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ARTICLES

The Demographics of Overconfidence

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As is well-known, investors are subject to overconfidence. Using a survey of about 2,000 defined contribution pension plan members, we not only corroborate this, but also explore the demographics of this behavioral flaw. Noting that overconfidence can be partitioned into certainty and knowledge, we find that highly-educated males who are nearing retirement, who have received investment advice, and who have experience investing for themselves, tend to have a higher certainty level. For some groups knowledge matches certainty. Because highly-educated males do not have higher levels of knowledge we conclude that they are more subject to overconfidence.

Introduction

Overconfidence is the tendency for people to overestimate their knowledge, abilities and the precision of their information. That most people are overconfident is well-documented by researchers in the psychology literature (Fischoff (1982)). In a research setting, overconfidence can be detected and even measured in several ways. Some studies have asked people to rate themselves relative to average on certain positive personal attributes such as athletic skill or driving ability. Generally more than 50% say they are better than average. This is the so-called *better-than average* effect (Svenson (1981)). Another strain of overconfidence is called *illusion of control* (Langer (1975)). Those so afflicted think they have more control over events than can objectively be true. Another popular way to tease out a discrepancy between knowledge and knowledge perception is to conduct what is termed a calibration test (Lichtenstein, Fischhoff and Phillips (1982)). In one variant, people are asked to provide (say) 90% confidence intervals for a series of questions which have known (or soon knowable) answers. Almost invariably, people manage to obtain a percentage much lower than 90% right.

Researchers have tried to explain why overconfidence is so prevalent among people, and, more puzzlingly, why people fail to learn from past mistakes. It is believed that many people possess certain behavioral biases that contribute to the longevity of overconfidence. One of these is *self-attribution bias* (Miller and Ross (1975)). People tend to attribute successes or good outcomes to their own abilities, while blaming failures on circumstances beyond their control, or plain bad luck. For example, a lot of people think highly of their investing ability. They believe they can time the market or pick the next hot stock. When the market is rising, most stocks will do well, including those that they pick, and most people will take that as a confirmation of their acumen. On the other hand, when their stocks drop in price, they will generally blame it on circumstances over which they had no control—such as the general condition of the market or the economy. As it were, people learn to be overconfident (Gervais and Odean (2001)).

Overconfidence is of interest because there is evidence that it can lead to suboptimal results. Deaves, Lüders and Luo (2005) performed a calibration test and then asked subjects to participate in experimental asset markets. After obtaining information on subjects' relative levels of overconfidence, they succeeded in correlating this with people's proclivity to trade: those who were most overconfident traded the most. Barber and Odean (2000) conducted a comprehensive study of the trading histories of over 60,000 U.S. discount brokerage investors between 1991 and 1996, and found that, while an average investor earned a return below the market by as much as 3.70%, the 20% of investors who traded the most underperformed the market by about 10%.

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While we know that investors as a whole are subject to the behavioral flaw of overconfidence, little work has been done on its demographics. One exception to this is the finding that gender and overconfidence are associated (Lundeberg, Fox and Punccohar (1994) and Barber and Odean (2001)), with males being most at risk. But what about such demographic characteristics as age, investment experience, education, income and wealth? Do these influence the existence and degree of overconfidence? One reason why this matters is that more and more individuals, especially through vehicles such as 401(k)'s, are being expected to manage significant amounts of their own money. The problem is that it is well documented that future retirees make potentially costly mistakes in managing their self-directed retirement accounts. Problems include insufficient saving (Mitchell and Utkus (2004)), asset allocation confusion (Benartzi and Thaler (2001) and Bhandari and Deaves (2005)) and suboptimal selection (Benartzi and Thaler (2002)), excessive choice paralysis (Iyengar, Jiang and Huberman (2004)) and unwise concentration in company stock (Benartzi (2001)). If we can learn what demographic groups are most at risk, it may be possible to target educational initiatives appropriately.

The purpose of this paper is to conduct an exploratory demographic analysis of overconfidence. We make use of a survey of approximately 2,000 Canadian defined contribution *(DC)* pension plan members.[1] While surveys are commonplace, this one was unique in consciously investigating the extent to which plan members fall prey to such behavioral flaws as overconfidence.[2] To preview, we first corroborate previous work by demonstrating the existence of overconfidence in this particular group of individuals. We also investigate the demographics of overconfidence, finding that highly-educated males are most susceptible. The first section briefly reviews the survey instrument, and presents broad-based evidence on the existence of overconfidence. In the next section we decompose overconfidence into levels of certainty and knowledge, and investigate which demographic factors are associated with certainty, knowledge and overconfidence. Finally the last section provides some perspective.

The Survey Instrument and Evidence on the Existence of Overconfidence

Early in 2004 a survey of Canadian *DC* pension plan members was conducted in order to ascertain satisfaction with their current pension plans and desire for changes. In addition, several questions were included to investigate investment knowledge and overconfidence in that knowledge. In most important respects there is little difference between U.S. and Canadian living standards, labor markets and pension arrangements.[3] The principle difference with respect to the latter is that Canada has been slower to adopt *DC*-type pension arrangements than has the U.S., but the trend in Canada has also been clearly towards decision- and risk-shifting to employees.[4] Participants were from a broad spectrum of industries, geographical areas and socioeconomic groups, and 17 pension plans were represented.[5] *Table 1* provides a snapshot of some of the overall demographics of the sample.[6] This group compares favorably to the rest of the North American labor force.[7]

Two five-option multiple-choice questions on historical Canadian asset class returns or yields were asked of survey respondents in order to test their knowledge level.[8] If someone obtained one (out of two) correct answers, her knowledge level was said to be 50%. More importantly, each question had a second part which asked the respondents how certain (in percentage terms) they were in their answers. Suppose that the average certainty level obtained by this same individual on the two questions was 60%. Since it is natural to define overconfidence as the difference between knowledge perception (the level of certainty) and actual knowledge (the percentage of correct answers), in the case of this individual her level of overconfidence was 10% (60%–50%).

Two questions of course tell us very little about either knowledge or overconfidence at the level of any particular *individual*. Twenty or more questions of this type would have been preferable for this purpose. That said, given the sample size, it should be possible to say something about knowledge vs. knowledge perception *in the aggregate* (and, in the next section, for groups).

On the first question, 32% of respondents obtained the correct answer. On the second, only 8% got it right.[9] Thus the average knowledge level was 20% (which is the same as mere guessing). The average certainty level was 42% (41% on the first question and 43% on the second). Simple arithmetic tells us that the average level of overconfidence in this sample was (a highly significant) 22%. The frequency distribution for overconfidence is shown in *Figure 1*. Most studies indicate that people in a multitude of settings are overconfident (Barber and Odean (1999)). Indeed here on average people are egregiously overconfident. Nevertheless the dearth of questions in this particular survey leads to a large percentage of respondents (21.8%) being underconfident. This is because for a certainty level of (say) 40% it just takes one (perhaps luckily) correct question to push people into underconfident territory.

Demographic Factors and Their Impact

The survey used here conveniently affords us with the set of demographic variables shown in *Table 2*. No-

Table 1. *A Demographic Snapshot of the Survey Respondents*

	Count	% (all) % (group)	Cert. Level	Std. Dev.	Inv. Know.	Std. Dev.	Over-confid.	Std. Dev.
Male/female			**Gender**					
Male	1159	61.95	0.4600	0.1756	0.1999	0.2642	0.2589	0.3060
OC	880	75.93	0.4870	0.1813	0.0932	0.1948	0.3939	0.2027
Not OC	279	24.07	0.3746	0.1304	0.5412	0.1378	-0.1667	0.1645
Female	712	38.05	0.3684	0.1620	0.2016	0.2733	0.1633	0.3137
OC	483	67.84	0.3890	0.1782	0.0435	0.1410	0.3455	0.1755
Not OC	229	32.16	0.3249	0.1175	0.5459	0.1446	-0.2210	0.1745
Total	1871	100	0.4251*	0.1761	0.2006	0.2676	0.2226*	0.3123
College?			**Education**					
None	221	11.76	0.3796	0.1729	0.2052	0.2637	0.1692	0.3092
OC	153	69.23	0.4111	0.1869	0.0686	0.1727	0.3425	0.1845
Not OC	68	30.77	0.3088	0.1231	0.5294	0.1185	-0.2206	0.1589
Some	460	24.48	0.4107	0.1840	0.2030	0.2687	0.2063	0.3210
OC	332	72.17	0.4413	0.1956	0.0738	0.1776	0.3675	0.1992
Not OC	128	27.83	0.3313	0.1266	0.5430	0.1407	-0.2117	0.1773
Grad.	1198	63.76	0.4388	0.1715	0.1989	0.2681	0.2385	0.3078
OC	884	73.79	0.4635	0.1807	0.0775	0.1810	0.3860	0.1929
Not OC	314	26.21	0.3694	0.1247	0.5462	0.1450	-0.1768	0.1692
Total	1879	100	0.4250*	0.1759	0.2006	0.2676	0.2225*	0.3119
Dollars			**Income**					
Up to 50k	571	31.05	0.3673	0.1700	0.1998	0.2792	0.1641	0.3237
OC	390	68.30	0.3862	0.1821	0.0385	0.1334	0.3477	0.1779
Not OC	181	31.70	0.3265	0.1319	0.5580	0.1606	-0.2315	0.1815
51k–100k	932	50.68	0.4378	0.1709	0.2034	0.2674	0.2334	0.3129
OC	680	72.96	0.4672	0.1774	0.0794	0.1829	0.3878	0.1920
Not OC	252	27.04	0.3583	0.1261	0.5417	0.1385	-0.1833	0.1709
Over 100k	336	18.27	0.4929	0.1745	0.1938	0.2500	0.2979	0.2810
OC	271	80.65	0.5137	0.1830	0.1181	0.2128	0.3956	0.2155
Not OC	65	19.35	0.4062	0.0982	0.5154	0.0870	-0.1092	0.1057
Total	1839	100	0.4259*	0.1760	0.2005	0.2681	0.2237*	0.3126

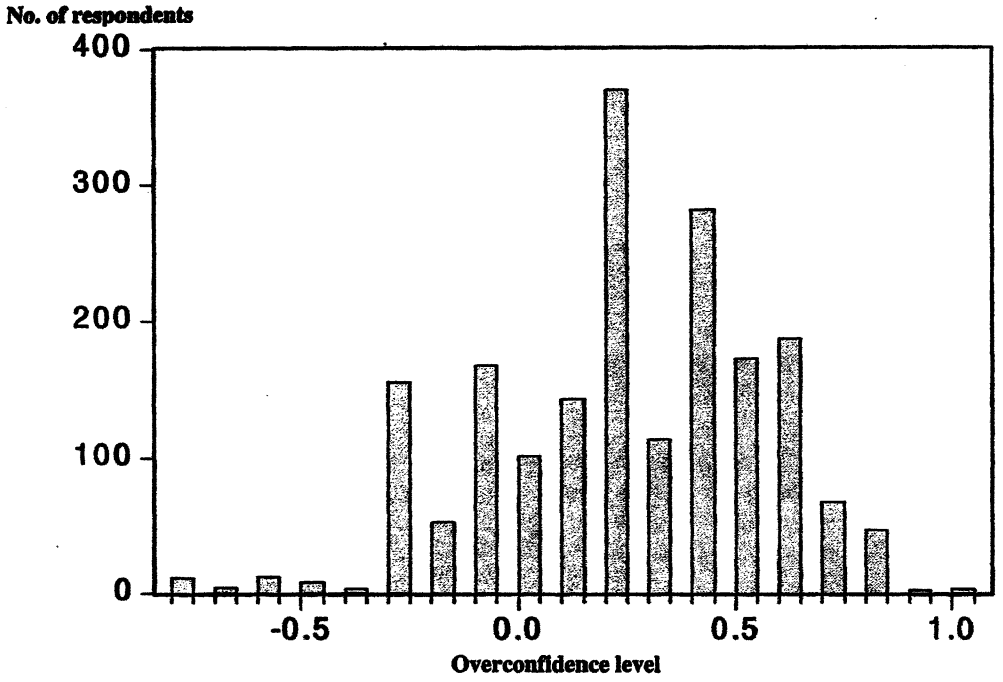
Note: Significant differences among subgroups are indicated in "Total" row, where * signifies 1% and # signifies 10%.

tice that there are three kinds of variables available: purely numerical variables, such as age; binary variables, such as marital status; and ordered categorical variables, such as income. For example, for income respondents could tick off one of four options: up to $25,000; $25,000–50,000; $50,000–100,000; and over $100,000.[10]

While our main concern is the demographic determinants of overconfidence, it is instructive to investigate this behavioral flaw by disaggregating its constituent parts. One might be overconfident because one is extremely confident or certain (and not quite sufficiently knowledgeable), or because one has very little knowledge (but a bit too much of a perception of knowledge). Returning to *Table 1*, we look at the impact of three key potential variables, gender, education and income on certainty level, investment knowledge and overconfidence.[11] Results of significance tests between subgroups are shown in the "Total" row. For example, in the case of gender, the average certainty level for men is 46% vs. 37% for women, and the difference is statistically significant at 1%. For investment knowledge there is no appreciable difference between genders. The implication must be that men are more overconfident than women, which we can indeed conclude at the 1% significance level. Similarly, for education and income we can conclude significant differences in certainty level and overconfidence—but not investment knowledge—among subgroups. Note that for both education and income the relationship appears to be monotonic, with higher education and higher income being associated with greater certainty and overconfidence.

It is possible that some variables might be proxying for others rendering associations spurious. Thus it is appropriate to turn to multivariate regressions. In *Table 3*, we provide the highlights of regressions of certainty level, investment knowledge and overconfidence on the same slate of demographic variables. Ordered categorical variables are treated in either of three ways. First, we convert them to numerical variables by interpolation.[12] Second, hypothesizing diminishing sensitivities for all variables with dollar magnitudes (income, wealth and pension size), we convert in these

FIGURE 1
Frequency Distribution of Overconfidence Level



Note: Overconfidence equals certainty level minus investment knowledge.

cases numerical magnitudes to logs. And, third, we convert ordered categorical variables to binary variables where we choose as a breakpoint that which (as closely as possible) equates the number of respondents on each side of the boundary. Standard ordinary least squares regression was used (subject to diagnostics).[13] For each dependent variable-independent variable manipulation technique combination, the regression that is shown includes all independent variables which passed a first-round cut significance test.[14]

It is clear that a number of factors are associated with a high degree of certainty. To focus on those where the evidence is most consistent (say where the variable in question is significant at 5% for all three independent-variable manipulation techniques), education, self-investment, advice-taking, gender and years to retirement all matter. The first three are quite intuitive. It is logical to believe that those possessing education, whether formal, induced by taking advice, or self-administered in the realm of the investments, are a fairly confident breed on average. Gender is also highly significant—in line with the psychological evidence. Finally, those close to retirement have a higher level of certainty. We offer no obvious explanation for the latter, other than that this group may have tried to acquire additional useful knowledge (perhaps through company seminars) in preparation for retirement and is consequently feeling comfortable. The rather low R^2's

Table 2. *Listing of Demographic Variables Available*

Variable Meaning	Variable Type
Age	Numerical
Years with company	Numerical
Years in DC	Numerical
Years to retirement	Numerical
Years to retirement by preference	Numerical
Self-investment? (makes own investment decisions or does not)	Indicator—two levels
Takes advice? (yes or no)	Indicator—two levels
Gender (male or female)	Indicator—two levels
Children (has or does not have)	Indicator—two levels
Marital status (married or not)	Indicator—two levels
Education (no college; some; graduated)	Ordered categorical variable
Income (0–25k; 25–50k; 50–100k; above 100k)	Ordered categorical variable
Wealth (0–50k; 50–100k; 100–200k; 200–300k; 300–500k; above 500k)	Ordered categorical variable
DC size (0–50k; 50–100k; 100–200k; 200–300k; 300–500k; above 500k)	Ordered categorical variable

Notes: More precisely, the self-investment question reads: "Which of the following statements best describes how you make most of your savings and investment decisions around retirement? A. I make these decisions completely on my own. B. I take the advice of others when making these decisions." Selecting A makes you a "self-investor." The advice question reads: "Did you receive any retirement planning recommendations or advice?"

Table 3. *Regressions of Certainty Level, Knowledge and Overconfidence on Demographic Variables*

	Certainty			Knowledge			Overconfidence		
Variables	**EQ. 1 (Num.)**	**EQ. 2 (Log Num.)**	**EQ. 3 (Binary)**	**EQ. 1 (Num.)**	**EQ. 2 (Log Num.)**	**EQ. 3 (Binary)**	**EQ. 1 (Num.)**	**EQ. 2 (Log Num.)**	**EQ. 3 (Binary)**
Constant	0.2103	0.0606	0.3534	0.1825	0.1318	0.1806	–0.0430	–0.1650	0.1779
	(0.0000)	(0.3355)	(0.0000)	(0.0000)	(0.0002)	(0.0000)	(0.5589)	(0.1208)	(0.0000)
Gender	0.0568	0.0560	0.0578	—	—	—	0.0537	0.0534	0.0563
(male=1)	(0.0000)	(0.0000)	(0.0000)				(0.0027)	(0.0033)	(0.0019)
Advice	0.0501	0.0482	0.0505	—	—	—	—	—	—
(yes=1)	(0.0000)	(0.0000)	(0.0000)						
DC size	–0.0001	0.0031	0.0212	—	—	—	–0.0000	0.0067	0.0293
	(0.4691)	(0.7630)	(0.0701)				(0.7526)	(0.6451)	(0.1165)
Education	0.0093	0.0086	0.0254	—	—	—	0.0159	0.0156	0.0425
	(0.0016)	(0.0036)	(0.0103)				(0.0022)	(0.0027)	(0.0155)
Income	0.0006	0.0301	0.0219	—	—	—	0.0006	0.0332	0.0188
	(0.0026)	(0.0271)	(0.0626)				(0.0638)	(0.1387)	(0.3623)
Self-inv.	0.0412	0.0412	0.0425	0.0266	0.0271	0.0272	—	—	—
(yes=1)	(0.0000)	(0.0000)	(0.0000)	(0.0401)	(0.0363)	(0.0354)			
Wealth	0.0000	0.0136	0.0167	0.0000	0.0116	0.0218	—	—	—
	(0.2881)	(0.0374)	(0.1373)	(0.2597)	(0.0762)	(0.0880)			
Years in DC	–0.0016	–0.0022	–0.0025	—	—	—	—	—	—
	(0.0671)	(0.0154)	(0.0033)						
Years to ret.	–0.0018	–0.0015	–0.0017	—	—	—	–0.0020	–0.0019	–0.0017
	(0.0031)	(0.0160)	(0.0034)				(0.0220)	(0.0361)	(0.0631)
Adjusted R^2	0.1068	0.1081	0.1035	0.0019	0.0030	0.0028	0.0255	0.0252	0.0228

Notes: P-values are below the coefficient estimates. For the certainty level equations, White standard errors, which are consistent in the presence of heteroscedasticity, are used, because it was not possible to reject heteroscedasticity at 10% for these equations.

should be noted. Still, given that a metric for certainty (as well as for investment knowledge and overconfidence) is being generated only on the basis of two questions, one should not be overly surprised by the quantity of noise.

Turning to the investment knowledge regressions, while the overall fit is very poor, we can tentatively conclude that self-investors have the most knowledge. It is likely that these people have the most to gain by getting it right since they are making their own decisions, and so have taken active steps to increase their relevant knowledge. That (general) education does not matter may seem striking. Clearly there is a big difference between a formal education and investment knowledge. Perhaps we should only really expect an impact when the (formal) education is business-related and this would likely be true only in a small minority of cases.

The results for the overconfidence regressions can be directly related to the previous two sets of results.[15] As was said before, overconfidence can arise because of excessive confidence or insufficient knowledge (or a combination of both). Given the greater knowledge of self-investors, it is not surprising to see that they are *not* more overconfident than average individuals. While they have a higher level of certainty, they also *know* more: these two effects cancel out. The same cancellation does not hold for some of the other variables. Specifically, gender and education are consistently associated with higher levels of overconfidence at 5% or better. Women do not differ in terms of knowledge, but, since they have much less certainty, they are less overconfident. Those with formal education do *not* know more about investments, but they think they do: thus they are overconfident. Here we might contrast the self-investors and the formally educated. Note that the latter refers to any field of education. Very little of this is much use for investment purposes. For example, having a degree in engineering is not likely to help you come up with better answers on investment knowledge questions. On the other hand, self-investors have acquired *pertinent* knowledge. Finally, there is some evidence that those close to retirement are at greater risk of overconfidence. While we offer no entirely satisfactory explanation of this, if this result is extendible to the general population, it is indeed an unfortunate one, as this is a group of people who are in a phase in their lives when mistakes can prove most costly.

Perspective

While future retirees in control of their retirement assets often make costly mistakes, because of overconfidence they may be too sure of themselves to obtain the sort of education that would allow them to avoid such errors. Still it is incumbent on plan sponsors to offer workers appropriate investment and retirement education. Unfortunately the efficacy of educational efforts seems to be modest (Lusardi (2004)).Perhaps the nature of the typical educational offering is the problem. Is it enough merely to expose individuals to basic investments, asset class returns and diversification? Arguably, a lot can be said for also teaching people the pitfalls of investor psychology, so they will be less likely to flee equities in the face of inevitable market declines, so they will be less likely to buy the latest hot fund, so they will be less likely to put most of their money into company stock, etc. Knowing the sorts of mistakes that they may fall prey to is for investors patently just as important as knowing the power of compounding.

Ideally, education can also be directed to those most at risk. One surprising result of this study has been to show that one group at risk (read: the formally educated) are not necessarily the ones we expect to be in this position. It would be useful if future research could provide additional insights in this regard.

Some (perhaps because of overconfidence, perhaps because of lack of time, perhaps because they feel it is beyond them) will not access any educational offerings, however well-designed. Such people should benefit from even more blatant steering. One approach is the provision of third-party advice. In fact some pension providers are now moving in this direction.[16] Another approach is pension design mechanisms to steer individuals in the normatively correct direction. Automatic enrolment (Madrian and Shea (2001)) is helpful in getting people to save. A program whereby people lock themselves into future scheduled deferral increases is effective in inducing people to save more (Thaler and Benartzi (2003)). Life cycle-type funds designed to dynamically adjust asset allocation as individuals approach their retirement dates are also increasingly coming into vogue.[17]

Notes

1. This survey was commissioned by *SEI Investments*. We thank them for making the survey data available.
2. See Deaves (2005) for an overview of all the behavioral aspects of this survey.
3. For example, see Osberg and Sharpe (2002).
4. Pension assets in the U.S. are now more than 50% in *DC* vs. *DB* (defined benefit). In Canada the figure is about 10%. For more on Canadian *DC* pension plans see Press (2002).
5. The identity of the actual companies is confidential.
6. Notice that the totals in *Table 1* are somewhat less than 2,000 and vary from panel to panel. The reason for this is that not all respondents answered all questions.
7. For example, according to *Statistics Canada's* (2002 and 2003) *Canadian Labour Force Survey*, males constitute 54% of the labor force. This is comparable to our sample in which 62% were males. The age structure of our sample was also reasonably close to that of the overall labor force.

8. The first question asked for the average return on the Canadian stock market (the *Toronto Stock Exchange Composite Index*) between 1982 and 2001. The second question asked for the average long-term Government of Canada bond yield during the same period. In both cases choices were in increments of 2%.
9. It will strike the reader as odd that respondents did worse than guessing (and significantly so) on the second question. The likely explanation is that people were surprised by how high the average bond yield has been over the last 20 years—with clearly some younger people having no memory of the high interest rates of the early 1980s. Answers were thus often based on the behavioral bias recency.
10. All dollar figures are in Canadian dollars. In late September, 2004, the exchange rate was around 0.78 U.S. dollars/Canadian dollar.
11. Similar data analyses for other explanatory variables are available on request.
12. The way we operationalized the conversion to numerical variables was to take the midpoint where there was one; and to depart by 20% for a one-sided (open-ended) interval. For example, below $25,000 was converted to $20,000 and $25,000–50,000 was converted to $37,500.
13. In all cases where it was possible to conclude heteroscedasticity (at 10%), the standard errors reported are White's which are consistent in the presence of heteroscedasticity.
14. Specifically, all variables which were significant at 10% or better (for one or more of the variable manipulation techniques) were included in the presented regressions.
15. If the exact same independent variable set over the same number of observations were used the overconfidence coefficient estimates would be *identical* to those from the first regression minus those from the second. The coefficients in the third regression are not exactly the same though because neither of these conditions is satisfied. For example, as was said above, the numbers of observations are very slightly different due to incompleteness of some answer sets.
16. To quote from one ad that came out in 2003, "*ING* and *Morningstar Associates* have joined forces to offer Defined Contribution Plan Sponsors a new level of fiduciary support. With our *Portfolio Blueprint* service, *Morningstar* will recommend an investment menu based on factors such as your employee demographics and the investment options available in your plan. When you adopt that menu, *Morningstar* will assume a fiduciary role as an investment advisor to your plan, providing you with in-depth analysis and recommendations.
17. *Fidelity's 20*xx funds are examples of this.

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