Estimating the Effect of Central Bank Independence on Inflation Using Longitudinal Targeted Maximum Likelihood Estimation

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joint work with
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Introduction

Why a further study on Central Bank Independence (CBI)?

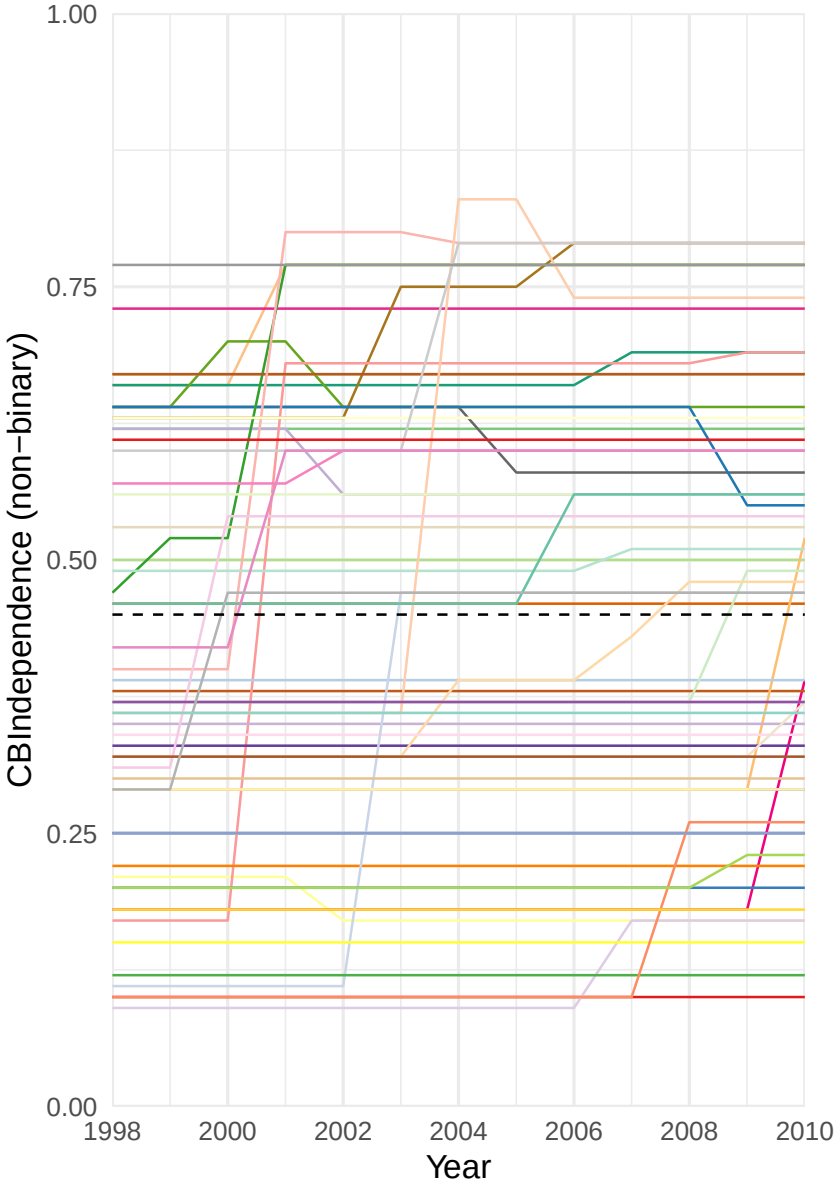
- Models in empirical studies often neglect a holistic causal framework which results in premature causal interpretation.
- Instrumental variable approaches have been proposed to tackle these problems but many authors have been unable to find strong instruments (e.g. Crowe and Meade; 2008).
- Effect estimation in practice: various practical challenges like small sample sizes, too many irrelevant covariates and too restrictive models lead to biased estimators for the causal effect.

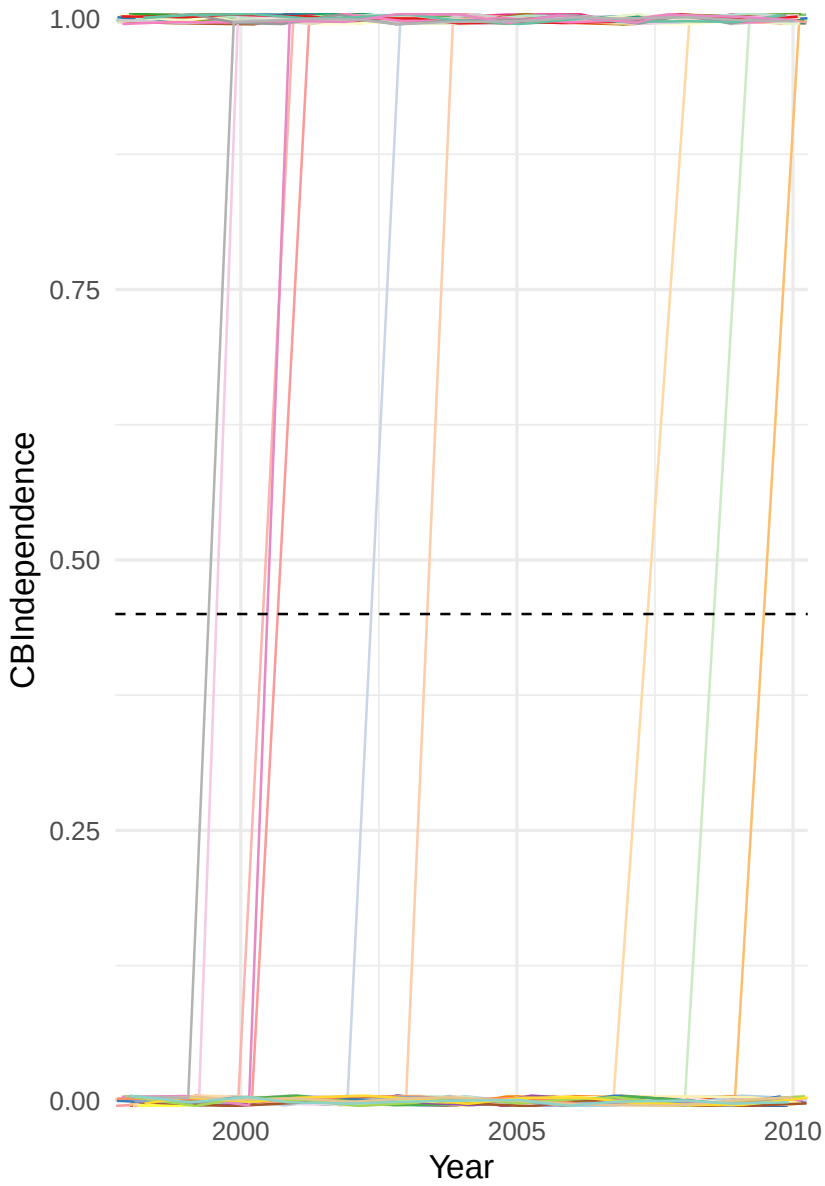
Question of our study: What (average) inflation would we observe in 10 years' time, if – from now on – each country's monetary institution had an independent central bank compared to the situation in which the central bank was not independent?

Data

- We accessed databases of the World Bank and the International Monetary Fund to collect annual data for economic, political, and institutional variables.
- Our aim was to include as many countries as possible in our analysis.
- Missing data (2.7%) lead to the use of multiple imputation.
- Finally, we obtained observations for 60 countries and 13 points in time (i.e., calendar years 1998–2010) for 19 measured variables.
- 20% of the 60 countries are low-income countries, 36% belong to the lower-middle-income category, 27% to the upper-middle-income category, and 17% belong to the high-income category.

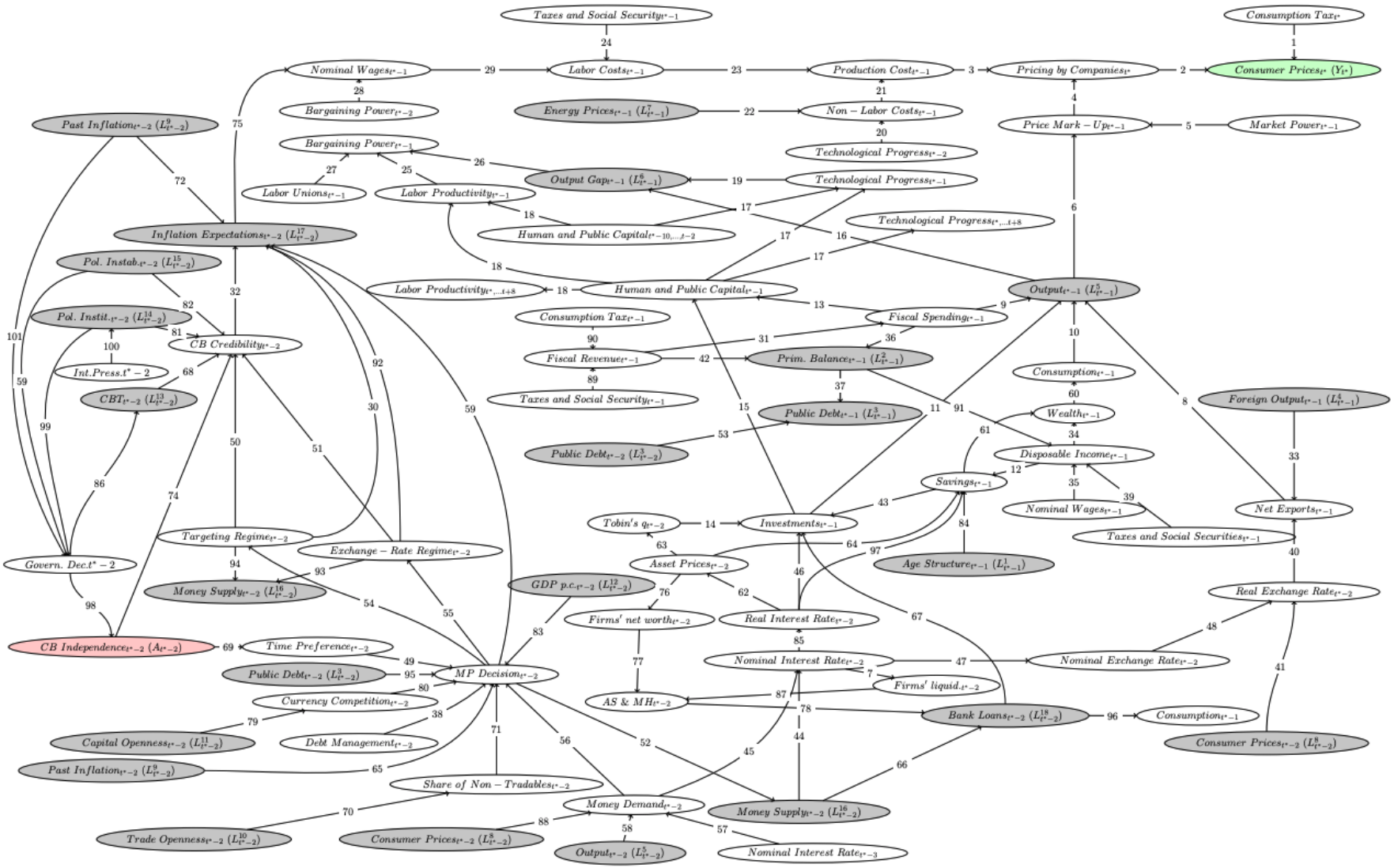
CBI Index: Dincer and Eichengreen (2014)





The Causal Analysis

The Economy as a DAG



Target Parameters

- Our target parameters are average treatment effects (ATEs)
- Three interventions. Two static and one dynamic.
  $\forall t^* \in \{1998, \ldots, 2008\}$ and $i \in \{1, \ldots, 60\}$

$\bar{d}^1_{t^*}$ = Set every CB i as "independent" for every t^*

$\bar{d}^2_{t^*}$ = Set a CB i as "independent" in t^* when inflation has exceeded 5% or was below 0% in the past seven years. Set "not independent" otherwise.

$\bar{d}^3_{t^*}$ = Set every CB i "not independent" for every t^*

$$\psi_{1,3} = \mathbb{E}(Y^{\bar{d}^1_{t^*}}_{2010}) - \mathbb{E}(Y^{\bar{d}^3_{t^*}}_{2010}), \quad (1)$$

$$\psi_{2,3} = \mathbb{E}(Y^{\bar{d}^2_{t^*}}_{2010}) - \mathbb{E}(Y^{\bar{d}^3_{t^*}}_{2010}). \quad (2)$$

Estimation Method

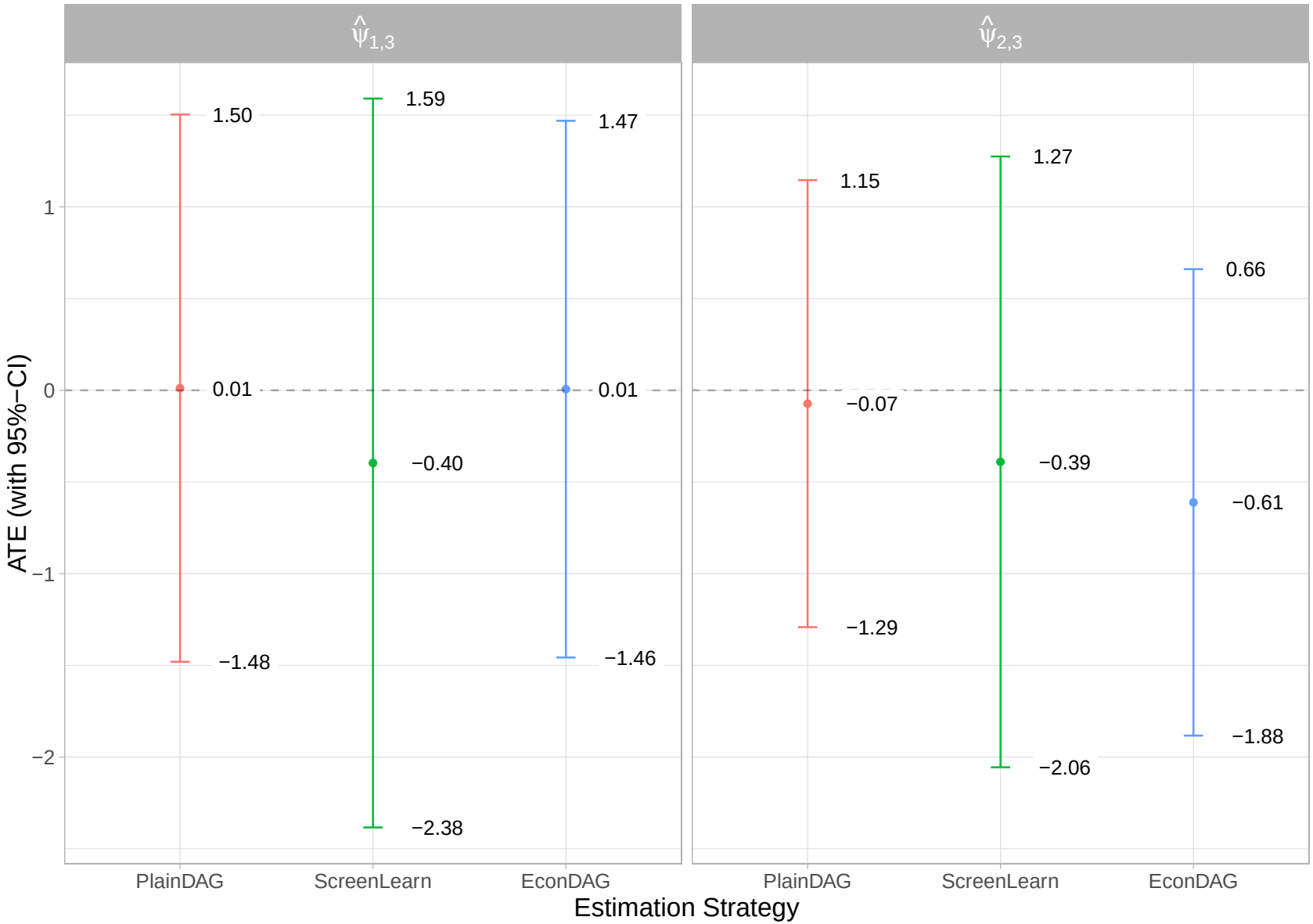
- Longitudinal Targeted Maximum Likelihood Estimation (LTMLE) has been mostly used in the field of bio statistics and epidemiology (van der Laan and Gruber; 2012).
- LTMLE is a doubly robust estimation technique that requires iteratively fitting models for the outcome and intervention mechanisms at each time point.
- LTMLE has the advantage that it can more readily incorporate **machine learning** methods while retaining valid statistical inference.
- Recent research has shown that this is important if correct model specification is difficult, such as when dealing with complex longitudinal data, potentially of small sample size, where relationships and interactions are most likely highly nonlinear and where the number of variables is large compared to the sample size (Tran et al.; 2019).

Which covariates need to be included?

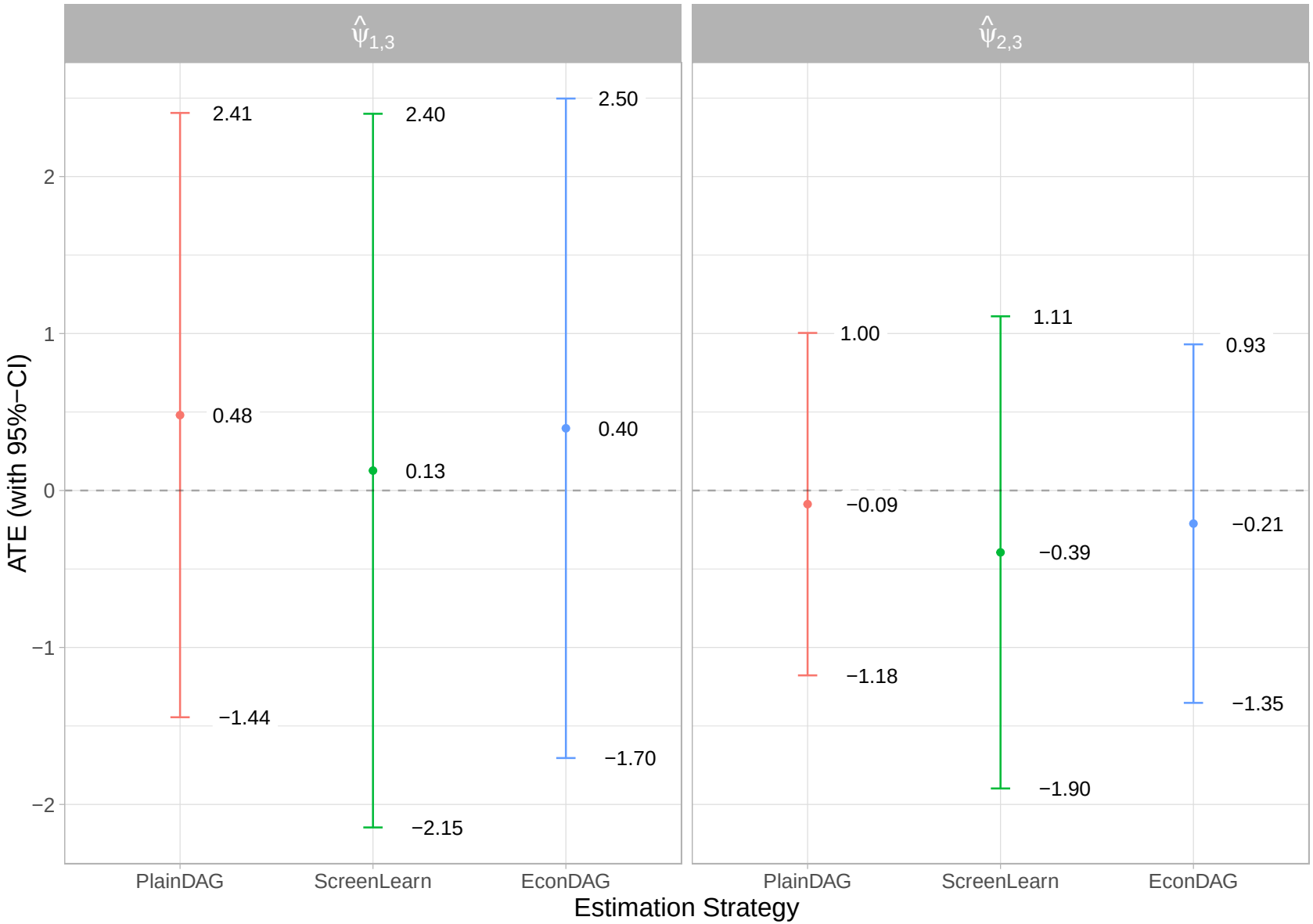
- **Main analysis – PlainDAG:** Models contain only the relevant baseline variables from 1998 that were measured prior to the first CBI intervention.
- Robustness check No. 1 – ScreenLearn: All measured variables are taken into account by the models with respect to the temporal ordering.
- Robustness check No. 2 – EconDAG: Models includes only variables that are measured during a particular 2-yearly transmission cycle, as defined by our DAG.

Results

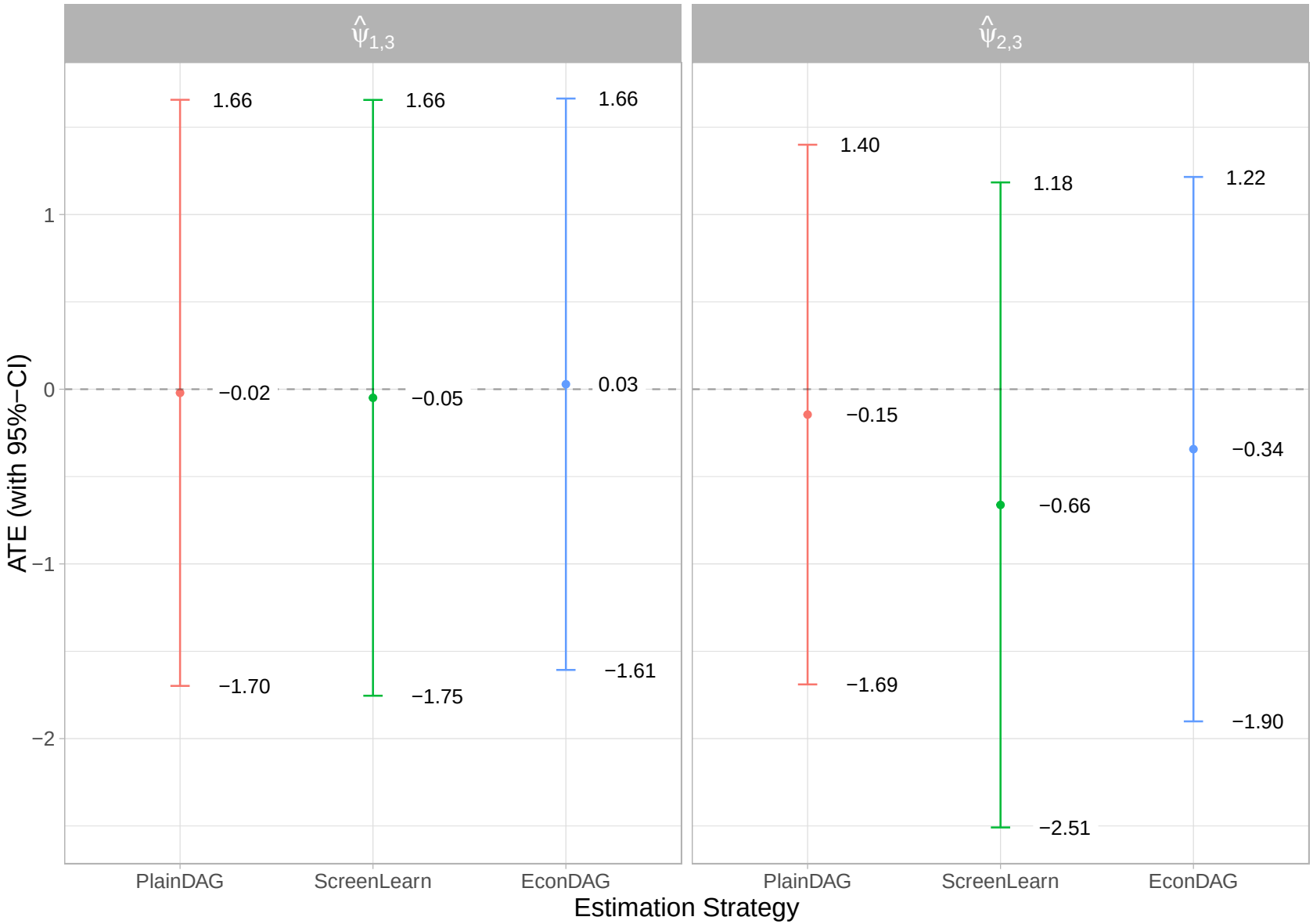
Results: Full Sample (n = 60)



Results: High income (n = 26)



Results: Low income (n = 34)



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