The Coronavirus Stimulus Package: How large is the transfer multiplier?

Christian Bayer (University of Bonn, CEPR, CESifo, IZA)

Benjamin Born (Frankfurt School, CEPR, CESifo)

Ralph Luetticke (University College London, CEPR)

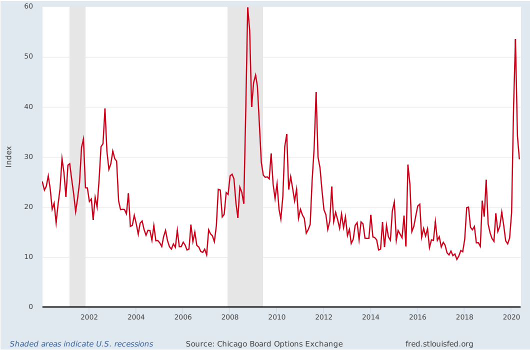
Gernot J. Müller (University of Tübingen, CEPR, CESifo)

MMCN Webinar Series

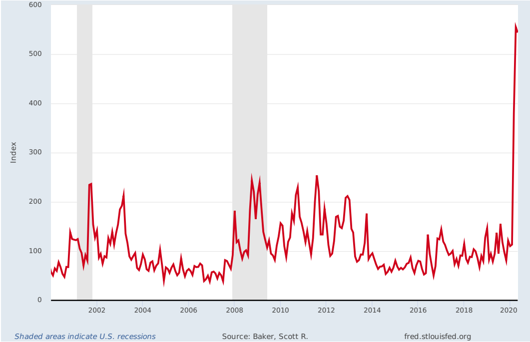
May 25, 2020

COVID-19 pandemic: major increase of economic uncertainty

VIX: Implied Stock Returns Volatility, 2000–20

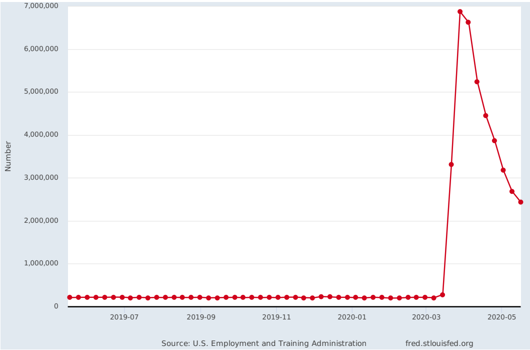


US: Economic Policy Uncertainty, 2000–20

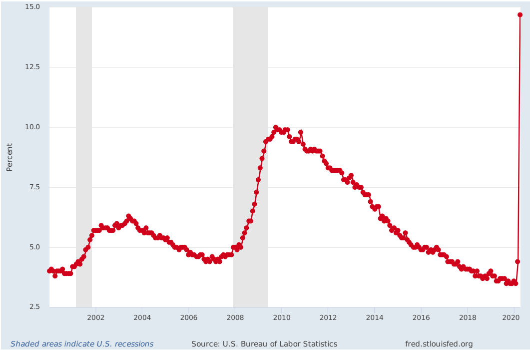


And particularly strong increase of household income risk

Unemployment benefits: weekly initial claims 2019–20



Unemployment rate 2000–20



. . . also unprecedented fiscal stimulus

"Coronavirus Aid, Relief and Economic Security" (CARES) Act

- Signed into law on March 27, 2020
- In total 2,000 billion USD fiscal stimulus → 10% of GDP

Large transfer component

- 1,200 USD to (bottom 90% of) all taxpayers in Q2, 2020
- Unemployment benefit top up of 600 USD/week (until July)
- Earmarked spending for each item: 250 billion USD

What we do: model economic fallout from COVID-19 as **Q-shock**

Starting in March 2020

- Fraction of people (and capital) w/o income because of quarantine
- Fraction of goods becomes unavailable because of lockdown or infection risk

Study dynamics as of February 2020, Q-shock partly anticipated

- Quarantine creates idiosyncratic income risk & reduces expected income
- Consumption complementary lowers aggregate demand (Guerrieri et al., 2020)

What we do: quantify transfer multiplier in **CARES Package**

Incomplete markets model

- Potentially large effects of income risk and
- differences in marginal consumption propensities across households

Medium-scale HANK model

- Estimated in Bayer et al. (2020): captures steady state wealth distribution of the US as well as business cycle dynamics
- Feed Q-shock and transfers into model:
  both conditional (UIB) and unconditional transfers of the CARES package

Preview of results

Q-shock induces major recession

- GDP drops by about 10%
- About 1/5 of effect caused household income risk

Transfer multiplier

- Sizeable for conditional transfers (UIB+): exceeds unity on impact, long-run: $0.3 - 1.0$
- Smaller for unconditional transfers

Related Literature (selection)

Model-based analysis of specific stimulus packages

- Cogan et al (2010), Cwik and Wieland (2012)

Transfer multipliers

- Coenen et al. (2012), Bilbiie et al. (2013), Giambattista and Pennings (2017), Mehrotra (2018), Gechert et al. (2020) etc.
- HANK models (and fiscal policy): Oh and Reis (2012), Kaplan et al. (2018), Hagedorn et al. (2019), Bayer et al. (2019)

Macro-Models of COVID Pandemics and Recession

- Fornaro and Wolf (2020), Eichenbaum et al. (2020), Faria-e-Castro (2020)

Model

Model overview

Households		Production Sector	Government
Obtain Income	Trade Assets	Produce and Differentiate Consumption Goods	Monetary Authority, Fiscal Authority
Wages -> set by unions -> s.t. adj. costs -> Idiosyncratic Risk **Interest** -> from bonds **Dividends** -> from capital: MPK -> liquid rental market **Profits** -> as "entrepreneurs"	**Bonds** (b>$\underline{B}$) = claims on HH debt, + government debt, (nominal, liquid) and **Illiquid Assets**, k = capital (trading friction)	**Intermediate goods producers** Rent capital & labor Competitive Market for Intermediate Goods **Entrepreneurs** Monopolistic resellers s.t. price adjustment costs Capital goods producers	Policy Rules: • **Monetary authority** sets nominal interest rate -> Taylor rule • **Fiscal authority** supplies government debt, consumes goods, taxes labor income and profits -> Expenditure Rule -> Tax rule

Worker-Households

Details

- Productivity h (idiosyncratic and risky)
- Labor/Leisure Choice
- Consume
- Cannot trade state-contingent claims
- Two Assets: Liquid nominal bond, illiquid capital

Households

- Households face productivity risk

$$\log h_{it} = \rho_h \log h_{it-1} + \epsilon^h_{it}, \quad \epsilon^h_{it} \sim N(0, \sigma_h)$$

- Union differentiates labor, driving a wedge between MPL and wages paid to workers.
- A fraction of households becomes "entrepreneurs" and earns all other pure rents. Stochastic transition into and out of this state
- A random fraction λ of households participates in the market for illiquid capital
- A random fraction of households transits into "quarantine": cannot supply labor

Household Planning Problem

- GHH preferences with constant Frisch elasticity:
  $\Longrightarrow$ representative labor supply of the non-quarantined N_t.
- Budget equation:

$$\begin{aligned} c_{it} + b_{it+1} + q_t k_{it+1} &= b_{it} \tfrac{R(b_{it}, R_t^b)}{\pi_t} + (q_t + r_t) k_{it} + \mathcal{T}_t(h_{it}) \\ &\quad + (1 - \tau_t)\left[(1 - Q_{it}) h_{it} w_t N_t + Q_{it} \mathcal{R}(h_{it}) h_{it} w_t N_t + \mathbb{I}_{h_{it} \neq 0} \Pi_t^U + \mathbb{I}_{h_{it} = 0} \Pi_t^F\right], \\ k_{it+1} &\geq 0, \quad b_{it+1} \geq \underline{B}\ , \end{aligned}$$

Household Planning Problem

- GHH preferences with constant Frisch elasticity:
  $\Longrightarrow$ representative labor supply of the non-quarantined N_t.
- Budget equation:
- Bellman equation:

$$V_t^a(b, k, h, Q) = \max_{k', b_a'} u[x(b, b_a', k, k', h, Q)] + \beta \mathbb{E}_t V_{t+1}(b_a', k', h', Q')$$

$$V_t^n(b, k, h, Q) = \max_{b_n'} u[x(b, b_n', k, k, h, Q)] + \beta \mathbb{E}_t V_{t+1}(b_n', k, h', Q')$$

$$\mathbb{E}_t V_{t+1}(b', k', h', Q') = \mathbb{E}_t \left[\lambda V_{t+1}^a(b', k', h', Q')\right] + \mathbb{E}_t \left[(1-\lambda) V_{t+1}^n(b', k, h', Q')\right]$$

Quarantine affects also capital

Fraction of workers affected by quarantine

- Effective labor supply $H_t = \int (1 - Q_{it}) h_{it} di$ (Normalize StSt $H = 1$)

Same fraction of capital is moved to quarantine

- without being able to redistribute capital to non-quarantined workers
- effective capital in production: $u_t * H_t * K_t$, where u_t is utilization

Embedded in an otherwise almost standard NK model

- Factor prices (for non-quarantined workers and capital) equal marginal products

$$w_t^F = \alpha mc_t \left(\frac{u_t K_t}{N_t} \right)^{1-\alpha},$$

$$r_t^F = u_t (1-\alpha) mc_t \left(\frac{N_t}{u_t K_t} \right)^{\alpha} - q_t^F \delta(u_t),$$

$$\delta(u_t) = \delta_0 + \delta_1 (u_t - 1) + \delta_2 / 2 (u_t - 1)^2$$

Embedded in an otherwise almost standard NK model

- Factor prices (for non-quarantined workers and capital) equal marginal products
- Dividend paid to capital owners:

$$r_t = r_t^F H_t - (1 - H_t)(\delta_0 - \delta_1 + \delta_2/2)$$

Embedded in an otherwise almost standard NK model

- Factor prices (for non-quarantined workers and capital) equal marginal products
- Capital Price equals cost of production of capital

$$1 = q_t \left[1 - \frac{\phi}{2} \left(\frac{I_t}{I_{t-1}} - 1 \right)^2 - \phi \left(\frac{I_t}{I_{t-1}} - 1 \right) \frac{I_t}{I_{t-1}} \right] + \beta q_{t+1} \phi \left(\frac{I_{t+1}}{I_t} - 1 \right) \left(\frac{I_{t+1}}{I_t} \right)^2$$

Embedded in an otherwise standard NK model

- Phillips Curve under quadratic price adjustment costs

$$\log\left(\frac{\pi_t}{\bar{\pi}}\right) = \beta E_t\left[\left(\frac{\pi_{t+1}}{\bar{\pi}}\right)\frac{Y_{t+1}}{Y_t}\right] + \kappa_y\left(mc_t - \frac{1}{\mu^y}\right),$$

- Wage Phillips Curve under quadratic price adjustment costs

$$\log\left(\frac{\pi_t^w}{\bar{\pi}^w}\right) = \beta E_t\left[\left(\frac{\pi_{t+1}^w}{\bar{\pi}^w}\right)\frac{N_{t+1}w_{t+1}^F}{N_t w_t^F}\right] + \kappa_w\left(\frac{w_t}{w_t^F} - \frac{1}{\mu^w}\right),$$

Government

Monetary Policy

- Monetary policy follows Taylor rule

$$\log \frac{R^b_{t+1}}{\bar{R}^b} = \rho_R \log \frac{R^b_t}{\bar{R}^b} + (1-\rho_R)\theta_\pi \log \frac{\pi_t}{\bar{\pi}}$$

- We abstract from output stabilization because output target is unclear

Government

Fiscal Policy

The government follows simple rules

- for government spending that reacts to government debt:

$$\frac{G_t}{\bar{G}} = \left(\frac{G_t}{\bar{G}}\right)^{\rho_G} \left(\frac{B_t}{\bar{B}}\right)^{(1-\rho_G)\gamma_B^G} , \quad (1)$$

where γ_B^G determines the degree of debt stabilization.

Government

Fiscal Policy

The government follows simple rules

- for government spending that reacts to government debt:
- and similarly for taxes:

$$\frac{\tau_t}{\bar{\tau}} = \left(\frac{\tau_t}{\bar{\tau}}\right)^{\rho_\tau} \left(\frac{B_t}{\bar{B}}\right)^{(1-\rho_\tau)\gamma_B^\tau} \quad . \tag{1}$$

Government

Debt

- Government debt determined by government budget constraint

$$B_{t+1} = G_t + \mathcal{T}_t + \mathcal{R}_t - T_t + R_t^b B_t / \pi_t \ ,$$

- where $T_t = \tau(N_t w_t + \Pi_t^U + \Pi_t^F)$
- and $\mathcal{T}_t$ and $\mathcal{R}_t$ are untargeted and targeted transfers

Calibration

Calibration

Liquidity and wealth

Table: Calibrated parameters (annual)

Targets	Model	Data	Source	Parameter
Mean illiquid assets (K/Y)	3.00	3.00	NIPA	Discount factor
Mean liquidity (B/Y)	0.60	0.60	FRED	Port. adj. probability
Top10 wealth share	0.67	0.67	WID	Fraction of entrepreneurs
Fraction borrowers	0.16	0.16	SCF	Borrowing penalty

Calibration: Households

Table: External/calibrated parameters (monthly frequency)

Parameter	Value	Description	Target
β	0.993	Discount factor	see Table 1
ξ	4	Relative risk aversion	Kaplan et al. (2018)
γ	2	Inverse of Frisch elasticity	Chetty et al. (2011)
λ	0.035	Portfolio adj. prob.	see Table 1
ρ_h	0.993	Persistence labor income	Storesletten et al. (2004)
σ_h	0.069	STD labor income	Storesletten et al. (2004)
ζ	0.0002	Trans. prob. from W. to E.	see Table 1
ι	0.024	Trans. prob. from E. to W.	Guvenen et al. (2014)
p_{ss}^{in}	1/5000	Trans. prob. into Q	
p^{out}	0.5	Trans. prob. out of Q	
$\bar{R}$	1.95%	Borrowing penalty	see Table 1

Calibration: Firms

Table: External/calibrated parameters (monthly frequency)

Parameter	Value	Description	Target
α	0.68	Share of labor	62% labor income
δ_0	0.717%	Depreciation rate	Standard value
$\bar{\eta}$	11	Elasticity of substitution	Price markup 10%
$\bar{\zeta}$	11	Elasticity of substitution	Wage markup 10%
Government			
$\bar{\tau}^L$	0.2	Tax rate level	$G/Y = 15\%$
$\bar{R}^b$	1.004	Nominal rate	1.6% p.a.
$\bar{\pi}$	1.00	Inflation	0% p.a.

Parameters: Estimated in Bayer et al. (2020)

Table: Aggregate frictions and policy rules

Real frictions				Nominal frictions			
δ_s	1.483	ϕ	2.093	κ	0.009	κ_w	0.011
Government spending				**Taxes**			
ρ_G	0.965	γ_B^G	-0.100	ρ_τ	0.965	γ_B^τ	-0.400
Monetary policy							
ρ_R	0.965	θ_π	1.500				

Solution

All IRFs obtained by linearization

- Using the method of Bayer and Luetticke, 2018.

To obtain the effect of conditional transfer

- Linearize around two steady states almost identical steady states: one with high transfer in Q-state, one with low transfer

Model simulation: Q-shock scenario and fiscal transfers under CARES act

The Q-shock

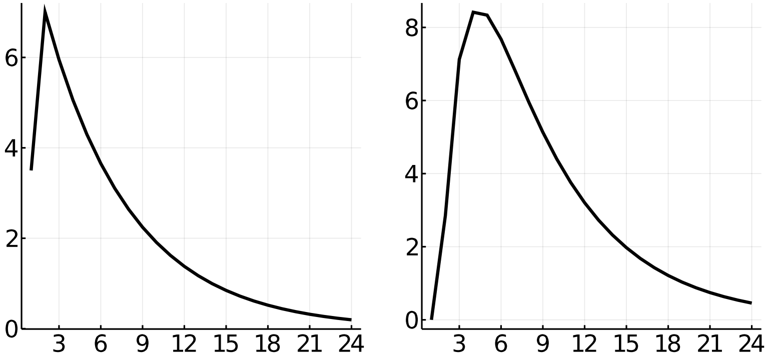
Quarantine shock (see also Guerrieri et al., 2020)

- Fraction of workers & capital receive no income; varieties not available
- Persistence parameter 0.85
- Incidence for bottom quarter of income distribution twice as high (Mongey and Weinberg 2020)

Timing ensures that uncertainty about income loss somewhat persistent

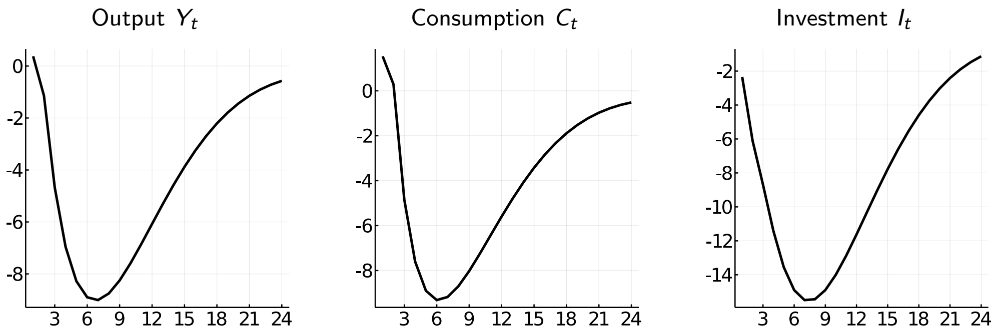
- February 2020: probability of quarantine as of March 3.5%
- March 2020: probability of quarantine as of April 7%

Percent of workers, capital, and goods under quarantine



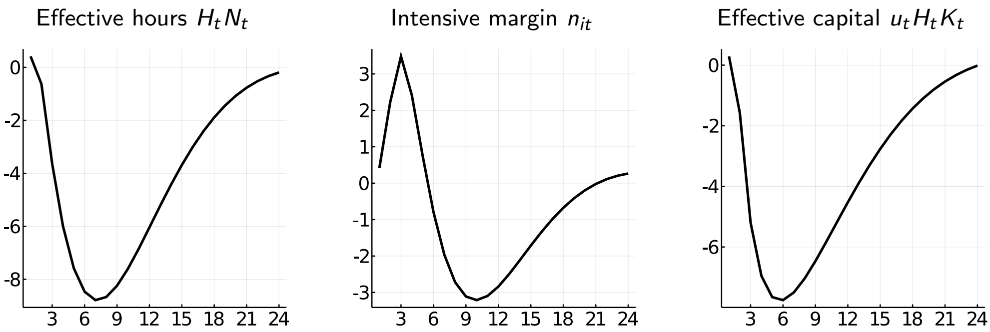
(a) Flow (b) Stock

Macroeconomic adjustment to Q-shock



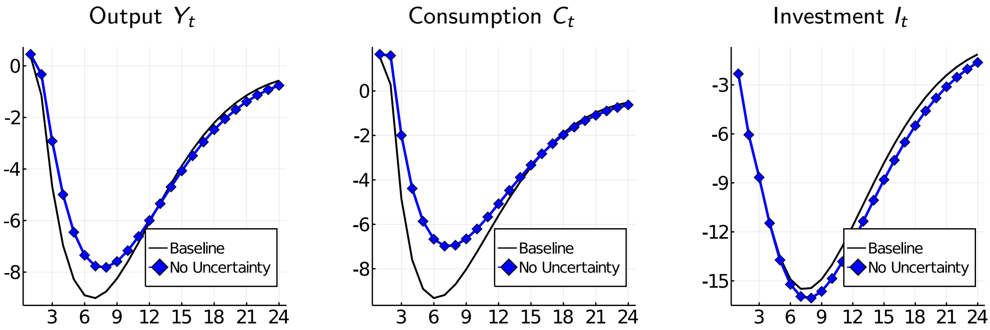
Y-axis: Percent deviation from steady state. X-axis: Months.

Macroeconomic adjustment to Q-shock



Y-axis: Percent deviation from steady state. X-axis: Months.

Uncertainty channel quantitatively important



Y-axis: percentage deviations from steady state. X-axis: Months.

Fiscal transfers under CARES act

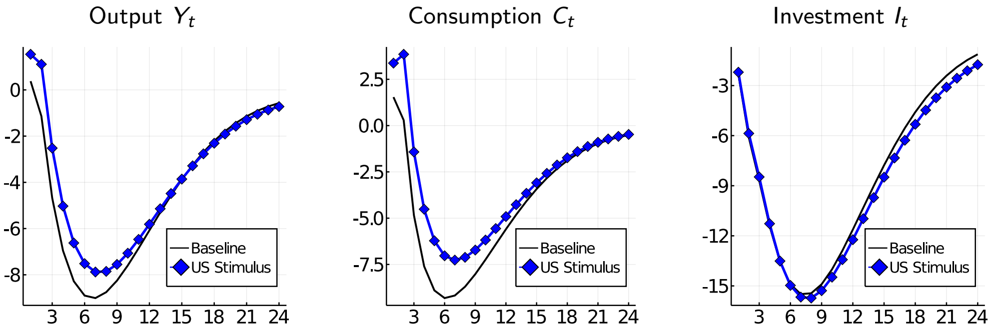
Unconditional transfers

- Every taxpayer receives 1200 USD
- Starting March 2020, persistence 0.5

Conditional transfers

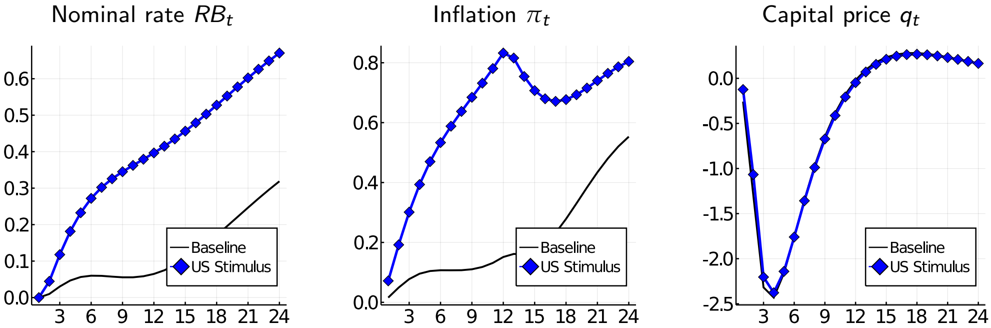
- Top up of unemployment benefit: 2400 USD per month
- For as long as people are unemployed
- Total amount: 500 billion, rather than 250 billion as earmarked under CARES act

Baseline Q-Shock and fiscal transfers under CARES



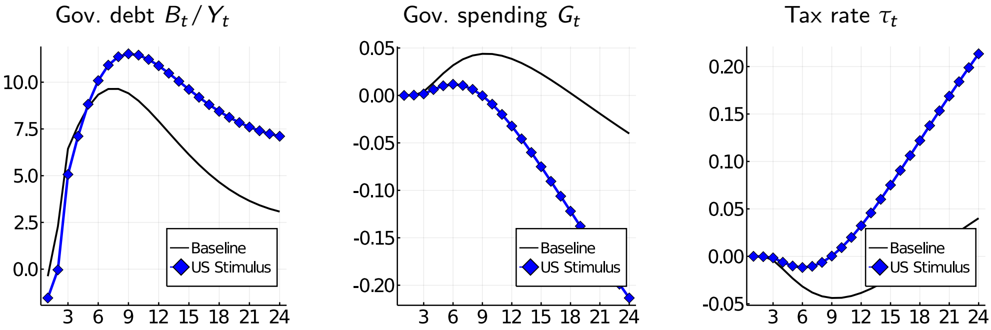
Y-axis: percent deviations from steady state. X-axis: Months.

Baseline Q-Shock and fiscal transfers under CARES



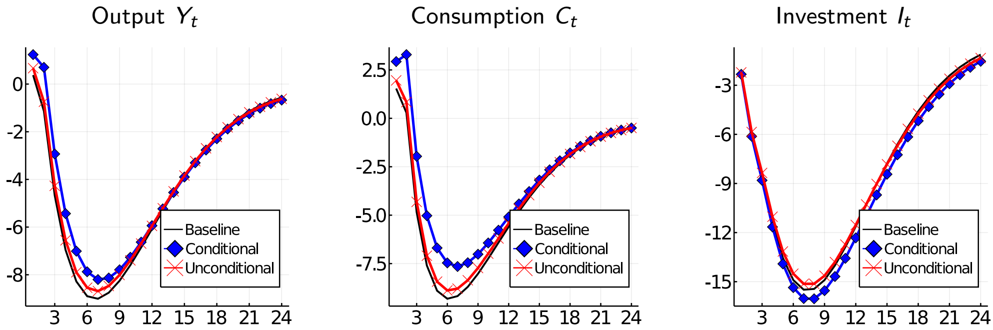
Y-axis: quantities reported in percent deviations from steady state, prices in annualized percentage points.
X-axis: Months.

Baseline Q-Shock and fiscal transfers under CARES



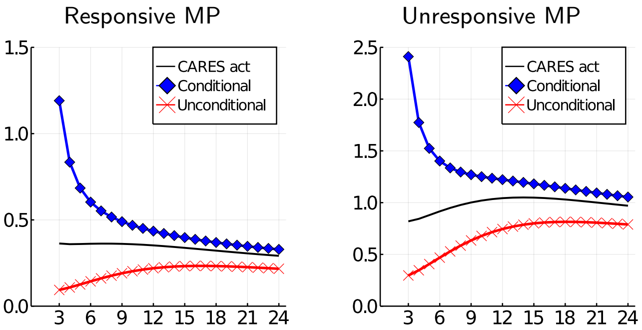
Notes: Y-axis: All quantities are reported in percent deviations from steady state. All prices are reported in annualized percentage points from steady state. X-axis: Months.

Conditional transfer does most of the trick



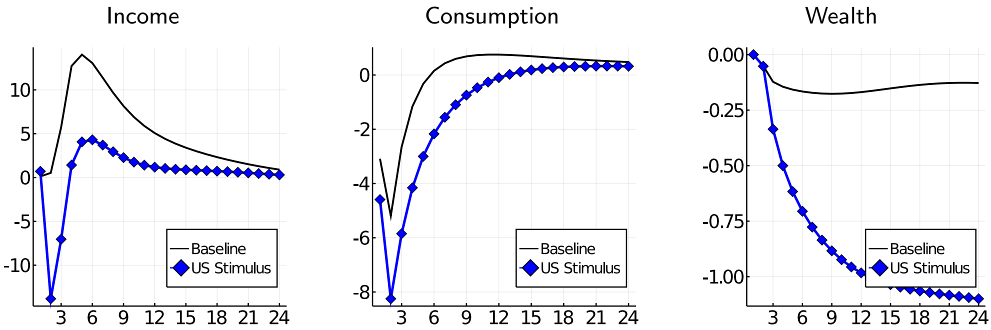
Y-axis: Percent deviation from steady state. X-axis: Months.

Cumulative Transfer Multiplier



Cumulative multiplier: $\sum_{j=1}^{k} y_i \,/\, \sum_{j=1}^{k} t_i$

Inequality: response of Gini coefficients



Y-axis: Quarterly percent deviation from steady state. X-axis: Quarters.

Conclusion

Concluding Remarks

Economic fallout from COVID-19: Q-shock

- Part of economy shuts down: workers, capital and goods under quarantine
- Focus on income risk due to unprecedented rise of unemployment

Quantitative evaluation within medium-scale HANK model

- Q-shock lowers output by about 10 percent, income risk accounts for about 1/5 of effect
- Conditional transfers particularly effective as they reduce income risk: multiplier larger than units in short run (fiscal insurance)
- Unconditional transfer less effective