

# Welfare and Spending Effects of Consumption Stimulus Policies

Christopher D. Carroll (JHU) Edmund Crawley (FED) William Du (JHU)  
Ivan Frankovic (BBK) Håkon Tretvoll (SSB)

4th Annual LAEF Conference  
Vanderbilt University

2025-04-04

Powered By



Viewpoints and conclusions stated in this paper are the responsibility of the authors alone and do not necessarily reflect the viewpoints of The Federal Reserve Board or The Deutsche Bundesbank.

## Motivation

- ▶ Fiscal policies that aim to boost consumption spending in recessions have been tried in many countries in recent decades

## Motivation

- ▶ Fiscal policies that aim to boost consumption spending in recessions have been tried in many countries in recent decades
- ▶ A lot of variation in such policies — may be due to little guidance from traditional macroeconomic models on which policies most effectively...

## Motivation

- ▶ Fiscal policies that aim to boost consumption spending in recessions have been tried in many countries in recent decades
- ▶ A lot of variation in such policies — may be due to little guidance from traditional macroeconomic models on which policies most effectively...
  - ▶ increase output (a 'GDP metric')

## Motivation

- ▶ Fiscal policies that aim to boost consumption spending in recessions have been tried in many countries in recent decades
- ▶ A lot of variation in such policies — may be due to little guidance from traditional macroeconomic models on which policies most effectively...
  - ▶ increase output (a ‘GDP metric’)
  - ▶ reduce misery (a ‘welfare metric’)

## Motivation

- ▶ Fiscal policies that aim to boost consumption spending in recessions have been tried in many countries in recent decades
- ▶ A lot of variation in such policies — may be due to little guidance from traditional macroeconomic models on which policies most effectively...
  - ▶ increase output (a ‘GDP metric’)
  - ▶ reduce misery (a ‘welfare metric’)
- ▶ Development of heterogeneous agent (HA) models shows that when heterogeneity (in e.g. wealth, income and/or education) is taken into account, the impact of income shocks depends on *intertemporal marginal propensity to consume* or iMPC

## Motivation

- ▶ Fiscal policies that aim to boost consumption spending in recessions have been tried in many countries in recent decades
- ▶ A lot of variation in such policies — may be due to little guidance from traditional macroeconomic models on which policies most effectively...
  - ▶ increase output (a ‘GDP metric’)
  - ▶ reduce misery (a ‘welfare metric’)
- ▶ Development of heterogeneous agent (HA) models shows that when heterogeneity (in e.g. wealth, income and/or education) is taken into account, the impact of income shocks depends on *intertemporal marginal propensity to consume* or iMPC
- ▶ In addition, availability of rich micro data (e.g. in Norway) provide first credible measures of the iMPC

## Motivation

- ▶ Fiscal policies that aim to boost consumption spending in recessions have been tried in many countries in recent decades
- ▶ A lot of variation in such policies — may be due to little guidance from traditional macroeconomic models on which policies most effectively...
  - ▶ increase output (a ‘GDP metric’)
  - ▶ reduce misery (a ‘welfare metric’)
- ▶ Development of heterogeneous agent (HA) models shows that when heterogeneity (in e.g. wealth, income and/or education) is taken into account, the impact of income shocks depends on *intertemporal marginal propensity to consume* or iMPC
- ▶ In addition, availability of rich micro data (e.g. in Norway) provide first credible measures of the iMPC
- ▶ **This paper:** Aim to evaluate three consumption stimulus policies in a HA model consistent with data on liquid wealth and *intertemporal* MPCs

## Related literature

- ▶ **Effects of transitory income shocks:** Parker, Souleles, Johnson and McClelland (2013); Broda and Parker (2014); Fagereng, Holm and Natvik (2021); Ganong, Greig, Noel, Sullivan and Vavra (2022)

## Related literature

- ▶ **Effects of transitory income shocks:** Parker, Souleles, Johnson and McClelland (2013); Broda and Parker (2014); Fagereng, Holm and Natvik (2021); Ganong, Greig, Noel, Sullivan and Vavra (2022)
- ▶ **HA models consistent with high MPCs:** Kaplan and Violante (2014); Auclert, Rognlie and Straub (2018); Carroll, Crawley, Slacalek and White (2020); Kaplan and Violante (2022)

## Related literature

- ▶ **Effects of transitory income shocks:** Parker, Souleles, Johnson and McClelland (2013); Broda and Parker (2014); Fagereng, Holm and Natvik (2021); Ganong, Greig, Noel, Sullivan and Vavra (2022)
- ▶ **HA models consistent with high MPCs:** Kaplan and Violante (2014); Auclert, Rognlie and Straub (2018); Carroll, Crawley, Slacalek and White (2020); Kaplan and Violante (2022)
- ▶ **State dependent multipliers (ZLB):** Christiano, Eichenbaum and Rebelo (2011); Eggertson (2011); Ramey and Zubairy (2018); Hagedorn, Manovskii and Mitman (2019)

## Related literature

- ▶ **Effects of transitory income shocks:** Parker, Souleles, Johnson and McClelland (2013); Broda and Parker (2014); Fagereng, Holm and Natvik (2021); Ganong, Greig, Noel, Sullivan and Vavra (2022)
- ▶ **HA models consistent with high MPCs:** Kaplan and Violante (2014); Auclert, Rognlie and Straub (2018); Carroll, Crawley, Slacalek and White (2020); Kaplan and Violante (2022)
- ▶ **State dependent multipliers (ZLB):** Christiano, Eichenbaum and Rebelo (2011); Eggertson (2011); Ramey and Zubairy (2018); Hagedorn, Manovskii and Mitman (2019)
- ▶ **Extended unemployment insurance:** Ganong, Greig, Noel, Sullivan and Vavra (2022); Kekre (2022)

## Related literature

- ▶ **Effects of transitory income shocks:** Parker, Souleles, Johnson and McClelland (2013); Broda and Parker (2014); Fagereng, Holm and Natvik (2021); Ganong, Greig, Noel, Sullivan and Vavra (2022)
- ▶ **HA models consistent with high MPCs:** Kaplan and Violante (2014); Auclert, Rognlie and Straub (2018); Carroll, Crawley, Slacalek and White (2020); Kaplan and Violante (2022)
- ▶ **State dependent multipliers (ZLB):** Christiano, Eichenbaum and Rebelo (2011); Eggertson (2011); Ramey and Zubairy (2018); Hagedorn, Manovskii and Mitman (2019)
- ▶ **Extended unemployment insurance:** Ganong, Greig, Noel, Sullivan and Vavra (2022); Kekre (2022)
- ▶ **Welfare measures in HA models:** Bhandari, Evans, Golosov and Sargent (2021); Dávila and Schaab (2022)

## Related literature

- ▶ **Effects of transitory income shocks:** Parker, Souleles, Johnson and McClelland (2013); Broda and Parker (2014); Fagereng, Holm and Natvik (2021); Ganong, Greig, Noel, Sullivan and Vavra (2022)
- ▶ **HA models consistent with high MPCs:** Kaplan and Violante (2014); Auclert, Rognlie and Straub (2018); Carroll, Crawley, Slacalek and White (2020); Kaplan and Violante (2022)
- ▶ **State dependent multipliers (ZLB):** Christiano, Eichenbaum and Rebelo (2011); Eggertson (2011); Ramey and Zubairy (2018); Hagedorn, Manovskii and Mitman (2019)
- ▶ **Extended unemployment insurance:** Ganong, Greig, Noel, Sullivan and Vavra (2022); Kekre (2022)
- ▶ **Welfare measures in HA models:** Bhandari, Evans, Golosov and Sargent (2021); Dávila and Schaab (2022)
- ▶ **High MPCs and impatience:** Parker (2017)

# Quantitative Economics

- ▶ These are *quantitative* questions: require *quantitative* realism ...

# Quantitative Economics

- ▶ These are *quantitative* questions: require *quantitative* realism ...
- ▶ ... about the differences that make a difference

# Quantitative Economics

- ▶ These are *quantitative* questions: require *quantitative* realism ...
- ▶ ... about the differences that make a difference
  - ▶ UI benefits (normally last 2 quarter)

# Quantitative Economics

- ▶ These are *quantitative* questions: require *quantitative* realism ...
- ▶ ... about the differences that make a difference
  - ▶ UI benefits (normally last 2 quarter)
    - ▶ not forever as conveniently assumed in many models

# Quantitative Economics

- ▶ These are *quantitative* questions: require *quantitative* realism ...
- ▶ ... about the differences that make a difference
  - ▶ UI benefits (normally last 2 quarter)
    - ▶ not forever as conveniently assumed in many models
  - ▶ Distributions of income, wealth

# Quantitative Economics

- ▶ These are *quantitative* questions: require *quantitative* realism ...
- ▶ ... about the differences that make a difference
  - ▶ UI benefits (normally last 2 quarter)
    - ▶ not forever as conveniently assumed in many models
  - ▶ Distributions of income, wealth
    - ▶ Profoundly important for (i)MPCs

# Quantitative Economics

- ▶ These are *quantitative* questions: require *quantitative* realism ...
- ▶ ... about the differences that make a difference
  - ▶ UI benefits (normally last 2 quarter)
    - ▶ not forever as conveniently assumed in many models
  - ▶ Distributions of income, wealth
    - ▶ Profoundly important for (i)MPCs
  - ▶ Differences in unemployment risks

# Quantitative Economics

- ▶ These are *quantitative* questions: require *quantitative* realism ...
- ▶ ... about the differences that make a difference
  - ▶ UI benefits (normally last 2 quarter)
    - ▶ not forever as conveniently assumed in many models
  - ▶ Distributions of income, wealth
    - ▶ Profoundly important for (i)MPCs
  - ▶ Differences in unemployment risks
  - ▶ Heterogeneity in income growth rates

# Quantitative Economics

- ▶ These are *quantitative* questions: require *quantitative* realism ...
- ▶ ... about the differences that make a difference
  - ▶ UI benefits (normally last 2 quarter)
    - ▶ not forever as conveniently assumed in many models
  - ▶ Distributions of income, wealth
    - ▶ Profoundly important for (i)MPCs
  - ▶ Differences in unemployment risks
  - ▶ Heterogeneity in income growth rates
- ▶ Interested in multipliers, but baseline is NOT a HANK model:

# Quantitative Economics

- ▶ These are *quantitative* questions: require *quantitative* realism ...
- ▶ ... about the differences that make a difference
  - ▶ UI benefits (normally last 2 quarter)
    - ▶ not forever as conveniently assumed in many models
  - ▶ Distributions of income, wealth
    - ▶ Profoundly important for (i)MPCs
  - ▶ Differences in unemployment risks
  - ▶ Heterogeneity in income growth rates
- ▶ Interested in multipliers, but baseline is NOT a HANK model:
  - ▶ HANK mechanisms behind multipliers are complex

# Quantitative Economics

- ▶ These are *quantitative* questions: require *quantitative* realism ...
- ▶ ... about the differences that make a difference
  - ▶ UI benefits (normally last 2 quarter)
    - ▶ not forever as conveniently assumed in many models
  - ▶ Distributions of income, wealth
    - ▶ Profoundly important for (i)MPCs
  - ▶ Differences in unemployment risks
  - ▶ Heterogeneity in income growth rates
- ▶ Interested in multipliers, but baseline is NOT a HANK model:
  - ▶ HANK mechanisms behind multipliers are complex
  - ▶ Away from ZLB, multipliers not necessarily much different in recessions

# Quantitative Economics

- ▶ These are *quantitative* questions: require *quantitative* realism ...
- ▶ ... about the differences that make a difference
  - ▶ UI benefits (normally last 2 quarter)
    - ▶ not forever as conveniently assumed in many models
  - ▶ Distributions of income, wealth
    - ▶ Profoundly important for (i)MPCs
  - ▶ Differences in unemployment risks
  - ▶ Heterogeneity in income growth rates
- ▶ Interested in multipliers, but baseline is NOT a HANK model:
  - ▶ HANK mechanisms behind multipliers are complex
  - ▶ Away from ZLB, multipliers not necessarily much different in recessions
- ▶ Robustness Exercise: HANK model

# Quantitative Micro Realism

- ▶ Idiosyncratic income process: Friedman/Muth (transitory and permanent shocks)

$\mathbf{p}$  – ‘permanent income’

$\xi$  – ‘transitory income shock’

$\psi$  – ‘permanent income shock’

$$\mathbf{p}_{t+1} = \Gamma^e \mathbf{p}_t \psi_{t+1}$$

$$y_{t+1} = \mathbf{p}_{t+1} \xi_{t+1}$$

- ▶  $\Gamma^e$ : education-specific income growth
- ▶ Evidence for permanent shocks: See Crawley, Holm, and Tretvoll (2024)

## Preferences, Beliefs, and Wealth

Infinite horizon model: target wealth depends on 'Growth Impatience' condition:

$$\underbrace{\left( \frac{(R \beta^e)^{1/\gamma}}{\Gamma^e \mathbb{E}[\psi^{-1}]} \right)}_{\text{'Growth Patience Factor'}} < 1 \quad (1)$$

## Preferences, Beliefs, and Wealth

Infinite horizon model: target wealth depends on 'Growth Impatience' condition:

$$\underbrace{\left( \frac{(R \beta^{e,i})^{1/\gamma}}{\Gamma^e \mathbb{E}[\psi^{-1}]} \right)}_{\text{'Growth Patience Factor'}} < 1 \quad (1)$$

Degree of impatience (1-GPF) determines size of target

- If everybody has same GPF, then target wealth is identical

## Preferences, Beliefs, and Wealth

Infinite horizon model: target wealth depends on 'Growth Impatience' condition:

$$\underbrace{\left( \frac{(R \beta^{e,i})^{1/\gamma}}{\Gamma^e \mathbb{E}[\psi^{-1}]} \right)}_{\text{'Growth Patience Factor'}} < 1 \quad (1)$$

Degree of impatience (1-GPF) determines size of target

- ▶ If everybody has same GPF, then target wealth is identical
- ▶ Fact: Wealth much more unevenly distributed than permanent income  
⇒ need heterogeneity in GPF

## Preferences, Beliefs, and Wealth

Infinite horizon model: target wealth depends on 'Growth Impatience' condition:

$$\underbrace{\left( \frac{(R \beta^{e,i})^{1/\gamma}}{\Gamma^e \mathbb{E}[\psi^{-1}]} \right)}_{\text{'Growth Patience Factor'}} < 1 \quad (1)$$

Degree of impatience (1-GPF) determines size of target

- ▶ If everybody has same GPF, then target wealth is identical
- ▶ Fact: Wealth much more unevenly distributed than permanent income  
⇒ need heterogeneity in GPF
- ▶ (If GPF  $\geq 1$ , target is  $\infty$ )

# Preferences, Beliefs, and Wealth

Infinite horizon model: target wealth depends on 'Growth Impatience' condition:

$$\underbrace{\left( \frac{(R \beta^{e,i})^{1/\gamma}}{\Gamma^e \mathbb{E}[\psi^{-1}]} \right)}_{\text{'Growth Patience Factor'}} < 1 \quad (1)$$

Degree of impatience (1-GPF) determines size of target

- ▶ If everybody has same GPF, then target wealth is identical
- ▶ Fact: Wealth much more unevenly distributed than permanent income  
⇒ need heterogeneity in GPF
- ▶ (If GPF  $\geq 1$ , target is  $\infty$ )

# Preferences, Beliefs, and Wealth

Infinite horizon model: target wealth depends on 'Growth Impatience' condition:

$$\underbrace{\left( \frac{(R \beta^{e,i})^{1/\gamma}}{\Gamma^e \mathbb{E}[\psi^{-1}]} \right)}_{\text{'Growth Patience Factor'}} < 1 \quad (1)$$

Degree of impatience (1-GPF) determines size of target

- ▶ If everybody has same GPF, then target wealth is identical
- ▶ Fact: Wealth much more unevenly distributed than permanent income  
⇒ need heterogeneity in GPF
- ▶ (If GPF  $\geq 1$ , target is  $\infty$ )

We use

- ▶ *Ex-ante* heterogeneity in discount factors  $\beta^{e,i}$

# Preferences, Beliefs, and Wealth

Infinite horizon model: target wealth depends on 'Growth Impatience' condition:

$$\underbrace{\left( \frac{(R \beta^{e,i})^{1/\gamma}}{\Gamma^e \mathbb{E}[\psi^{-1}]} \right)}_{\text{'Growth Patience Factor'}} < 1 \quad (1)$$

Degree of impatience (1-GPF) determines size of target

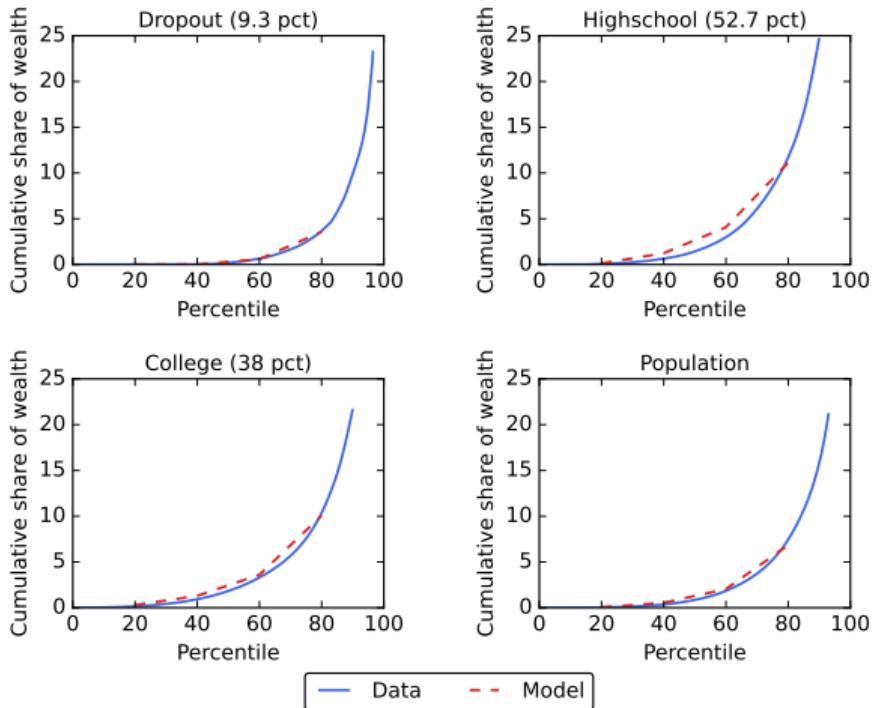
- ▶ If everybody has same GPF, then target wealth is identical
- ▶ Fact: Wealth much more unevenly distributed than permanent income  
⇒ need heterogeneity in GPF
- ▶ (If GPF  $\geq 1$ , target is  $\infty$ )

We use

- ▶ *Ex-ante* heterogeneity in discount factors  $\beta^{e,i}$
- ▶  $\Gamma^e$  or  $R$  would do as well

# Consistency With Micro Evidence (1)

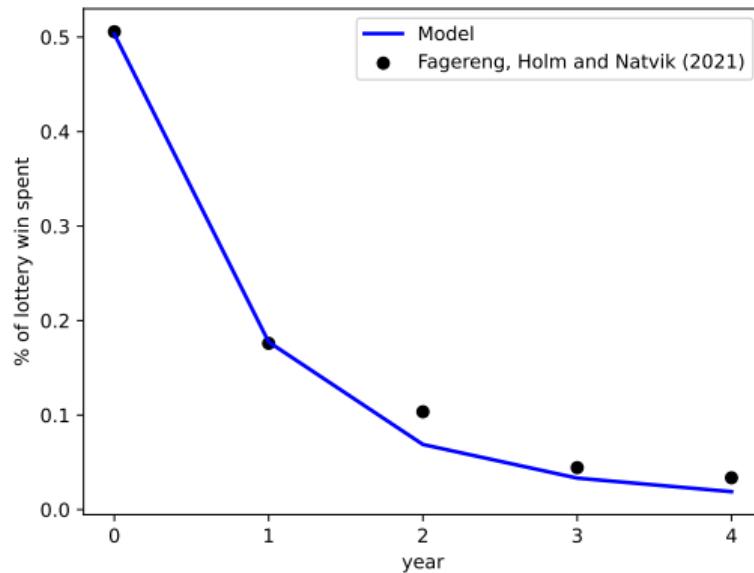
Liquid Wealth from  
Survey of Consumer  
Finances (SCF)



- ▶ Education groups:  $e \in \{\text{'Dropout'}, \text{'Highschool'} \text{ and } \text{'College'}\}$
- ▶ Each group has distribution of discount factors  $\beta_{e,i}$

## Consistency With Micro Evidence (2)

Intertemporal MPC from Fagereng, Holm, Natvik (2021)



Modeling device: 'Splurge' in consumption

## Splurge consumption

- ▶ Exogenous fraction of income directly consumed
- ▶ Model consistent with spending patterns over time after a transitory income shock
- ▶ Evidence: High liquid wealth hh also have high MPCs
  - ▶ Kueng (2018); Crawley and Kuchler (2023); Graham and McDowell (2024)
- ▶ Possible microfoundations:
  - ▶ Spending on durables (Browning and Crossley, 2009; Laibson et al., 2022)
  - ▶ A form of present bias (Indarte et al., 2024, Maxted et al., 2024)
- ▶ Robustness: Model w/o splurge consumption

# Evaluation of consumption stimulus policies in the US

- ▶ Policies we consider:

# Evaluation of consumption stimulus policies in the US

- ▶ Policies we consider:
  - ▶ Stimulus check for \$1200 (means-tested)

# Evaluation of consumption stimulus policies in the US

- ▶ Policies we consider:
  - ▶ Stimulus check for \$1200 (means-tested)
  - ▶ Extension of unemployment benefits from 6 months to 1 year

# Evaluation of consumption stimulus policies in the US

- ▶ Policies we consider:
  - ▶ Stimulus check for \$1200 (means-tested)
  - ▶ Extension of unemployment benefits from 6 months to 1 year
  - ▶ Payroll tax cut by 2% for 2 years

# Evaluation of consumption stimulus policies in the US

- ▶ Policies we consider:
  - ▶ Stimulus check for \$1200 (means-tested)
  - ▶ Extension of unemployment benefits from 6 months to 1 year
  - ▶ Payroll tax cut by 2% for 2 years
- ▶ Motivation:

# Evaluation of consumption stimulus policies in the US

- ▶ Policies we consider:
  - ▶ Stimulus check for \$1200 (means-tested)
  - ▶ Extension of unemployment benefits from 6 months to 1 year
  - ▶ Payroll tax cut by 2% for 2 years
- ▶ Motivation:
  - ▶ Economic Stimulus Act of 2008 (stimulus checks)

# Evaluation of consumption stimulus policies in the US

- ▶ Policies we consider:
  - ▶ Stimulus check for \$1200 (means-tested)
  - ▶ Extension of unemployment benefits from 6 months to 1 year
  - ▶ Payroll tax cut by 2% for 2 years
- ▶ Motivation:
  - ▶ Economic Stimulus Act of 2008 (stimulus checks)
  - ▶ Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 (UI extension and tax cut)

# Evaluation of consumption stimulus policies in the US

- ▶ Policies we consider:
  - ▶ Stimulus check for \$1200 (means-tested)
  - ▶ Extension of unemployment benefits from 6 months to 1 year
  - ▶ Payroll tax cut by 2% for 2 years
- ▶ Motivation:
  - ▶ Economic Stimulus Act of 2008 (stimulus checks)
  - ▶ Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 (UI extension and tax cut)
- ▶ Evaluation criteria:

# Evaluation of consumption stimulus policies in the US

- ▶ Policies we consider:
  - ▶ Stimulus check for \$1200 (means-tested)
  - ▶ Extension of unemployment benefits from 6 months to 1 year
  - ▶ Payroll tax cut by 2% for 2 years
- ▶ Motivation:
  - ▶ Economic Stimulus Act of 2008 (stimulus checks)
  - ▶ Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 (UI extension and tax cut)
- ▶ Evaluation criteria:
  - ▶ Spending multipliers

# Evaluation of consumption stimulus policies in the US

- ▶ Policies we consider:
  - ▶ Stimulus check for \$1200 (means-tested)
  - ▶ Extension of unemployment benefits from 6 months to 1 year
  - ▶ Payroll tax cut by 2% for 2 years
- ▶ Motivation:
  - ▶ Economic Stimulus Act of 2008 (stimulus checks)
  - ▶ Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 (UI extension and tax cut)
- ▶ Evaluation criteria:
  - ▶ Spending multipliers
  - ▶ Welfare (only recession-related welfare impact)

## Preview of results

- Welfare measure: Extension of UI benefits is the clear winner

## Preview of results

- ▶ Welfare measure: Extension of UI benefits is the clear winner
  - ▶ Targeted at individuals with high MPCs and high recession-related welfare losses

## Preview of results

- ▶ Welfare measure: Extension of UI benefits is the clear winner
  - ▶ Targeted at individuals with high MPCs and high recession-related welfare losses
  - ▶ But: higher spending may continue after recession is over

## Preview of results

- ▶ Welfare measure: Extension of UI benefits is the clear winner
  - ▶ Targeted at individuals with high MPCs and high recession-related welfare losses
  - ▶ But: higher spending may continue after recession is over
- ▶ Spending multiplier: Stimulus check has the highest multiplier

## Preview of results

- ▶ Welfare measure: Extension of UI benefits is the clear winner
  - ▶ Targeted at individuals with high MPCs and high recession-related welfare losses
  - ▶ But: higher spending may continue after recession is over
- ▶ Spending multiplier: Stimulus check has the highest multiplier
  - ▶ Not well targeted, but increases income immediately

## Preview of results

- ▶ Welfare measure: Extension of UI benefits is the clear winner
  - ▶ Targeted at individuals with high MPCs and high recession-related welfare losses
  - ▶ But: higher spending may continue after recession is over
- ▶ Spending multiplier: Stimulus check has the highest multiplier
  - ▶ Not well targeted, but increases income immediately
- ▶ Tax cut

## Preview of results

- ▶ Welfare measure: Extension of UI benefits is the clear winner
  - ▶ Targeted at individuals with high MPCs and high recession-related welfare losses
  - ▶ But: higher spending may continue after recession is over
- ▶ Spending multiplier: Stimulus check has the highest multiplier
  - ▶ Not well targeted, but increases income immediately
- ▶ Tax cut
  - ▶ Poorly targeted and much spending likely to occur after end of recession

## Preview of results

- ▶ Welfare measure: Extension of UI benefits is the clear winner
  - ▶ Targeted at individuals with high MPCs and high recession-related welfare losses
  - ▶ But: higher spending may continue after recession is over
- ▶ Spending multiplier: Stimulus check has the highest multiplier
  - ▶ Not well targeted, but increases income immediately
- ▶ Tax cut
  - ▶ Poorly targeted and much spending likely to occur after end of recession
- ▶ Robustness in a HANK and SAM model

## Preview of results

- ▶ Welfare measure: Extension of UI benefits is the clear winner
  - ▶ Targeted at individuals with high MPCs and high recession-related welfare losses
  - ▶ But: higher spending may continue after recession is over
- ▶ Spending multiplier: Stimulus check has the highest multiplier
  - ▶ Not well targeted, but increases income immediately
- ▶ Tax cut
  - ▶ Poorly targeted and much spending likely to occur after end of recession
- ▶ Robustness in a HANK and SAM model
  - ▶ Very similar pattern for cumulative multipliers

# Model

## Household problem

- ▶ Idiosyncratic, stochastic income process  $y_{i,t}$

## Household problem

- ▶ Idiosyncratic, stochastic income process  $\mathbf{y}_{i,t}$
- ▶ Estimated splurge factor  $\varsigma$ :  $\mathbf{c}_{sp,i,t} = \varsigma \mathbf{y}_{i,t}$

## Household problem

- ▶ Idiosyncratic, stochastic income process  $\mathbf{y}_{i,t}$
- ▶ Estimated splurge factor  $\varsigma$ :  $\mathbf{c}_{sp,i,t} = \varsigma \mathbf{y}_{i,t}$

## Household problem

- ▶ Idiosyncratic, stochastic income process  $\mathbf{y}_{i,t}$
- ▶ Estimated splurge factor  $\varsigma$ :  $\mathbf{c}_{sp,i,t} = \varsigma \mathbf{y}_{i,t}$
- ▶ Remaining consumption  $c_{opt,i,t}$  is chosen to maximize utility

$$\sum_{t=0}^{\infty} \beta_{e,i}^t (1 - D)^t \mathbb{E}_0 u(\mathbf{c}_{opt,i,t}). \quad (2)$$

( $D$ : end-of-life probability,  $u$ : CRRA utility function)

## Household problem

- ▶ Idiosyncratic, stochastic income process  $\mathbf{y}_{i,t}$
- ▶ Estimated splurge factor  $\varsigma$ :  $\mathbf{c}_{sp,i,t} = \varsigma \mathbf{y}_{i,t}$
- ▶ Remaining consumption  $c_{opt,i,t}$  is chosen to maximize utility

$$\sum_{t=0}^{\infty} \beta_{e,i}^t (1 - D)^t \mathbb{E}_0 u(\mathbf{c}_{opt,i,t}). \quad (2)$$

( $D$ : end-of-life probability,  $u$ : CRRA utility function)

- ▶ Budget constraint, given existing market resources  $\mathbf{m}_{i,t}$  and income state, and a no-borrowing constraint:

$$\mathbf{m}_{i,t+1} = R \underbrace{(\mathbf{m}_{i,t} - \mathbf{c}_{sp,i,t} - \mathbf{c}_{opt,i,t})}_{\geq 0 \text{ (no-borrowing constraint)}} + \mathbf{y}_{i,t+1} \quad (3)$$

( $R$ : exogenous gross interest rate)

## Income process

- ▶ Income subject to transitory, unempl. and permanent shocks

$$\mathbf{y}_{i,t} = \begin{cases} \xi_{i,t} \mathbf{p}_{i,t}, & \text{if employed} \\ 0.7 \mathbf{p}_{i,t}, & \text{if unemployed for } \leq 2q \\ 0.5 \mathbf{p}_{i,t}, & \text{if unemployed } \geq 2q \end{cases} \quad (4)$$

( $\xi_{i,t}$ : trans. shock,  $p$ : perm. income)

## Income process

- ▶ Income subject to transitory, unempl. and permanent shocks

$$\mathbf{y}_{i,t} = \begin{cases} \xi_{i,t} \mathbf{p}_{i,t}, & \text{if employed} \\ 0.7 \mathbf{p}_{i,t}, & \text{if unemployed for } \leq 2q \\ 0.5 \mathbf{p}_{i,t}, & \text{if unemployed } \geq 2q \end{cases} \quad (4)$$

( $\xi_{i,t}$ : trans. shock,  $p$ : perm. income)

- ▶ 'Permanent income':  $\mathbf{p}_{i,t+1} = \underbrace{\psi_{i,t+1}}_{\text{perm. shock}} \underbrace{\Gamma_{e(i)}}_{\text{educ.-specific growth}} \mathbf{p}_{i,t}$

## Income process

- ▶ Income subject to transitory, unempl. and permanent shocks

$$\mathbf{y}_{i,t} = \begin{cases} \xi_{i,t} \mathbf{p}_{i,t}, & \text{if employed} \\ 0.7 \mathbf{p}_{i,t}, & \text{if unemployed for } \leq 2q \\ 0.5 \mathbf{p}_{i,t}, & \text{if unemployed } \geq 2q \end{cases} \quad (4)$$

( $\xi_{i,t}$ : trans. shock,  $p$ : perm. income)

- ▶ 'Permanent income':  $\mathbf{p}_{i,t+1} = \underbrace{\psi_{i,t+1}}_{\text{perm. shock}} \underbrace{\Gamma_{e(i)}}_{\text{educ.-specific growth}} \mathbf{p}_{i,t}$

## Income process

- ▶ Income subject to transitory, unempl. and permanent shocks

$$\mathbf{y}_{i,t} = \begin{cases} \xi_{i,t} \mathbf{p}_{i,t}, & \text{if employed} \\ 0.7 \mathbf{p}_{i,t}, & \text{if unemployed for } \leq 2q \\ 0.5 \mathbf{p}_{i,t}, & \text{if unemployed } \geq 2q \end{cases} \quad (4)$$

( $\xi_{i,t}$ : trans. shock,  $p$ : perm. income)

- ▶ 'Permanent income':  $\mathbf{p}_{i,t+1} = \underbrace{\psi_{i,t+1}}_{\text{perm. shock}} \underbrace{\Gamma_{e(i)}}_{\text{educ.-specific growth}} \mathbf{p}_{i,t}$

- ▶ Model is a simplified model of households (no heterogeneity in hh size)

## Income process

- ▶ Income subject to transitory, unempl. and permanent shocks

$$\mathbf{y}_{i,t} = \begin{cases} \xi_{i,t} \mathbf{p}_{i,t}, & \text{if employed} \\ 0.7 \mathbf{p}_{i,t}, & \text{if unemployed for } \leq 2q \\ 0.5 \mathbf{p}_{i,t}, & \text{if unemployed } \geq 2q \end{cases} \quad (4)$$

( $\xi_{i,t}$ : trans. shock,  $p$ : perm. income)

- ▶ 'Permanent income':  $\mathbf{p}_{i,t+1} = \underbrace{\psi_{i,t+1}}_{\text{perm. shock}} \underbrace{\Gamma_{e(i)}}_{\text{educ.-specific growth}} \mathbf{p}_{i,t}$

- ▶ Model is a simplified model of households (no heterogeneity in hh size)
- ▶ Replacement rates reflect some degree of hh incurance (Rothstein and Valetta, 2017)

## Employment status and recessions

- ▶ Employment status is subject to a Markov process
  - ▶ Employed consumer: continue being employed or become unemployed
  - ▶ Unemployed consumers: receives benefits for two quarters
- ▶ Bureau of Labor Statistics: Report unemployment rates by education group
- ▶ Recession is given by an MIT shock
  - ▶ Unemployment rate doubles in each education group
  - ▶ Expected length of unemployment increases from 2 to 4q
  - ▶ End of recession occurs as a Bernoulli process calibrated for an avg. rec. length of 6q

# Aggregate demand effects

(as in Krueger, Mitman and Perri, 2016)

- ▶ Baseline: No feedback from aggregate consumption to income

# Aggregate demand effects

(as in Krueger, Mitman and Perri, 2016)

- ▶ Baseline: No feedback from aggregate consumption to income
- ▶ Extension: We allow for aggregate demand effects from consumption on income during the recession

## Aggregate demand effects

(as in Krueger, Mitman and Perri, 2016)

- ▶ Baseline: No feedback from aggregate consumption to income
- ▶ Extension: We allow for aggregate demand effects from consumption on income during the recession
- ▶ The AD effect is given by

$$AD(C_t) = \begin{cases} \left(\frac{C_t}{\tilde{C}}\right)^\kappa, & \text{if in a recession} \\ 1, & \text{otherwise,} \end{cases} \quad (5)$$

where  $\tilde{C}$  is the level of consumption in the steady state.

## Aggregate demand effects

(as in Krueger, Mitman and Perri, 2016)

- ▶ Baseline: No feedback from aggregate consumption to income
- ▶ Extension: We allow for aggregate demand effects from consumption on income during the recession
- ▶ The AD effect is given by

$$AD(C_t) = \begin{cases} \left(\frac{C_t}{\tilde{C}}\right)^\kappa, & \text{if in a recession} \\ 1, & \text{otherwise,} \end{cases} \quad (5)$$

where  $\tilde{C}$  is the level of consumption in the steady state.

- ▶ Idiosyncratic income in the extension model is then given by

$$\mathbf{y}_{AD,i,t} = AD(C_t) \mathbf{y}_{i,t}. \quad (6)$$

## Parameters calibrated for each education group

|  | Dropout | Highschool | College |
|--|---------|------------|---------|
| Percent of population  | 9.3     | 52.7       | 38.0    |
| Avg. quarterly PI of “newborn” agent (\$1000)                  | 6.2     | 11.1       | 14.5    |
| Std. dev. of log(PI) of “newborn” agent                        | 0.32    | 0.42       | 0.53    |
| Avg. quarterly gross growth rate of PI ( $\Gamma_e$ )          | 1.0036  | 1.0045     | 1.0049  |
| Unemployment rate in normal times (percent)                    | 8.5     | 4.4        | 2.7     |
| Probability of entering unemployment ( $\pi_{eu}^e$ , percent) | 6.2     | 3.1        | 1.8     |
| Probability of leaving unemployment ( $\pi_{ue}$ )             | 0.667   | 0.667      | 0.667   |

- ▶ Mincer (1991) and Elsby and Hobjin (2010): Education groups differ in the incidence of unemployment, not its duration

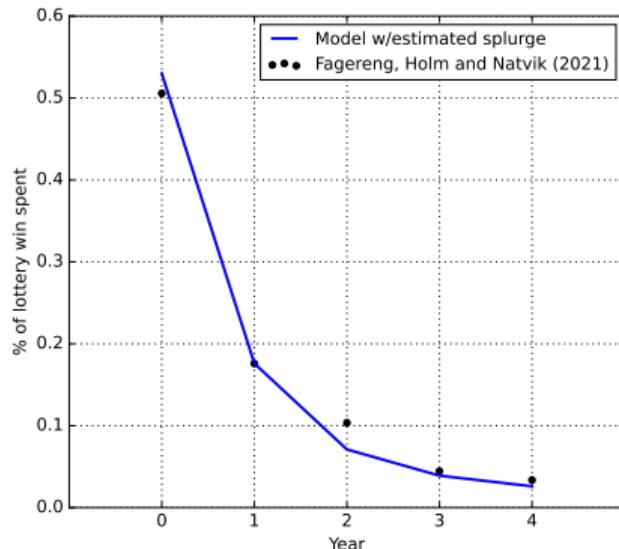
# Results

## Untargeted moments (1)

Non-targeted moments by wealth quartile

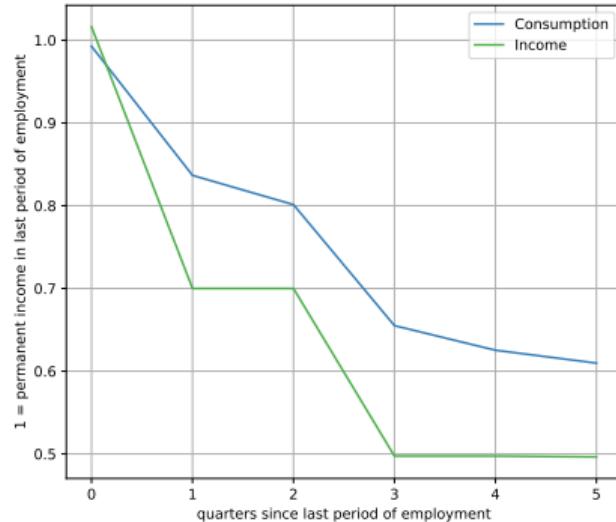
|   | WQ 4 | WQ 3 | WQ 2 | WQ 1  |
|---|------|------|------|-------|
| Percent of liquid wealth (data)                     | 0.14 | 1.60 | 8.51 | 89.76 |
| Percent of liquid wealth (model, baseline)          | 0.12 | 0.98 | 3.85 | 95.0  |
| Percent of liquid wealth (model, Splurge=0)         | 0.10 | 1.07 | 4.24 | 94.60 |
| Avg. lottery-win-year MPC<br>(model, incl. splurge) | 0.74 | 0.61 | 0.48 | 0.32  |
| Avg. lottery-win-year MPC<br>(model, splurge=0)     | 0.69 | 0.53 | 0.36 | 0.14  |

## Untargeted moments (2)



Share of lottery win spent

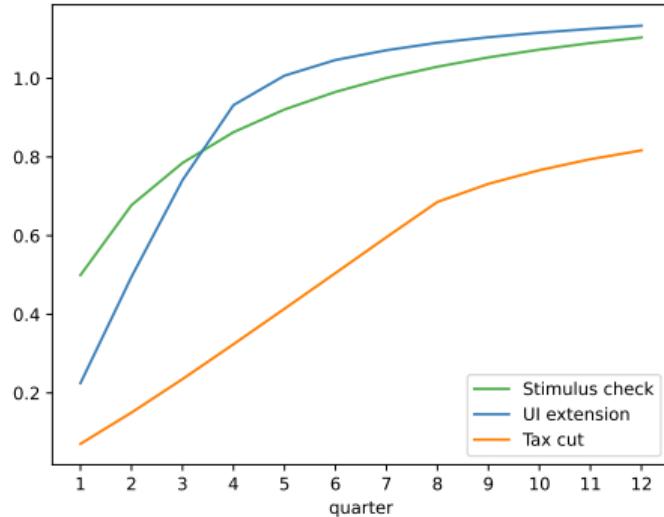
- ▶ Ganong and Noel (2019): UI expiry  $\Rightarrow$  drop of 12 percent (month)
- ▶ Our model  $\Rightarrow$  drop of 18 percent (quarter)



Spending upon expiry of UI benefits

# Multipliers

$$M_t^P = \frac{\text{NPV of induced consumption up to } t}{\text{NPV of the cost of the policy}}$$

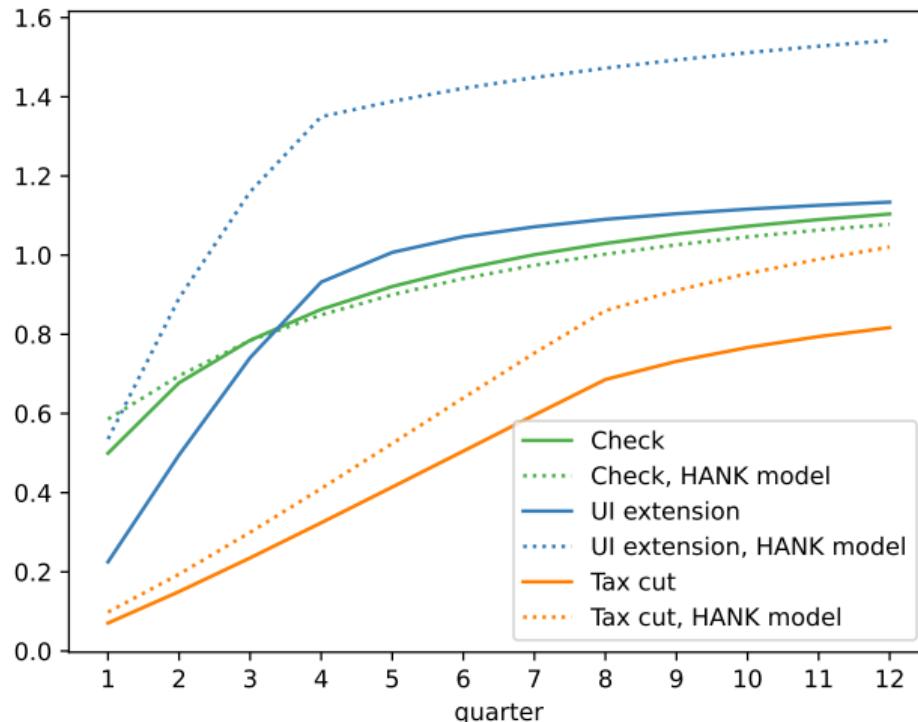


|  | Stimulus check | UI extension | Tax cut |
|--|----------------|--------------|---------|
| 10y-horizon Multiplier (no AD effect)        | 0.88           | 0.91         | 0.85    |
| 10y-horizon Multiplier (AD effect)           | 1.23           | 1.21         | 0.98    |
| Share of policy expenditure during recession | 100.0%         | 79.6%        | 57.8 %  |

## Robustness: Multipliers in a HANK and SAM model — Setup

- ▶ Evaluate the policies in a relatively standard HANK and SAM model (Du, 2024)
- ▶ New Keynesian: Monopolistic competition + sticky prices
- ▶ Search and matching: Random search, labor market tightness affects job finding and vacancy filling probabilities
- ▶ Government policy: Monetary and fiscal rules
- ▶ Fiscal multipliers through an intertemporal Keynesian cross mechanism
  - However: No state dependence
- ▶ Solution method  $\Rightarrow$  cannot evaluate effects starting in a deep recessionary state
  - This also implies that we cannot use our welfare measure

## Robustness: Multipliers in a HANK and SAM model — Results



## Welfare measure

- ▶ Aim: Welfare measure does not reflect benefits of redistribution in “normal” times

$$\mathcal{W}(\text{policy}, \text{Rec}, \text{AD}) = \frac{1}{\mathcal{N}} \sum_{i=1}^N \sum_{t=0}^{\infty} \frac{1}{R^t} \frac{u(\mathbf{c}_{it,policy,Rec,AD}) - u(\mathbf{c}_{it,none,Rec,AD})}{u'(\mathbf{c}_{it,normal})}$$

where  $\mathcal{N} = NPV(\text{policy}, \text{Rec}, \text{AD})$

## Welfare measure

- ▶ Aim: Welfare measure does not reflect benefits of redistribution in “normal” times
- ▶ Want: Utility-based measure of benefits of implementing a policy in a recession

$$\mathcal{W}(\text{policy}, \text{Rec}, \text{AD}) = \frac{1}{\mathcal{N}} \sum_{i=1}^N \sum_{t=0}^{\infty} \frac{1}{R^t} \frac{u(\mathbf{c}_{it,policy,Rec,AD}) - u(\mathbf{c}_{it,none,Rec,AD})}{u'(\mathbf{c}_{it,normal})}$$

where  $\mathcal{N} = NPV(\text{policy}, \text{Rec}, \text{AD})$

## Welfare measure

- ▶ Aim: Welfare measure does not reflect benefits of redistribution in “normal” times
- ▶ Want: Utility-based measure of benefits of implementing a policy in a recession
- ▶ Welfare weights:  $u'(\mathbf{c}_{it,normal})$

$$\mathcal{W}(\text{policy}, \text{Rec}, \text{AD}) = \frac{1}{\mathcal{N}} \sum_{i=1}^N \sum_{t=0}^{\infty} \frac{1}{R^t} \frac{u(\mathbf{c}_{it,policy,Rec,AD}) - u(\mathbf{c}_{it,none,Rec,AD})}{u'(\mathbf{c}_{it,normal})}$$

where  $\mathcal{N} = NPV(\text{policy}, \text{Rec}, \text{AD})$

## Welfare measure

- ▶ Aim: Welfare measure does not reflect benefits of redistribution in “normal” times
- ▶ Want: Utility-based measure of benefits of implementing a policy in a recession
- ▶ Welfare weights:  $u'(\mathbf{c}_{it,normal})$
- ▶ Measure for a given *policy* with  $Rec, AD \in \{0, 1\}$

$$\mathcal{W}(\text{policy}, Rec, AD) = \frac{1}{N} \sum_{i=1}^N \sum_{t=0}^{\infty} \frac{1}{R^t} \frac{u(\mathbf{c}_{it,policy}, Rec, AD) - u(\mathbf{c}_{it,none}, Rec, AD)}{u'(\mathbf{c}_{it,normal})}$$

where  $\mathcal{N} = NPV(\text{policy}, Rec, AD)$

## Welfare measure

- ▶ Aim: Welfare measure does not reflect benefits of redistribution in “normal” times
- ▶ Want: Utility-based measure of benefits of implementing a policy in a recession
- ▶ Welfare weights:  $u'(\mathbf{c}_{it,normal})$
- ▶ Measure for a given *policy* with  $Rec, AD \in \{0, 1\}$

$$\mathcal{W}(\text{policy}, Rec, AD) = \frac{1}{N} \sum_{i=1}^N \sum_{t=0}^{\infty} \frac{1}{R^t} \frac{u(\mathbf{c}_{it,policy}, Rec, AD) - u(\mathbf{c}_{it,none}, Rec, AD)}{u'(\mathbf{c}_{it,normal})}$$

where  $\mathcal{N} = NPV(\text{policy}, Rec, AD)$

- ▶ Normal times:  $\mathcal{W}(\text{policy}, 0, 0) = 1$  (for  $\Delta \mathbf{c}_{it} \approx 0$ )

## Welfare results

|   | Stimulus check | UI extension | Tax cut |
|---|----------------|--------------|---------|
| $\mathcal{W}(\text{policy}, Rec = 0, AD = 0)$ | 0.96           | 0.85         | 0.99    |
| $\mathcal{W}(\text{policy}, Rec = 1, AD = 0)$ | 1.00           | 1.83         | 0.97    |
| $\mathcal{W}(\text{policy}, Rec = 1, AD = 1)$ | 1.35           | 2.15         | 1.11    |

- ▶ Normal times: Welfare of UI extension  $< 1$  due to concavity of  $u(\cdot)$   
Relatively large change in  $\mathbf{c}_{it}$  for small number of households

## Welfare results

|   | Stimulus check | UI extension | Tax cut |
|---|----------------|--------------|---------|
| $\mathcal{W}(\text{policy}, Rec = 0, AD = 0)$ | 0.96           | 0.85         | 0.99    |
| $\mathcal{W}(\text{policy}, Rec = 1, AD = 0)$ | 1.00           | 1.83         | 0.97    |
| $\mathcal{W}(\text{policy}, Rec = 1, AD = 1)$ | 1.35           | 2.15         | 1.11    |

- ▶ Normal times: Welfare of UI extension  $< 1$  due to concavity of  $u(\cdot)$   
Relatively large change in  $c_{it}$  for small number of households
- ▶  $AD = 0$ : Benefit of UI extension since recession increases unemployment  $\Rightarrow$  increased marginal utility for affected households

## Welfare results

|   | Stimulus check | UI extension | Tax cut |
|---|----------------|--------------|---------|
| $\mathcal{W}(\text{policy}, Rec = 0, AD = 0)$ | 0.96           | 0.85         | 0.99    |
| $\mathcal{W}(\text{policy}, Rec = 1, AD = 0)$ | 1.00           | 1.83         | 0.97    |
| $\mathcal{W}(\text{policy}, Rec = 1, AD = 1)$ | 1.35           | 2.15         | 1.11    |

- ▶ Normal times: Welfare of UI extension  $< 1$  due to concavity of  $u(\cdot)$   
Relatively large change in  $\mathbf{c}_{it}$  for small number of households
- ▶  $AD = 0$ : Benefit of UI extension since recession increases unemployment  $\Rightarrow$  increased marginal utility for affected households
- ▶  $AD = 1$ : Stimulating spending during recession increases measure for all policies

## Conclusion: Comparing the policies

- ▶ Comparison of three consumption stimulus policies in a HA model consistent with data on the distribution of liquid wealth and intertemporal MPCs

## Conclusion: Comparing the policies

- ▶ Comparison of three consumption stimulus policies in a HA model consistent with data on the distribution of liquid wealth and intertemporal MPCs
- ▶ Welfare measure: UI extension is the clear bang-for-the-buck winner

## Conclusion: Comparing the policies

- ▶ Comparison of three consumption stimulus policies in a HA model consistent with data on the distribution of liquid wealth and intertemporal MPCs
- ▶ Welfare measure: UI extension is the clear bang-for-the-buck winner
- ▶ The stimulus check is less well targeted, but...

## Conclusion: Comparing the policies

- ▶ Comparison of three consumption stimulus policies in a HA model consistent with data on the distribution of liquid wealth and intertemporal MPCs
- ▶ Welfare measure: UI extension is the clear bang-for-the-buck winner
- ▶ The stimulus check is less well targeted, but...
  - ▶ is transferred immediately ensuring that money arrives when it is most valuable

## Conclusion: Comparing the policies

- ▶ Comparison of three consumption stimulus policies in a HA model consistent with data on the distribution of liquid wealth and intertemporal MPCs
- ▶ Welfare measure: UI extension is the clear bang-for-the-buck winner
- ▶ The stimulus check is less well targeted, but...
  - ▶ is transferred immediately ensuring that money arrives when it is most valuable
  - ▶ is more easily scaled up to provide more stimulus

## Conclusion: Comparing the policies

- ▶ Comparison of three consumption stimulus policies in a HA model consistent with data on the distribution of liquid wealth and intertemporal MPCs
- ▶ Welfare measure: UI extension is the clear bang-for-the-buck winner
- ▶ The stimulus check is less well targeted, but...
  - ▶ is transferred immediately ensuring that money arrives when it is most valuable
  - ▶ is more easily scaled up to provide more stimulus
- ▶ The tax cut is both poorly targeted and may yield substantial spending after the recession is over

## Conclusion: Comparing the policies

- ▶ Comparison of three consumption stimulus policies in a HA model consistent with data on the distribution of liquid wealth and intertemporal MPCs
- ▶ Welfare measure: UI extension is the clear bang-for-the-buck winner
- ▶ The stimulus check is less well targeted, but...
  - ▶ is transferred immediately ensuring that money arrives when it is most valuable
  - ▶ is more easily scaled up to provide more stimulus
- ▶ The tax cut is both poorly targeted and may yield substantial spending after the recession is over
- ▶ Framework can be used to evaluate other candidate policies

Thank you for your attention!

- ▶ Access the paper, presentation slides and code at:  
<https://github.com/econ-ark/HAFiscal>



# Appendix

## Parameters — same for all types

| Parameter   | Notation      | Value  |
|---|---------------|--------|
| Risk aversion   | $\gamma$      | 2.0    |
| Splurge   | $\varsigma$   | 0.249  |
| Survival probability, quarterly                             | $1 - D$       | 0.994  |
| Risk free interest rate, quarterly (gross)                  | $R$           | 1.01   |
| Standard deviation of transitory shock                      | $\sigma_\xi$  | 0.346  |
| Standard deviation of permanent shock                       | $\sigma_\psi$ | 0.0548 |
| Unemployment benefits replacement rate (share of PI)        | $\rho_b$      | 0.7    |
| Unemployment income w/o benefits (share of PI)              | $\rho_{nb}$   | 0.5    |
| Avg. duration of unemp. benefits in normal times (quarters) |               | 2      |
| Avg. duration of unemp. spell in normal times (quarters)    |               | 1.5    |
| Consumption elasticity of aggregate demand effect           | $\kappa$      | 0.3    |

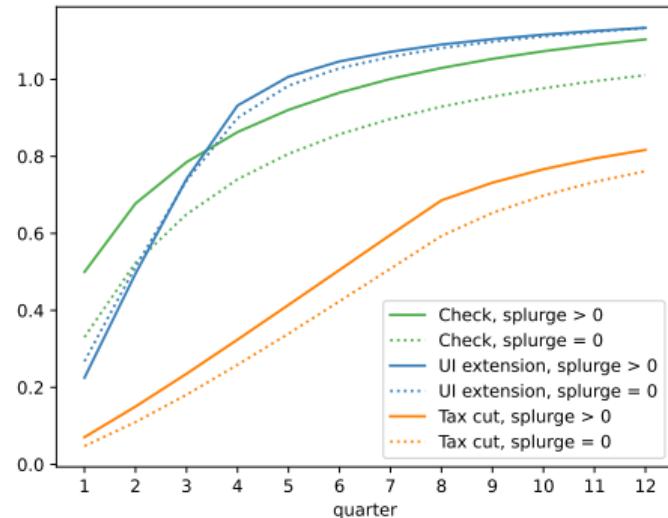
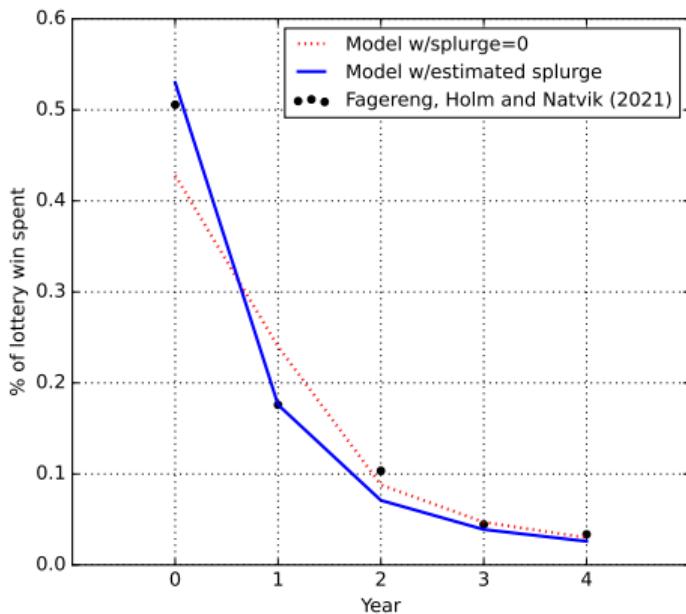
Go back

## Parameters describing the policies

| Parameters describing policy experiments      |            |
|---|------------|
| Parameter                                     | Value      |
| Change in unemployment rates in a recession   | ×2         |
| Expected unemployment spell in a recession    | 4 quarters |
| Average length of recession                   | 6 quarters |
| Size of stimulus check                        | \$1,200    |
| PI threshold for reducing check size          | \$100,000  |
| PI threshold for not receiving check          | \$150,000  |
| Extended unemployment benefits                | 4 quarters |
| Length of payroll tax cut                     | 8 quarters |
| Income increase from payroll tax cut          | 2 percent  |
| Belief (probability) that tax cut is extended | 50 percent |

Go back

## Robustness: Model w/o splurge consumption



|   | Stimulus check | UI extension | Tax cut    |
|---|----------------|--------------|------------|
| $\mathcal{W}(\text{policy}, Rec = 1, AD = 1)$ | 1.27(1.35)     | 2.12(2.15)   | 1.09(1.11) |