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Are Economists More Likely to Hold Stocks?

Abstract: A large register-based panel data set containing detailed information on educational attainments as well as financial and socioeconomic variables for individual investors enables us to test the hypothesis that due to informational advantages economists are more likely to hold stocks than otherwise identical investors. Firstly, we consider the change in stockholdings associated with (*i*) completing an economics education and (*ii*) an economist moving into the household. Secondly, we model the stock market participation decision by a probit model with unobserved individual heterogeneity. This model allows us to control for both observable and unobservable investor characteristics. Thirdly, instrumental variables estimation allows us to identify the causal effect of an economics education on stock market participation for individuals who are induced to acquire an economics education due to a university opening. Throughout, we focus explicitly on the effect of a *change* in educational status on the likelihood of holding stocks. Our overall result is that economists have a significantly higher probability of participating in the stock market than investors with any other education. This result is shown to be highly robust. Finally, we find that economists hold more stocks value-wise than similar investors with other educational backgrounds.

Keywords: Investor Education; Portfolio Choice; Stock Market Participation.

JEL Classifications: G11; I29; J24.

1 Introduction

It is puzzling why so many households (more than half of them) choose not to participate in the stock market.[1] In fact, standard portfolio choice models imply that investors hold portfolios comprising *all* assets: In the standard model with no trading costs and investors having constant relative risk aversion, all investors hold the same portfolio of risky assets (the "market portfolio") which includes *all* the risky assets in the economy. Household portfolio heterogeneity then boils down to heterogeneity with respect to how much is invested in the risk-free asset and the risky market portfolio (depending on the investor's risk aversion) and heterogeneity with respect to the correlation of non-financial income with the return on the portfolio of risky assets (see for instance Viceira, 2001 and Massa and Simonov, 2006). Empirically, however, it turns out that stock market participation is strongly correlated with income, wealth, and – important for the message of this paper – the level of education of the investor.

There is a large literature investigating whether investors with high levels of education are more likely to hold stocks.[2] The general finding is that investors with a university degree have a higher propensity to invest in the stock market than investors with a high school degree or primary school degree only. The explanation most often proposed is that "education reduces the fixed costs of participating, by making it easier for would-be investors to understand the market's risk-reward trade-offs, execute trades etc." (Hong, Kubik and Stein, 2004, p. 138). In this paper, we take the literature one step further by evaluating whether *the kind* of investor education is important for the stock market participation decision.

We take as our starting point the fact that there are costs associated with stock investments. Such costs include not only the monetary costs associated with investments in the stock market, but also costs reflecting time spent on understanding risk-return trade-offs and information about stock markets. Inspired by Mankiw and Zeldes (1991), Haliassos and Bertaut (1995), Bertaut (1998), Vissing-Jørgensen (2004), Peress (2004), and Guiso and Jappelli (2005) we examine the hypothesis that if some agents are better able to gather and understand information about stock markets and investment opportunities, their effective costs of stock market participation are lower and these investors will consequently have a higher probability of participating in the stock market. We hypothesize that economists – investors who have received formal education about economics and investment opportunities in gen-

[1] Hong, Kubik and Stein (2004) report that 51% of U.S. households did not hold stocks in 1998, neither directly nor indirectly, Guiso, Haliassos and Jappelli (2003) find that 76% of the European households did not hold stocks in 1998, and, as we show in this paper, 72% of Danish individuals did not invest in stocks, neither directly nor through mutual funds, in 2001.

[2] See for instance Mankiw and Zeldes (1991), Haliassos and Bertaut (1995), Bertaut (1998), Guiso, Haliassos and Jappelli (2003), and Vissing-Jørgensen (2004).

eral – are an example of investors that are better able to absorb and understand information about stock market related issues. We exploit a unique data set that allows us to investigate whether the stock market participation of an investor increases after the investor has learned about economics. Our most important result is that the probability of participating in the stock market increases after an investor has completed an economics education, also after controlling for many observed and unobserved background characteristics of the investors. In relation to the literature, we thus find that the effect that information and education has on the stock market participation decision is not fully captured by the length of the investor's education – the kind of education and information the investor receives is also important.

We also make a methodological point in the paper: In all our tests, we focus explicitly on the question of whether *a change in educational status* changes the likelihood of an investor holding stocks. We do so for the following reason: Our overall result that economists have a higher probability of holding stocks compared to otherwise identical investors is consistent with the view that economists have a higher probability of participating in the stock market because they have more knowledge about investment opportunities and risk-return trade-off. In principle, however, there are other reasons that could account for our results. For instance, economists could be less risk averse or more optimistic than other investors. In order to evaluate whether it is really information about economics that makes economists more prone to holding stocks, we examine changes in stock-market participation occurring as a result of an individual becoming an economist, the underlying hypothesis being that it is more likely that an economics education changes an investor's knowledge about investment opportunities than it changes risk aversion or other unobservable investor-specific characteristics. By making such extensive use of the panel nature of the data, we differ from the related literature on the determinants of stock-market participation, as it is customary in the literature to run static probit models. We show that the effects from such static probit models that do not take into account the dynamic nature of key variables (in our case, the completion of a particular education) can be exaggerated. We believe this is a noteworthy methodological message of our paper.

In order to investigate our main hypothesis, we analyze a unique data set that provides us with very detailed information on investor education and stock market participation decisions, as well as a host of other detailed control variables. More specifically, we use a representative sample of 10% of the Danish population for which we have annual data during the 5-year period 1997-2001. In total, we have annual observations on the stock market participation decisions and control variables of more than 400,000 individual investors. In addition to the sheer magnitude of the number of investors (which allows us i.a. to zoom in on the group of investors we are mostly interested in, economists, while at the same time preserving

enough observations to conduct reliable inference), our data set offers several advantages over, for instance, the PSID or the CEX data sets that are often used in studies of US individuals' stock market participation decisions. First of all, our data are register-based data and not survey data, i.e. our data do not suffer from the "recall bias" documented in Vissing-Jørgensen (2002).[3] Second, we have very detailed information on the educational choices of investors, i.e. we can provide more detailed information about the relation between stock market participation choices and education than what is generally found in the literature. Third, the data contain the total value of many of the assets that investors hold, enabling us to control for variables that many existing studies of stock market participation do not have access to, such as the value of real estate and holdings of bonds. Finally, we have a large number of socioeconomic control variables enabling us to focus on the effect of educational choices on stock market participation behavior after accounting for these potentially important background characteristics.

Our benchmark statistical model, from which we derive our main result that the probability of holding stocks increases when an individual graduates from an economics education, is a probit model with unobserved investor effects that are allowed to be correlated with observed investor characteristics. Using this model, we find that the effect of becoming an economist is both economically and statistically important for the stock market participation decision. The size of the effect is about two percentage points which, viewed in the light of an overall participation rate of 23% throughout our sample period, is an economically sizable effect, too. In robustness tests, we verify that the amount of information about economics matters in the sense that investors with a long economics education have an even higher probability of participating in the stock market than investors with a shorter economics education. Also among highly educated investors, economists have a significantly higher stock market participation probability than investors with any other educational background.

In addition to corroborating the robustness of the results from this extended probit model, we verify that our overall result holds true also when we use other estimation strategies. For instance, we first use the difference-in-differences method to show that the change in the stock-market participation probability that occurs when an individual completes an economics education is significantly positive. Likewise, we show that the stock-market participation probability of an investor increases when an economist moves into the household. Furthermore, we use an instrumental variables (IV) method to document that the positive effect from an economics education on stock market participation is a causal effect. The fact that we exploit two different sources of exogenous variation in the data is an essential novelty of this paper:

[3]The "recall bias" refers to fact that some respondents in surveys report that they have moved from being non-stock holders to become stock-holders, and, at the same time, report that they have not made any stock market investments.

First, the exogenous variation in information about the stock market obtained when some investors move together with an economist. Second, the exogenous variation in individuals acquiring an economics education because of a university opening. Hence, IV estimation allows us to identify the causal effect of an economics education on stock market participation for a subsample of individuals who choose to acquire an economics education because of a university opening.

Our investigation is related to several strings in the literature, apart from its direct relation to the stock-market participation literature. For instance, our work is related to that of Bernheim and Garrett (2003) and Bernheim, Garrett and Maki (2001) who show, respectively, that financial education in the workplace significantly increases the probability of savings in general, and that households who were exposed to financial curricula during high school have higher savings rates than others.

As learning about financial markets and risk-return trade-offs can be achieved by studying economics but also more informally if the investor learns from peers, our paper is also related to the recent literature on social interaction and stock market participation. Hong *et al.* (2004) show that households that socially interact with their neighbors or attend church are more likely to invest in the stock market and Duflo and Saez (2002) demonstrate that the decision of workers to participate in retirement plans is influenced by the choices of their colleagues. In this paper we account for peer effects by investigating the effect of having (and getting) a spouse with an economics education.

It should also be noted that since we investigate the presumption that investors with economics insights are more likely to invest in the stock market, our paper is also related to the studies that show that investor information affects portfolio choice, such as Coval and Moskowitz (1999, 2001) and Grinblatt and Keloharju (2000) who show that investors invest in the stocks of the companies they are most familiar with.

Guiso and Jappelli (2005) include an indicator for an economics education and find that it significantly increases financial awareness. There are several differences between our approach and theirs. First and foremost, we comprehensively exploit the panel structure of out data. Second, Guiso and Jappelli focus on financial awareness, defined as knowledge about (even if only by hearsay) a financial asset, such as a stock or a bond. We, on the other hand, study whether an economics education actually increases stock-market participation. Third, our data are register based, and, hence, much more comprehensive than the survey data used by Guiso and Jappelli.[4] Finally, we pay special attention to the role of information about economics, whereas an economics education is only one of many determinants included in the

[4]Of course, the data set used by Guiso and Jappelli includes features we, on the other hand, cannot study using our data; for instance, the determinants of the level of financial awareness that are extracted from surveys.

regressions in Guiso and Jappelli, i.e. we try hard to evaluate whether it really is information about economics that make more economists invest on the stock market.

Why is it important to know what makes investors hold stocks? First, Mankiw and Zeldes (1991) document that there are differences in the consumption patterns of stock holders and non-stock holders, therefore the degree of non-participation in the stock market has consequences for the distribution of welfare in the economy. In addition, Cocco, Gomes and Maenhout (2005) calibrate directly the welfare losses from not participating in the stock market and report that these losses are considerable, often exceeding 1.5-2% of annual consumption. Furthermore, Palacios-Huerta (2001) finds that the stock market participation puzzle contributes towards explaining the international diversification puzzle. Likewise, Basak and Cuoco (1998), Parker (2001), Guvenen (2005), and Malloy, Moskowitz and Vissing-Jørgensen (2005) find that limited asset market participation contributes towards explaining the equity premium puzzle, and Guvenen and Kuruscu (2006) find that the resulting market incompleteness is important for understanding the behavior of asset prices. Finally, the public opinion on stock-related issues most likely depends upon the degree of stock market participation amongst individuals in the economy and hereby the development of the stock market culture. For instance, debates about the desirability of individuals having more freedom in allocating their mandatory pension savings, depend upon the extent to which individuals are likely to posses information that makes them able to efficiently allocate funds on the financial markets.

The remaining part of the paper is structured as follows. In the next section, we introduce our data set. Section 3 analyses the effect of changes in investor status, first when an investor becomes an economist and second when an economist moves into the investor's household. The probit model and the associated empirical results are discussed in Section 4. In Section 5 we provide the instrumental variables analysis. Some further robustness tests are discussed in Section 6. In Section 7, we analyze the amount of investors' portfolios that are invested in stocks. Finally, Section 8 concludes.

2 Data

For our empirical analysis we use a very rich register-based panel data set comprising a random 10% sample of the Danish population that covers the time period 1997-2001.[5] The data set is hosted by the Danish Institute of Governmental Research (AKF), and it stems from Statistics Denmark, who have gathered the data from different sources, mainly from administrative registers.

[5] In 1997, financial institutions started to automatically register holdings of stocks, whereas before 1997 investors had to self-report to the tax authorities their holdings of stocks. As a consequence, we see clear biases in the data for the degree of stock market participation before 1997.

For each individual, we have access to the value of a number of financial variables that apply at the end of each year (originally collected for tax reporting purposes): Cash holdings, stock holdings, bond holdings, taxable property value, the compulsory (labor-contract based) pension contributions, and the contributions to private pension funds.[6] We also know the yearly income measured by the gross non-capital income.

Exact information about the educational history of each individual is available. Hence, we also know whether the individuals are currently undertaking an education (both students and apprentices). The individuals are divided into 11 groups based on the subject of their highest completed education. We single out economics as one of the groups. The economics group includes individuals who have completed a theoretical economics education at university level (BA, Master, and PhD) or at short cycle higher education level as well as individuals who have completed a relevant apprenticeship education in the financial services industry, e.g. bank clerks. In its entirety, the subject-based educational groups are as follows (the proportion of the sample in each group is provided in the lower part of Table 1): educator/teacher, humanities/arts, agriculture/food/forestry/fishing, business/commercial (excluding economics), social sciences (excluding economics), health care, natural sciences/technical educations, police/armed forces/transportation, high school, basic school/preparatory school, and economics.

The data source also contains information on a number of socioeconomic factors that are applied as control variables, including age, gender, marital status, and children living at home. We also have access to various information about the investor's cohabitant/spouse (in the following the spouse).

We restrict our sample to individuals older than 18 years (the age of majority). We exclude individuals born before 1920 because there were no regulations on compulsory school attendance before that. On top of that, the educational information is very poor for individuals born before 1920. After these restrictions, we have observations on 405,271 individuals during the five-year period 1997-2001. The data form an unbalanced panel data set, since some people enter the sample when they turn 18, and other leave the sample as they die or move abroad. On average, the individuals are observed for 4.6 years such that we have in total 1,870,324 observations of individual investor decisions.

[6] Mutual fund investments are included in the stock and bond holdings. Mixed mutual funds (both bonds and stocks) are counted in the stock holdings. The mixed mutual funds account for around 5% of the Danish mutual funds. So, the stock holdings are slightly overvalued at the expense of the bond holdings. Investments through mutual funds only make up 5.8% of total investments.

2.1 Descriptive Statistics

Unless otherwise noted, we consider the pooled data set covering the entire 5-year sample period using real 2002 DKK amounts. However, as will become evident below, we make heavy use of the panel nature of the data. The rate of exchange at the end of 2002 was 7.0784 DKK/USD. Summary statistics are provided in Table 1. The first column considers the entire sample and the second column only the group of economists.

The average person in the sample is 45.3 years old and has 11.3 years of education. 49.8% are males, 51.5% are married, 14.1% have children younger than 7 years old living at home, and 17.1% have children between 7 and 18 years old living at home. 7.4 % are students receiving a government grant, and 3.6% are apprentices.

A rather large proportion of the sample, 31.7%, has only basic education (18.7% 7 years and 13.0% 9 years, respectively), and a small group, 5.9%, has also attended preparatory school (10 years).[7] High school and apprenticeship educations account for 44.2 % of the sample (12 years). 3.5% of the sample has a short-cycle higher education (14 years) and 10.3% has a bachelor degree/medium-cycle higher education (16 years). A relatively small proportion, 4.2%, holds a master degree (18 years), and even fewer, 0.2%, a Ph.D. degree (20 years).

The average non-capital income is DKK 235,637. The average individual in the sample holds DKK −18,273 cash at year end. 25% of the individuals in the sample take out private pension schemes (private pension contributions are registered from 1999 onwards). This proportion is rather small, because many Danish employees (71%) have pension schemes in their labor contracts. The average amount paid to compulsory pension schemes is DKK 11,372, whereas the average amount spent on private pension schemes is DKK 4,128 per year across all individuals in the sample. 60% own their own home and the average taxable property value across all individuals equals DKK 366,822. 8.2 % of the individuals participate in the bond market, i.e. own bonds at year end (excluding mortgage backed-bonds and bond debt).

There are 46,038 observations of economists' investment decisions. The average economist is younger than other investors (40.9 years) and has a longer education (14.1 years). Furthermore, the financial situation is on average better than that of other investors. A larger proportion of economists participate in the bond market, namely 13%.

[7] The 7-year compulsory school attendance was replaced with 9 years compulsory school attendance in 1972 applying to cohorts born in 1959 and onwards.

2.2 Stock Market Participation Rates

An investor is defined to participate in the stock market if the investor holds stocks with a value in excess of DKK 1,000 (around USD 141) at year end.[8] Hereby, we obtain the stock market participation indicators for each individual for each year.[9]

Overall, 23.1% participate in the stock market. Figure 1 shows the average rates of participation across the subject-based educational groups for the entire 1997-2001 period. The proportion that participates in the stock market varies greatly across the educational groups. Particularly, the stock market participation rate is much higher for economists than for others, around 42% compared to 25% or less for the other educational groups.

Figure 2 shows the time series of stock market participation rates for the entire sample as well as for economists. The overall rate of participation in the stock market is remarkably stable at around 23%. The stock market participation rate for economists increases in the sample period, from a low of 37% to a high of 47%.

More males than females participate in the stock market, 24.9% compared to 21.3%.

3 Changes in Investor Status

In this section we analyze the effect on stock market participation of an investor changing status, first when the investor becomes an economist and second when an investor moves together with an economist. In this way we make explicit use of the panel nature of the data.

3.1 Becoming an Economist

The basic hypothesis we pursue in this paper is that more economists hold stocks because they have been exposed to economics curricula during their study and consequently have an informational advantage compared to other investors. We do so by evaluating whether an investor changes behavior in the stock market after receiving a formal education about economics. In this section, we present results that compare the stock-market participation of investors who have just finished their economics education with their stock-market participation before finishing their education.

[8] Investors are defined as participating in the stock market if they have stocks in excess of a small threshold value. This excludes individuals who e.g. have been given a single stock by their employer as a Christmas present. Previous studies have applied a zero threshold value. Our conclusions are robust to the exact choice of threshold value.

[9] We stress that our stock market participation variable reflects an active decision of the investor to buy stocks or mutual funds. In order words, we do not consider a mandatory contribution to a public pension scheme as an active stock market participation decision, as, in Denmark, the investor has no say over such contributions during the period under investigation.

We select a subsample of individuals completing an education in 2000, and let $Econ_i = 1$ for individuals completing an economics education and $Econ_i = 0$ for the remaining.[10] We are interested in estimating the average effect on stock-market participation for the investors that complete an economics education: $E\left[S_{it}^1 - S_{it}^0 | Econ_i = 1\right]$ for $t > 0$, where S_{it}^1 is the stock market participation indicator for investor i at time t when the investor completes an economics education and equivalently S_{it}^0 is the stock market participation indicator when the investor does not complete an economist education. Since the stock market participation decision of an investor cannot be observed both when the investor completes and does not complete an economics education, the central problem of evaluating this effect is the construction of counterfactuals. In the following, we analyze whether the probability of holding stocks increases for investors who complete an economics education at time $t = 0$ using a commonly used evaluation strategy, namely the difference-in-differences estimator.

The difference-in-differences estimator compares the changes in participation rates for investors completing an economics education with the changes in participation rates for investors who do not complete an economics education. The implicit identifying assumption is that if none of the investors had completed an economist education, the change in stock market participation rates would have been the same for the two groups of investors, i.e. the change in the stock market participation rate of the investors not completing an economist education serves to benchmark common year and/or age effects among the investors. The resulting estimator is:

$$E[S_{i1}^1 - S_{i,-1}^0 | Econ_i = 1] - E[S_{i1}^0 - S_{i,-1}^0 | Econ_i = 0] = 0.06. \quad (1)$$

The difference-in-differences estimator is significantly positive (t-value 3.59). This implies that the stock market participation rate of investors who complete an economics education increases significantly by six percentage points as a result of them completing their education.[11]

In (1) we do not control for investor-specific background characteristics but compare directly with investors not completing an economics education. Yet, it is interesting to evaluate whether controlling for background information affects the results. To this end, let $After_i = \mathbf{1}[t > 0]$ denote the indicator of whether the observation is after the individual graduated. Then the difference-in-differences estimator of the effect of becoming an economist on the stock market participation is the estimated coefficient to $After_i * Econ_i$ in a regression

[10] 423 individuals complete a formal economics education in 2000, whereas 6,670 individuals complete another education in 2000.

[11] An alternative measure is the before-after estimator that compares the participation rates of investors the year before and the year after they complete an education as economist. The before-after estimator is also significantly positive and it amounts to 0.10.

of S_i on $After_i$, $Econ_i$, $After_i * Econ_i$, and various additional control variables.[12] Table 2 presents the results based on no additional control variables (column 1), on socioeconomic and financial control variables (column 2), and on socioeconomic, financial, and educational group control variables (column 3).[13] It is seen that the magnitude is slightly smaller when additional control variables are included in the regression, as it goes from 6 percentage points to around 4 percentage points, but the effect from becoming an economist remains significant.

3.2 An Economist Moves In

A related approach is an investigation of what happens when an investor moves together with an economist. In other words, an investigation of the effect of the exogenous information shock that an investor receives if an economist (spouse) moves into the investor's household. The hypothesis is that an investor with an economist spouse has lower participation costs because of information sharing in the household. We thus expect an increase in the probability of holding stocks when an investor moves together with an economist.

Let $D_i = 1$ for investors who move together with an economist at $t = 0$, and $D_i = 0$ for the investors who do not cohabit with an economist during the observation period.[14] The difference-in-differences estimator compares the changes in participation rates for investors moving together with an economist with the changes in participation rates for investors who do not move together with an economist, i.e. the change in the stock market participation rate of the investors actually not moving together with an economist serves to benchmark common year and/or age effects among the investors. The difference-in-differences estimator is given by replacing $Econ_i$ by D_i in equation (1), and amounts to 0.05, as can be seen from column (4) in Table 2. Given that the difference-in-differences estimator is significantly positive, we find that the stock market participation rate of investors that move together with an economist increases by five percentage points, most likely as a result of their social interaction with the economist.[15] We also estimate the difference-in-differences estimator controlling for the investors own financial, socioeconomic, and educational background. The results are shown in Table 2 (columns 5-6). As above, the estimate of the effect on the stock market participation probability of moving together with an economist decreases when more explanatory variables

[12] See e.g. Heckman, LaLonde and Smith (1999) for details.

[13] In Table 2, we only present the estimated coefficient to $After_i * Econ_i$ in order to focus on the essential. In the following section, we present the effects of all the control variables using a comprehensive probit analysis and the complete sample. Below, we also present in a detailed description of the control variables.

[14] In order to observe the investors and all the control variables both in the year before and the year after they start cohabiting with an economist, we only consider investors who move together with an economist in the penultimate year of the sample, namely year 2000. 675 investors move together with an economist in 2000.

[15] The "before-after" estimator compares the participation rates of investors the year before and the year after they move together with an economist. This estimate is also significantly positive, 0.04.

are included, from 0.05 to 0.04, but it still remains significant.

4 Are Economists Really More Likely to Hold Stocks?

In this section, we present results from a probit model where we evaluate whether economists also have a higher probability of participating in the stock market after controlling for differences in *observed* background characteristics as well as allowing for *unobserved* individual heterogeneity.

4.1 Model

To answer the question of whether economists have a higher probability of participating in the stock market than otherwise comparable individuals, we investigate the factors that collectively determine individuals' choice of participation in the stock market.

In each time period, the investor faces the decision of whether to participate in the stock market or not. According to the random utility model, the utility-maximizing investor chooses the alternative that provides the investor with the highest utility. Let the utility that investor i derives from participating in the stock market in time period t be given by U_{it}, and normalize the utility that the investor derives from non-participation to be equal to zero for all investors, $i = 1, ..., N$, and time periods, $t = 1, ..., T_i$. Thus, investor i participates in the stock market in period t, if and only if the investor gets greater utility from participation than from non-participation, that is if and only if $U_{it} > 0$. Although we do not observe all aspects of the investor's utility, we do observe some background characteristics of the investor, X_{it}, where the educational-group indicators are of principal interest. Hence, we decompose the investor's utility into two parts: The representative utility, which is a linear function of the observable characteristics, βX_{it}, and the unobservable factors that affect utility but are not included in the representative part, ε_{it}. The stock market participation decision can therefore be modeled as:

$$S_{it} = \mathbf{1}\left[\beta X_{it} + \varepsilon_{it} > 0\right], \tag{2}$$

where S_{it} denotes the indicator for active participation in the stock market of individual i at time t. If the error terms are assumed independent and identically standard normally distributed, $\varepsilon_{it} \sim N(0, 1)$, we obtain the standard univariate probit model used in the related literature.

4.1.1 Individual Heterogeneity. In order to investigate whether economists differ from other groups of investors with respect to differences in unobserved characteristics, we allow for

unobserved individual heterogeneity in the probit model. It is essential to allow the unobserved individual heterogeneity to be correlated with the observed individual characteristics, since there is substantial evidence that there are ability differences across educational groups, see for instance Willis and Rosen (1979), Carneiro, Hansen and Heckman (2003), and Arcidiacono (2004). A common way to allow for arbitrary correlation is to use a fixed effects approach, where the individual effects are estimated along with the other parameters. A drawback of this approach, however, is its inability to identify the effect of time-invariant explanatory variables and the incidental parameters problem.[16] For this reason, we focus on a model where we parameterize the random individual effects in order to deal with individual fixed effects that are correlated with the explanatory variables. That is, we directly specify the distribution of the individual effects conditional on the means of the time-varying explanatory variables, as first suggested by Mundlak (1978).[17] This way of accounting for individual effects is fairly standard (see e.g. Wooldridge, 2001 for a more detailed discussion).

4.1.2 Specification of Individual Heterogeneity. We decompose the error term in the standard probit model in equation (2) into an individual specific part and an individual time specific part, $\varepsilon_{it} = \alpha_i + u_{it}$, and specify the individual effect, α_i, as a linear projection on the within-individual means of the time-varying explanatory variables, $\overline{F_i}$. Thus the portion of unobserved individual specific factors that affect utility, is given by:

$$\alpha_i = \alpha \overline{F_i} + c_i, \tag{3}$$

where $c_i \sim N\left(0, \sigma_c^2\right)$. This portion reflects the investor's propensity to participate in the stock market, and depends both on observed (through $\overline{F_i}$) and unobserved (through c_i) individual specific factors. Substituting equation (3) into the standard probit model in equation (2) yields the following model for the stock market participation decision:

$$S_{it} = \mathbf{1}\left[\beta X_{it} + \alpha \overline{F_i} + c_i + u_{it} > 0\right], \tag{4}$$

where $u_{it} \sim N(0,1)$, and the error components u_{it} and c_i are assumed to be independent for all $i = 1, .., N$ and all $t = 1, ..., T$. Hence, σ_c^2 measures the variance in unobserved utility across individuals relative to the variance across time for each individual, and the proportional contribution of the individual-specific variance component to the total variance is given by

[16] The incidental parameters problem, first noted by Heckman (1981), refers to the fact that estimation of the N individual effects together with β leads to inconsistent estimates of β with T fixed and $N \to \infty$.

[17] A more general correlation structure could be allowed for by specifying the distribution of the individual effect conditional on all explanatory variables, as suggested by Chamberlain (1980). Given the huge size of our unbalanced panel data set, this turned out to be computationally infeasible.

$\rho = \frac{\sigma_c^2}{\sigma_c^2+1}$. Thereby, ρ is indicative of the relative importance of the unobserved individual effect.

The inclusion of the observed individual fixed effects, $\overline{F}_i$, has the additional advantage that it takes care of all selectivity that is dependent on observed time-invariant factors, thus it ensures that the unobserved random individual effects c_i are uncorrelated with the explanatory variables.

4.1.3 Marginal Effects. Our primary interest lies in the marginal effects of the explanatory variables on the probability of participating in the stock market. The marginal effect of an explanatory variable on the choice probability equals the change in the probability caused by a change in the relevant explanatory variable holding all other variables fixed at their mean values except length of education which is fixed at 9 years (basic schooling). For continuous variables the marginal effects concern infinitesimal changes, for indicator variables they concern changes from 0 to 1, and for discrete variables they concern a one unit increase. Note that marginal effects of the explanatory variables are calculated as the average partial effects on the stock market participation choice probability conditional on the unobserved random individual effects being at its mean values, $c_i = 0$.

4.2 Explanatory Variables

In the estimations, the principal explanatory variables are the subject-based educational-group indicators. In addition hereto, we apply a number of control variables, see also the discussion in Section 2 above.

The following financial control variables are applied: Bond market participation indicator (1 if participation), non-capital income, cash holdings, taxable property value, compulsory pension contribution, and private pension contribution (an indicator function captures that the private pension contribution is not registered during the first two years of the sample). Furthermore, to control for business cycle effects, we apply the return on the KFX index (the Danish blue-chip index, currently denoted the OMXC20) in the year prior to the investor's stock market participation decision. The KFX index then captures all the relevant information that is year-specific and affects the individuals' stock market participation decisions.[18]

The socioeconomic explanatory variables are: Age, marital indicator (1 if married), gender (1 if male), indicator for having children below 7 years old living at home (1 if yes), and indicator for having children between 7 and 18 years old living at home (1 if yes).

[18] We have also estimated the model with year-specific effects, but without the KFX index; since we cannot separately identify year effects and the effect of the KFX stock market index which varies over time, but not over individuals in a cross-section. This did not change the other estimated coefficients significantly.

To accommodate for the fact that some investors are students at year end and thereby somewhat misplaced in the educational group for the highest completed education before starting the new education, we apply an indicator variable for being a student receiving a government grant and another indicator for undertaking an apprenticeship education (student with wage). These variables capture that the investors are acquiring new information in their ongoing education. Furthermore, we presume that households share information. Therefore, we include an indicator for whether the investor's spouse is an economist, since this provides the investor with information about economics. Finally, we apply the length of highest completed education as a control variable.

Note that the panel data structure is pivotal for this estimation strategy. The effect of time-invariant variables, like gender, is identified by time-demeaning of the random effects, like in a standard random effects model. However, the effect of time-varying variables is to a large extent identified by their variation over time. Focusing on the educational indicators, their effects are identified by investors completing the education during the observation period, and their fixed effects are identified by all investors having the education (both those who completed the education before and during the observation period).[19]

4.3 Results from the Individual Heterogeneity Probit Model

The results from the probit model with unobserved individual heterogeneity are shown in Table 3. The first column of Table 3 contains the coefficient estimates and the second column the marginal effects on the probability of participating in the stock market. The first part of the table concerns the explanatory variables, whereas the second part of the table concerns the individual effects.

Unobserved individual heterogeneity is important: The contribution of the individual-specific variance component to the total variance is large and amounts to 90%, $\widehat{\rho} = 0.9$. Furthermore, the likelihood ratio test strongly rejects the hypothesis of $\rho = 0$.

The coefficient to the economics indicator is strongly significant and positive. From this we conclude that economists have a higher probability of holding stocks than investors with basic school (the indicator for basic schooling as highest completed education is left out of the model, i.e. this is the reference group towards which we compare individuals with other educations).

Notice, that the coefficient estimates give us limited information because their relative sizes

[19] We verify that there is sufficient variation in the variables; e.g. for economists 8,765 investors are economists for the entire period, 1,736 become economists during the period, and the remaining 394,770 investors stay non-economists for the entire period.

carry little information, only their signs and level of significance are relevant. In contrast, the influence of an explanatory variable can be evaluated by the size of its marginal effect; the larger the marginal effect, the more important the variable is for the decision to participate in the stock market.

The marginal effect of being an economist on the probability of stock-market participation is 1.7 percent points, and is by far the largest marginal effect for the educational-group indicators. Thus, becoming an economist increases the probability of holding stocks by around two percentage points compared to having only 9 years of basic schooling. The increase of 1.7 percent points can be compared to the overall participation rate of approximately 23%, i.e. an effect of 1.7 percent points corresponds to 7.6 percent of total participation, to put the effect into perspective. In this sense, the effect is also economically significant. It should also be noticed that when we control for detailed background characteristics and allow for individual effects, the effect of becoming an economist is reduced from the four to six percentage points mentioned in Section 3 to around two percentage points.

In addition, it is important to notice that the one and only kind of education that leads to a significant increase in the stock market participation probability is the economics education. Becoming an educator/teacher significantly lowers the probability of participating in the stock market by 0.2 percentage points.

There are several other variables in our probit model than the educational group indicators. For instance, most of the financial variables are significant and have a positive marginal effect on the stock market participation probability. The positive effect from income confirms common knowledge from the literature that income plays a prominent role in determining whether an investor participates in the stock market or not. The marginal effect from the lagged return of the KFX index to the stock market participation probability is also significantly positive. This corresponds well with the notion that when the stock market is rising, investors are more interested in investing in stocks.

The probability of investing in stocks increases when the investor's spouse is an economist, as the marginal effect from the spouse being an economist is significantly positive. This is consistent with information sharing in households, as well as the hypothesis that information about economics increases the probability of investing in stocks. This also corroborates the findings from the difference-in-differences estimators for investors moving together with an economist, cf. Section 3 above.

Turning to the second part of Table 3, we find that the unobserved individual effects are positively correlated with some of the educational fixed effects, and the highest correlation is with the economics education. The interpretation is that investors who are more prone to

invest in stocks also have a higher propensity of being economists. Investors having an education within educator/teacher, agriculture/food/forestry/fishing, business/commercial, health care, and police/armed forces/transportation are also more prone to hold stocks. However, the correlations with the unobserved individual effects are lower for these groups' fixed effects than for the economics' fixed effect. Furthermore, the unobserved individual effects are positively correlated with all the financial variables' fixed effects (except non-financial income), and most strongly with the fixed effect of bond market participation.

To conclude, even though economists have unobservable characteristics that make them more prone to holding stocks, there is a significantly positive marginal effect on the probability of participating in the stock market of acquiring a formal economics education. Indeed, the marginal effect from an economics education is larger than for any other education, and it is the only one being significantly positive.

4.3.1 Consequences of Allowing for Unobserved Individual Effects. The stock market participation literature referenced in the introduction is generally based on the standard probit model in equation (2). Such a standard probit model does not account for unobservable individual effects nor does it make fully use of the panel-dimension of the data. Above, we show that the individual effects are significant and therefore should be taken into account. In other words, a standard probit model applied to our data set would be misspecified. Nevertheless, to compare with the literature, we estimate the standard probit model using the same explanatory variables as above. The major difference between the results from the standard probit model and the probit model with individual effects is that the absolute sizes of the estimated marginal effects are reduced. For instance, the standard probit model would imply that the effect of becoming an economist increases the probability of holding stocks by as much as 18 percentage points compared to having only 9 years of basic schooling (results not tabulated). This should be compared with the marginal effect of 1.7 percentage points we report in Table 3.[20] In other words, a standard probit model exaggerates the coefficient estimates. We believe this is an important methodological message of our paper.

4.3.2 Conditional Fixed Effects Logit Model. An alternative way to investigate the causality question is to estimate a conditional fixed effects logit model. It has the same drawbacks (and advantages) as our parameterized random effects probit, since both methods allow correlation between the individual effect and the observable variables in a restricted time-invariant fashion. However, the fixed effects logit model has the additional drawback that it

[20] The finding that the coefficients are higher in the standard probit model is general: For instance, the marginal effect of age is 0.0045 in a standard probit model, whereas it is 0.0004 in Table 3, the marginal effect of income in a standard probit model is 0.14, whereas it is 0.005 in Table 3, etc.

suffers from the incidental variables problem, since consistency relies on the assumption that $S_{i1}, ..., S_{iT_i}$ are independent conditional on (X_i, α_i). The parameterized random effects probit model, on the other hand, allows unrestricted serial dependence in S_{it} (also conditional on X_i and α_i).[21] As expected, the fixed effects logit provides conclusions similar to the ones in Section 4.3, only with slightly higher point estimates (the results are available upon request). For instance, the only positive and significant marginal effect from the educational subject indicators is that from being an economist, which increases the probability of participating in the stock market by 4.6 percentage points, whereas becoming a teacher/educator significantly lowers the probability by 3.6 percentage points.[22]

5 Instrumental Variables Analysis

An advantage of the individual effects probit model presented in Section 4 is that it uses the total sample and it investigates the effect of *all* educational subjects on the stock market participation decisions. A possible disadvantage of the model with individual effects, however, is that it imposes strict assumptions on the distribution of the unobserved variables. For this reason, we now take a more flexible approach, where we primarily focus on the binary choice of an economics education and try to unravel whether the positive effect it has on stock market participation really is a causal effect. We use an IV approach to estimate the causal effect of an economics education on the stock market participation decision. As is common, the IV analysis is restricted to the subsample that is likely to be affected by the instrument. In compensation, the IV analysis takes care of any bias in the estimated effect caused by unobserved variables that drive both the stock market participation decision and the choice of an economics education.

The explanatory variable of primary interest is the indicator for whether individual i has an economics education. The estimated coefficient to the economics indicator can suffer from endogeneity bias arising from two sources: selection on outcomes and/or selection on unobservable variables. First, if individuals self-select into economics education based on expected future stock market gains, the choice of economics may be endogenous in the stock market participation equation. For example, if individuals who aspire to get substantial financial gains by making risky stock investments choose an economics education in order to enhance their possibilities of making (more) successful stock investments, it may lead to an upward bias. Secondly, unobserved ability bias arises if for example the most talented individuals (who a priori are better able to gather and understand information about stock

[21] See for instance Wooldridge (2001) for a thorough discussion of these issues.

[22] Note that the effect of the male indicator is not identified by the fixed effects logit, as no individuals change gender during the observation period. Hence, it had to be dropped from this estimation.

markets) choose an economics education, and we fail to control for this talent. In this case the estimated effect of having an economics education will also be upward biased. Similarly, the estimated effect could be biased if individuals choosing an economics education are less risk averse or have an innate taste for finance. The IV approach deals with both sources of endogeneity, and accordingly, all the posed issues.

We use the opening of a new university as an instrument for choosing an economics education.[23] More precisely, we identify the causal effect of having an economics education on the stock market participation decision by exploiting the exogenous variation that is obtained from the opening of Aalborg University situated in the County of Northern Jutland which is a remote part of Denmark. The opening of Aalborg University made it possible for the high school graduates in the area surrounding Aalborg to acquire an economics education at university level without moving residence, i.e. the university opening (suddenly) induces some of them to choose an economics education (or other educations offered at Aalborg University). Since mobility costs may be substantial, the university opening induces exogenous variation in the costs of choosing an economics education (that is independent of individual characteristics).

5.1 IV Estimation Sample

From the original random sample comprising 10% of the Danish population above 18 years, we select a subsample of potential recruits for the new university. Hence, we select individuals who lived in the County of Northern Jutland and who completed high school around the time of the opening of Aalborg University in September 1974. That is, we select individuals who graduate from high school in the county of Northern Jutland in June 1972, 1973, 1974, and 1975, respectively.[24] The County of Northern Jutland is an isolated part of Denmark, and before the opening of Aalborg University, the closest university was in Aarhus (about 120 kilometers away from Aalborg). It is plausible that some high school graduates in the county are not willing to move to acquire an economics education, and yet they will acquire an economics education at the local university once they get the opportunity. The identification of the causal effect on stock market participation of having an economics education is provided by the exogenous variation obtained by the existence of these individuals.

All in all, the IV subsample comprises 577 individuals who, during the five-year period 1997-2001, made 2795 stock market investment decisions. We see that a larger portion of

[23] We are grateful to Helena Skyt Nielsen for suggesting this type of instrument.

[24] To make our estimations more efficient and robust to the possibility that individuals speculate in the university opening, either by postponing or speeding up the educational decision, we have included all the cohorts of high school graduates from 1972 to 1975 in the main analysis. Including only the 1973 and 1974 cohorts in the analysis does not change the conclusions.

the individuals completing high school in 1974-1975 in the County of Northern Jutland are economists, and subsequently more of them participate on the stock market (in 1997-2001). 31% of the individuals in the 1972-1973 cohort participate in the stock market and 3% are economists, while the corresponding figures are 35% and 5%, respectively, for the 1974-1975 cohort. t-tests confirm that these differences are significant. Hence, it appears that the university opening induces some high school graduates to choose an economics education, and that this has a positive effect on their subsequent stock market participation. The fact that we both observe the stock market participation decisions and educations of these individuals about 25 year after their high school graduation, illustrates the long time-series dimension of our panel data and the detailed information about the investors that we have access to.

5.2 IV Estimation and Identification

To take into account the nonlinearity in both the stock market participation decision and the choice of an economics education, the IV analysis is done by estimating the bivariate probit model:

$$S_{it} = \mathbf{1}\left[\beta_S \widetilde{X}_{it} + \delta Econ_{it} + \xi_{it} > 0\right] \tag{5}$$

$$Econ_{it} = \mathbf{1}\left[\beta_E \widetilde{X}_{it} + \gamma Z_i + \nu_{it} > 0\right], \tag{6}$$

where $Econ_{it}$ denotes the indicator for individual i having completed an economics education at time t and $\widetilde{X}_{it}$ contains the background characteristics of investor i excluding the educational-group indicators. The error terms are assumed independent and identically bivariate standard normally distributed, $\binom{\xi_{it}}{\nu_{it}} \sim N_2\left(\binom{0}{0}, \begin{bmatrix} 1 & \rho \\ \rho & \sigma^2 \end{bmatrix}\right)$, i.e. it is the (seemingly unrelated) bivariate probit model. Z_i is an indicator for whether individual i completed high school in 1974-75 (the year of the university opening and the year after), and thus had the option to acquire an economics education at the local university at a lower cost. We have imposed the exclusion restriction that Z_i does not directly affect stock market participation, it only affects stock market participation through the effect it has on individual choice of economics education. Hence, we use Z_i as an instrument for acquiring an economics education.

Having one instrument implies that we can endogenize the decision to undertake one education. As we are primarily interested in the economics education, equation (6) models the decision to undertake an economics education.[25] We include only the $Econ_{it}$ indicator in equation (5) because we focus on the causal effect from choosing an economics education on

[25] Ideally, there would be an instrument available for each educational decision. Table 2 shows that by far the strongest influence from education on the stock market participation decision is from the economics education. This also suggests to focus the IV analysis on the economics education.

the stock-market participation.

In order to efficiently estimate the causal effect we need to have a proper instrument. In our framework, Z_i is a valid instrument if the coefficient to Z_i is significant in the economics education selection equation (6), and Z_i is independent of ξ_i and ν_i. That is, the university opening should influence stock market participation only through the effect it has on the probability of obtaining an economics education. This condition is very reasonable in our application, but it is inherently untestable. The opening of Aalborg University works as an exogenous shock that induces more high school graduates in the surrounding county to choose an economics education. Whether the individual is born such that it graduates from high school in 1972-73 or in 1974-75 is independent of the individual's ability, taste for finance, and risk preferences. Therefore, it is reasonable that the observed difference in stock-market participation for these two high school cohorts about 25 years after their high school graduation arises because more in the latter cohort are induced to choose an economics education because of the university opening.

All in all, we believe that the opening of the university is a valid instrument and allows us to estimate the causal effect on the stock-market participation probability from having a formal education in economics: It predicts the choice of economics (also after partialling out any other explanatory variables), it is unrelated to unobserved heterogeneity (e.g. ability, taste for finance, and risk preferences), and it is redundant in the structural model of stock market participation, i.e. any stock market participation differences between the two high school cohorts can be assumed to be captured by the observed explanatory variables.

5.3 IV Results

Table 4 shows the results from the IV analysis. The first column refers to the selection equation (6): The significantly positive coefficient to the university opening indicator implies that significantly more individuals acquire an economics education as a result of the university opening. This is in correspondence with the simple t-tests we mentioned above; here, we show that the difference is significant also when conditioning on the background characteristics of the individuals.

The second column of Table 4 displays the stock market participation equation (5) estimates. Most importantly, the marginal effect of an economics education is significantly positive (and amounts to 0.49, however, with large standard errors). In other words, the effect of having an economics education is significant and positive when we account for the possible endogeneity bias in the effect of the economics education. Since the identification stems from exogenous variation in the cost of acquiring an economics education, we conclude that the

economics education has a strong causal impact on the stock market participation decision for those individuals affected by the university opening. We interpret this as hard evidence that it really is information (from the formal economics education) that makes economists more likely to invest in stocks.

At first hand it might seem that the estimated effect of an economics education is rather high.[26] However, the effect is very reasonable for the following reason: The estimated effect of an economics education of 0.49 corresponds to an effect of 49 *percentages*, and not 49 percentage *points*, i.e. the stock market participation probability is 49 percentages higher for those high school graduates who acquire an economics education given the opportunity of acquiring it at Aalborg University, but would not have chosen an economics education without this opportunity. For instance, if the increase in the stock market participation probability is, say, 3.5 percentage points on average for the sample of high school graduates in Northern Jutland, it could be 3 percentage points for non-economists and approximately 4.5 percentage points for economists. The reason why the marginal effect of the economist indicator of Table 4 measures percentages, while that of the probit model of Table 3 measures percentage points, is that the former is a (weighted average of) local average treatment effect(s) (LATE): $\frac{E[S_{it}|\widetilde{X}_{it},Z_i=1]-E[S_{it}|\widetilde{X}_{it},Z_i=0]}{E[Econ_{it}|\widetilde{X}_{it},Z_i=1]-E[Econ_{it}|\widetilde{X}_{it},Z_i=0]}$, i.e. it measures the difference in the stock-market participation probability between those individuals who graduate from high school after the opening of Aalborg University and those who graduate before relative to the difference in the corresponding probability to become an economist.

5.3.1 Robustness of IV Estimates. In an appendix that is available upon request, we document that the IV estimates are both internally valid and (qualitatively) robust.

Regarding the strength of the instrument and the sensitivity of the IV estimates, we compare our estimates from the bivariate probit model to conventional IV (2SLS) estimates and treatment–effects estimates from a control function approach that assumes linearity in the stock market participation equation (5), but allows non-linearity in the economics selection equation (6). The 2SLS estimates are significantly positive, but very high and imprecise. The control function approach, however, gives estimates very similar to the bivariate probit model. This suggests that it is important to allow for nonlinearity in the selection equation (6), but not the outcome equation (5). We expect that the imprecision in the 2SLS estimates arises because the linear probability model provides a poor approximation for the two binary decisions relative to the probit model - in particular the binary choice of an economics education.

Regarding the validity of the instrument, we show that the two high school cohorts that graduate before and after the university opening, respectively, appear to be identical at high

[26] We thank an anonymous referee for pointing this out to us.

school graduation, i.e. there are no systematic and significant differences between observable characteristics of the two high school cohorts at high school graduation.

To check whether other macroeconomic factors may have affected the two high school cohorts differently, we use the corresponding high school cohorts from another county as a control group. The high school cohorts from the two counties are presumably affected in the same way by macroeconomic factors, however, the control group should not be affected by the university opening. Indeed, we find that this is the case; corroborating the validity of our instrument.

Finally, the appendix includes a map of Denmark where for instance the position of Aalborg University can be seen.

5.4 Causality and Identification

In the individual heterogeneity probit model in equation (4), if individuals' "taste for finance" varies over time, we cannot distinguish a possible causal effect running from a degree in economics to the stock-market participation decision from a hypothesis that a "taste for finance" makes some individuals more likely to enroll in economics *and* invest in stocks. Therefore, we also use the IV-approach that exactly tackles this issue of causality. Indeed, if we believe that a "taste for finance" is independent of which high school cohort an individual belongs to, our IV-results show that the effect of an economics education is a causal effect - at least for those individuals induced to acquire an economics education because of the university opening.

The finding that economists are more likely to hold stocks is independent of the identifying assumption. The identifying assumption in the IV analysis is that the university opening only affects stock market participation through the effect it has on individuals' choice of an economics education. The subpopulation affected by the instrument consists of individuals who finish high school in the early 1970s. Hence, the individuals identifying the causal effect of economics on stock market participation are older, better educated and wealthier than the average. On the other hand, the identifying assumption in the parameterized random effects probit model is that the unobserved individual effects are random, but have a time-invariant mean (which depends on observed individual fixed effects). The effect is identified by younger individuals who have just completed their education. For these individuals, who are younger and less wealthy than the average, we also report a positive significant effect - although smaller in magnitude than for the older and wealthier. In the difference-in-differences analysis of Section 3 the identifying assumption is that an individual does not choose spouse on the basis of the individual's proneness to participate in the stock market. We find that

interacting closely with an economist spouse increases stock market participation significantly.

Overall, we present results from different kinds of analyses that use different identifying assumptions, and they all hint at a causal effect of an economics education on the stock market participation decision. Since we believe that it is more likely that an economics education increases investors' stock of knowledge (about economics in general), rather than changes other unobserved characteristics (such as investor risk aversion), we interpret the clear-cut results from these analyses as indicating that more economists hold stocks because they know more about economics, stock markets, and investment opportunities in general.

6 Robustness Tests

In this section we provide further evidence of the robustness of the results. The results are not tabulated, but are available upon request.

6.1 Highly-Educated Investors

Above we argue that the costs associated with time spent on gathering and understanding information about the stock market are lower for investors with higher ability (e.g. longer education), and especially for investors with an economics education. In the probit model, we control for the level of education by including years of schooling as a control variable. In order to make a comparison between investors with the same length of education, we estimate the random effects probit model on a subsample of investors with at least 18 years of schooling, i.e. the roughly 5% of the investors with a master or Ph.D. degree. Since there is evidence of ability sorting across levels of education, but not across subjects of education within a given level, this analysis is presumably free of unobserved ability bias (such evidence is for instance found by Berger, 1988 and Arcidiacono, 2004).

There are 19,233 investors with an education of at least 18 years. The groups of investors with basic school and high school drop out of the sample. The comparison group is now police/armed forces/transportation. The most important result is that the economics education still has the highest marginal effect on the stock market participation probability compared to investors with other educations.

6.2 Economists' Information Acquisition

Our presumption is that the longer an economics education is, the more information the investor has about economics and thereby about stock market investments. There are $5,148$ investors with economics educations of 2, 4, and 6 years beyond high school, i.e. in total 14,

16, and 18 years of schooling.[27] This means that the investors in the economics group have different levels of information about the stock market due to differences in time spent on the formal economics education.

We estimate the individual heterogeneity probit model for the subsample of economists and exclude years of schooling from the set of explanatory variables. Instead, we use separate indicators for the medium and high level economics education and let the short level economics group be the reference group. We find that both medium and long economics educations significantly increase the stock market participation probability compared to having a short economics education. The marginal effects from medium and long economics education are not significantly different. So investors with a medium or long economics education are more likely to be stock holders than investors with a short economics education.

6.3 Dynamic Probit Model

An interesting extension of our individual effects probit model is a dynamic model with state dependence capturing the possibility that current behavior on financial markets depends on past behavior. If the investor participated in the stock market last period, the investor has already paid part of the participation costs, and probably has more knowledge about investment opportunities than current non-participants. Thus, we expect that participation last period has a positive effect on the probability of participating this period. This is indeed what we find when we estimate the random effects probit model extended with the 1-period lagged stock market participation indicator as an additional explanatory variable.[28] We deal with the initial conditions problem using the method of Wooldridge (2005). The largest marginal effect is now from the lagged stock market participation indicator and equals 0.81, which reveals that stock market participation is highly persistent over time. Still, the marginal effect from being an economist amounts to 0.08 and it is significant and much larger than for any of the other educational groups. These results corroborate our presumption that there are fixed stock market participation costs, and that these costs are lower for economists.

7 Do Economists also Hold more Stocks?

Until now, we focus on the stock market participation decision. Since investors first decide whether or not to participate, and subsequently decide on the amount to invest in stocks

[27] We exclude the apprenticeship educated economists as well as the very few economists with a PhD degree.

[28] We use the random effects dynamic probit model where the individual effects are not parametrized. We do not parametrize the individual effects due to identification problems. This is the reason why this is not our reference model throughout.

if they participate, it is interesting to evaluate whether information about economics also changes the proportion of investors' financial wealth invested in stocks. In this section, we pursue this task.

We investigate what determines the fraction of stock holdings out of the total value of the assets, where the total value of assets is the sum of an investor's holdings of stocks, bonds, cash, and real estate. We also look at the fraction of bonds out of total assets, and the stock-to-bond ratio. Economists that hold stocks, hold on average the same fraction of their total assets in stocks as do other investors that participate in the stock market (19.29% for economists versus 19.27% for other investors). On the other hand, the economists that hold bonds, hold slightly less of their total assets in bonds, compared to the other investors that hold bonds (18.7% versus 21.0% for the other investors).

As researchers, we only observe the stock market investments of the investors that participate in the stock market, i.e. we do not observe what the non-participants would have held, had they chosen to participate. In other words, we need a sample selection model that corrects for the selection of individuals into the group of stock market participants in order to answer whether economists also hold more stocks. We use Heckman's (1979) two-step selection model to investigate how investors' stock holdings relative to total assets vary with the observable explanatory variables.[29] In Table 5, we present results from the second step of the Heckman two-step estimation.[30] The most important result from Table 5 is that – among the educational indicator variables – the coefficient to the economist indicator is again the largest. In other words, we find that economists also have the highest propensity to hold relatively more stocks in their portfolio, controlling for other factors.

We also investigate the individuals' holdings of stocks relative to their holdings of bonds. Unconditionally, we find that the economists that hold *both* bonds and stocks, hold a much higher fraction of their wealth in stocks; on average, they hold 7.6 times more of their wealth in stocks than in bonds – the comparable number for the non-economist investor is 3.8. Interestingly, however, the fact that economists appear to hold relatively more stocks than bonds compared to other investors disappears when we account for selection into the group of active investors and condition on observable characteristics.

[29] Vissing-Jørgensen (2002) pursues the same kind of portfolio choice analysis. However, she does not have access to as detailed financial variables, nor as detailed educational variables, as we do. Furthermore, she estimates the Lee (1981) simultaneous equation selection model, which is essentially the same as Heckman's two-step selection model, however, slightly more general and asymptotically more efficient. We find almost identical results from estimating the simultaneous and the two-step selection models, respectively. This is not surprising given the huge size of our dataset.

[30] In the Heckman (1979) two-step estimation, the first step is a standard probit model for stock market participation, which is sufficient for producing consistent estimates of the factors affecting the share of stocks in the total asset portfolio in the second step.

Overall, we conclude that our finding that economists participate more in the stock market and hold more stocks than other investors, even if not a higher stock-to-bond ratio, is comparable to the finding of Calvet, Campbell and Sodini (2006) who show (using Swedish data) that sophisticated investors invest more efficiently but also more aggressively.

8 Conclusion

It is puzzling that so few individuals hold stocks. In our data, only 23% of the investors have decided to actively participate in the stock market, even though standard portfolio theory predicts that all investors should hold some fraction of risky assets in their wealth portfolio.

A promising explanation of the stock market participation puzzle is that there are costs associated with stock market participation which deter individuals from entering the stock market. Such costs include both the monetary costs associated with stock investments and costs that reflect the time spent on understanding risk-return trade-offs and general information about stock markets. Thus, if some agents are better able to gather and understand information about investment opportunities and stock markets, their effective costs of stock market participation will be lower and consequently they will have a higher probability of participating in the stock market. Previous studies have shown that income, wealth, and length of education are important factors in determining stock market participation, but our study is the first to apply detailed educational information. In particular, we test the hypothesis that economists have a higher probability of investing in stocks due to informational advantages. We use a unique register-based panel data set covering the period 1997-2001 comprising more than 1.87 million observations on individual investor choices at year-end, as well as a wide range of other background characteristics assumed to affect the investment choices.

We confirm the hypothesis that economists have a higher probability of holding stocks. We also report that our result that economists have a higher probability of holding stocks is robust across a wide range of specifications and estimation strategies.

Having established that economists have a higher tendency to hold stocks, it would be interesting to evaluate whether economists also perform better on the stock market, i.e. whether their risk-adjusted returns are higher than those that otherwise comparable investors obtain. Such an investigation, however, would require access to, and use of, economists' and other investors' trades in individual assets. Another issue that would be interesting to investigate is whether economists' different stock market behavior also has consequences for their welfare, as measured through economists' consumption patterns. For instance, it could be interesting to follow up on the findings of Mankiw & Zeldes (1991) and see whether economists also choose other consumption patterns as a result of their different behavior on the stock market.

These, and other related questions, require use of data in addition to those we have access to in the present paper. Nevertheless, we hope to find answers to such questions in future work.

References

Arcidiacono, P. (2004): "Ability Sorting and the Returns to College Major", *Journal of Econometrics*, 121(1-2), 343-375.

Basak, S. and D. Cuoco (1998): "An Equilibrium Model with Restricted Stock Market Participation", *Review of Financial Studies*, 11, 309-341.

Berger, M. (1988): "Predicted Future Earnings and Choice of College Major", *Industrial and Labor Relations Review*, 41(3), 418-429.

Bernheim, B. D. and D. M. Garrett (2003): "The Effects of Financial Education in the Workplace: Evidence from a Survey of Households", *Journal of Public Economics*, 87, 1487-1519.

Bernheim, B. D., D. M. Garrett. and D. Maki (2001): "Education and Saving: The Long-Term Effects of High-School Financial Curriculum Mandates", *Journal of Public Economics*, 80(3), 435-465.

Bertaut, C. C. (1998): "Stockholding Behavior of U.S. Households: Evidence from the 1983-1989 Survey of Consumer Finances", *The Review of Economics and Statistics*, 80(2), 263-275.

Calvet, L. E., J. Y. Campbell and P. Sodini (2006): "Down or Out: Assessing the Welfare Costs of Household Investment Mistakes", *NBER Working Paper* No. 12030.

Carneiro, P., K. T. Hansen and J. J. Heckman (2003): "Estimating Distributions of Treatment Effects with an Application to the Returns to Schooling and Measurement of the Effects of Uncertainty on College Choice", *International Economic Review*, 44(2), 361-422.

Chamberlain, G. (1980): "Analysis of the Covariance with Qualitative Data", *Review of Economic Studies*, 47, 225-238.

Cocco, J. F., F. J. Gomes, and P. J. Maenhout (2005): "Consumption and Portfolio Choice over the Life Cycle", *Review of Financial Studies*, 18(2), 491-533.

Coval, J. and T. J. Moskowitz (1999): "Home Bias at Home: Local Equity Preference in Domestic Portfolios", *Journal of Finance*, 54, 2045-2074.

Coval, J. and T. J. Moskowitz (2001): "The Geography of Investment: Informed Trading and Asset Prices", *Journal of Political Economy*, 109(4), 811-841.

Duflo, E. and E. Saez (2002): "Participation and Investment Decisions in a Retirement Plan: The Influence of Colleagues' Choices", *Journal of Public Economics*, 85, 121-148.

Grinblatt, M. and M. Keloharju (2000): "The Investment Behavior and Performance of Various Investor Types: A Study of Finland's Unique Data Set", *Journal of Financial Economics*, 55, 43-67.

Guiso, L., M. Haliassos, and T. Jappelli (2003): "Household Stockholding in Europe: Where Do We Stand and Where Do We Go?", *Economic Policy*, 18, 123-170.

Guiso, L. and T. Jappelli (2005): "Awareness and Stock Market Participation", *Review of Finance*, 9(4), 537-567.

Guvenen, F. (2005): "A Parsimonious Macroeconomic Model for Asset Pricing: Habit Formation or Cross-Sectional Heterogeneity", *Manuscript*, University of Rochester.

Guvenen, F. and B. Kuruscu (2006): "Does Market Incompleteness Matter for Asset Prices?", *Journal of European Economics Association*, forthcoming.

Haliassos, M. and C. C. Bertaut (1995): "Why Do So Few Hold Stocks?", *Economic Journal*, 105, 1110-1129.

Heckman, J. J. (1979): "Sample Selection Bias as a Specification Error", *Econometrica*, 47(1), 153-161.

Heckman, J. J. (1981): "The Incidental Parameters Problem and the Problem of Initial Conditions in Estimating a Discrete Time Discrete Data Stochastic Process", in *Structural Analysis of Discrete Data with Econometric Applications*, eds C. F. Manski and D. McFadden, MIT Press.

Heckman, J. J., R. LaLonde and J. Smith (1999): "The Economics and Econometrics of Active Labor Market Programs", in *Handbook of Labor Economics*, eds O. Ashenfelter and D. Card, Chapter 31, Vol. IV, 1865-2073.

Hong, H., J. D. Kubik and J. C. Stein (2004): "Social Interaction and Stock-Market Participation", *Journal of Finance*, 59(1), 137-164.

Lee, L. F. (1981): "Simultaneous Equations Models with Discrete and Censored Variables", in C. F. Manski and D. McFadden, eds., *Structural Analysis of Discrete Data with Econometric Applications*, MIT Press, Cambridge, MA.

Malloy, C. J., T. J. Moskowitz, and A. Vissing-Jørgensen (2005): "Long-Run Stockholder Consumption Risk and Asset Returns", *Manuscript*, GSB, University of Chicago.

Mankiw, G. N., and S. Zeldes (1991): "The Consumption of Stockholders and Nonstockholders", *Journal of Financial Economics*, 29(1), 97-112.

Massa, M. and A. Simonov (2006): "Hedging, Familiarity and Portfolio Choice", *Review of Financial Studies*, 19(2), 633-685.

Mundlak, Y. (1978): "On The Pooling of Time Series and Cross Section Data", *Econometrica*, 46(1), 69-85.

Palacios-Huerta, I. (2001): "The Human Capital of Stockholders and the International Di-

versification Puzzle", *Journal of International Economics*, 54(2), 309-331.

Parker, J. (2001): "The Consumption Risk of the Stock Market", *Brookings Papers on Economic Activity,* 2, 279-348.

Peress, J. (2004): "Wealth, Information Acquisition, and Portfolio Choice", *Review of Financial Studies*, 17(3), 879-914.

Viceira, L. M. (2001): "Optimal Portfolio Choice for Long-Horizon Investors with Nontradeable Labor Income", *Journal of Finance*, 56(2), 433-470.

Vissing-Jørgensen, A. (2002): "Towards an Explanation of Household Portfolio Choice Heterogeneity: Nonfinancial Income and Participation Cost Structures", *NBER Working Paper* No. 8884.

Vissing-Jørgensen, A. (2004): "Perspectives on Behavioral Finance: Does Irrationality Disappear with Wealth? Evidence from Expectations and Actions", in *NBER Macroeconomics Annual*, ed. by Mark Gertler, and Kenneth Rogoff, Ch. 2, 139206. MIT Press.

Willis, R. J. and S. Rosen (1979): "Education and Self-Selection", *Journal of Political Economy*, 87(5), 7-36.

Wooldridge, J. M. (2001): "Econometric Analysis of Cross Section and Panel Data", MIT Press, Cambridge, MA.

Table 1: Descriptive Statistics

Variables	Mean All	Mean Economists
Age	45,34	40,92
	(16.63)	(12.76)
Married	0,5152	0,5664
Male	0,4982	0,5395
Children 0-6 Years	0,1420	0,2187
Children 7-18 Years	0,1709	0,1965
Non-capital Income	235636	373736
	(224694)	(583887)
Cash Holdings	-18273	-41119
	(487937)	(598725)
Taxable Property Value	366822	541370
	(861801)	(1246691)
Private Pension Contribution	2497	3290
	(20654)	(21117)
Public Pension Contribution	11372	32284
	(33445)	(86643)
Bond Market Participation Rate	0,0821	0,1286
KFX Return	0,2005	
	(0.2225)	
Student, Goverment Grant	0,0743	0,0750
Student, Wage	0,0362	0,0243
Length of Education	11,31	14,13
	(3.007)	(2.526)
Educator/Teacher	0.0500	
Humanities/Arts	0.0190	
Argriculture/Food/Forestry/Fishing	0,0598	
Business (excl. Economics)	0,1267	
Social Science (excl. Economics)	0,0334	
Health Care	0,0622	
Natural Sciences/Technical Educations	0,1898	
Police/Armed Forces/Transportation	0,0112	
High School	0,1026	
Basic School/Preparatory School	0,3257	
Economics	0,0246	

Notes to Table 1: The table shows summary statistics for the entire sample (column 1) and for economist (column 2). For indicator variables the proportion of the sample included in the group is shown. Otherwise, the table provides the mean and standard deviation in parenthesis.

Table 2: Difference-in-Differences Estimation

	Difference-in-Differences estimator, (standard errors)					
	Economist			Economist Spouse		
	(1)	(2)	(3)	(4)	(5)	(6)
Difference-in-Differences estimate						
After*Econ(Spouse)	0.06 **	0.05 **	0.04 *	0.05 **	0.04 **	0.04 *
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)
Additional control variables:						
Socioeconomic and financial variables		+	+		+	+
Educational subject indicators			+			+

Notes to Table 2: The table shows the difference-in-differences estimates for the effect of becoming an economist (columns 1-3) and from getting an economist spouse (columns 4-6). The difference-in-differences estimates are calculated in a regression framework and are based on applying no additional control variables (columns 1 and 4), on socioeconomic and financial control variables (columns 2 and 5), and on socioeconomic, financial and educational group indicator control variables (columns 3 and 6) (standard errors in parenthesis). ***, **, * indicates parameter significance at the 1%, 5%, 10% level of significance, respectively.

Table 3: Probit Model for Stock Market Participation with Individual Effects

Explanatory Variables	βs	dΦs/dx
Intercept	-6.2471 ***	
	(0.0518)	
Age	0.0386 ***	0.0004
	(0.0006)	(0.0000)
Married	-0.2232 ***	-0.0021
	(0.0149)	(0.0002)
Male	0.1237 ***	0.0011
	(0.0125)	(0.0001)
Children 0-6 Years	0.0945 ***	0.0010
	(0.0152)	(0.0002)
Children 7-18 Years	0.0179	0.0002
	(0.0149)	(0.0001)
Bond Market Participation	-0.0933 ***	-0.0008
	(0.0111)	(0.0001)
Non-Capital Income/1,000,000	0.5621 ***	0.0052
	(0.0228)	(0.0004)
Cash Holdings/100,000	0.0029 ***	0.0000
	(0.0008)	(0.0000)
Taxable Property Value/100,000	-0.0460 ***	-0.0004
	(0.0083)	(0.0001)
Cumpulsory Pension Contribution /10,000	0.0061 ***	0.0001
	(0.0009)	(0.0000)
Private Pension Contribution/10,000	0.0168 ***	0.0002
	(0.0014)	(0.0000)
KFX	0.4083 ***	0.0038
	(0.0112)	(0.0002)
Student, Government Grant	-0.0980 ***	-0.0008
	(0.0183)	(0.0002)
Student, Wage	-0.1056 ***	-0.0009
	(0.0200)	(0.0002)
Spouse Education, Economics	0.1558 ***	0.0018
	(0.0470)	(0.0007)
Length of Education	0.0022	0.0000
	(0.0087)	(0.0001)
Educator/Teacher	-0.2461 ***	-0.0017
	(0.0893)	(0.0004)
Humanities/Arts	-0.0608	-0.0005
	(0.1026)	(0.0008)
Agriculture/Food/Forestry/Fishing	-0.0017	0.0000
	(0.0764)	(0.0007)
Business/Commercial (excl. Economics)	0.0250	0.0002
	(0.0690)	(0.0007)
Social Science (excl. Economics)	0.0328	0.0003
	(0.0657)	(0.0007)
Health Care	-0.0961	-0.0008
	(0.0753)	(0.0005)
Natural Sciences/Technical Educations	0.0568	0.0005
	(0.0652)	(0.0007)
Police/Armed Forces/Transportation	-0.0828	-0.0007
	(0.1121)	(0.0008)
High School	-0.0718	-0.0006
	(0.0526)	(0.0004)
Economics	0.7149 ***	0.0174
	(0.0835)	(0.0044)

Table 3 *continued*

Mean(Married)	0.3853 ***	0.0035
	(0.0198)	(0.0003)
Mean(Children 0-6 Years)	-0.0482 *	-0.0004
	(0.0278)	(0.0003)
Mean(Children 7-18 Years)	-0.1933 ***	-0.0018
	(0.0228)	(0.0002)
Mean(Bond Market Participation)	4.7770 ***	0.0439
	(0.0278)	(0.0026)
Mean(Non-Capital Income/1,000,000)	-0.4641 ***	-0.0043
	(0.0291)	(0.0004)
Mean(Cash Holdings/100,000)	0.0460 ***	0.0004
	(0.0008)	(0.0000)
Mean(Taxable Property Value/100,000)	0.4265 ***	0.0039
	(0.0098)	(0.0003)
Mean(Compulsory Pension Contribution/10,000)	0.0546 ***	0.0005
	(0.0016)	(0.0000)
Mean(Private Pension Contribution/10,000)	0.2042 ***	0.0019
	(0.0038)	(0.0001)
Mean(Spouse Education, Economics)	0.0023	0.0000
	(0.0638)	(0.0006)
Mean(Length of Education)	0.0695 ***	0.0006
	(0.0096)	(0.0001)
Mean(Educator/Teacher)	0.2122 **	0.0020
	(0.0991)	(0.0009)
Mean(Humanities/Arts)	-0.1247	-0.0011
	(0.1161)	(0.0011)
Mean(Agriculture/Food/Forestry/Fishing)	0.3324 ***	0.0031
	(0.0837)	(0.0008)
Mean(Business/Commercial (excl. Economics))	0.3127 ***	0.0029
	(0.0738)	(0.0007)
Mean(Social Science (excl. Economics))	0.0779	0.0007
	(0.0794)	(0.0007)
Mean(Health Care)	0.2154 ***	0.0020
	(0.0826)	(0.0007)
Mean(Natural Sciences/Technical Educations)	0.1008	0.0009
	(0.0702)	(0.0006)
Mean(Police/Armed Forces/Transportation)	0.5105 ***	0.0047
	(0.1331)	(0.0012)
Mean(High School)	0.2753 ***	0.0025
	(0.0613)	(0.0006)
Mean(Economics)	1.2598 ***	0.0116
	(0.0918)	(0.0009)
σ^c	2.9984	
	(0.0064)	
ρ	0.8999	
	(0.0004)	
Log likelihood	-440884	
LR test of $\rho = 0$	840000	
Number of Observations	1870324	
Number of Investors	405271	

Notes to Table 3: The table shows the parameter estimates and the marginal effects from the probit regression with individual effects. The dependent variable is the stock market indicator. The comparison groups are women, not married, not having children below 18 living at home, not undertaking an education, and basic school as highest completed education. The first column provides the parameter estimates and the second column the marginal effects, (standard errors in parentheses). ***, **, * indicates parameter significance at the 1%, 5%, 10% level of significance, respectively. The marginal effects of the explanatory variables are calculated as the average effects on the choice probability of stock market participation conditional on the unobserved random individual effects being at its mean values, $c_i = 0$. σ_c indicates the cross-individual standard deviation relative to the within-individual standard deviation, and ρ indicates the proportion of total variance contributed by the individual specific variance component.

Table 4: IV Analysis

Explanatory Variables	Stock market Participation **βs** **(Std. Err)** **[dΦs/dx]**	Economics Selection **βE** **(Std. Err)** **[dΦE/dx]**
Intercept	-0.1653 (0.4843) [0.0000]	-4.2329 (0.9500) [0.0000]
Age	0.0024 (0.0093) [0.0009]	0.0189 (0.0172) [0.0012]
Married	0.0214 (0.0593) [0.0077]	0.2019 * (0.1133) [0.0120]
Male	0.0703 (0.0547) [0.0254]	0.1720 (0.1044) [0.0110]
Children 0-6 Years	0.1171 (0.0735) [0.0431]	0.1629 (0.1205) [0.0116]
Children 7-18 Years	0.1151 ** (0.0586) [0.0414]	-0.4021 *** (0.1040) [-0.0281]
Bond Market Participation	0.7230 *** (0.1063) [0.2799]	0.4839 *** (0.1454) [0.0456]
Non-Capital Income/1,000,000	-0.2860 ** (0.1270) [-0.1030]	0.5610 *** (0.1680) [0.0357]
Cash Holdings/100,000	0.0074 * (0.0038) [0.0027]	-0.0029 (0.0064) [-0.0002]
Taxable Property Value/100,000	0.0164 *** (0.0040) [0.0060]	-0.0029 (0.0075) [-0.0002]
Cumpulsory Pension Contribution /10,000	0.0463 *** (0.0092) [0.0168]	0.0122 (0.0127) [0.0008]
Private Pension Contribution/10,000	0.1000 *** (0.0165) [0.0363]	-0.0753 ** (0.0318) [-0.0048]
KFX	0.0674 (0.1299) [0.0244]	-0.0254 (0.2379) [-0.0016]
Spouse Education, Economics	-0.3598 *** (0.1385) [-0.1192]	0.8034 *** (0.1528) [0.0996]
Length of Education	-0.0503 *** (0.0115) [-0.0182]	0.0706 *** (0.0225) [0.0045]
Economics	1.3521 ** (0.5586) [0.4939]	
University opening indicator		0.2446 ** (0.0986) [0.0152]
Observed Probability, P_1	0.3324	0.0394
Predicted Prob. (at mean), P_1	0.3298	0.0276
Log likelihood	-2,032.2924	
Pseudo R-square		
Number of Observations	2795	
Number of Investors	577	

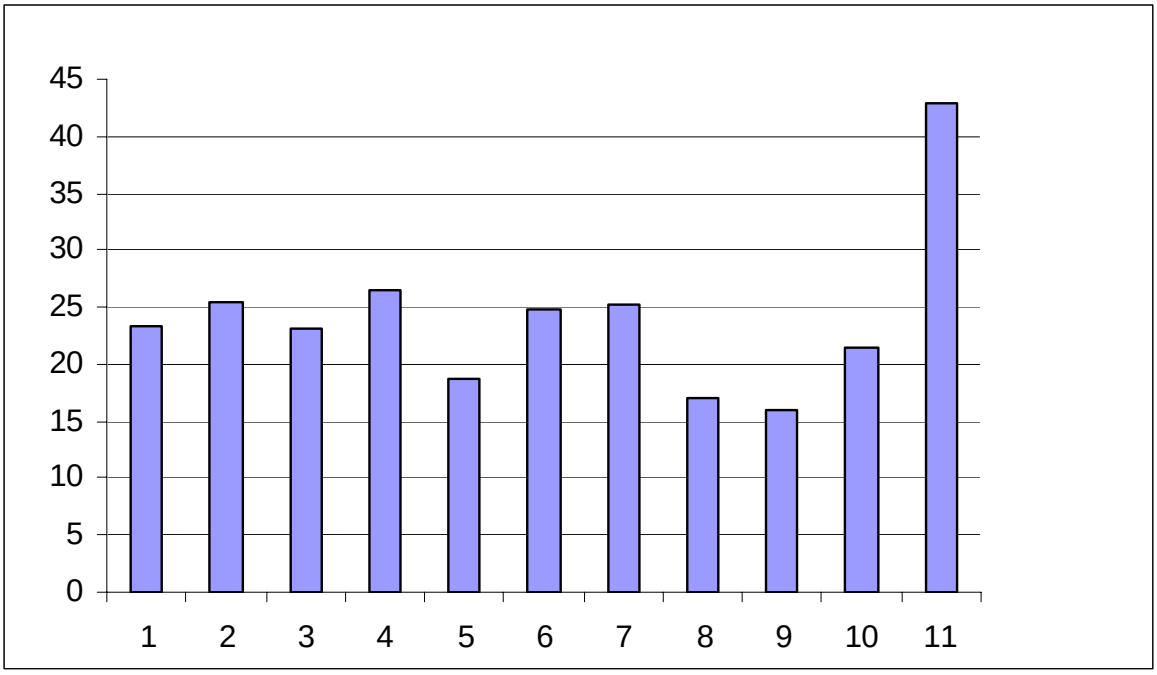
Notes to Table 4: The table shows the results from the IV analysis based on a subsample of investors from the County of Northern Jutland who graduated from high school in 1972-1975. The columns show the parameter estimates (standard errors in parentheses) and their marginal effects [in square brackets] from the bivariate probit model. The first column concerns the stock market participation equation and the second column concerns the economics selection equation. ***, **, * indicates parameter significance at the 1%, 5%, 10% level of significance, respectively.

Table 5: Second Step Estimates of the Heckman (1979) 2-Step Estimation Procedure

Explanatory Variables	β_{sw}
Intercept	-0.7484 ***
	(0.0126)
Age	0.0046 ***
	(0.0001)
Married	-0.0072 ***
	(0.0012)
Male	-0.0278 ***
	(0.0012)
Children 0-6 Years	-0.0771 ***
	(0.0018)
Children 7-18 Years	-0.0635 ***
	(0.0016)
Bond Market Participation	0.1906 ***
	(0.0034)
Non-Capital Income/1,000,000	0.0328 ***
	(0.0022)
Cash Holdings/100,000	0.0043 ***
	(0.0001)
Taxable Property Value/100,000	-0.0061 ***
	(0.0007)
Cumpulsory Pension Contribution /10,000	0.0018 ***
	(0.0001)
Private Pension Contribution/10,000	0.0050 ***
	(0.0002)
KFX	0.1316 ***
	(0.0027)
Student, Government Grant	0.1322 ***
	(0.0029)
Student, Wage	0.0690 ***
	(0.0036)
Spouse Education, Economics	0.0247 ***
	(0.0033)
Length of Education	0.0139 ***
	(0.0004)
Educator/Teacher	-0.0930 ***
	(0.0038)
Humanities/Arts	-0.0477 ***
	(0.0047)
Agriculture/Food/Forestry/Fishing	0.0032
	(0.0030)
Business/Commercial (excl. Economics)	0.0191 ***
	(0.0023)
Social Science (excl. Economics)	-0.0088 **
	(0.0038)
Health Care	-0.0317 ***
	(0.0032)
Natural Sciences/Technical Educations	-0.0174 ***
	(0.0023)
Police/Armed Forces/Transportation	-0.0480 ***
	(0.0059)
High School	0.0516 ***
	(0.0028)
Economics	0.1404 ***
	(0.0040)
Mill's λ	0.4384 ***
	(0.0050)
ρ_s	0.97557
σ_s	0.4493

Notes to Table 5: The table shows the parameter estimates from the second stage of the Heckman two-step estimation, where the probit model in Table 2 comprises the first stage. The dependent variable is the value of stocks relative to the value of total assets in the investors' wealth portfolio. The table displays the parameter estimates and (standard errors in parentheses) of the regression equation: $\frac{S^*_{it}}{W_{it}} = X_{it}\beta_{SW} + \varepsilon_{SW_{it}}$, where the participation equation indicates that $\frac{S^*_{it}}{W_{it}}$ is only observed if $S^*_{it} = X_{it}\beta_S + \varepsilon_{S_{it}} > 0$. The distribution of the error terms is given by $\varepsilon_{SW_{it}} \sim N(0, \sigma^2_S)$, $\varepsilon_{S_{it}} \sim N(0,1)$, and $corr(\varepsilon_{SW_{it}}, \varepsilon_{S_{it}}) = \rho_S$. The comparison groups are women, not married, not having children below 18 living at home, not undertaking an education, and basic school as highest completed education. ***, **, * indicates parameter significance at the 1%, 5%, 10% level of significance, respectively.

Figure 1: Stock Market Participation Rates across Educational Groups



Notes to Figure 1: The figure shows the proportion (in percentage) of investors who hold stocks across educational groups, 1997-2001. Subject 1: Education. Subject 2: Humanities/arts. Subject 3: Agriculture/food/forestry/ fishing. Subject 4: Business/Commercial (excluding economists). Subject 5: Social sciences (excluding economists). Subject 6: Health care. Subject 7: Natural sciences/technical educations. Subject 8: Police/armed forces/transportation. Subject 9: High school Subject 10: Basic school/preparatory school Subject 11: Economics.

Figure 2: Stock Market Participation over Time

Notes to Figure 2: The figure shows the time-series of the proportion (in percentage) of investors (all and economists) who hold stocks.

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