Trajectories of Adolescent Marijuana Use: A Retrospective Longitudinal Analysis

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The Problem

- Hundreds of variables linked with marijuana use
- Studies often based on cross-sectional designs that do not allow distinctions between outcomes that follow marijuana use from variables that anticipate use
- Why? Because few of these variables are amenable to manipulation

For Prevention Purposes, We Need:

- A method that allows for some clues regarding the most plausible causal factors in marijuana use

and

- That identifies linkages that probably are *not* indicative of causal relations

Useful Approach: Granger Causation

- Determine if changes from T_1 to T_n on Variable A are related to changes in Variable B at T_{n+1}
- To do so, we constrain Variable B so that it remains constant from T_1 to T_n
- Variations in B [which are nonexistent] cannot be associated with variations in A
- Changes in Variable A from T_1 to T_n that presage systematic changes in B from (T_1 and T_n to T_{n+1}) are identified as *potential* causes of B

Useful Approach: Example of Granger Causation

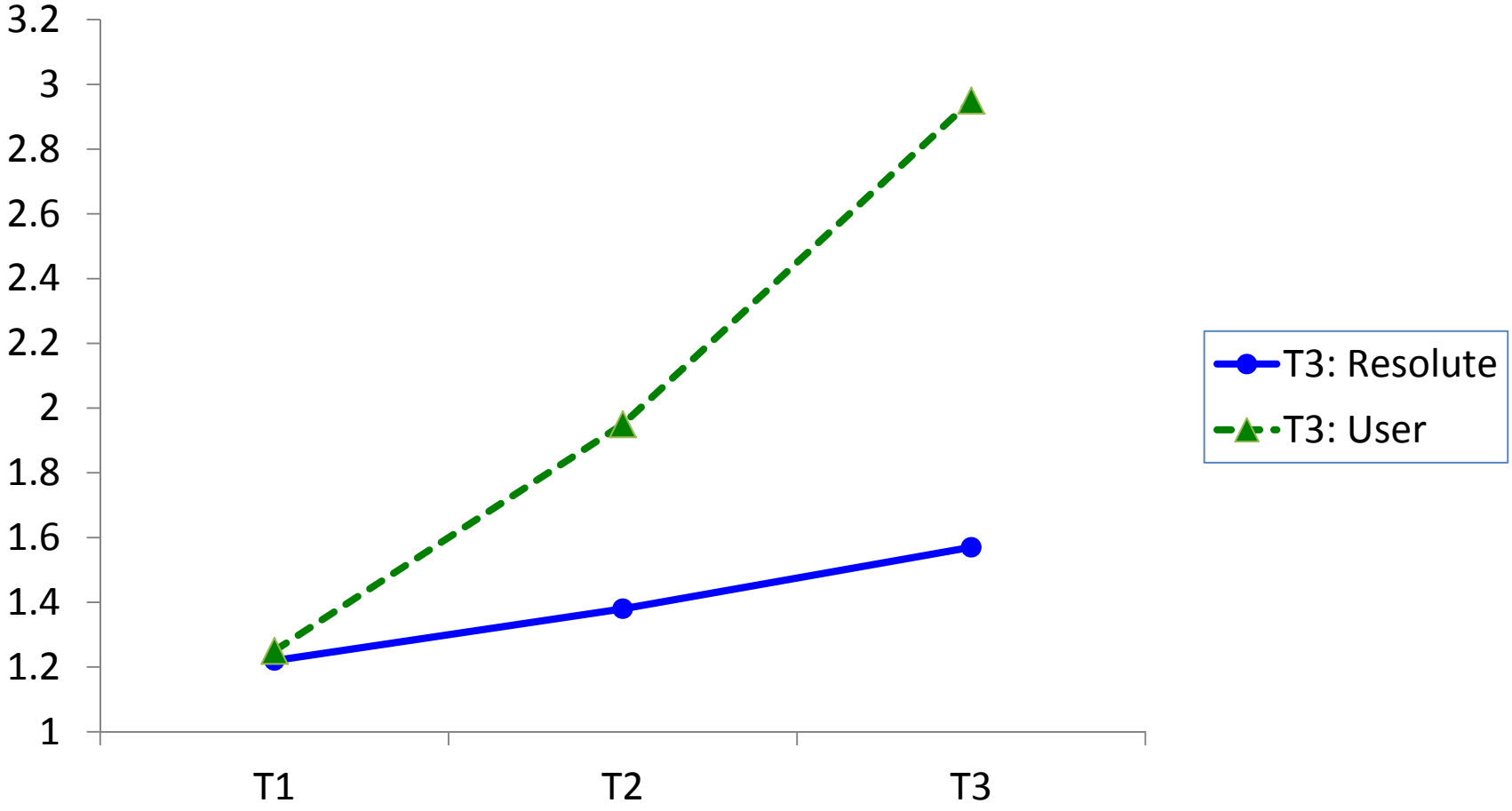
- Determine if changes from T_1 to T_2 on Alcohol Use A are related to changes in Marijuana Use at T_3
- To do so, we constrain Marijuana Use so that it remains constant from T_1 to T_2
- Thus, variations in Marijuana Use [which are nonexistent] cannot be associated with variations in Alcohol Use
- Changes in Alcohol Use from T_1 to T_2 that presage systematic changes in Marijuana (from T_1 and T_2 to T_3) are identified as *potential* causes of B

A Concrete Example

- We collect marijuana use data across three time points (T1—T3)
- Only nonusers at T1 and T2 are eligible (i.e., we constrain marijuana use)
- We investigate its linkages with a variable known to be associated with marijuana use (e.g., alcohol use).
- At T3, some will have begun using marijuana, others not.
- Will users' pattern of alcohol use from T1 to T2 differ from that of nonusers?
- If so, Granger suggests this might implicate alcohol use as a potential cause of marijuana use

Alcohol Use

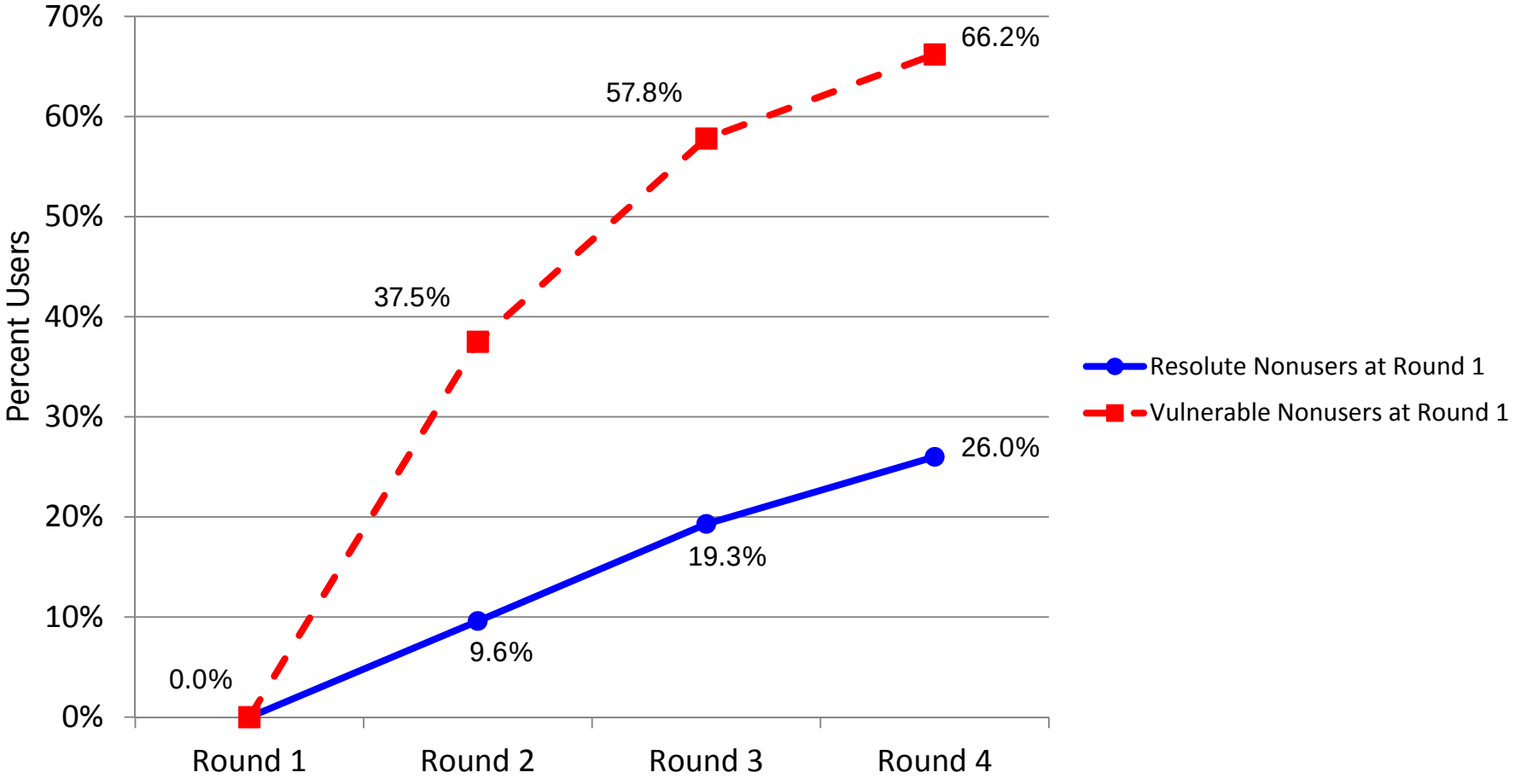
[at T1 & T2, both groups are resolute nonusers of marijuana]



Fitting NSPY Data to Granger's Model

- Used 1,968 subjects with complete data from first 3 years of a 4 year panel study (NSPY)
- Further constrained data by using only resolute nonusers at Year 1 & 2 (T1 &T2)
- At T3, we identified subjects as:
  - Resolute Nonusers ["definitely will not use"]
  - Vulnerable Nonusers [not "definitely will not"]
  - Users

Marijuana Usage Growth in Two Samples of (Round 1) Nonusers [NSPY data]



Longitudinal Analysis

- Variables investigated were (the usual suspects):
  - Academic performance
  - Delinquency
  - Refusal strength
  - Sensation seeking
  - Marijuana approval
  - Parental monitoring
  - Cigarette use
  - Alcohol use

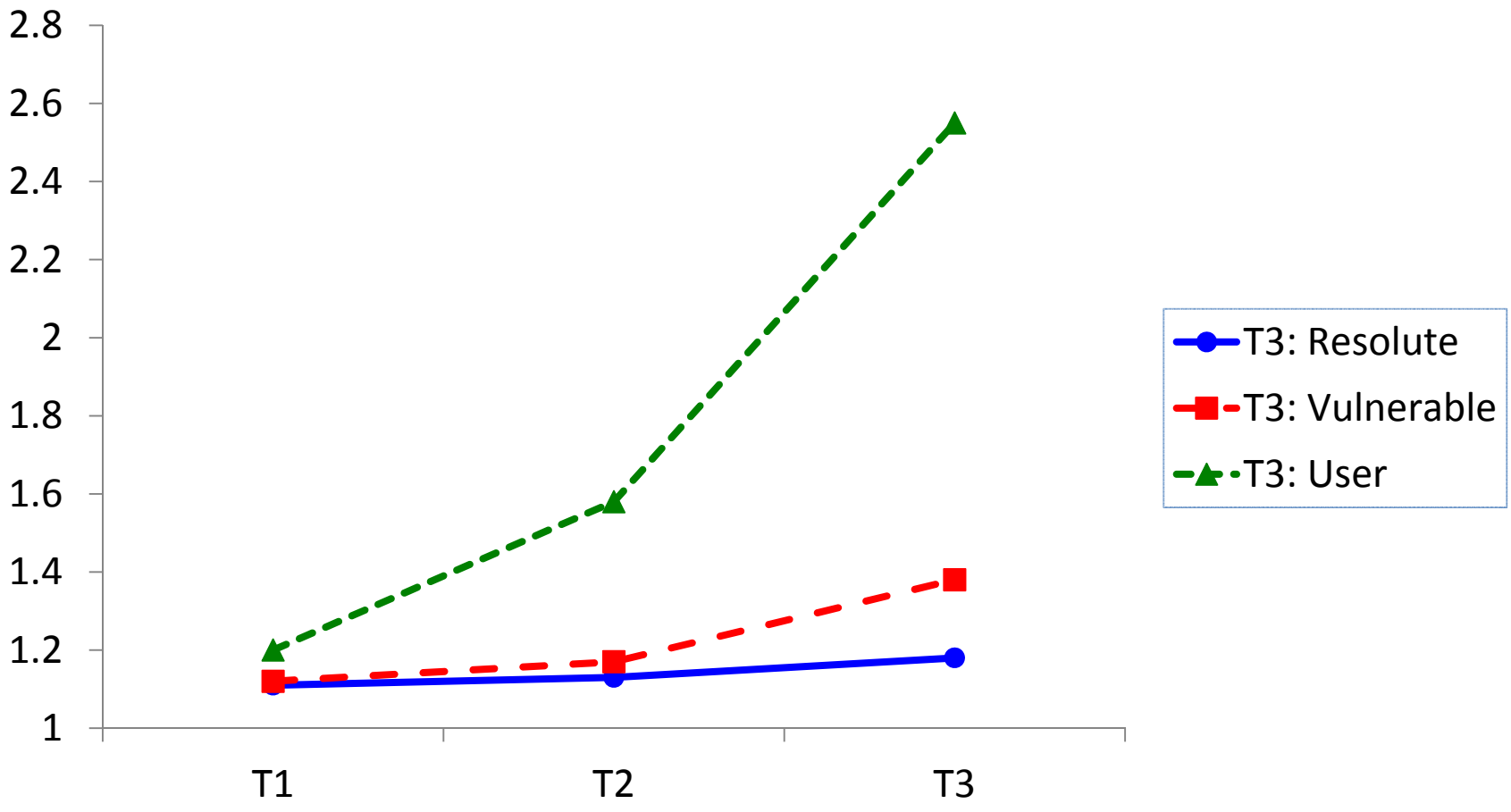
The central question

- Do changes in the marijuana risk variables that occurred between T1 to T2 (among resolute nonusers) *anticipate* changes in marijuana use at T3?
- Remember, marijuana use is held constant at T1 & T2

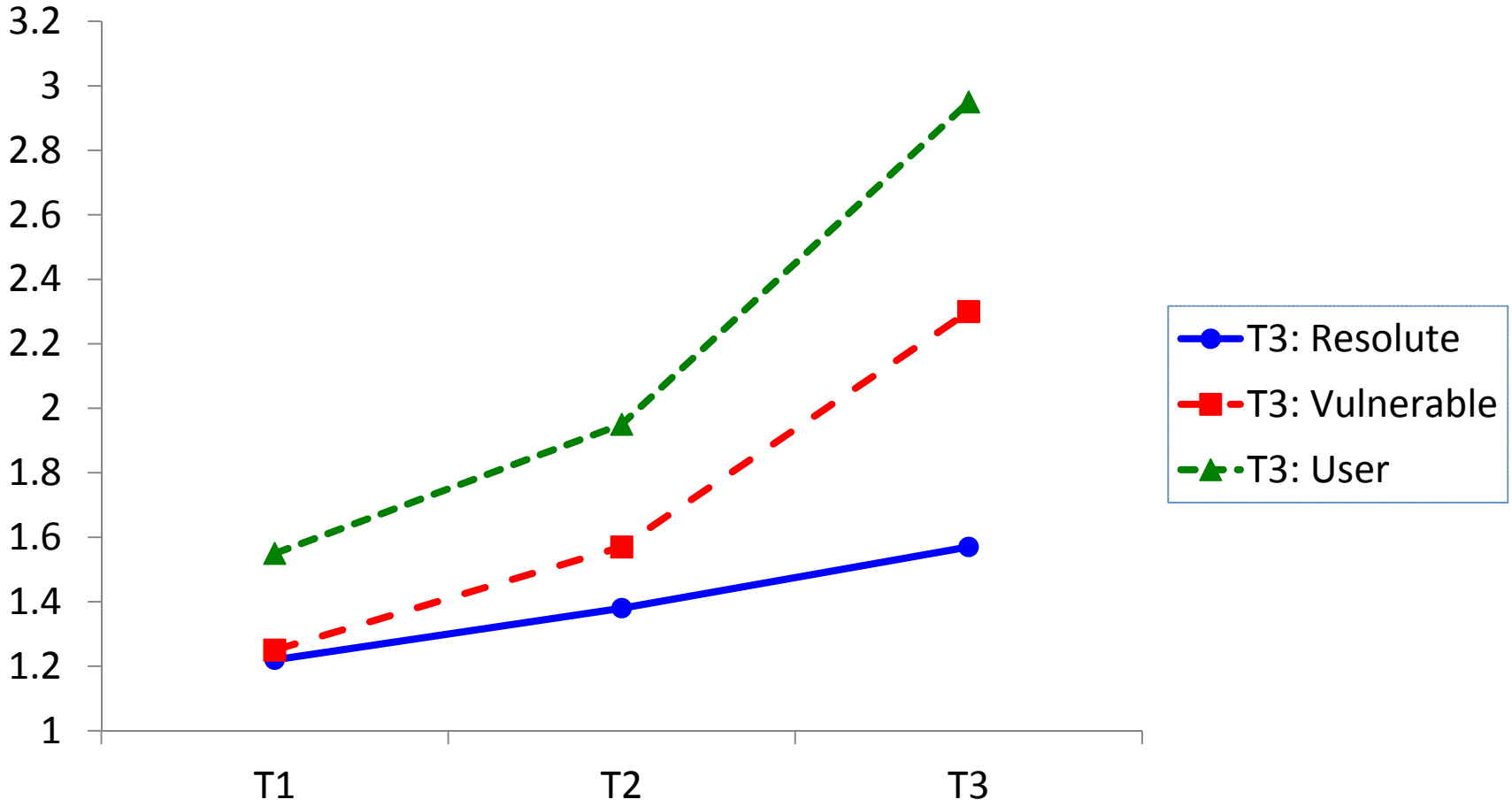
Three trajectory patterns emerged in the analysis: Pattern 1: Cigarettes and Alcohol Use

- Minor between-group differences in alcohol and cigarette usage at T1
- Significant jump in cigarette or alcohol use at T2 predicted those who would become marijuana users at T3

Cigarette Use



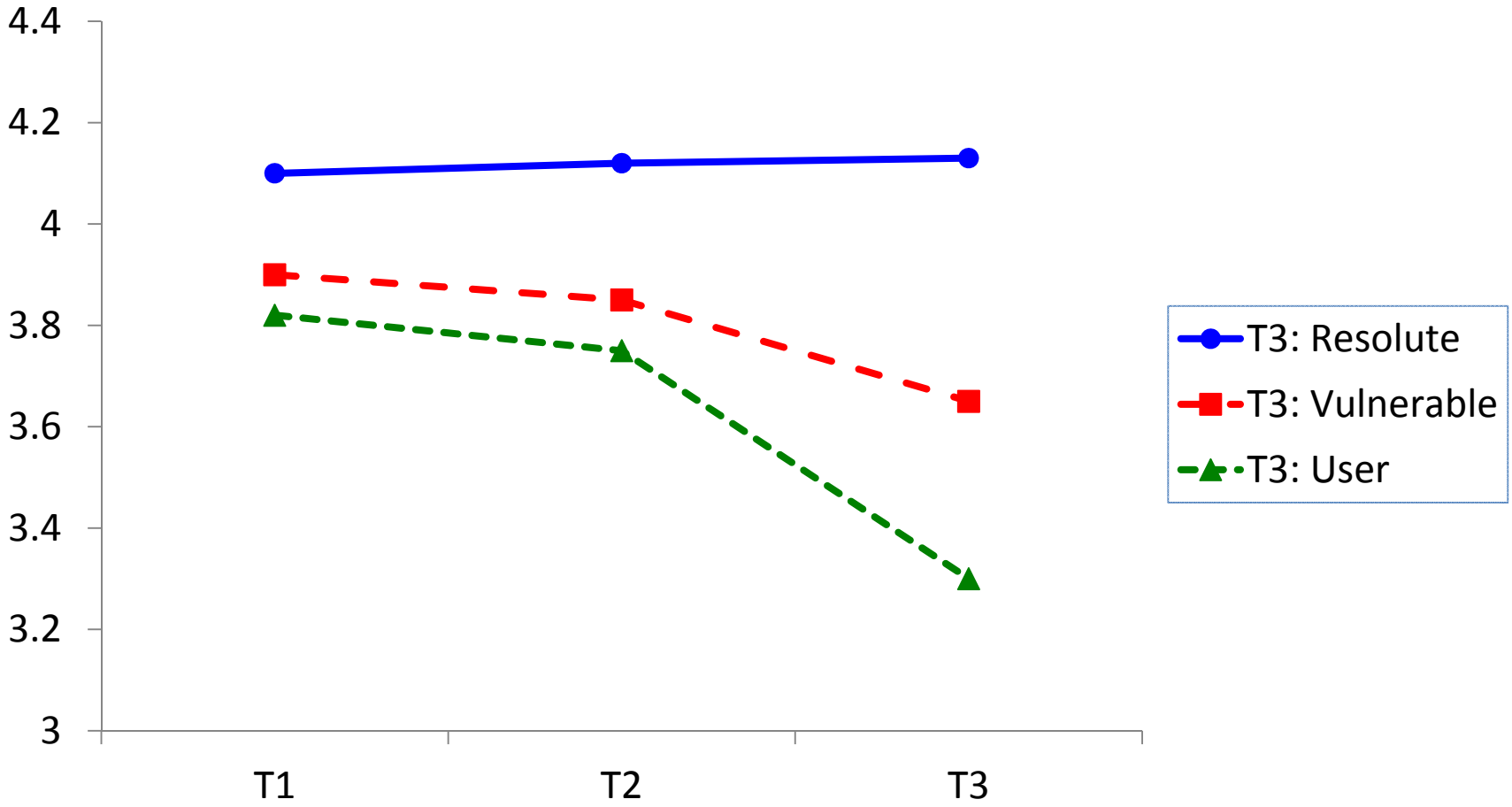
Alcohol Use


3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
T1
T2
T3
T3: Resolute
T3: Vulnerable
T3: User

Pattern 1a: Parental Monitoring

- No differences in monitoring evident at T1 in any pair-wise between-group comparison.
- By T2, youth who were to become marijuana users reported significantly less monitoring than those who remained abstinent at T3
- So, too, did those who were to become vulnerable to marijuana use

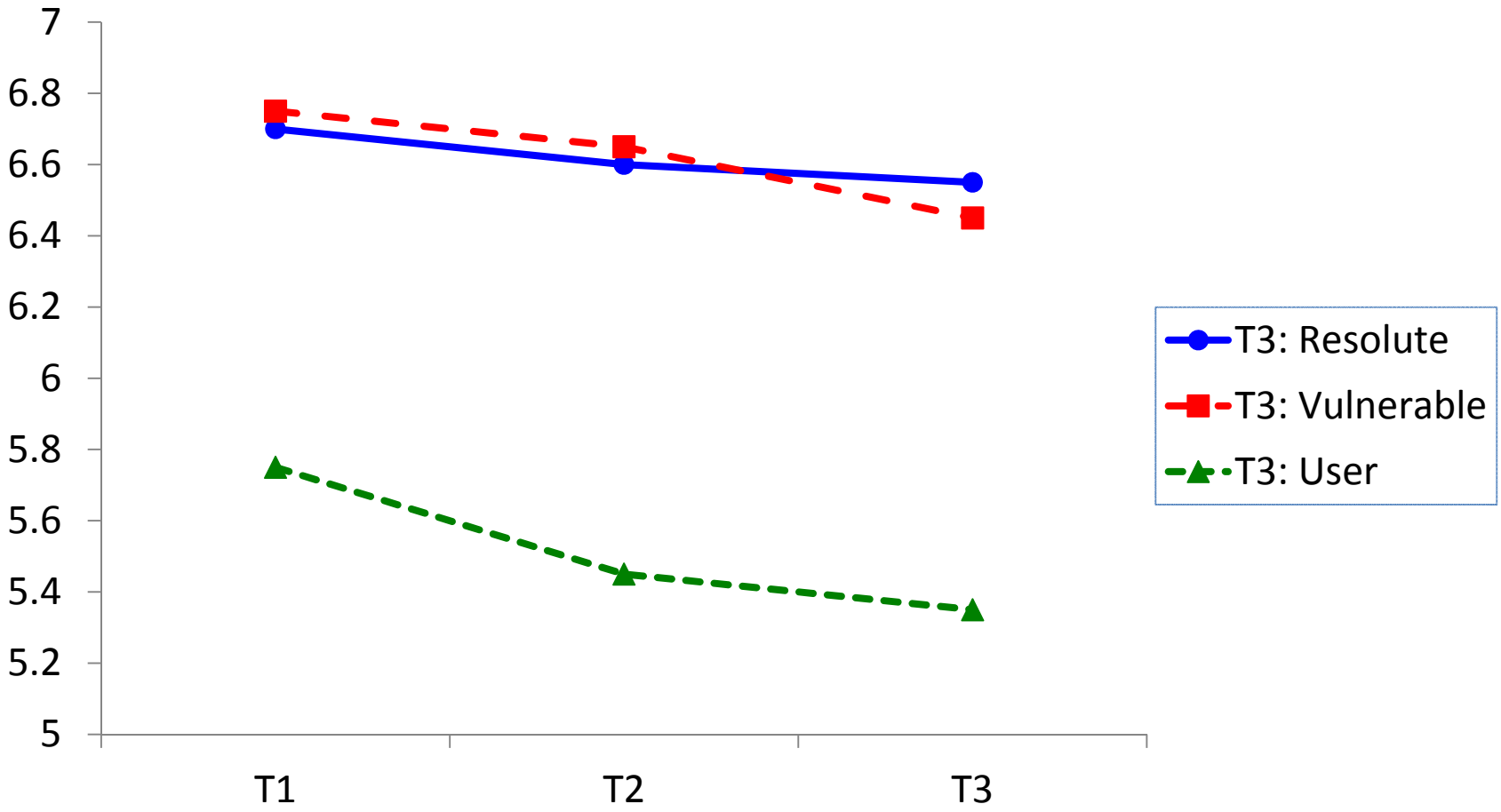
Parental Monitoring



Pattern 2: Academic performance

- The second pattern was uniquely associated with academic performance
- No statistically significant interaction of risk status with measurement period, and the only variable on which resolute and vulnerable nonusers did not differ at any time point.
- The academic achievement of respondents who remained resolutely abstinent across all measurement periods was indistinguishable from those who became vulnerable at T3
- But, academic performance of both of these groups significantly exceeded that of those who become marijuana users at T3, at every measurement period.
- These differences were apparent even at T1

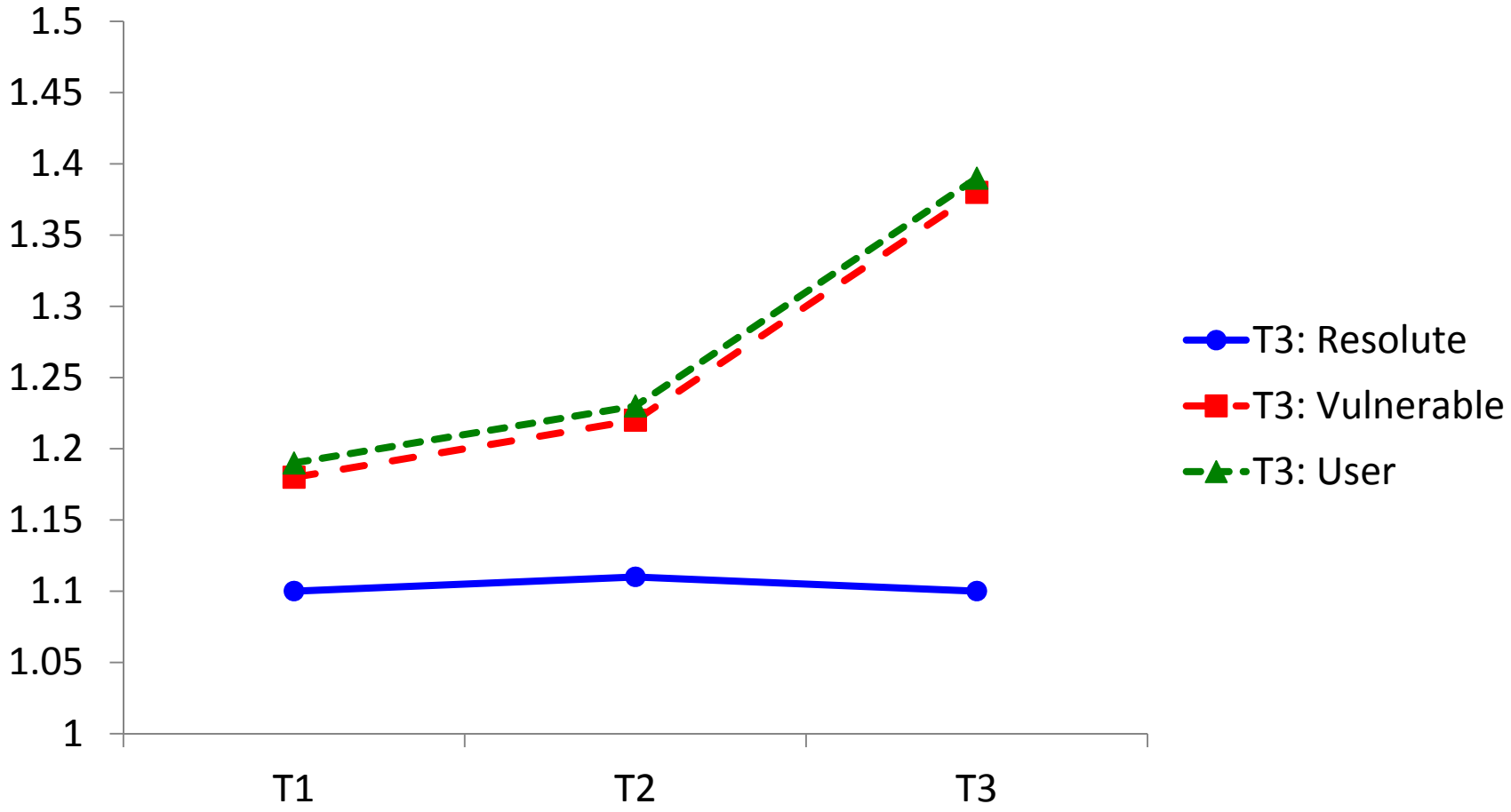
Academic Performance



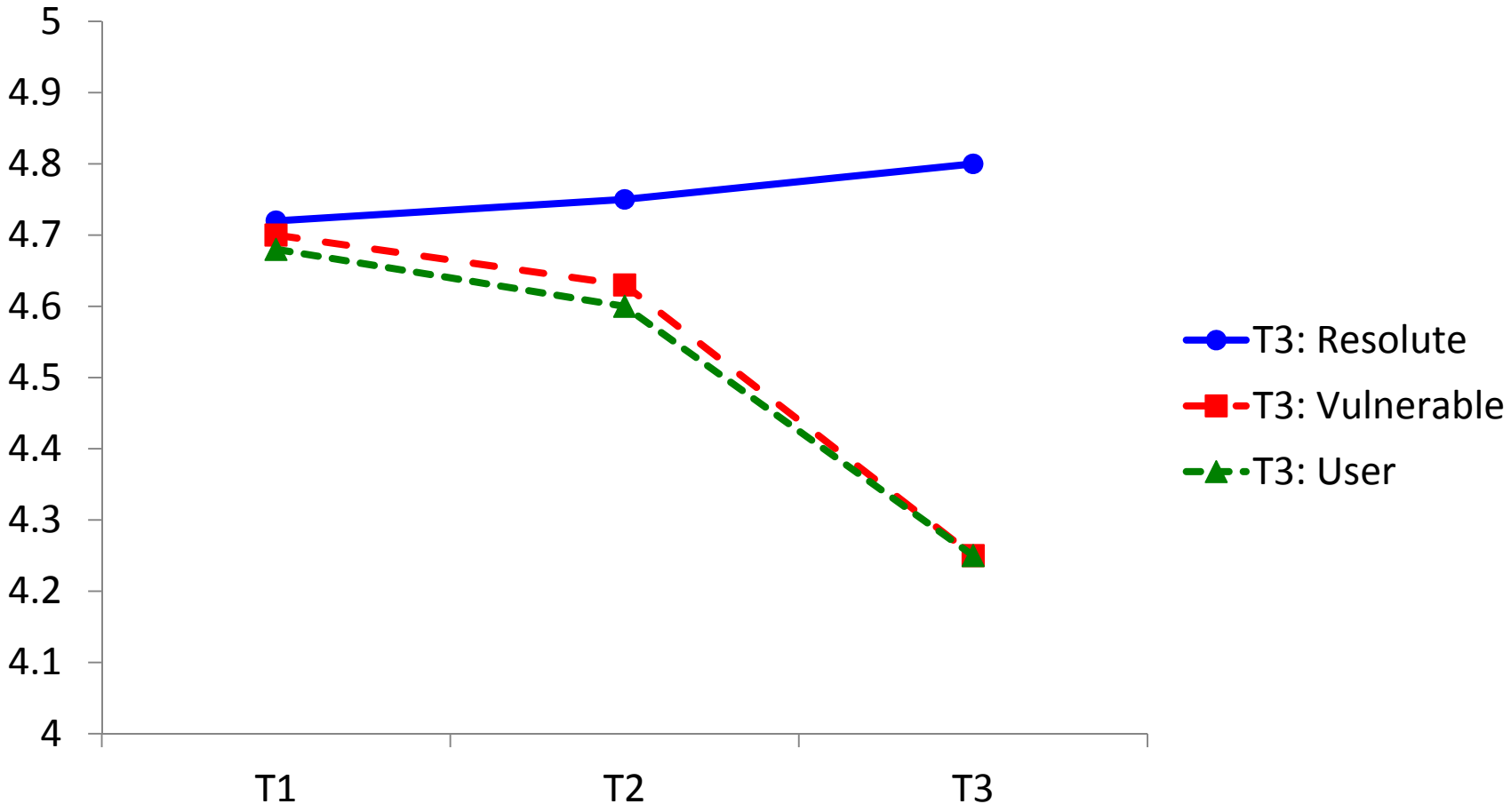
Pattern 3: Refusal Strength, Delinquency, Sensation Seeking, and Marijuana Approval

- Statistically significant differences between resolute nonusers and both users and vulnerable nonusers at T1.
- These differences between the resolute nonusers and the other two groups remained at T2
- Results suggest an association between the risk variables and future use, but the linkage is ambiguous with regard to cause, insofar as T3 vulnerable *nonusers* are almost indistinguishable from T3 *users*.

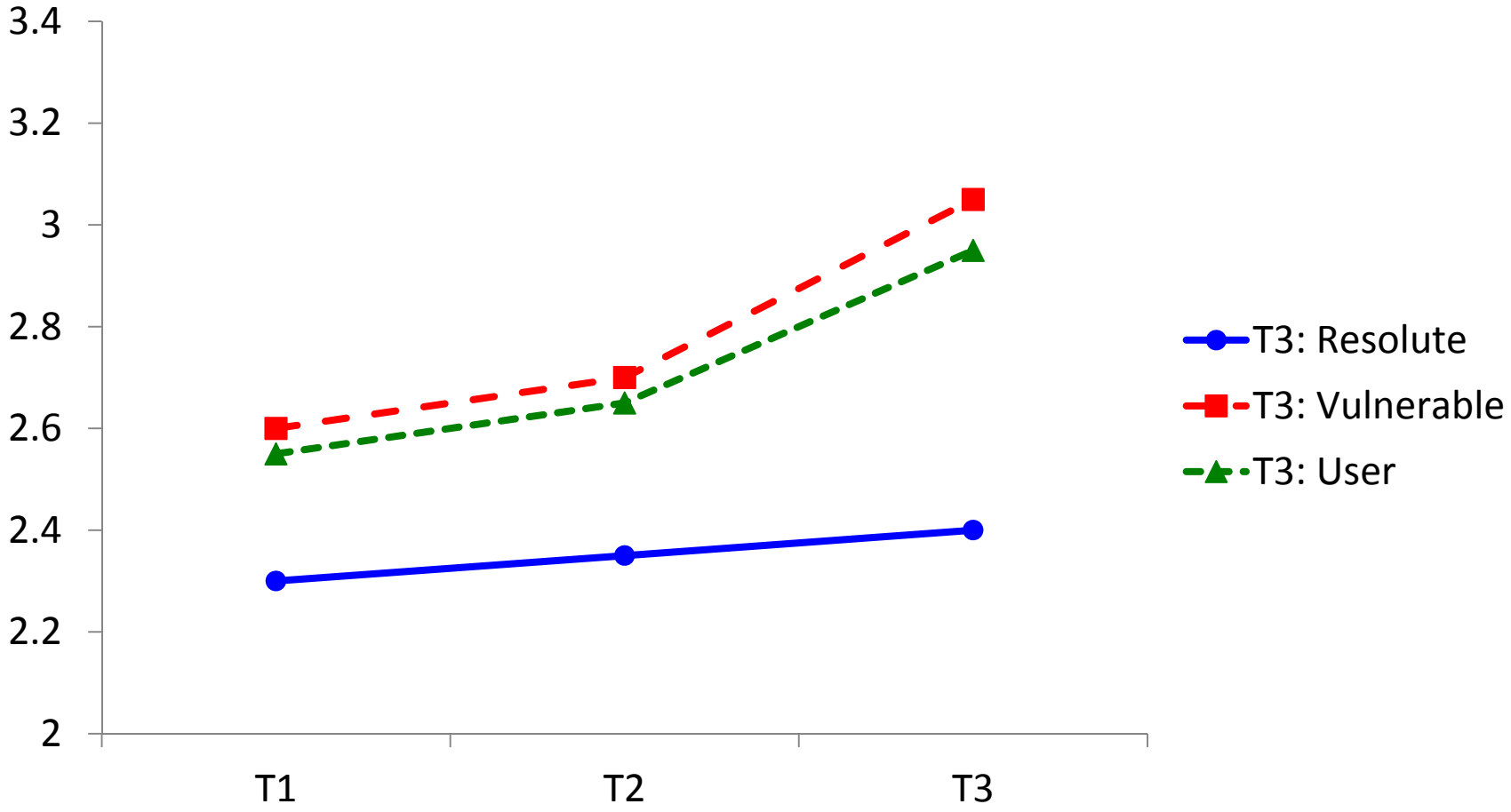
Delinquency



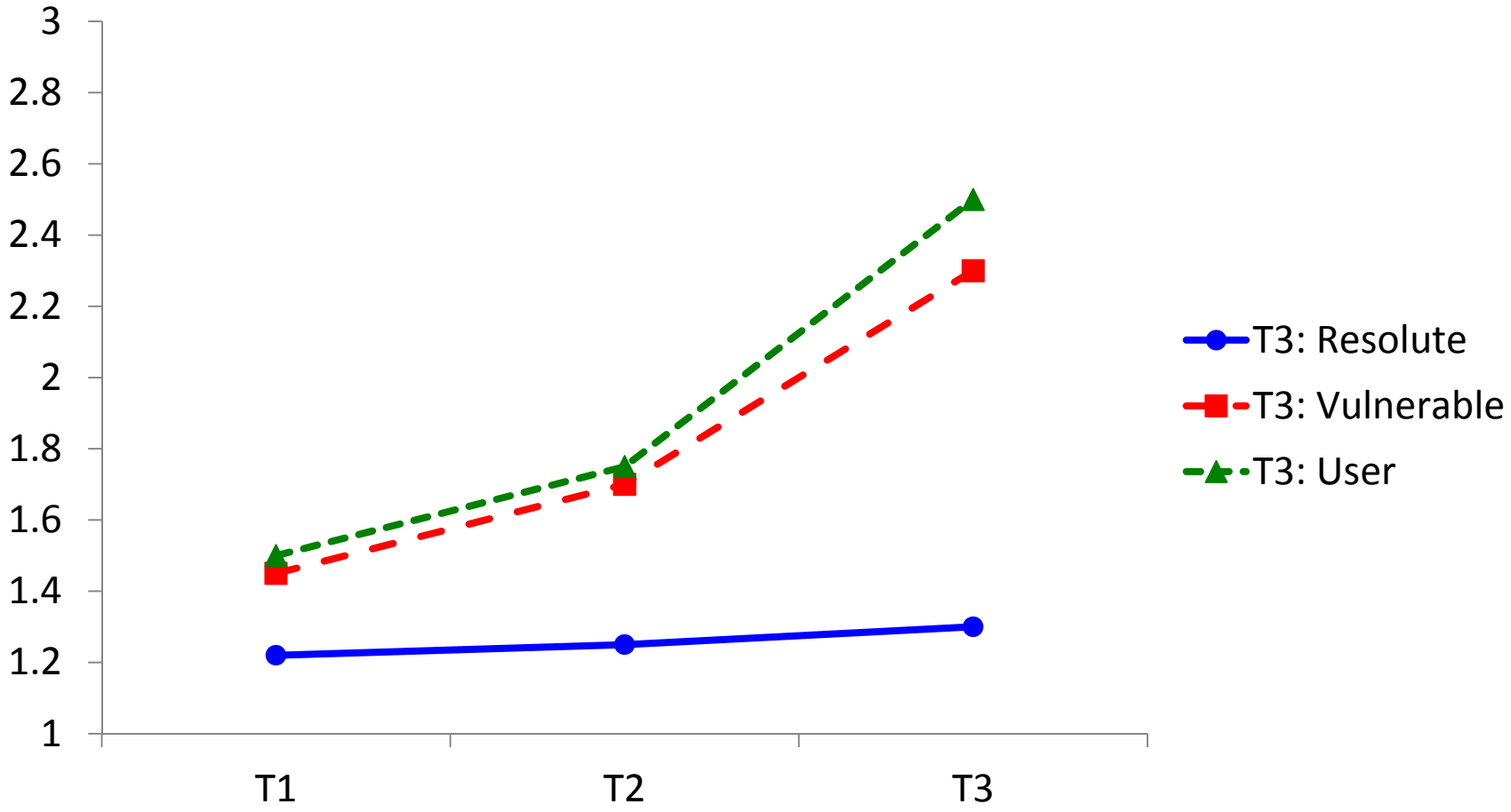
Refusal Strength



Sensation Seeking



Marijuana Approval



Some observations on Granger Causality

- Granger causality does not satisfy our usual experimentally oriented definition of cause
- Apparent causal relations it identifies may be spurious
- But, Granger's model may provide promising leads when deciding which variables are more or less likely to be associated with a given behavior (in our case, marijuana initiation)
- Also, whereas positive associations may help identify potentially useful predictors, equally important is the information drawn from the negative case, when relations between putative causal variables do *not* support even Granger's requirements.
- Such variables would appear considerably less likely to satisfy more stringent, experimentally based inferences of causation, and so in this sense, both positive and negative outcomes using this quasi-experimental approach may prove informative

Thank you for your attention