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

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Bonn Macro Week

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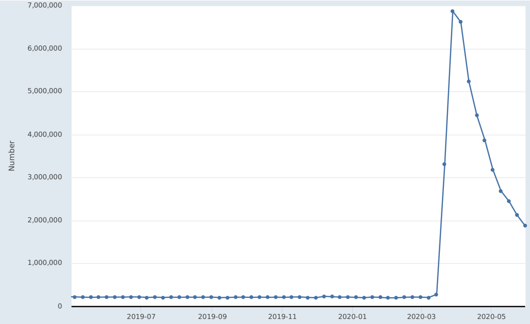
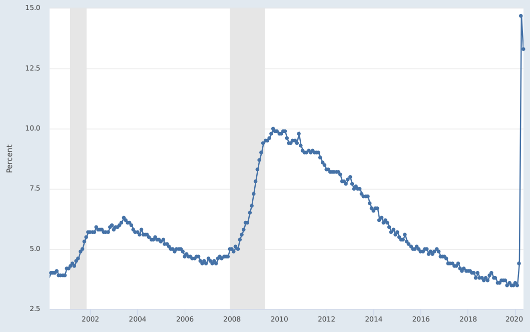
COVID-19 pandemic: major increase in household income risk

Unemployment benefits: weekly initial claims 2019–20



Unemployment rate 2000–20



. . . but 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 13.5% over the first year
- About 1/10 of effect caused by household income risk
- About 3/4 of effect caused by consumption complementarity

Transfer multiplier

- Sizeable for conditional transfers (UIB+): exceeds unity on impact, long-run: $0.5 - 1.5$
- Smaller for unconditional transfers

Related Literature (selection)

Model-based analysis of specific stimulus packages

- Cogan et al. (2010), Cwik/Wieland (2011)

Transfer multipliers

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

Macro-Models of COVID Pandemics and Recession

- Fornaro/Wolf (2020), Guerrieri et al. (2020), Eichenbaum et al. (2020), Faria-e-Castro (2020), Glover et al. (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

- 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:
  $\implies$ representative labor supply of the non-quarantined N_t.
- Budget equation:

$$c_{it} + b_{it+1} + q_t k_{it+1} = b_{it} \frac{R(b_{it}, R_t^b)}{\pi_t} + (q_t + r_t) k_{it} + \mathcal{T}_t(h_{it}) \\ + (1 - \tau_t)[(1 - Q_{it}) h_{it} w_t N_t + Q_{it} \mathcal{R}(h_{it}) h_{it} w_t N_t + \mathbb{I}_{h_{it} \neq 0} \Pi_t^U + \mathbb{I}_{h_{it} = 0} \Pi_t^F],$$

$$k_{it+1} \geq 0, \quad b_{it+1} \geq \underline{B}$$

Household Planning Problem

- GHH preferences with constant Frisch elasticity:
  $\implies$ 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 and product varieties

Fraction of workers affected by quarantine

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

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

Loss in varieties decreases effective productivity further

- Fraction $1 - \Psi_t$ of varieties not available
- Total production: $Y_t = \Psi_t^{\frac{1}{\sigma-1}} H_t Y_t^F$, where $\Psi_t^{\frac{1}{\sigma-1}}$ captures love for variety in preferences

Embedded in an otherwise almost standard NK model

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

$$
\begin{aligned}
w_t^F &= \alpha mc_t \left(\frac{u_t K_t}{N_t}\right)^{1-\alpha}, \\
r_t^F &= u_t(1-\alpha) mc_t \left(\frac{N_t}{u_t K_t}\right)^{\alpha} - q_t^F \delta(u_t), \\
\delta(u_t) &= \delta_0 + \delta_1 (u_t - 1) + \delta_2/2 (u_t - 1)^2
\end{aligned}
$$

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 Calvo (1983) with indexation

$$\log\left(\frac{\pi_t^F}{\bar{\pi}}\right) = \beta \mathbb{E}_t \log\left(\frac{\pi_{t+1}^F}{\bar{\pi}}\right) + \kappa_Y \left(mc_t / \Psi_t^{\frac{1}{\eta_S - 1}} - \frac{1}{\mu^Y} \right),$$

- π_t^F is the gross inflation rate of the average price of final goods
- P_t, the ideal price index, then exhibits an inflation rate $\pi_t = \pi_t^F \left(\frac{\Psi_{t-1}}{\Psi_t}\right)^{\frac{1}{\eta_S - 1}}$.

Embedded in an otherwise standard NK model

- Wage Phillips Curve under Calvo (1983) with indexation

$$\log\left(\frac{\pi_t^W}{\bar{\pi}_W}\right) = \beta \mathbb{E}_t \log\left(\frac{\pi_{t+1}^W}{\bar{\pi}_W}\right) + \kappa_w \left(\frac{w_t}{w_t^F} - \frac{1}{\mu^W}\right),$$

Government

Monetary Policy

- Monetary policy follows Taylor rule

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

- 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)	2.85	2.86	NIPA	Discount factor
Mean liquidity (B/Y)	0.55	0.56	FRED	Port. adj. probability
Top-10 wealth share	0.67	0.67	WID	Fraction of entrepreneurs
Fraction borrowers	0.14	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	0.055	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^{in}_{ss}	0.0002	Trans. prob. into Q	see text
p^{out}	0.5	Trans. prob. out of Q	see text
$\bar{R}$	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 (goods)	Price markup 10%
$\bar{\eta}^S$	3	Elasticity of substitution (sectors)	See text
$\bar{\zeta}$	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/Luetticke, 2018.

To obtain the effect of conditional transfer

- Linearize around two 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

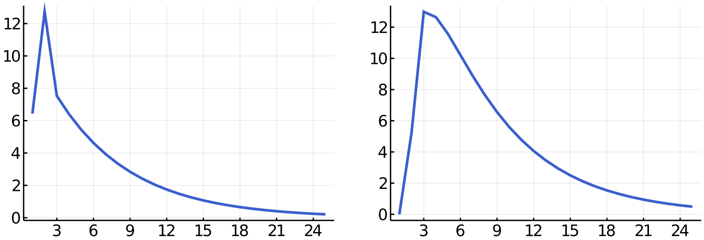
Quarantine shock

- 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 et al 2020)

Inflow into Quarantine set to UI claims

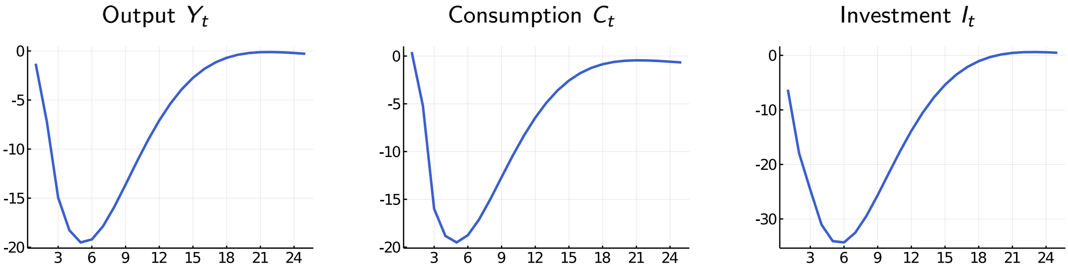
- February 2020: probability of quarantine as of March 6.4%
- March 2020: probability of quarantine as of April 12.7%
- April 2020: probability of quarantine as of May 7.5%

Percent of workers, capital, and goods under quarantine



(a) Flow (b) Stock

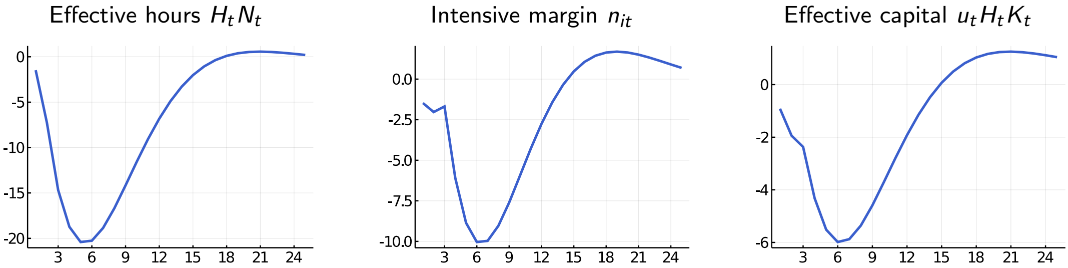
Macroeconomic adjustment to Q-shock



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

Equal incidence
No loss of varieties

Macroeconomic adjustment to Q-shock



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

Fiscal transfers under CARES act

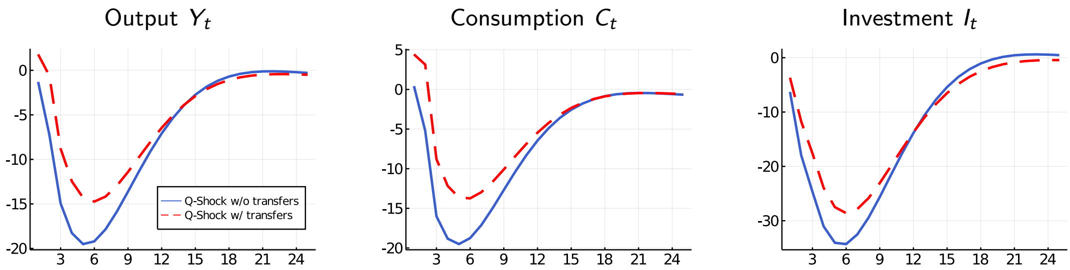
Unconditional transfers

- Every taxpayer receives 1200 USD (except for top-10% of income distribution)
- Starting March 2020, persistence 0.5

Conditional transfers

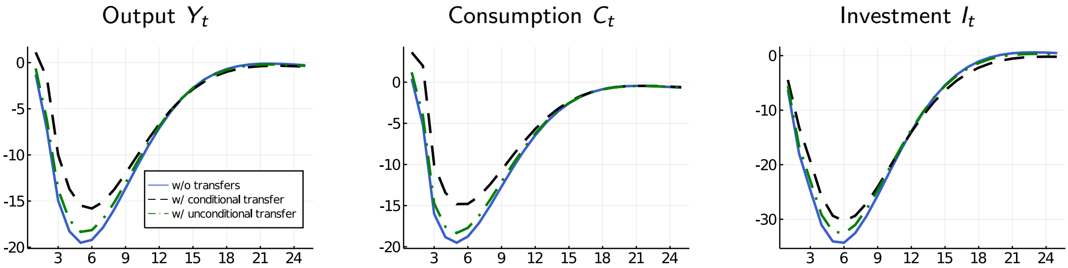
- Top up of unemployment benefit: 600 USD per week
- For as long as people are unemployed
- Total amount: 733 billion, rather than 250 billion as earmarked under CARES act

Baseline Q-Shock and fiscal transfers under CARES



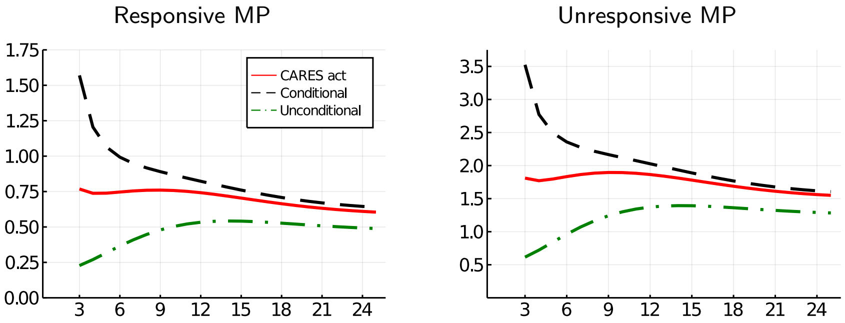
Y-axis: percent deviations from steady state. X-axis: Months.

Conditional transfer does most of the trick



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

Cumulative Transfer Multiplier



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

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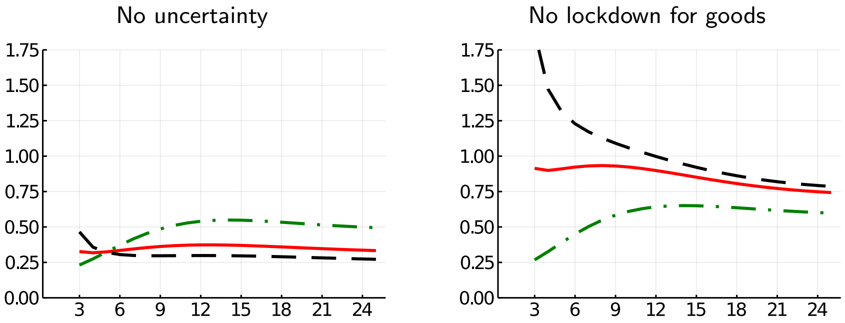
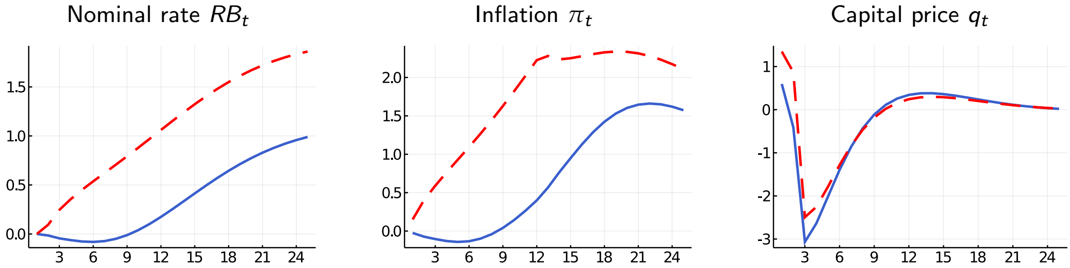


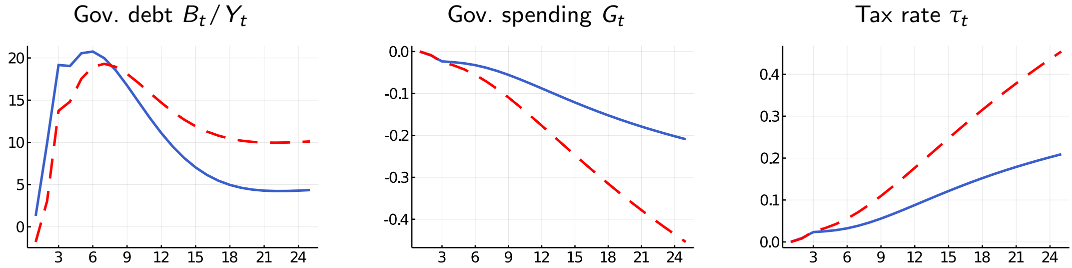
Cumulative multiplier: $\sum_{j=1}^{k} y_i \,/\, \sum_{j=1}^{k} t_i$

Baseline Q-Shock and fiscal transfers under CARES



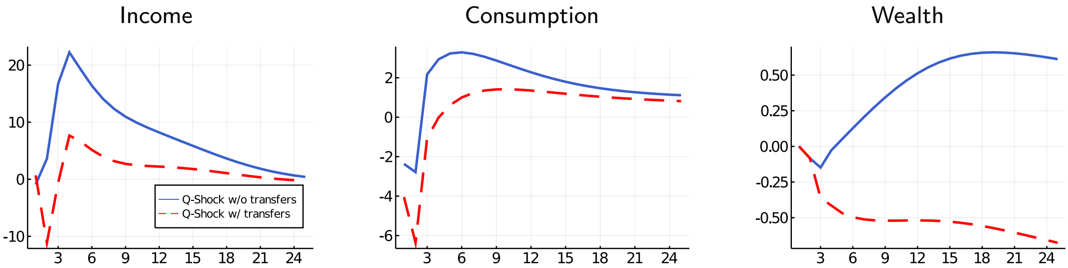
Y-axis: quantities reported in percent deviations from steady state, prices in annualized percentage points. Inflation is computed year on year. X-axis: Months.

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.

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

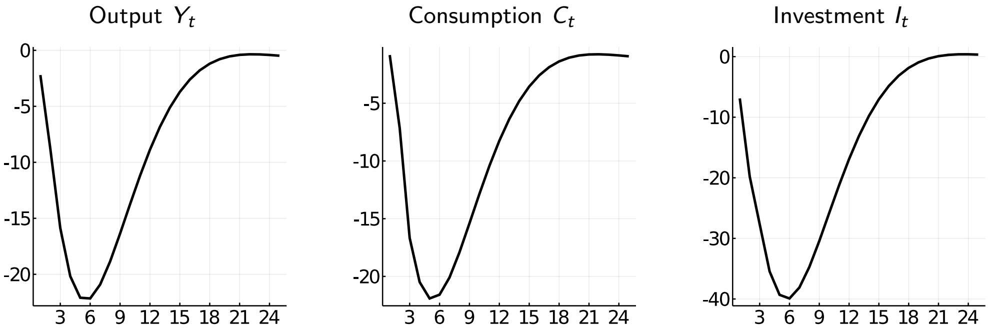
- Part of economy shuts down: workers, capital and goods under quarantine
- Focus on income risk due to unprecedented rise of unemployment

Quantitative evaluation within medium-scale HANK model

- Q-shock lowers output by 13.5 percent in 2020, income risk accounts for about 1/10 of effect
- Conditional transfers particularly effective as they reduce income risk: multiplier larger than unity in short run (fiscal insurance)
- Unconditional transfer less effective

Backup Slides

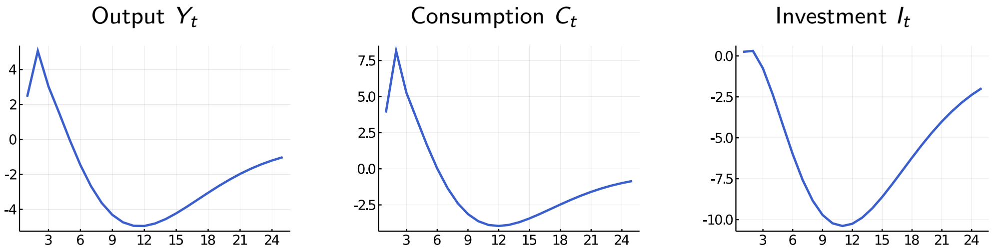
Equal probability to enter quarantine



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

▸ Back

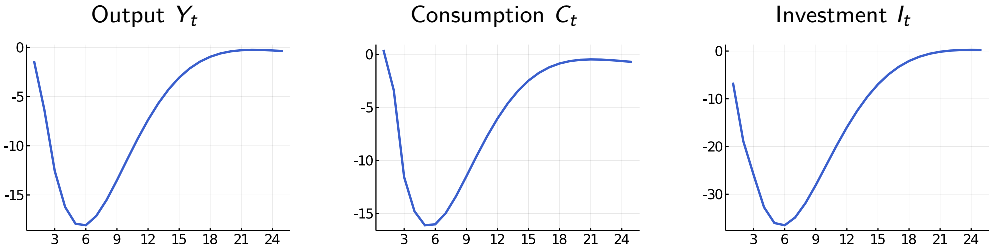
No unavailability of varieties



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

Back

Uncertainty channel: consumption and investment



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

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