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Abstract

In view of the transition to funded individual account plans in many nations around the world, it is of interest to evaluate how the introduction of a funded defined contribution retirement system affects participants' propensity to participate in the stock market. This chapter evaluates what we call the "Swedish experiment," where, in 2000, the traditional Swedish pay-as-you go retirement system was partially replaced by a national defined contribution plan. Our main question is whether individuals perceive their investments in the pension scheme as a substitute for direct investments, and whether allocating more equities in their pension accounts induces participants to reduce or increase their directly-held equity investments. The results show that investors do not perceive direct investment in the equity market as a close substitute for their retirement accounts, suggesting that an individual account system does not crowd out direct equity market investment. Accordingly, the new Swedish system may actually help educate investors of the benefits of stock market participation, increasing participation and therefore, indirectly, boosting saving.

Disciplines

Economics

Comments

The published version of this Working Paper may be found in the 2007 publication: *Redefining Retirement: How Will Boomers Fare?.*

Chapter 12

Pension Portfolio Choice and Menu Exposure

Anders Karlsson, Massimo Massa, and Andrei Simonov

This chapter examines how the introduction of a funded defined contribution (DC) retirement system affects participants' propensity to participate in the stock market. This is an interesting topic in view of the transition to funded individual account plans in many nations around the world. Here we focus on what we call the 'Swedish experiment;' in the year 2000, the traditional Swedish pay-as-you-go retirement system was partially replaced by a national DC plan commonly referred to as the premium pension (PPM) system (Sunden 2000). Our main question is whether individuals perceive their investments in the pension scheme as a substitute for direct investments, and whether allocating more equities in their pension accounts induces participants to reduce or increase their directly held equity investments.

Standard portfolio choice theory suggests that investors would choose an optimal overall market exposure taking into account both direct and indirect (e.g. through a pension scheme) investment in equity. That is, pension and nonpension equity holdings would be seen as substitutes, at least to a first order. By contrast, behavioral finance theorists instead hypothesize that investors tend to categorize their investments, along with associated gains and losses, according to narrow categories. This approach, labeled 'mental accounting' or 'narrow framing', predicts that investors apply such mental accounting to stock holdings and react separately to gains and losses for different stocks (Barberis and Huang 2001).

The implications of the two theories are starkly different. Standard portfolio theory would posit that inducing investors to hold their retirement accounts in pension funds would crowd out direct equity investment. Behavioral theory, instead, suggests that if investors perceive their investment in pension funds and equity to be different sorts of accounts, one investment would not necessarily crowd out the other. The best way to examine this issue is to see whether introducing a DC individual account system changes investor incentives to directly participate in the stock market. To do a proper analysis, we would require information on investors'

portfolio choices before the change, and to explore what happened after the introduction of the new pension system. Until now, this sort of information has been unavailable.

Our contribution is to exploit data on a large and representative sample of Swedish individuals tracked over time. Not only do we have information on their wealth, income, tax position, and demographic characteristics, but also we have semiannual information on the value of each investor's stock positions as well as the daily value of his transactions in the PPM system. In particular, the data-set on the individual retirement accounts includes all individual choices made from the introduction of the system until October 2004. We use the evidence provided on investors' patterns in the PPM system to test whether having a pension account containing mutual fund investments changes investor incentives to participate directly in the stock market.

The results show that investors do not perceive direct investment in the equity market as a close substitute for their retirement accounts, suggesting that an individual account system does not crowd out direct equity market investment. The new Swedish system may actually help educate investors of the benefits of stock market participation, increasing participation and therefore, indirectly, boosting saving. In what follows, we first describe the Swedish experiment and provide institutional details. Next, we describe the data and our main evidence. A short conclusion offers policy implications.

The Swedish 'Experiment'

The Swedish government made changes to its old pay-as-you-go national retirement program in the fall of 2000. The 'basic' portion of the system is a guaranteed benefit designed to ensure that no retiree will be completely without benefits in retirement, regardless of her or his previous income. There are two earnings-related elements of the new pension system, one being the Notional Defined Contribution (NDC) plan, financed by a tax of 16 percent of annual pay; revenue from this system is used to finance current retirees, and the amount paid in also serves as a base in calculating future pension payments. The second earnings-related component, of most interest here, is the premium pension (PPM) portion. This is financed by a mandated contribution 2.5 percent of annual pay, which is invested according to each individual's discretion. At inception, each participant was mailed a prospectus describing the investment menu of 464 funds, from which the participant had to elect from 1 to 5 of these choices.

Table 12-1 represents the information provided to investors in the PPM system. In addition to the fund identification number, name, and fund family, information is provided on fees, past return, and risk. Risk is

TABLE 12-1 Extract from the PPM Investor Information Folder, for a Specific Fund Example

Fund Number	Fund Name and Management Company	Information Regarding Fund	Fund Fee (%/yr)	Percentage Return 99-12-31 (After Fees)						Total Risk
				In the Year					Last 5 yrs	Last 3 yrs
				1995	1996	1997	1998	1999		
191080	Baring Global Emerging Markets; Baring International Fund Managers (Ireland) Ltd	Emerging market equity and equity related assets	1.59	–32	10	25	–25	77	25.3	32 (Red)

Source: Premiepensionsmyndigheten (2000).

Notes: The percentage return for the last five years equals the compounded annual growth rate of return for the years 1995 through 1999. The total risk corresponds to an annualized percentage standard deviation of three-year monthly historical fund returns. The total risk is also categorized into five different classes, and colors, with respect to standard deviation; Class 1: very low risk, dark green, and percentage standard deviation in the range 0–2; Class 2: low risk, light green, and 3–7; Class 3: average risk, yellow, and 8–17; Class 4: high risk, orange, and 18–24; Class 5: very high risk, red, and 25+.

represented by a simplified graph displaying a jagged red line for very risky or a flat green line for very low risk. There are five risk categories of this kind. In addition, each fund has a number representing the fund's annualized standard deviation over the past thirty-six months. If, for some reason, no menu choice is actively elected, the participant's money is invested in the default which is the Seventh Swedish Pension Fund; this is an equity fund run by the government. The accrued amount from the PPM part will be paid out on a monthly basis to the individual at the time of retirement.

In total, 18.5 percent of the annual pension-based income for each individual is invested to finance this system, and all annual income from the age of 16 is included. Yet there is a contribution crediting limit: individuals who earn more than 7.5 income 'base amounts'[1] per year are only credited with 18.5 percent of 7.5 income base amounts, even though they still pay the contribution on their entire pension-based income.[2] The first pension investments in the PPM system, in October 2000, involved 4.4 million individuals. At that time, workers' initial contribution was set at 2 percent of pay for 1997–8 and 2.5 percent for 1999 and 2000. The average amount invested was 12,651 SEK for the entire population and 13,506 SEK for those who made an active investment election;[3] the maximum invested was 26,202 SEK.

When the PPM system was introduced, the government and the mutual fund industry launched a massive advertising campaign (Cronqvist and Thaler 2004; Cronqvist 2006). Though low on information content (level of fees, risks, etc.), the ads did help create a positive image of investing in financial markets. More than 86 percent of all investors were exposed to TV ads, 75 percent were exposed to some advertising in print media, 59 percent saw some kind of outdoor ads, and 36 percent listened to radio ads (Cronqvist 2006). Accordingly, virtually the entire population was exposed to information about investing in financial markets at the time of the PPM launch.

Figure 12-1 shows how the Swedish stock market peaked in March 2000 showing a 15-month gain of 141 percent (January 1999–March 2000). In the second half of 2000 (when the PPM was introduced), the market fell 20 percent, and it then continued to fall for the first 6 months of 2001, dropping about 15 percent further.

About 6 percent of our sample population was invested directly in the stock market in June 30, 1999. This figure increased to 8.5 percent by June 2000 and further to 9 percent by the end of 2000 and 9.35 percent by June 2001. Thus, our three dates after this extreme bull market show an increase in stock market participation. This increased interest for the stock market could be a delayed reaction of the 1999 bull market. But it is also possible that rising interest in the stock market despite the bear market of 2000–1 can be attributed to the substantial marketing
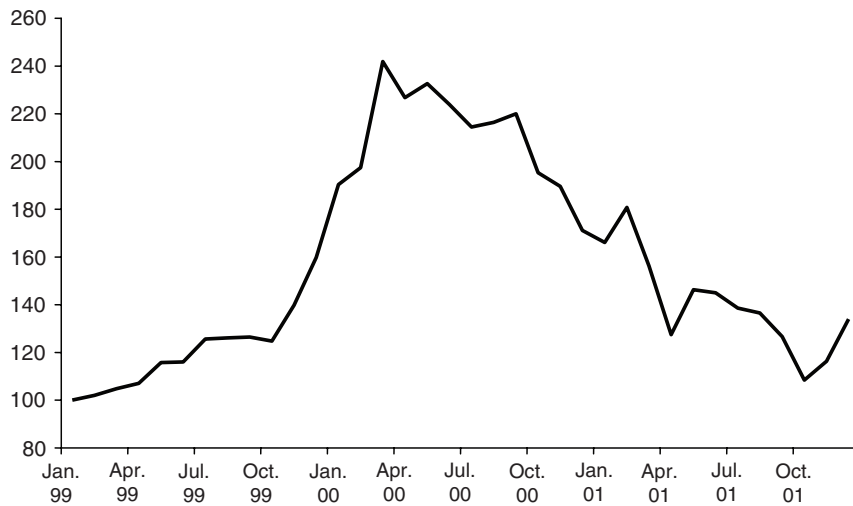
Figure 12-1. Swedish stock market index. (*Source*: Ibbotson Associates (MSCI-Sweden Sweden Total Return Index, data ID IBOR002028 in SEK January 1999 = 100).)

campaigns in 2000 encouraging individuals to make an active choice in PPM.

The Data

To analyze investment choices under the PPM model, we have collected data from three different sources: investment allocations in the PPM system, investor stock market holdings' and investor demographics. Our sample is a representative cross section of the Swedish workforce, whose PPM investment choices have been linked to individual demographic data collected by Statistics Sweden for the year 2000. This linked data-set makes it possible to study investment behavior in great detail.

Asset Allocation Information

Data on individual retirement accounts are collected from PPM, and they indicate all individual choices made from the introduction of the system until October 2004. Both the transaction date and clearing date are known. We also know the universe of funds that was available to investors at each point in time. Thus, for each individual, there is information on the amount invested in each fund, and in which funds the individual invested. Approximately two-thirds of the 4.4 million participants in PPM made an

active investment decision. For these individuals, we can investigate the exact allocation of assets in their portfolios. The remaining third did not make an active investment decision, so their money was defaulted into the government-run equity fund.

Portfolio Data

For each investor, we have detailed information about individual stockholdings, mutual funds, bank accounts, real estate, and other types of wealth for the period 1995–2000. The Security Register Center (VPC or Vardepapperscentralen) have data on both stocks held directly and in a street name, including holdings of US-listed ADRs. In addition, SIS Ägarservice AB collects information on the ultimate owners of shares held via trusts, foreign holding companies, and the like (cf. Sundin and Sundquist 2002). Overall, the records provide information about the owners of 98 percent of the market capitalization of publicly traded Swedish companies. For the median company, we have information about 97.9 percent of the equity, and in the worst case, 81.6 percent of market capitalization of the company. The data provided by SIS Ägarservice AB are linked by Statistics Sweden to the demographic data described below.

Additional Data

We also use data on demographic statistics reported by Statistics Sweden, the Swedish version of the US Census Bureau. Data sources include HEK 2000 (a report on household economics), IoF 2000 (a report on individual and household measures of income), and SUN 2000 (a report on educational status). These three reports represent a cross section of the Swedish population and contain detailed information including the amount of foreign assets held per person by asset class. The data also describe individuals' demographic status in 2000, at the time the initial PPM choice was made. We also have information on the investor's age as of December 31, 2000, whether the investor is an immigrant, his income, and net wealth,[4] if the investor lives in an urban or rural area or small town, the investor's education level and major, his occupation, sex, and marital status. Excluding individuals too young or too old to make a selection in the PPM system in 2000, the sample includes 15,651 individuals, of whom 10,373 made an active choice.

Preliminary descriptive statistics appear in Table 12-2, where we note that the average investor holds 2.60 funds (conditional on making an active choice, 3.47 funds). Men hold slightly fewer funds than women; though the difference is statistically significant, the economic magnitude is only

TABLE 12-2 Descriptive Statistics for PPM Investors

	Mean	Std. Dev.
ENTERSIM	0.010	0.010
ENTERAFTER	0.012	0.012
EXITSIM	0.053	0.057
EXITAFTER	0.086	0.079
Choice	0.669	0.221
Equity	0.901	0.170
Number of funds	2.602	1.409
Age	43.028	11.111
Swede	0.887	0.316
Income	202,269	188,121
Net wealth	444,108	3,174,320
Urban	0.354	0.478
Town	0.356	0.479
Rural	0.289	0.454
Education: less then high school	0.181	0.385
Education: high school	0.513	0.500
Education: college	0.306	0.461
Major: social science	0.262	0.440
Major: engineering	0.239	0.426
Major: medical	0.134	0.341
Major: other	0.365	0.482
Occ: public sector	0.287	0.452
Occ: private sector	0.558	0.500
Occ: self-employed	0.048	0.213
Occ: other	0.108	0.310
Male	0.509	0.500
Married	0.778	0.415

Source: Authors' calculations.

Notes: $N = 15{,}497$. Key outcomes are ENTERSIM if between July 2000 and December 2000; ENTERAFTER takes the value of 1 if a person entered the stock market between January 2001 and June 2001; both are set to 0 otherwise. EXITSIM (EXITAFTER) equals 1 if person exited the stock market between July 2000 and December 2000 (January 2001 and June 2001) and 0 otherwise. CHOICE is set to 1 if investor made an active choice in the PPM system, 0 otherwise; Equity represents the amount invested in equity divided by the total amount held in the PPM. Number of funds represents the number of funds included in the participant's PPM portfolio. Age refers to the participant's age as of December 31, 2000; Sweden is set to 1 if the individual was born in Sweden, 0 else; INCOME is the individual's net income in 2000; NET WEALTH is the individual's net wealth, which is the market value of financial wealth + real estate − debt; Urban, Town, and Rural are set to 1 respectively if the individual lived in one of the three major cities in Sweden, any smaller town, or on the countyside, correspondingly; education level is split into three dummies set to 1 if the person's schooling was less than, equal to, or more than high school, correspondingly; Education major is split into four dummies set to 1 if person's higher education major was social science, engineering, medical, or other; occupation is split into four dummies set to 1 if the person was employed in the public sector, private sector, self employed, or unknown employment/unemployed; Male is set to 1 if the person was male; and Married is set to 1 if the person was married.

about 0.02. Younger investors (under age 40) hold more funds than older persons (3.27 and 3.71 respectively). Note that while portfolios of older investors are less exposed to equity and less risky. Older investors hold 80 percent of their portfolios in equity versus 86 percent for young investors. Turning to transactions, investors on average rebalance their portfolios 1.64 times over our time period (with the median of 1, a 99th percentile of 8 and a maximum of 155). This frequency is lower for men (women rebalance 1.59 times per year, while the men did so 1.70 times per year).[5]

Investment Patterns in the PPM System

In what follows, we first analyze how investors choose the funds in their retirement account. Some investors choose specific combinations of equity and bond funds. We call them active investors. Others do not make a deliberate choice but instead opt for the default government-run equity fund. Next, we focus on stock market participation to test the link between the choice in the PPM system and stock market participation. We show that for the case of the active investors being active in their retirement choice increases the probability of stock market participation. That is, an individual who did not participate in the stock market is more likely to enter it once he has been presented with the new pension scheme. This effect is not only statistically significant but also economically relevant.

Choice of Funds

The key question of interest is whether PPM participation affects stock market participation. We first approach this by providing descriptive statistics about how investors select their funds in the PPM system. Some investors make a deliberate choice and choose specific combinations of equity and bond funds, while others just opt for the default. This allows us to define active and passive investors.

Table 12-3 describes entry and exit rates, defined as ratio of people who entered or exited the stock market between two different periods. Our focus is on two periods: simultaneous with the rollout of the PPM system (January 7, 2000–December 31, 2000) and after the PPM system was in place (January 1, 2001–June 30, 2001). Panel A compares people who actively choose funds in the PPM system to those who did not, whereas more than 66 percent of the households made a deliberate decision. These households were younger, in general. If we concentrate on ENTERSIM, one can see that entry rate is almost two times larger (1.25% vs. 0.65%) among the people who made active choice. This difference is also statistically significant (p-value of both t-test and Wilcoxon test is 0.0009). Similar

TABLE 12-3 Entry and Exit Rates as Function of PPM Investment Choice

	ENTERSIM		*ENTERAFTER*		*EXITSIM*		*EXITAFTER*	
	N	*Mean*	*N*	*Mean*	*N*	*Mean*	*N*	*Mean*
Panel A: Entry and Exit Rates as Function of Active Choice								
Choice								
0 (No choice)	4,792	0.0065	4,783	0.0084	332	0.0663	341	0.1114
1 (Active choice)	9,378	0.0125	9,314	0.0135	995	0.0533	1,059	0.0784
Test of the difference								
t-statistic		−3.3285		−2.6921		0.8877		1.8907
p-value		0.0009		0.0071		0.3748		0.0589
Wilcoxon' Z		−3.3266		−2.6919		0.8881		1.8890
p-value		0.0009		0.0071		0.3747		0.0589
Panel B: Entry and Exit Rates as Function of Number of Funds Chosen								
Number of funds								
1	6,140	0.0085	6,119	0.0083	490	0.0633	511	0.0978
2	1,272	0.0071	1,266	0.0150	120	0.0250	126	0.0556
3	1,997	0.0080	1,993	0.0085	212	0.0566	216	0.1157
4	1,872	0.0107	1,865	0.0123	173	0.0751	180	0.0611
5	2,889	0.0177	2,854	0.0196	332	0.0482	367	0.0763
Test of the difference between groups 1 and 5								
t-statistic		−3.8360		−4.5921		0.9126		1.1067
p-value		0.0001		0.0000		0.3617		0.2687
Wilcoxon' Z		−3.8330		−4.5870		0.9130		1.1070
p-value		0.0001		0.0000		0.3614		0.2685
Test of the difference between groups 1 and combined 2, 3, 4, and 5								
t-statistic		−2.0229		−3.3178		−0.8139		−1.1525
p-value		0.0431		0.0009		0.4158		0.2493
Wilcoxon' Z		−2.0229		−3.3170		−0.8140		−1.1530
p-value		0.0431		0.0009		0.4156		0.2492

This table reports entry and exit rates for subgroups of people who actively selected funds in the PPM system, and the ones who did not (Panel A); and subgroups of people who choose different number of funds (Panel B).

Source: Authors' calculations.

Note: For variable definitions, see Table 12-2.

results were obtained for period after introduction of PPM system (January 2001–June 2001). People who made active choice 61 percent more likely to enter stock market during this period (1.35% vs. 0.84%, *p*-value of mean and median test is 0.0071). At the same time, active participation in PPM system does not affect exit rate strongly. Panel B divides the sample into subgroups of investors who choose different numbers of funds. As in Panel A, people who choose multiple funds are more likely than people

who choose only one fund to enter the stock market and same chances to exit.

Pension Choice and Stock Market Participation

We next focus on the link between PPM system choice and stock market participation. We focus both on investors who did participate in the stock market and look at their exit rates, and also those who did not participate initially and evaluate their later entry rates. These we model as a function of investors' demographic characteristics and choices made in the PPM system. The sample is affected by selection bias inasmuch as people with certain demographic characteristics are more likely to invest in the stock market. To deal with this issue, we estimate a two-stage Heckman-type probit selection model for the decision to enter the stock market (cf. van de Ven and van Praag 1981). That is, we first estimate the probability that the investor holds equity already at time $t - 1$, and then, conditional on that behavior, we relate it to the decision to enter the stock market. For example, for investor j with characteristics x_j, z_j we estimate the following equation:

$$\text{Entry}_j = (\boldsymbol{x}_j \beta + u_{1j} > 0).$$

The selection equation is $z_j \gamma + u_{2j} > 0$, where $u_1 \sim N(0, 1)$, $u_2 \sim N(0, 1)$ and $\text{corr}(u_1, u_2) = \rho$. Choice in the pension scheme is posited to depend on a number of investor demographic characteristics, income, wealth, residential location, and education.[6]

The dependent variables of most interest are indicators of individuals exiting or entering the stock market during this period, and a continuous variable for how much the individual investor has increased or decreased her investments. In particular, ENTERSIM takes the value of 1 if the investor entered the stock market simultaneous with the PPM launch (July 1, 2000–December 31, 2000), while ENTERAFTER takes the value of 1 if the person entered the stock market after the launch (January 1, 2000–June 30, 2001). Similarly, EXITSIM (EXITAFTER) takes the value of 1 if the person exited the stock market between July 1, 2000 and December 31, 2000 (or January 1, 2001–June 30, 2001).

The behavioral variables on which we focus most are choice, equity, and number of funds. We refer to these as proxies for activity in the PPM system. Choice takes on a value of 1 if the investor made an active choice in the PPM system, and equals 0 otherwise. Equity represents the fraction invested in equity out of the total amount invested in PPM. Number of funds refers to the number of funds included in the investor's PPM portfolio. Also included are other demographic factors defined as above.

Table 12-4 illustrates one specification for the period during the introduction of PPM system (July 2000–December 2000) and a second after the introduction of the PPM system (January 2001–June 2001). We start by considering the decision to enter the stock market, and we provide results for models with and without a Past Stock Market Participation Dummy (set equal to one if investor held equity in December 1998, June 1999, or December 1999). The results confirm that those who made a deliberate choice under the PPM system have a higher probability of stock market participation. In particular, there is always a positive relationship between our three proxies for activity in the PPM system, namely Choice, Equity, and Number of funds, and the ensuing decision to enter the stock market. This result is robust, holding for all specifications and cases presented. Not only is it statistically significant but also economically relevant; thus making a deliberate choice under the PPM increases the probability of stock market participation by 0.28 percent (see bold value in row one, column five). This is equivalent to a 24 percent increase with respect to the unconditional mean. Analogously, a one standard deviation rise in the number of funds that the investor selects for his retirement portfolio raises the probability of stock market entry by 0.12 percent (bold value in row two, column 11). This represents a 10 percent increase with respect to the unconditional mean. Finally, an increase in the fraction invested in equity funds by one standard deviation increases the probability of stock market entry by 0.4 percent. This represents a 34 percent increase with respect to the unconditional mean. These results hold for both after the introduction of PPM system (January 2001–June 2001) and also during the PPM introduction (July 2000–December 2000; and point estimates in this earlier period are somewhat larger).

We now consider the decision to exit the market with estimates appearing in Table 12-5. Here, results indicate that making a deliberate choice under the PPM system is either irrelevant to the investor's exit decision, or it reduces the probability of leaving the stock market (after the introduction of PPM system). The results for the period of July 2000–December 2000 (Panel A) show that our three proxies for activity in the PPM system do not affect the exit decision at this point. In Panel B, after the introduction of PPM (January 2001–June 2001), there is always a negative relationship between our three proxies for activity in the PPM system and the probability of leaving the stock market. This result holds across all the different specifications. The results are strongly statistically significant, but the economic significance is modest. In particular, making a deliberate choice in the retirement account reduces the probability of leaving the stock market by 0.22 percent, or 2.8 percent of unconditional mean. Analogously, an increase in the number of funds that the investor selects for his retirement portfolio by one standard deviation decreases the probability of leaving the

TABLE 12-4 Effect of PPM Choice on Entry Decision

	Est.	t-stat	ME	Est.	t-stat	ME	Est.	t-stat	ME	Est.	t-stat	ME
Panel A: Decision to Enter the Stock Market: July 2000–December 2000												
Decision to participate in the stock market (ENTERSIM)												
Choice	0.212	(4.25)	0.0038	0.201	(3.84)	0.0039	0.056	(5.60)	0.0011	0.053	(4.80)	0.0011
Number of funds												
Equity							0.286	(4.98)	0.0054	0.279	(4.67)	0.0055
Past Participation Dummy	1.083	(10.08)	0.0763	1.100	(9.96)	0.0773	1.094	(10.16)	0.0755			
Pseudo R^2	0.094			0.072			0.097			0.076		
Panel B: Decision to Enter the Stock Market: January 2001–July 2001												
Decision to participate in the stock market (ENTERAFTER)												
Choice	0.127	(2.51)	0.0028	0.1253	(2.79)	**0.0028**	0.0570	(3.81)	0.0012	0.0533	(3.99)	**0.0012**
Number of funds							0.1810	(2.39)	**0.0039**	0.1732	(2.55)	0.0040
Equity												
Past Participation Dummy	0.604	(4.36)	0.0327	0.6786	(4.63)	0.0339	0.6494	(4.70)	0.0332			
Pseudo R^2	0.103			0.096			0.104			0.098		

This table reports the results of two-stage Heckman-type Probit selection models for the decision to enter the stock market during the introduction of PPM system (July 2000–December 2000, reported in Panel A) versus after the introduction of PPM system (January 2001–June 2001, reported in Panel B). We report the result for two specifications with and without Past Participation Dummy (which is equal to 1 if the person held equity in our sample in December 1998, June 1999, or December 1999. Other control variables are described in Table 12-2. Marginal effects (ME) are given for the second stage; *t*-statistics are reported in parentheses.

Source: Authors' calculations.

Notes: All controls from Table 12-2 and an intercept are also included in the model.

TABLE 12-5 Effect of PPM Choice on Exit Decision

	Est.	t-stat	ME	Est.	t-stat	ME	Est.	t-stat	ME	Est.	t-stat	ME
Panel A: Decision to Exit the Stock Market: July–December 2000												
Decision to participate in the stock market (EXITSIM)												
Choice	−0.030	(−0.40)	−0.0002	−0.052	(−0.55)	−0.0005						
Number of funds				−0.009	(−0.23)	0.0000	−0.004	(−0.09)	0.0000			
Equity	0.427	(6.24)	0.0033				0.113	(1.21)	0.0007911	0.104	(1.43)	0.0011
Past Participation Dummy				0.427	(5.97)	0.0033	0.400	(5.48)	0.0039884			
Pseudo R^2	0.086			0.085			0.086			0.053		
Panel B: Decision to Exit the Stock Market: January–July 2001												
Decision to participate in the stock market (EXITAFTER)												
Choice	−0.215	(−3.19)	−0.0022	−0.215	(−3.18)	**−0.0021**						
Number of funds				−0.068	(−2.05)	−0.0007	**−0.069**	(−2.09)	−0.0006			
Equity	−0.075	(−0.85)	−0.0007				−0.315	(−3.74)	**−0.0031**	−0.315	(−3.79)	−0.0030
Past Participation Dummy				−0.064	(−0.69)	−0.0006	−0.075	(−0.84)	−0.0007			
Pseudo R^2	0.047			0.046			0.052			0.051		

This table reports the results of two-stage Heckman-type Probit selection models for the decision to exit the stock market during the introduction of PPM system (July 2000–December 2000, reported in Panel A) and after the introduction of PPM system (January 2001–June 2001, reported in Panel B). We report the results for two specifications with and without Past Participation Dummy which is equal to 1 if the person held equity in sample in December 1998, June 1999, and December 1999. Other control variables are our described in Table 12-2. We report marginal effects (ME); *t*-statistics are reported in parentheses.

Source: Authors' calculations.

Notes: All controls from Table 12-2 and an intercept are also included in the model.

stock market by 0.07 percent (about 0.8% of unconditional mean). Finally, an increase in the fraction invested in equity funds by one standard deviation reduces the probability of leaving the stock market by 0.31 percent. This represents a 3.9 percent decrease with respect to the unconditional mean.[7]

Overall, then, the findings suggest a sort of 'learning effect'. That is investors afforded the choice to invest their retirement money in equity funds and then make a deliberate choice to do so, are more likely to enter the stock market.

Pension Choice and Stock Market Participation: Controlling for Endogeneity.

Next we consider the issue of endogeneity which arises because the investor determines the value for his Choice, Equity, and Number of Funds variables jointly with the decision to participate in the stock market. To correct for this, we adopt an Instrumental Variables (IV) methodology. Specifically, we estimate both a two-Stage Least Squares (2SLS) linear probability model and an IV-Probit model of the decision to enter the stock market, as a function of our three proxies for activity in the PPM system as well as the other controls. We use as instruments Age and Age squared.

Our estimates appear in Tables 12-6 and 12-7, where the explanatory variable in Panel A is the active choice decision under the PPM system; in Panel B, it is the number of funds chosen; and in Panel C, it is the fraction of equity in the chosen portfolio. As in the previous case, we estimate a specification for the period during the introduction of PPM system (July 2000–December 2000) and after the introduction of the PPM system (January 2001–June 2001).

As before, there is a positive relationship between the three proxies for PPM activity and the ensuing decision to enter the stock market. Furthermore, this result holds across all specifications and is economically significant. For example, an increase in the probability of making a deliberate choice in the retirement account triples the unconditional probability of stock market entry. Marginal effect related to making active choice is about 3 percent, which is three times unconditional probability of entry. Similar numbers for the effect of choosing multiple funds and choosing larger fraction of equity are 35 percent and 170 percent increase with respect to unconditional probability of entry, correspondingly. These results hold for both the period during the introduction of PPM system (July 2000–December 2000) and afterward as well (January 2001–June 2001).[8]

TABLE 12-6 Effect of PPM Choice on Entry Decision: IV Estimates

	Entry June–Dec 2001 (ENTERSIM)							Entry Jan–June 2001 (ENTERAFTER)						
	First Stage		2SLS		Probit			First Stage		2SLS		Probit		
	Est.	t-stat	Est.	t-stat	Est.	t-stat	ME	Est.	t-stat	Est.	t-stat	Est.	t-stat	ME
Panel A: Decision to Enter Stock Market and Make Active Choice in PPM System														
Choice			0.0337	(1.91)	1.1501	(4.09)	0.0316			0.0576	(1.96)	1.6570	(7.24)	0.1149
Past Participation Dummy	0.0333	(0.71)	0.1256	(11.66)	0.9555	(4.89)	0.0878	0.0413	(0.58)	0.0669	(5.32)	0.4576	(2.41)	0.0577
	F-test of instruments		*Hansen OIR Test*		*Wald Exogeneity Test*			*F-test of instruments*		*Hansen OIR Test*		*Wald Exogeneity Test*		
	F-stat.	*p-val*	*Hansen J*	*p-val*	χ^2	*p-val*		*F-stat.*	*p-val*	*Hansen J*	*p-val*	χ^2	*p-val*	
	31.52	0.000	1.528	0.2164	8.300	0.004		29.78	0.000	0.161	0.688	22.020	0.000	
Panel B: Decision to Enter the Stock Market and Number of Funds Chosen in PPM System														
Number of funds			0.0048	(1.77)	0.1806	(3.49)	0.0038			0.0066	(1.94)	0.2590	(3.49)	0.0062
Past Participation Dummy	0.0363	(0.31)	0.1265	(11.89)	1.0777	(7.76)	0.0795	0.0893	(0.59)	0.0687	(5.62)	0.6906	(2.27)	0.0373
	F-test of instruments		*Hansen OIR Test*		*Wald Exogeneity Test*			*F-test of instruments*		*Hansen OIR Test*		*Wald Exogeneity Test*		
	F-stat.	*p-val*	*Hansen J*	*p-val*	χ^2	*p-val*		*F-stat.*	*p-val*	*Hansen J*	*p-val*	χ^2	*p-val*	
	213.78	0.000	0.711	0.399	6.410	0.011		211.75	0.000	0.015	0.9033	6.470	0.011	

Panel C: Decision to Enter the Stock Market and Fraction of Equity Chosen in PPM System

Equity	0.0393 (0.88)	0.0211 (1.79)	0.8268 (4.11)	0.0179	0.0429 (0.64)	0.0270 (1.99)	1.0972 (4.35)	0.0317
Past Participation Dummy		0.1259 (11.80)	1.0442 (7.09)	0.0765		0.0680 (2.10)	0.6407 (2.32)	0.0382

F-test of instruments		Hansen OIR Test		Wald Exogeneity Test		F-test of instruments		Hansen OIR Test		Wald Exogeneity Test	
F-stat.	*p-val*	*Hansen J*	*p-val*	χ^2	*p-val*	*F-stat.*	*p-val*	*Hansen J*	*p-val*	χ^2	*p-val*
155.78	0.000	0.503	0.478	8.230	0.004	152.56	0.000	0.122	0.7253	13.270	0.000

This table reports the result of 2SLS linear probability model and IV-Probit estimates of a decision to enter the stock market as a function of active choice decision (Panel A), number of funds chosen (Panel B), and fraction of equity in the chosen portfolio (Panel C). We used as instruments Age and squared Age of the investor. We report the results of first stage estimate and joint F-test of significance of the instruments. For 2SLS linear probability model, we report Hansen over identifying restrictions test. For IV-probit estimates, we report Wald test of exogeneity. We report marginal effects (ME) for probit estimates; *t*-statistics are reported in parentheses.

Source: Authors' calculations.

Notes: All controls from Table 12-2 and an intercept are also included in the model.

TABLE 12-7 Effect of PPM Choice on Exit Decision: IV Estimates

Panel A: Decision to Exit the Stock Market and Active Choice in PPM System

	Exit June–Dec 2000 (EXITSIM)							Exit Jan–June 2001 (EXITAFTER)						
	First Stage		2SLS		Probit			First Stage		2SLS		Probit		
	Est.	t-stat	Est.	t-stat	Est.	t-stat	ME	Est.	t-stat	Est.	t-stat	Est.	t-stat	ME
Choice			0.4046	(1.31)	2.2024	(2.88)	0.4726			−0.0835	(−0.29)	−0.7281	(−0.59)	−0.1334
Past Participation Dummy	−0.0061	(−0.91)	0.0525	(3.15)	0.1701	(2.76)	0.0578	−0.0082	(−1.22)	−0.0114	(−0.73)	−0.0719	(−0.83)	−0.0101

F-test of instruments		Hansen OIR Test		Wald Exogeneity Test		F-test of instruments		Hansen OIR Test		Wald Exogeneity Test	
F-stat.	p-val	Hansen J	p-val	χ^2	p-val	F-stat.	p-val	Hansen J	p-val	χ^2	p-val
2.28	0.103	0.981	0.322	36.72	0.000	2.33	0.0977	2.96	0.085	0.170	0.169

Panel B: Decision to Exit the Stock Market and Number of Funds Chosen in PPM System

	Exit June–Dec 2000 (EXITSIM)							Exit Jan–June 2001 (EXITAFTER)						
	First Stage		2SLS		Probit			First Stage		2SLS		Probit		
	Est.	t-stat	Est.	t-stat	Est.	t-stat	ME	Est.	t-stat	Est.	t-stat	Est.	t-stat	ME
Number of funds			0.0396	(1.96)	0.3858	(3.02)	0.0607			−0.0243	(−1.05)	−0.1462	(−1.98)	−0.0199
Past Participation Dummy	0.0542	(1.47)	0.0465	(3.30)	0.3368	(3.56)	0.0564	0.0590	(1.74)	−0.0062	(−0.39)	−0.0463	(−0.51)	−0.0063

F-test of instruments		Hansen OIR Test		Wald Exogeneity Test		F-test of instruments		Hansen OIR Test		Wald Exogeneity Test	
F-stat.	p-val	Hansen J	p-val	χ^2	p-val	F-stat.	p-val	Hansen J	p-val	χ^2	p-val
26.660	0.000	0.154	0.695	7.800	0.005	25.480	0.000	1.911	1.669	5.320	0.021

Panel C: Decision to Exit the Stock Market and Fraction of Equity Chosen in PPM System

Equity		0.2415	(1.77)	1.9007	(5.46)	0.4385		−0.1114	(−0.76)	−0.6713	(−1.74)	−0.0915
Past Participation Dummy	−0.0107 (−1.29)	0.0517	(3.57)	0.2976	(3.57)	0.0715	−0.0131 (−1.90)	−0.0109	(−0.70)	−0.0687	(−0.76)	−0.0093

F-test of instruments		Hansen OIR Test		Wald Exogeneity Test			F-test of instruments		Hansen OIR Test		Wald Exogeneity Test	
F-stat.	p-val	Hansen J	p-val	χ²	p-val		F-stat.	p-val	Hansen J	p-val	χ²	p-val
9.350	0.000	0.431	0.511	18.350	0.000		9.380	0.000	1.900	0.168	1.100	0.294

This table reports the result of 2SLS linear probability model and IV-probit estimates of a decision to exit the stock market as a function of active choice decision (Panel A), number of funds chosen (Panel B), and fraction of equity in the chosen portfolio (Panel C). We used as instruments Age and squared Age of the investor. We report the results of first stage estimate and joint F-test of significance of the instruments. For 2SLS linear probability model, we report Hansen over identifying restrictions test. For IV-probit estimates, we report Wald test of exogeneity. We report marginal effects (ME) for Probit estimates, and t-statistics are reported in parentheses.

Source: Authors' calculations.

Notes: All controls from Table 12-2 and an intercept are also included in the model.

We now consider the decision to exit the market. When endogeneity is properly controlled, it is interesting that the results for the period July 2000–December 2000 now show a strong positive impact of our proxies for activity in PPM on the decision to exit the stock market. It is consistent with some participants in the stock market (probably bubble era entries) being induced by the PPM publicity campaigns to review stock market risks (or perhaps they simply looked at their holdings which dropped 20% in value during that period) and decided to leave. The decision to leave the stock market after the introduction of the PPM system proves to be unrelated to the PPM behavior. Results in Table 12-7 are weaker than those reported in Table 12-5; further the 2SLS estimates lose significance, as do the estimates based on the Choice variable (Panel A). The estimates based on the Number of Funds and the Fraction of Equity are, however, still negative and significant.

Overall, these findings again support a 'learning effect'. In other words, exposure to decision-making about risky choices educates people. Those who otherwise would not have made risky decisions are thereby induced to participate in the stock market.

A Counterfactual Test

Next we perform a counterfactual experiment to test whether our main explanatory variables—Choice, Number of Funds, and Equity—might proxy for some individual-specific characteristics that are not necessarily related to the introduction of the PPM system. That is, it might be that people who make a deliberate selection of pension assets, or people that invest most of their contributions in equity are also the ones who would in any case participate more in the stock market, regardless of whether PPM is in force.

To address this issue, we re-estimate the same model as before, but now over a different period. Specifically, we select a time prior to the introduction of the PPM, so entry and exit decisions now refer to December 1999–June 2000. The goal is to use the same model as before. We hypothesize that if the decision to participate in the stock market is related to the introduction of the new pension scheme, as opposed to individual-specific characteristics, we would anticipate that the very same variables which explain stock market participation later on would also explain it beforehand. Results in Table 12-8 support our hypothesis. That is, we find no relationship between our main explanatory variables and the decision to enter or exit the stock market. For the control variables, instead, the same relationship holds. This suggests that it was the introduction of the new Swedish retirement scheme that affected stock market behavior as opposed

TABLE 12-8 Placebo Test: Effect of PPM Choice on Entry Decision before PPM System Introduction: IV Estimates

Panel A: Decision to Enter Stock Market from December 1999 to June 2000

Choice	First Stage Est.	(t-stat)	2SLS Est.	(t-stat)	Probit Est.	(t-stat)	First Stage Est.	(t-stat)	2SLS Est.	(t-stat)	Probit Est.	(t-stat)	First Stage Est.	(t-stat)	2SLS Est.	(t-stat)	Probit Est.	(t-stat)
Number of funds			0.0091	(0.20)	0.1060	(0.12)			0.0028	(0.56)	0.0448	(0.65)			0.0139	(0.65)	0.2591	(0.86)
Equity	0.0509	(0.88)	0.3610	(7.78)	1.4901	(16.40)	0.0916	(0.36)	0.3612	(7.74)	1.4903	(18.30)	0.0485	(0.87)	0.3608	(7.73)	1.4835	(18.94)
Past Participation Dummy																		

	F-test of instruments F-stat.	p-val	Hansen OIR Test Hansen J	p-val	Wald Exogeneity Test χ²	p-val
(1)	30.310	0.000	1.506	0.220	0.000	0.988
(2)	219.110	0.000	1.311	0.252	0.090	0.762
(3)	153.720	0.000	1.246	0.264	0.140	0.711

Panel B: Decision to Exit the Stock Market from December 1999 to June 2000

Choice	First Stage Est.	(t-stat)	2SLS Est.	(t-stat)	Probit Est.	(t-stat)	First Stage Est.	(t-stat)	2SLS Est.	(t-stat)	Probit Est.	(t-stat)	First Stage Est.	(t-stat)	2SLS Est.	(t-stat)	Probit Est.	(t-stat)
Number of funds			0.0949	(1.29)	0.0983	(1.28)			0.0201	(1.07)	0.3612	(1.87)			0.1166	(1.10)	1.6020	(1.14)
Equity	0.0193	(0.49)	0.0298	(2.56)	0.3442	(4.73)	0.2074	(1.20)	−0.5894	(−27.96)	−2.1812	(−3.51)	−0.0016	(−0.03)	−0.5868	(−27.02)	0.3687	(1.27)
Past Participation Dummy																		

	F-test of instruments F-stat.	p-val	Hansen OIR Test Hansen J	p-val	Wald Exogeneity Test χ²	p-val
(1)	4.750	0.009	0.553	0.457	2.470	0.116
(2)	19.040	0.009	0.626	0.429	2.250	0.134
(3)	9.150	0.000	0.478	0.489	5.940	0.015

This table reports the result of 2SLS linear probability model and IV-Probit estimates of a decision to enter (Panel A) and exit the stock market as a function of PPM choice. The entry and exit referred to the period from December 1999 to June 2000 (prior to PPM introduction). We used as instruments Age and squared Age of the investor. We report the results of first stage estimate and joint F-test of significance of the instruments. We report Hansen over identifying restrictions test. For IV-probit estimates, we report Wald test of exogeneity. Past Participation Dummy is defined as equal to 1 if the person held equity in our sample in December 1998 or June 1999; t-statistics are reported in parentheses.

Source: Authors' calculations.

Notes: All controls from Table 12-2 and an intercept are also included in the model.

to participants' characteristics. The findings also provide strong evidence of causality from PPM choice to subsequent investment behaviors.

Discussion and Conclusion

This chapter has focused on how the introduction of a DC retirement system affects investors' propensity to participate directly in the stock market. Our unique evidence on investor patterns before and after the Swedish PPM was introduced permits us to focus on the decision to invest in stocks. Results show how this pattern changes, once investors were permitted to participate in the new pension system. Specifically, we showed that introducing the chance to invest in retirement funds increased peoples' tendency to enter the stock market. We also show that investors who made a deliberate choice of their pension asset allocation also boosted stock market participation once the plan was in place. Investors who previously did not participate in the stock market turn out to have a higher likelihood of entering once they are presented with the new pension scheme.

What this means, we argue, is that requiring workers to invest in mutual funds can act as a triggering device which induces them to enter the stock market as well; being induced to choose among different pension funds appears to 'educate' participants about the stock market. The fact that investors do not treat their retirement account investments as close substitutes for direct equity investment also implies that the adoption of a capitalization-based system does not necessarily crowd out direct investment. This may be of interest to policymakers in the current debate about moving from a pay-as-you-go to a fully funded DC system.

Acknowledgments

Notes

[1] For the year 2006, one income base amount equals 44,500 SEK.

[2] For example, for a person with 360,000 SEK as her pension-based income in the year 2006, only 18.5% of 333,750 SEK (7.5 × 44,500) will count toward her pension. In other words, her defined contribution to PPM in 2006 is 8,344 SEK (0.025 × 333,750), which is the maximum contribution per individual for that year. The typical exchange rate in 2000 was 10 SEK for US$1 and for 2006 around 7 SEK/USD.

[3] The slightly higher average for active investors is consistent with Engström and Westerberg (2003) who show that active investors tend to have slightly higher income than the 'default' investors.

[4] Net wealth is made up of the market value of domestic and international financial assets such as bank account, fixed income, mutual funds, stocks and options, and an estimated market value of real estate, minus debt.

[5] The table also shows that the average age of our sample is 43; 89% were born in Sweden; average gross income in 2000 was 202,269 SEK, and average net wealth was 444,108 SEK. Some 29% lived in the countryside, with the remaining 71% living in either one of the three major cities in Sweden (35%) or in a town (36%). Few, 18%, had not completed high school; 51% had completed high school; and 31% went to college. Around one-quarter majored in social science (including economics, law, sociology and so on); another quarter had an engineering major; 13% majored in medicine; and 36% had unspecified majors. Public sector employees made up 29% of the sample, while 56% were in the private sector and only 5% were self-employed. Most (78%) were married and 51% were male. After matching all the different sources, 154 observations were deleted due to missing demographic information.

[6] Specifically, we control on investors' Age in 2000; Swedish nationality; Net Income (in 2000 measured as the logarithm of income in SEK plus 1); Net Wealth defined as the market value of financial wealth and real estate less the value of debt (measured as the logarithm of Net Wealth plus 1); Urban, which takes the value of 1 if the investor lived in one of the three major cities in Sweden; Town takes the value of 1 if the investor lived in a smaller town; and Rural equals 1 if the investor lived in the countryside. We also include three variables which measure educational levels, respectively set to 1 if the person's schooling was less than, equal to, or exceeded high school. We control for participants' education major by using four variables which take on a value of 1 if the investor's higher education major was social science, engineering, medical school, or other respectively. Analogously, we control for occupational differences using four variables set to 1, respectively, if the person was employed in the public sector, private sector, self employed, or had unknown employment or was unemployed. Finally, we include Male and Married controls, respectively set to 1 if the investor were a male and 1 if the investor was married. To achieve identification, in Tables 12-3 and 12-4, we used Age, Age Squared, and set of dummies related to education major in selection equation and not in the second stage.

[7] It is interesting that, for most of our estimates, the correlation coefficients of the Probit and selection equation error terms are not statistically significant (i.e. in our case, selection does not affect the Probit results). This allows us to ignore the issues of selectivity and to concentrate on the issues related to the endogeneity of the choice.

[8] It is worth noticing that the tests of the goodness of instruments show indeed that our instruments do a good job. We report the first-stage estimates and a joint F-test of significance of the instruments; they are jointly significant at the first stage. For the 2SLS linear probability model, we report Hansen over identifying restrictions test. For IV-probit estimates we report Wald test of exogeneity. For 2SLS estimates, the test of over identified restrictions fails to reject the model.

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