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

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COVID-19 pandemic: major increase of economic uncertainty
The Coronavirus Stimulus Package: How large is the transfer multiplier?

And particularly strong increase of household income risk

Unemployment benefits: weekly initial claims 2019–20

Unemployment rate 2000–20

Shaded areas indicate U.S. recessions

Source: U.S. Bureau of Labor Statistics

Source: U.S. Employment and Training Administration

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Introduction

Motivation

... 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 \textbf{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

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Model
## Model overview

<table>
<thead>
<tr>
<th>Households</th>
<th>Production Sector</th>
<th>Government</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obtain Income</td>
<td>Trade Assets</td>
<td>Produce and Differentiate Consumption Goods</td>
</tr>
<tr>
<td>Wages</td>
<td>Bonds (b&gt;B) = claims on HH debt, + government debt, (nominal, liquid) and</td>
<td>Intermediate goods producers Rent capital &amp; labor</td>
</tr>
<tr>
<td>-&gt; set by unions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-&gt; s.t. adj. costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-&gt; Idiosyncratic Risk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest</td>
<td>Illiquid Assets, k = capital (trading friction)</td>
<td>Competitive Market for Intermediate Goods</td>
</tr>
<tr>
<td>-&gt; from bonds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dividends</td>
<td></td>
<td>Entrepreneurs Monopolistic resellers s.t. price adjustment costs</td>
</tr>
<tr>
<td>-&gt; from capital: MPK</td>
<td></td>
<td>Capital goods producers</td>
</tr>
<tr>
<td>-&gt; liquid rental market</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-&gt; as “entrepreneurs”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **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 \( \lambda \) 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:
  \[ \Rightarrow \] representative labor supply of the non-quarantined \( N_t \).

- Budget equation:

\[
\begin{align*}
    c_{it} + b_{it+1} + q_t k_{it+1} &= b_{it} \frac{R(b_{it}, R^b_t)}{\pi_t} + (q_t + r_t) k_{it} + T_t(h_{it}) \\
    &\quad + (1 - \tau_t) [(1 - Q_{it}) h_{it} w_t N_t + Q_{it} R(h_{it}) h_{it} w_t N_t + \mathbb{I}_{h_{it} \neq 0} \Pi^U_t + \mathbb{I}_{h_{it} = 0} \Pi^F_t], \\
    k_{it+1} &\geq 0, \quad b_{it+1} \geq B,
\end{align*}
\]
Household Planning Problem

- GHH preferences with constant Frisch elasticity:
  \[ V^a_t(b, k, h, Q) = \max_{k', b'_a} u(x(b, b'_a, k, k', h, Q)) + \beta E_t V^a_{t+1}(b'_a, k', h', Q') \]
  \[ V^n_t(b, k, h, Q) = \max_{b'_n} u(x(b, b'_n, k, k, h, Q)) + \beta E_t V^n_{t+1}(b'_n, k, h', Q') \]

- Budget equation:

- Bellman equation:
  \[ E_t V^a_{t+1}(b', k', h', Q') = E_t [\lambda V^a_{t+1}(b', k', h', Q')] + E_t [(1 - \lambda) V^n_{t+1}(b', k, h', Q')] \]
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: $u_t \times H_t \times K_t$, where $u_t$ is utilization
Embedded in an otherwise almost standard NK model

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

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

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

\[ \delta(u_t) = \delta_0 + \delta_1 (u_t - 1) + \delta_2 / 2 (u_t - 1)^2 \]
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Model

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

\[
1 = q_t \left[ 1 - \frac{\phi}{2} \left( \frac{l_t}{l_{t-1}} - 1 \right)^2 - \phi \left( \frac{l_t}{l_{t-1}} - 1 \right) \frac{l_t}{l_{t-1}} \right] + \beta q_{t+1} \phi \left( \frac{l_{t+1}}{l_t} - 1 \right) \left( \frac{l_{t+1}}{l_t} \right)^2
\]
Embedded in an otherwise standard NK model

- Phillips Curve under quadratic price adjustment costs

\[
\log \left( \frac{\pi_t}{\bar{\pi}} \right) = \beta E_t \left[ \left( \frac{\pi_{t+1}}{\bar{\pi}} \right) \frac{Y_{t+1}}{Y_t} \right] + \kappa_y \left( m c_t - \frac{1}{\mu_y} \right),
\]

- Wage Phillips Curve under quadratic price adjustment costs

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

Government

Monetary Policy

- Monetary policy follows Taylor rule

\[
\log \frac{R_{t+1}^b}{R_b} = \rho_R \log \frac{R_t^b}{R_b} + (1 - \rho_R) \theta_\pi \log \frac{\pi_t}{\pi}
\]

- 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:

\[
\frac{G_t}{G} = \left( \frac{G_t}{G} \right)^{\rho_G} \left( \frac{B_t}{B} \right)^{(1-\rho_G)\gamma_B^G},
\]

(1)

where \( \gamma_B^G \) determines the degree of debt stabilization.
The government follows simple rules

- for government spending that reacts to government debt:

- and similarly for taxes:

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

<table>
<thead>
<tr>
<th>Targets</th>
<th>Model</th>
<th>Data</th>
<th>Source</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean illiquid assets (K/Y)</td>
<td>3.00</td>
<td>3.00</td>
<td>NIPA</td>
<td>Discount factor</td>
</tr>
<tr>
<td>Mean liquidity (B/Y)</td>
<td>0.60</td>
<td>0.60</td>
<td>FRED</td>
<td>Port. adj. probability</td>
</tr>
<tr>
<td>Top10 wealth share</td>
<td>0.67</td>
<td>0.67</td>
<td>WID</td>
<td>Fraction of entrepreneurs</td>
</tr>
<tr>
<td>Fraction borrowers</td>
<td>0.16</td>
<td>0.16</td>
<td>SCF</td>
<td>Borrowing penalty</td>
</tr>
</tbody>
</table>
## Calibration: Households

### Table: External/calibrated parameters (monthly frequency)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$</td>
<td>0.993</td>
<td>Discount factor</td>
<td>see Table 1</td>
</tr>
<tr>
<td>$\xi$</td>
<td>4</td>
<td>Relative risk aversion</td>
<td>Kaplan et al. (2018)</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>2</td>
<td>Inverse of Frisch elasticity</td>
<td>Chetty et al. (2011)</td>
</tr>
<tr>
<td>$\lambda$</td>
<td>0.035</td>
<td>Portfolio adj. prob.</td>
<td>see Table 1</td>
</tr>
<tr>
<td>$\rho_h$</td>
<td>0.993</td>
<td>Persistence labor income</td>
<td>Storesletten et al. (2004)</td>
</tr>
<tr>
<td>$\sigma_h$</td>
<td>0.069</td>
<td>STD labor income</td>
<td>Storesletten et al. (2004)</td>
</tr>
<tr>
<td>$\zeta$</td>
<td>0.0002</td>
<td>Trans. prob. from W. to E.</td>
<td>see Table 1</td>
</tr>
<tr>
<td>$\iota$</td>
<td>0.024</td>
<td>Trans. prob. from E. to W.</td>
<td>Guvenen et al. (2014)</td>
</tr>
<tr>
<td>$p_{in}^{ss}$</td>
<td>1/5000</td>
<td>Trans. prob. into $Q$</td>
<td></td>
</tr>
<tr>
<td>$p_{out}$</td>
<td>0.5</td>
<td>Trans. prob. out of $Q$</td>
<td></td>
</tr>
<tr>
<td>$\bar{R}$</td>
<td>1.95%</td>
<td>Borrowing penalty</td>
<td>see Table 1</td>
</tr>
</tbody>
</table>
Calibration: Firms

Table: External/calibrated parameters (monthly frequency)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha$</td>
<td>0.68</td>
<td>Share of labor</td>
<td>62% labor income</td>
</tr>
<tr>
<td>$\delta_0$</td>
<td>0.717%</td>
<td>Depreciation rate</td>
<td>Standard value</td>
</tr>
<tr>
<td>$\bar{\eta}$</td>
<td>11</td>
<td>Elasticity of substitution</td>
<td>Price markup 10%</td>
</tr>
<tr>
<td>$\bar{\zeta}$</td>
<td>11</td>
<td>Elasticity of substitution</td>
<td>Wage markup 10%</td>
</tr>
</tbody>
</table>

**Government**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Description</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\bar{\tau}^L$</td>
<td>0.2</td>
<td>Tax rate level</td>
<td>$G/Y = 15%$</td>
</tr>
<tr>
<td>$\bar{R}^b$</td>
<td>1.004</td>
<td>Nominal rate</td>
<td>1.6% p.a.</td>
</tr>
<tr>
<td>$\bar{\pi}$</td>
<td>1.00</td>
<td>Inflation</td>
<td>0% p.a.</td>
</tr>
</tbody>
</table>
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Parameters

Parameters: Estimated in Bayer et al. (2020)

Table: Aggregate frictions and policy rules

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Real frictions</th>
<th>Nominal frictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\delta_s$</td>
<td>1.483</td>
<td>$\kappa$ 0.009</td>
</tr>
<tr>
<td>$\phi$</td>
<td>2.093</td>
<td>$\kappa_w$ 0.011</td>
</tr>
</tbody>
</table>

Government spending

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Real frictions</th>
<th>Nominal frictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\rho_G$</td>
<td>0.965</td>
<td>$\gamma^G_B$ -0.100</td>
</tr>
<tr>
<td>$\gamma_B$</td>
<td>-0.100</td>
<td></td>
</tr>
</tbody>
</table>

Taxes

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Real frictions</th>
<th>Nominal frictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\rho_\tau$</td>
<td>0.965</td>
<td>$\gamma^\tau_B$ -0.400</td>
</tr>
</tbody>
</table>

Monetary policy

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Real frictions</th>
<th>Nominal frictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\rho_R$</td>
<td>0.965</td>
<td>$\theta_{\pi}$ 1.500</td>
</tr>
<tr>
<td>$\theta_{\pi}$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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Parameters

Solution

All IRFs obtained by linearization


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%
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Results

Percent of workers, capital, and goods under quarantine

(a) Flow

(b) Stock
Macroeconomic adjustment to Q-shock

Output $Y_t$

Consumption $C_t$

Investment $I_t$

Macroeconomic adjustment to Q-shock

Effective hours $H_t N_t$

Intensive margin $n_{it}$

Effective capital $u_t H_t K_t$

Uncertainty channel quantitatively important

**Output** $Y_t$

**Consumption** $C_t$

**Investment** $I_t$

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

Output $Y_t$

Consumption $C_t$

Investment $I_t$

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

Output $Y_t$

Consumption $C_t$

Investment $I_t$

Cumulative Transfer Multiplier

Cumulative multiplier: \( \sum_{j=1}^{k} y_i / \sum_{j=1}^{k} t_i \)
Inequality: response of Gini coefficients

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