Value versus growth investing: Why do different investors have different styles?*

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Abstract

We find that several factors explain an individual investor's style, i.e., the value versus growth orientation of the investor's stock portfolio. First, we find that an investor's style has a biological basis and is partially ingrained in an investor from birth. Second, we show that an investor's hedging demands as well as behavioral biases explain investment style. Finally, an investor's style is explained by life course theory in that experiences, both earlier and later in life, are related to investment style. Investors with adverse macroeconomic experiences (e.g., growing up during the Great Depression or entering the labor market during an economic recession) or who grow up in a lower socioeconomic status rearing environment have a stronger value orientation several decades later. Our research contributes a new perspective to the long-standing value and growth debate in finance.

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1. Introduction

The concepts of value and growth investing have a long history in financial economics. Today, some 2,050 value funds and 3,200 growth funds cater to investors with preferences for these investment styles.[1] For more than two decades, Morningstar has provided a Value-Growth Score to help investors choose a fund with their preferred style. Fidelity, the world's largest provider of employer-sponsored retirement plans such as 401(k) plans, prominently features a description of value and growth funds on their Learning Center website.[2] There are best-selling books about both value and growth strategies, and countless business magazine articles boast recommendations about the "best value funds" or the "best growth funds." Wall Street professionals are educated about value and growth investing already in business school, with many Master of Business Administration (MBA) programs today offering, e.g., value investing courses. Most important, from the perspective of academic research, one of the most debated issues in the past several decades is the differential returns of investments in value versus growth stock portfolios, that is, the value premium debate (e.g., De Bondt and Thaler, 1985; Fama and French, 1992, 1993, 1996; Lakonishok, Shleifer, and Vishny, 1994; Daniel and Titman, 1997).[3]

Despite all this attention to value and growth investing, little research has attempted to explain the determinants of an individual's investment style (e.g., Kumar, 2009a). That is, why are some investors relatively more value oriented, while others are more growth oriented? In this paper, we argue that differences in investment styles across individuals, in principle, stem from two non-mutually exclusive sources: a biological predisposition that translates into a preference for value or growth stocks and environmental factors that determine an individual's portfolio tilt with respect to value and growth.

In recent years, individual characteristics of importance for portfolio choice, e.g., having a propensity to take financial risk or exhibiting investment biases, have been shown to be partly explained by an individual's genetic composition (e.g., Cesarini, Dawes, Johannesson, Lichtenstein, and Wallace, 2009; Barnea, Cronqvist, and Siegel, 2010; Cesarini, Johannesson, Magnusson, and Wallace, 2012; Cronqvist and Siegel, 2014). As a result, we hypothesize that an individual's investment style has a biological basis, i.e., a preference for value versus growth stocks could partially be ingrained in an investor from birth. We begin our empir-

[1] Source is Morningstar.com.

[2] See https://www.fidelity.com/learning-center/mutual-funds/growth-vs-value-investing.

[3] The value premium debate has not been limited to only the US stock market. It extends to several international stock markets (e.g., Chan, Hamao, and Lakonishok, 1991; Fama and French, 1998; Daniel, Titman, and Wei, 2001) and also to other asset classes (e.g., Asness, Moskowitz, and Pedersen, 2013). We refer to Fama and French (2012) for recent empirical evidence on the prevalence of a value premium in international stock markets.

ical analysis by assessing whether and to what extent variation in investment style across individual investors correspond to genetic variation across these investors.

We then examine which individual characteristics explain investment style and relate the evidence to portfolio choice and asset pricing models that account for the value premium (e.g., Fama, 1996; Larsen and Munk, 2012; Gârleanu, Kogan, and Panageas, 2012), as in the empirical investigation of household portfolio choices in Betermier, Calvet, and Sodini (2014). In rational models, differences in portfolio holdings are generally determined by investors' hedging demands. Behavioral models of the value premium, meanwhile, suggest that the value premium arises due to overreaction or excessive extrapolation of past performance or due to non-standard preferences.

Finally, based on life course theory, an approach to research in social psychology and neuroscience,[4] which has recently made its way into finance research (e.g., Kaustia and Knüpfer, 2008, Malmendier and Nagel, 2011, 2013; Schoar and Zuo, 2013), we hypothesize that an individual's specific life experiences affect behavior, including the individual's investment style, later in life. We consider several potentially relevant, and plausibly exogenous, life experiences of individuals. We analyze whether experiencing an adverse and significant macroeconomic event, e.g., growing up during the Great Depression, affects an individual's value versus growth orientation. We also analyze the impressionable years during an individual's life course, e.g., the economic conditions when an individual entered the labor market for the first time. Finally, we also examine the socioeconomic status (SES) of the rearing environment in which the individual grew up.

The experience of Benjamin Graham and T. Rowe Price, Jr., constitute a colorful illustration of some of our hypotheses. Graham is commonly dubbed the "father of value investing" because he preferred stocks with comparatively low valuation ratios and other characteristics that subsequently came to define value investing. Price, the founder of the large money management company with his name, is often referred to as the "father of growth investing" because of his preference for companies characterized by strong earnings growth, research and development (R&D) intensity, and innovative technology. Their different investment styles could very well have a biological basis, but this is not possible to investigate without data on their genetic differences. Graham grew up very poor, with his father passing away unexpectedly when he was young and his mother losing the family's savings in the stock market crash known as the Panic of 1907. Among his brothers, Graham was often tasked with bargain hunting at different grocery stores (e.g., Carlen, 2012). In comparison, Price had a privileged upbringing, his father being an medical doctor who served as a surgeon

[4]For further details and references related to life course theory, see, e.g., Giele and Elder (1998) and Elder, Johnson, and Crosnoe (2003).

his entire professional career for a rapidly expanding railroad company, a growth company at that time. We hypothesize that such differences in life experiences can contribute to differences in investment styles later in life.

Our research contributes a new perspective to the long-standing value versus growth debate in finance. First, an investor's style has a biological basis. A preference for value versus growth stocks is partially ingrained in an investor already from birth. We estimate that genetic differences across individuals explain about 26% of the variation in value versus growth orientation, if using price-to-earnings (P/E) ratios as an investment style measure, and about 27% if using Morningstar's Value-Growth Score. Second, we examine which individual characteristics explain investment style. Concurring with prior household finance evidence supporting risk-based theories of the value premium (e.g., Betermier, Calvet, and Sodini, 2014), we find that investors' hedging demands related to human capital and displacement risk as well as behavioral biases in form of a preference for speculative assets contribute to investment style. Finally, an investor's style is explained by life course theory in that experiences, both earlier and later in life, are related to investment style. In particular, investors with adverse macroeconomic experiences have stronger preferences for value investing later in life. For example, those who grew up during the Great Depression have portfolios with average P/E ratios that are 1.7 (or about 11% at the median) lower, controlling for individual characteristics. Consistent with an impressionable years hypothesis, those who entered the labor market for the first time during an economic recession are also more value oriented later on. We also find that those who grew up in a lower status socioeconomic rearing environment have a stronger value orientation later in life.

The paper is organized as follows. Section 2 reviews related research. Section 3 introduces our data. Section 4 reports our results and robustness checks, and Section 5 concludes.

2. Related research

In this section, we review models that have implications for why some individual investors could prefer a more value-oriented investment style while others could be more growth-oriented.[5]

[5] For a review of empirical evidence related to value and growth investing, see, e.g., Chan and Lakonishok (2004).

2.1. Evolutionary models

Economists have for some time argued that preferences, for example with respect to risk, are shaped by evolutionary forces (e.g., Robson, 2001). Empirical research has provided evidence that variation of preferences across individual investors reflects genetic differences between individuals. For example, Cesarini, Dawes, Johannesson, Lichtenstein, and Wallace (2009) and Barnea, Cronqvist, and Siegel (2010) show that about 30% of the cross-sectional variation in financial risk preferences is explained by biological predispositions.[6]

Similarly, Rayo and Becker (2007) and Brennan and Lo (2011) present evolutionary models to explain how behaviors, which are not rational in standard economic models that emphasize utility maximization by individual agents and are therefore considered behavioral biases, could emerge from human evolution.[7] Recent research has again provided empirical evidence that is consistent with a relation between, on the one hand, biological predispositions and, on the other hand, behavioral biases (e.g., Cesarini, Johannesson, Magnusson, and Wallace, 2012; Cronqvist and Siegel, 2014).

We thus examine to what extent investors' choices of value- versus growth-oriented investments reflect innate preferences or biases and show the relative importance of biological and environmental factors for investors' investment style.

2.2. Finance models

Numerous studies consider the return premium associated with investments that are long value (cheap) stocks and short growth (expensive) stocks, both in US markets (e.g., Fama and French, 1992) and outside the US (e.g., Fama and French, 1998; Asness, Frazzini, and Pedersen, 2012). What are the implications for the portfolio composition of individual investors?

2.2.1. Rational models

Lynch (2001), Jurek and Viceira (2011), and Larsen and Munk (2012) derive the optimal asset allocation for an investor whose entire wealth consists of financial assets. Differently from traditional portfolio choice models that focus on the allocation between the risk-free asset and the equity market, these studies explicitly include value and growth stocks with return properties estimated from US data. All three studies find that investors should hold

[6] Some research in the intersection of finance and neuroscience has even identified specific candidate genes involved in explaining differences in financial risk taking across individuals (e.g., Kuhnen and Chiao, 2009; Dreber, Apicella, Eisenberg, Garcia, and Zamore, 2009; Zhong, Israel, Xue, Ebstein, and Chew, 2009).

[7] For further details and references, see, e.g., Cosmides and Tooby (1994), Chen, Lakshminarayanan, and Santos (2006), and Santos and Chen (2009).

value stocks due to the high Sharpe ratio of value stocks. This value tilt decreases with investors' risk aversion and with the investment horizon. Longer investment horizons lead to a lower value tilt and generally to a relatively higher allocation toward growth stocks because of investors' intertemporal hedging demands.[8] Intertemporal hedging demands arise due to return predictability. For example, mean reversion is smaller for value than for growth stocks, making value stocks relatively riskier over longer horizons, consistent with evidence from asset pricing research (e.g., Campbell and Vuolteenaho, 2004).

Fama (1996) and Cochrane (2007) consider the portfolio choice implications of the value premium from an equilibrium perspective. The value premium arises because it represents exposure to a priced state variable. In these multifactor models, investors hold multifactor efficient portfolios consisting of the market portfolio and a hedge portfolio, the mimicking portfolio for the state variable, for example, in the form of the Fama and French HML (high minus low) portfolio. Because the market portfolio needs to be held in equilibrium, an investor's allocation will deviate from the market portfolio to the extent that the investor is different from the average investor. Investors with below average risk aversion or with below average exposure to the state variable underlying the value premium have a long position in the HML portfolio and thereby a value tilt in their overall portfolio, while more risk-averse investors with above average exposure to the underlying state variable tilt their portfolio toward growth via a short position in the HML portfolio.

The nature of the priced state variable underlying the value premium is still the object of much research in finance. For example, Liew and Vassalou (2000) find a positive correlation between HML and future gross domestic product (GDP) growth, suggesting that those particularly exposed to macroeconomic conditions would overweight growth stocks at the expense of value stocks. Bansal and Yaron (2004) relate the value premium to long-run consumption risk, such that long horizon investors should be expected to favor growth over value stocks. Fama and French (1996) suggest that negative shocks to distressed value firms lower the value of human capital, implying that those with relatively more human capital should hold growth instead of value stocks. More recently, Gârleanu, Kogan, and Panageas (2012) show in a general-equilibrium overlapping-generations model how technological innovation reduces the value of existing firms as well as the human capital of older workers. In their model, though, financial capital is more exposed to this displacement risk than human capital, such that agents with more financial wealth relative to total wealth favor growth stocks over value stocks.

Differently from the above models that introduce nonmarket risk state variables to explain the value premium, others such as Zhang (2005) and Petkova and Zhang (2005) suggest that

[8]Larsen and Munk (2012) find only very slight horizon dependence due to small hedging positions.

the value premium is consistent with the conditional capital asset pricing model (CAPM).[9] While the ability of conditional CAPMs to empirically fit asset return data is unclear (e.g., Lewellen and Nagel, 2006 and Gilbert, Hrdlicka, Kalodimos, and Siegel, 2014), portfolio choice implications of conditional CAPM models differ from those above, in particular with respect to investors' risk aversion. Specifically, differences in risk aversion across investors simply lead to different allocations between the market portfolio and the risk-free asset. That is, a particularly risk-seeking investor uses leverage to increase her holding of the market portfolio instead of tilting her portfolio toward value stocks. In practice, though, some individuals can face leverage constraints (e.g., Constantinides, Donaldson, and Mehra, 2002) and could use value or growth stocks as a substitute for leverage.[10]

Finally, independently of the nature of the value premium and even if it reflects only time-varying market exposure, we expect rational investors to hold value and growth stocks to the extent that such tilts allow investors to hedge background risks such as labor income risk. For example, we expect a rational investor whose idiosyncratic labor income is negatively correlated with the return of value (growth) stocks, and who has not insured her labor income otherwise, to overweight value (growth) stocks in her portfolio (e.g., Cochrane, 2007 and Davis and Willen, 2013).[11]

2.2.2. Behavioral models

While the above models provide a rational explanation of the value premium and of investors' asset allocation choices, several behavioral models suggest that the value premium arises due to systematic mispricing. For example, Lakonishok, Shleifer, and Vishny (1994) argue that the return of growth, or glamour, stocks is not related to a source of systematic risk but is the result of investor sentiment, and they provide evidence that value investing results in higher returns because it exploits behavioral biases of some investors. In other behavioral models, the value premium reflects positive feedback trading (e.g., De Long, Shleifer,

[9] Jagannathan and Wang (1996), Palacios-Huerta (2003), Santos and Veronesi (2006), and Sylvain (2014) also offer (approximate) conditional CAPM explanations of the value premium. These models, though, require the inclusion of human capital in the total wealth portfolio. Santos and Veronesi (2006) show that these models imply two-factor models consisting of the market return and the return to (aggregate) human capital.

[10] We thank the referee for this insight. Retail investors could use a value tilt if value stocks are riskier or they could use a growth tilt to capture the stronger upside performance of growth stocks. If leverage constraints are widespread, such a growth tilt could contribute to the emergence of the value premium similar to the return difference between high and low beta stocks in Asness, Frazzini, and Pedersen (2012) and Frazzini and Pedersen (2014).

[11] Empirical research in finance has so far produced inconclusive evidence on whether individual investors' hedging demands affect portfolio choice (e.g., Heaton and Lucas, 2000; Massa and Simonov, 2006; Bonaparte, Korniotis, and Kumar, 2014 and Addoum, Korniotis, and Kumar, 2014).

Summers, and Waldmann, 1990; Hong and Stein, 1999; Barberis and Shleifer, 2003), conservatism, and representativeness (e.g., Barberis, Shleifer, and Vishny, 1998) or overconfidence (e.g., Daniel, Hirshleifer, and Subrahmanyam, 1998; Daniel, Titman, and Wei, 2001). As a result, we can expect that those who display more behavioral biases have a stronger growth orientation.

2.3. Life course theory

In this section, we review previous research related to life course theory.

2.3.1. Macroeconomic experiences

Experiencing an adverse and significant macroeconomic event can have long-term and persistent effects on an individual's behavior much later in life. The Great Depression is the macro event that has so far been studied most in-depth in social science, and a variety of outcomes have been examined. See Elder (1974) for one of the first and most extensive studies of the long-term effects of the Great Depression. Several researchers have argued that the Great Depression created a depression generation, whose behavior affected the macro economy for decades after the Depression ended. For example, Friedman and Schwartz (1963) suggest that the Great Depression "shattered" beliefs in capitalism.

In their Depression Babies study, Malmendier and Nagel (2011) show that individuals who have experienced relatively low stock market returns in their lives subsequently do not participate in the stock market and they take significantly less financial risk if they do participate. Others have analyzed the importance of recent return experiences on the behavior of young investors in the 1990s (e.g., Vissing-Jørgensen, 2002; Greenwood and Nagel, 2009). Graham and Narasimhan (2004) show that corporate executives who experienced the Great Depression choose more conservative capital structures. Recessions have also been shown to significantly affect outcomes ranging from fertility (e.g., Ben-Porath (1973)) to infants' and adults' health (e.g., Ruhm, 2000; Dehejia and Lleras-Muney, 2004). Other economists have also found that macro events have long-term effects on individual preferences. For example, Alesina and Fuchs-Schüendeln (2005) report that post-reunification East Germans (particularly older cohorts) have stronger preferences for, e.g., redistribution than otherwise similar West Germans. More recently, Malmendier and Nagel (2013) show that differences in life experiences of high or low inflation predict differences in subjective inflation expectations.

Those who have more salient experiences of difficult economic conditions, characterized by the absence of financial resources, can develop a more value-oriented investment style, with a preference for stocks that could seem relatively cheaper.

2.3.2. Impressionable years

Several studies in social psychology suggest that experiences in early adulthood are important for preferences later in life (e.g., Krosnick and Alwin, 1989). An individual's core beliefs and preferences seem to crystallize during a period of great neurological plasticity in early adulthood the so-called impressionable years and remain largely unchanged thereafter.[12] In economic research, Giuliano and Spilimbergo (2013) has recently showed that experiencing an economic recession during the impressionable years (18-25 years old) significantly affects redistribution and political preferences much later in life.

We also examine whether an individual entered the labor market for the first time in an economic recession. This measure comes with the caveat that it is somewhat less exogenous compared with the impressionable years because individuals can to some extent endogenously choose when they enter the labor market by increasing their investment in education. We still find it informative to examine the time of an individual's labor market entry because it has been shown to be important in other studies of economic outcomes (e.g., Malmendier, Tate, and Yan, 2011; Schoar and Zuo, 2013). This is also a period when many individuals start to invest in the stock market, so it seems possible that an individual's investment style could also be affected.

An effect on investment style of labor market conditions at the time of an individual's first employment can also be less direct. For example, Oyer (2008), Kahn (2010), and Oreopoulos, von Wachter, and Heisz (2012) report that the market conditions at the time of an individual's labor market entry have persistent effects on earnings because of the initial labor market conditions affecting an employee's task-specific human capital accumulation. That is, an effect on an individual's value versus growth orientation could be indirect through an effect on earnings. As a result, it is important to control for earnings in our analysis.

2.3.3. Rearing environment

The argument that the rearing environment, and other early life experiences, can have significant long-term and persistent effects on an individual's behaviors later in life has recently made its way into economic research. Most existing studies investigate outcomes such as education and earnings. For example, economists have shown that birth order and family size affect educational attainment and earnings later in life (e.g., Black, Devereux, and Salvanes, 2005). Relatively few studies examine outcomes of primary interest to finan-

[12]Recent research on neurological development shows that, in the developing brain, the volume of gray matter in the cortex gradually increases until about adolescence but then sharply decreases as the brain prunes away neuronal connections that are deemed superfluous to the adult needs of the individual (e.g., Spear, 2000).

cial economists. An exception is Chetty, Friedman, Hilger, Saez, Schanzenbach, and Yagan (2011) who report that the preschool (kindergarten) environment explains some asset allocation decisions later in life, such as contributing to a 401(k) retirement savings plan and owning a home.[13]

In this study, we focus on the rearing environment within the family during an individual's upbringing. We hypothesize that the socioeconomic status of the rearing environment in which an individual grows up explains differences in investment style later in life.[14]

3. Data

In this section, we introduce our data.

3.1. Individual characteristics

To study the extent to which variation in investment styles across a large sample of individual investors reflects innate differences, we employ data on identical, or monozygotic (MZ), and fraternal, or dizygotic (DZ), twins. We construct our data set by matching a large number of twins from the Swedish Twin Registry (STR), the world's largest twin registry, with data from individual tax filings and other databases. In Sweden, twins are registered at birth, and the STR collects additional data through in-depth interviews.[15] STR's data provide us with the zygosity of each twin pair.[16]

Table 1 reports summary statistics for the twins in our data set and their individual characteristics. Panel A shows that we have data on a total of 10,490 identical twins and 24,486 fraternal twins, who participate in the stock market. Opposite-sex twins are the most common (38%); identical male twins are the least common (13%). Panel B reports summary

[13]Even the pre-birth, i.e., in utero, environment has been shown to predict subsequent economic outcomes and behaviors. See, e.g., Almond and Currie (2011) and Cronqvist, Previtero, Siegel, and White (2014).

[14]We refer to, e.g., Bisin and Verdier (2000, 2001) for work related to the social transmission of preferences and behavior from parents to their children.

[15]STR's databases are organized by birth cohort. The Screening Across Lifespan Twin, or SALT, database contains data on twins born 1886-1958. The Swedish Twin Studies of Adults: Genes and Environment database, or STAGE, contains data on twins born 1959-1985. In addition to twin pairs, twin identifiers, and zygosity status, the databases contain variables based on STR's telephone interviews (for SALT), completed 1998-2002, and combined telephone interviews and Internet surveys (for STAGE), completed 2005-2006. For further details about STR, see Lichtenstein, Sullivan, Cnattingius, Gatz, Johansson, Carlström, Björk, Svartengren, Wolk, Klareskog, de Faire, Schalling, Palmgren, and Pedersen (2006).

[16]Zygosity is based on questions about intra-pair similarities in childhood. One of the questions was: Were you and your twin partner during childhood "as alike as two peas in a pod" or were you "no more alike than siblings in general" with regard to appearance? STR has validated this method with DNA analysis as having 98% accuracy on a subsample of twins. For twin pairs for which DNA (deoxyribonucleic acid) has been collected, zygosity status is based on DNA analysis.

statistics for individual characteristics, including age, education, marital status, net worth, and disposable income, which we include as controls when we estimate models in Section 4. The average size of investors' holdings of stocks and equity mutual funds in our data set, about $33,500, is comparable to those in other data sets of a broad set of individual investors, e.g., 24,600 euros in Grinblatt and Keloharju (2009).[17]

[Insert Table 1 about here.]

3.2. Investment-style measures

Prior to the abolishment of the wealth tax in Sweden in 2007, all Swedish banks, brokerage firms, and other financial institutions were required by law to report to the Swedish Tax Authority information about individuals' portfolios (i.e., stocks, bonds, mutual funds, and other securities) owned on December 31. We have matched the individuals in our data set with portfolio data between 1999 and 2007, the entire period for which data are available. For each individual, our data set contains all securities owned at the end of the year (identified by each security's International Security Identification Number (ISIN)), the number of each security owned, and the end of the year value. Security level data have been provided by S&P CapitalIQ and Morningstar. In our data set, there is a total of about two thousand different individual stocks and about one thousand different mutual funds.

We categorize each investor's value versus growth tilt on a continuum. For individual stocks, we construct two measures of value versus growth orientation using different scaled prices: P/E Ratio (price/earnings) and P/B Ratio (price/book).[18] For each individual, we compute the value-weighted average ratio for each year in the panel. Appendix A reports definitions for our investment style measures. For mutual funds, we also construct two measures: Morningstar's Value-Growth Score, which varies from -100 (value) to +400 (growth); and name-based Value/Growth Measure, which is -1 if a fund's name contains "value," +1 if a fund's name contains "growth" or "technology," and zero otherwise. We use the same method as for stocks to construct a measure for each individual and year.

Panel A of Table 2 reveals that while identical and fraternal twins are relatively similar with respect to these value versus growth orientation measures, significant variation exists in investment style across different investors. It is this variation that we decompose and

[17] We use the average end-of-year exchange rate 19992007 of 8.0179 Swedish krona per US dollar to convert summary statistics in the table. When we estimate models in Section 4, all values are in Swedish krona.

[18] We check that our results are robust to outliers. Following Capital IQ's practice, the ratios are censored at 0 and 300. Winsorizing at the 1% level does not change any of the reported results. Our results are also robust to variable transformations (e.g., log) used to reduce the skewness of scaled price distributions.

explain in Section 4. Panel B shows that all measures of the value versus growth orientation of investors' portfolios are significantly positively correlated, suggesting that investors have a consistent preference for certain investment styles.

[Insert Table 2 about here.]

4. Results

We first examine to what extent an individual's investment style is explained by biological predispositions. We then investigate the relation between individual characteristics and an investor's value versus growth orientation. Finally, we analyze environmental experiences that life course theory suggests can influence an individual's investment style.

4.1. Biological predispositions and investment style

In this section, we first report separate correlations for identical versus fraternal twins for each of our measures of investment style. We then provide formal estimation results from decomposing the variation in investment style into genetic and environmental components. To do so, we use empirical methods from quantitative behavioral genetics research that have recently been employed also in research in economics (e.g., Cesarini, Dawes, Johannesson, Lichtenstein, and Wallace, 2009; Barnea, Cronqvist, and Siegel, 2010). The approach involves maximum likelihood estimation (MLE) of a random effects model but relies on an intuitive and simple insight: Identical twins share 100% of their genes, while the average proportion of shared genes is only 50% for fraternal twins,[19] so if identical twins are more similar with respect to their investment styles than are fraternal twins, then there is evidence that value versus growth orientation is partly explained by genetic predispositions. For further details, see Appendix B.

4.1.1. Evidence from correlations

Fig. 1 reports correlations by genetic similarity, i.e., for identical twins and fraternal twins (separately for same- and opposite-sex twins), for measures of value versus growth orientation. Panel A presents results for individual stocks; Panel B, for mutual funds.

[19] Genome sequencing has recently revealed that humans and, e.g., the common chimpanzee (*Pan troglodytes*) share about 96% of their genes (e.g., Mikkelsen, 2005), and the genetic overlap is even greater among humans. That is, the 50% refers to only the proportion of genes that makes different humans different from each other. For some individual characteristics, particularly physical attributes, there is no variation across individuals.

Several conclusions emerge from this exercise. First, we find that identical twins' investment styles are significantly more correlated compared with fraternal twins. For example, the Pearson correlation coefficient among identical twins is 0.49 for the average P/E ratio of their stock holdings, compared with 0.35 among fraternal twins (0.34 for opposite-sex fraternal twins). Using the P/B ratio, we find a correlation of 0.39 for identical twins and of 0.25 for fraternal twins, again confirming a larger correlation for identical twins relative to fraternal twins. A similar conclusion emerges for mutual funds. For example, the Pearson correlation coefficient among identical twins is 0.31 for the average Value-Growth Score by Morningstar for their mutual fund holdings, compared with only 0.14 for fraternal twins (0.12 for opposite-sex fraternal twins). Similarly, for our name-based value versus growth measure we find a correlation of 0.44 for identical twins and a correlation of 0.29 for fraternal twins. That is, genetically more similar investors have more similar investment styles. This evidence suggests that genetic differences affect value versus growth orientation among individual investors.

Second, we find that the correlations among identical twins are significantly below one. That is, even genetically identical investors show significant differences with respect to their investment styles. This evidence shows the importance of the environment in shaping an investor's value versus growth orientation, and it emphasizes the importance of analyzing the effect on investment style of experiences and events during an individual's life course.

4.1.2. Evidence from variance decomposition

Tables 3 and 4 report results from decomposing investment styles into genetic and environmental variation. We report the proportions of the variation in investment styles across individuals that are explained by genetic (A), common environmental (C), and individual-specific environmental (E) factors (for details, see Eq. (5) in Appendix B). We first regress each investment style measure on a set of individual characteristics as well as year fixed effects and then we decompose the residual variation. We include the following individual characteristics in each case: gender, age, education, marital status, disposable income, and net worth.

The evidence in Table 3 confirms the correlation evidence and shows that variation across investors with respect to value versus growth orientation of their stock portfolio is partially genetic.[20] The estimates of the A component vary between 26% and 40% and are statistically significant for each investment-style measure. The C component is significantly smaller and

[20] We focus on the most commonly used measures in practice related to value versus growth orientation. As a robustness check, we also examine price/sales (P/S) and price/cash flow (P/C) ratios. The A components for these measures are similar to those reported for standard measures such as P/E and P/B ratios.

varies between 0% and 11%. The remaining variation in investment style is explained by individual-specific experiences and events.[21]

[Insert Table 3 about here.]

While the evidence reported so far involves individual stocks, we also decompose the variation in investment style using data on mutual funds. We use two measures, the Value-Growth Score by Morningstar and a name-based value/growth measure. These measures provide a salient way for an individual investor to choose exposure based on his or her value versus growth preference. Our conclusions from Table 3 are not affected. The estimates of the A component vary between 26% and 27%, and they are statistically significant for both investment-style measures, while estimates of the C component are 0% in both cases.

Even though estimates of the A component based on holdings of individual stocks (Table 3) are less precise than those based on holdings of mutual funds (Table 4), each of the investment style measures reveals a statistically significant A component. It should also be emphasized that recent studies related to individual investor behavior have had difficulties explaining even 10% of the cross-sectional variation when including a large set of individual characteristics (e.g., Brunnermeier and Nagel, 2008). Overall, we conclude that an individual's investment style has a biological basis, i.e., a preference for value versus growth stocks is partially ingrained in an investor from birth.

[Insert Table 4 about here.]

It is important to emphasize several assumptions, and associated caveats, of the models we estimate. First, the equal environments assumption (EEA) is one important assumption. If an individual's parents or others in the environment treat identical twins more similarly than fraternal twins, then the estimated genetic component (A) can be upward-biased. From research in behavioral genetics research, when the EEA has been challenged most rigorously, the evidence suggests that bias from violations of the EEA is not first order (e.g., Bouchard (1998)).[22] Second, the model we estimate assumes an additive genetic component. We also estimate ADE models, with an additional factor for dominance genetic variation. We find that the resulting D components are small in magnitude and not statistically significant

[21] The E component is also absorbing idiosyncratic measurement error. Because our data set comes from the Swedish Tax Agency, which obtains the data directly from financial institutions, reporting errors should be relatively rare in our specific sample.

[22] Researchers have studied twins reared apart for which there is no common parental environment, and these studies generally produce estimates similar to those using twins who were reared together (e.g., Bouchard, Lykken, McGue, Segal, and Tellegen, 1990).

from zero, while the A components continue to account for a similar proportion of the variation. This reduces concerns that our estimated model is misspecified. Third, including opposite-sex twins in our analysis may result in a bias in favor of a genetic component, but we have checked that our results are similar if we restrict our analysis to only same-sex twins. Fourth, positive assortative mating between the twins' parents would make fraternal twins more similar relative to identical twins and would bias the estimate of the genetic (A) component downward (e.g., Neale and Maes, 2004). Finally, the model we estimate does not consider interactions between genes and the environment (e.g., some environmental factors can prevent genetic factors from expressing themselves) and genetic and environmental factors might not be uncorrelated (e.g., genetic factors could steer the individual to be exposed to certain environments).[23]

4.2. Individual characteristics and investment style

We examine which individual characteristics explain an investor's investment style, and we relate the evidence to rational and behavioral portfolio choice and asset pricing models discussed in Sub-section 2.2.2. We run panel regressions of each investor's annual P/E ratio, the value-weighted average of all stocks in the investors' portfolio at the end of the year, on investor characteristics typically determined in the previous year. All specifications include year fixed effects. We use two-way clustering by year and twin pair (e.g., Thompson, 2011), i.e., the residual correlation can be different from zero if observations are in the same year or in the same twin pair.

In Column 1 of Table 5, we regress the average P/E ratio on standard socioeconomic characteristics. We also include the proportion of an individual's financial assets invested in risky equities, which is a common measure of investors' financial risk-taking propensity (e.g., Merton, 1969; Samuelson, 1969). We find that portfolios of older (younger) investors are significantly more value- (growth-) oriented. The average P/E ratio of the stock portfolio of a 65 year old investor is 6.0 (39% at the median) lower compared with a 25-year-old. If younger investors have longer investment horizons, this result is consistent with the portfolio choice models of Lynch (2001), Jurek and Viceira (2011), and Larsen and Munk (2012). At the same time, the results in Column 1 do not suggest that investors' risk aversion is significantly related to investors' value or growth tilts. The share invested in risky equities as well as investors' net worth have a positive, but insignificant effect on the average P/E ratio. Men who are often more risk seeking than women (e.g., Sundén and Surette, 1998; Croson and Gneezy, 2009) have an insignificant value tilt in their portfolios. Besides age, only disposable

[23] For an extensive review of research on gene-environment interactions, see Rutter (2006).

income has a significant effect on the portfolio's value versus growth orientation. Possibly consistent with human capital-related hedging motives, investors with higher disposable income exhibit a preference for growth stocks.

[Insert Table 5 about here.]

In Column 2, we examine such hedging motives in more detail. First, to better capture investors' human capital and its exposure to a possible state risk factor, we include investors' educational achievement,[24] their *labor* income, and the full-sample correlation between investors' labor income growth and changes in GDP per capita. Consistent with the predictions of multifactor efficient portfolio choice models (e.g., Fama, 1996; Cochrane, 2007) and the view that the value premium is related to human capital, we find that investors' with more human capital in the form of more education and higher levels of labor income prefer growth stocks, as do investors whose labor income covaries more positively with GDP growth. That is, investors whose labor income is reduced in bad states of the world prefer growth over value stocks, a behavior that seems consistent with models in which the value premium represents compensation for distress risk (e.g., Fama and French, 1993). We also find support for the prediction by Gârleanu, Kogan, and Panageas (2012) that in a world with technological innovation and displacement risk agents with relatively more financial wealth tilt their portfolios toward growth stocks. Overall these results are in line with predictions of rational models for the value premium and consistent with Betermier, Calvet, and Sodini (2014) who also analyze Swedish individual investors' portfolio style and report similar findings.

In addition to risk-taking and hedging motives, we also explore whether investors who exhibit more behavioral biases in the investment domain are more growth oriented. Our evidence is also supportive of such a prediction. The results in Column 3 of Table 5 suggest that a 1 standard deviation increase in the bias index of Cronqvist and Siegel (2014) corresponds to an average P/E ratio that is about 1.6 higher (10% at the median).[25] Several authors have suggested that investors could prefer stocks with speculative characteristics such as high volatility (e.g., Shefrin and Statman, 2000; Barberis and Huang, 2008, Kumar, 2009b; Dorn and Huberman, 2010). In Column 4, we explicitly test for this specific explanation and also include the contemporaneous annualized monthly volatility of an investor's portfolio. The effect of the bias index decreases and becomes insignificant, and we find strong support that investors who select high volatility portfolios also tilt their portfolio toward growth stocks.

[24] "Less than a high school degree" is the omitted educational outcome.

[25] The bias index covers six prominent investment biases. It is available only as a time-invariant measure. For details, see Cronqvist and Siegel (2014).

Finally, investors could select volatile growth stocks because they face leverage constraints that prevent them from increasing the riskiness of their portfolio otherwise. In Column 5, we therefore consider a subset of investors whose debt to asset ratio is at most 20% and often zero and who are therefore unlikely leverage constraint. The results are essentially unchanged relative to those of the full sample and suggest that leverage constraints do not explain investors' portfolio choice with respect to value and growth stocks.

Overall, we find support for rational as well as behavioral finance models. In particular, our results suggest that investors hedge human capital and displacement risks with growth stocks. At the same time, we find that investors' biases, in particular a possible preference for lottery type stocks, also make them favor growth over value stocks. Therefore, the value premium could reflect both a risk-based compensation and mispricing due to speculative retail investors (see, e.g., Han and Kumar, 2013).

4.3. Life course theory and investment style

In this sub-section, we examine to what extent differential life experiences and events of individuals explain differences in investment styles much later in life. Based on pre-existing research in social psychology and neuroscience, we consider several types of potentially relevant, and plausibly exogenous, life experiences of individuals: macroeconomic experiences, the impressionable years, and the rearing environment.

4.3.1. Macroeconomic experiences

First, we analyze whether a long-term and persistent effect exists on an individual's investment style of growing up during the Great Depression. We investigate the effect on value versus growth orientation of being born between 1920 and 1929, using the same Depression Baby definition as Schoar and Zuo (2013).[26]

The result in Column 1 in Panel A of Table 6 shows that individuals who grew up during the Great Depression show significantly more value orientation in their stock portfolios several decades later in life. We find that those who grew up during the Great Depression have portfolios with average P/E ratios that are about 1.7 (11% at the median) lower compared with those of other investors. It is important to emphasize that we control for disposable income and net worth, which can also be affected by a Great Depression experience, so our results are not simply reflecting long-term wealth differences. In Column 2 we analyze the subsample of those born 1910 to 1939, i.e., a subset of only older individuals. Some of

[26]Sweden was affected by the Wall Street Crash of 1929 and was also the origin of the so-called Kreuger Crash of 1932, with adverse international macroeconomic consequences deepening the Great Depression in several countries, including the US.

these individuals were treated by growing up during the Great Depression, while others were arguably not treated as severely but are slightly younger or slightly older than the Great Depression cohort. The previous conclusion of a Depression Baby effect remains. While economically still significant, the effect is statistically weaker (p-value = 11.9%).

[Insert Table 6 about here.]

Even with age as a control variable, the short sample period makes it challenging to separate a Great Depression cohort effect from a life-cycle effect. We therefore analyze an individual's overall GDP growth experience during his or her life as an alternative measure of macroeconomic experiences. We measure the average GDP growth from an individual's birth year until the start of our data set. In Column 3, we find that experiencing stronger GDP growth results in a relatively more growth-oriented investment style. We find that for a 100 basis points per year higher average GDP growth experience, the average P/E ratio of the stock portfolio of the investor is 1.4 higher (9% compared with the median) compared with those of other investors, controlling for individual characteristics.

Research in financial economics has so far provided inconclusive evidence on whether more distant or more recent experiences are weighted more in individual investor's financial decision making. Some recent papers, e.g., Malmendier and Nagel (2011), explicitly estimate a weighting function and report that more recent stock market returns affect stock market participation and financial risk-taking relatively more than distant experiences. Other papers (e.g., Cronqvist, Previtero, Siegel, and White, 2014) emphasize early life experiences (even the prenatal and in utero environment) for financial risk taking propensities later in life, following a large literature in economics related to the fetal origins hypothesis (see, e.g., Currie (2011) and the references therein). Some papers emphasize the early postnatal environment (e.g., Cunha and Heckman, 2010). For example, Chetty, Friedman, Hilger, Saez, Schanzenbach, and Yagan (2011) show that the pre-school (kindergarten) environment explains some asset allocation decisions later in life. Still other papers, e.g., Schoar and Zuo (2013), report empirical evidence consistent with the importance of the impressionable years and the first labor market entry. We have reestimated the result for individual GDP growth experience using a simple weighting function. We assign proportionately increasing and decreasing weights to more recent experiences. For an individual who is T years old, the weights for year $i = 1....T$ are specified by $\sum_{i=1}^{T} iw = 1$ and $\sum_{i=1}^{T}(T+1-i)w = 1$, respectively, where $w \in [0,1]$. We find a statistically insignificant relation, i.e., for value versus growth orientation we cannot conclude that more distant, or more recent, GDP experiences are more important.

Finally, we examine whether Individual HML Experience, based on the return on a Swedish HML factor portfolio, explains subsequent investment styles. That is, do those who have experienced higher HML returns during his or her life develop into a more value-oriented investor? We construct the measure in a similar way to the individual GDP growth experience measure using data provided by Kenneth French.[27] In Column 1 in Panel B of Table 6, we report no statistically significant relation between individual HML experience and value versus growth orientation. For a subsample we are also able to collect detailed data on professional finance experience based on the International Standard Classification of Occupations (ISCO-88) by the International Labour Organization (ILO). We then interact individual HML experience with an indicator variable for professional finance experience. In Column 2, we find that the interaction effect is statistically insignificant, i.e., more financially sophisticated investors do not seem influenced by HML experience.

4.3.2. Impressionable years

We also examine persistent effects of the economic conditions during the years of an individual's first labor market entry and the impressionable years (18-25 years). There exists no similar classification of recessions to the National Bureau of Economics Research's business cycle database for our sample, so we analyze several alternative measures of recessions. We define a recession as a period with a year of negative GDP growth +/− 1 year.[28] Column 1 in Panel A of Table 7 shows that individuals who entered the labor market during a recession have portfolios with an average P/E ratio that is 0.9 lower (6% at the median) compared with those of other investors, although the effect is not statistically significant.

[Insert Table 7 about here.]

In Column 2 we report results for the most severe economic recessions someone in our sample experienced. We find that those who entered the labor market in a severe recession, i.e., during World War I, the Great Depression, or World War II, have portfolios with average P/E ratios that are 3.2 lower (21% at the median) compared with those of other investors. That is, the estimated effect is about three times larger for experiencing the most severe recessions. It is important to emphasize that our model specification controls for disposable

[27]We compute HML returns from the year an individual entered the labor market for the first time. This increases the sample size for the HML factor portfolio because we have data starting only in 1975. Our results are also robust to using data for the HML factor portfolio for Europe (e.g., Fama and French, 2012) for which we have data starting only in 1990 (not tabulated). The value premium in Swedish stocks has been shown to be around 8% (e.g., Fama and French, 1998; Hansson, 2004).

[28]Our results are similar if we include only the years of negative GDP growth, but such a measure is more susceptible to criticisms of exogeneity compared with a measure that also includes +/− 1 year.

income and net worth, i.e., there is a direct effect of economic recessions on investment style later in life, in addition to any indirect effect from lower income of those who entered the labor market in economic recessions (e.g., Oreopoulos, von Wachter, and Heisz, 2012).

Finally, in Panel B we find an equally strong effect if we examine whether an individual experienced a severe economic recession during the impressionable years (e.g., Giuliano and Spilimbergo, 2013). We also compare the effects of the economic conditions during the 18-25 years with experiences somewhat earlier (10-17 years) and somewhat later (26-33) in life. We find that the effect of severe recession experiences during the 10-17 year period is of smaller economic magnitude (0.79/2.90 = 27.2%) compared with the effect for the impressionable years. A statistical test reveals that the difference between the impressionable years effect and the 10-17 years effect is statistically significant. We conclude that the economic conditions during the years of an individual's first labor market entry and the impressionable years are important for the individual's investment style later in life.

4.3.3. Rearing environment

We also investigate whether the rearing environment has significant and persistent effects on an individual's investment style later in life. We examine the socioeconomic status of an investor's parents. We are not able to measure parents' SES precisely when an individual grew up, so we use parents' net worth at the start of our data set as a proxy measure.[29] The results are reported in Table 8. We find that individuals who grew up in a lower SES environment, i.e., relatively poor, show significantly more value orientation in their stock portfolios later in their lives. Investors at the bottom of the parental wealth distribution (10th percentile) have portfolios with average P/E ratios that are 0.92 (or about 6.2% at the median) lower compared with investors at the top of the distribution (90th percentile). We show that this effect is robust within each generation by controlling for birth cohort (decade) fixed effects, so this result is not specific to, e.g., the Great Depression cohort.

[Insert Table 8 about here.]

Overall, we find support for the hypothesis that life experiences affect an individual's investment style. By controlling for education, income, and net worth, we can rule out that these effects operate merely through an investor's economic circumstances. Instead, our evidence is consistent with experiences early in life affecting investors' preferences and

[29] To avoid that our results are affected by parents who were alive in 1999, but passed away during our sample period, and consequently affect the portfolio composition of their children through wealth shocks or direct inheritances of equity assets (e.g., Andersen and Nielsen, 2011), we exclude individuals whose parents passed away during our sample period.

beliefs. If shared by a sufficiently large part of the population, such experiences could result in legacy effects that affect the relative demand for value versus growth stocks and thereby possibly the value premium, similar to the implications of Friedman and Schwartz (1963) and Cogley and Sargent (2008) for the equity premium.

5. Conclusion

We find that several factors explain an individual investor's style, i.e., the value versus growth orientation of the investor's stock portfolio. First, we estimate that genetic differences across individuals explain a significant proportion of the variation in value versus growth orientation, whether we analyze P/E ratios as an investment-style measure, or Morningstar's Value-Growth Score. Such a biological basis of individuals' investment style likely reflects partially innate preferences as well as genetically influenced characteristics of investors' economic circumstances that affect portfolio choice.

Second, we examine in detail which individual characteristics explain investment style. We find that investors' hedging demands related to human capital and displacement risk as well as behavioral biases contribute to investment style. Investors with more human capital and whose labor income is more correlated with GDP growth hold more growth stocks. We also find that investors who exhibit more behavioral biases in the investment domain in particular in the form of a preference for speculative assets are more growth oriented.

Finally, we find that an investor's style is explained by life course theory in that experiences, both earlier and later in life, are related to investment style. Investors with adverse macroeconomic experiences have stronger preferences for value investing later in life, even when differences in income and net worth are accounted for. For example, those who grew up during the Great Depression have portfolios with average P/E ratios that are significantly lower several decades later in life. Consistent with an impressionable years hypothesis, those who enter the labor market for the very first time during a severe economic recession are also more value-oriented later on. This evidence contributes to a growing literature in finance and economics that shows the importance of life experiences and events for economic behavior later in life.

Our results have several implications for understanding the value premium. They suggest that the value premium could reflect both risk-based compensation and mispricing due to investors' behavioral biases. But our findings also imply that the overall composition of investor population, with respect to genetic make-up, age, and life experiences, can affect the relative demand for value versus growth stocks and in the end potentially the value premium.

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Appendix A. Variable definitions

A.1. Investment style measures

P/E Ratio	Value-weighted price to earnings ratio for an individual's direct stock holdings. Data are from CapitalIQ.
P/B Ratio	Value-weighted market to book value of equity ratio for an individual's direct stock portfolio. Data are from Capital IQ.
Morningstar's Value-Growth Score	Value-weighted Morningstar score of value versus growth from -100 (value) to +400 (growth). Data are from Morningstar.
Name-based Value/Growth Measure	Value-weighted indicator that is -1 if a fund's name contains "value," +1 if a fund's name contains "growth" or "technology," and zero otherwise. Data are from Morningstar.

A.2. Individual characteristics

Male	Indicator that is one if an individual is male and zero otherwise.
College or More	Indicator that is one if an individual has attended college and zero otherwise.
High School	Indicator that is one if an individual has completed high school (gymnasium) and zero otherwise.
No Education Data Available	Indicator variable that equals one if no educational data are available for an individual and zero otherwise.
Married	Indicator that is one if an individual is married and zero otherwise.
Net Worth	Difference between end-of-year market values of an individual's assets and liabilities (in nominal Swedish krona).
Disposable Income	An individual's disposable income (in nominal Swedish krona), i.e., sum of income from labor, business, and investment, plus received transfers, less taxes, and alimony payments.
Share in Equities	Market value of direct and indirect equity holdings divided by market value of all financial assets.
Financial Wealth	The market value of an individual's financial assets as reported by Statistics Sweden at the end of each year, expressed in nominal Swedish Krona. Financial assets include checking, savings, and money market accounts, (direct and indirect) bond holdings, (direct and indirect) equity holdings, investments in options and other financial assets such as rights, convertibles, and warrants.
Labor Income	An individual's work-related income (in nominal Swedish krona) in a given year.
Labor Income Correlation	Time series correlation of an individual's log of labor income growth and GDP growth in Sweden. GDP growth data are from the World Development Indicators (WDI).
Investment Bias Index	For each of six investment behavior, the variable is zero (least biased), one, or two (most biased). The behaviors are diversification, home bias, turnover, disposition effect, performance chasing, and skewness preference. The index is the sum across the investment behaviors.
Volatility	Using twelve monthly return observations for each asset in an individual's equity portfolio, we calculate the average annualized return volatility for each individual's portfolio and year.

A.3. Life-cycle experience and events

Depression Baby	Indicator that is one if an individual is born 1920-1929, and zero otherwise.
Individual GDP Growth Experience	Average GDP growth in Sweden from an individual's birth year to 2000.
Individual Sweden HML Experience	Average Fama and French Sweden HML return from the year an individual entered the labor market for the first time (if after 1975) to 2000. Data are from Kenneth French.
Professional Finance Experience	Using data on an individual's occupation, based on the International Standard Classification of Occupations (ISCO-88) by the International Labour Organization (ILO) and available for a subset of our sample, we identify individuals with work experience related to finance.
First Labor Market Entry in Recession	Indicator that is one if an individual entered the labor market for the first time during a year with negative GDP growth +/- 1 year and zero otherwise.
First Labor Market Entry in Severe Recession	Indicator that is one if an individual entered the labor market for the first time during World War I, the Great Depression, or World War II and zero otherwise.
Parents' Net Worth	Difference between market values of combined assets and liabilities (in nominal Swedish krona) of an individual's parents at the end of 1999.

Table 1

Summary statistics: individual characteristics

This table reports summary statistics for the sample of twins and their individual characteristics. The variables are defined in Appendix A.

Panel A: Twins by zygosity and gender

		Identical twins			Fraternal twins			
Variable	All twins	Male	Female	All	Same sex: male	Same sex: female	Opposite sex	All
N	34,976	4,496	5,994	10,490	5,064	6,300	13,122	24,486
Percentage	100	13	17	30	14	18	38	70

Panel B: Individual characteristics

	All twins	Identical twins			Fraternal twins		
Variable	*N*	Mean	Median	Standard deviation	Mean	Median	Standard deviation
Age	153,743	50.88	52	16.39	55.41	56	14.15
College or More	153,743	54%	100%	50%	45%	0%	50%
High School	153,743	22%	0%	41%	25%	0%	43%
No Education Data Available	153,743	9%	0%	29%	10%	0%	30%
Married	153,743	53%	100%	50%	59%	100%	49%
Net Worth (US dollars)	153,030	140,934	73,336	336,746	153,406	80,819	728,368
Financial Wealth (US dollars)	153,743	63,500	23,000	263,750	68,250	25,375	633,750
Share in Equities	153,030	58%	61%	34%	57%	59%	34%
Disposable Income (US dollars)	153,743	36,418	27,813	43,403	39,661	29,434	66,227
Labor Income (US dollars)	153,030	32,875	29,500	24,500	33,250	29,000	27,000
Labor Income Correlation	152,425	-3%	-4%	40%	-5%	-7%	39%
Investment Bias Index	123,158	4.28	4.00	2.34	4.24	4.00	2.31
Volatility	132,042	26%	23%	14%	25%	23%	14%

Table 2

Summary statistics: investment style measures

This table reports summary statistics (Panel A) and correlations (Panel B) for the investment-style measures. The variables are defined in Appendix A. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Panel A: Summary statistics

		Identical twins			Fraternal twins		
Variable	*N*	Mean	Median	Standard deviation	Mean	Median	Standard deviation
Individual stocks							
P/E Ratio	138,063	23.3	15.4	22.9	22.5	14.9	21.8
P/B Ratio	151,729	3.3	2.3	3.6	3.2	2.2	3.4
Mutual funds							
Morningstar's Value-Growth Score	147,818	156.0	153.6	25.6	154.8	152.8	24.8
Name-based Value/Growth Measure	195,438	0.08	0.00	0.22	0.07	0.00	0.21

Panel B: Correlations

Variable	P/E Ratio	P/B Ratio	Morningstar Value-Growth Score
P/B Ratio	0.26***		
	(*N* = 77,980)		
Morningstar's Value-Growth Score	0.06***	0.04***	
	(*N* = 59,577)	(*N* = 65,341)	
Name-based Value/Growth Measure	0.06***	0.02***	0.51***
	(*N* = 77,981)	(*N* = 85,509)	(*N* = 66,017)

Table 3

Variance decomposition of investment style: individual stocks

This table reports results from maximum likelihood estimation. The different investment style measures are modeled as linear functions of observable individual characteristics (gender, age, education, marriage status, disposable income, and net worth), year fixed effects, and unobservable random effects representing additive genetic effects (A), share environmental effects (C), and an individual-specific error (E). For each estimated model, we report the variance fraction of the residual explained by each unobserved effect (A Share, for the additive genetic effect; C Share, for common environmental effect; E Share, for the individual-specific environmental effect) and the bootstrapped standard errors (one thousand resamples). The variables are defined in Appendix A. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Estimate	P/E Ratio	P/B Ratio
A Share	0.255**	0.396**
	0.067	0.094
C Share	0.112**	0.000
	0.046	0.049
E Share	0.632***	0.604***
	0.027	0.060
Individual characteristics	Yes	Yes
Year fixed effects	Yes	Yes
N	63,592	63,592

Table 4

Variance decomposition of investment style: mutual funds

This table reports results from maximum likelihood estimation. The different investment style measures are modeled as linear functions of observable individual characteristics (gender, age, education, marriage status, disposable income, and net worth), year fixed effects, and unobservable random effects representing additive genetic effects (*A*), shared environmental effects (*C*), and an individual-specific error (*E*). For each estimated model, we report the variance fraction of the residual explained by each unobserved effect (*A* Share, for the additive genetic effect; *C* Share, for common environmental effect; *E* Share, for the individual-specific environmental effect) and the bootstrapped standard errors (one thousand resamples). The variables are defined in Appendix A. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Estimate	Morningstar's Value-Growth Score	Name-based Value/Growth Measure
A Share	0.273***	0.257**
	0.011	0.014
C Share	0.000	0.000
	0.000	0.006
E Share	0.727***	0.743***
	0.011	0.011
Individual characteristics	Yes	Yes
Year fixed effects	Yes	Yes
N	85,388	85,388

Table 5

Individual characteristics and investment style

This table reports coefficient estimates from panel regessions with year fixed effects. Robust standard errors are two-way clustered by twin pair and year. The variables are defined in Appendix A. ***, **, and * indicate significance at the 1%, 5% and 10% level, respectively.

Variable	(1)	(2)	(3)	(4)	(5)
Age	-0.15***	-0.10***	-0.08***	-0.06***	-0.07***
	(0.05)	(0.04)	(0.03)	(0.02)	(0.03)
Male	-0.19	0.07	-0.20	-0.49**	-0.31
	(0.24)	(0.22)	(0.19)	(0.21)	(0.23)
Married	0.21	0.35*	0.23	0.16	0.34
	(0.24)	(0.19)	(0.18)	(0.18)	(0.25)
Log (Net Worth)	0.56	-0.38	-0.52**	-0.51*	-0.49*
	(0.40)	(0.26)	(0.26)	(0.26)	(0.29)
Log (Disposable Income)	1.71***	0.54*	0.27	0.26	0.30
	(0.57)	(0.33)	(0.28)	(0.24)	(0.27)
Share in Equities	2.30	2.99*	2.83*	2.65	2.82
	(1.41)	(1.64)	(1.66)	(1.65)	(1.77)
Log (Financial Wealth)		1.31***	1.34**	1.29**	1.34***
		(0.49)	(0.53)	(0.51)	(0.51)
Log (Labor Income)		0.84***	0.78***	0.62**	0.63***
		(0.25)	(0.29)	(0.26)	(0.22)
Labor Income Correlation		0.60***	0.69***	0.68***	0.56***
		(0.18)	(0.21)	(0.22)	(0.21)
College or More		1.55***	1.31***	1.12***	0.85**
		(0.38)	(0.45)	(0.39)	(0.38)
High School		0.96***	0.89***	0.80***	0.60**
		(0.29)	(0.29)	(0.26)	(0.25)
No Education Data Available		0.51	0.69	0.54	0.35
		(0.44)	(0.49)	(0.51)	(0.56)
Investment Bias Index			0.67***	0.11	0.11
			(0.24)	(0.32)	(0.33)
Volatility				25.20***	22.64***
				(8.24)	(8.35)
Constant	7.08	3.86	5.68	3.18	3.00
	(9.06)	(8.40)	(8.12)	(8.37)	(8.96)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
N	106,518	106,518	77,078	77,078	49,528
Sample	All	All	All	All	Leverage <20%
R-squared	0.19	0.19	0.20	0.22	0.22

Table 6

Life course theory and investment style: macroeconomic experiences

This table reports coefficient estimates from panel regressions with individual characteristics and year fixed effects. Robust standard errors are two-way clustered by twin pair and year. The variables are defined in Appendix A. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	(1)	(2)	(3)
Panel A: Great Depression and gross domestic product (GDP) growth experiences			
Depression Baby	-1.74***	-0.72	
	0.64	0.46	
Individual GDP Growth Experience			1.42**
			0.57
Constant	5.10***	-1.40	2.49
	1.35	3.98	1.64
Individual characteristics	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Sample	All	Born 1910 to 1939	All
N	107,658	31,932	107,658
R-squared	0.19	0.17	0.19
Panel B: Individual high minus low (HML) return experience			
Individual Sweden HML Experience	0.01	-0.47	
	0.02	0.41	
Individual Sweden HML Experience		0.72	
x Professional Finance Experience		1.02	
Professional Finance Experience		-3.34	
		5.49	
Constant	9.42***	19.56**	
	(3.18)	(8.70)	
Individual Characteristics	Yes	Yes	
Year Fixed Effects	Yes	Yes	
Sample	First job after 1975	First job after 1975	
N	27,523	8,755	
R -squared	0.20	0.18	

Table 7

Life course theory and investment style: impressionable years

This table reports coefficient estimates from panel regressions with individual characteristics and year fixed effects. Robust standard errors are two-way clusteresd by twin pair and year. The variables are defined in Appendix A. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

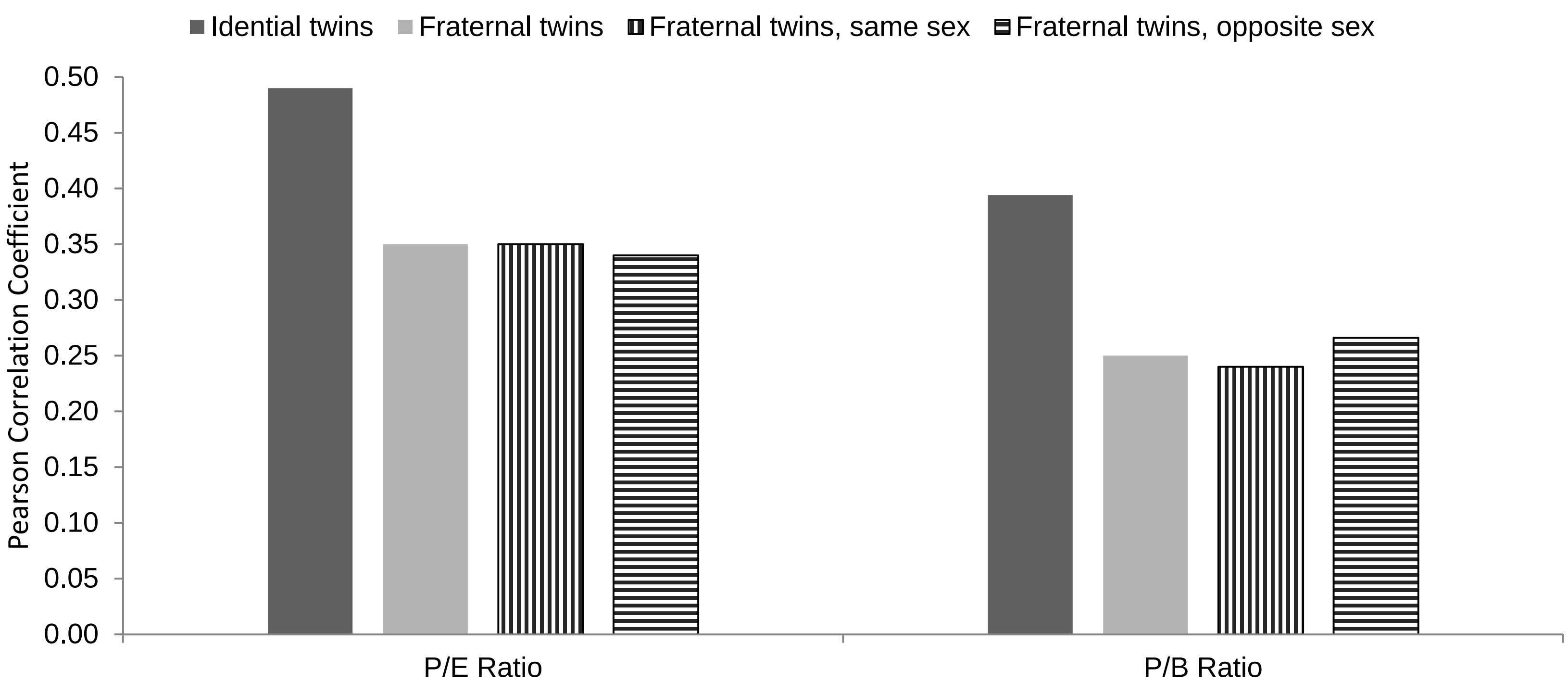
Variable	(1)	(2)	(3)	(4)
Panel A: Years of first labor market entry				
First Labor Market Entry in Recession	-0.87			
	0.59			
First Labor Market Entry in Severe Recession		-3.24**		
		1.37		
Individual characteristics	Yes	Yes		
Year fixed effects	Yes	Yes		
N	95,272	95,272		
R -squared	0.19	0.19		
Panel B: Impressionable years				
18-25 Years Old in Severe Recession	-3.07***			-2.90***
	1.11			0.99
10-17 Years Old in Severe Recession		-0.65*		-0.79**
		0.34		0.38
26-33 Years Old in Severe Recession			-1.26	-1.24
			0.98	1.07
Individual characteristics	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
N	105,393	105,393	105,393	105,393
R -squared	0.19	0.19	0.19	0.19

Table 8

Life course theory and investment style: rearing environment

This table reports coefficient estimates from panel regressions with individual characteristics, year fixed effects, and birth cohort (by decade) fixed effects (Column 2). Robust standard errors are two-way clustered by twin pair and year. The variables are defined in Appendix A. ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Variable	(1)	(2)
Log (Parents' Net Worth)	0.21**	0.22**
	0.10	0.10
Individual characteristics included	Yes	Yes
Year fixed effects	Yes	Yes
Birth cohort (decade) fixed effects	No	Yes
N	22,484	22,484
R -squared	0.15	0.15


Idential twins
Fraternal twins
Fraternal twins, same sex
Fraternal twins, opposite sex
Pearson Correlation Coefficient
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
P/E Ratio
P/B Ratio

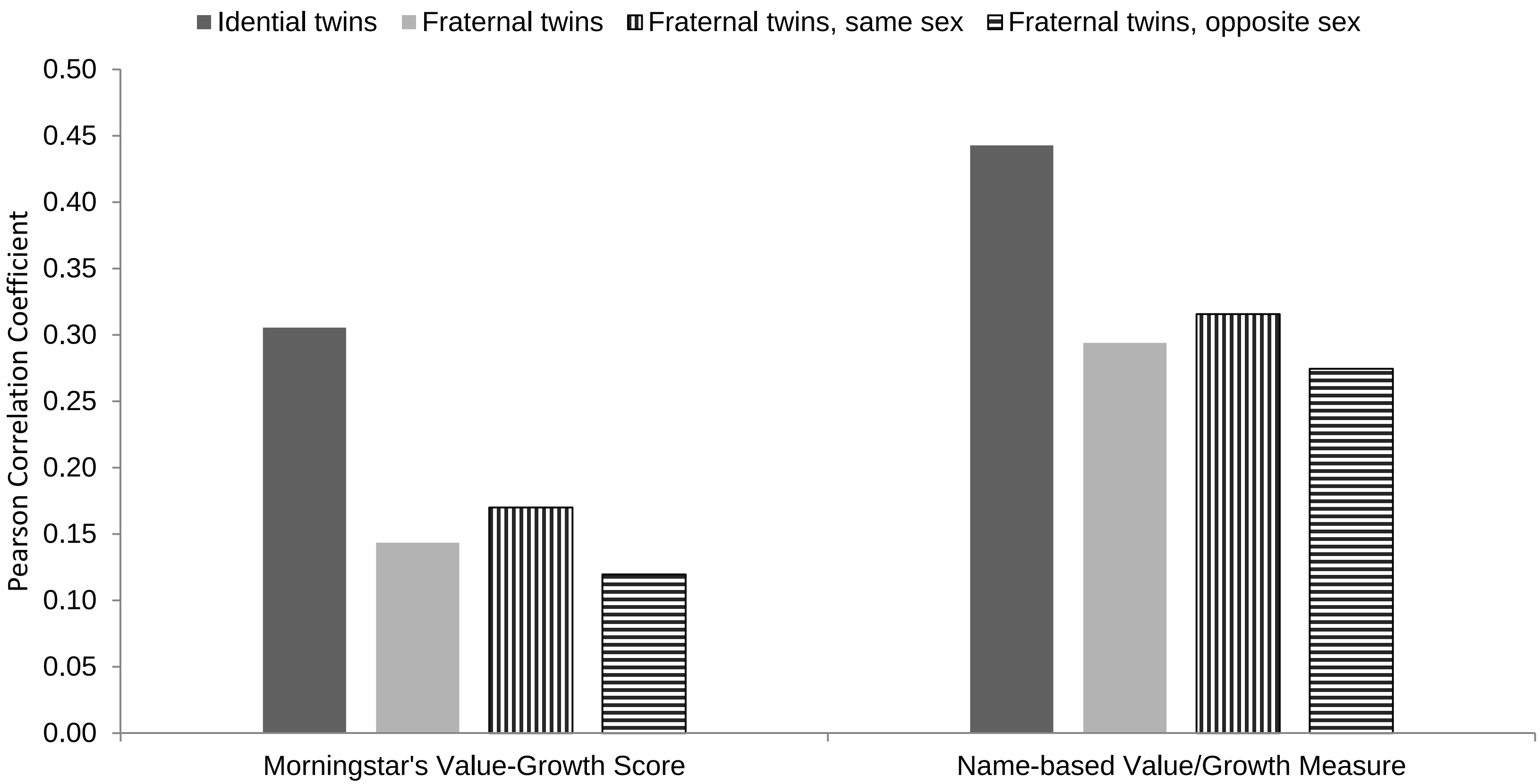


Fig.1. Correlations by genetic similarity (individual stocks and mutual funds). Panel A reports Pearson correlation coefficients for investment style for different types of twin pairs. The investment style measures are calculated using individual stock holdings only. Panel B reports Pearson correlation coefficients for investment style for different types of twin pairs. The investment style measures are calculated using mutual fund holdings only. All variables are defined in Appendix A.

Appendix B

In this Appendix, we describe the empirical methodology employed to decompose the cross-sectional variation in individual investors' investment styles into genetic and environmental components. We model the value versus growth orientation, vg_{ij}, for twin pair i and twin j (1 or 2) as a function of observable socioeconomic individual characteristics $\mathbf{X}_{ij}$ and three unobservable random effects, an additive genetic effect, a_{ij}, an effect of the environment common to both twins (e.g., upbringing), c_i, and an individual-specific effect, e_{ij}, which also absorbs idiosyncratic measurement error:

$$vg_{ij} = \beta_0 + \beta_1 \mathbf{X}_{ij} + a_{ij} + c_i + e_{ij}. \tag{1}$$

In quantitative behavioral genetics research, this model is referred to as an ACE model, where A stands for additive genetic effects, C for common environment, and E for individual-specific environment.[30] The additive genetic component a_{ij} in Equation (1) represents the sum of the genotypic values of all genes that influence an individual's behavior. Each individual has two, potentially different, versions (alleles) of each gene (one is from each parent), and each version is assumed to have a specific, additive effect on the individual's behavior. The genotypic value of a gene is the sum of the effects of both alleles present in a given individual. Consider, for example, two different alleles $A1$ and $A2$ for a given gene and assume that the effect of the $A1$ allele on investment style is of magnitude α_1, and the effect of the $A2$ allele is α_2. An individual with genotype $A1A1$ would experience the genetic effect $2\alpha_1$, and genotype $A1A2$ would have a genetic effect of $\alpha_1 + \alpha_2$.[31] We also assume that a_{ij}, c_i, and e_{ij} are uncorrelated with one another and across twin pairs and normally distributed with zero means and variances σ_a^2, σ_c^2, and σ_e^2, so that the total residual variance σ^2 is the sum of the three variance components ($\sigma^2 = \sigma_a^2 + \sigma_c^2 + \sigma_e^2$).

Identification of variation due to a_{ij}, c_i, and e_{ij} is possible due to constraints on the covariance matrices for these effects. These constraints are the result of the genetic similarity of twins and assumptions about upbringing and other aspects of the common environment. Consider two twin pairs $i = 1, 2$ with twins $j = 1, 2$ in each pair, where the first is a pair of identical twins and the second is a pair of fraternal twins. The additive genetic effects are $a = (a_{11}, a_{12}, a_{21}, a_{22})'$. Identical and fraternal twin pairs differ in their genetic similarity, i.e., the off-diagonal elements related to identical twins in the matrix in Eq.(2) are 1 as the proportion of shared additive genetic variation is 100% between identical twins. In contrast, for fraternal twins the proportion of the shared additive genetic variation is on average only 50%,[32] i.e., the off-diagonal elements related to fraternal twins in the matrix in Eq.(2) are

[30] See, e.g., Falconer and Mackay (1996) for a more detailed discussion of quantitative behavioral genetics research.

[31] The extent to which the effect of two different alleles deviates from the sum of their individual effects is called dominance deviation.

[32] Genome sequencing has recently revealed that humans and, e.g., the common chimpanzee (*Pan troglodytes*) share about 96% of their genes (e.g., Mikkelsen, 2005), and the genetic overlap is even greater among humans. That is, the 50% refers to only the proportion of genes that makes different humans different from each other.

1/2.[33] As a result, for these two twin pairs, the covariance matrix with respect to a_{ij} is

$$\mathrm{Cov}(a) = \sigma_a^2 \begin{bmatrix} 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1/2 \\ 0 & 0 & 1/2 & 1 \end{bmatrix}. \tag{2}$$

The common environmental effects are $c = (c_{11}, c_{12}, c_{21}, c_{22})'$. The model assumes that identical and fraternal twins experience the same degree of similarity in their common environments (the equal environments assumption). That is, the off-diagonal elements related to either identical or fraternal twins in the matrix in Eq. (3) are 1. Assuming that identical and fraternal twins experience the same degree of similarity in their common environment, any excess similarity between identical twins is due to the greater proportion of genes shared by identical twins than by fraternal twins. As a result, for the two twin pairs, the covariance matrix with respect to c_i is

$$\mathrm{Cov}(c) = \sigma_c^2 \begin{bmatrix} 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 1 \end{bmatrix}. \tag{3}$$

The individual-specific environmental effects are $e = (e_{11}, e_{12}, e_{21}, e_{22})'$. These error terms represent, for example, life experiences, but also idiosyncratic measurement error. That is, the off-diagonal elements related to either identical or fraternal twins in the matrix in Eq.(4) are 0. As a result, for the two twin pairs, the covariance matrix with respect to e_{ij} is

$$\mathrm{Cov}(e) = \sigma_e^2 \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}. \tag{4}$$

We use maximum likelihood to estimate the model in Eq.(1). Finally, we calculate the variance components A, C, and E. A is the proportion of the total residual variance that is related to an additive genetic factor:

$$A = \frac{\sigma_a^2}{\sigma^2} = \frac{\sigma_a^2}{\sigma_a^2 + \sigma_c^2 + \sigma_e^2} \tag{5}$$

The proportions attributable to the common environment (C) and individual-specific environmental effects (E) are computed analogously. Standard errors reported in the tables are bootstrapped with one thousand repetitions.

[33] For an intuitive explanation of the proportion of the shared additive genetic variation for fraternal twins as well as non-twin siblings, consider a single gene, of which one parent has allele A1 and A2, while the other parent has allele A3 and A4. Any of their off-spring will have one of the following combinations as they get one allele from each parent: A1A3, A1A4, A2A3, or A2A4. Suppose one fraternal twin is of type A1A3. The overlap with the fraternal twin sibling will be 1 if the sibling is of type A1A3, 1/2 if type A1A4, 1/2 if type A2A3, and 0 if the type is A2A4. This implies an average overlap of 1/2. For a formal derivation, see e.g., Falconer and Mackay (1996).