which in turn led to a fall in consumption and a new trajectory for saving and wealth. Clearly, consumers would like to guard themselves against unpleasant surprises, such as illustrated in Figure 5a. An obvious strategy to do this is to save more as a matter of precaution. A vast literature has developed this so-called "precautionary saving motive".

The extent to which consumers increase their saving when facing future risk is governed by "prudence" (Kimball, 1990; Gollier, 2001). By definition, a consumer is prudent if adding a zero-mean risk to her future wealth raises her optimal saving. An example of a zero-mean risk would be one where a consumer's next year's endowment has an equal probability of being higher or lower with respect to a baseline by, say, $1,000. Whether a consumer is prudent depends on her preferences.[2] Consumers may not be prudent, and hence will decrease saving if we make future financial resources more risky. Although the name might suggest it, prudence is not related one-to-one to risk aversion, as will become clearer below.[3]

[2] To be precise, a necessary and sufficient condition for prudence is that an agent's marginal utility of future consumption is convex (Gollier, 2001, Proposition 60).

[3] This does not mean that there is no relation, but only that one cannot infer one from the other without additional assumptions; for instance, if preferences exhibit constant relative risk aversion, then (relative) prudence is equal to (relative) risk aversion + 1 and is essentially identified by the relative risk aversion.

While there is no logical reason why consumers would have to increase saving in the face of increased future uncertainty, empirical work suggests that generally an increase in risk leads to more saving, although the estimated sizes of precautionary saving vary considerably across studies. See for instance, Dynan (1993), Guiso, Jappelli, Terlizesse (1992), Lusardi (1997), Hubbard, Skinner, and Zeldes (1994a, 1994b, 1995), Banks, Blundell, and Brugiavini (2001).

Liquidity constraints can take various forms. The simplest form is a ceiling on the amount of money one can borrow. In many instances such a ceiling is not cast in stone and if one is willing to pay higher interest on the money borrowed, it is possible to increase the loan amount. More generally, the term "liquidity constraint" refers to the fact that borrowing rates are higher than lending rates. Liquidity constraints induce extra saving[4] in several ways. The most straightforward case is where in a given period one would like to borrow, but cannot do so because of insufficient collateral or insufficient prospects of being able to pay back a loan in the future. However, even if a constraint is not binding in a given period (i.e., income is higher than planned expenditures), the fact that one may face liquidity constraints in the future may increase saving in the current period. In particular, liquidity constraints interact with income uncertainty since it increases the probability that adverse income shocks may necessitate the need to borrow in some future period.

The intuitive effect of liquidity constraints is that it shortens one's time horizon. Without liquidity constraints, the consumption effects of an adverse income shock in a given period may be spread out over many periods by borrowing money to pay for consumption in a given period and then reducing consumption in all subsequent periods by a little bit, rather than immediately cutting consumption by the total shortfall in income. This mechanism is known as time diversification and tends to reduce risk aversion (e.g., Gollier, 2001). If liquidity constraints are binding, the possibility to spread out the consumption shortfall over many periods is absent, or at least more limited, and this acts as a shortening of the time horizon with a resulting increase in risk aversion. The only way to reduce the risk of such a forced reduction in consumption is to save more. Savings then act as a "buffer stock" (Deaton, 1991; Carroll, 1992, 1997). Thus, liquidity constraints increase saving, even if they are not binding in the current period.

2.5. Portfolio Composition and Saving

Commonly in economic models, consumers are assumed to be risk-averse. That is, whenever a consumer is given a choice between a fixed amount of money and a gamble with expected payoff equal to the fixed amount, she will prefer the fixed amount. For example, a risk-averse consumer will always prefer to receive $1,000 for certain to a gamble that pays out $2,000 with probability one half and nothing with probability one

More generally, it is related in the sense that if absolute risk aversion is decreasing in wealth, then consumers are prudent. These terms will be defined more precisely below.

[4] Or reduce negative saving.

half. As a result of this, a risk-averse consumer will only be willing to invest some of her savings in a risky asset if the expected return of the risky asset is higher than of a riskless asset. The extent to which an individual is willing to invest in risky assets is determined by this individual's risk aversion. The literature distinguishes several measures of risk aversion, including coefficients of absolute and relative risk aversion. For the current discussion, the exact definitions of these risk aversion measures are of no great consequence.[5] If a risky asset is available with an expected return larger than of an available riskless asset (e.g., putting money in a savings account), the standard theory predicts that an individual will always put some money into the risky asset. How much is put in the risky asset is a function of the risk aversion of the individual: the more risk-averse the agent is, the less she will put in the risky asset.

Since risky assets on average have a higher rate of return (otherwise risk-averse agents would never buy them), it is of interest to know which people have the lowest risk aversion (or equivalently the highest risk tolerance, the inverse of risk aversion), as, on average, these are the people that will realize the highest return on their investment portfolio. On the other hand, even though the average return on risky portfolios is higher, this of course does not carry over to every individual portfolio and the higher riskiness implies a higher dispersion in outcomes than for less risky portfolios.

One "stylized fact" is that people with more wealth own more risky assets (e.g., stocks). See e.g., Hochgürtel (1998), Barsky et al. (1997), Carroll (2001), Hurd (2001). Under reasonable assumptions on the form of the utility function, this is indeed predicted by the theory. The theory predicts that for risk-averse consumers an increase in wealth increases the amount of stocks if individuals have decreasing absolute risk aversion. However, following an increase in wealth, the share of risky assets may or may not increase. For the share to increase, relative risk aversion must decrease with wealth. The usual assumption is that it is constant, and thus the portfolio share should be independent of wealth. Empirically, the evidence is not clear-cut: evidence on relative risk aversion sometimes points at an increasing relationship to wealth (for example, Guiso and Paiella, 2001); correlations between portfolio shares of risky assets and wealth are sometimes positive, consistent with decreasing relative risk aversion. However, a positive correlation between a risky asset portfolio share and wealth may also arise because of fixed portfolio management costs. Altogether, the relation between theory and the share of risky assets in total wealth is not yet clear-cut.

Given that we are interested in the size and composition of portfolios with which people reach retirement age, the natural context in which to consider risk aversion is intertemporal. That is, one should consider investments with an eye on their contribution to the financial resources at retirement. The first implication of that viewpoint is that young people should invest in a more risky way than older people. This is due to time diversification, i.e., the possibility for younger people to spread out any bad investment

[5] Formally, a utility function exhibits risk aversion if the function is concave. The degree of absolute risk aversion is defined as minus the ratio of the second derivative of the utility function and the first derivative. If we multiply this quantity by the argument of the utility function we obtain the degree of relative risk aversion.

outcome over a longer period of their life. This supports the usual advice by financial planners to reduce exposure to risk when one gets older.

Another consequence of using an intertemporal framework is that we have to consider saving and investment decisions jointly. Consider a case where an individual can divide savings into riskless and risky assets (with higher expected return than the riskless asset). Will this individual save more than if only a riskless asset were available? This is relevant to assess the effects on saving decisions of financial innovation, such as the addition of new instruments. The answer depends on the structure of the individual's preferences, and in particular on this individual's prudence and risk aversion. If her prudence is sufficiently large relative to her risk aversion, the presence of a risky asset will increase saving. If not, the availability of a risky asset will reduce saving.[6]

To understand this result, recall that if a risky asset is available, an agent will always invest something in it. By investing something in the risky asset the total expected return on assets increases. In itself, the increase of resources in the future due to the higher expected return of the investment in the risky asset will lead to a fall in saving in the current period. However, also recall that precaution leads to more saving currently if uncertainty about the future goes up. The investment in the risky asset does exactly that: It increases uncertainty about the future. Whether the increase in current saving as a result of increasing future uncertainty dominates the fall in current saving as a result of the higher expected lifetime resources depends not only on the strength of the precautionary motive, but also on how much is invested in the risky asset. The more risk-averse the individual is, the smaller the amount she will invest in a risky asset. Thus, in the case of high risk aversion and small precaution, the investment in a risky asset will be modest with little effect on the amount of precautionary saving. Hence, current saving will fall as a result of higher expected future resources. In the opposite case of a strong precautionary motive and low risk aversion, a considerable amount will be invested in the risky asset; this increases uncertainty considerably and through a strong precautionary motive, this will lead to positive effect on current saving that dominates the negative effect caused by the increase in expected lifetime resources.

Which effect dominates empirically is a somewhat undecided issue, but under plausible assumptions about individual utility functions, it appears likely that the introduction of risky assets will decrease saving.

Of course, investment risk is not the only risk that affects consumption possibilities. Different people are exposed to different amounts and different kinds of risk and one would expect this to affect an individual's investment portfolio. Intuitively, one might think that when one is exposed to risk in one dimension, one becomes more averse to risk in another dimension. For instance, other things being equal, an individual with a very uncertain income may want to invest in a safer portfolio than someone whose income is virtually guaranteed. It turns out that such an effect of "background risk" on risk aversion will only hold if preferences satisfy certain logical conditions (Kimball, 1993;

[6] Saving will increase if and only if the degree of absolute prudence is larger than twice the degree of absolute risk aversion. See Gollier (2001).

Gollier and Pratt, 1996; Gollier, 2001). Empirical work by Guiso, Jappelli, Terlizesse (1996) indicates that the presence of background risk lowers the willingness of households to hold risky assets. Similarly, Haliassos and Bertaut (1995) find that people in risky occupations are less likely to hold stocks. Using a self-reported measure of risk aversion, Guiso and Paiella (2001) find that the presence of background risk increases measured risk aversion. Thus, we tentatively conclude that individual preferences do satisfy the logical conditions for an increase in background risk to increase risk aversion.

As noted above, the presence of liquidity constraints works as if risk aversion increases. Guiso, Jappelli, Terlizesse (1996) indeed find some evidence that the presence of liquidity constraints reduces the demand for risky assets. Liquidity constraints may also have other implications for portfolio choice. For instance, if an individual faces borrowing ceilings this may induce her to hold more assets in liquid form than she would otherwise (Paxson, 1990).

Recall that if a risky asset (that pays a premium) is offered, a consumer will always invest something in it. This statement can be generalized to the case where one can choose from a whole array of risky assets. Unless the returns on these assets are perfectly correlated, an investor should have a portfolio that has at least a little of each. Of all the predictions of the theory, this is probably the one that is most clearly false. For example, a majority of households does not own any stock. One can think of various reasons why portfolios are incomplete, i.e., do not contain all assets. Haliassos and Bertaut (1995) list a number of reasons, including the cost of acquiring information about stocks, transactions costs (see also Vissing Jørgensen, 2000), minimum investment requirements, and deviations from the expected utility models underlying the LCH. They find a strong effect of education, which suggests that stocks, being fairly complicated products, require a certain amount of knowledge that may be lacking in some parts of the population. This is supported by a finding by King and Leape (1998) that about 40 percent of the non-stockholders in their sample (of Canadian respondents) state that they did not know enough about the stock market.

Somewhat in line with the interpretation of these education effects, Benartzi and Thaler (2001) provide strong empirical evidence that portfolio choice may be a much less rational and forward-looking process than economic theory suggests. In particular, they provide evidence for what they call the "*1/n* strategy" among participants in defined contribution saving plans: participants tend to divide their contributions evenly across the funds offered in the plan. Thus the extent of stockholding may be expected to be influenced not only by the behavior of individual investors, but also by the behavior of institutions offering different investment options.

2.6. Labor Market Re-entry as Insurance

One way in which individuals can insure against adverse financial shocks is to vary the amount of labor supply. In the context of retirement, it is then particularly important to

know how easy it is for the retired to re-enter the labor market. See, e.g., Bodie, Merton, Samuelson (1992).

2.7. Family Decisions and Gender

Most of the theory and the empirical research on saving and portfolio allocation are cast in terms of individual choice, even if the data used often pertain to households. In principle, gender and family issues may have important policy implications. For instance, Turner (2001) cites evidence that women invest more conservatively than men. This is consistent with parallel evidence that women are more risk-averse than men (Guiso and Paiella, 2001; Barsky et al., 1997; Shubert et al., 1999; Kapteyn and Teppa, 2001). If that is true, women may experience lower rates of return on defined contribution pension investments and a systematic difference in financial resources in retirement may emerge. Yet, the evidence on gender differences in financial risk taking appears not to be clear-cut and may simply be a reflection of other differences between women and men, e.g., differences in financial education. Uccello (2000) suggests that there are no clear differences in financial risk taking between men and women within families, i.e., the investment strategies of spouses appear to be quite similar.

A particular issue arises at retirement if a retiring male has the option of choosing sole or joint survivor benefits; see Section 3.

2.8. The Role of Education

Saving and investment decisions for retirement require the solution of complicated decision problems. One would not expect everybody to be equally good at this. As indicated above at a number of junctures, both saving and portfolio decision are significantly affected by education (Bernheim, Garrett, Maki, 2001; Lusardi, 2000).

Indirect effects of education can be found in the literature on social capital and investment. Guiso, Sapienza, and Zingales (2000) show that social capital affects the willingness to hold risky portfolios (someone with more social capital will invest more in risky assets, in particular stock, because it requires trust). Trust is required since risky assets holdings involve delegation (in the case of direct stockholding one delegates to the company's management; in case of indirect holding through funds one delegates to the fund manager). Furthermore, and here education comes in, the effect of social capital is particularly strong among the less educated, since they lack the ability to directly manage their portfolio and are thus forced to delegate. Another study is by Harrison, Kubic, and Stein (2001) who argue that social interactions (social capital) increase stock market participation because they enhance the transfer of information among individuals; the presence of highly educated individuals within a community should therefore benefit all its members.

2.9. Retirement Saving, Tax Incentives, Social Security, and Pensions

Bernheim (1999) recently provided an excellent review of the literature on taxation and saving. Here we briefly touch on three important issues: (1) the saving effects of various forms of tax-deferred saving vehicles such as IRAs and 401(k)s, (2) the displacement effects of pensions and social security on private retirement saving, and (3) the effect of implicit taxes in income maintenance programs on saving behavior.

Theoretically, the effect of tax deferred saving vehicles on private saving is ambiguous. For instance by putting money into an IRA an individual avoids paying taxes on part of her income now, but will have to pay taxes on the money taken out of the IRA later. Not having to pay tax on the income put in an IRA amounts to an increase in the rate of return on saving. Such an increase in the rate of return has two effects. First, the higher return on the investment in an IRA makes it attractive to save, because it lowers the price of future consumption relative to the price of current consumption. Next to this "substitution effect" there is also an "income effect." The higher rate of return amounts to an increase in lifetime resources, which in itself raises current consumption, and hence lowers saving. In view of this theoretical ambiguity, empirical research has to settle the issue of the direction and the strength of the tax subsidy effect on private saving. Different researchers have reached very different conclusions. Authors such as Engen, Gale and Scholz (1996) find that these saving incentives have little or no effect, whereas others, notably Venti and Wise (1990, 1991, 1995) find very substantial effects. Clearly the answer to the question of the effectiveness of saving incentives is very important in view of the total amount of taxes foregone as a result of these incentives.

One of the clear implications of the above graphical illustrations of the LCH is that people should save more for retirement the lower their retirement income will be relative to their pre-retirement earnings. Conversely, the more generous pensions or social security income will be, the less incentive there is to save for retirement. This is known as the "displacement effect" of pensions and social security on private savings (Feldstein, 1994). Yet, empirical research has shown repeatedly that households with relatively generous pensions are also the households that save the most or at least do not save less than other households (e.g., Gustman and Steinmeier, 1998). However, this may simply reflect differences in tastes: some people have a stronger taste for saving than others. And those that do tend to both arrange for more generous pensions and to accumulate more private wealth. Assuming that on average the tastes for saving do not differ substantially across countries, a cross-country comparison should bear out that in countries with more generous old age pensions systems people save less than in countries with less generous systems. See below.

Government regulations may impose various implicit taxes on saving. A particularly important class of implicit taxes consists of asset-based means tests in various income maintenance programs, like Temporary Assistance to Needy Families (TANF), Medicaid, or Food Stamps. As a result, someone with low and uncertain income has a strong incentive not to save if income maintenance is asset-tested, because every time she experiences a bad income draw, she first has to run down her assets before qualifying for

income support. She can maintain a higher consumption level on average by not saving and drawing income support if income falls below the cut-off point for qualification. Hubbard, Skinner, Zeldes (1994a, 1994b, 1995) show that a model incorporating these features along with uncertainty and liquidity constraints is able to reproduce the observed wealth distribution and its evolution over time quite well.

3. Legal and Institutional Environments

This section describes legal issues and institutional features that affect retirement income. It is organized by subject matter and directly compares the American, Italian, and Dutch environments on each issue. In separate subsections, we highlight the three legs of the proverbial retirement income stool: social security, occupational pensions, and private savings. In addition, given the insurance that it offers against lower-than-expected returns on investments, we discuss opportunities for labor force participation at older ages.

Laws and institutions are changing continuously. As a general rule, we describe the status around the time of our household surveys, i.e., from roughly 1995 to 1999, and note major changes over time only where relevant. All amounts are in 1998 currencies, unless stated otherwise. We converted all amounts in Dutch guilders (NLG) or Italian liras (ITL) into euros (€) at the exchange rates that were irrevocably fixed at the euro's conceptual introduction in the beginning of 1999: € 1 = NLG 2.20371 = ITL 1936.27. On 1/1/1999 the exchange rate of the euro and the U.S. dollar ($) was $ 1 = € 0.857. On 1/1/2002 the exchange rate was $ 1 = €1.124. For purposes of comparing purchasing power, an exchange rate of one-to-one is probably a reasonable approximation.

3.1. Social Security

In the United States, social security is mainly provided as Old-Age and Survivors Insurance (OASI).[7] It makes cash payments to retired workers, spouses of retired workers, and widows and children of deceased workers. A separate program, Supplemental Security Income (SSI), makes cash payments to, among others, needy elderly. The Italian social security program, Programma Nazionale di Sicurezza Sociale, makes cash payments to retired workers and widow(er)s of deceased workers; it also guarantees a minimum benefit for the poor. The Italian program does not have a spousal benefit. In the Netherlands, cash payments are made to elderly individuals—regardless of their work history—on the basis of the General Old-Age Act (Algemene Ouderdoms Wet, AOW). Young orphans and non-elderly widows may receive benefits under the General Survivors Act (Algemene Nabestaanden Wet, ANW). We use the term "social security" to refer to all programs that pay cash benefits to the elderly, regardless of whether the entitlement originates from contributive insurance or social assistance.

[7] Unless noted otherwise, our discussion does not extend to public support for the disabled and their dependents.

All three social security programs are predominantly funded on a pay-as-you-go (PAYG) basis. The United States maintains a buffer in the form of an OASI trust fund. There is no trust fund in Italy. Italian social security outlays currently exceed contributions; the difference is financed from general tax revenues. The Netherlands instituted a trust fund in 1996.

In all three countries, participation in social security is mandatory, and coverage is nearly universal. Almost all elderly (are eligible to) receive some benefits.

Table 1 gives an indication of the generosity of social security in the three countries. The first column shows social security expenditures as a percentage of GDP. Italy spent approximately 15.7 percent of GDP on social security in 1999, far higher than the United States (3.9 percent in 2000) and the Netherlands (5.0 percent in 1999). This is in minor part explained by the age structure of its population. The second column shows the elderly dependency ratio, i.e., the size of the population that is at least 65 years old as a fraction of the working age population. Italy again tops the list, but the differences are not large.[8] The third column shows the ratio of social security outlays as a fraction of GDP and the dependency ratio. It may be interpreted as a measure of the generosity of each country's social security program. Italy remains far above the other two countries. This is largely because occupational pensions, which play a significant role in the United States and the Netherlands, are negligible in Italy—see below. In addition, until recently, early retirement was very widespread in Italy, especially in the public sector. Several categories of public employees could retire after 15-20 years of contributions. Early retirement essentially increases the dependency ratio.

Table 1. Social Security Outlays and Dependency Ratios

	(1) Social security outlays as percentage of GDP (1999)	(2) Population age 65+ as percentage of pop'n age 25-64 (1994)	Ratio of (1) and (2)
United States	3.9	24.8	0.156
Italy	15.7	29.6	0.523
Netherlands	5.0	24.4	0.208

Sources: Board of OASI Trustees (2001), Social Security Administration (2000); Franco (2000); Kapteyn and De Vos (1999); Bureau of the Census (1996).

Funding

The American OASI program is funded by payroll taxes, interest earnings on the OASI trust fund, and taxation of benefits. Payroll taxes account for 86 percent of the program's income. Both employers and employees contribute 5.3 percent of wages up to a

[8] Italy's fertility rate was very low during the 1990s, well below the replacement level. While the dependence ratio is only somewhat larger in Italy than in the U.S. and the Netherlands, the difference is expected to increase markedly in the future.

maximum ($80,400 per year in 2001, adjusted annually). The self-employed contribute 10.6 percent. At present, total income of the OASI program exceeds its expenses by about 37 percent. The surplus feeds the OASI trust fund, which, by the end of 2000, contained 260 percent of annual expenses. General tax revenues fund the SSI program.

The Italian program is funded by payroll taxes and general tax revenue. Employers and employees contribute 18.93 percent and 8.34 percent of wages, respectively, for a total of 27.27 percent. There is no maximum contribution. The program's outlays currently exceed its contributions. The difference, about 8-17 percent of payroll (Brugiavini 1999), is funded from general tax revenues.

The Dutch social security program is funded by a payroll tax of 17.9 percent of taxable income up to a maximum (€ 22,235 in 2000, adjusted annually). This tax is levied on all persons with taxable income, including capital income and income from unemployment benefits and other social assistance programs. It only applies to persons under age 65. Until recently, the program was funded purely as pay-as-you-go, with contribution rates that varied slightly from year-to-year. In 1996, a trust fund was established. At the end of 1998, the fund contained €2.1 billion (0.55 percent of GDP) (Bovenberg and Meijdam, 1999).

Benefit Calculations

Social security benefits are paid in the form of a life-long annuity in all three countries.

In the United States, OASI benefits are a function of historical earnings, retirement age, and marital status. The covered worker must have had at least 10 years with non-negligible earnings. Briefly, the benefit calculation is as follows. Historical earnings (up to the taxable ceiling) are indexed by average social security wages in the economy; the 35 highest years of earnings are averaged and converted into a Primary Insurance Amount (PIA) using a progressive formula. Workers who retire at the full retirement age receive monthly benefits equal to the PIA. The full retirement age is currently 65, but will gradually increase to 67 for individuals born in 1938 or later.

The spouse of a retired worker receives one-half of his/her spouse's benefit or full benefits on the basis of his/her own earnings history, whichever is larger. The widow of a retired worker is eligible for benefits on the basis of his/her own earnings history or 100 percent of his/her spouse's benefit, whichever is larger. A couple of which the wife has low lifetime earnings thus receives 150 percent of the husband's PIA while both are alive and 100 percent after he becomes deceased.

Roughly two out of three beneficiaries claim benefits before age 65. Benefits are reduced permanently in proportion to the number of months before age 65 that one claims benefits. The earliest time at which retired workers and their spouses may claim is at age 62, when benefits are reduced by 20 percent. Widows may claim as early as age 60, with

a 25 percent reduction. Benefits may also be delayed to as late as age 70, with permanent benefit increases.

While the benefit formula indexes historical earnings by average earnings in the economy, benefits are adjusted annually in tandem with the Consumer Price Index.

In 2001, average retired worker benefits were $845 per month. Aged couples received an average of $1,410 per month, and single elderly widow(er)s $811. The replacement rate for unmarried individuals with average wages ($32,000 in 2000) was approximately 44 percent. The nationwide average replacement rate, including spousal and other derived benefits, was approximately 56 percent in 1995 (Blöndal and Scarpetta, 1998).

There is no minimum OASI benefit. However, regardless of their earnings history, elderly individuals (couples) are eligible for a monthly SSI benefit of $530 ($796). Income from other sources generally reduces these amounts dollar-for-dollar.

In Italy, social security benefit calculations changed materially in 1992 and, to a lesser extent, in 1995. The changes will be phased in over a long period. Workers with at least 18 years of contributions in 1995 will receive benefits computed on the basis of the rules applying before the 1992 reform (Franco 2000). For purposes of our analysis, which focuses on individuals age 50 and older, the pre-1992 regime therefore applies.

Under the pre-1992 rules, eligibility requires at least 15 years of contributions. Private sector workers may retire with full benefits at age 60 (men) or 55 (women) or after 35 years of social security tax payment, whichever is earlier. For public sector employees, only 20 (men) or 15 (women) years of tax payments are required. Benefits are a function of number of years worked and so-called pensionable earnings. For private sector employees, pensionable earnings are equal to the average earnings of the last five years prior to retirement. (For public sector employees, pensionable earnings are based on the last paycheck only.) Pensionable earnings are converted into social security benefits by applying a 2 percent factor (referred to as the rate of return) for each year of social security tax payment up to a maximum of 40 years (Brugiavini 1999). A worker can thus get at most 80 percent of his pensionable earnings. Earnings that enter the calculation of pensionable earnings are capped. Benefits are therefore also capped, at approximately €6,000 per month in 2000. Contributions are not subject to any maximum. There is no actuarial adjustment for retirement age.[9]

There are no spousal benefits in Italy. However, the entire benefit becomes payable to a surviving spouse upon death of the retiree.

The benefit is never lower than a means-tested minimum benefit. The minimum benefit was approximately €370 per month in 2000. The means test reduces benefits if total

[9] The 1992 and 1995 reforms made fundamental changes to benefit calculations. Benefits are now uncapped but progressive and there is an actuarial adjustment for retirement age. On average, the new rules will reduce benefits by 27-29 percent (Beltrametti 1994; Rostagno 1996).

income exceeds approximately twice the minimum benefit for single retirees (four times for married couples). A substantial fraction of retirees receive this minimum benefit.

Benefits increase regularly with nominal wage growth, that is, consumer price growth plus real earnings growth. Pensioners with a low benefit level receive full compensation for consumer price growth; for high benefit levels, the adjustment only accounts for three-quarters of CPI growth.

In the Netherlands, social security benefit rules are simpler than in the United States and Italy. In particular, earnings history does not play a role: the benefits are almost exclusively a function of marital status and residency history. In 2001, unmarried individuals age 65 or older receive €883 per month (70 percent of minimum wage); married couples with both spouses at least age 65 receive €1,206 per month (100 percent of minimum wage). Married couples with one spouse below age 65 receive between €603 and €1,206, depending on the younger spouse's income (Social Insurance Bank 2000). The eligibility age is 65 and there is no provision for early retirement.[10] There is no link between labor force participation and entitlement to social security. The full benefits apply to residents who have lived their entire working life (age 15-64) in the Netherlands; benefits are reduced by 2 percent for every year spent abroad (Kapteyn and De Vos, 1999). Net benefits increase annually with net minimum wage, which is linked to nominal contractual wage growth.[11]

Table 2 summarizes social security contribution rates and average replacement rates for the three countries. The replacement rates are the average over four scenarios and may therefore differ from the average nationwide replacement rates.[12]

Table 2. Contribution and Replacement Rates

	Contribution rate (% of taxable income)			Average replacement rate
	Employer	Employee	Total	
United States	5.26	5.26	10.52	56.0
Italy	18.93	8.34	27.27	80.0
Netherlands	0.00	17.90	17.90	45.8

Source: Blöndal and Scarpetta (1998)

[10] Occupational pensions often offer bridge benefits between the (early) retirement age and age 65.
[11] During the late 1980s and early 1990s, this indexation rule was not applied and the minimum wage remained constant in nominal terms. Consequently, benefits decreased in real terms. The shortfall was compensated by occupational pensions, which are almost universal (see below).
[12] The replacement rates are computed as averages of four scenarios: two earnings levels (average and two third of average) and two household compositions (single worker and worker with a dependent spouse). The earnings profile is assumed to be flat and earnings are revalued according to changes in average earnings. The rates refer to basic pensions, means-tested supplements, and mandatory occupational pensions only.

Taxation of Benefits

In the United States, up to 85 percent of OASI benefits may be subject to federal income tax, depending on the taxpayer's income and filing status. If income from sources other than social security plus one-half of OASI benefits is below $25,000 for a single person ($32,000 for a married couple), OASI benefits are not taxed.[13] Above those limits, a portion (up to 85 percent) of benefits is taxable. At the state level, OASI benefits are fully or partially taxed in 15 states. In 1998, the highest marginal federal income tax rate, applicable above married couples' income of $278,450, was 39.6 percent. The highest marginal state income tax rate varied from zero in nine states without state income taxation to 12 percent in North Dakota.

In Italy, social security benefits are taxed as ordinary income. In 1998, the highest marginal tax rate, applicable above individuals' income of €18,076, was 46 percent. Spouses are taxed separately.

In the Netherlands, social security benefits are taxed as ordinary income. However, tax rates for elderly individuals are 17.9 percentage points lower than for those under age 65 because the elderly are not liable for social security premiums. Above incomes of €22,300 per year, there is no age difference in marginal tax rates. In 2000, the highest marginal tax rate, applicable above individuals' income of €48,980, is 60 percent. This tax rate is set to decrease gradually as of 2001. Spouses are taxed separately.

Solvency Outlook

At present, the American OASI program's income exceeds its expenses by approximately 37 percent. However, retirement of the baby boom generation is expected to financially strain the program. The trustees of the American OASI program project that total income will fall short of total expenses starting in the year 2016. By 2040, the trust fund is expected to be depleted. At that time, tax revenues are only sufficient to cover 73 percent of expenses.

The Italian program is severely out of balance. At present, its outlays exceed its contributions by approximately 37 percent. Italy's fertility rate is among the lowest in the world (1.2 children per woman in 1999) and the ratio of the elderly to the working age population is expected to increase from 26 percent in 2000 to 48 percent in 2030 (Franco 2000). The imbalance is expected to continue and even worsen unless additional reforms are enacted.

In the Netherlands, population aging will also lead to future solvency problems. The problems are partially offset by the existence of the recently introduced trust fund and by steadily increasing labor force participation among women (Bovenberg and Meijdam, 1999).

[13] Unlike most dollar amounts in OASI legislation, these income thresholds are not indexed.

3.2. Occupational Pensions

Occupational pensions are retirement income schemes that are sponsored by employers. We use the term "occupational" rather than "private" pensions to indicate that plans sponsored by public sector employers are included.

The United States, Italy, and the Netherlands vary widely in the role of occupational pensions. They are widespread, well funded, and generous in the Netherlands; largely immaterial for most Italians (except for so-called severance pay arrangements, see below); and at roughly equal footing with social security in the United States. Table 3 shows pension assets as a percentage of GDP, the fraction of retirees with any pension benefits, and the fraction of the working population that is covered by a pension plan.

Table 3. Importance of Occupational Pensions (Late 1990s)

	Funds (% of GDP)	Percent of retirees receiving pension	Percent working pop'n covered
Italy	Negligible	Negligible	0.02
Netherlands	118	76 (men) 23 (women)	90
U.S.	66	48 (men) 26 (women)	44

Source: Johnson (1999)

Traditionally, employer-sponsored pensions in the United States have been of the defined benefit (DB) type. The plans are specific to individual employers, not to industry groups such as is mostly the case in the Netherlands.[14] Given that there are tens of thousands different plans, their features vary widely. Portability is very limited. The benefit is typically fixed in nominal terms upon job separation. An increasing fraction of DB plans—64 percent in 1993—offers the option of a lump sum distribution upon job separation (Scott and Shoven, 1996). Workers who take that option may leave the distribution tax-sheltered by investing it in an IRA or they may cash it out (Hurd, Lillard, and Panis, 1998). Cashed-out distributions are subject to income tax and, if the beneficiary is under age 59½, a 10 percent penalty. Prior to the disbursement of pension funds, employers bear the risks associated with their investments.

In 1978, 38 percent of American workers were covered by a DB pension, compared to only 21 percent in 1997 (Department of Labor, 2001). Instead, defined contribution (DC) plans are becoming more widespread (up from seven percent in 1978 to 25 percent in 1997). Under DC plans, retirement income depends on the level of contributions and the rate of return earned on those contributions. Workers typically decide on the allocation on their plan balance and bear the investment risk.

[14] The Pension Benefit Guaranty Corporation, a federal agency, guarantees pension payments to retirees whose pension plan ended.

Approximately one-half of DB plans are formally integrated with social security (Slusher 1998). Integration is generally achieved through one of two methods. First, pension plans with an offset formula reduce a retiree's pension benefits by a portion of his or her (usually estimated) OASI benefits. The offset may not exceed half of the gross pension amount (Slusher, 1998). Second, benefits may be based on earnings in excess of some level set by the plan (EBRI 1982; Munnell 1977). For example, a plan may offer a higher benefit schedule for earnings above the OASI taxable limit. For DC plans, only excess provisions are applicable. Bender (1999) found that 8 percent of DC plan holders faced an excess provision.

Widowhood benefits are the norm in American pensions. The 1984 Retirement Equity Act protects spouses of deceased workers that are either retired or vested in their private plan. DB plans must offer a qualified pre-retirement survivor annuity if a married participant with a vested interest dies before receiving benefits; the benefit payment after retirement must be a qualified joint and survivor annuity in which survivor benefits are between 50 and 100 percent of worker benefits. The rights to survivor annuities may be waived within limits, including written spousal consent witnessed by a notary or plan representative. DC plans presume that the spouse is the beneficiary should the worker die before retirement. Upon retirement, several payment options are available; if a lifelong annuity is chosen, the same survivor benefit rules apply as under DB plans. (Hurd, Lillard, and Panis, 1998).

In Italy, the social security program was traditionally intended to provide comprehensive retirement income. (This helps explain why social security outlays are so high in Italy compared to the U.S. and the Netherlands.) In light of the social security program's uncertain financial outlook, Italy established DC pension plans in 1992. These plans are still in their infancy. As of March 1999, only approximately 400,000 workers were enrolled in a DC plan; total assets represented only 0.015 percent of GDP (Banca d'Italia, 1999). With few exceptions, there are no DB plans.

While not strictly a pension plan, so-called severance pay arrangements have long played an important role in Italian retirement income security. They are somewhat similar to DC plans, but are paid out upon job separation, regardless of age. Employers contribute 6.9 percent of workers' wages into a self-administered fund (Franco 2000). Workers earn a legally determined return on those funds of 1.5 percent plus three-fourths of the inflation rate. While this severance entitlement is accruing, the worker has a secure but uncollectable credit with his employer, who retains full discretionary powers over the funds (Franco, 2000).[15] Upon job separation, there is a lump sum severance payment, which is subject to personal income tax. However, to mitigate the impact of progressive taxation on a lump sum, the tax base and rate are defined in a way such that the rate is roughly equal to the rate on one annual contribution. Severance pay credits comprised 5.2 percent of household financial wealth in 1997 (authors' calculations, based on the 1998 Survey of Household Income and Wealth).

[15] The DC plans that were introduced in the mid-1990s must be carved-out of the 6.9 percent severance pay contributions. Since severance pay funds are a source of inexpensive corporate finance, employers have been reluctant to set up DC plans.

In the Netherlands, occupational pensions are widespread and large. Plans are organized by industry sectors and administered by industrial organizations. All pensions are DB pensions. They are easily ported across employers. If a worker's previous and new employers belong to the same industrial organization, portability is merely an administrative issue. If the employers belong to different industrial organizations, the plan administrators settle internally such that the previous administrator disburses a lump sum to the new administrator. The employee receives credit for accumulated pension rights as part of the new pension.[16] All benefits are paid in the form of a lifelong annuity; lump sum distributions upon job termination are not allowed.

Upon death of the retired worker, most Dutch pension plans promise a widowhood benefit of around 70 percent of the retired worker benefit. Starting in 1999, unmarried workers have the option of selecting higher, single life annuities upon reaching age 65.

In the United States, occupational pension benefits are taxable as ordinary income at the federal level. Most states provide a partial or full exemption. In Italy and the Netherlands, occupational pension benefits are taxed as ordinary income. The Italian severance pay lump sum distributions are taxed at a rate that is roughly equal to the marginal rate that applies to the former worker's income bracket.

Of course, what matters for individual households is the combined replacement rate resulting from the combination of social security and occupational pensions. Table 4 provides an estimate of the after tax replacement rates in the three countries for a "typical" (median) household. Clearly, the replacement rate is highest in the Netherlands and lowest by far in the U.S. Based on microdata from the three countries, we calculated and report below an alternative measure of replacement rate.

Table 4. After-Tax Median Replacement Rates

Country	Replacement rate
Italy	75
Netherlands	91
U.S.	41

Source: Gruber and Wise (1999)

3.3. Private Savings

In addition to claims on social security and occupational pensions, individuals build up private savings to support them during retirement. Private savings may take many forms. They may be held in financial instruments, in real estate, or other. They are not restricted to after-tax funds. Specifically, we include IRAs, term life insurance, and similar tax-

[16] For example, suppose someone worked for 12 years under a plan which promises a benefit equal to 1.5 percent of last earned salary for every year worked. His new plan promises 2.0 percent of last earned salary per year worked. The worker receives credit in his new plan for 12*1.5/2.0=9 years of work, as-if those years were worked at the new employer under the new pension plan.

sheltered accounts among private savings. The largest differences in private saving across United States, Italy, and the Netherlands lie in opportunities to save in tax-sheltered instruments.

The American 1974 Employee Retirement and Income Security Act (ERISA) established Individual Retirement Accounts (IRAs) as a mechanism for accumulating retirement savings. Individuals may contribute up to $2,000 annually to IRAs. In traditional IRAs, contributions are tax-deductible; distributions (including interest) are taxed at the time of the distribution. Contributions are fully tax deductible only for persons whose income falls below certain phase-out levels, which depend on whether the person is covered by an occupational pension. Since 1997, so-called Roth IRAs allow for after-tax contributions; distributions (including interest) are tax-free.

Individuals who separate from a job with a pension plan may often take a lump sum distribution of their pension rights. Such distributions may be rolled over into an IRA and remain tax-sheltered. There is no limit on the amount that may be contributed to IRAs in this manner.

By the end of 1999, the assets in IRAs amounted to $2.47 trillion (Copeland 2001). By comparison, assets of private DB and DC pension plans amounted to $2.14 trillion and $2.53 trillion, respectively (Federal Reserve 2001).

There is no Italian equivalent of IRAs. However, all Italians are eligible for term life insurance contracts. The general principle of taxation on these contracts is very favorable: both contributions and benefits are partially tax-exempt. Up to a limit of €1,291, 22 percent of contributions are tax deductible. If benefits are paid in the form of an annuity, 40 percent is tax-exempt and the remainder taxed as general income; if benefits are paid as a lump sum, the difference between the lump sum and the sum of premiums is taxed at 12.5 percent. There are early withdrawal penalties. The value of life insurance contracts comprised 5.5 percent of household financial wealth in 1997 (authors' calculations, based on the 1998 SHIW).

The situation is similar in the Netherlands. Dutch law does not recognize IRAs, but offers tax advantages for term life insurance policies. The limit up to which contributions are tax-deferred has fluctuated widely. Prior to 1992, the limit was €7,300, fixed in nominal terms. In 1992, the limit was lowered. For the year 2000, it was €5,600 for a married couple. (Starting in 2001, the limit is lower yet at only €1,000; it is higher for individuals with income over which no pension rights are accumulated, such as the use of a company car.) Dutch term life insurance payments must take the form of a lifelong or fixed-term annuity. The annuity benefits are subject to income tax.

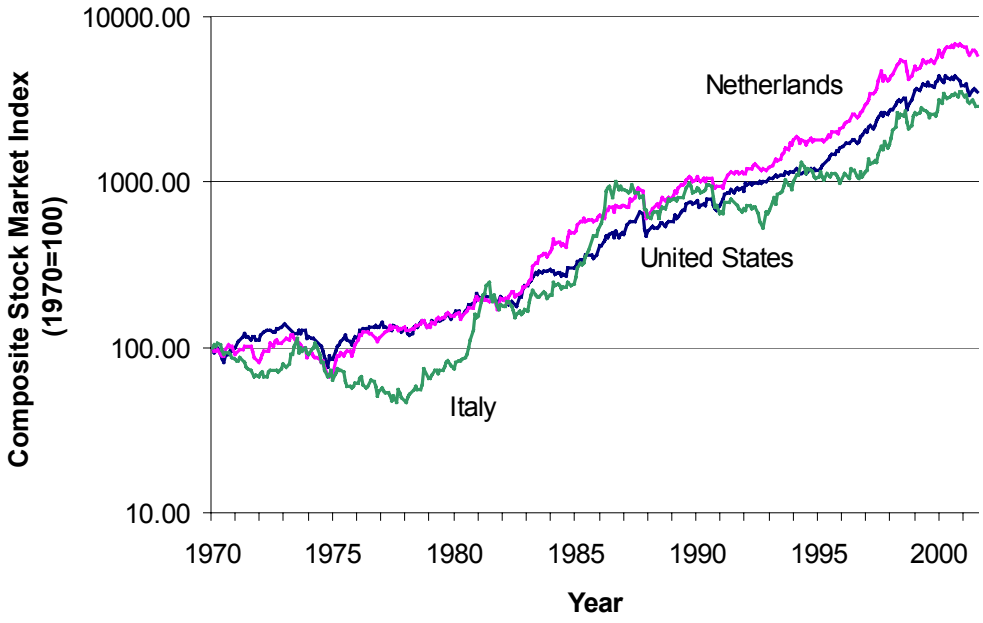

Figure 6. Composite Stock Market Indices, 1970-2001 (log-scale)

Figure 6 depicts composite stock market indices for the three countries between 1970 and mid-2001, normalized to 100 in 1970. For all three countries, it shows the Morgan Stanley Capital International (MSCI) index, representative of large companies and computed consistently over time and across countries. The overall annual rate of return, including re-invested dividends, was highest in the Netherlands (13.8 percent nominal, 10.9 percent real), followed by the United States (11.9 percent nominal, 8.3 percent real) and Italy (11.2 percent nominal, 2.3 percent real). The Italian market exhibited markedly more volatility. For example, the standard deviation of annual nominal returns in Italy was 34.4 percent, compared to 16.6 percent in the U.S. and 21.7 percent in the Netherlands.

3.4. The Structure of Capital Markets

Access to capital markets for households varies across the three countries. We start out with discussing housing transactions and mortgages. Next we look at transaction costs of stock purchases.

Transaction costs of housing in the United States consist largely of real estate agent fees. Real estate agents charge approximately 6 percent of the house price, to be levied from the seller. Fees for legal issues (including escrow fees), loan appraisal, et cetera are roughly 2 percent, paid jointly by the seller and the buyer. Transfer taxes are negligible in most areas. House transaction costs are higher in Italy than in the United States. Real estate agent fees are 8-10 percent, paid jointly by the seller and the buyer. A transfer tax of 6-7 percent applies. In the Netherlands, transaction costs of housing consist largely of

a transfer tax of 6 percent of the house price. Real estate agents typically charge 1.5 percent of the house price. If both seller and buyer retain an agent the total cost of real estate agents will be 3 percent, but in many cases only a seller will use the services of a real estate agent. Other administrative fees (mainly for a notary public) are minimal by comparison. Generally, the Dutch transaction process is very simple in comparison to the U.S. process.

There is a well-developed mortgage market in the United States, including a standardized secondary market. Buyers may choose variable or fixed interest rate loans of up to 30 years' maturity. The typical down payment is 10 or 20 percent of the value of the house, but full financing is available. Interest payments are generally fully deductible for income tax purposes. The mortgage market is much less developed in Italy, perhaps due to banks' limited ability to sell the house in case of default on mortgage payments. Anecdotal evidence suggests that the associated legal proceedings may take as long as 10 years. Banks therefore typically require a down payment of 40-50 percent of the price of the house. In the Netherlands, the mortgage market is well-developed with a wide variety of loan options available. Many mortgage products are tied to life insurances, largely to take maximal advantage of the tax deductibility of mortgage interest. In principle, there are no down payment requirements. To cover the transaction costs of buying a house, mortgages of up to 110 percent of the transaction price are available and common. In 1998, per capita mortgage debt in the United States ($15,421) and the Netherlands (€14,167) were almost identical and about ten times as large as in Italy (€1,415) (De Nederlandsche Bank 2001; Federal Reserve 2001).

Home ownership in the Netherlands has risen strongly over the past three decades, leading to strong cohort effects in home ownership. Older generations are much less likely to own a home than young cohorts, reflecting the highly regulated housing market in the Netherlands in the first few decades after WW II. Figure 7 illustrates the cohort effects in homeownership in the Netherlands. The graph is based on data from the Socio-Economic Panel (which will be described more fully in the next section). The graph shows home ownership rates for five-year birth cohorts. The cohorts are indicated by the median year of birth for each cohort: for example, "63" indicates households whose head was born between 1961 and 1965. We observe that among younger cohorts (those born after 1951) there are no discernible cohort effects. These cohorts start buying their own home in their early twenties and by age 35-40 a home ownership rate of 65 percent is reached. Older cohorts start home buying at a later age and home ownership plateaus at a (much) lower level.

Figure 7. Home Ownership of Different Cohorts in the Netherlands

The result of the cohort effects in home ownership in the Netherlands is that for the age group we are considering (50 and over) home ownership in the Netherlands is much lower than in Italy or the U.S. Table 5 illustrates the differences across the three countries.

Table 5. Percentage of Families Reporting Housing Wealth

	Aged 55		Aged 67	
	Singles	Couples	Singles	Couples
United States	56.3	89.8	65.8	88.3
Italy	69.5	83.2	63.4	82.4
Netherlands	32.8	59.7	18.6	40.8

Source: OECD 1998. AWP 4.3

The three countries may also face different transaction costs for the purchase and sale of stocks. An informal Internet search in March 2002 revealed roughly comparable fees for unassisted stock transactions via online brokers. In the United States, E-Trade (us.etrade.com) charges $14.95-19.95 per transaction and Charles Schwab (www.schwab.com) $29.95 for up to 1,000 shares. In the Netherlands, Robeco (www.robecodirect.nl) charges 0.3-0.4 percent of the total transaction, often with a €15 minimum. In Italy, Twicetrade (www.twicetrade.it) charges €12 plus the lower of €0.019 per share and €19. The differences are not large. However, they reflect current online trades only. Actual average commissions during our analysis period (mid to late 1990s), when online banking was far less developed, are likely much higher. We do not have comparable information on trends in transaction costs.

3.5. Labor Force Participation at Older Ages

The opportunity to work at older ages offers insurance against insufficient retirement income. It may therefore induce relatively risky strategies for investment of retirement funds. The three countries differ somewhat in the existence of such opportunities. Barriers may be legal, fiscal, or practical.

Legally, the American Age Discrimination in Employment Act (ADEA) of 1967 proscribes discrimination on the basis of age. Mandatory retirement is prohibited since 1978, and there is no upper age limit to the law since 1986. There are a few exceptions, such as for police officers and firefighters. Also, compulsory retirement at age 65 is permitted for executives and high-level policy makers that are entitled to retirement benefits of at least $44,000 per year. In Italy and the Netherlands, employers may terminate workers' employment contracts when workers reach the compulsory retirement age. In Italy, the compulsory retirement age is 65 for men and 60 for women; in the Netherlands, it is 65 for both men and women. Naturally, employers may let employees work indefinitely; compulsory retirement is an employer right, not an obligation.

Even when there are no legal obstacles to continued work, the tax structure may make it very undesirable to do so. Based on Diamond and Gruber (1999), Brugiavini (1999), and Kapteyn and De Vos (1999), Gruber and Wise (1999) summarize the implicit tax on earnings in the year following the typical early retirement age (62 in the U.S., 55 in Italy, 60 in the Netherlands). The tax accounts for continued contributions to social security (and, in the Netherlands, to virtually universal occupation pensions), accrual rules, and foregone benefit payments. They find that the implicit tax is 81 percent in Italy, 141 percent in the Netherlands, and –1 percent in the United States. These rates are computed based on typical work scenarios; the calculation is likely very different for elderly without much social security or pension income. For them, work may continue to be an attractive safety net.

The role of work at older ages may be reduced for other reasons, such as anticipated poor health and a limited willingness of employers to accommodate the special needs of older workers. The general state of the economy may further limit employment opportunities. During our sample period of the mid-1990s, the American economy was growing fairly rapidly, with declining unemployment rates. Similarly, the Dutch economy was expanding, and the sentiment that older workers had to make way for younger ones gradually changed in favor of acceptance of higher retirement ages. By contrast, the Italian economy continued to be weak, with high unemployment rates, particularly in the southern part of the country. Nationwide, the unemployment rate averaged around 11 percent, but it was around 20 percent in the southern regions and about 7 percent in the northern regions. High unemployment rates may make finding or retaining work at older ages very difficult.

3.6. Exposure to Risks

The main risks with large financial consequences for individuals age 50 and older are health-related. In all three countries, workers may count on long-term disability insurance in case of disability. Generally, public disability insurance schemes are more generous in Italy and the Netherlands than in the United States, but Italian disability insurance payments vary with the severity of the disability. In many cases, workers are covered by private disability insurance in all three countries.

After retirement, Americans face greater risks of large out-of-pocket medical expenses than their Dutch and Italian counterparts. In the Netherlands, virtually all elderly are covered by comprehensive health insurance with negligible out-of-pocket expenses. In Italy, the public health system grants essentially free assistance to the entire population in case of illness. However, only in-patient assistance is provided, implying substantial out-of-pocket expenses for the elderly in case of a serious illness that requires little hospital care. In the United States, the elderly may face serious out-of-pocket medical expenses, depending on their insurance coverage. Elderly with low income and financial assets are typically eligible for Medicaid, which offers fairly comprehensive insurance, including for deductibles. The risks are also limited for elderly that are covered by both private health insurance and Medicare, a public health insurance program for the elderly and disabled. However, American elderly who rely only on Medicare face substantial risks of large out-of-pocket expenses. Medicare consists of two components. Coverage for Part A is almost universal; it covers in-patient expenses in hospitals and skilled nursing facilities. Most elderly also have supplemental (Part B) coverage, purchased at subsidized rates. Medicare requires co-payments that can be substantial, especially in the case of long hospital stays.

4. Data

Our analysis is based on microdata on individuals age 50 and older from each country. For the United States, we use the Health and Retirement Study (HRS); for Italy, the Survey of Household Income and Wealth (SHIW); and for the Netherlands, the SocioEconomic Panel (SEP). We now briefly describe each survey.

4.1. United States

We use the HRS, including its elderly "AHEAD" cohort. The HRS is a national longitudinal sample of households with at least one person born in 1931-1941 (51-61 years old at the 1992 baseline) or 1923 or before, i.e., with at least one person aged 70 or over in 1993. The 1998 interview added the 1924-30 and 1942-47 birth cohorts, so that the most recent data cover all individuals age 50 and older. We use the 1998 data and rely on other waves (1992-2000) where longitudinal information is needed.

The principal objective of the HRS is to monitor economic transitions in work, income, wealth, and changes in health status. The first wave of data was collected in 1992 (1993 for the pre-1923 birth cohort), with follow-ups fielded at approximately two-year intervals. Blacks, Hispanics, and Florida residents were over sampled at a rate of two to one.

The 1998 HRS contained 21,351 respondents: 8,949 men and 12,402 women.

4.2. The Netherlands

For the Netherlands, we rely primarily on the SocioEconomic Panel (SEP), a representative panel survey conducted by Statistics Netherlands. The SEP covers about 5,000 households and is representative of the non-institutionalized Dutch population. The SEP contains detailed information about a number of household demographic characteristics and collects data on household income and wealth. It has a number of desirable attributes. It has been collected annually since 1984 so that time-series changes can be readily analyzed and it is a panel so that individual changes over time can be isolated. Since 1987, the SEP contains a wealth module. The assets distinguished in the SEP include: (1) checking accounts; (2) savings and deposit accounts; (3) saving certificates (certificates of deposit); (4) bonds, mortgage bonds; (5) shares, mutual funds, options, and other securities; (6) value of the primary residence; (7) other real estate (not used for own residence); (8) value of the car(s); (9) net worth of own company (for the self-employed); (10) life insurance mortgage; and (11) other assets. These assets are reported at the current market value. The liabilities include: (1) personal loans; (2) revolving credit; (3) debt with mail orders, retail debt; (4) other purchases on credit; (5) hire-purchase; (6) remaining mortgage debt; (7) collateral-based loans; (8) debt with relatives and friends; (9) other outstanding debt, unpaid bills; (10) other debt. These categories have varied somewhat during the course of the panel. Because of problems collecting the data, since 1990 no asset and debt information was collected on the self-employed.

In 1997, the SEP contained 8,904 respondents: 4,385 men and 4,519 women.

4.3. Italy

The main wealth data for Italy is the Survey of Household Income and Wealth (SHIW), collected by the Banca d'Italia, Italy's central bank. Its main purpose is to collect detailed data on demographics, household consumption, income, and balance sheets. This survey is representative of the Italian population and has been fielded biannually since 1984. Financial wealth data have only been publicly available since 1989. Beginning in 1989, some but not all of the households were re-interviewed in subsequent panels. The panel component has increased over time—in 1989, 29 percent of the households were re-interviewed and by 1995, 45 percent were re-interviewed. The sample size is about 8,500 households. Financial asset items include transaction and

savings accounts, certificates of deposits, government bonds, corporate bonds, stocks, mutual funds, life insurance, cash value of defined contribution pension funds, and foreign assets. Net real assets include real estate, business, valuables, and the stock of durables net of liabilities. Liabilities are mortgage and other real estate debt, consumer credit, personal loans, and credit card debt.

5. Method and Hypotheses

The aim of this paper is to exploit institutional variation across countries to shed light on the effect of different policies on the wealth accumulation and portfolio choices of households near or in retirement. Since, at this stage, we are only considering three countries, we have in a sense only three data points to generalize from. Thus, if we were to take a completely a-theoretical approach we would have very few degrees of freedom to establish any empirical regularity with reasonable confidence. We therefore take a different approach. Drawing on our review of the literature and the description of institutional differences across countries we formulate a number of stylized predictions, which are next confronted with the data at hand. The more these predictions are corroborated by the microdata, the more confident we can be that the policies in the different countries help explain the differences in wealth accumulation and portfolio composition that we observe. In principle, one can try to add more countries to the analyses in later work to further gauge the role of policies in explaining observed differences.

An important caveat in our analysis will be that we generally assume that policies are exogenous. Thus, for example, we exclude the possibility that social security benefits are generous because citizens of a country have an innate tendency to save too little for retirement.

5.1. Hypotheses

We briefly characterize a number of stylized facts that we would expect to hold in the microdata across the different countries as a result of the institutional differences described in the preceding section, and based on the results from the literature reviewed in Section 3. We formulate our "predictions" as rather informal hypotheses, with generally a *ceteris paribus* clause to account for other counteracting institutional effects.

Hypothesis 1: The displacement effects of retirement benefits

A straightforward implication of the LCH is that more generous retirement benefits will induce less saving for retirement. We will therefore consider replacement rates at retirement in the three countries and predict that the country with the lowest replacement rate will be the country with the highest saving rate, *ceteris paribus*. Based on the discussion in Sections 3.1 and 3.2 we expect retirement savings to be most prominent in the U.S. and least prominent in the Netherlands, at least at the median.

Hypothesis 2: The effect of earnings and consumption uncertainty

Saving for precautionary reasons should be most prominent in a country with the highest earnings uncertainty. We will invoke subjective information on earnings uncertainty to support the assumption that earnings uncertainty is highest in the U.S. and hence that we would expect to have the highest level of precautionary saving in the U.S., again under *ceteris paribus* conditions. In addition to earnings uncertainty, consumption uncertainty may be important as well. A prime example of consumption uncertainty would be the possibility of unforeseen large out-of-pocket medical expenses. It appears that this kind of consumption risk is considerably larger in the U.S. than in Europe. Hence, even after retirement, when earnings uncertainty presumably does not play a role anymore, we would still expect precautionary motives to lead to a stronger desire to hold bequeathable wealth in the U.S. than in Italy or the Netherlands.

Hypothesis 3: The role of capital market imperfections

In the basic, stripped down, version of the LCH, consumers may be borrowing to finance consumption at young age and enter middle age with negative wealth. Only after earnings exceed optimal lifetime consumption, will saving become positive. Clearly such a pattern will not be observed if capital market imperfections prevent substantial borrowing at young ages. A point in case is the possibility to obtain home mortgages. As observed in Section 3.4, the typical minimum down payment requirement in the U.S. is 10-20 percent. In Italy the minimum down payment is on the order of 40-50 percent. In the Netherlands one can buy a house with a negative down payment up to 10 percent (i.e., one can borrow 110 percent of the market value of the house). Differences in capital market structure in the three countries thus predict that Italy should have the highest saving rate and the Netherlands the lowest. In addition, when considering net household wealth, Italy should be the country where net wealth, as a percentage of gross wealth, is highest.

Hypothesis 4: Portfolio composition

The preceding hypotheses imply higher levels of private wealth in Italy and the U.S. upon retirement than in the Netherlands. Our review of the literature then suggests that stock ownership in Italy and the U.S. should be higher than in the Netherlands. On the other hand, the less well-developed capital market in Italy may reduce stock ownership in Italy. Similarly, the existence of more earnings and consumption uncertainty (e.g., medical expenses) in the U.S. may depress stock ownership in favor of more secure assets. We hypothesize that stock ownership in the Netherlands will be the lowest among the three countries, because of the lowest level of private wealth. In the U.S., the combination of a well-developed capital market and a high level of private wealth for retirement and precautionary purposes should induce a relatively high level of stock ownership.

6. Empirical analysis

We begin by presenting a number of relevant descriptive statistics for the three countries. We then discuss the evidence in favor of (or against) the hypotheses we have formulated above. Most of the analyses are in simple tabular form, with sometimes an excursion to multivariate analyses.

6.1. Descriptive Statistics

For Italy and the Netherlands, we restrict our analysis to households with a head over age 50. For the United States, we consider the entire 1998 HRS, including its War Babies, Children of the Depression Age, and AHEAD cohorts, jointly representative of the population age 51 and older. Table 6 presents data for 1998 for the United States and Italy and 1997 for The Netherlands. The table indicates that the age distributions in the three countries are very similar, with samples roughly equally split between heads of household under and over age 65. Italian and Dutch respondents are somewhat more likely to be married than American respondents. Based on the educational distributions reported in Table 6, U.S. respondents appear to be somewhat better educated than their Italian and Dutch counterparts. The comparison should be interpreted with caution, though, because the schooling systems differ greatly across the three countries.

Table 6. Demographics and Income
(Unit of observation: Household)

	U.S.	Italy	Netherlands
Number of households	14,147	4,200	1,487
Age household head			
50-59	35.1	38.0	33.0
60-64	13.7	16.8	15.4
65+	51.2	45.2	51.6
Household Structure			
Couple	53.4	67.4	60.8
Single male	11.1	8.8	10.6
Single female	35.5	23.8	28.7
*Education household head**			
Elementary	33.0[a]	51.8	30.6
Some high school		24.8	18.4[b]
High school	29.2	16.5	32.2[c]
Some college	37.8	7.0	18.8[d]
HH non-capital income			
Mean	$26,500	€24,000	€24,600
Median	$18,800	€20,400	€21,300

Note: Definitions of education categories vary:
[a] less than high school; [c] middle vocational;
[b] lower vocational/junior high school; [d] at least high school

The mean non-capital after-tax household income in the U.S. was higher than in Italy and the Netherlands, whereas median income was lower.[17] The pattern reversal reflects a more equal income distribution in Italy and the Netherlands compared to the United States.

Our hypotheses are couched in terms of accumulated savings and allocation into risky assets. Given the information in the microdata, we define risky assets as stock and bond holdings. An intuitive measure of risky asset allocation is the ratio of risky assets to net worth. Unfortunately, non-negligible subsamples report zero or negative net worth, so that the ratio of risky assets to net worth cannot be determined or is very difficult to interpret. Instead, we define two related measures. Consider households' balance sheets in Figure 8.

Assets		**Liabilities**	
Safe (cash, savings accounts)	S	Net worth	NW
Risky (stocks, bonds)	R	Debts (mortgage and other)	D
Gross housing (housing equity + mortgage debt)	H		
Other	O		
Gross wealth	GW	Gross wealth	GW

Figure 8. Stylized Household Balance Sheet

We decompose the ratio of risky assets to net worth as follows:

$$\frac{R}{NW} = \frac{R}{GW}\frac{GW}{NW} = \frac{R}{GW} \Big/ \frac{NW}{GW} = \text{Exposure}/\text{Solvency}$$

Very few respondents report having no gross wealth at all. Both "exposure," defined as the ratio of risky assets to gross wealth, and "solvency," defined as the ratio of net worth to gross wealth, are therefore straightforward to construct.

Table 7 characterizes the size and composition of bequeathable household wealth in the three samples. The American and Italian figures are based on 1998 HRS and SHIW, the Dutch on the 1997 SEP. As predicted, the Netherlands has by far the lowest level of private household wealth, both in the mean and in the median. Partly this reflects the lower home ownership rate in the Netherlands for these older cohorts. Stock or bond ownership is highest in the U.S. (33 percent) and lowest in the Netherlands (19 percent). Following Figure 8, we aggregated assets in four broad categories: (1) Safe assets (saving

[17] The American HRS collects gross income data, whereas the Italian SHIW and Dutch SEP ask for after-tax income. We estimated tax liabilities to convert the American income data to be net of taxes. Since the state of residence and many financial details are unknown, we assume standard deductions and account for federal taxation only. This includes federal income tax and Federal Insurance Contributions Act (FICA) liabilities. Incomes after state income tax, where applicable, are therefore slightly lower than reported in Table 6.

and checking accounts, cash); (2) risky assets (stocks and bonds); (3) housing and other real estate; (4) other. Since the Dutch sample excludes self-employed, we have excluded business equity in all countries. U.S. households clearly hold the most risky assets, both in absolute value and as a fraction of gross wealth. Dutch households hold more of their gross wealth in safe assets than the Americans and Italians. Again, this partly reflects the lower home ownership rate in the Netherlands for this age group. In both the U.S. and the Netherlands, the share of risky assets increased between 1992 and 1997/8 (not shown). The average solvency ratios are large and negative in the United States and Italy, indicating that the ratios are dominated by households with negative net worth that is large relative to their reported gross wealth.

Table 7. Assets and Asset Allocation
(Unit of observation: household)
(Monetary values in $ for the U.S. and in € for Italy and the Netherlands)

		U.S.	Italy	Netherlands
Gross wealth	mean	276,200	168,100	95,300
	median	130,000	96,500	45,200
Net worth	mean	253,400	166,200	79,300
	median	105,000	95,000	33,500
Owns house (%)	mean	76.8	71.8	46.5
	median	100	100	0
Owns stocks/bonds (%)	mean	33.0	26.8	18.7
	median	0	0	0
Exposure (R/GW)	mean	0.079	0.051	0.039
	median	0	0	0
Solvency (NW/GW)	mean	-51.8	-18.3	0.62
	median	1	1	1
Housing equity (if owner)	mean	128,200	121,800	111,600
	median	95,000	100,000	95,800
Stocks/bonds (if owner)	mean	169,500	54,483	45,700
	median	45,000	20,000	16,900
Portfolio shares (%)				
Safe (S/GW)	mean	20.4	29.4	43.4
Risky (R/GW)	mean	7.9	5.1	3.9
House (H/GW)	mean	45.6	53.2	38.6
Other (O/GW)	mean	26.0	12.3	14.0

6.2. Empirical Evidence for the Hypotheses

Hypothesis 1: The displacement effects of retirement benefits

Although we have provided some evidence that replacement rates at retirement are lowest in the U.S. and highest in the Netherlands, it is useful to exploit our microdata to shed further light on this. The replacement rates given in Section 3.2 above were based on hypothetical (median) individuals in the three different countries, and on "plausible"

institutional parameters. Here we take a different approach. We exploit the longitudinal nature of the data to consider incomes in the waves before and after a respondent first reports being retired to gauge the actual change in income experienced by those who retire. For example, if someone first reports being retired in 1994, we consider incomes as reported in 1993 and 1995. (In the American HRS and Italian SHIW data, the waves are two years apart, except three years for the 1995-8 SHIW.) This approach avoids contamination from part-year employment. We consider *household* non-capital income before and after *individual* retirement. This assumes resource sharing within a household, so that for instance a transfer of resources by other household members compensates for a drop in the new retiree's income. This assumption acknowledges the joint nature of retirement decisions (e.g., Zweimüller and Winter-Ebmer, 1996; Gustman and Steinmeier, 1994). Finally, we consider after-tax income,[18] expressed in constant 1998 dollars.

The top panel of Table 8 presents empirical after-tax replacement rates for the United States based on the 1992-2000 HRS. The table compares incomes in the wave before retirement and the wave after retirement,[19] i.e., at t-2 and t+2. Post-retirement income is substantially lower than pre-retirement income, both in the mean and the median.[20] The average replacement rate is well above unity, but this is driven by a small number of respondents with particularly low pre-retirement income. The median replacement rate is 75.7 percent. There is large variation: at the 10th percentile, income dropped by three-quarters after retirement, whereas it increased by three-quarters in real terms at the 90th percentile.

To put these findings in perspective, compare the income changes between the year before retirement and the year after retirement with income changes of individuals who did not retire (i.e., who worked in years *t-2, t, t+2*, or who were retired in all three waves). We observe that the latter individuals also experienced a decline in real income, at least at the median. The decline in income is far smaller at the median (2.2 percent) than the median decline among newly retired individuals (24.3 percent).

The replacement rate improves if we assume that individuals who retire can annuitize their wealth and consume the annuity. Adding the annuity value of bequeathable wealth to post-retirement income, possible consumption levels exceed pre-retirement income for most households. We define the generalized replacement rate as the sum of post-retirement income and annuity value of private wealth divided by pre-retirement income. At the median, the generalized replacement rate is above one (111.4 percent). Even at the 10th percentile, post-retirement consumption may be sustained at almost half the level of pre-retirement income.

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[18] See footnote 17 (page 38).

[19] For the United States and Italy, retirement is defined based on respondents' own report of (complete) retirement status. For the Netherlands, retirement is defined as receiving some form of income transfer (pension, disability, or unemployment benefits), being over 50 years old, and not doing any work for pay.

[20] In order to exploit the longitudinal feature of the HRS, the sample consists of original HRS respondents, i.e., those born in 1931-41 and their spouses. The sample is thus younger than the sample used in Table 6, which included all HRS cohorts. This explains why mean and median income levels in Table 8 exceed those in Table 6.

The bottom part of Table 8 presents a similar analysis for household net worth around retirement and compares changes to wealth changes of households in which no retirement takes place. Most households experience wealth growth, but wealth grows somewhat faster for households who do not have a recently retired member. At the median, the increase is 2.2 percent among households that transitioned through retirement and 6.6 percent among those who did not.

Table 8. Empirical replacement rates, wealth accumulation, and income growth in the United States

	Obs.	Mean	10th Percentile	Median	90th Percentile
Newly retired					
Pre-retirement HH non-capital income	1,953	36,600	6,900	30,600	69,500
Post-retirement income	1,797	26,100	6,500	21,200	47,300
Post-retirement income + annuity value of wealth	1,797	44,100	9,000	34,100	83,100
Replacement rate (%)	1,749	147.1	28.7	75.7	175.2
Generalized repl. rate[a]	1,749	261.0	47.6	111.4	271.6
Not newly retired					
Non-capital HH inc. t-2	29,442	36,800	7,000	30,000	69,200
Non-capital HH inc. t+2	28,894	35,900	6,300	29,500	68,700
Income ratio (t+2)/(t-2) (%)	19,463	213.1	33.5	97.8	179.6
Newly retired					
Pre-retirement HH net worth	1,982	215,200	1,100	115,600	491,600
Post-retirement HH net worth	1,815	254,900	1,000	124,700	594,500
Wealth growth (%)	1,746	41.9	-85.1	2.2	169.0
Not newly retired					
Net worth t-2	29,735	246,400	2,500	113,200	552,200
Net worth t+2	29,204	267,700	3,200	119,900	588,000
Wealth growth (%)	19,936	114.3	-83.2	6.6	192.8

[a] Post-retirement non-capital household income + annuity value of wealth divided by pre-retirement non-capital household income. The annuity value assumes a 3 percent interest rate.

Similar to Table 8, Table 9 documents income replacement rates, wealth accumulation, and income growth in Italy, based on 1987-98 data. Table 8 was in 1998 dollars; Table 9 in 1998 euros. As in the United States, real household non-capital income tends to drop after retirement. However, the declines are milder. At the median, post-retirement Italian household incomes replace 85.9 percent of pre-retirement income, about ten percentage points above the median U.S. replacement rate. While there is substantial variation, the differences are smaller than in the U.S. For example, at the 10^{th} and 90^{th} percentile, post-retirement incomes are about 50 percent below and above their pre-retirement levels, compared to three-quarter differences in the United States. At the median, real incomes among households that did not transition through a retirement remained almost exactly constant. Naturally, the replacement rates increase when

including the annuity value of net worth. The median generalized replacement rate for new retirees in Italy is 124.5 percent, again greater than in the United States (111.4 percent).

Italian households enjoyed greater wealth gains than American households during the mid and late 1990s. At the median, net worth among households with a new retiree increased by 24 percent. This gain exceeds the gain among households that did not experience a retirement (14.5 percent), probably because of severance payments (see above).

Table 9. Empirical replacement rates, wealth accumulation, and income growth in Italy

	Obs.	Mean	10th Percentile	Median	90th Percentile
Newly retired					
Pre-retirement HH non-capital income	402	33,800	15,300	30,150	55,300
Post-retirement income	402	30,300	11,600	26,150	51,800
Post-retirement income + annuity value of wealth	402	46,100	14,000	39,100	79,500
Replacement rate (%)	402	97.3	49.1	85.9	147.5
Generalized repl. rate[a]	402	143.7	65.5	124.5	231.9
Not newly retired					
Non-capital HH inc. t-2	5,682	25,300	9,800	21,500	45,100
Non-capital HH inc. t+2	5,682	26,000	9,600	21,400	46,300
Income ratio (t+2)/(t-2) (%)	5,673	112.0	57.9	100.8	170.0
Newly retired					
Pre-retirement HH net worth	402	187,200	7,700	122,650	435,200
Post-retirement HH net worth	402	225,000	11,100	153,650	515,400
Wealth growth (%)	398	320.8	-68.4	24.0	350.6
Not newly retired					
Net worth t-2	5,682	154,600	3,800	87,900	350,600
Net worth t+2	5,682	189,900	4,400	110,000	431,500
Wealth growth (%)	5,595	305.2	-73.3	14.5	373.2

[a] Post-retirement non-capital household income + annuity value of wealth divided by pre-retirement non-capital household income. The annuity value assumes a 3 percent interest rate.

Table 10 shows the same set of statistics for the Netherlands, based on 1984-97 income reports and 1987-97 wealth data. Income and wealth values are in 1998 euros. Dutch replacement rates generally exceed those of both the United States and Italy. At the median, fully 102.3 percent of real pre-retirement income is replaced. The spread is narrower than in the other two countries. At the 10^{th} and 90^{th} percentile, only about one-third of pre-retirement income is lost or gained, compared to one-half in Italy and three-quarters in the United States. Dutch households without a new retiree also fared well—at the median, their real household non-capital income rose by 8.1 percent. The spread is again small, much smaller than in the United States and Italy. (This is in part explained

by the fact that the Dutch income and wealth figures refer to survey waves that are only two years apart; the Dutch SEP survey is conducted annually, whereas American HRS and Italian SHIW waves are generally two years apart.) Adding in the annuity value of net worth increases the replacement rates, though not by very much. This reflects the small average wealth holdings among Dutch households.

In the Netherlands, households with a newly retired member enjoyed an increase of 4.5 percent in net worth, far lower than in Italy but somewhat higher than in the United States. The increase among households without a retiring member was one-eighth in two years time, more than the comparable American and Italian figures.

Table 10. Empirical replacement rates, wealth accumulation, and income growth in the Netherlands

	Obs.	Mean	10th Percentile	Median	90th Percentile
Newly retired					
Pre-retirement HH non-capital income	772	22,200	10,500	18,800	38,600
Post-retirement income	772	21,900	10,900	18,600	37,400
Post-retirement income + annuity value of wealth	772	26,900	12,100	22,900	49,700
Replacement rate (%)	772	113.9	68.0	102.3	138.3
Generalized repl. rate[a]	772	137.1	80.8	114.5	187.2
Not newly retired					
Non-capital HH inc. t-1	52,333	27,300	12,600	25,900	43,200
Non-capital HH inc. t+1	52,333	29,600	13,000	28,100	47,000
Income ratio (t+1)/(t-1) (%)	52,333	124.3	81.8	108.1	138.9
Newly retired					
Pre-retirement HH net worth	802	63,400	600	23,400	172,600
Post-retirement HH net worth	802	67,000	800	23,000	175,400
Wealth growth (%)	800	-82.0	-61.2	4.5	128.3
Not newly retired					
Net worth t-1	55,995	47,900	100	23,300	121,500
Net worth t+1	55,995	57,100	400	31,100	141,100
Wealth growth (%)	55,995	118.2	-79.7	12.5	164.2

[a] Post-retirement non-capital household income + annuity value of wealth divided by pre-retirement non-capital household income. The annuity value assumes a 3 percent interest rate.

In summary, replacement rates are lowest in the United States and highest in the Netherlands, with a gap at the median of 26.6 percentage points. However, American households accumulate far more private savings than their Dutch counterparts. The replacement rate gap narrows to just 3.1 percentage points when we include the annuity value of net worth in the calculations. This is fully consistent with a life cycle model in which retirement saving is crowded out by institutional old age pension provisions in the Netherlands, but much less so in the U.S.

Hypothesis 2: The effect of earnings and consumption uncertainty

Casual observation would suggest that in the U.S., earnings uncertainty is considerably larger than in Italy or the Netherlands. Social insurance programs (unemployment, sickness, disability) in the two European countries are generally more generous than in the U.S., and employment protection laws make it relatively hard to fire employees in Italy and the Netherlands. An interesting piece of direct evidence on earnings uncertainty comes from a common question asked in the HRS, the SHIW, and the Dutch CentER Savings Survey (CSS), a panel of about 2,000 households. The question asks respondents directly for the amount of income uncertainty they face. Figure 9, taken from Guiso, Jappelli and Pistaferri (1999), shows the cumulative distribution of the coefficient of variation of income uncertainty for the U.S., the Netherlands, and Italy. (The relevant curve for Italy is *CV(y)*; the other one excludes unemployment insurance.) The figure illustrates that income uncertainty across respondents has about the same distribution in Italy and the Netherlands (top two curves). The U.S. distribution is lying much more to the right, confirming that U.S. respondents report much more income uncertainty than the respondents in the two European countries. Several authors have found that, within a country, income uncertainty explains differences in saving behavior and in portfolio composition among citizens.

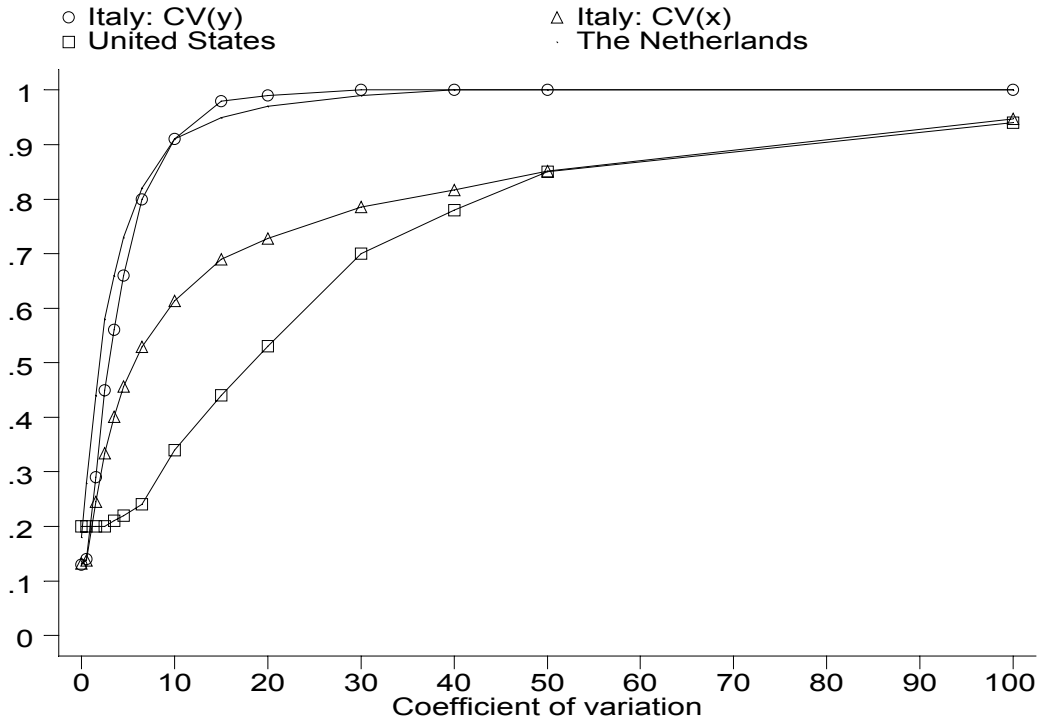

Figure 9. Cumulative Distribution of Income Uncertainty

A problem in a cross-country context with the data at hand is that we do not have individual information on the amount of uncertainty faced by the individuals in our sample. Since there are at least two different strong incentives for households in the U.S. to accumulate more private wealth than in Italy or the Netherlands (precaution and to

provide for retirement), it is probably impossible to disentangle the relative influence of the two different incentives. We have argued above that in any case retirement provisions provide a powerful explanation for the difference in wealth accumulation between the U.S. and the Netherlands. Providing further insight into the patterns of wealth accumulation in Italy, the Netherlands, and the U.S., Table 11 presents results of a regression of household net worth on a number of household characteristics.

Since both household income and net worth have a skewed distribution, we have applied a log-like transformation to these variables. A direct logarithmic transformation is not possible, since both variables can take on negative values. Hence we adopted the inverse hyperbolic sine: $h(x)=log[\sqrt{(x^2+1)}+x]$. For values of x not too close to zero $h(x)$ is approximately equal to $log(2x)$ for positive x and - $log(2x)$ for negative x. The function $h(x)$ is anti-symmetric: $h(x)=- h(-x)$. The drawback of the inverse hyperbolic sine in comparison to the logarithm is that it is not invariant to a change of units. The regressions reported involve both quantities measured in U.S. dollars and quantities measured in euros. If we were to use logs of the monetary variables, the currency differences would simply be absorbed in the country-specific intercepts. For the inverse hyperbolic sine, that is only approximately true.

Table 11 presents two regressions. The first regression involves full interactions of all variables with country dummies, which is equivalent with having separate equations for each country. It turned out that the age functions of Italy and the Netherlands are quite similar, an impression that was confirmed by a statistical test. Hence, the regression was repeated with identical age functions for the Netherlands and Italy. We specified the effect of age on wealth accumulation as a fifth degree polynomial. Rather than presenting the estimated coefficients of the polynomials, we sketch the estimated age functions in Figure 10.

Table 11. Cross country regressions for net worth

Dependent variables: Inverse hyperbolic sine h(.) of household net worth		
	Separate age functions	IT/NL same age function
Dummy SEP1992	541.482	4.479
	(0.74)	(6.26)**
Dummy SEP1997	541.655	4.673
	(0.74)	(6.49)**
Dummy HRS1992	622.872	-41.788
	(0.86)	(0.56)
Dummy HRS1998	622.080	-42.579
	(0.85)	(0.57)
h(non-cap hh inc.) US	0.308	0.308
	(17.61)**	(17.61)**
h(non-cap hh inc.) IT	0.668	0.668
	(11.80)**	(11.81)**
h(non-cap hh inc.) NL	0.031	0.024
	(0.72)	(0.56)
Dummy retired, US	-0.697	-0.697
	(11.52)**	(11.52)**
Dummy retired, IT	0.907	0.933
	(5.21)**	(5.57)**
Dummy retired, NL	0.530	0.648
	(2.05)*	(3.15)**
High school, US	1.073	1.073
	(8.68)**	(8.68)**
More than H.S., US	1.682	1.682
	(18.07)**	(18.06)**
Some high school, IT	0.900	0.916
	(4.73)**	(4.86)**
High school, IT	1.529	1.550
	(6.89)**	(7.03)**
Some college, IT	2.016	2.017
	(6.47)**	(6.48)**
Lower voc./jr. high, NL	1.034	1.009
	(4.02)**	(3.94)**
Middle vocational, NL	2.044	1.989
	(8.92)**	(8.82)**
Some college, NL	2.829	2.788
	(10.42)**	(10.41)**
Observations	21,517	21,517
R-squared	0.08	0.08

Absolute value of t statistics in parentheses;
Significance: * = 5%; ** = 1%

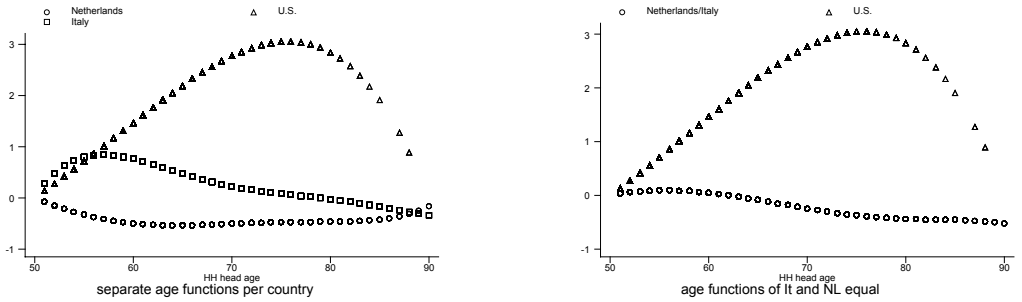

Figure 10. Estimated age functions in the net worth regressions

Figure 10 shows that after age 50, American households keep accumulating wealth at a brisk pace, whereas the age profile in the Netherlands and Italy is approximately flat or slightly downward sloping. This would be consistent with the prevalence of a precautionary motive to guard against high out-of-pocket medical costs in the U.S. as compared to Italy and the Netherlands. Here, and repeatedly in subsequent analyses below, we have to offer the caveat that we are not controlling for cohort effects, so that the age effects we observe may be (and probably are) contaminated by cohort effects. Disentangling age and cohort effects is beyond the scope of the current study.

Since the definitions of education levels differ substantially across the three countries, all education dummies are country-specific. The lowest education category is always the reference category. Net worth increases monotonically with education in all three countries.

The effect of being retired differs substantially across the three countries, with a negative effect in the U.S. and positive effects in the Netherlands and Italy. We should be somewhat careful in interpreting these results, as retirement status is correlated with age. In particular, the negative effect of being retired on net worth in the U.S should be considered jointly with the strong positive age effect on net worth, shown in Figure 10. More importantly, retirement may be partly endogenous in the sense that retirement is more likely for individuals with more wealth. Thus the positive sign of the retirement dummy in Italy and the Netherlands may simply reflect that people with more wealth are more likely to retire. With this interpretation, the sign of the retirement dummy in the U.S. is harder to understand.

Household income has a positive influence on capital accumulation. However, the strength of the effect varies substantially across the three countries. In the Netherlands the effect of income is very small and not statistically significant. In Italy and the U.S. it is much bigger and very significant. The discussion of the next hypothesis interprets this pattern.

Hypothesis 3: The role of capital market imperfections

The implications of the differences in capital markets in the U.S., the Netherlands, and Italy are that *ceteris paribus*, Italy should have the highest saving rate and the

Netherlands the lowest (Section 6). In addition, when considering net household wealth Italy should be the country where net wealth, as a percentage of gross wealth, should be highest. The former implication is hard to test directly, because of other factors influencing saving rates, but the latter implication is easy to verify, by reference to Table 8 above.

Table 7 shows that median solvency (net worth divided by gross wealth) is equal to one in all three countries. The ratios of median net worth and median gross wealth in Table 7 are 0.81 in the U.S., 0.98 in Italy, and 0.74 in the Netherlands. Thus, for a given level of net worth Italian households borrow considerably less money than households in the U.S. and the Netherlands. The weaker borrowing constraints in the latter countries induce lower private capital accumulation.

Somewhat tentatively, we interpret the high coefficient of non-capital income in the wealth regressions in Table 11 for Italy as another indication of the relevance of borrowing constraints. Conceivably, the harder it is to borrow money to invest in profitable undertakings (e.g., real estate or stocks), the more important income becomes as a source of capital for investment. Thus *ceteris paribus* the connection between income and wealth accumulation would be stronger in Italy than in the U.S. or the Netherlands.

Hypothesis 4: Portfolio composition

In Section 55, we hypothesized that stock ownership in the Netherlands will be the lowest among the three countries, because of the lowest level of private wealth. In the U.S., the combination of a well-developed capital market and a high level of private wealth for retirement purposes should induce a relatively high level of stock ownership. Italy should be in between, because it has a relatively high level of private wealth but a less-developed capital market. To shed light on the plausibility of these hypotheses, Table 12 presents results from cross-country regressions of the share of risky assets (stocks and bonds) in gross wealth. The approach is similar to the approach in Table 11. We start with separate analyses by country and then simplify the model by imposing equality of parameters allowed by the data. Since shares are between zero and one by construction, we use a two-limit Tobit model to estimate the equation, with a lower limit equal to zero and an upper limit equal to one.

The first column presents estimates of the unrestricted equations. A test for equality of the age functions across countries is far from rejection and hence the second column imposes equal age functions. A test of equality of the income coefficients across the three countries is almost rejected at the 5 percent level ($F(2,21419)=2.83$, $p=.0590$). Similarly, we cannot reject the hypothesis that the net worth coefficients of the U.S. and Italy are equal ($F(1, 21419)=2.73$, $p=.0984$) at the 5 percent level. The last column presents estimation results with these equalities imposed. Figure 11 sketches the estimated age function, which turns out to be fairly flat in the age range where most of the data points are.

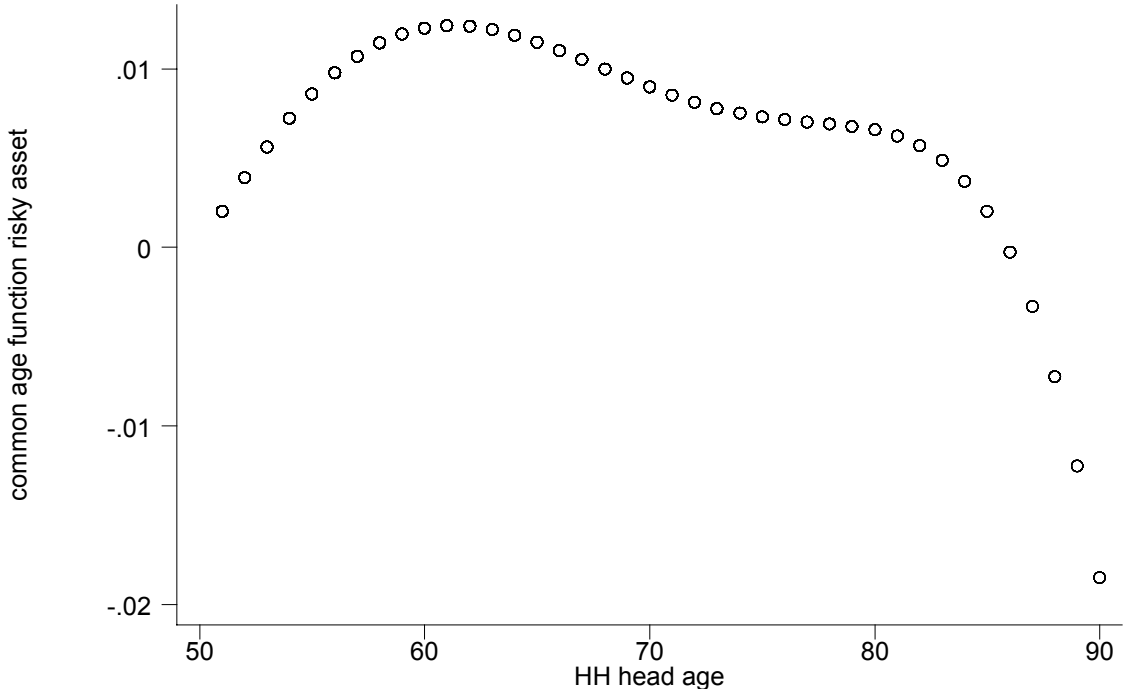

Figure 11. A common age function to predict risky asset share across the three countries

Table 12. The share of risky assets across countries

Dependent variables: share of risky assets in gross wealth			
	(1)	(2)	(3)
Dummy HRS1992	-43.591	0.205	0.062
	(0.63)	(2.45)*	(4.19)**
Dummy HRS1998	-43.554	0.244	0.101
	(0.63)	(2.92)**	(6.47)**
Dummy SEP1992	-29.098	-0.437	-0.643
	(0.42)	(3.60)**	(7.54)**
Dummy SEP1997	-29.077	-0.415	-0.631
	(0.42)	(3.39)**	(7.28)**
h(non-cap inc.) US	0.015	0.015	
	(9.17)**	(9.24)**	
h(non-cap inc.) IT	0.018	0.019	
	(2.83)**	(2.91)**	
h(non-cap inc.) NL	0.004	0.004	
	(1.00)	(0.96)	
h(net worth) US	0.052	0.052	
	(32.30)**	(32.36)**	
h(net worth) IT	0.060	0.061	
	(12.01)**	(12.14)**	
h(net worth) NL	0.109	0.109	0.105
	(15.32)**	(15.30)**	(14.67)**

Dependent variables: share of risky assets in gross wealth			
	(1)	(2)	(3)
Dummy retired, US	-0.000	0.001	0.001
	(0.00)	(0.17)	(0.17)
Dummy retired, IT	0.075	0.067	0.068
	(4.89)**	(4.87)**	(4.95)**
Dummy retired, NL	0.031	0.047	0.050
	(1.10)	(2.39)*	(2.50)*
High school, US	-0.005	-0.006	-0.006
	(0.43)	(0.52)	(0.54)
More than H.S., US	0.075	0.074	0.074
	(9.45)**	(9.34)**	(9.29)**
Some H.S., IT	0.085	0.089	0.093
	(5.14)**	(5.49)**	(5.80)**
High school, IT	0.143	0.146	0.155
	(7.83)**	(8.09)**	(8.91)**
Some college, IT	0.154	0.156	0.169
	(6.31)**	(6.38)**	(7.35)**
L.voc./j.high, NL	-0.011	-0.015	0.003
	(0.33)	(0.46)	(0.10)
Middle voc., NL	0.088	0.084	0.094
	(3.38)**	(3.22)**	(3.55)**
Some college, NL	0.170	0.169	0.182
	(6.09)**	(6.10)**	(6.49)**
h(non-cap income)			0.015
			(9.67)**
h(net worth)			0.053
			(34.39)**
Observations	21447	21445	21344
Pseudo R-squared	.21	.21	.21

Absolute value of t statistics in parentheses;
Significance: * = 5%; ** = 1%

For convenience, we restrict a discussion of Table 12 to the last column. Household income has a relatively small but significant direct influence on the share of risky assets held. Its influence is positive, which would be consistent with a model where income can be used to buffer risks incurred by investing in the risky assets (i.e., having a higher non-capital income reduces background risk in some informal sense). Of course, there is also an indirect effect of income via its effect on total net worth, as discussed with respect to Table 11 above. Net worth has a positive effect on the share of risky assets in all three countries, as expected.

The share of risky assets in gross wealth increases with education in all countries (except the difference between high school and less than high school in the U.S.; the difference between these two education levels is not statistically significant). This can be interpreted in at least two different ways: (1) owning stocks or bonds requires a certain level of knowledge which is more likely to be present among the higher-educated; (2) a

higher education level reduces risks in the labor market and this reduction in background risk makes an individual less risk-averse.

We note that the indicator for being retired is insignificant in the U.S and significantly positive in both Italy and the Netherlands. A possible interpretation is that after retirement income and consumption risks have essentially disappeared in Italy and the Netherlands, whereas in the U.S. consumption risk associated with adverse health shocks becomes more important. This risk reduction after retirement in Italy and the Netherlands would allow households to take on more risk in the stock market.

It is tempting to interpret the country- and wave-specific dummies as propensities to hold risky assets after controlling for the variables listed in Table 12. One should note however, that in general the values of the dummies are sensitive to the scaling of the monetary variables. If for instance, we switch from dollars and euros to thousands of dollars and euros, then to a good approximation all monetary variables are reduced by *ln(1,000)=6.91*. Since the monetary variables have different coefficients for different countries such changes in monetary units affect country- and wave-specific dummies differentially, without changing the underlying model. The only valid comparison in Table 12 is between Italy and the U.S. in the last column, because we have restricted the coefficients of net worth and household income to be equal. We notice that the dummies for the U.S. are significantly positive, consistent with the notion that a more developed capital market in the U.S. facilitates stock and bond ownership, controlling for education, wealth, and demographics.

7. Concluding Remarks

The analysis in this report is a first attempt at consistently exploiting institutional variation across countries to improve our understanding of wealth accumulation and portfolio choice of households at or near retirement. The number of countries considered so far is limited, as is the amount of detail in the data that we have been able to use. The stylized facts that we are able to glean from the microdata are certainly consistent with the hypotheses that we have, somewhat loosely, formulated. In summary, their main implications are as follows:

- Americans should save more for retirement than the Dutch or the Italians;
- Americans should save more due to more exposure to uninsurable income and consumption risk;
- Italians should save more due to severe borrowing constraints in their country;
- The Dutch should have relatively low stockholdings due to the low level of private wealth;
- Stock-ownership in the U.S. should be higher than in Italy because of more developed capital markets in the United States.

While each of these implications is borne out by the data, it is in general not possible to establish the relative magnitude of factors influencing wealth accumulation or portfolio choice. For instance, both low replacement rates at retirement and higher consumption

and income risk in the U.S. imply that Americans should save more than Europeans. Without further analysis, it is not possible to determine what the relative role of these factors is.

It is worthwhile to extend the current analysis in two main directions. First, it is very desirable to add countries to have more institutional variation that can be exploited. Second, the current data can be analyzed more extensively, and more information can be brought to bear on the hypotheses formulated. In particular, we intend to exploit the longitudinal nature of the data more, e.g., to disentangle age and cohort effects but also to exploit time series variation in addition to cross-sectional and cross-country variation. This will also allow us to address some endogeneity issues, like the timing of retirement.

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