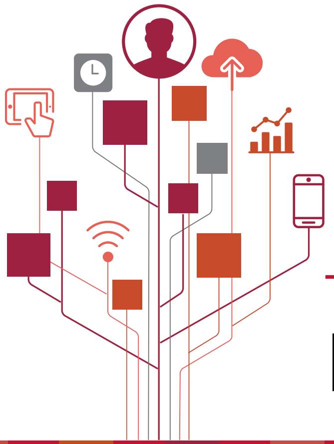


The Digital Investor

Patterns in digital adoption

Vanguard Research | July 2017

More than ever, the financial services industry is engaging clients through the digital realm. Entire suites of financial solutions, from investing to retail banking, can be accessed via the web. With the wealth of information available online, individuals have the opportunity to take the reins on their own finances. But how are they combing through this abundance of information and making financial decisions? Vanguard has created this research series to understand more about digital investors' online behavior and their decision-making process. In the first installment, we examine the willingness of investors to sign up for digital access through the web or mobile app.

Digital registration among Vanguard retail clients

Digital adoption is popular among retail investors.

Digital adoption among Vanguard retail investors is widespread and nearly universal. A total of 83% of investors are registered for digital access to their accounts via the web or mobile app. The adoption rate is even higher among new Vanguard clients, with 85% registering at account opening.

Older investors are less likely to register for digital access.

There is a pronounced age effect in new clients' propensity to register for digital access. Older investors are much more reluctant to adopt the digital channel. For example, investors ages 75 and older are 22% less likely to register at account opening than those ages 25–34, and investors ages 65–74 are 11% less likely. Industry and Vanguard survey research suggest that this is largely a cohort effect rather than an age effect, although we cannot disentangle the two effects.

Not all investors are quick to adopt the digital platform.

Digitally reluctant investors—new clients who do not register for digital access upon account opening—are generally unlikely to adopt digital access over time. There is a 50/50 chance that the median investor who does not register for digital access in the first month will do so within two years of opening the account.

Introduction

Individuals are increasingly turning to the internet as a platform to socialize, access and disseminate information, and purchase goods and services. A 2016 study by the Pew Research Center found that 87% of adult Americans use the internet, compared with 76% in 2010 and 68% in 2005.[1] For businesses, the internet offers the ability to service clients beyond normal operating hours and avoid delays in communication via traditional mail and telephone channels.

The financial services sector in particular has been transformed by the rising use of digital channels. Most consequential financial decisions by households—in such diverse areas as banking, credit cards, mortgages, insurance, and investments and retirement—are now intermediated by a digital environment in some form. For individuals, financial relationships can be managed "on the go" or from the comfort of one's home, untethered to the bricks and mortar of a traditional financial institution.

Vanguard's retail investment business in the United States is an example of a largely digital financial environment. The retail unit services more than 7 million individual investors, mostly through digital interactions, and secondarily through phone and mail. As of December 31, 2016, 83% of Vanguard retail clients were registered for digital access. In the first quarter of 2017, the retail website vanguard.com and its associated mobile app experienced more than 52 million visits from existing and prospective clients. By comparison, the retail unit received a little over 2 million phone calls during the same period. Digital investors can open accounts online, view investment information, execute trades, and make deposits or withdrawals. Non-digital clients can manage their accounts only by telephone or through the mail.

From a research perspective, digital registration is just one aspect of a broader psychological and behavioral phenomenon known as "financial attention."[2] Financial attention is the way individuals interact with information in their financial decision-making. Individuals can attend to financial information in a variety of ways—by actively seeking it out, by avoiding it, by acting upon it directly, or by procrastinating in taking action. Digital environments permit exceptional precision in tracking the relationship between investors' consumption of information and their subsequent behavior.

As part of our exploration of financial attention in a digital era, we begin with a basic question: How willing are investors to sign up for digital access through the web or a mobile device? We examine the factors associated with new Vanguard retail investors' decisions to register for digital access when opening an account. Then, for those who do not register for digital access upon account opening—the digitally reluctant—we look at how their likelihood of doing so evolves over time. At the heart of our work is an important question about the role of age versus demographic cohort in influencing the adoption and use of technology.

Data and methodology

Our study is based on more than a half-million new retail clients who joined Vanguard in calendar years 2015 and 2016 and who were at least 18 years old upon entry.[3] Clients can register for digital access as part of the account-opening process or at any point afterward. This study captures organic demand for digital registration because there were no interventions (such as educational or marketing campaigns) to promote digital registration during these two years.

Investors in our sample were on average 42 years old when they opened their Vanguard account (**Figure 1**). Nearly half of the sample was under age 35, while 10% were 65 and older. The median investor was in a single-Vanguard-investor household with a single account. New accounts had a median balance of $3,000 (an average balance of $30,354) at the end of the first month. Investors were 55% male and 45% female. The median investor invested most of his/her portfolio (91%) in risky assets, defined here as either equity or fixed income investments.

1 See Anderson and Perrin (2016) for further information.

2 See Sicherman, Loewenstein, Seppi, and Utkus (2016) for a review of financial attention literature and a discussion of the "ostrich" effect—the tendency for investors not to look at their accounts after a fall in the stock market.

3 This sample excludes those for whom key data elements are missing.

Figure 1. Characteristics of new clients as of entry month

New retail clients who entered in 2015–2016

	All clients	Timely digital registrants	Non-digital registrants
Percent of all clients	100%	85%	15%
Number of clients	534,898	453,527	81,372
Demographics			
Female	45%	44%	54%
Average (median) age	42 (37)	41 (36)	49 (47)
Age category			
18–24	14%	14%	14%
25–34	31%	33%	20%
35–44	16%	17%	13%
45–54	14%	14%	16%
55–64	15%	14%	20%
65–74	7%	6%	10%
75 +	3%	2%	7%
Average (median) total account balance	$30,354 ($3,000)	$29,145 ($3,000)	$37,089 ($3,039)
Balance category			
$0	25%	24%	27%
$1–$9,999	50%	52%	40%
$10,000–$24,999	9%	9%	11%
$25,000–$49,999	5%	4%	7%
$50,000–$99,999	4%	4%	6%
$100,000–$249,999	4%	4%	6%
$250,000–$999,999	2%	2%	3%
$1 million +	<1%	<1%	<1%
Average (median) number of Vanguard clients in household	1.3 (1)	1.3 (1)	1.3 (1)
Account structure complexity			
Average (median) number of accounts	1.1 (1)	1.1 (1)	1.1 (1)
Owns Vanguard-administered defined contribution (DC) account	0.16%	0.17%	0.08%
Owns Uniform Gifts to Minors Act (UGMA) account	0.02%	0.02%	1%
Owns trust	0.3%	0.3%	2%
Investment complexity			
Average (median) number of funds	2 (1)	2 (1)	2 (1)
Average (median) proportion of total account balance in risky assets	56% (91%)	54% (87%)	66% (99%)
Owns any mutual fund	58%	56%	69%
Owns any ETF	4%	5%	2%
Owns any individual securities	4%	4%	4%

Notes: Risky assets consist of any assets that are subject to market volatility. Number of clients excludes those missing key information. Timely registrants are those who registered for digital access within 31 days of joining Vanguard.

Source: Vanguard, 2017.

We further classified these new clients into two groups based on their digital registration behavior within the first month (31 days) of joining Vanguard:

- Immediate digital registrants—clients who digitally registered within the first month
- Digitally reluctant investors—clients who did not digitally register within the first month

In our sample of new clients, 85% were immediate digital registrants, and 15% were digitally reluctant investors.

Who registers immediately for digital access?

To understand those who register immediately for digital access, we used a probit model to analyze the determinants of immediate digital registration. Our model estimates how a given factor associates with an investor's propensity to digitally register within the first month of account opening. As previously noted, 85% of all new investors registered for digital access in the first month.

Overwhelmingly, age is the most significant determinant of immediate digital registration (**Figure 2**). Generally, older clients are less likely to be immediate digital registrants, controlling for all other observable characteristics.[4] Investors ages 75 and older are 22% less likely to register in the first month, relative to our reference group, ages 25–34. Those ages 65–74 are 11% less likely to immediately register than the reference group. For example, if an investor in the age group of 25–34 has a 90% probability of digital registration within the first month, he would have only a 70.2% probability of immediate registration if he were 75 or older.

Immediate digital registration falls slowly with age, starting with the reference age group of 25–34—with one exception. Investors ages 18–24 are slightly less likely to immediately register than those ages 25–34. This is true even after controlling for total account balance, Uniform Gifts to Minor Act (UGMA) account ownership, trust account ownership, and other observable characteristics. We attribute this at least partially to the fact that some of these accounts may still be under the control or influence of parents, not the younger account holders themselves.

One possible reason older investors may not register for digital access is that they are generally wealthier and are perhaps more reluctant to expose their greater wealth to the potential risks of digital access. However, this finding persists even after controlling for total account balance. In fact, we find that those who invest $100,000 or more are more likely to immediately register than the reference group—those with $50,000 to $99,999. Specifically, the two most affluent groups, investors with total account balances of $250,000 to $999,999 and those with $1 million or more, are 4% and 5% more likely to register in the first month than the reference category, respectively. Investors who open their accounts with a balance of $1 to $9,999 are also 5% more likely to immediately register. A possible explanation for this finding is that these investors are more likely to contribute to their account after an initial opening amount, and digital registration makes doing so easier.

Gender has a relatively modest effect on immediate digital registration. On average, females are 4% less likely to register in the first month than males.

Another notable finding is that ETF owners are 8% more likely to immediately register relative to those who do not purchase ETFs. This result could be because of a variety of factors, such as ETF investors being more financially sophisticated or being more active investors seeking digital trading access.

There are other statistically significant factors (including specialty account ownership, such as trusts), but these pertain to only a tiny fraction of our sample. A noteworthy "non-finding" is that the share of risky assets (equity and fixed income investments) held by investors does not significantly relate to digital access.[5] In other words, the percent of total account balance invested in risky assets does not seem to affect immediate digital registration, even when controlling for investment types, such as ETFs, mutual funds, and individual securities.

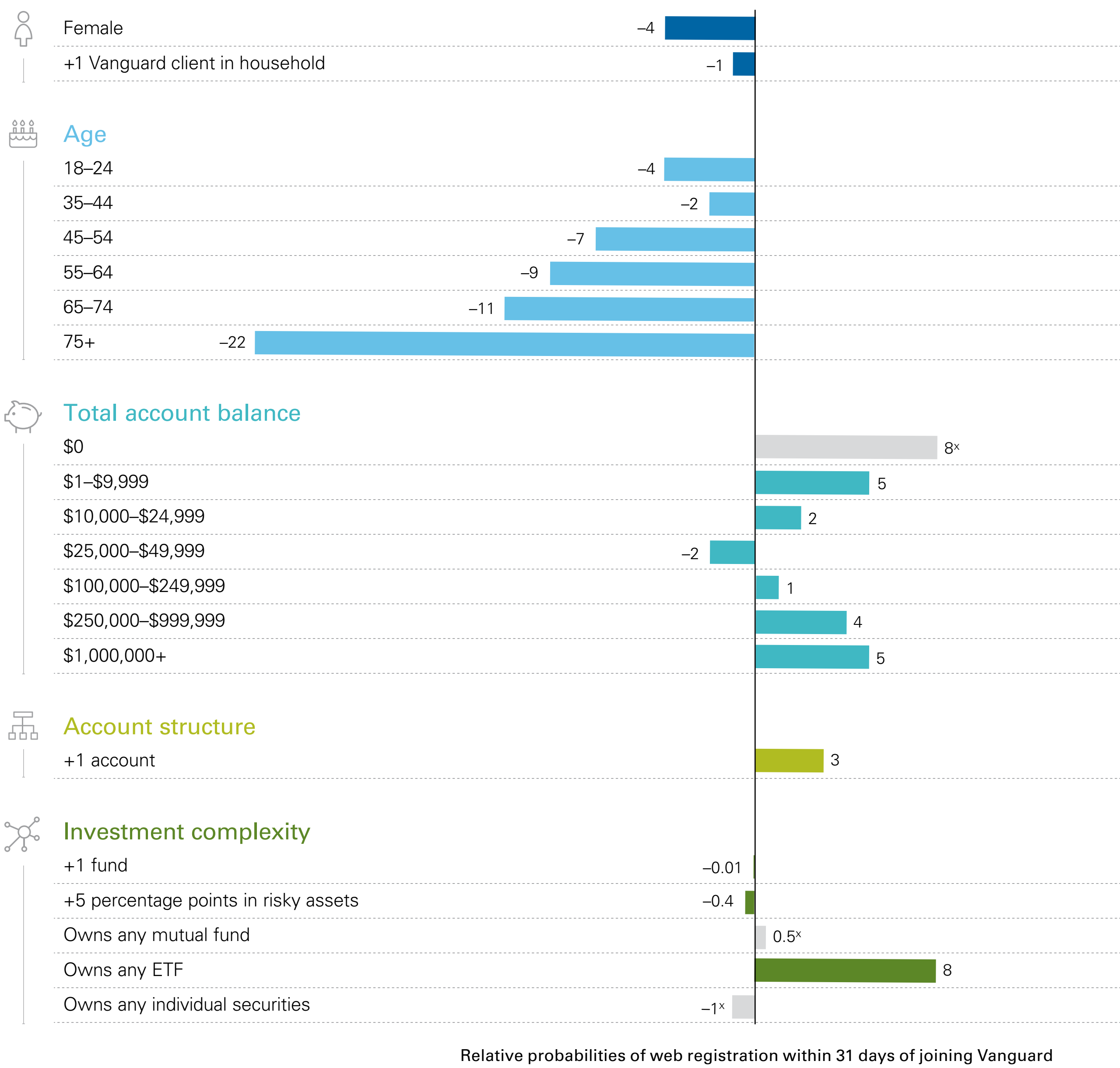
Overall, the characteristics we observe explain 30% of the variation in new investors' propensity for digital registration in the first month.

4 All discussions of the determinants of digital registration are conditional on holding all other observable characteristics at their observed values. This qualification is left out of the rest of the paper for conciseness.

5 The same result is obtained if we control only for equity share held by investors.

Figure 2. Predictors of timely digital registration for new clients

85% of new clients who entered in 2015–2016 digitally registered within the first 31 days upon entry



Note: Standard errors are clustered at the zip code level. All variables are statistically significant at the 5% level except for those in gray and marked with x. For categorical variables, marginal effects are measured against: male, age 25–34, and total account balance of $50,000–$99,999. +1 Vanguard client in household is relative to a baseline of a single-Vanguard-client household. +5 percentage points in risky assets is done at the expense of a reduction in money market holdings and on a baseline of 90% risky assets/10% money market. +1 fund is relative to a baseline of one fund. +1 account is relative to a baseline of one account. Marginal effects are calculated by holding other characteristics at their observed values. Vanguard-administered DC account, UGMA account, and trust account ownerships are also included as covariates. Their marginal effects, although statistically significant, are left out of the figure above because an insignificant proportion of retail clients owns these account types.

Source: Vanguard, 2017.

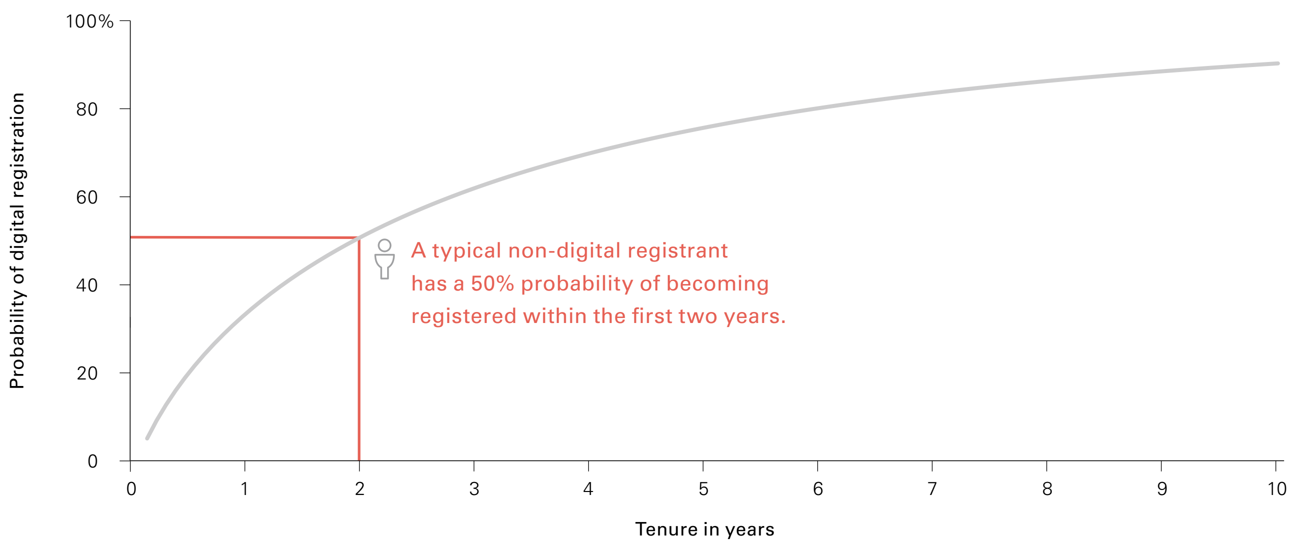
Do the digitally reluctant eventually register?

Digitally reluctant investors are those who did not register for digital access in the first month. In our sample, they accounted for 15% of all new Vanguard retail investors in 2015 and 2016. But how long would it take for these individuals to eventually register for digital access? We use survival analysis to understand their propensity to register for digital access over time.[6]

We find that digitally reluctant investors are truly reluctant and are slow to register. The typical digitally reluctant investor has a 33% probability of registering within the first year, a 50% probability—the chance of a coin flip—of registering within two years, and a 90% probability of registering within a decade of account opening (**Figure 3, A**).[7] The typical digitally reluctant investor's expected time to digital registration is 3.8 years.

Figure 3. Subsequent digital registration of a typical non-digital registrant

Panel A. Cumulative probability of digital registration for a typical non-digital registrant



Notes: A typical non-digital registrant is chosen to be male, age 25–34, with a total account balance of $50,000–$99,999, who owns mutual funds but no ETFs, individual securities, UGMAs, or trusts, who has 90% in risky assets and 10% in money markets, who does not have a DC account with Vanguard, who has two funds and one account, and who is the only Vanguard client in his household.

Source: Vanguard, 2017.

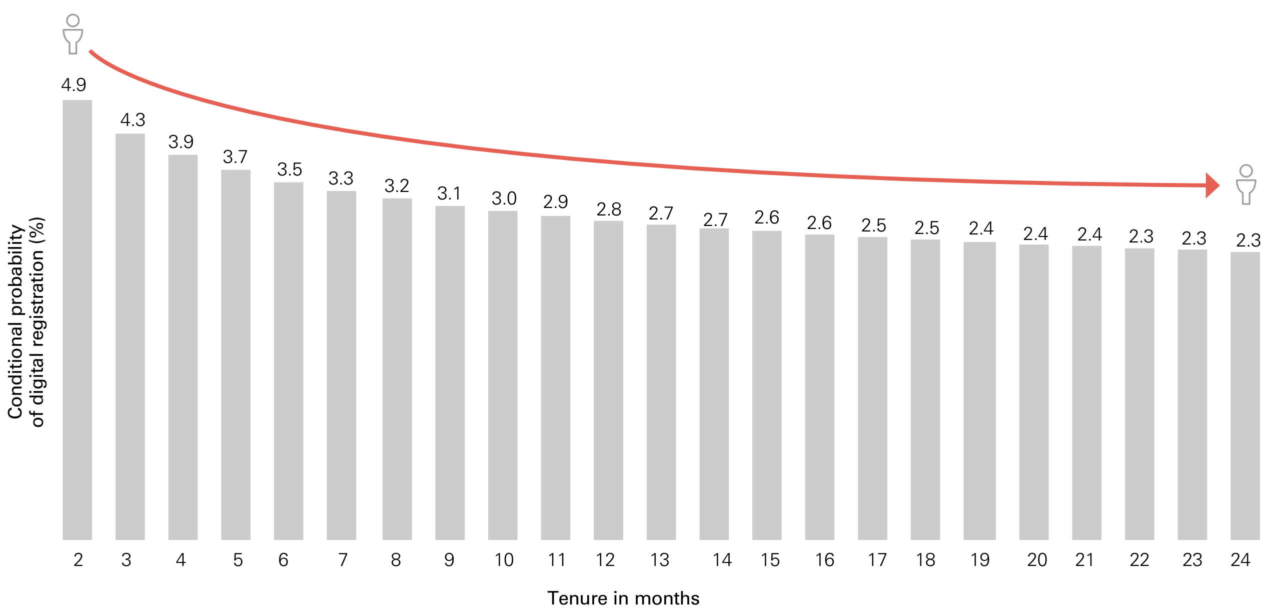
6 Survival analysis is used to examine the relationship between the time until an event happens and covariates that may affect the time elapsed.

7 The typical digitally reluctant investor is defined as one who takes the median value, of those who did not register in the first month, for all observable characteristics as of the end of the first month: male, age 45–54, with a total account balance of $1–$9,999, 90% of which is in risky assets and 10% in money markets, owns mutual funds but no ETFs or individual securities, owns two funds in one account, does not have a Vanguard-administered defined contribution account, UGMA account, or trust account, and is the only Vanguard client in his household. These characteristics are fixed in estimating his expected time to digital registration and his propensity to register in the subsequent months.

For the typical digitally reluctant investor, the probability of registering for digital access declines over time (**Figure 3, B**). Assuming that the investor does not register for digital access in the first month, there is a 4.9% probability that he will register in the second month. If he does not register in the second month, there is a 4.3% probability that he will register in the third month. And conditional on not registering in the third month, his probability of registering in the fourth month is 3.9%. In general, a retail client's propensity to register for digital access is the highest right after an account is opened and declines with account tenure.

Figure 3. *(Continued).* **Subsequent digital registration of a typical non-digital registrant**

Panel B. Conditional probability of digital registration for a typical non-digital registrant



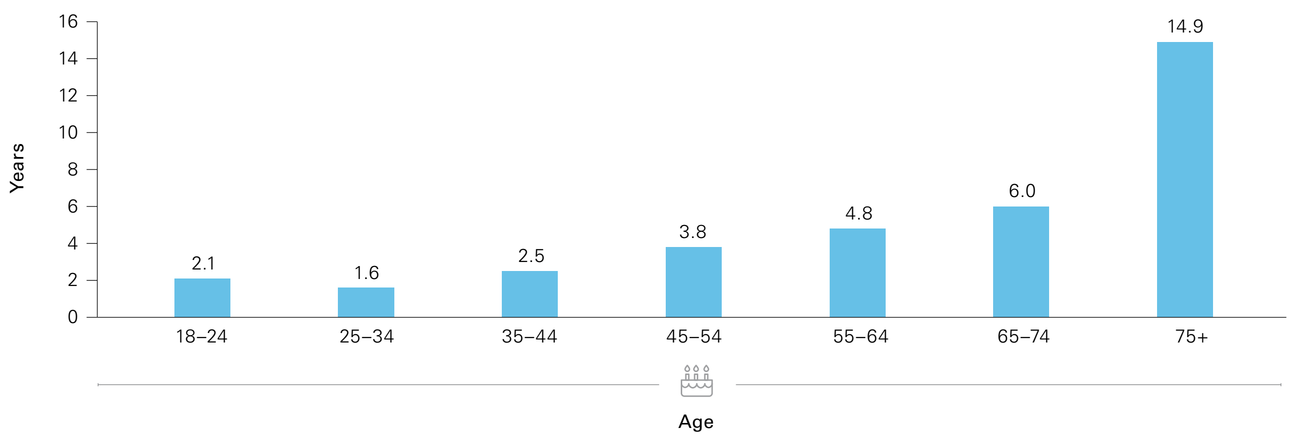
Notes: A typical non-digital registrant is chosen to be male, age 25–34, with a total account balance of $50,000–$99,999, who owns mutual funds but no ETFs, individual securities, UGMAs, or trusts, who has 90% in risky assets and 10% in money markets, who does not have a DC account with Vanguard, who has two funds and one account, and who is the only Vanguard client in his household. Displayed conditional probabilities are rounded to the nearest tenth.

Source: Vanguard, 2017.

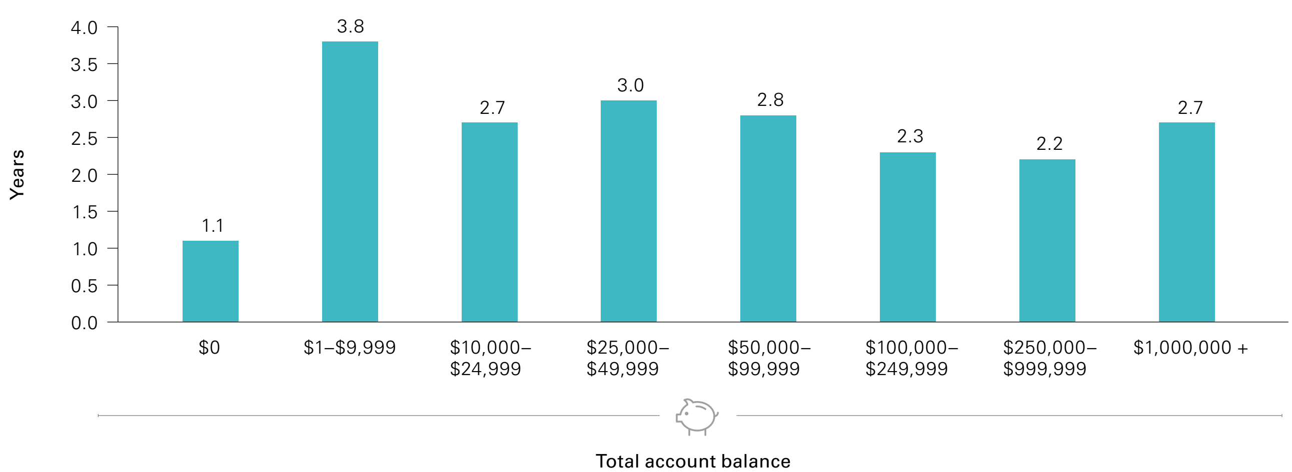
As with immediate digital registration, age is a strong factor associated with digitally reluctant investors' propensity to register. Expected time to digital registration among digitally reluctant investors generally increases with age (**Figure 4, A**).[8] For a typical investor ages 25–34, the expected time to registration is 1.6 years. That estimate jumps to 6 years for those ages 65–74 and to 14.9 years for those age 75 and older. On the other hand, there is no clear relationship between expected time to digital registration and account balance (**Figure 4, B**).[9]

Figure 4. Expected time to digital registration of a typical non-digital registrant

Panel A. Expected time to digital registration by age



Panel B. Expected time to digital registration by total account balance



Notes: A typical non-digital registrant is chosen to be male, age 25–34, with a total account balance of $50,000–$99,999, who owns mutual funds but no ETFs, individual securities, UGMAs, or trusts, who has 90% in risky assets and 10% in money markets, who does not have a DC account with Vanguard, who has two funds and one account, and who is the only Vanguard client in his household. Panel A illustrates the typical non-digital registrant's expected time to digital registration for different age assumptions, and Panel B illustrates his expected time to digital registration for different total account balance assumptions, while fixing all other characteristics at their median values.

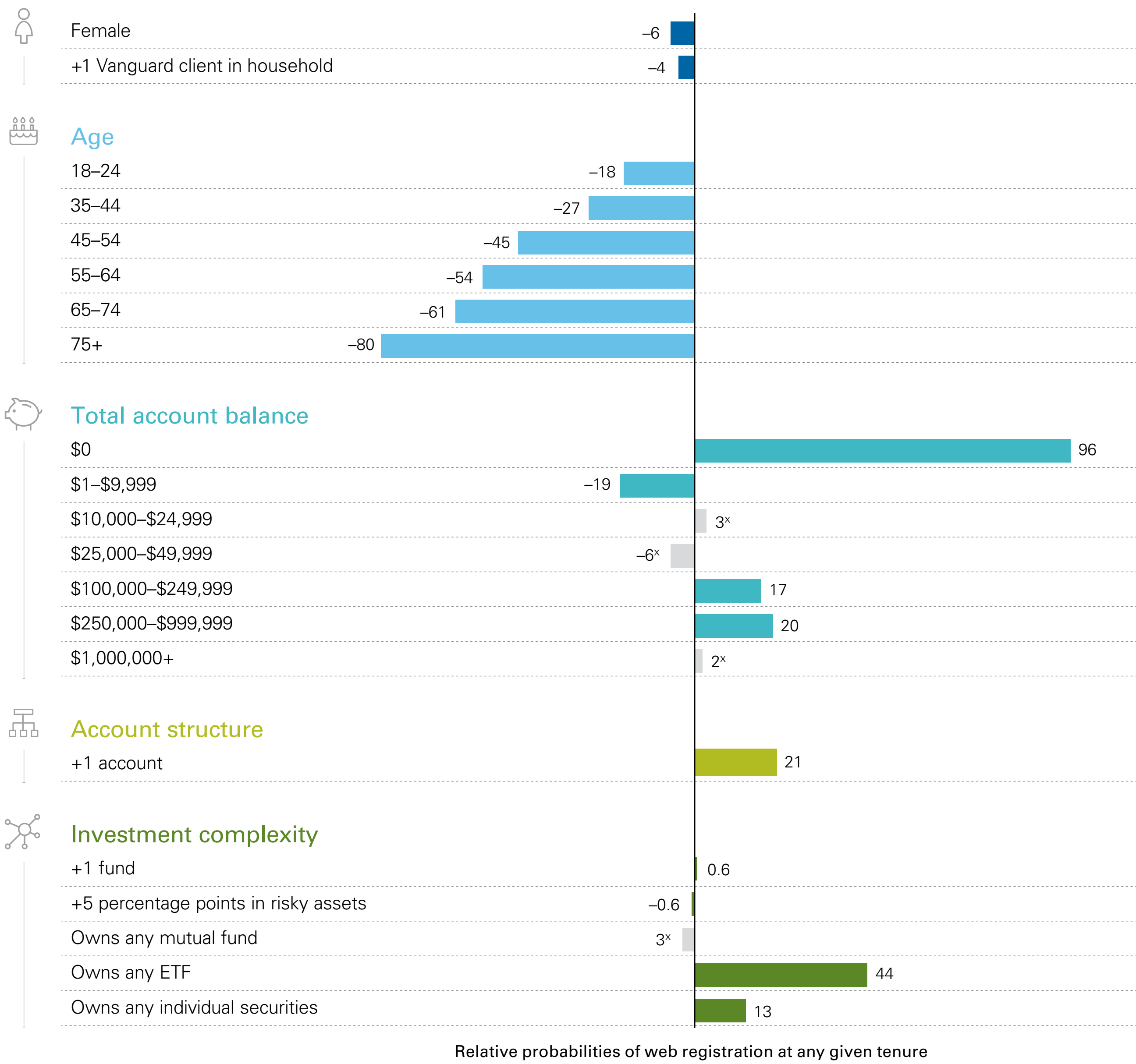
Source: Vanguard, 2017.

8 All observable characteristics other than age are fixed at their median values as in the characterization of a typical client who does not register for digital access in the first month.

9 All observable characteristics other than total account balance are fixed at their median values as in the characterization of a typical client who does not register for digital access in the first month.

For digitally reluctant investors, we investigated the characteristics associated with the decision to register in the next month, given they have not yet registered (**Figure 5**).[10] Again, age is the most powerful negative factor associated with digital registration, with those ages 75 and older 80% less likely to register in the following month relative to the reference group of ages 25–34.

Figure 5. Predictors of digital registration for non-digital registrants at any given tenure



Notes: Marginal effects (measured in percent change) is relative the reference group's probability of digital registration in the following month, conditional on non-registration thus far. The probabilities of digital registration conditional on non-registration thus far for a typical digitally reluctant investor are presented in Figure 3, B. Standard errors are clustered at the client level. All variables are statistically significant at the 5% level except for those in gray and marked with x. For categorical variables, marginal effects are measured against: male, age 25–34, and total account balance of $50,000–$99,999. +5 percentage points in risky assets is done at the expense of a reduction in money market holdings. Vanguard-administered DC account, UGMA account, and trust account ownerships are also included as covariates. Their marginal effects, although statistically significant, are left out of the figure above because an insignificant proportion of retail clients owns these account types.

Source: Vanguard, 2017.

10 The propensity for digital registration (measured in percent change) is relative the reference group's probability of digital registration in the following month, conditional on non-registration thus far.

The relationship between account balance and the propensity to register for digital access in the subsequent month is less clear. Compared with the reference group of total account balances between $50,000 and $99,999, those with $100,000 to $249,999 are 17% more likely to register for digital access in the following month, and those with $250,000 to $999,999 are 20% more likely. However, there is no statistically significant difference in the propensity to register between those with a total account balance of $1 million or more and the reference group. On the other hand, those with total account balances of $10,000 to $49,999 register with the same propensity as those in the reference group, but those with total account balances of $1 to $9,999 are 19% less likely to register than those in the reference group. Those with $0 in their retail accounts are on average 96% more likely to register in the following month than the reference group. We again attribute this finding to the possibility that these investors are more likely to make future deposits into their accounts.

On average, females who have not registered are 6% less likely than males to register for digital access in the following month.

ETF ownership increases digitally reluctant investors' propensity to register for digital access in the next month by 44%, and individual securities ownership increases it by 13%. As before, one possible explanation is that ETF and individual securities investors have more incentives to monitor their investments.

Specialty account ownerships such as trusts remain statistically significant in predicting digital registration, but they affect an insignificant proportion of this sample. Once again, the percentage of total account balance invested in risky assets does not significantly predict digital registration in the following month.

Overall, the characteristics we observe explain 10% of the variation in digital registration among the digitally reluctant investors in a survival analysis framework.

Older investors: Is it an age or cohort effect?

One of the major findings in our empirical modeling is the sharp fall-off of digital adoption by age, particularly among investors 65 and older. At the heart of this finding is an enduring question surrounding the relationship between age and technology adoption: Is it a cohort effect, meaning it is tied to a specific demographic group and its lifetime experience? Or is it an age effect, meaning that as younger cohorts age, they too will become more digitally reluctant? If it is a cohort effect, digital adoption at older ages will rise over time as younger investors, with a lifetime of digital experience, become older. If it is an age effect, younger investors will become less interested in digital access as they age, much like today's older investors.

Given the nature of our data set, we cannot conclusively decompose our finding into an age effect and a cohort effect. However, industry and Vanguard survey data suggest that the explanation for older investors' behavior could be cohort related. A 2014 Pew Research Center survey reveals that among seniors 65 and older, internet and broadband use drops significantly around age 75.[11] Smartphone usage is also significantly lower for those ages 65 and over compared with the general population. The same survey indicates that the hurdles older Americans face in adopting new technologies include physical or health issues, skepticism about the benefit of technology, and difficulty learning new technologies. These factors seem to be more associated with prior experience with a given technology rather than with age. AARP's Attitude, Trend, & Opinion Monitor survey from July 2016 tells a similar story. Whereas 65% of those ages 50–59 and 57% of those ages 60–69 report that they perform banking or financial transactions online, only 42% of those 70 and older do.[12]

11 See Smith (2014) for more details.
12 See Anderson (2016) for more details.

Summary and implications

Registering for digital access is the first and most fundamental decision in a broader phenomenon known as financial attention. At Vanguard, digital registration is nearly universal, but we find a pronounced age effect among those choosing not to register. In particular, investors ages 65 and older are less likely to register in the first month, and if they don't register in the first month, they take longer to eventually register.

Is this reflective of an age effect or a cohort effect? Although we cannot answer this question with our data set, industry and Vanguard survey research suggests a strong cohort effect is at play. Therefore, as today's digitally savvy younger investors become older, rates of digital adoption among older households will likely climb. Of course, it remains to be seen if a newer technology, such as virtual reality, might eventually replace today's web and smartphone access. In the meantime, levels of digital registration are likely to continue to rise as we gradually move to an age of universal digital access among investors. But for the foreseeable future, non-digital channels appear to be the dominant means through which financial institutions engage with older investors.

In future installments of our Digital Research series, we will examine the online behavior of our digitally registered retail clients. In doing so, we hope to gain more insights into their investment-decision process and financial attention.

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