

Welfare and Spending Effects of Consumption Stimulus Policies

Christopher D. Carroll Edmund Crawley
Ivan Frankovic Håkon Tretvoll

Oslo Macro Group, February 14, 2023

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
- ▶ 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

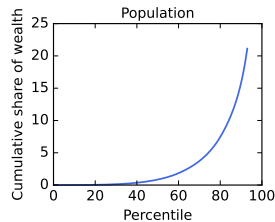
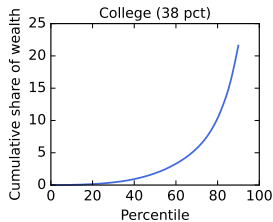
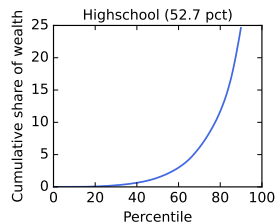
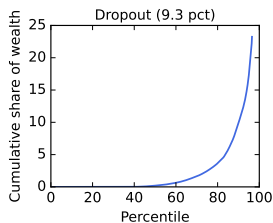
Evaluation of consumption stimulus policies

- ▶ Policies we consider:
 - ▶ Stimulus check
 - ▶ Extension of unemployment benefits
 - ▶ Payroll tax cut
- ▶ Evaluation criteria:
 - ▶ Spending multipliers
 - ▶ Welfare
- ▶ Key features of the policies:
 - ▶ Targeting
 - ▶ Timing of spending
 - ▶ Scalability

Consistent with data 1: SCF liquid wealth

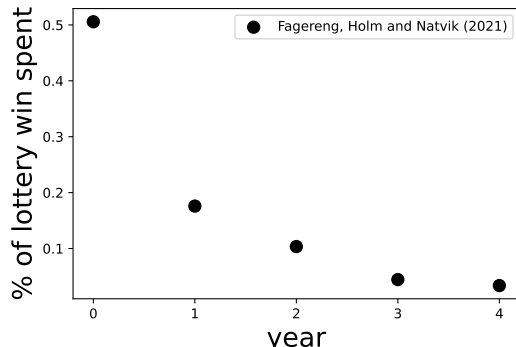
Definition: Kaplan and Violante (2014)

Modelling device: *Ex-ante* heterogeneity in discount factors



Consistent with data 2: iMPC from FHN (2021)

Modelling device: 'Splurge' in consumption



- Auclert, Rognlie and Straub (2018): Also cite FHN for evidence on iMPCs

Preview of results

- ▶ Welfare measure: Extension of UI benefits is the clear winner
 - ▶ Targeted at individuals with high MPCs
 - ▶ They also tend to have high MU of consumption
 - ▶ But: higher spending may continue after recession is over
- ▶ Spending multiplier: Stimulus check has the highest multiplier
 - ▶ Not well targeted, but increases income immediately
 - ▶ Spending happens during recession
 - ▶ Also: more easily scaled up
- ▶ Tax cut: both poorly targeted and substantial amount of income boost may occur after the recession is over

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)
- ▶ **Welfare measures in HA models:** Bhandari, Evans, Golosov and Sargent (2021); Dávila and Schaab (2022)
- ▶ **Extended unemployment insurance:** Ganong, Greig, Noel, Sullivan and Vavra (2022); Kekre (2022)
- ▶ **High MPCs and impatience:** Parker (2017)

Model

Consumer problem

- ▶ Education groups $e(i)$: "Dropout", "Highschool", "College"
⇒ different distributions of subjective discount factors β_i
- ▶ Stochastic income process $\mathbf{y}_{i,t}$
- ▶ An exogenously given fraction of income is consumed directly (the 'splurge')

$$\mathbf{c}_{sp,i,t} = \varsigma \mathbf{y}_{i,t} \quad (1)$$

- ▶ Given the splurge, remaining consumption $c_{opt,i,t}$ is chosen to maximize the perpetual-youth lifetime expected-utility

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

where D is the end-of-life probability and $u(\cdot)$ is a standard CRRA utility function

Consumer problem - Part II

- The optimization is subject to the budget constraint, given existing market resources $\mathbf{m}_{i,t}$ and income state, and a no-borrowing constraint:

$$\mathbf{a}_{i,t} = \mathbf{m}_{i,t} - \mathbf{c}_{sp,i,t} - \mathbf{c}_{opt,i,t} \quad (3)$$

$$\mathbf{m}_{i,t+1} = R\mathbf{a}_{i,t} + \mathbf{y}_{i,t+1}, \quad (4)$$

$$\mathbf{a}_{i,t} \geq 0,$$

where R is the gross interest factor.

Income process

- ▶ Income subject to permanent, transitory, and unempl. shocks
- ▶ "Permanent income" p evolves according to

$$\mathbf{p}_{i,t+1} = \psi_{i,t+1} \Gamma_{e(i)} \mathbf{p}_{i,t}, \quad (5)$$

$\psi_{i,t+1}$: shock to permanent income

$\Gamma_{e(i)}$: education-specific average growth rate of income

- ▶ Total income s.t. transitory shock $\xi_{i,t}$ and employment status

$$\mathbf{y}_{i,t} = \begin{cases} \xi_{i,t} \mathbf{p}_{i,t}, & \text{if employed} \\ \rho_b \mathbf{p}_{i,t}, & \text{if unemployed with benefits} \\ \rho_{nb} \mathbf{p}_{i,t}, & \text{if unemployed without benefits} \end{cases} \quad (6)$$

where ρ_x are the status-specific replacement rates.

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
- ▶ 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
- ▶ Extension: We allow for aggregate demand effects from consumption on income during the recession
- ▶ The AD effect is given by

$$AD(C_t) = \begin{cases} \left(\frac{C_t}{\tilde{C}}\right)^\kappa, & \text{if in a recession} \\ 1, & \text{otherwise,} \end{cases} \quad (7)$$

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

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

$$\mathbf{y}_{AD,i,t} = AD(C_t)\mathbf{y}_{i,t}. \quad (8)$$

Three policies to fight the recession

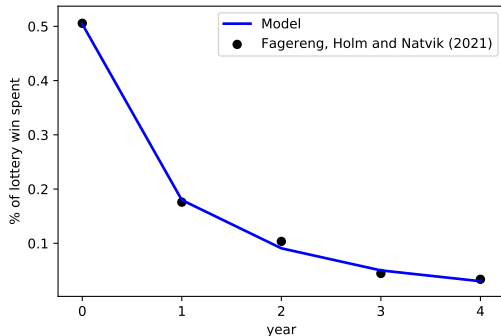
- ▶ Stimulus check
 - ▶ Everyone receives a check for \$1,200 in q1 of the recession
 - ▶ Check is means-tested: Full check if perm. income \leq \$100k; Falls linearly for higher incomes and zero for those \geq \$150k
 - ▶ Extended unemployment benefits
 - ▶ Unemployment benefits are extended from 2 to 4 q
 - ▶ Extension occurs regardless of whether recession ends
 - ▶ Payroll tax cut
 - ▶ Employees payroll tax rate is reduced such that income rises by 2% for 8q
-
- ▶ For welfare measure: Compare policies of equal cost
 - ▶ Policies are debt-financed and repayed after the short recessions we focus on

Parametrization

Parametrization — Strategy

- ▶ First: Estimate the splurge factor in a Norwegian version of the economy — match iMPCs from FHN (2021)
- ▶ Calibrate a set of parameters that affect all education groups equally
- ▶ Calibrate a set of parameters that match features of the different education groups
- ▶ Estimate a discount factor distribution for each education group to match within-group distribution of liquid wealth
 - ▶ β_e : center of discount factor distribution
 - ▶ ∇_e : spread of discount factor distribution
 - ▶ Uniform distribution, approximated with 7 different types

iMPC from FHN (2021)



- ▶ Estimated splurge factor: $\varsigma = 0.31$
- ▶ Robustness exercise: How close do we get and what are our results if we set $\varsigma = 0$? To be computed...

Parameters — same for all types

Parameters that apply to all types		
Parameter	Notation	Value
Risk aversion	γ	2.0
Splurge	ς	0.307
Survival probability, quarterly	$1 - D$	0.994
Risk free interest rate, quarterly (gross)	R	1.01
Standard deviation of transitory shock	σ_{ξ}	0.346
Standard deviation of permanent shock	σ_{ψ}	0.0548
Unemployment benefits replacement rate (share of PI)	ρ_b	0.7
Unemployment income w/o benefits (share of PI)	ρ_{nb}	0.5
Avg. duration of unemp. benefits in normal times (quarters)		2
Avg. duration of unemp. spell in normal times (quarters)		1.5
Probability of leaving unemployment	π_{ue}	0.667
Consumption elasticity of aggregate demand effect	κ	0.3

Parameters — same for all types

Parameters that apply to all types		
Parameter	Notation	Value
Risk aversion	γ	2.0
Splurge	ς	0.307
Survival probability, quarterly	$1 - D$	0.994
Risk free interest rate, quarterly (gross)	R	1.01
Standard deviation of transitory shock	σ_{ξ}	0.346
Standard deviation of permanent shock	σ_{ψ}	0.0548
Unemployment benefits replacement rate (share of PI)	ρ_b	0.7
Unemployment income w/o benefits (share of PI)	ρ_{nb}	0.5
Avg. duration of unemp. benefits in normal times (quarters)		2
Avg. duration of unemp. spell in normal times (quarters)		1.5
Probability of leaving unemployment	π_{ue}	0.667
Consumption elasticity of aggregate demand effect	κ	0.3

Parameters — by education group Policy parameters

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 (Γ_e)	1.0036	1.0045	1.0049
Unemployment rate in normal times (percent)	8.5	4.4	2.7
Probability of entering unemployment (π_{eu}^e , percent)	6.2	3.1	1.8

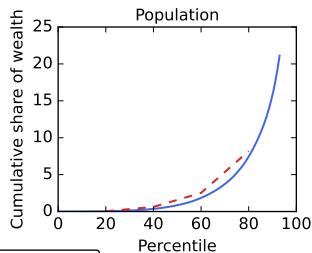
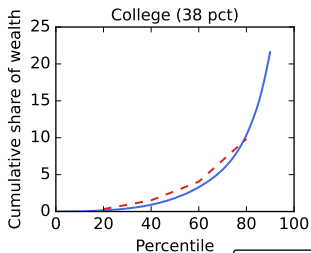
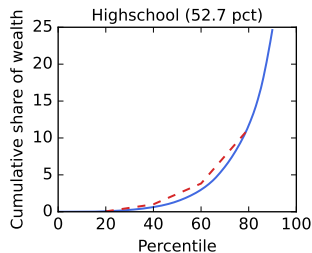
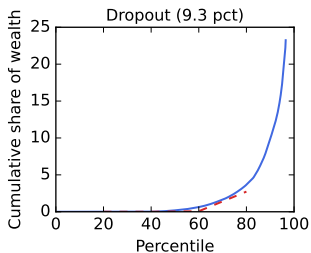
Estimated discount factor distributions

	Dropout	Highschool	College
(β_e, ∇_e)	(0.694, 0.542)	(0.904, 0.099)	(0.978, 0.015)
(Min, max) in approximation	(0.230, 0.995)	(0.819, 0.989)	(0.965, 0.991)

Estimation targets	Dropout	Highschool	College
Median LW/ quarterly PI (data, percent)	4.64	30.2	112.8
Median LW/ quarterly PI (model, percent)	4.64	30.2	112.8

Non-targeted moments	Dropout	Highschool	College	Population
Percent of total wealth (data)	0.8	17.9	81.2	100
Percent of total wealth (model)	12.4	18.6	69.0	100
Avg. annual MPC (model, incl. splurge)	0.79	0.78	0.54	0.69

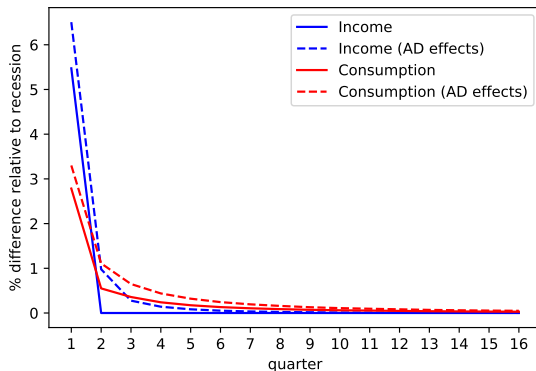
SCF liquid wealth



— Data - - - Model

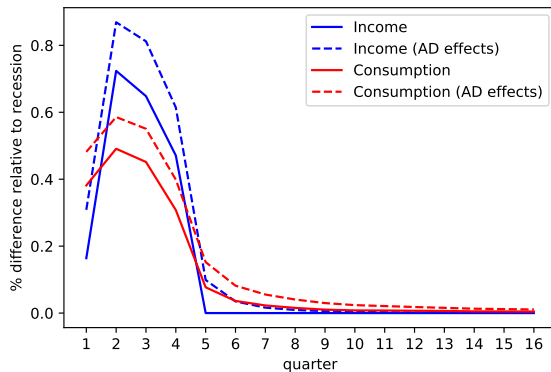
Results

IRFs for stimulus check



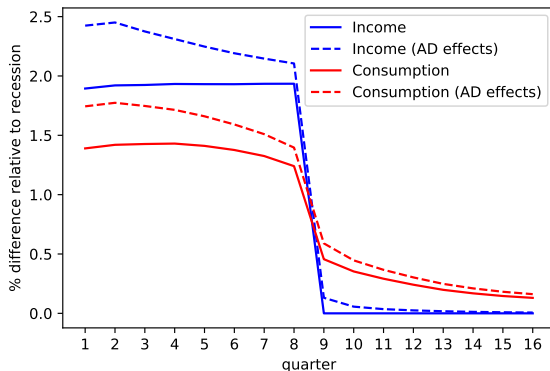
- ▶ W/o AD effects: Q1 income is 5.5% higher; consumption jumps by 3%
- ▶ With AD effects: Q1 income is 6.5% higher; consumption elevated for longer time

IRfs for extension of unemployment benefits



- ▶ W/o AD effects: quarterly income increases by max 0.7 percent, consumption response shows anticipation of longer duration
- ▶ With AD effects: extra boost to income by 0.2 percent, consumption stays elevated for longer time

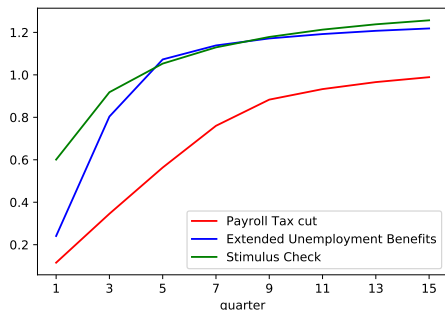
IRFs for payroll tax cut



- ▶ W/o AD effects: income rises by close to 2 percent; Consumption jumps by 1.5 percent and drops sharply after the income decline.
- ▶ With AD effects, income rises by 2.5 percent, declines steadily as the recession's likelihood decreases

Multipliers when aggregate demand effects are present

$$M_t^P = \frac{\text{Net present value of policy-induced consumption up to } t}{\text{Net present value of the cost of the policy}}$$



	Tax Cut	UI extension	Stimulus check
Long-run Multiplier	1.079	1.275	1.339
Policy expenditure during recession	57.6%	80.6%	100.0 %

Welfare measure construction

Guiding principles

1. Each consumer is valued equally by the social planner
2. Utility from splurge in the same way as other spending
3. No social benefit to the policies outside of a recession

Simple aggregation of consumer util. only satisfies principle 1 & 2:

$$\mathcal{W}(\text{policy}, \text{Rec}, \text{AD}) = \frac{1}{N} \sum_{i=1}^N \sum_{t=0}^{\infty} \beta_S^t u(\mathbf{c}_{it, \text{policy}, \text{Rec}, \text{AD}})$$

- ▶ $\mathbf{c}_{it, \text{policy}, \text{Rec}, \text{AD}}$: consumption paths (including splurge) for each consumer / policy
- ▶ $\text{Rec} \in \{1, 0\}$: recession indicator, $\text{AD} \in \{1, 0\}$: AD ind.
- ▶ $\beta_S = 1/R$: social planner's discount factor

Welfare measure construction II

To satisfy principle 3 we define $\mathcal{C}(\text{policy}, \text{Rec}, AD) =$

$$\left(\underbrace{\frac{\mathcal{W}(\text{policy}, \text{Rec}, AD) - \mathcal{W}(\text{None}, \text{Rec}, AD)}{\mathcal{W}^c}}_{\text{I}} - \underbrace{\frac{PV(\text{policy}, \text{Rec})}{\mathcal{P}^c}}_{\text{II}} \right) - \left(\underbrace{\frac{\mathcal{W}(\text{policy}, 0, 0) - \mathcal{W}(\text{None}, 0, 0)}{\mathcal{W}^c}}_{\text{III}} - \underbrace{\frac{PV(\text{policy}, 0)}{\mathcal{P}^c}}_{\text{IV}} \right)$$

- ▶ I: Policy-induced increase in agg. welfare (in bp of SS-cons.)
- ▶ II: Cost of policy \Leftrightarrow I - II: Net agg. welfare increase
- ▶ III - IV: Net welfare impact of policy outside of recession
- ▶ \mathcal{C} measures only welfare effects beyond pure redistribution

Welfare results

	Check	UI	Tax Cut
$\mathcal{C}(\text{policy}, \text{Rec}, 0)$	0.011	0.580	0.002
$\mathcal{C}(\text{policy}, \text{Rec}, AD)$	0.171	1.266	0.065

- ▶ All policies adjusted to the fiscal size of the UI extension
- ▶ Interpretation: A welfare gain of $x \Leftrightarrow$ social planner is indifferent between
 - ▶ the stimulus policy being implemented in response to a recession and
 - ▶ a permanent increase in the baseline consumption of the total population by x basis points (0.01% of baseline cons.)
- ▶ All policies much more effective when multiplier present

Conclusion: Comparing the policies

- ▶ We have compared 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
- ▶ Other (competing?) models to evaluate these policies should match similar features of the data at the micro level

Appendix

Parameters describing the policies [Back](#)

Parameters describing policy experiments	
Parameter	Value
Change in unemployment rates in a recession	$\times 2$
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

Robustness: Different replacement rates

► Discount factor distributions:

			Dropout		Highschool		College	
Splurge			β	∇	β	∇	β	∇
Basel.	$(\rho_b = 0.7, \rho_{nb} = 0.5)$	0.307	0.694	0.542	0.904	0.099	0.978	0.015
Alt.	$(\rho_b = 0.3, \rho_{nb} = 0.15)$	0.307	0.599	0.687	0.852	0.159	0.968	0.028

► Welfare results:

		Stimulus check	UI extension	Tax cut
no AD effects	Baseline $(\rho_b = 0.7, \rho_{nb} = 0.5)$	0.011	0.580	0.002
	Altern. $(\rho_b = 0.3, \rho_{nb} = 0.15)$	0.043	1.913	0.003
AD effects	Baseline $(\rho_b = 0.7, \rho_{nb} = 0.5)$	0.171	1.266	0.065
	Altern. $(\rho_b = 0.3, \rho_{nb} = 0.15)$	0.169	2.620	0.052

Robustness: Different interest rates

		Dropout		Highschool		College	
	Splurge	β	∇	β	∇	β	∇
$R = 1.005$	0.307	0.701	0.520	0.909	0.099	0.983	0.014
$R = 1.01$ (baseline)	0.307	0.694	0.542	0.904	0.099	0.978	0.015
$R = 1.015$	0.307	0.691	0.542	0.899	0.099	0.973	0.016