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Article

Gender Differences in Risk-Taking Investment Strategies in Defined Contribution Plans

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Abstract: We study gender differences in risk-taking investment strategies in Defined Contribution (DC) plans with the help of data from the US Federal Reserve Board's Survey of Consumer Finances (SCF). By DC plans, we refer not only to employer-sponsored plans such as 401(k)s and 403(b)s, but also to Individual Retirement Accounts (IRAs) and Roth and Keogh accounts. We suggest our own split of the SCF DC plans into risk-free and risky ones, and we build risky shares of total DC plans. We compare the risky shares of females and males in two different settings. In the first setting, we work with two samples of single people, and in the second setting we work with an extended SCF sample. In both settings, we conclude that there are no significant differences in the risky shares of total DC plans between (single) women and (single) men but that there are significant gender differences in risky IRAs and 401(k)s between (single) women and (single) men. We conclude with policy implications.

Keywords: Defined Contribution Plans; gender differences; retirement investment; single households; financial risk-taking; Survey of Consumer Finances; policy implications



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1. Introduction

More and more Americans are called on a daily basis to participate actively in the building of their retirement wealth. The US government has been consistently “nudging” individuals and households in this direction by passing laws designed to encourage personal savings, typically by creating tax-favored savings accounts such as Individual Retirement Accounts (IRAs) and 401k(s) (Thaler and Sunstein 2008, p. 105). One of the characteristic features of such US retirement plans and accounts is that the participants are called to make their own investment decisions. “Investment choice is arguably a source of empowerment” for individuals, as Bajtelsmit and Bernasek (2001, p. 2) note. However, at the same time, investment choice can also be a great source of stress, since individuals are called on a frequent basis to make and revise their asset-allocations, take responsibility for their portfolio choices, and work for years, with patience and willpower, to accumulate their retirement wealth.

Investment choice is hampered by risk. Fredman (1996, p. 25) characterizes risk as “a complex, and multidimensional concept with no single measure”. In the presence of risk, individuals manifest risk aversion, a behavior equivalent to individuals’ reluctance to accept risk Pålsson (1996). In the literature studying investment choice, individuals’ risk aversion is attributed to several individual features of the investors, both subjective and objective Sung and Hanna (1996, p. 11). Actually, we encounter several individuals’ traits explaining risk aversion varying from the age and income of the investor to their

investment knowledge. The individual characteristic of our own interest and study is that of the gender of the individual.

In the 1990s, a significant stream of research started suggesting that women are more conservative investors than men, exhibiting greater financial risk aversion. [Embrey and Fox \(1997\)](#) offer a comprehensive literature review on the first insightful works on the topic. The gender argument continued, highlighting the repercussions of this behavior on women's long-term investment goals, with the most prominent being the accumulation of adequate retirement wealth, which is also the focus of our own research. The seminal works by [Hinz et al. \(1997\)](#), [Bajtelsmit and VanDerhei \(1997\)](#), [Sundén and Surette \(1998\)](#), [Bajtelsmit et al. \(1999\)](#), [Bajtelsmit and Bernasek \(2001\)](#), as well as [Bernasek and Shwiff \(2001\)](#), offer corroborative evidence of gender differences in risk-taking related to retirement decisions. Of course, we need to acknowledge that besides gender, most of the aforementioned works account and control for more demographic factors and characteristics, with the factors varying from age and race to marital status and financial knowledge. As far as the findings are concerned, the results are mixed, sample-dependent, and at times contradictory; however, they strongly complement the study of the role of gender.

More works studying gender differences in retirement strategies followed, and below, we indicatively refer to some of them, emphasizing the different settings and databases used. [Agnew et al. \(2008\)](#) use a controlled experiment to investigate the role of gender for individuals at retirement in the choice between purchasing an annuity or investing their savings on their own. [Arano et al. \(2010\)](#) study retirement asset allocations to investigate whether women, as a demographic group are more risk averse than men, by using data from a mail survey sent to tenure-track faculty at all Kansas Regents institutions. [Morrin et al. \(2011\)](#) use a decision simulation to study gender effects on hypothetical 401(k) retirement plans as a function of fund assortment size. [Romm \(2015\)](#) uses data from the US Health and Retirement Study to study the effect of retirement date expectations on pre-retirement wealth accumulation, focusing on the role of gender and bargaining power in married US households. [Montford and Goldsmith \(2016\)](#) address inadequate retirement savings among Americans, especially women, by extending work done in psychology of investing, and examining the relationship between gender and investment risk, and the role financial self-efficacy plays by collecting data from U.S. student subjects. [Lei \(2019\)](#) focuses on the role of gender and marital status on stock investment in IRAs with the help of data from the Survey of Consumer Finances. [Maddala and Lahiri \(2020\)](#) use data from the National Longitudinal Survey of Youth (NLSY), and the Health and Retirement Study (HRS) survey to study interactive effects of gender and marital status on asset allocation decisions in (IRAs), trying to understand the relationship over a wide age range.

As a last note, in this short literature review, we deem it worthwhile to refer to important works studying gender differences in retirement savings not only in the US but also in different countries all over the world. For instance, [Blake et al. \(2007\)](#) present us with data from the United Kingdom, [Säve-Söderbergh \(2012\)](#) study gender differences in risk-taking pension behaviors of the Swedish workforce, [Fernández-López et al. \(2015\)](#) investigate gender differences in retirement attitudes of eight European countries, [Kristjanpoller and Olson \(2015\)](#) examine the retirement investment decisions of women and men in Chile, [Watanabe \(2017\)](#) gives us a study from Japan, and [Feng et al. \(2019\)](#) cover the Australian case. Most of these works document gender gaps in retirement savings along with gender gaps in pension knowledge, with women investing more conservatively than men. At this point, we also wish to emphasize the assumed repercussions of conservative investment strategies. To that effect, we first stress that investing and risk go hand-in-hand, since even for the safest investments, such as the ones on U.S. government bonds, there are risks involved—the risk of inflation, for instance, which might erode the assets' value. Risks involved become more elaborate and more complex for riskier investments, such as the ones in stock. However, the basic premise in finance literature is that over the long-run, riskier assets accumulate more earnings [Markowitz \(1968\)](#). Thus, without wishing to underestimate the trade-offs between average returns and the volatility in returns, we deem

risk-taking to be a potential driver and determinant of retirement wealth, and the lack of risk-taking as a potential barrier in adequate retirement preparedness.

Today, the argument of women being ill-prepared for their retirement days due to inadequate investment risk-taking seems more timely than ever. According to the US Department of Labor (DOL 2019), women are more likely to work in part-time jobs that do not qualify for a retirement plan. Furthermore, working women are more likely than men to interrupt their careers to take care of family members. Thus, women are working fewer years than men, contributing less in their retirement, and building lower lifetime savings. The ensuing gender gap in retirement savings is accentuated by a continuing gender pay gap. The gender pay gap in the US has been narrowing over the last decades with the female/male earnings ratio having increased from about 60% before the 1980s to about 79% by 2014 (Blau and Kahn 2017), and improving even more in the public sector as Hamidullah et al. (2021) report. However, we also have evidence of persisting gender pay gaps among employees in several sectors (for instance, Chen et al. 2021). Thus, we cannot leave out the gender pay gap from our considerations.

At the same time, we need to account for the fact that women live longer than men. On average, a female retiring at age 65 can expect to live another 21 years, nearly 3 years longer than a man the same age (DOL 2019). Moreover, according to Lusardi and Mitchell (2011a), women suffer from “accute” financial illiteracy, that is they lack sufficient knowledge of fundamental financial concepts. Lusardi and Mitchell (2011b) report findings that women are generally less financially knowledgeable than men; indicatively, women appear less likely to respond correctly to a question concerning risk diversification than men and more likely to not know the answer, as opposed to answering incorrectly. This financial illiteracy further ill-equips women for planning and making retirement investment decisions that could potentially secure them a higher return for their retirement days. For all of the above reasons, women faced with the reality of lower average earnings than those of men, and the prospect of a longer retirement period, accompanied by the anxiety of uncertain ageism are under the “microscope” of policy advisers, who with the help of researchers and marketers alike are seeking to better understand and boost women’s investment retirement strategies and decisions.

In the current paper, we continue this pursuit to detect the role of gender in investment decisions related to retirement wealth. In particular, we study gender differences in risk-taking investment strategies in the accumulation of US retirement wealth with the help of data from the US Federal Reserve Board’s Survey of Consumer Finances (SCF) for 2019, the latest available SCF dataset. With regards to the US retirement wealth, we focus on employer-sponsored plans, and in particular on Defined Contribution (DC) plans, such as 401(k)s, 403(b)s, or other thrift saving accounts from current or past jobs. Additionally, following the insightful argument by Munnell (2013, p. 1) that “more than half of money collected” in retirement savings through 401(k) plans “now resides in Individual Retirement Accounts”, in the consideration of DC plans, our coverage also includes Individual Retirement Accounts (IRAs), Roth accounts, and Keogh accounts. In our work, we aspire to add to the existing literature studying gender differences in investment risk-taking in the accumulation of retirement wealth through our own approach and with the pivotal help of data from the SCF. We note that the SCF is frequently praised in the literature as “the best available source of individual household wealth data collected in the United States” (Bajtelsmit and Bernasek 2001, p. 4), offering access to a rich data set of retirement assets, not easily available in the literature, which allows us to study the previously considered enriched definition of DC plans.

Following this enriched consideration of DC plans, we proceed with our own suggested split of DC plans into risk-free and risky ones, a split in which we again take advantage of all the information available in the SCF, by probing into respondents’ responses and extracting their risk-taking with regards to their retirement decisions. Subsequently, we construct ratios of risky DC plans over total DC plans, and further compare the mean risky ratios of female and male investors into two different settings. In the first setting, and

as the most direct test of gender differences, we compare the mean risky ratios of single females and single males. In the second setting, taking advantage of the SCF's uniquely available information on the DC plans of both spouses or partners in the households of couples, we split each couple into two separate observations, and by creating an extended sample, we compare the mean risky shares of female and male investors.

When it comes to our contribution to research, we first comment that our work uses data from the latest wave of the highly popular SCF, and adds new information to the existing literature that explores gender differences in financial risk-taking with regards to the accumulation of retirement wealth. Further, our work outcomes are linked to investment vehicles such 401k(s) and IRAs that constitute the state-of-the-art gateways of retirement savings. Combining information on the balances of such retirement assets is not frequently encountered in the literature, and we have tried to make the most of all information available in the 2019 SCF. Furthermore, our suggested split of DC plans into risk-free and risky ones offers a guide for all the researchers wishing to explore risk-taking in retirement decision-making by employing the latest SCF data. Lastly, our work contributes to the research body that informs policy by offering a step towards policy recommendations with regards to the role of gender in retirement investment strategies.

The structure of our paper is as follows. In Section 2, we present the database of the project, and the methodology we follow. In particular, we cover in detail the SCF DC plans that we consider in our analysis, and proceed with the computation of their dollar value. We also present our own suggested split of the DC plans encountered in the SCF into risk-free and risky ones, and further build the ratios of risky DC plans. Furthermore, we describe in detail the sub-samples of the 2019 SCF that we employ in the two settings of the paper. In Section 3, we proceed with the empirical results of both settings and the findings of our work. In Section 4, we discuss the policy implications of our paper's outcomes, and we sketch the future directions of our research.

2. Materials and Methods

For the purposes of our work, we employ the latest SCF, that of 2019. The SCF is a triennial interview survey of a nationally representative sample of US families, sponsored by the Board of Governors of the Federal Reserve System with the cooperation of the US Department of the Treasury. We note here that with the term "families", the SCF includes one-person families. The SCF aims to provide detailed information on the financial characteristics of US households. In particular, the survey collects data on families' assets and liabilities, their current and past employment, their pensions, their income, their inheritances, and their consumer attitudes. Data on the demographics of the families are also collected.

2.1. DC Plans in the 2019 SCF

We note that the retirement assets comprising our paper's consideration of DC plans are scattered in several sections of the SCF. In Figure 1, we summarize, schematically, all the components of the DC plans that we consider in the 2019 SCF.

We note that the code names that appear in parentheses in Figure 1 correspond to the variables that we produce upon computing the retirement assets' dollar values. We stress that all our computations are available to the reader upon request. We also repeat that the DC plans we consider in our work include IRAs and Roth and Keogh accounts, as well as specific employer-sponsored accounts. In what follows, we proceed with a more detailed presentation of the DC plans' components as encountered in the SCF, as well as with the computation of the total dollar value of DC plans in the SCF.

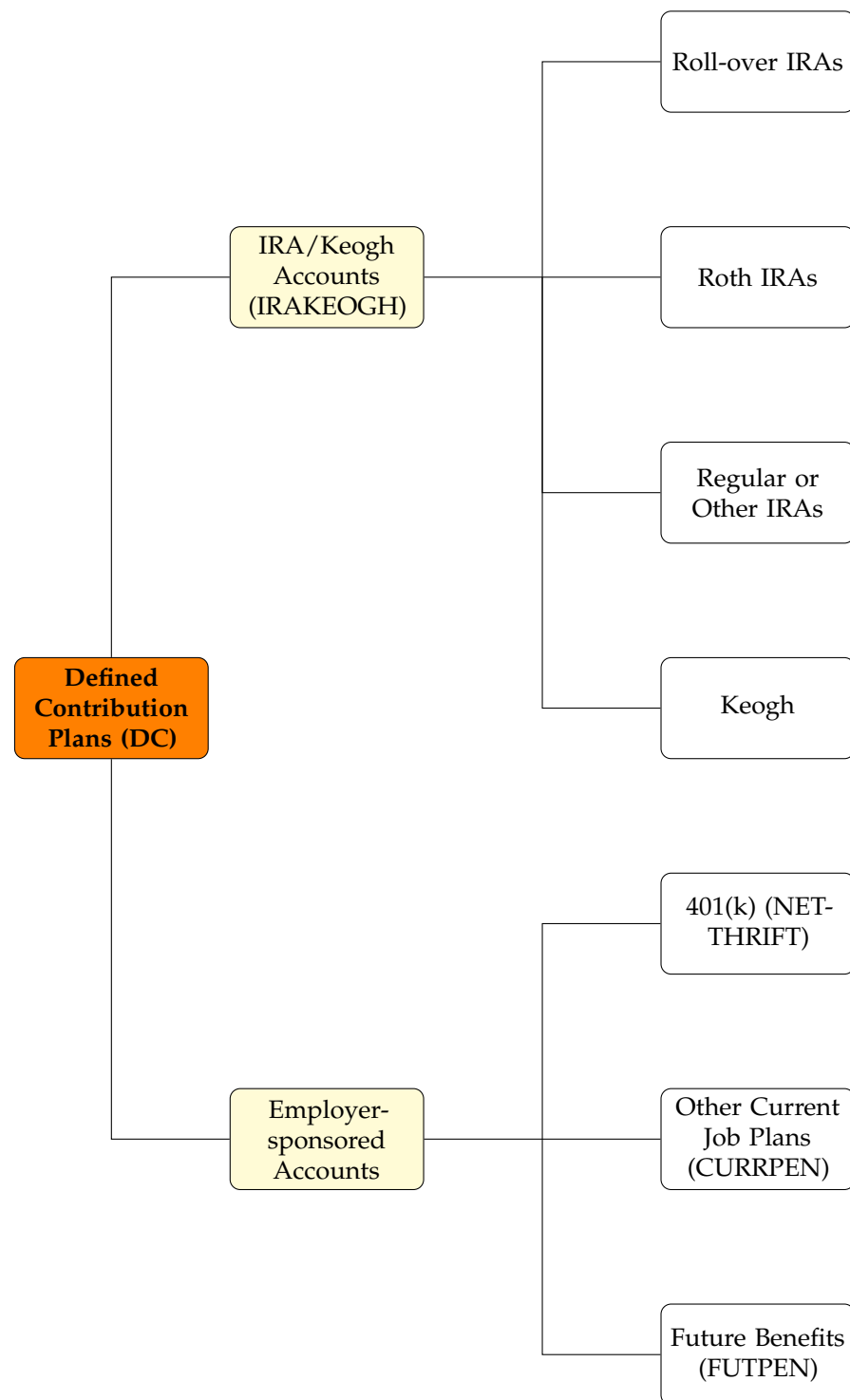


Figure 1. Defined Contribution Plans in the 2019 SCF. Source: U.S. Federal Reserve Boards' Survey of Consumer Finances for 2019.

In particular, with regards to IRAs and Keogh accounts, we follow the SCF's codebook (FRB 2020), and we refer to "accounts that the respondents might have "rolled over" into an IRA after leaving a previous job, as well as Roth IRAs, or any other type of IRA or Keogh account that is not part of a retirement plan on a current or past job". The computations lead us to the (IRAKEOGH) component of Figure 1.

With regards to the employer-sponsored accounts, we follow Bhutta et al. (2020, p. 33), as well as the FED's algorithm for the computation of quasi-liquid retirement accounts,

and we refer to accounts such as “401(k), 403(b), thrift savings accounts from current or past jobs, other current job plans from which loans or withdrawals can be made, as well as accounts from past jobs from which the family expects to receive the account balance in the future”. For readers not familiar with the US retirement plans, we wish to offer an idea of the names behind such plans. For instance, a 401(k) is a tax deferred, defined contribution retirement plan that takes its name from a Section of the Internal Revenue Code, Section 401(k), that permits an employer to create a retirement plan to which employees may contribute a portion of their wages on a pretax basis. A similar rationale applies to a 403(b) plan and other similarly named retirement plans. We also need to mention that for these plans, respondents might have become indebted by acquiring a loan against the plan(s). In our computations, we account for such a possibility, which is why in Figure 1 we refer to (NETTHRIFT) as the net value of thrift-type plans for the respondent’s accounts.

In Figure 1, there is a reference to two more components (CURRPEN) and (FUTPEN). These are two sub-categories of retirement plans referring to current or future pension plans encountered in the SCF, which constitute a considerably smaller part of the respondents’ retirement wealth. Nonetheless, we decided to include them in our computations because of their liquid nature.

In any case, we stress that we confine the analysis to all the aforementioned accounts because of their portability across jobs or their “transactability”, that is those assets’ ease in selling them or trading them, a mechanism permitting the adjustment of the households’ portfolios. As an important last note, we mention that following footnote 49, on p. 33 of [Bhutta et al. \(2020\)](#), we share the approach that because of difficulties in translating future income streams directly into a current value, we do not include in our analysis two common types of retirement plans, namely Social Security (the federally funded Old-Age and Survivors’ Insurance program (OASI)), and employer-sponsored defined-benefit plans.

Following the presentation of all components, we give the total dollar value of our DC plans in Equation (1).

$$DC = IRAKEOGH + NETTHRIFT + CURRPEN + FUTPEN \quad (1)$$

2.2. Risk-Free and Risky DC Plans in the SCF

For the purposes of our research, the next major challenge encountered upon reading the SCF lies in the split of the DC plans into risk-free and risky ones. We repeat that one of the characteristic features of all the US retirement plans of our research is that the participants are called to make their own investment decisions. In order to determine the respondents’ risk taking in their investment decisions, we turn to the SCF and delve into the specifics of the available investment questions of the survey.

By delving into the SCF, we realize that for most asset categories of the SCF, including the retirements accounts and plans of our study, there is only one relevant investment question, which whenever asked has the same format. In particular, upon detecting an account or plan and computing its dollar value, the SCF investment question investigating the investment vehicle of the account or plan in question is the following.

“How is the money in (this/these) account(s) invested? Is it all in stocks, all in interest-earning assets, is it split between these, or something else?”

Following this question, the respondents of the SCF are given several options to select from. In the public SCF data set, (the one that the Federal Reserve provides and the one that we also work with), the available respondents’ options are as follows.

1. ALL IN STOCKS
2. ALL IN INTEREST EARNING ASSETS/BONDS
3. SPLIT
30. MUTUAL FUND OR ETF (NOT A PREFERRED RESPONSE)
- 7. OTHER
0. Inap.

Given the above format of the investment strategy question and its available responses for the public data set, we move on with suggesting our own distinction of assets into risk-free and risky ones. In particular, considering the qualitative character of the responses of this investment question, as well as the limited information that is available, we proceed with the following steps in our classifications. If the account or plan in question is invested “ALL IN INTEREST EARNING ASSETS/BONDS”, we qualify the account or plan as safe. Furthermore, we consider the options “ALL IN STOCKS” or “OTHER” as of full or mixed risk. Thus, we characterize any account or plan invested in any of these three options as risky. For the remaining two options of “SPLIT”, and “MUTUAL FUND OR ETF” investment strategies, we follow a 50-50 approach by classifying half the account or plan as risky, and the other half of the account or plan as safe. We wish to elaborate on these two last classifications, and emphasize the rationale of our decision. First, we stress that to the best of our knowledge, there are not too many similar attempts classifying SCF assets into risk-free and risky encountered in the literature. From our side, we consulted the insightful works of [Jianakoplos and Bernasek \(1998\)](#) and [Chang et al. \(2018\)](#) so as to study their approach in the classification of SCF’s risky and risk-free assets, and their own handling of “SPLIT” and “MUTUAL FUND” strategies. [Jianakoplos and Bernasek \(1998\)](#), working with the 1989 SCF, follow a very rough classification of characterizing everything not invested in “ALL IN INTEREST EARNING ASSETS/BONDS” as risky, while [Chang et al. \(2018\)](#), working with SCF data spanning from 1998 to 2007, proceed with different weights varying from 0.50 to 1 for different types of mutual funds and from 0.30 to 1 for different types of the corresponding split strategies. Due to the fact that these papers worked with earlier waves of the SCF with different options given to the respondents of the surveys, we could not get a direct guideline for the newest waves of the SCF. Thus, for our own approach, following the options available in the latest waves of the SCF, and of that of 2019 in particular, as well as the assumed weights from theory for a diversified portfolio [Damodaran \(1996\)](#), [Pennacchi \(2008\)](#), [Eeckhoudt et al. \(2011\)](#), we deemed the use of a 0.5 weight as more balanced.

Following the above consideration, we proceed with building safe IRAs and Keogh accounts (IRAKHSAFE), safe thrift savings accounts (NETTHRIFTSAFE), safe current pensions, (CURRPENSAFE) and safe future pensions (FUTPENSAFE). Similarly, we build risky IRAs and Keogh accounts (IRAKHRISKY), risky thrift savings accounts (THRIFTRISKY), risky current pensions (CURRPENRISKY), and risky future pensions (FUTPENRISKY). Once more, all computations are available to the reader upon request.

In Equation (2), we compute the total dollar value of the safe DC plans by summing up all safe components.

$$DCSAFE = IRAKHSafe + NETTHRIFTSafe + FUTPENSAFE + CURRPENSAFE \quad (2)$$

Similarly, in Equation (3), we compute the total dollar value of risky DC plans.

$$DCRISKY = IRAKHRISKY + NETTHRIFTRISKY + CURRPENRISKY + FUTPENRISKY \quad (3)$$

Lastly, we proceed with the construction of the risky share of DC plans, which we define as the ratio of total DC plans invested in risky plans. More specifically, by employing the total dollar value of DC plans (DC) and the total dollar value of the risky DC plans (DCRISKY), we build the risky ratio in Equation (4).

$$DCRatio = \frac{DCRISKY}{DC} \quad (4)$$

Having the risky shares of total DC plans for all respondents, we are interested in having a look at the distribution of risky DC shares across different age groups for all the women and men of the 2019 SCF. In the empirical literature that studies risk-taking related to retirement savings, age is a factor very frequently under consideration. However, the findings with regards to the role of age are mixed. The predominant life-cycle theory dictates that risk tolerance should decrease with age, since older individuals have less time to recover losses than younger individuals [Grable and Lytton \(1998\)](#). [Riley and Chow \(1992\)](#) document that risk aversion decreases with age until the age of 65 and then increases.

Other researchers, for instance, [Van Rooij et al. \(2011\)](#) find that age has no significant effect on equity investment. In any case, we also wish to offer a glimpse of our own data. To that effect, we construct a set of dummy variables indicating into which of ten age categories the household head falls. In Tables 1 and 2, we present the risky shares of total DC plans across the aforementioned age groups for the women and men respectively of the 2019 SCF.

Table 1. Distribution of Risky Shares of DC Plans Across Ten Age Groups for Women in the 2019 SCF.

Age Group	<25	26–30	31–35	36–40	41–45	46–50	51–55	56–60	61–65	>65
Risky DC Share	0.615	0.559	0.653	0.663	0.606	0.617	0.588	0.540	0.566	0.535
Observations	13	31	32	31	34	49	58	48	59	144

Table 2. Distribution of Risky Shares of DC Plans Across Ten Age Groups for Men in the 2019 SCF.

Age Group	<25	26–30	31–35	36–40	41–45	46–50	51–55	56–60	61–65	>65
Risky DC Share	0.508	0.602	0.562	0.588	0.612	0.625	0.592	0.583	0.556	0.571
Observations	173	44	97	147	200	207	254	332	310	592

Furthermore, we conduct two *t*-tests, one for women, and one for men, to test whether the distribution of risky shares of DC plans is statistically different across the different age groups for each group. Our findings indicate that the distribution of risky shares of total DC plans for women is statistically different across the age groups (p -value = 0.0141) but the distribution of risky shares for men across the ten age categories is not statistically different (p -value = 0.2178).

Next, we wish to compare the mean risky shares of female and male investors. However, before proceeding, given the generic SCF format of the investment question that we presented above, we need to start our gender approach with an important realization. The gender of the investment decision-maker is not unquestionably clear in the SCF household. We may assume that the respondent of the survey is the same person taking the investment decisions in the household but strictly speaking, there is no specific SCF question investigating the exact identity of the investment decision-maker. This is even more problematic in the case of mixed-sex couples. To overcome this difficulty, first we adopt a common approach encountered in the gender literature, [Embrey and Fox \(1997\)](#), [Jianakoplos and Bernasek \(1998\)](#), and we consider as the most direct test of gender differences in portfolio allocation, the test between households headed by never married females, and households headed by never married males. As a secondary approach, we proceed with a series of assumptions that allows us to look at more SCF households and test for gender differences in an extended sample.

2.3. The 2019 SCF Dataset

In the 2019 SCF, we encounter 5777 families. In Table 3, we present the distribution of the 5777 households according to marital status, and we proceed with the creation of the sub-samples of our research.

Table 3. Sample Frequencies of Households by Marital Status in the 2019 SCF.

Marital Status	2019 SCF	
Married	3108	53.80%
Living with a partner	497	8.60%
Separated	140	2.42%
Divorced	726	12.57%
Widowed	383	6.63%
Never Married	923	15.98%
Total	5777	

2.3.1. Two Sub-Sample(s) of Single Households

Table 3 shows that in the 2019 database, we encounter 923 cases of never married households. Out of these 923 cases, 347 never married respondents or 38% of this sub-sample reports participation in a DC plan. In Table 4, we wish to give to the reader an idea of the allocation of investment strategies followed by never married women and never married men in 2019. That is, we wish to compare, how many never married women, and how many never married men invest their money “ALL IN STOCKS” or “ALL IN INTEREST EARNING ASSETS/BONDS” or in “SPLIT” strategies or in a “MUTUAL FUND OR ETF”. We do this for every SCF retirement asset category used in our DC plans definition, that is for IRA/Keogh accounts (IRAKEOGH), 401(k)s (NETTHRIFT), other Current Job Plans (CURRPEN), and Future Benefits (FUTPEN). By observing Table 4, we mark an overall small participation in the building or retirement wealth. Furthermore, we have not computed any significant differences in the sub-categories between single women and single men; that is, there is no significant difference in the IRAKEOGH invested “ALL IN STOCKS” between single women and single men, and so on and so forth for all the other retirement vehicles and investment strategies.

Table 4. How Do Single Women and Single Men Invest Their Retirement Wealth? By “Single” we Refer to “Never Married” Individuals.

	Single Women				Single Men			
	IRAKEOGH	NETTHRIFT	CURRPEN	FUTPEN	IRAKEOGH	NETTHRIFT	CURRPEN	FUTPEN
1. ALL IN STOCKS	13	32	0	6	28	30	1	5
2. ALL IN BONDS	6	9	0	3	8	10	0	5
3. SPLIT	37	79	2	9	46	86	1	8
30. MUT.FUND/ETF	8	6	0	0	8	6	0	1
-7. OTHER	1	1	0	0	1	0	0	0
0. No such plan	380	318	443	427	387	346	476	459
Observations	445	445	445	445	478	478	478	478

Supplementarily, we consider one more sub-sample. In particular, in order to increase the sample size of never married households with DC plans, we share one more approach from the [Jianakoplos and Bernasek \(1998, p. 622\)](#) work, that is, we consider as single people not only “never married” but also “widowed” and “divorced” individuals. Jianakoplos 346 and Bernasek themselves ([Jianakoplos and Bernasek 1998, p. 622](#)) acknowledge the issue of “the extent to which widows and/or divorced women, for instance, continue the investment strategies begun by their late or ex-husbands” but still, they allow for this consideration and its underlying assumptions. In our work, proceeding with the same consideration, we get a sub-sample of 2032 households, out of which 819 cases are reporting participation in a DC plan. In Table 5, we give the allocation of investment strategies followed by the women and men of this sub-sample in the 2019 SCF. Once more, we have not computed any significant differences in the number of plans held in each retirement vehicle, and each investment strategy between single women and single men.

We note that it is debatable here whether the heterogeneity introduced by adding formerly-married individuals to never married individuals is worth the trouble. In the empirical part, we explore this issue further.

Table 5. How Do Single Women and Single Men Invest Their Retirement Wealth? By “Single” we Refer to “Never Married”, “Divorced”, and “Widowed” Individuals.

	Single Women				Single Men			
	IRAKEOGH	NETTHRIFT	CURRPEN	FUTPEN	IRAKEOGH	NETTHRIFT	CURRPEN	FUTPEN
1. ALL IN STOCKS	46	67	4	15	60	59	4	14
2. ALL IN BONDS	23	28	4	6	18	15	3	9
3. SPLIT	139	152	10	26	91	138	6	16
30. MUT.FUND/ETF	19	7	0	2	18	8	0	2
-7. OTHER	4	1	0	0	3	0	0	0
0. No such plan	936	912	1149	1118	675	645	852	824
Observations	1167	1167	1167	1167	865	865	865	865

2.3.2. An Alternative Sample of Females and Males

We consider it worthwhile to explore a more elaborate sample of individuals being based not only on the original full sample of the 5777 SCF respondents but also on another 3605 cases, namely the 3108 spouses and 497 partners for the cases of SCF respondents being married or living with a partner. The rationale for such a consideration is that when it comes to the SCF, the variables related to pensions are among the very few variables collected separately for the respondent, and the spouse or partner of the respondent. Indicatively, we give below a few SCF questions extracting these pieces of information.

How much (in total) is in your **(husband/wife/partner)’s** Roth IRA accounts(s)?

How much (in total) is in your **(husband/wife/partner)’s** roll-over IRA accounts(s)?

How much (in total) is in your **(husband/wife/partner)’s** Keogh account(s)?

...

What is the balance of (yours/**his/her/his or her**) pension account now?

Thus, besides the DC plans of the 5777 respondents of the survey, we could consider the DC plans of another 3605 cases. In the literature, we report that we encounter researchers espousing the same approach, but also other researchers not agreeing with this approach. Indicatively, we refer to [Sundén and Surette \(1998, p. 207\)](#), as well as to [Bajtelsmit and Bernasek \(2001, p. 4\)](#), who also split couples into two separate observations, on the grounds of studying the retirement assets’ balances of individuals, rather than of households. [Yilmazer and Lyons \(2010\)](#) also refer to the literature of treating married couples as single decision-making units. In any case, in our approach, we also split the SCF couples into two observations including separately data for the DC plans of the respondents and the DC plans of the respondents’ spouses or partners.

Methodologically, we compute separately the DC plans of the respondent’s spouse or partner, and we further distinguish these DC plans into risk-free ones and risky ones following the same steps that we presented in Section 2.2. The code for our computations for the accounts and plans of the respondents’ spouses or partners is available upon request. Next, we consider the DC plans of all the original respondents of the survey (that is the 5777 individuals) along with the DC plans of the additional 3108 spouses and 497 partners. As a result, we investigate for gender differences in risk-taking behavior in retirement plans in a sample of 9382 individuals. In Table 6, we give the allocation of investment strategies followed by the women and men of this sub-sample in the 2019 SCF. We comment that we have not computed any significant differences in the number of plans held in each retirement vehicle, and each investment strategy between all women and all men of this extended sample.

In this alternative sample, we note that 4747 cases or 51% of the sample reports participation in a DC plan. We note that by pooling all women and all men, we introduce heterogeneity in the form of marital status. In the empirical part, we examine this further.

Table 6. How Do Women and Men Invest Their Retirement Wealth?

	Women				Men			
	IRAKEOGH	NETTHRIFT	CURRPEN	FUTPEN	IRAKEOGH	NETTHRIFT	CURRPEN	FUTPEN
1. ALL IN STOCKS	394	274	23	94	451	327	23	99
2. ALL IN BONDS	124	89	13	39	144	127	13	40
3. SPLIT	706	663	64	165	817	918	59	160
30. MUT.FUND/ETF	124	54	8	15	150	87	8	12
-7. OTHER	6	1	1	0	7	2	1	0
0. No such plan	3496	3769	4741	4537	2963	3071	4428	4221
Observations	4850	4850	4850	4850	4532	4532	4532	4532

2.3.3. Sample Variability and Imputation Error in the SCF

As a last important methodological note before proceeding with our empirical analysis, we refer that in our SCF computations, we need to account for two types of error. First, we need to account for possible sample variability error, attributed to the fact that the SCF sample is not an equal-probability design. To tackle this type of error, we report that the statistics of our work will be sample weighted.

Second, we need to account for the effects of imputation error, an error attributed to the fact that missing or incomplete information in the SCF is imputed in multiple ways. To tackle this type of error, we report that we will be using data from all five implicates provided by the SCF, employing the “repeated-imputation inference” (RII) technique, as described analytically in [Rubin \(2004\)](#), and as given from a user’s point of view in [Montalto and Sung \(2004\)](#).

3. Results

For the purposes of our data analysis, we work with Stata/SE 17.0. In what follows, we proceed with presenting our findings for the sub-samples of our research.

3.1. Part I: The Two Sub-Samples of Single Households

We repeat that by “singles”, we originally refer to “never married” individuals and subsequently to a more elaborate consideration that includes “never married”, “divorced”, and “widowed” individuals. We present the results in Tables 7 and 8, respectively, in which, besides the mean shares of total risky DC plans for single women and single men, we also include the mean shares of risky IRA accounts, the mean shares of risky Thrift Plans, the mean shares of risky current pensions, and the mean shares of risky future pensions for both single women and single men. The standard errors are reported in parentheses.

From Table 7, we deduce the following information. First, we observe that the risky shares of total DC plans are not significantly higher for never married men versus the ones for never married women. However, we do observe significant differences in the shares of risky IRAs with never married men holding more risky assets than never married women. This result with regards to risk-taking in IRAs is in accordance with similar findings in the literature. For instance, [Lei \(2019\)](#) using data from the 2013 SCF finds that single women are less likely to own stocks and invest in fewer stocks in their IRAs. We also note that there are no significant differences in the shares of risky Thrift Plans over Total DC plans between single females and single men. Lastly, the ratios of risky current and future pensions are negligible in terms of their magnitude in the portfolio of total DC plans, and there are no significant differences in risky holdings for single women and single men. With regards to our non-significant findings, which show no gender differences in retirement risk-taking between never married women and never married men, we remark that this finding could be an indicator of similar patterns of retirement investment behavior for male and female singles. However, we wish to stress the limitation of the sample size, which in the case of never married individuals in the 2019 SCF is admittedly small.

Table 7. Mean Risky Shares of Never Married Females and Never Married Males.

WEIGHTED Data	Never Married Women	Never Married Men
Risky IRA/Roth/Keogh	0.162 (0.020)	0.230 [†] (0.024)
Risky Thrift Plans	0.370 (0.027)	0.336 (0.025)
Risky Current Pensions	0.005 (0.003)	0.005 (0.005)
Risky Future Pensions	0.050 (0.014)	0.030 (0.010)
Risky Defined Contribution Plans	0.586 (0.021)	0.601 (0.020)
Observations	163	186

[†] The difference in mean ratios is significantly different from zero at the 5% level.

Table 8. Mean Risky Shares of Single Females and Single Males.

WEIGHTED Data	Single Women	Single Men
Risky IRA/Roth/Keogh	0.235 (0.015)	0.258 (0.018)
Risky Thrift Plans	0.267 (0.016)	0.281 (0.017)
Risky Current Pensions	0.022 (0.006)	0.023 (0.007)
Risky Future Pensions	0.054 (0.009)	0.042 (0.008)
Risky Defined Contribution Plans	0.577 (0.013)	0.603 (0.015)
Observations	455	364

From Table 8, we observe the following points. First, we remark that the risky shares of total DC plans, the shares of risky IRAs over total DC plans, and the shares of risky Thrift Plans over Total DC plans are not significantly different between single women and single men. Further, the ratios of risky current and future pensions are negligible in terms of their magnitude in the portfolio of total DC plans, while there are no significant differences in risky holdings between single women and single men. In this sub-sample of singles, we have increased the sample size by including “divorced” and “widowed” individuals. We are intrigued by the non-significant gender differences, which lead us to further support the similarity in retirement investment behaviors between female and male singles that we recorded earlier in Table 7. In the literature, when it comes to retirement preparedness, single women are often at a financial disadvantage compared to single men. For instance, [Kopanidis et al. \(2017\)](#) refer to single women as financially disadvantaged with regards to their retirement planning due to lower accumulated savings compared to male retirees. [Sundén and Surette \(1998\)](#), using data from the 1992 and 1995 SCF, find that single women are more cautious than single men, having a lower likelihood to invest mostly in stocks in their DC plans. Our work does not corroborate this pattern; instead, it reveals a lack of gender differences. This could reveal a convergence in female and male investment behaviors of single-headed households but it could also be a random finding. We would need more observations, and account for more factors for further examination.

Heterogeneity in the “Singles” Sample

Here we explore heterogeneity in the singles sample by examining the difference in the ratios of risky DC plans between never married women and formerly-married women, as well as between never married men and formerly-married men. In Table 9, we present the results of paired *t*-tests for the aforementioned sub-groups and we further note whether the mean difference in the ratios is significantly different from zero.

Table 9. Paired *t*-tests for Never Married and Formerly Married Individuals.

WEIGHTED Data	Observations	Mean	Std. Err.
Ratio of Risky DC Plans for Never Married Women	163	0.586	0.023
Ratio of Risky DC Plans for Formerly Married Women	163	0.584	0.021
<i>t</i> -test = 0.0707 Two-tailed <i>p</i> -value = 0.9437			
Ratio of Risky DC Plans for Never Married Men	178	0.606	0.021
Ratio of Risky DC Plans for Formerly Married Men	178	0.606	0.023
<i>t</i> -test = −0.0066 Two-tailed <i>p</i> -value = 0.9947			

From Table 9 we see that the mean difference of risky shares of DC plans for never married women and formerly married women is not significantly different from zero. The same applies for the mean difference of risky shares of DC plans for never married men and formerly married men. Thus, we may conclude that our elaborate consideration of singles was worth the effort.

3.2. Part II: The Extended Sample of Women and Men

We proceed with comparing the mean risky shares between females and males in the extended sample of 9382 individuals, which includes the DC Plans of all the original 5777 respondents of the survey along with the DC plans of the additional 3108 spouses and 497 partners. We present the results in Table 10, where once again, besides the mean shares of total risky DC plans of female and male investors, we also include the shares of risky IRA accounts, the shares of risky Thrift Plans, the shares of risky current pensions, and the shares of risky future pensions for both women and men. All standard errors are reported in parentheses.

Table 10. Mean Risky Shares of Females and Males in the Extended SCF 2019 Sample.

WEIGHTED Data	Women	Men
Risky IRA/Roth/Keogh	0.308 (0.007)	0.275 [†] (0.007)
Risky Thrift Plans	0.232 (0.007)	0.258 [†] (0.006)
Risky Current Pensions	0.013 (0.002)	0.018 [†] (0.002)
Risky Future Pensions	0.038 (0.003)	0.032 (0.003)
Risky Defined Contribution Plans	0.592 (0.006)	0.583 (0.005)
Observations	2219	2528

[†] The difference in mean ratios is significantly different from zero at the 5% level.

By observing the results in Table 10, we deduce the following information. First, we remark that the mean risky shares of total DC plans are not significantly different between men and women. This is one of the most interesting findings of our research, since it reveals a convergence in the behaviors of female and male investors with regards to total risk

taking in the building of their retirement wealth. This convergence could be a random event for this particular 2019 data point but it could also be the positive outcome of a systematic effort of financial education and planning with regards to retirement vehicles. Perhaps, repeating the tests in the 2022 SCF, which is currently under data collection, could solidify whether individuals' behaviors in total risk-taking converge for both women and men. However, in the current findings, besides the ratios of total risk-taking, we need to account for the individual risky shares. In particular, we observe significant differences between women and men in the mean shares of risky IRAs over total DC plans, the mean shares of risky Thrift Plans over DC plans, and the risky shares of current pensions over DC plans. It is noteworthy that the direction of the significant difference reveals that men manifest greater risk-taking than women in their Thrift Plans (401(k)s, 403(b)s), and Current Pensions, but it is women who indicate more risk-taking behavior than men in their IRAs, Roth accounts, and Keogh accounts. Lastly, we observe that the mean ratios of risky future pensions are negligible in terms of their magnitude in the portfolio of total DC plans for both groups and there are no significant differences in these risky holdings for women and men.

We wish to focus our commentary on the results referring to shares of risky IRAs and risky Thrift Plans, which constitute the biggest shares of the retirement portfolios. With regards to IRAs, [Lei \(2019\)](#) comments on IRAs' relatively loose eligibility criteria, especially compared to 401(k) plans. Perhaps these loose eligibility criteria make IRAs more attractive to women for planning their retirement, considering the concerns raised in the Introduction Section that women are called to undertake part-time assignments or interrupt their careers more often to take care of family. Thus, certain structural features of IRAs could explain women's higher risk-taking in these retirement vehicles. With regards to Thrift Plans, our finding is in accordance with other works; for instance, [Bernasek and Shwiff \(2001\)](#) find that men allocate more to stocks in their 401(k)s than women. We think that perhaps Thrift Plans, being employment-based plans, could benefit from a looser layout such as the one achieved by the passing of the 1981 Economic Recovery Tax Act, which allowed more individuals to own and contribute to IRAs. A similar loosening could help women to participate more in Thrift Plans, and subsequently undertake more risk.

Heterogeneity in the Alternative Sample

Here we test for heterogeneity by examining the difference in the ratios of risky DC plans between single women and married/cohabiting women, as well as between single men and married/cohabiting men. In [Table 11](#), we present the results of paired *t*-tests for the aforementioned sub-groups and we further depict whether the mean difference in the ratios is significantly different from zero.

Table 11. Paired *t*-tests for Single and Married/Cohabiting Individuals.

WEIGHTED Data	Observations	Mean	Std. Err.
Ratio of Risky DC Plans for Single Women	455	0.577	0.013
Ratio of Risky DC Plans for Married/Cohabiting Women	455	0.604	0.013
<i>t</i> -test = −1.3768 Two-tailed <i>p</i> -value = 0.1692			
Ratio of Risky DC Plans for Single Men	364	0.603	0.015
Ratio of Risky DC Plans for Married/Cohabiting Men	364	0.584	0.014
<i>t</i> -test = 0.9487 Two-tailed <i>p</i> -value = 0.3434			

[Table 11](#) reveals that the mean difference of risky shares of DC plans for single women and married/cohabiting women is not significantly different from zero. The same applies for the mean difference of risky shares of DC plans for single men and married/cohabiting men. Thus, we may deduce that our more elaborate consideration has not altered our conclusions.

4. Discussion

In our paper, taking advantage of the richness of the information available in the SCF, and its latest setup for 2019, we suggested an enriched consideration of DC plans. We constructed risky ratios of total DC plans, and we compared the mean risky ratios of total DC plans between females and males into two different settings. Interestingly enough, in both settings, we concluded with no significant differences in the risky shares of total DC plans between (single) women and (single) men. However, we did record significant differences in the risky shares of IRAs, Thrift Plans (401(k)s, and 403(b)s), and Current Pensions between women and men. The lack of significant gender differences in the risky shares of total DC plans is an encouraging sign that women are catching up in financial risk-taking, which could be attributed to the continuing efforts of financial education of both women and men. An equally encouraging finding is women's higher manifested risk-taking in risky IRAs, Roth accounts, and Keogh accounts. Perhaps this result could be used as an indicator of more ease on women's part with the more loose eligibility structure of an IRA or Roth or Keogh account, which allows relatively easier participation. However, the structure of 401(k)s, and the employee's role and contribution, need to get clearer to potential participants. The significant differences in risky shares of Thrift Plans, showing men exhibiting more risk-taking than women, add to this need. We stress that proving that certain groups of individuals distinguished by an individual characteristic, such as their gender, are more risk averse than others, could have major implications in the effective conduct of risk management, as well as the efficient design of public policy calling for policies on risk being tailored to the gender of the individual (Damodaran 2007, p. 43).

In terms of public policy design, in an era of self-directed accounts and continuing gender pay gaps, persistent gender differences make critical the role of education, and financial education in particular. The retirement journey for all individuals is long and highly idiosyncratic, making a "one-size-fits-all" approach narrow-minded and unrealistic. However, there are some basic tenets that should be promoted and safeguarded. For instance, the trade-off between financial risk and financial return, the need for portfolio diversification, and long-term investment are all concepts stemming from an adequate financial education. Dwyer et al. (2002) record that women exhibit less risk-taking than men in their largest, and riskiest mutual fund investment decisions; however, they also find that the impact of gender on risk-taking is significantly weakened when investor knowledge of financial markets and investments are controlled. More specifically, if risk-taking is a prerequisite for adequate retirement income but not a given in today's female investors' behavior, public policies should safeguard women by educating them towards a realistic and timely allocation of their portfolios.

We wish to underline the need for financial education from one more angle. Börsch-Supan et al. (2018) refer to the cognitive and emotional state of "saving regret", which they define as "the wish in hindsight to have saved more earlier in life". The authors try to measure and also investigate the causes of saving regret looking at indicators for procrastination and life-time shocks. They find high levels of saving regret in their sample but they also attribute more variation of this regret in shocks than in procrastination, suggesting that the preferred policy course might involve information and education to help individuals better assess the likelihood of shocks and the probability of major life-course events. Thus, in an era when the anxiety about having adequate savings to retire is increasing, financial education is of key importance.

We close with the potential future directions of our research, where we mention the following points. First, we stress that the SCF remains a valuable tool in our investigation of gender differences. The first next step for us constitutes into studying gender differences in risk-taking in retirement investment strategies with the use of a regression framework accounting for a series of demographic characteristics. The second step for us is to make use of more waves of the SCF, and study risk-taking in retirement wealth over time. Besides the SCF inspection, we also wish to briefly refer to a series of alternative approaches that could help us in the study of gender differences in financial risk-taking. In particular, as an

alternative pattern of study, we wish to refer to a rich series of experiments, investigating risky choice through a great gamut of instruments. Indicatively, we refer here to questionnaires (Kogan and Dorros 1978), gambles (Eckel and Grossman 2008), and more elaborate computer-administered experiments (Croson and Gneezy 2009). Further, we comment that we single out specific experiments related to the study of gender differences and statistical stereotypes in risk-taking, and financial risk-taking in particular, such as those by Zinkhan and Karande (1991) or Eckel and Grossman (2008), which we deem as worthwhile of future study in terms of replication, enrichment, and repetition in varied settings.

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