Genetic Architecture of Political and Economic Traits

David Cesarini

CESS, Economics Department
New York University

Workshop to Explore SSGAC • 29 October 2011

Responses to the Inferential Challenge

1. Expand Sample Size & Refine Phenotype Measurement
   - E.g., medical consortia and the present effort
   - Reliability & biological proximity

2. Use Different Analytical Techniques
   - Individual SNP associations will be difficult, perhaps impossible, to establish in sample sizes of ~10,000.
   - Polygenic Risk Score estimation (Purcell et al., 2009)
   - GREML analyses (Yang et al., 2010)

SALTY Questionnaire

- Swedish Twin Registry (STR), is a large twin registry in the world and routinely administers surveys to Swedish twins (Lichtenstein et al. 2006).
- The SALTY survey, administered in 2010, contains an entire section dedicated to measuring economic behaviors, attitudes and outcomes.
- Respondents can be matched to other administrative data.
- The survey generated a total of 11,743 responses, a response rate of ~50%. Finally, 800 people were asked to complete the survey twice.
- Approximately 4,000 SALTY respondents have been comprehensively genotyped as part of the TwinGene sample (n=10,000)

Political Ideology Dimension

- To measure political attitudes we used a battery of 34 questions about the attitudes towards various policy issues, which were included in SALTY.
- On each question the respondents listed their attitude towards the policy on a 5-point scale from (1) “very good proposal” to (5) “very bad proposal”.
- We factor analyzed the items, retaining five factors and performing a varimax rotation of the data (Kaiser, 1958).
- The factor structure we uncovered was similar to what has previously been found, with five main dimensions.

Risk Attitudes

Risk General and Risk Financial (Dohmen et al. 2006; forthcoming)

How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please tick a box on the scale, where the value 1 means: unwilling to take risks and the value 10 means: fully prepared to take risks.

Risk Financial is constructed from a similarly phrased question.

Risk HRS (Barsky et al. 1997, Sahm, 2007 and Kimball, Sahm and Shapiro, 2008).

Similar to the hypothetical gambles used in the Health and Retirement Survey. Individuals were asked to respond to a series of questions about a guaranteed monthly salary of SEK 25,000 for the rest of their lives or a gamble in which there is a 50-50 chance of earning either SEK 50,000 or SEK X for the rest of their lives.

Trust

Trust (National Opinion Research Center's General Social Survey**).**

"Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people? Please tick on the scale below, where the value 1 means "need to be very careful" and the value 10 means "most people can be trusted"."

"Do you think that most people would try to take advantage of you if they got the chance, or would they try to be fair? Please tick on the scale below, where the value 0 means "would take advantage of me" and the value 10 means "would treat me fairly"."

Different Analytical Approaches

- Yang et al. (2010) developed a method for the cumulative effect of the genotyped SNPs.
  - Idea: to see examine how phenotypic similarity is associated with genetic distance, measured from dense SNP data.

- Polygenic risk prediction (e.g., Purcell et al., 2009).
  - Idea : even when effect sizes are small, it may still be possible to make statistically efficient use of the joint predictive power of the SNPs.

GREML

GREML estimates are a lower bound of narrow heritability.

- Output can be interpreted as the *ultimate* predictive value that can be obtained.
- Applying the method, Yang et al. (2010) found that the measured SNPs could account for 45% of the variance in human height.
- Davies et al. (2011) apply the method to cognitive ability and obtain point estimates of 0.40-0.51.
- Used the GCTA software (Yang et al., 2011) to estimate “heritability” of some economic and political phenotypes.

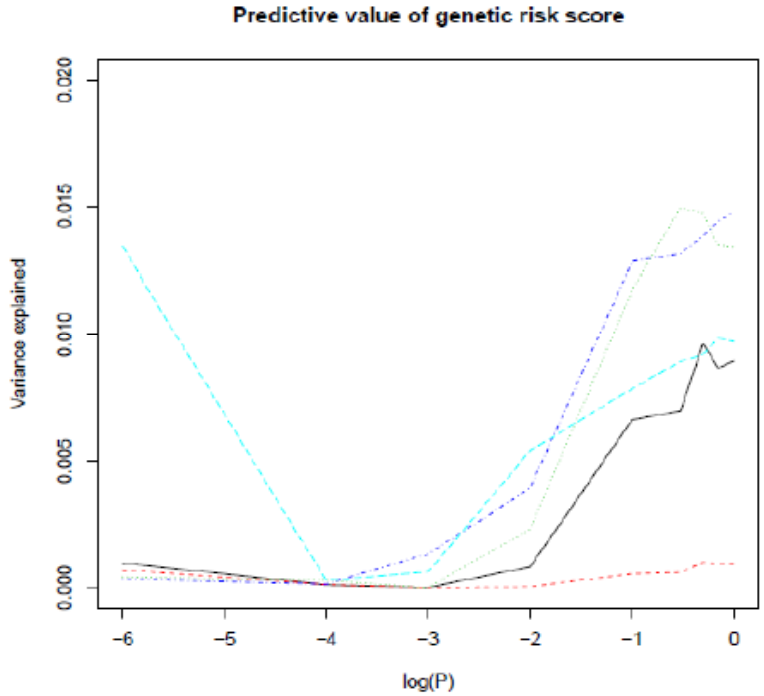
GREML Estimates

Table 2: GREML Estimates for TwinGene data

	Economic Behavior	Economic Preferences		Political Attitudes				
	Education	Risk	Trust	Imm/Crime	Econ. Policy	Environ.	Femin.	Foreign Policy
V(g)/V(P)	0.524	0.058	0.294	0.248	0.453	0.070	0.000	0.184
s.e.	0.157	0.163	0.162	0.161	0.166	0.163	0.159	0.163
p-value	0.000	0.362	0.037	0.060	0.004	0.338	0.500	0.132
N	2229	2142	2206	2170	2170	2170	2170	2170
Chr. R^2	0.051	0.177	0.063	0.003	0.249	0.092	0.048	0.029
Reliability	-	0.71	0.63	0.86	0.84	0.62	0.78	0.72

Prediction Analysis

- Split the sample into an 80% training sample and a 20% validation sample.
- Constructed a genetic risk score from GWAS in the training sample (nothing genome-wide significant).
- SALTY phenotypes – no out-of-sample predictability.
- Education – out-of-sample predictability ~1% (work by Thomas Frisell).



David Cesarir

Conclusion

- These results consistent with these traits having a complex architecture, with highly diffuse and small genetic effects scattered across the genome.

- Some predictability for educational attainment when sample size is 8,000.

- These results are relevant for evaluating the extent to which the promises of “genoeconomics” are likely to be realized any time soon.