Effects of Health Care Policy Uncertainty on Households' Portfolio Choice

Thomas T. Wiemann
University of Chicago

Robin L. Lumsdaine
Kogod School of Business, American University;
Erasmus School of Economics, Erasmus University Rotterdam;
National Bureau of Economic Research;
Tinbergen Institute

April 4, 2023

Introduction: Health Care Policy Uncertainty (HCPU)

Health care is a central topic of policy debate in the US

- ▷ Health care reform is 2nd largest source of policy uncertainty in US (Baker et al., 2016)

Health care is a major source of household consumption expenditures

- ▷ approx. 22% of total household consumption expenditures in 2019

For HHs, HCPU is uncertainty about future spending needs

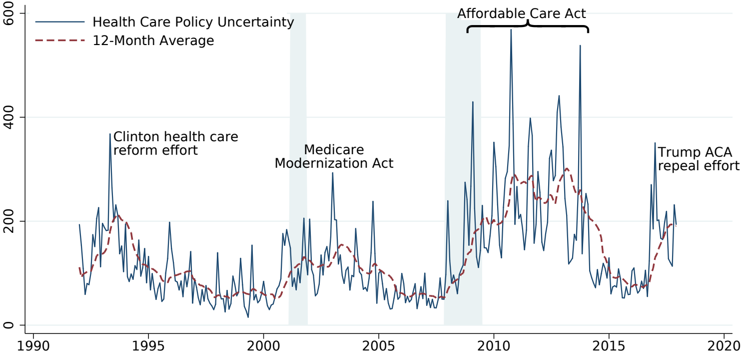
- ▷ Similar to uncertainty about future income

Empirical research question:

- ▷ Do households adjust exposure to other types of risk?
- ▷ Δ HCPU $\Rightarrow$ Δ HHs' relative demand for risky assets?

Health Care Policy Uncertainty

Figure 1: Health Care Policy Uncertainty Index 1992 – 2017



Source. Baker et al. (2016) and authors' calculations.

Key Identification Challenges

Causal identification in observational settings is difficult...

- ... especially when the variable of interest is macroeconomic

HCPU is entangled with other macro. variables (Bloom, 2014)

- Conditional independence assumptions rarely plausible

For a given period, there is no cross-sectional variation in HCPU levels

- Conventional diff-in-diff not applicable

There is no untreated group

- No evident control comparison

Econometric research question:

- Identifying the causal effect of a macro. variable on a micro. outcome

This Paper

Develops nonparametric identification approach for macro. effects

- ▷ Leverage exogenous exposure to macro. variable
- ▷ Restrict unobserved heterogeneity in direct effects of exposure

Estimates causal effects of HCPU on relative demand for risky assets

- ▷ HCPU important determinant of households' financial decisions

Related literature:

1. Shift-share designs: Adao et al. (2019); Goldsmith-Pinkham et al. (2020); Borusyak et al. (2022); ...
2. Difference-in-differences: De Chaisemartin and d'Haultfoeuille (2018); Callaway et al. (2021); ...
3. Policy uncertainty: Pástor and Veronesi (2013); Baker et al. (2016); Gulen and Ion (2016); Gábor-Tóth and Georgarakos (2019); ...

Outline

1. Identification
   - ▷ Framework
   - ▷ Point Identification of Relative Effects
   - ▷ Partial Identification of Absolute Effects
2. Empirical Results

Outline

1. **Identification**
   - **Framework**
   - Point Identification of Relative Effects
   - Partial Identification of Absolute Effects
2. Empirical Results

Causal Model

Causal model:

$$Y_{i,t} = W_t(\beta^w + \xi^w_{i,t}) + W_t Z_{i,t}(\beta^{wz} + \xi^{wz}_{i,t}) + Z_{i,t}(\beta^z + \xi^z_{i,t}) + \varepsilon_{i,t},$$

- ▷ W_t and $Z_{i,t}$ are observed determinants of $Y_{i,t}$
- ▷ $\varepsilon_{i,t}$ are other (unobserved) determinants of $Y_{i,t}$
- ▷ $(\beta^w, \beta^{wz}, \beta^z)$ are unknown *fixed* coefficients
- ▷ $(\xi^w_{i,t}, \xi^{wz}_{i,t}, \xi^z_{i,t})$ are unknown *random* coefficients

In the paper: Nonparametric potential outcomes

$$Y_{i,t}(w, z) \equiv g(w, z, U_{i,t}),$$

where $U_{i,t}$ captures unobserved determinants & unobserved heterogeneity.

Empirical Setting

Causal model:

$$Y_{i,t} = W_t(\beta^w + \xi^w_{i,t}) + W_t Z_{i,t}(\beta^{wz} + \xi^{wz}_{i,t}) + Z_{i,t}(\beta^z + \xi^z_{i,t}) + \varepsilon_{i,t},$$

Mapping $(Y_{i,t}, Z_{i,t}, W_t)$ to the data:

- i are households in the health and retirement study (HRS)
- $t \in \{1994, 1996, \ldots, 2014\}$ are HRS survey waves
- $Y_{i,t} \equiv$ share of risky (safe) assets over financial wealth
- $Z_{i,t} \equiv$ "unexpected" changes in health
- W_t is the health care policy uncertainty index of Baker et al. (2016)

Parameter Definitions

Individual causal effect of ΔW_t:

$$\begin{aligned}\Delta_{i,t}(z) &\equiv \frac{\partial}{\partial w} Y_{i,t}(w,z) \\ &= (\beta^{w} + \xi^{w}_{i,t}) + z(\beta^{wz} + \xi^{wz}_{i,t})\end{aligned}$$

Average causal effect (ACE):

$$\text{ACE} \equiv E\left[\Delta_{i,t}(Z_{i,t})\right]$$

Conditional average difference of causal effects (DCE):

$$\text{DCE}(z', z) \equiv E[\Delta_{i,t}(z')|Z_{i,t} = z'] - E[\Delta_{i,t}(z)|Z_{i,t} = z]$$

ACE and DCE are complementary:

- ▷ ACE captures the level-impact averaged across households
- ▷ DCE captures relative-impact between households

Assumptions

Four assumptions for point identification of the DCE:

A.1 Exogenous Exposure

A.2 Exogenous Heterogeneous Effects

A.3 Stationary Unobserved Heterogeneity

A.4 Common Support

Additional assumption for partial identification of the ACE:

A.5 Bounded *Conditional* Average Causal Effects

Assumption: Exogenous Exposure

Assumption 1 (Exogenous Exposure)

$E[\varepsilon_{i,t}|W_t, Z_{i,t}] = E[\varepsilon_{i,t}|W_t]$.

In words:

- $Z_{i,t}$ is as good as randomly assigned
- Could consistently estimate causal effect of $Z_{i,t}$ on $Y_{i,t}$

A.1 common in Shift-Share designs (Goldsmith-Pinkham et al., 2020)

But stronger than in difference-in-difference designs

- Paper generalizes **A.1** to "Parallel Changes" assumption

Assumption: Exogenous Exposure (Contd.)

In this paper, exposure $Z_{i,t} \equiv$ constructed health shocks

We follow literature on effects of health on portfolio choice:

- ▷ Five base health categories
  - (i) # severe health conditions
  - (ii) # nights spent in hospital
  - (iii) # ADLs and IADLs limitations
  - (iv) # limitations to mobility
  - (v) self-reported health
- ▷ Residualize w.r.t. key household characteristics & past values
- ▷ Wu (2003); Rosen and Wu (2004); Berkowitz and Qiu (2006); Edwards (2008); Coile and Milligan (2009); Love and Smith (2010); Yogo (2016)

Assumption: Exogenous Heterogeneous Effects

Details

Assumption 2 (Exogenous Heterogeneous Effects)

(i) $E[\xi^z_{i,t}|W_t, Z_{i,t}] = E[\xi^z_{i,t}|Z_{i,t}]$.

(ii) $E[\xi^{wz}_{i,t}|W_t, Z_{i,t}] = E[\xi^{wz}_{i,t}|Z_{i,t}]$.

(iii) $E[\xi^w_{i,t}|W_t, Z_{i,t}] = E[\xi^w_{i,t}|Z_{i,t}]$.

Key economic substance of **A.2** in this paper:

- ▷ Health shocks shouldn't affect responses to other macro. variables

Key concern: Recession-based economic uncertainty

- ▷ HCPU less cyclical than other types of policy uncertainty
- ▷ Data consists of HHs aged +65, most are retired

Core assumption:

- ▷ Health shocks don't affect responses to other types of PU
- ▷ E.g., Health shocks don't affect responses to *trade* policy uncertainty

Additional Assumptions

A.3 restricts shift in the distribution of unobservables:

Assumption 3 (Stationary Unobserved Heterogeneity)

$\forall z \in \operatorname{supp} Z_{i,t}$ it holds that

(i) $E[\xi^{z}_{i,t'} | Z_{i,t'} = z] = E[\xi^{z}_{i,t} | Z_{i,t} = z]$,

(ii) $E[\xi^{wz}_{i,t'} | Z_{i,t'} = z] = E[\xi^{wz}_{i,t} | Z_{i,t} = z]$,

(iii) $E[\xi^{w}_{i,t'} | Z_{i,t'} = z] = E[\xi^{w}_{i,t} | Z_{i,t} = z]$.

A.4 ensures conditional expectations are well-defined:

Assumption 4 (Common Support)

$f_{WZ}(w, z) > 0, \ \forall w \in \operatorname{supp} W_t, z \in \operatorname{supp} Z_{i,t}$.

Outline

1. **Identification**
   - Framework
   - **Point Identification of Relative Effects**
   - Partial Identification of Absolute Effects

2. Empirical Results

Point Identification of Relative Effects

Recall: $\text{DCE}(z', z) \equiv E[\Delta_{i,t}(z')|Z_{i,t} = z'] - E[\Delta_{i,t}(z)|Z_{i,t} = z]$

Theorem 1 (Point Identification of the DCE)

Let Assumptions 1 to 4 hold. Then, $\forall w', w \in \text{supp}\, W_t, z', z \in \text{supp}\, Z_{i,t}$,

$$\begin{aligned} &DCE(z', z)\big(w' - w\big) \\ &= (E[Y_{i,t'}|W_{t'} = w', Z_{i,t} = z'] - E[Y_{i,t}|W_t = w, Z_{i,t} = z']) \\ &\qquad - (E[Y_{i,t'}|W_{t'} = w', Z_{i,t} = z] - E[Y_{i,t}|W_t = w, Z_{i,t} = z]). \end{aligned}$$

Assumptions 1 to 4 are sufficient for relative effects

- ▷ Similar to difference-in-difference identifying the ATT
- ▷ But: No identification of *levels* unless $E[\Delta_{i,t}(z)|Z_{i,t} = z] = 0$

Outline

1. **Identification**
   - ▷ Framework
   - ▷ Point Identification of Relative Effects
   - ▷ **Partial Identification of Absolute Effects**
2. Empirical Results

Partial Identification of Absolute Effects

Second identification result based on simple insight:

$$\begin{aligned} E\left[\mathrm{DCE}(Z_{i,t}, z)\right] &= E\left[\Delta_{i,t}(Z_{i,t})\right] - E\left[\Delta_{i,t}(z) | Z_{i,t} = z\right] \\ &= \mathrm{ACE} - \mathrm{CATE}(z) \end{aligned}$$

- ▷ No identification of levels b/c $\mathrm{CATE}(z)$ is unrestricted

Is such conservativeness for $\mathrm{CATE}(z)$ always necessary?

- ▷ Better: Are all values of $\mathrm{CATE}(z)$ consistent with economic theory?

In this paper: Sign restrictions motivated by theory on *background risk*

- ▷ When faced with an undiversifiable risk, *risk averse* agents decrease their exposure to other types of risk (Pratt and Zeckhauser, 1987; Kimball, 1993; Gollier and Pratt, 1996)
- ▷ Here: HHs never increase their exposure to rate-of-return risk

$$\mathrm{CATE}(z) \leq 0, \ \forall z \in \operatorname{supp} Z_{i,t}$$

Partial Identification of Absolute Effects (Contd.)

Theorem 2 translates bounds of CATE(z) to bounds of the ACE:

Theorem 2 (Partial Identification of the ACE)

Let Assumptions 1 to 4 hold. If $CATE(z) \leq 0, \forall z \in \operatorname{supp} Z_{i,t}$, *then*

$$ACE \leq \min_{z \in \operatorname{supp} Z_{i,t}} E\left[DCE(Z_{i,t}, z)\right].$$

Note: Knowledge of CATE(z) for some z implies point identification

When is Theorem 2 useful?

Outline

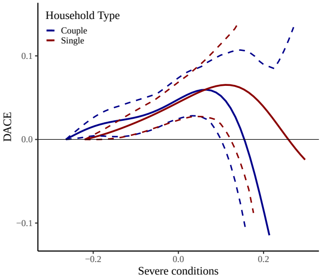
1. Identification
   - ▷ Framework
   - ▷ Point Identification of Relative Effects
   - ▷ Partial Identification of Absolute Effects

2. **Empirical Results**

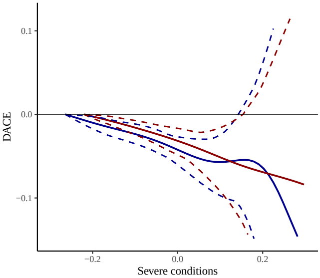
Results: DCE Estimates (Severe Conditions)

Construct parameter estimates via kernel methods. Estimation details.

Figure 2: Normalized DCE Estimates for Couple and Single Households



(a) Safe asset share

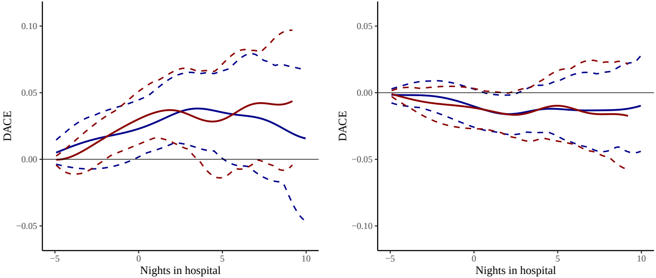


(b) Risky asset share

Notes. Estimates are relative to the baseline of households that are in substantially better health than expected, defined here as having a more favorable unexpected change in the corresponding health category than 95% of households in the sample.

Results: DCE Estimates (Nights in Hospital)

Figure 4: Normalized DCE Estimates for Couple and Single Households



(a) Safe asset share (b) Risky asset share

Results: ACE-Bound Estimates

Table 1: Bounds on the Average Causal Effect

Safe Asset Share		Risky Asset Share	
Couples (1)	Singles (2)	Couples (3)	Singles (4)
0.051	0.039	-0.022	-0.033
[0.015, 1]	[0.012, 1]	[-1, 0.005]	[-1, -0.013]

Notes. Brackets contain 95% confidence intervals.

- ▷ 70% increase in HCPU ⇒ singles decrease risky assets by 2.3pp
- ▷ 70% increase in HCPU akin to substantive reduction in health (Rosen and Wu, 2004; Edwards, 2008; Love and Smith, 2010)

Conclusion

Nonparametric identification of macro. variable effect on micro. outcome

- ▷ Settings with unknown exposure differences
- ▷ Settings without a non-treated group

Policy uncertainty key source of uncertainty households face

- ▷ Provide flexible identification and estimation framework

Empirical analysis of effects of HCPU

- ▷ Health shocks induce heterogeneous responses to HCPU
- ▷ HCPU causes HHs to substantially reduce rate-of-return risk

References I

Adao, R., Kolesár, M., and Morales, E. (2019). Shift-share designs: Theory and inference. *Quarterly Journal of Economics*, 134(4):1949–2010.

Atella, V., Brunetti, M., and Maestas, N. (2012). Household portfolio choices, health status and health care systems: A cross-country analysis based on SHARE. *Journal of Banking & Finance*, 36(5):1320–1335.

Athey, S., Tibshirani, J., and Wager, S. (2019). Generalized random forests. *The Annals of Statistics*, 47(2):1148–1178.

Baker, S. R., Bloom, N., and Davis, S. J. (2016). Measuring economic policy uncertainty. *Quarterly Journal of Economics*, 131(4):1593–1636.

Berkowitz, M. K. and Qiu, J. (2006). A further look at household portfolio choice and health status. *Journal of Banking & Finance*, 30(4):1201–1217.

Bloom, N. (2014). Fluctuations in uncertainty. *Journal of Economic Perspectives*, 28(2):153–76.

References II

Borusyak, K., Hull, P., and Jaravel, X. (2022). Quasi-experimental shift-share research designs. *Review of Economic Studies*, 89(1):181–213.

Callaway, B., Goodman-Bacon, A., and Sant'Anna, P. H. (2021). Difference-in-differences with a continuous treatment. *Working paper arXiv:2107.02637*.

Coile, C. and Milligan, K. (2009). How household portfolios evolve after retirement: The effect of aging and health shocks. *Review of Income and Wealth*, 55(2):226–248.

De Chaisemartin, C. and d'Haultfoeuille, X. (2018). Fuzzy differences-in-differences. *Review of Economic Studies*, 85(2):999–1028.

Edwards, R. D. (2008). Health risk and portfolio choice. *Journal of Business & Economic Statistics*, 26(4):472–485.

Gábor-Tóth, E. and Georgarakos, D. (2019). Economic policy uncertainty and stock market participation. Center for Financial Studies Working Paper No 590.

References III

Goldsmith-Pinkham, P., Sorkin, I., and Swift, H. (2020). Bartik instruments: What, when, why, and how. *American Economic Review*, 110(8):2586–2624.

Gollier, C. and Pratt, J. W. (1996). Risk vulnerability and the tempering effect of background risk. *Econometrica*, 64(5):1109–1123.

Gulen, H. and Ion, M. (2016). Policy uncertainty and corporate investment. *The Review of Financial Studies*, 29(3):523–564.

Hastie, T. and Tibshirani, R. (1993). Varying-coefficient models. *Journal of the Royal Statistical Society: Series B*, 55(4):757–779.

Kimball, M. S. (1993). Standard risk aversion. *Econometrica*, 61(3):589–611.

Love, D. A. and Smith, P. A. (2010). Does health affect portfolio choice? *Health Economics*, 19(12):1441–1460.

Pástor, L. and Veronesi, P. (2013). Political uncertainty and risk premia. *Journal of Financial Economics*, 110(3):520–545.

Pratt, J. W. and Zeckhauser, R. J. (1987). Proper risk aversion. *Econometrica*, 55(1):143–154.

References IV

Rosen, H. S. and Wu, S. (2004). Portfolio choice and health status. *Journal of Financial Economics*, 72(3):457–484.

Smith, J. P. (1999). Healthy bodies and thick wallets: The dual relation between health and economic status. *Journal of Economic Perspectives*, 13(2):145–166.

Wu, S. (2003). The effects of health events on the economic status of married couples. *Journal of Human Resources*, 38(1):219–230.

Yogo, M. (2016). Portfolio choice in retirement: Health risk and the demand for annuities, housing, and risky assets. *Journal of Monetary Economics*, 80:17–34.

Assumption: Exogenous Heterogeneous Effects (Details)

back

A.2 restricts unobserved heterogeneity in the effects of W_t and $Z_{i,t}$:

(i) imposes exogenous direct effects of exposure $Z_{i,t}$
  - ▷ Effect of $Z_{i,t}$ should not be mediated by correlates of W_t

(ii) imposes exogenous indirect effects of exposure $Z_{i,t}$
  - ▷ Effect of correlates of W_t should not be mediated by $Z_{i,t}$

(iii) imposes constant effects of W_t given $Z_{i,t}$
  - ▷ Used here for convience, see paper for generalization

When is Theorem 2 useful?

back

Note even without our approach:

$$\text{CATE}(z) \leq 0, \ \forall z \in \text{supp}\, Z_{i,t} \quad \Rightarrow \quad ACE \geq 0$$

The usefulness of our approach thus depends on deviation from zero of

$$\min_{z \in \text{supp}\, Z_{i,t}} E\left[\text{DCE}(Z_{i,t}, z)\right]$$

Difference from zero crucially depends on the relevance of $Z_{i,t}$:

- ▷ If $\text{CATE}(z') - \text{CATE}(z) = 0$, bound is 0
- ▷ Greater heterogeneity w.r.t. $Z_{i,t}$ $\Rightarrow$ more informative bound

Choice of a relevant $Z_{i,t}$ is therefore important

- ▷ But: No "weak IV" zero-denominator issues for irrelevant $Z_{i,t}$

When is Theorem 2 useful? (Contd.)

back

Can we expect $Z_{i,t} \equiv$ health shocks to be sufficiently relevant?

Key mechanisms through which health shocks affect responses to HCPU

- Worse health $\Rightarrow$ higher expenditure risk induced by HCPU
- *Much* worse health $\Rightarrow$ lower lifespan & consumption utility
- See, e.g., Smith (1999); Atella et al. (2012)

Likely rich heterogeneity in the responses to HCPU w.r.t. health shocks

Estimation

back

We estimate the model parameters via

$$Y_{i,t} = \beta_w(Z_{i,t})W_t + \beta_z(Z_{i,t}) + \varepsilon_{i,t}$$

- Varying coefficient model (Hastie and Tibshirani, 1993)
- Computation via LLR and GRF of Athey et al. (2019)

Construct parameter estimates via

$$\widehat{DCE}(z', z) = \hat{\beta}_w(z') - \hat{\beta}_w(z)$$

and

$$\widehat{ACE} = \frac{1}{NT}\sum_{i,t} \hat{\beta}_w(Z_{i,t}) - \hat{\beta}_w(\tilde{z}),$$

for *a priori* determined value $\tilde{z} \in \operatorname{supp} Z_{i,t}$

Intuition: Equal bias in regressions of $Y_{i,t}$ on W_t for different values $Z_{i,t}$