

Molecular Genetics, Risk Aversion, Return Perceptions, and Stock Market Participation

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ABFER

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Understanding behavior

- Why do we make the choices we do?

- Our common environment?

 - Culture, schools, parents?

- Our unique environment?

 - Things that happen to me alone

- Genetics?

Our “nurture”
(life experience)



Interaction

Our “nature”

It is not “nature” *versus* “nurture” that determines our choices.

It is nature *plus* nurture.

The question is the influence of each.

What percent of the following traits do you expect to derive from genetic endowments?

According to
genetic research

- Eye color
- Height
- School achievement
- Spatial ability (e.g., navigation)
- General intelligence



How much do genetic influences affect individuals' behavior with regard to their financial perceptions and choices?

Understanding behavior with regard to perceptions and financial choices

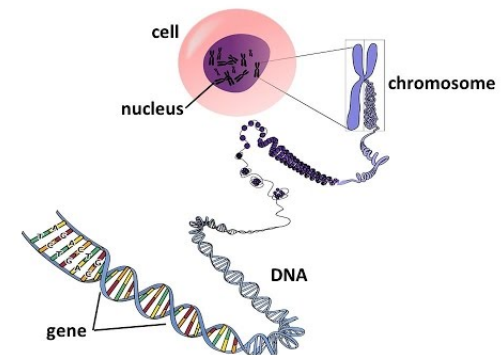
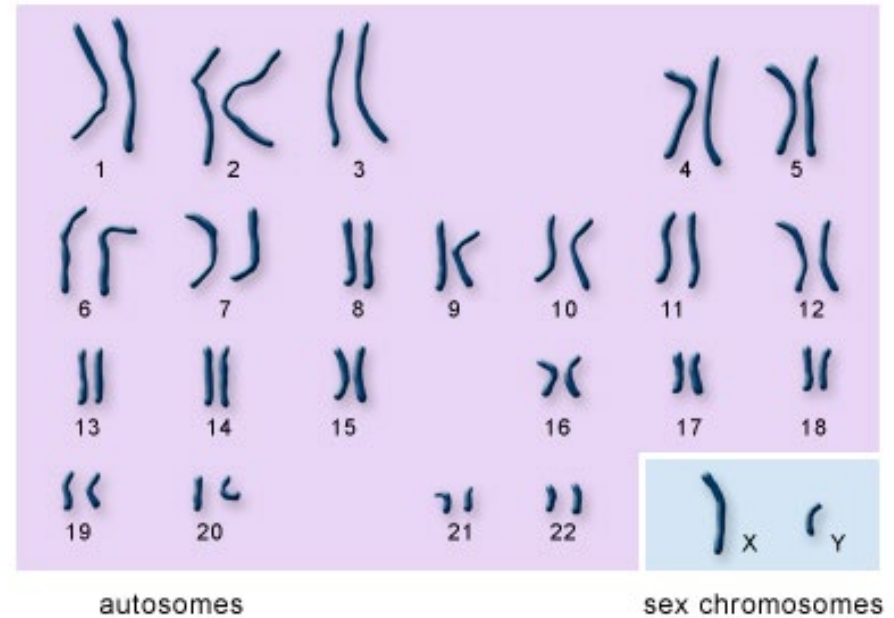
- Individuals' perceptions and financial choices
 - Choice to participate in the equity markets
 - Risk aversion
 - Expectations of return distributions
- How much derives from genetic endowment and how much from the environment?

Understanding behavior from the influence of genetics

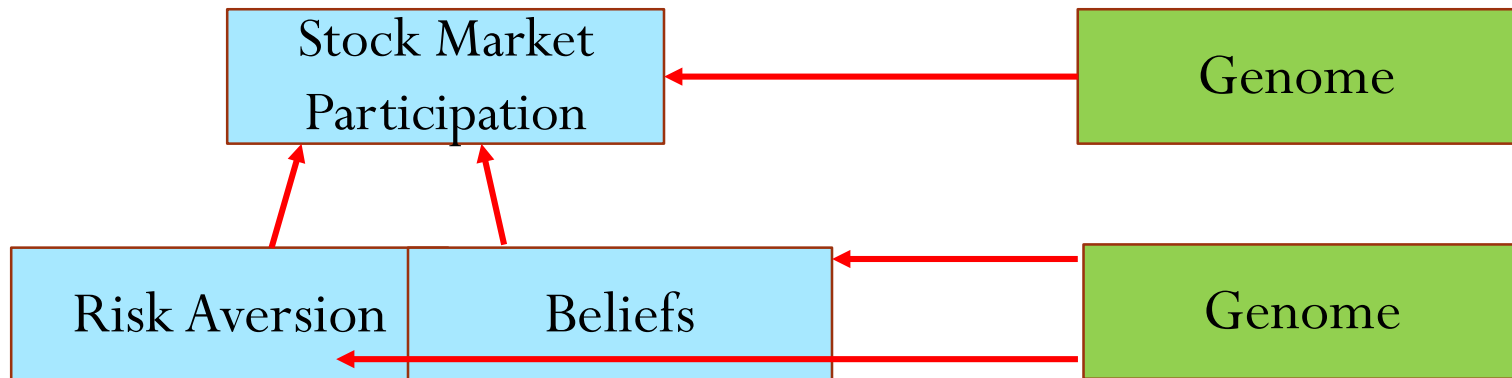
- Evolution of genetics research in the last decade
 - From twin studies to molecular genetics
 - Twin studies → *how much* (for your population, given assumptions)
 - Molecular genetics → *how and why* for broad characteristics that are polygenic in nature and not well understood

Molecular genetics

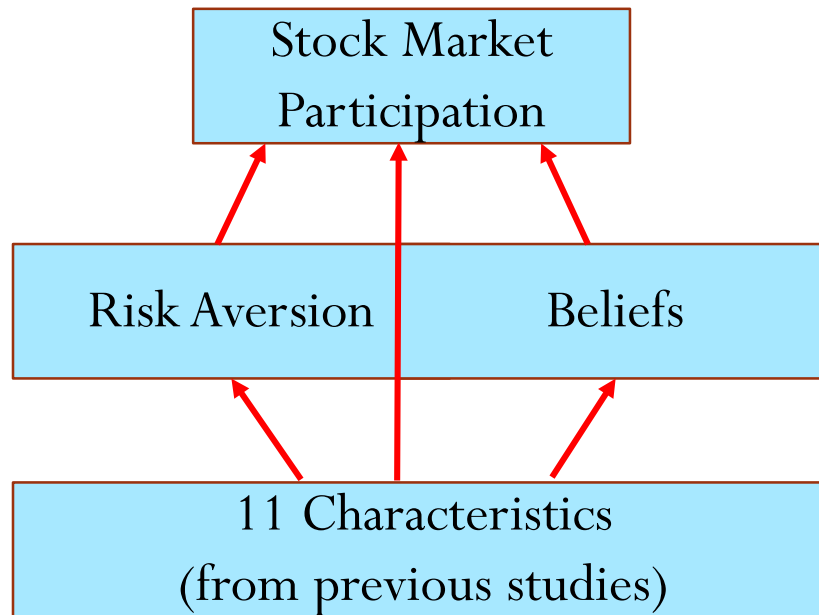
- Genome – genetic information needed to build and maintain a human
- Contained in 23 pairs of chromosomes within every cell in your body
- Each chromosome is one long DNA molecule
- Genes are the parts of the DNA that “code” for protein
 - 99% of DNA is non-coding



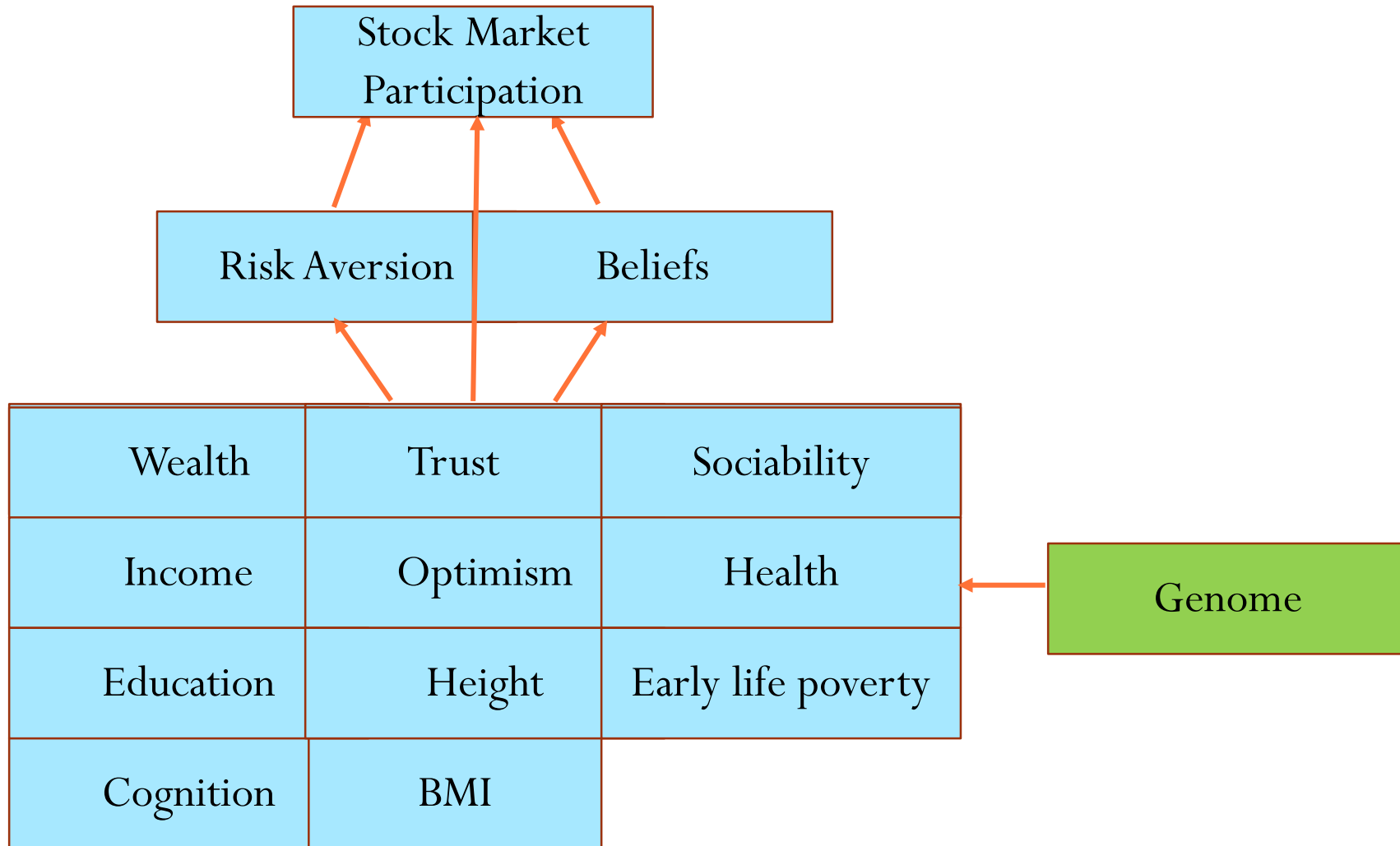
Motivation for our study



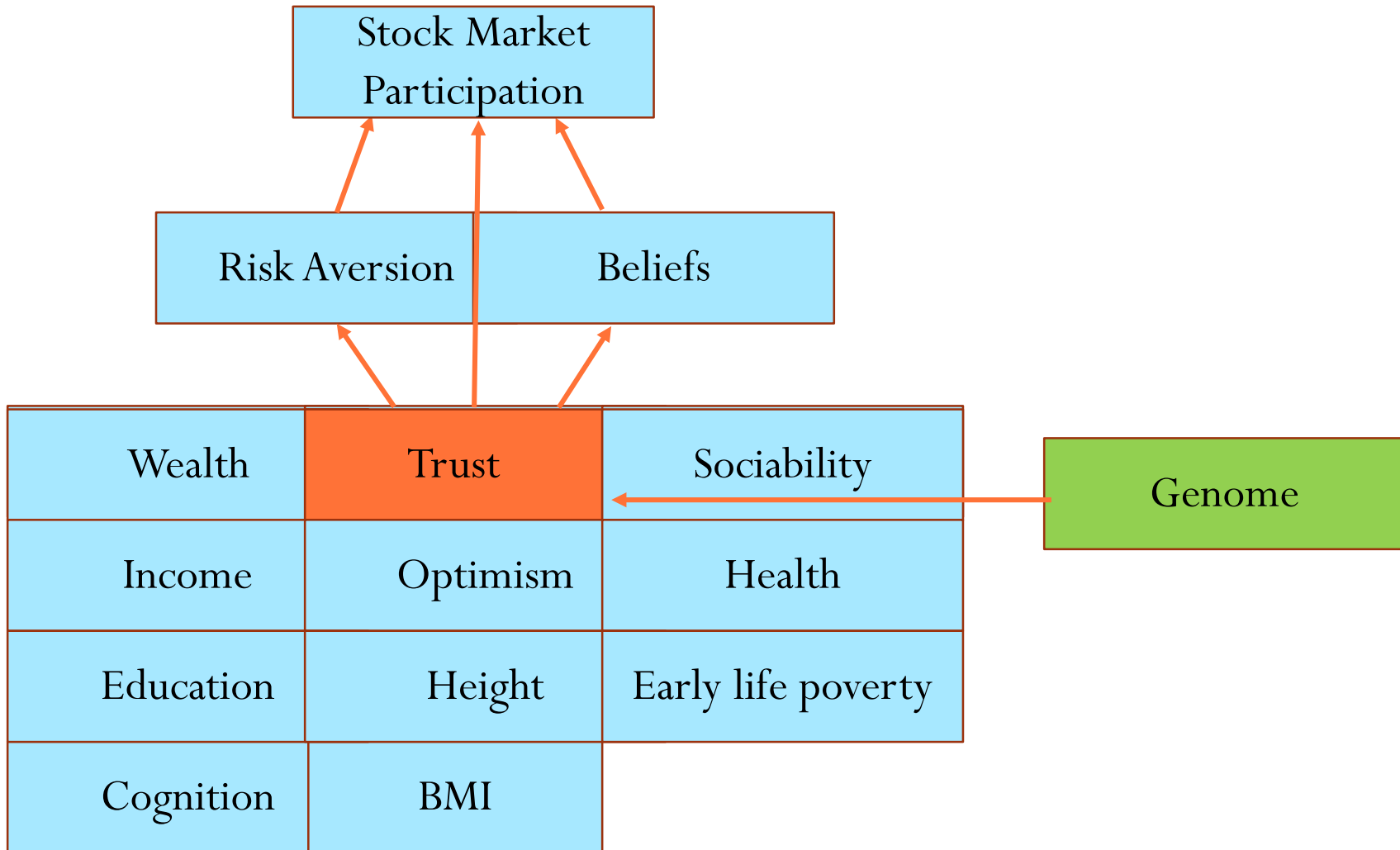
Motivation



Motivation



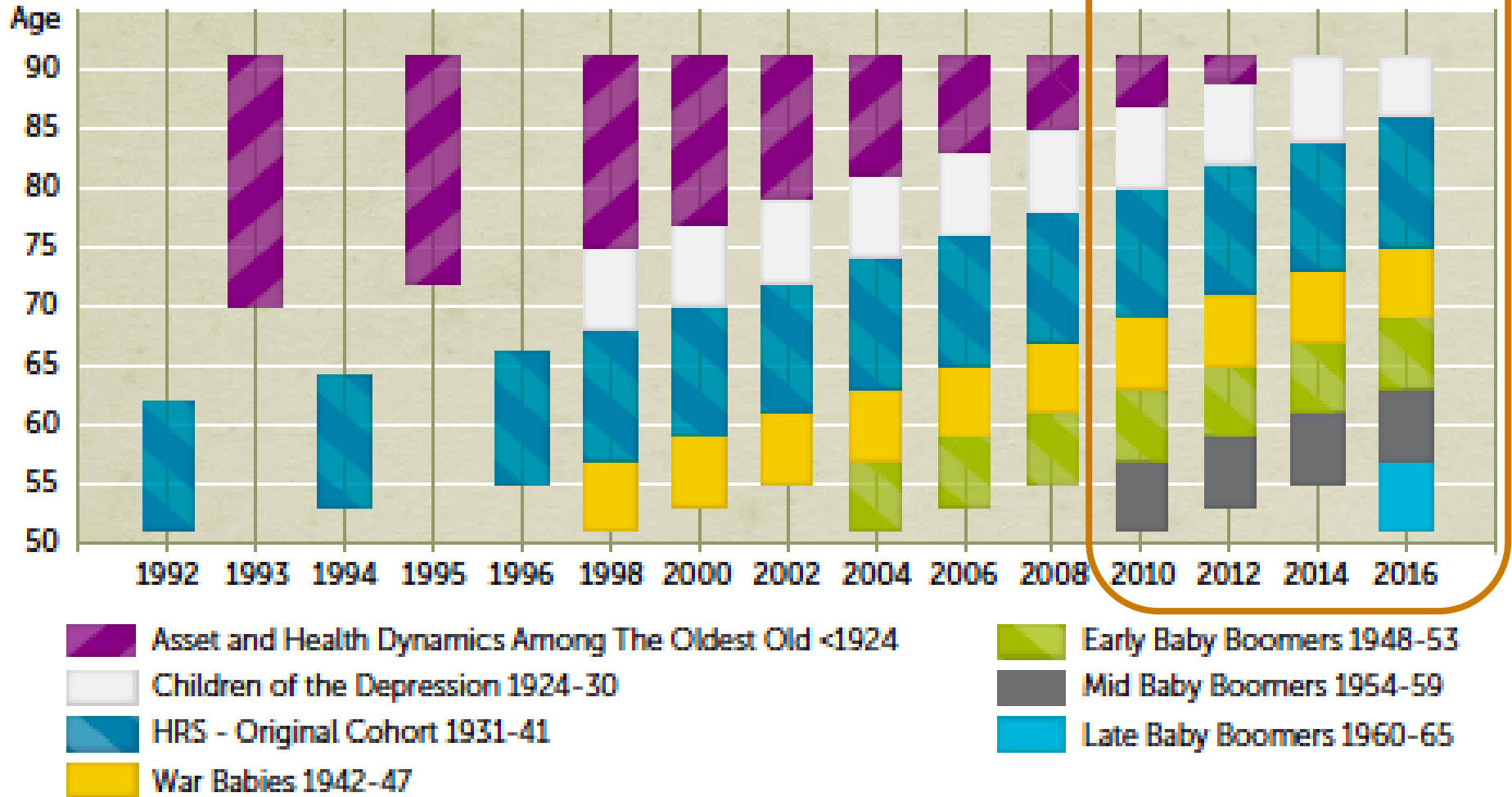
Motivation



Data

- U.S. Health and Retirement Study (SSA and NIA)
 - Every two years (1992-2016)
 - Adults ages 50-80
 - Many questions around topics including work, investments, etc.
- Delivered in waves over time
 - New respondents added
 - New questions developed

FIGURE A-4 Longitudinal cohort design of the HRS



Our sample: 5,560 individuals and
12,633 individual-year observations

Data

- U.S. Health and Retirement Study (SSA and NIA)
 - Every two years (1992-2016)
 - Adults ages 50-80
 - Many questions around topics including work, investments, etc.
- Delivered in waves over time
 - New respondents added
 - New questions developed
 - **Genetic sample collection began in 2006**

Primary variable to capture genetic influence

- A polygenic score (PGS) aggregates millions of individual loci across the human genome and weights them by the strength of their association to produce a single quantitative measure of genetic risk. (HRS Survey)

The goal of a PGS is provide an index to predict a particular trait

- PGS for a variety of phenotypes have been constructed for HRS respondents who provided salivary DNA. PGS for each phenotype are based on a single, replicated genome-wide association study (GWAS). (HRS Survey)

Data

- Genetics

- Educational Attainment PGS
- General Cognition PGS
- Neuroticism PGS
- Depressive Symptoms PGS

- Myocardial Infarction PGS
- Coronary Artery Disease PGS
- BMI PGS
- Height PGS

- Outcomes

- Participate in equity market
- % Equity held
- Self-rated risk aversion
- $P(R_M > 0\%)$
- $P(R_M > 20\%)$
- $P(R_M < -20\%)$

- Traditional investor characteristic variables

- Wealth
- Income
- Education
- Cognition
- Trust
- Sociability
- Optimism
- Early life poverty
- Height
- BMI
- Health

- Controls

- Gender
- Age
- HRS Wave
- Retired
- Married
- Genetic PCs

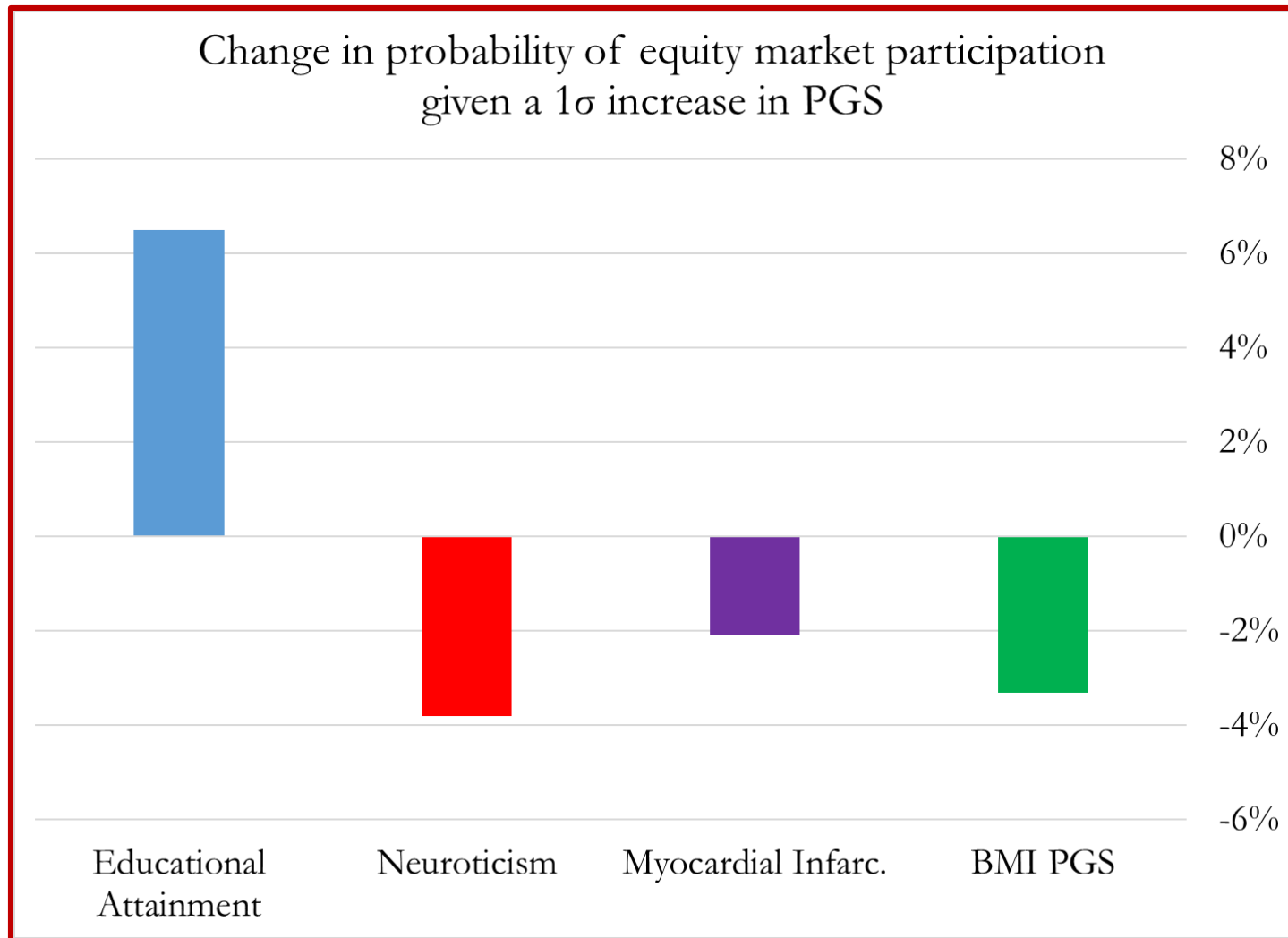
Genetics and stock market participation

- Q1 - Do genetic endowments help explain variation in stock market participation?



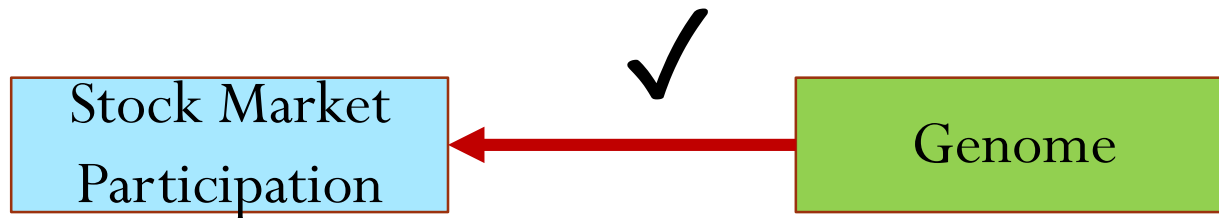
➔ Regress stock market participation on each PGS with controls included

Genetics and likelihood of holding any stock



Genetics and stock market participation

- Q1 - Do genetic endowments help explain variation in stock market participation?



➔ Yes, substantial predictability

Why?

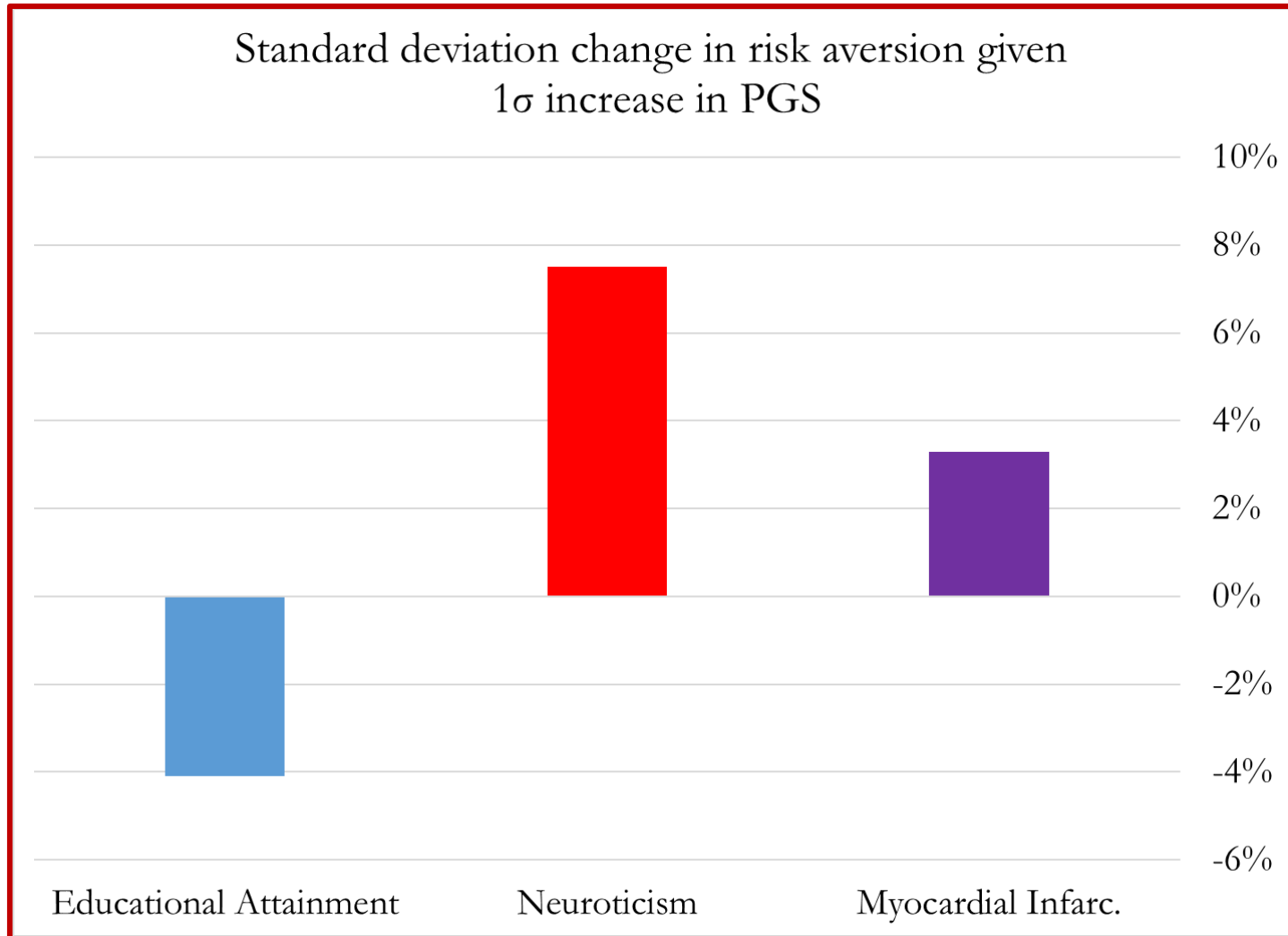
Why? Do genetics explain risk aversion and beliefs?

- Q2 - Do genetic endowments help explain variation in risk aversion and in beliefs regarding stock returns?

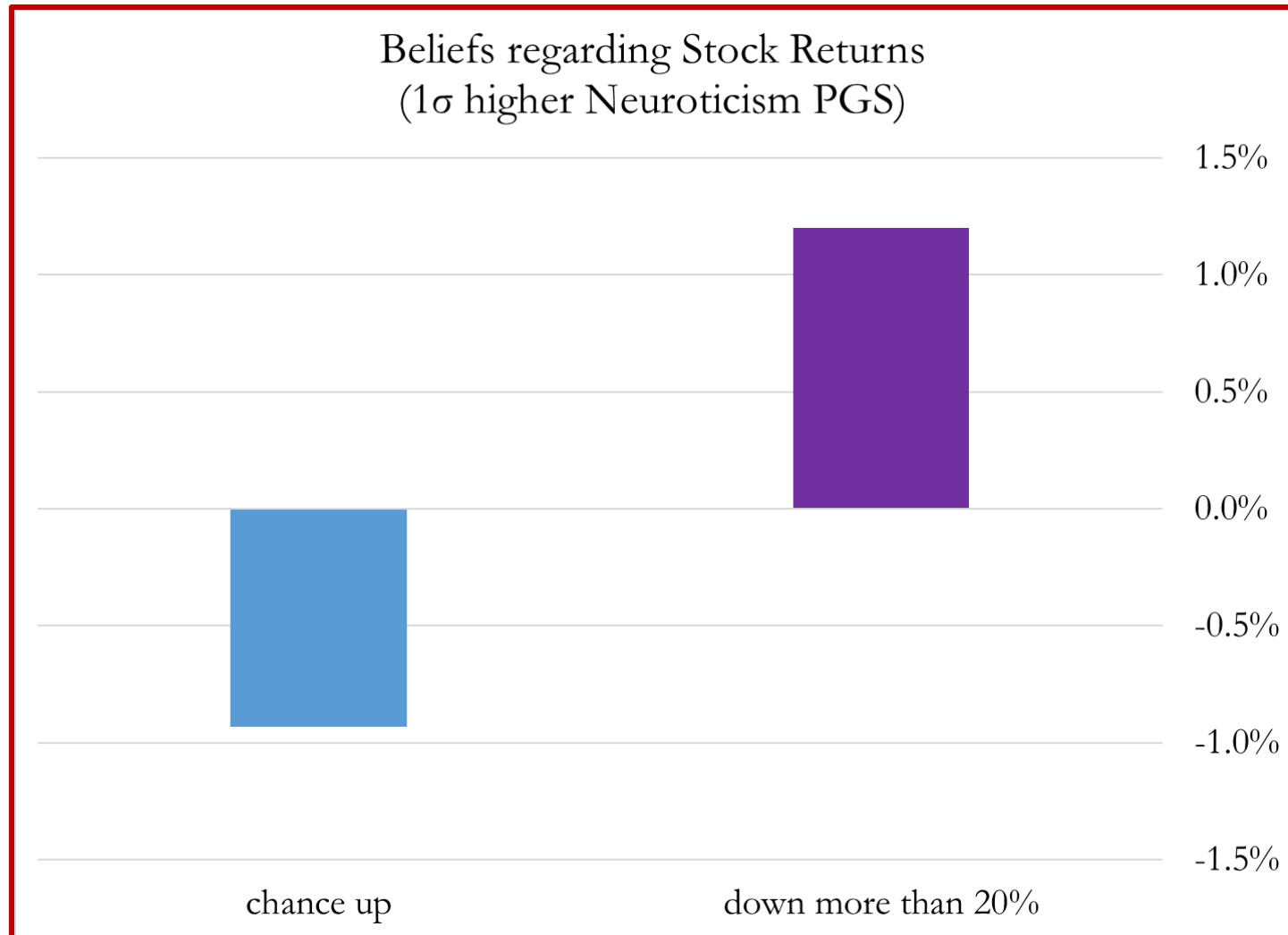


- Regress risk aversion and beliefs on controls and each PGS

Genetics and risk aversion

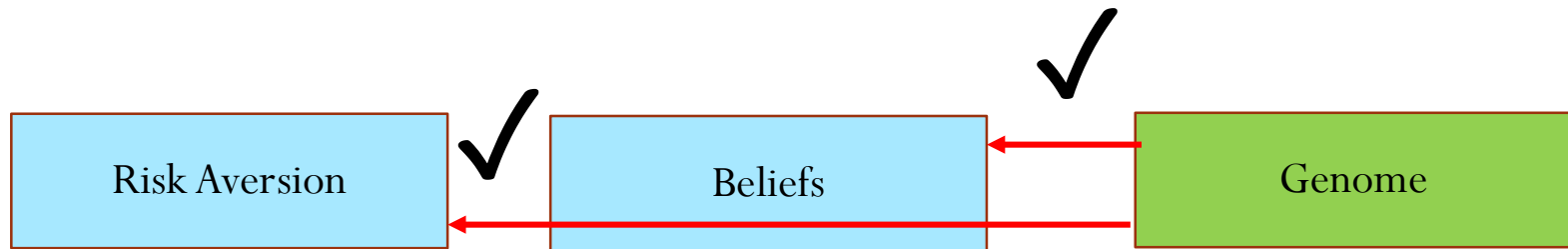


Genetics and beliefs regarding stock returns



Do genetics explain risk aversion and beliefs

- Q2 - Do genetic endowments help explain variation in risk aversion, and beliefs regarding stock returns?

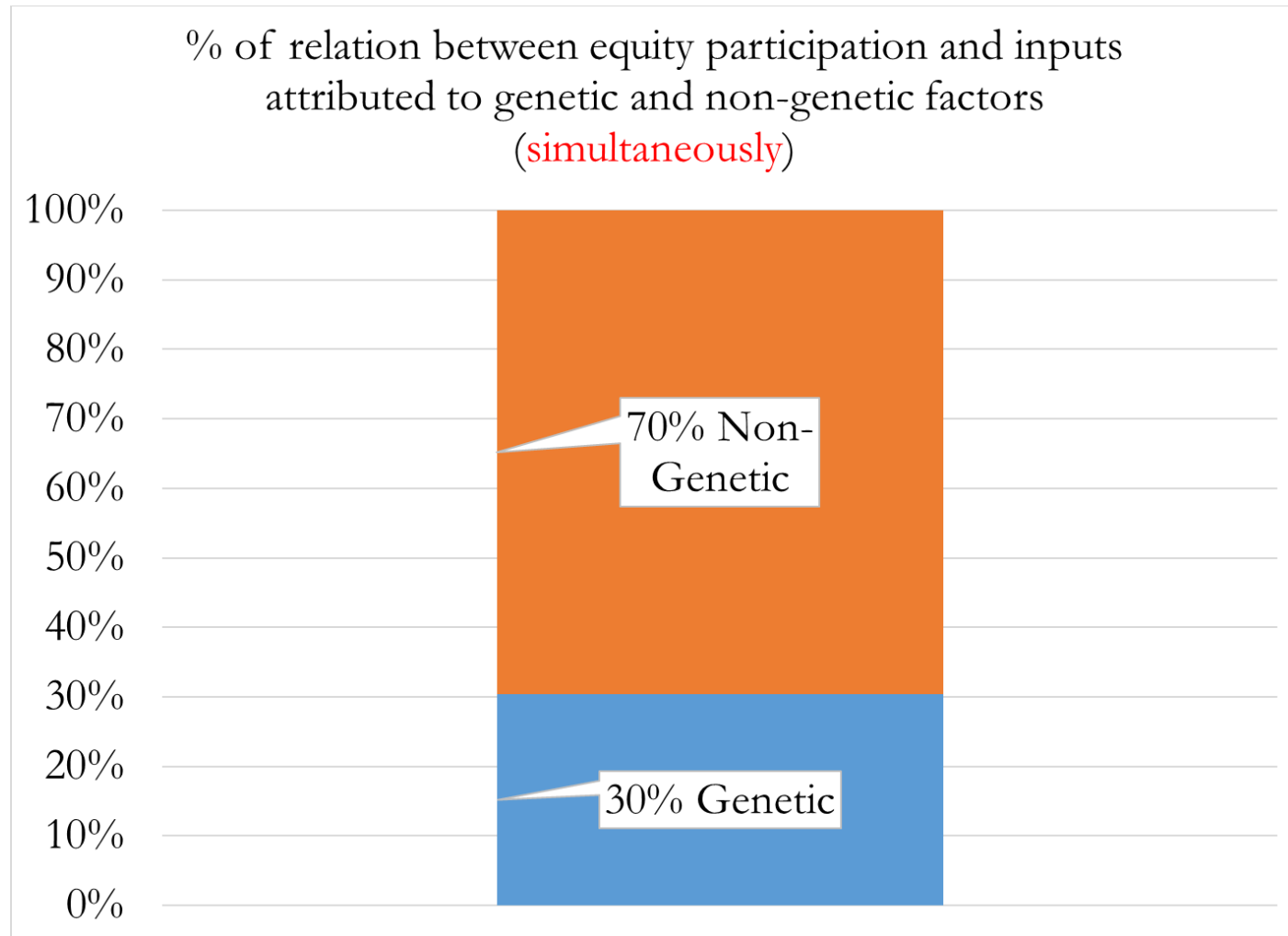


- Yes, PGSs impact both risk aversion and beliefs

Genetics, holding stocks, risk aversion, and beliefs

- Q3 – How much of the relation between stock market participation and risk aversion/beliefs can be explained by the 8 genetic components?
 - Step 1: Remove variation in participation, risk aversion, and beliefs related to control variables (e.g., age, gender, married, retired, HRS waves, & genetic PCs)
 - “Orthogonalized” participation, risk aversion, beliefs
 - Step 2: Regress orthogonalized risk aversion (or beliefs) on the 8 PGSs
 - fitted value is “genetic component”
 - residual is “non-genetic component”
 - Step 3: Regress orthogonalized participation on genetic and non-genetic components and partition R^2

Stock market participation, risk aversion, and beliefs



Traditional explanatory variables and genetics

- Q3 – Can genetics help explain the relation between risk aversion, beliefs, and stock market participation? And, if so, how much?

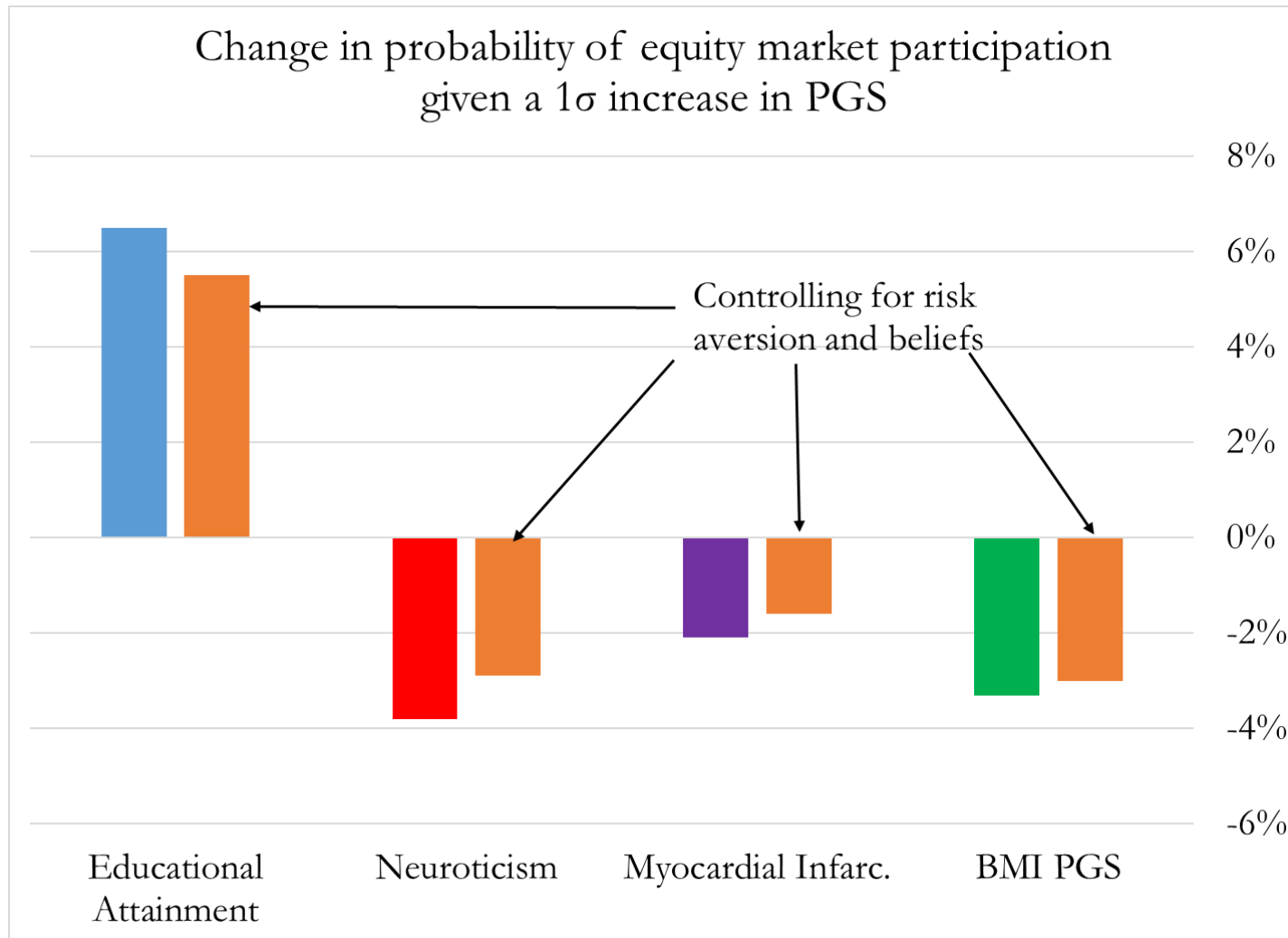
✓ Yes

- Best estimate:
 - 30% due to these eight genetic endowments
 - 70% not explained by these eight non-genetic endowments

Genetics, holding stocks, risk aversion, and beliefs

- Q4 – Can genetics impact on risk aversion and beliefs fully explain the relation between genetics and stock market participation?
 - Perhaps PGS better capture risk aversion and beliefs?
 - Other factors (that are captured by the PGSs) impact stock market participation
- Regress stock market participation on controls, risk aversion, beliefs, and each PGS individually

Genetics and likelihood of holding any stock



Genetics, holding stocks, risk aversion, and beliefs

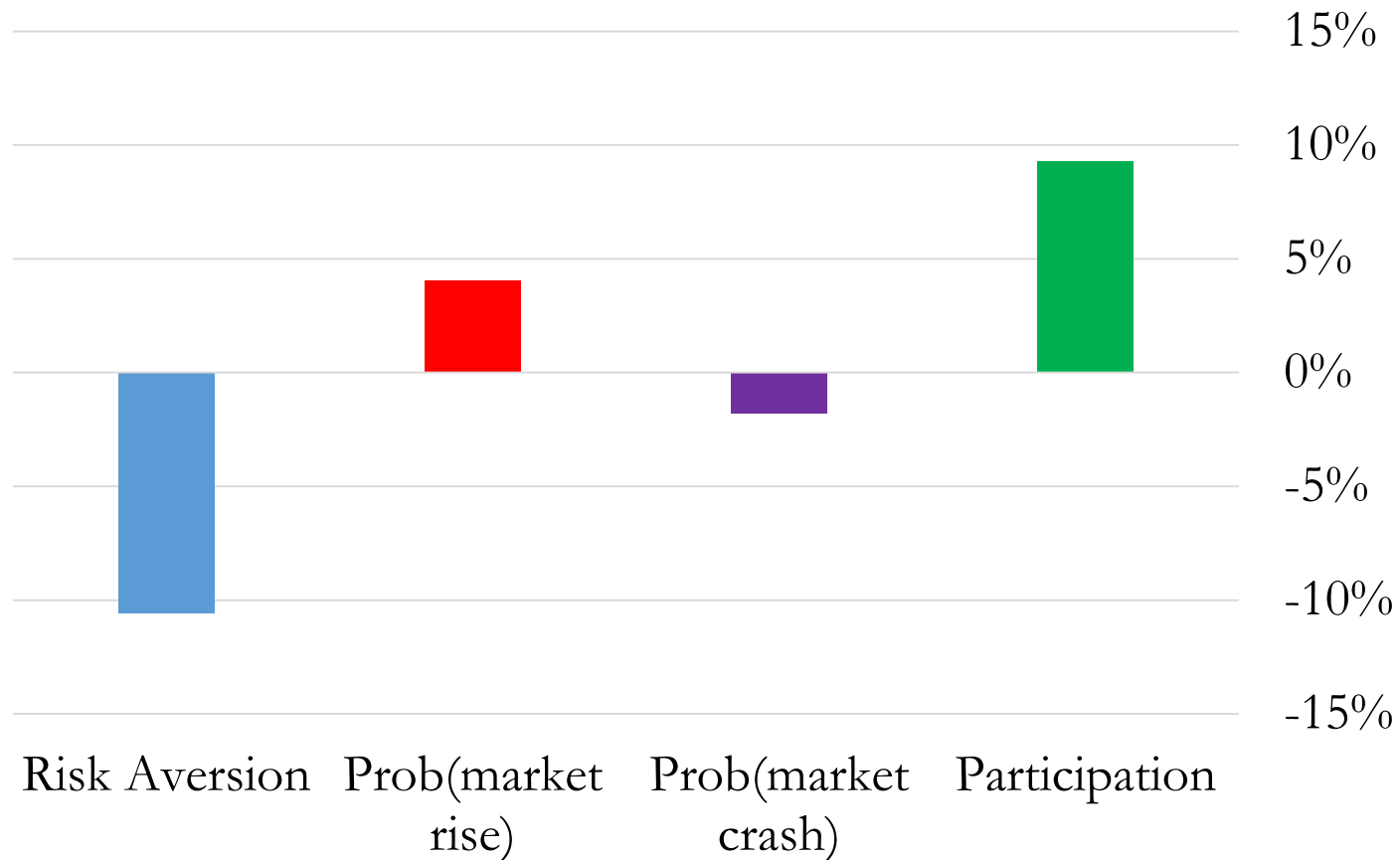
- Q4 – Can genetics impact on risk aversion and beliefs fully explain the relation between genetics and stock market participation?
 - No
 - The PGS may better capture risk aversion and beliefs
 - Other factors (related to PGSs) impact stock market participation
 - ➔ Look at traditional investor characteristic variables (e.g., trust) and PGSs

Investor characteristics from previous literature and genetics

- Q5 – Can genetics help explain the relation between investor characteristics and stock market participation, risk aversion, and beliefs?
- Step 1: Confirm relation between investor characteristics (e.g., trust) and stock market participation

Economic outcomes and investor characteristics, trust, without genetics

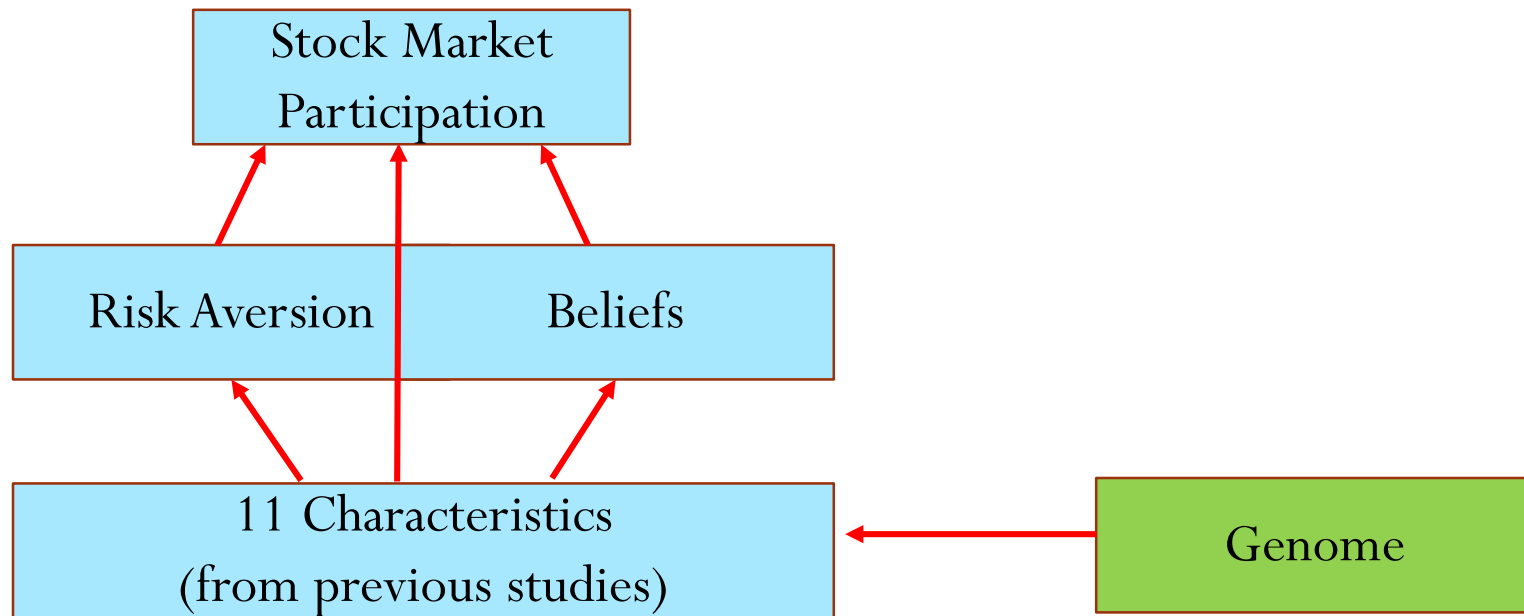
Impact of 1 σ higher Trust (phenotype)
(includes control variables)



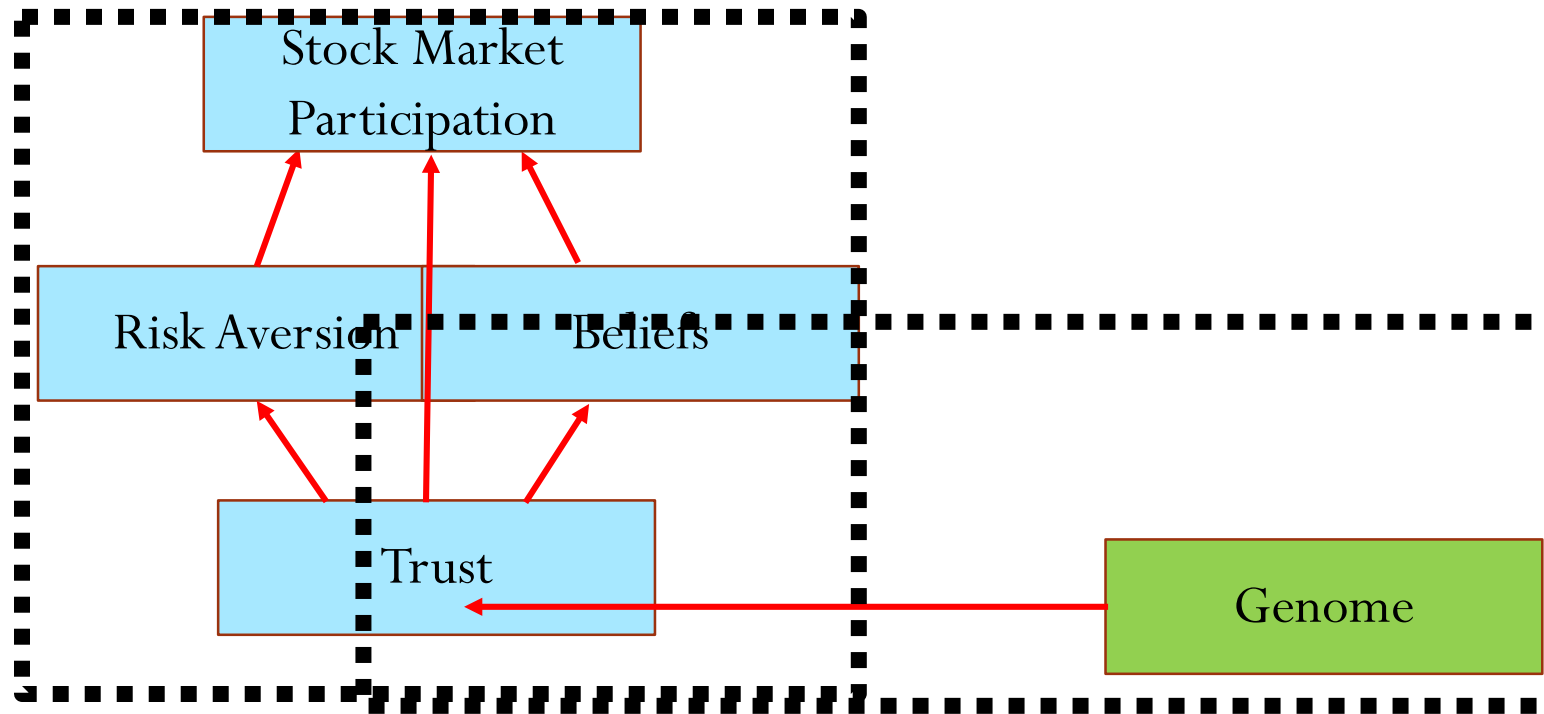
Investor characteristics from the extant literature and genetics

- Q5 – Can genetics help explain the relation between investor characteristics and stock market participation, risk aversion, and beliefs?
 - Step 1: Confirm relation between investor characteristics (e.g., trust) and stock market participation
 - ✓
 - Higher trust → lower risk aversion, more bullish beliefs, and greater equity market participation
 - Step 2: Examine if genetics help to explain variation in investor characteristics (e.g., trust)

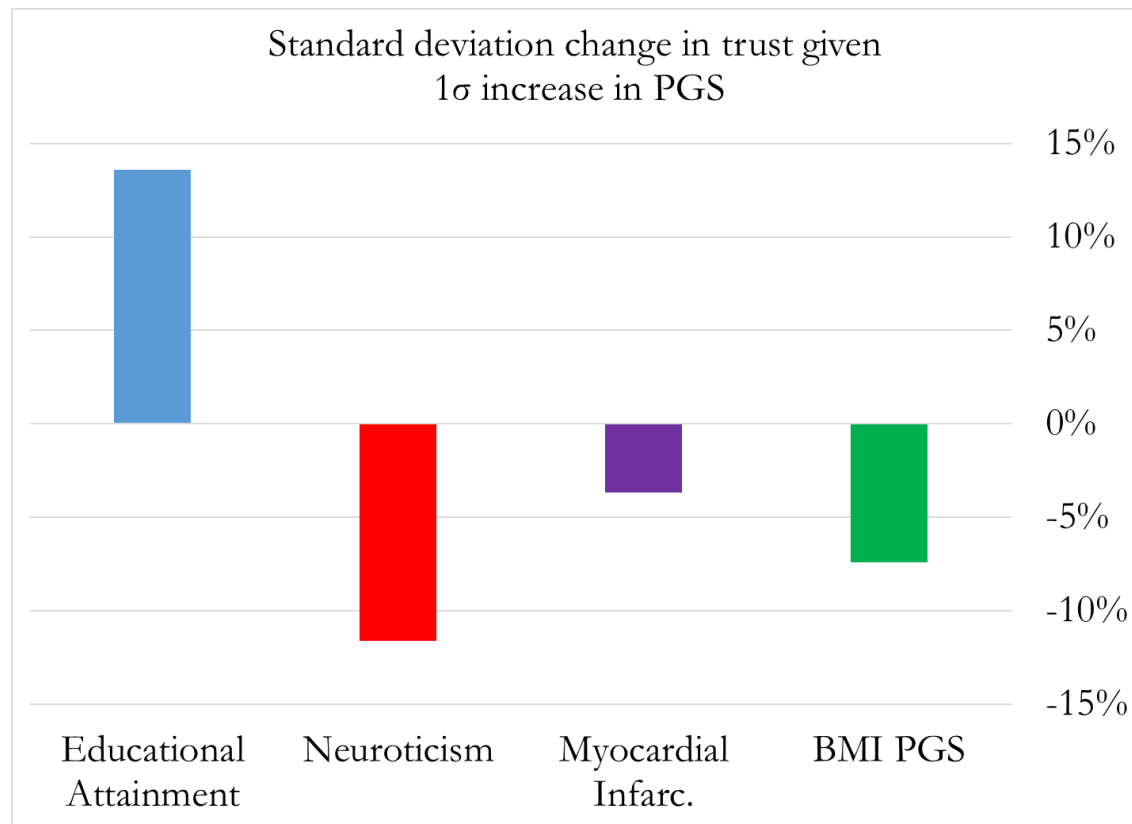
Does it occur because the genome influences the 11 characteristics?



Example: Does it occur because the genome influences trust?



Genetics and trust



Investor characteristics from the extant literature and genetics

- Q5 – Can genetics help explain the traditional relation between investor characteristics and stock market participation, risk aversion, and beliefs?

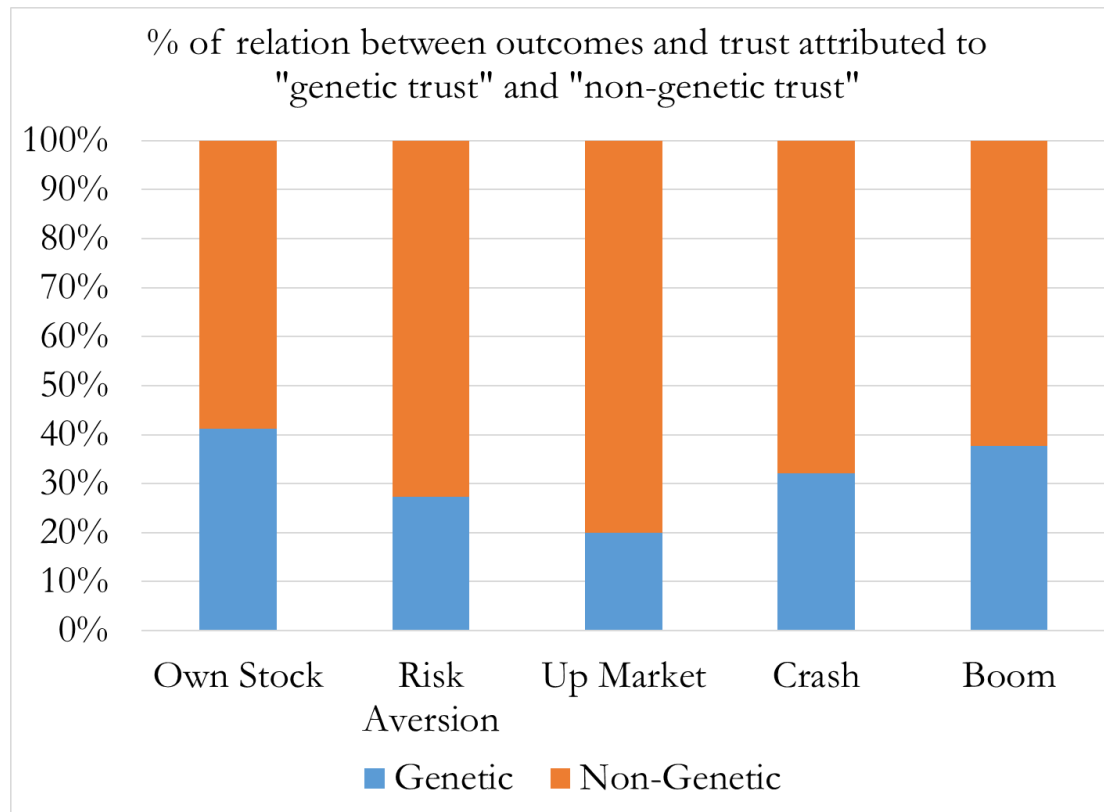
✓ Yes

- PGS → trust
- Trust → risk aversion, beliefs and participation

Investor characteristics and genetics

- Q6 – How much of the relation between outcomes and investor characteristics is due to genetic vs non-genetic variation in characteristics?
 - Step 1: Remove variation in outcomes and characteristics attributed to the control variables: “Orthogonalized” participation, risk aversion, beliefs, trust
 - Step 2: Regress orthogonalized trust on the eight PGSs
 - fitted value is “genetic component”
 - residual is “non-genetic component”
 - Step 3: Regress orthogonalized participation on genetic and non-genetic components of trust and partition R^2

Genetics and trust



Investor characteristics and genetics

- Q6 – Can genetics help explain the relation between investor characteristics and stock market participation, risk aversion, and beliefs? And if so, how much?

✓ Yes

- Across the 11 characteristics ~
 - Equity participation: 38% genetic/62% non-genetic
 - Risk aversion: 20% genetic/80% non-genetic
 - Beliefs: 46% genetic/54% non-genetic

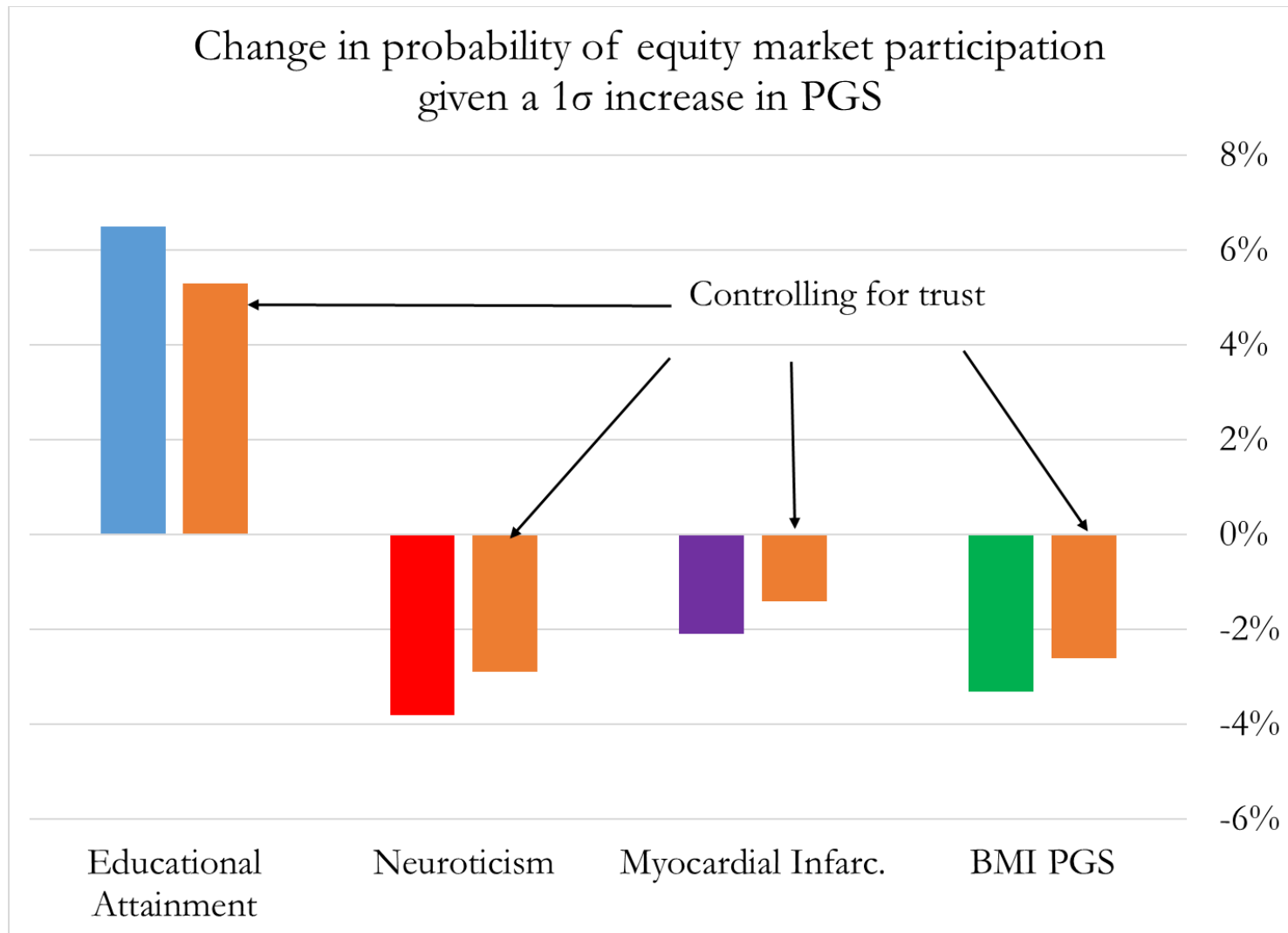
- | | | |
|-------------|----------------------|----------|
| ○ Wealth | ○ Trust | ○ Height |
| ○ Income | ○ Sociability | ○ BMI |
| ○ Education | ○ Optimism | ○ Health |
| ○ Cognition | ○ Early life poverty | |

*11 characteristics
from previous
research*

Investor characteristics and genetics

- Q7 – Which investor characteristics are channels for the PGSs?
 - Does Neuroticism PGS impact stock market participation through its impact on trust?
 - Regress participation on controls, PGS, and trust to examine
 - Does realized trust subsume the predictability due to the Neuroticism PGS?

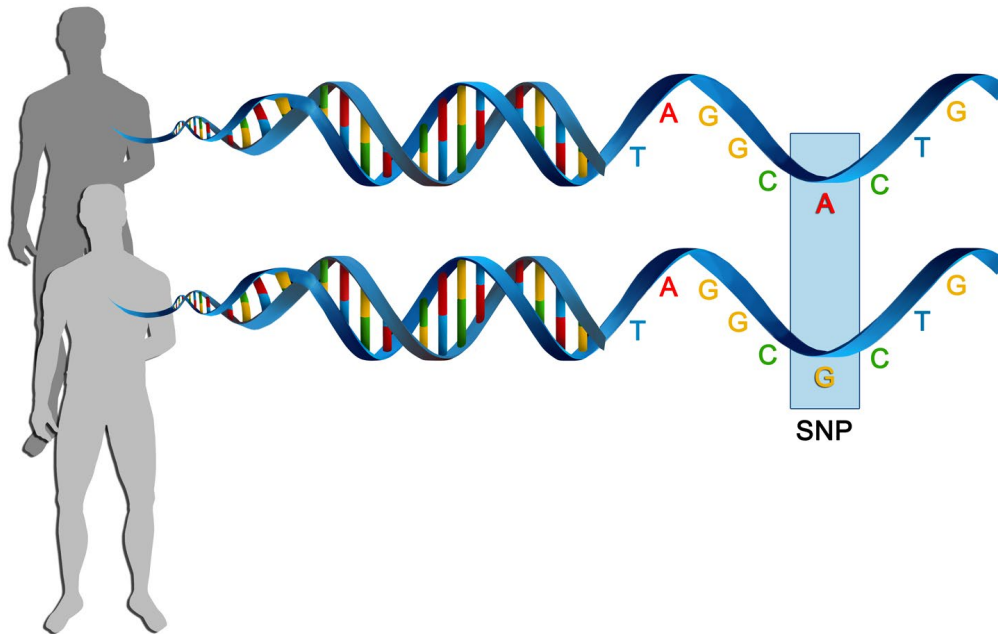
Genetics and likelihood of holding any stock



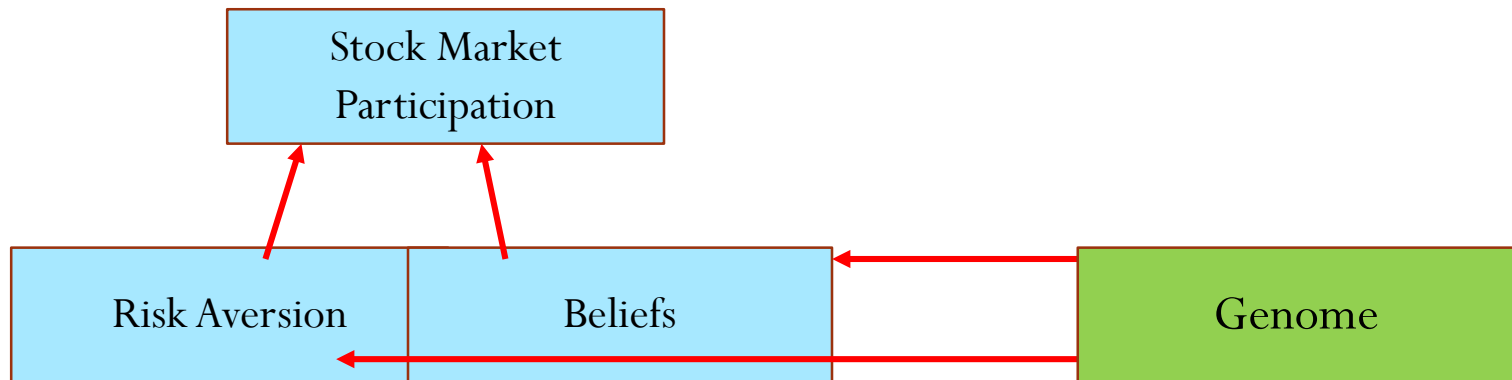
Investor characteristics and genetics

- Q7 – Which investor characteristics are channels for the PGSs?
 - For some PGSs, we identify specific channels:
 - Height PGS no longer predicts participation after controlling for realized height
 - For other PGSs, channels remain unidentified:
 - Neuroticism PGS predicts participation when we include any of the 11 investor characteristics (e.g., wealth, trust, optimism

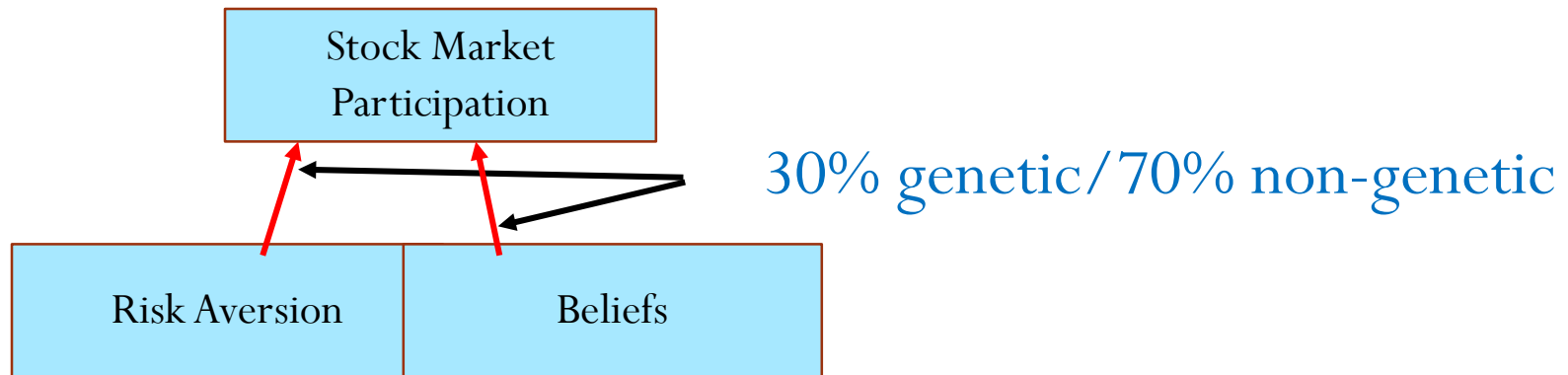
Summing up...



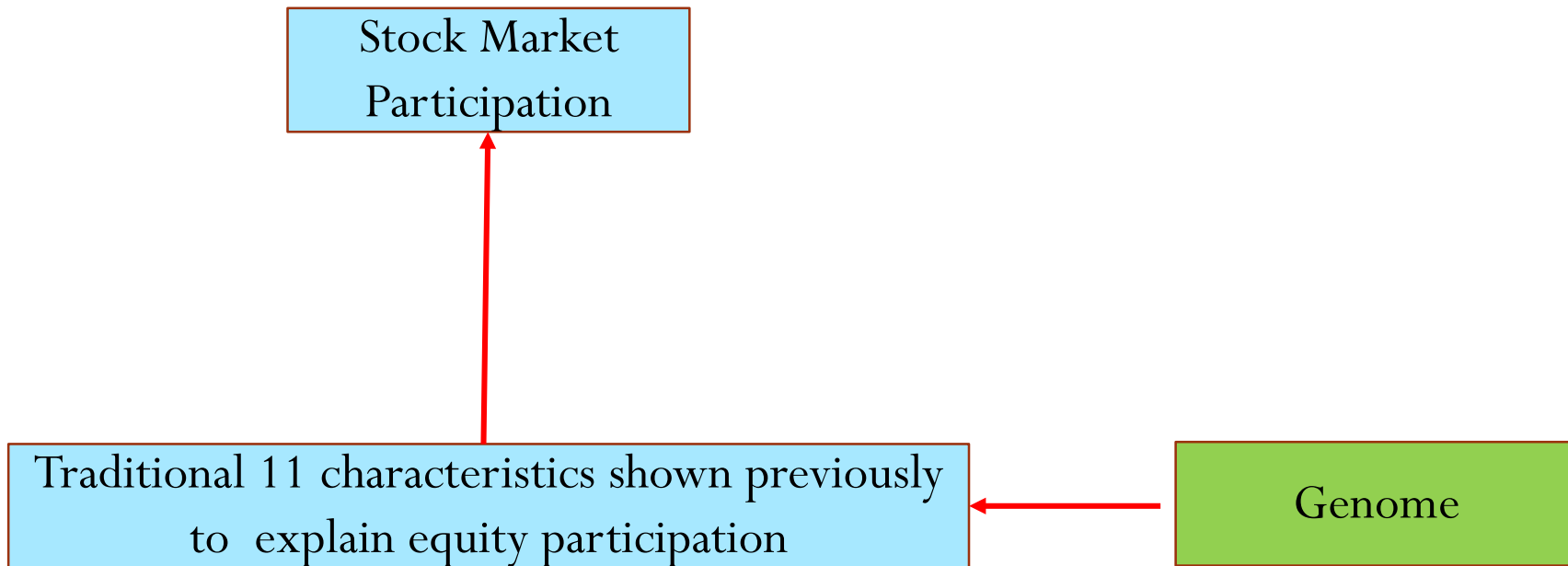
Summing up...



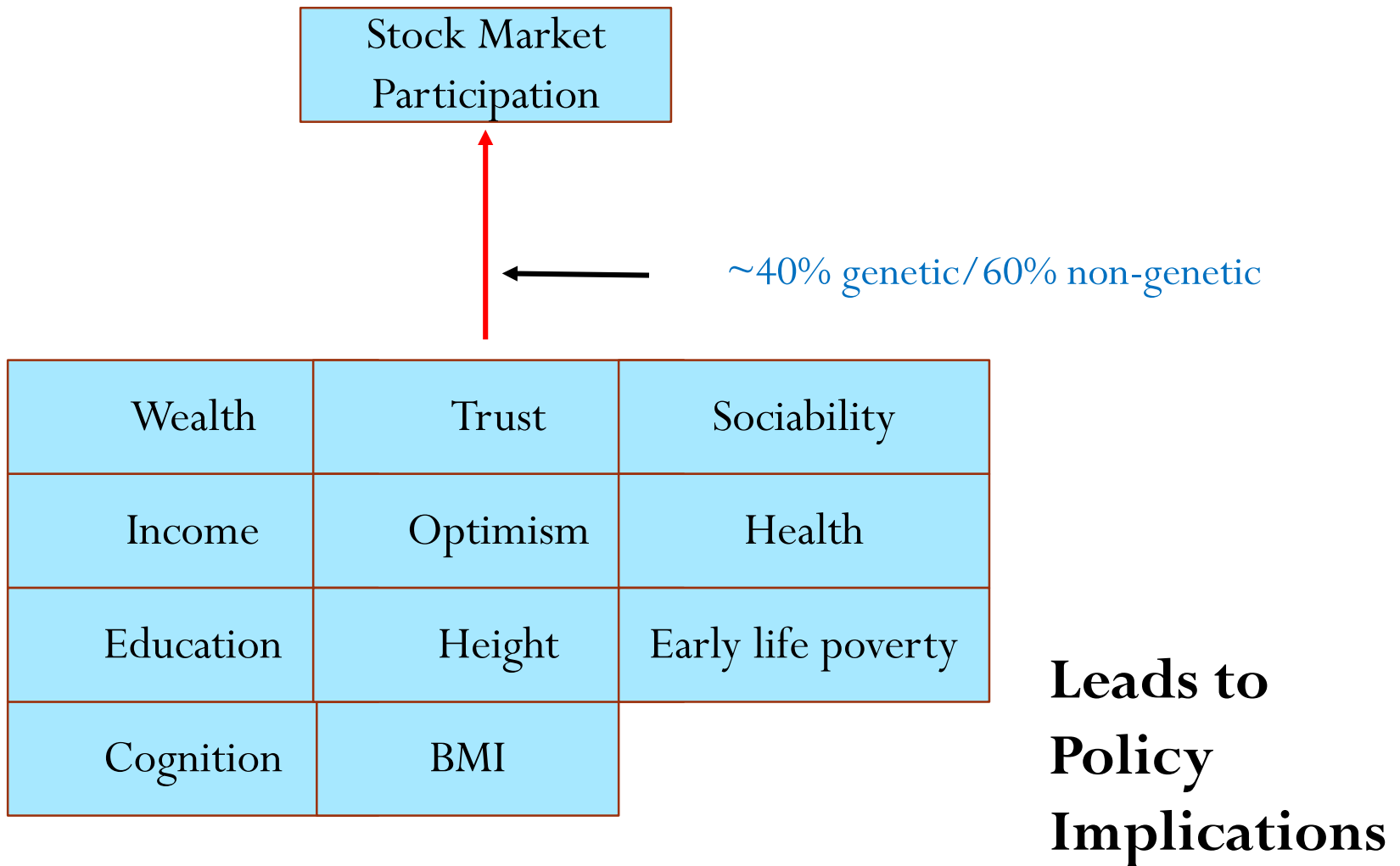
Summing up...



Summing up...



Summing up and conclusions





Thank
you!

