Asset Prices and Aggregate Demand in a "Covid-19" Shock: A Model of Endogenous Risk Intolerance and LSAPs

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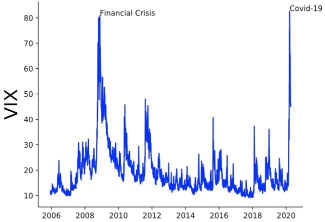
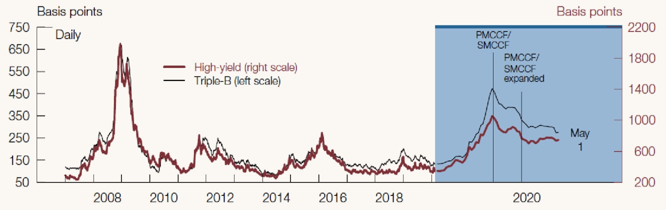
A non-financial shock almost turns into a Financial Crisis...



Widespread reaction:
S&P500 declined by 30% in weeks

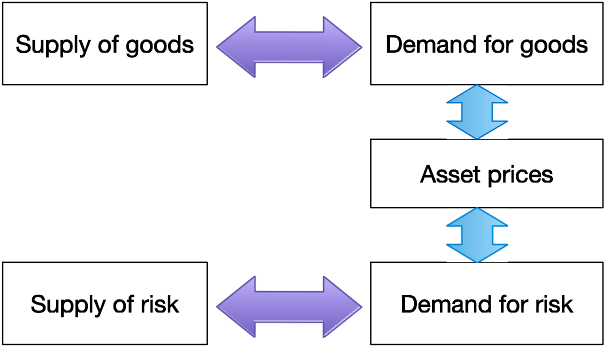
Massive policy intervention:
Fed pledged 20% of US GDP

Figure F. Corporate Bond Spreads to 10-Year Treasury



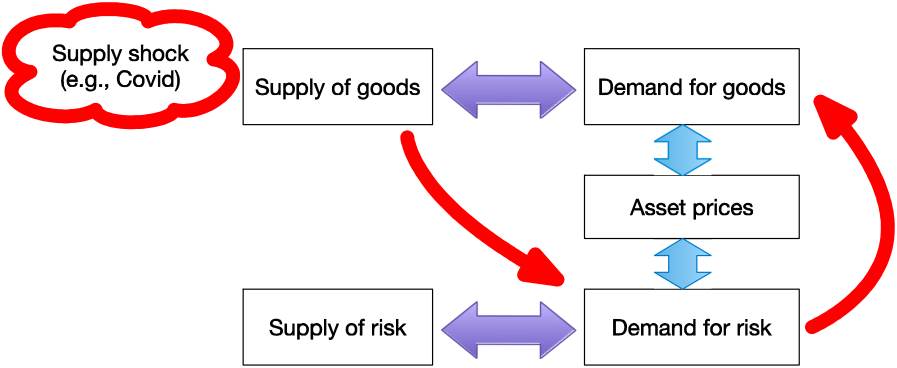
Paper: (i) **Endogenous risk intolerance** and demand (ii) **LSAPs**

How to absorb goods and risks? Problems are linked

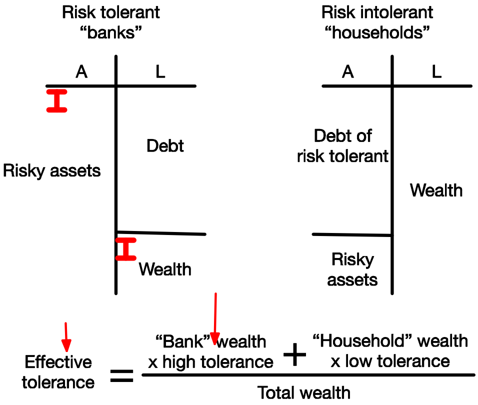


Heterogeneity: Risk tolerant and intolerant investors
(Intermediary asset pricing. Empirically important)

Main results: Financial amplification of the "Covid" shock



Key mechanism: "Bank" losses reduce risk tolerance



- With constrained interest rate, **downward spirals**.
- **"LSAPs":** The *consolidated* government *absorbs* some of the risk
  - Powerful because they reverse the downward spirals

Summary of the model

- Single factor, capital. Potential output z_t. Actual output y_t
- Periods $t \geq 1$: No uncertainty, $y_t = z_t$, and balanced growth
- Period 0: Aggregate risk. Productivity growth $LN\left(g - \frac{\sigma^2}{2}, \sigma\right)$
  - Shocks to $z_0 \leq 1$. Output y_0 demand-determined (sticky prices)
- Market portfolio with (ex-dividend) price $z_0 P_0$
- Two agents b, h with EIS=1, $\tau^b > \tau^h$. Initial leverage $l \in (0, 1)$
- Central bank: $r_0^f = \max\left(0, r_0^{f*}\right)$ where r_0^{f*} replicates $y_0 = z_0$

The model has three key equations

- **Output-asset price relation** (wealth effects+):

$$y_0 = c_0 \simeq \rho z_0 P_0$$

  - Efficient asset price per supply is $P^* = 1/\rho$. Define $p_0 \equiv \frac{P_0}{P^*}$

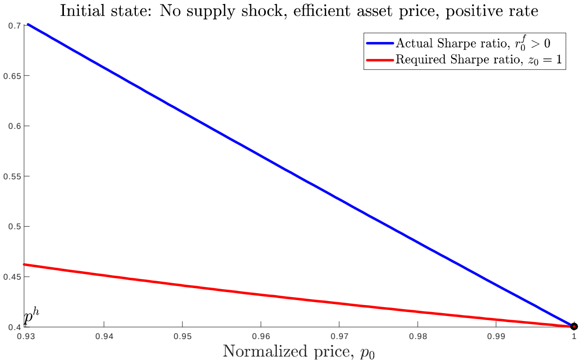
- **Risk balance condition (**supply of risk = demand):

$$\sigma \simeq \tau_0 \frac{\rho + g - \log(p_0) - r_0^f}{\sigma}$$

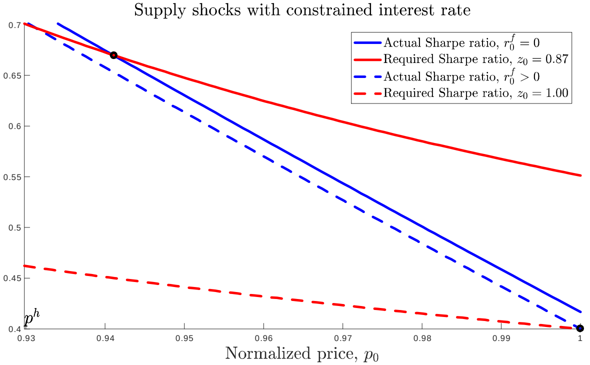
- **Risk tolerance-asset price relation**. Increasing:

$$\tau_0(z_0 p_0) = \tau^h + \underbrace{\left(1 - \frac{l}{z_0 p_0}\right)\kappa}_{\text{banks' wealth share}} \left(\tau^b - \tau^h\right)$$

$$\overbrace{\frac{\sigma}{\tau_0\left(z_0 p_0\right)}}^{\textbf{Required Sharpe ratio}} = \overbrace{\frac{\rho + g - \log\left(p_0\right) - r_0^f}{\sigma}}^{\textbf{Actual Sharpe ratio}}$$



A supply shock can trigger an asset price spiral

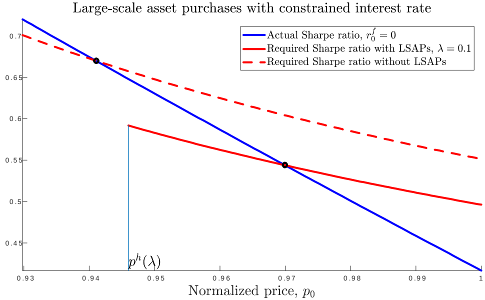


$$\frac{\sigma}{\tau_0 \left(z_0 p_0 \right)} = \frac{\rho + g - \log \left(p_0 \right) - r_0^f}{\sigma}$$

- Steeper red-line (high $\frac{\tau^b}{\tau^h}$,high l_0, low z_0) means greater amplification
- With sufficiently steep red-line, there are ▸ multiple equilibria

LSAPs increase asset prices and mitigate the spiral

Modeling LSAPs: Government buys risky assets (non-Ricardian)



$$\frac{\sigma(1-\lambda)}{\tau_0\left(z_0 p_0\right)} = \frac{\rho + g - \log\left(p_0\right) - r_0^f}{\sigma}$$

- Steeper red-line (high $\frac{\tau^b}{\tau^h}$, high l_0, low z_0): greater marginal impact

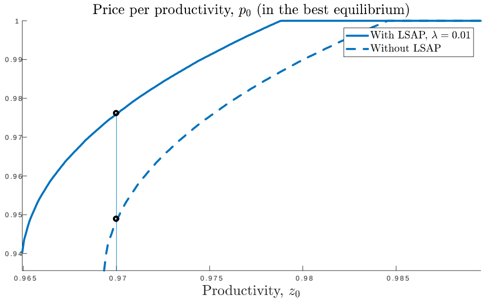
With calibrated demand (in)elasticity, effects are large

Calibration based on **the price elasticity of asset demand:**

- Pre-shock elasticity $= 1$ (Conservative. Gabaix-Koijen $\simeq 0.2$)
- Leverage from the Fed's June 2020 stress tests, $l \simeq 0.71$

Risk-tolerance heterogeneity helps match inelasticity in normal times

Productivity shocks move prices a lot. LSAPs are powerful

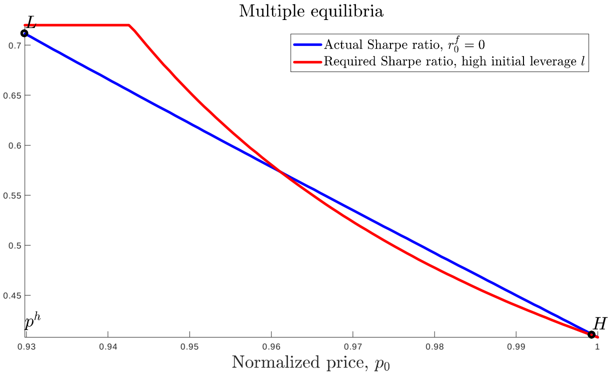


Final remarks: A risk-centric perspective on "Covid-19"

- **Asset price spirals and aggregate demand** can **amplify real shocks** when economic agents have **heterogeneous risk tolerance**
  - As supply (or demand) drops, so do asset prices
  - The "representative investor" becomes less risk tolerant
  - An interest rate cut is the most effective response
  - Without it, asset prices drop further and trigger a downward spiral
  - ▸ Corporate debt overhang and insolvencies amplify the spiral
- LSAPs work by reducing the supply of risk market needs to absorb
  - The rationale is **to boost aggregate demand** via **asset prices**
- With calibrated asset demand (in)elasticities, effects are large

With high leverage, there are multiple equilibria

back to supply shocks



$$\frac{\sigma}{\tau_0\left(z_0 p_0\right)} = \frac{\rho + g - \log\left(p_0\right) - r_0^f}{\sigma}$$

Large-scale asset purchases (LSAPs)

back

Government Balance Sheet
Before LSAP

A	L
Future tax revenues (claims on future generation)	Government wealth (spending, transfers to future generation)
η^g units of m	$\eta^g z_0 P_0$

After LSAP

A	L
λ units of m	$\lambda z_0 P_0$ units of f
η^g units of m	$\eta^g z_0 P_0$

LSAPs (λ) reduce the risk that private sector needs to absorb:

$$\frac{\sigma(1-\lambda)}{\tau_0\left(z_0 p_0\right)} = \frac{\rho + g - \log\left(p_0\right) - r_0^f}{\sigma}$$

A quantification based on demand (in)elasticity

- Let $q_0\left(p_0\right) = q_0^b + q_0^h$ denote the asset demand. **Elasticity:**

$$\frac{\partial \log q_0}{\partial \log p_0} = -\frac{1}{r_0 - r_0^f} + \underbrace{\frac{\frac{l}{z_0 p_0}}{\frac{\tau^h/\kappa}{\tau^b - \tau^h} + 1 - \frac{l}{z_0 p_0}}}_{\text{risk heterogeneity raises the INELASTICITY}}$$

- **Marginal price impact of shocks:**

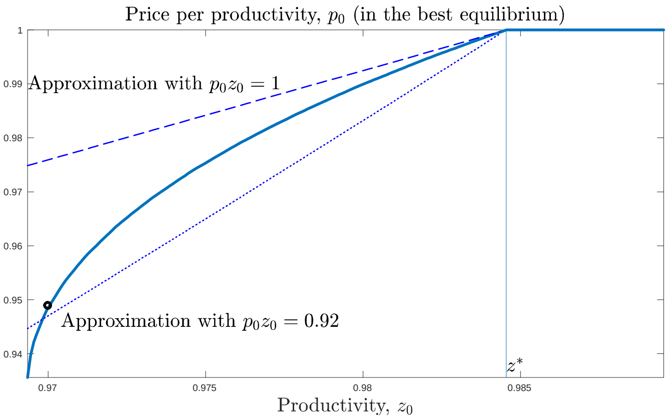
$$\frac{d \log p_0}{d \log z_0} = \frac{\frac{\partial \log q_0}{\partial \log z_0} \text{ (induced flows. same as INELASTICITY)}}{\frac{\partial \log q_0}{-\partial \log p_0} \text{ (elasticity. price change to absorb flows)}}$$

Calibration:

- Pre-shock elasticity $= 1$ (Conservative. Gabaix-Koijen $\simeq 0.2$)
- Leverage from the Fed's June 2020 stress tests, $l \simeq 0.71$

With calibrated demand (in)elasticity, effects are large

Pre-shock approximation: $\left.\frac{d\log p_0}{d\log z_0}\right|_{p_0 z_0=1} = \frac{1.63}{2.63-1.63} = 1.63$



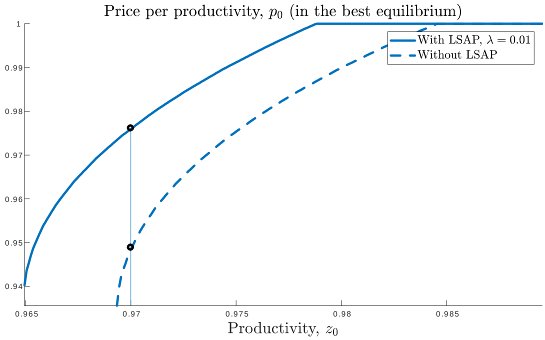
Post-shock approximation: $\left.\frac{d\log p_0}{d\log z_0}\right|_{p_0 z_0=0.92} = \frac{2.07}{2.63-2.07} \simeq 3.66$

- Shock increases **effective** leverage $\frac{l}{p_0 z_0} = 0.77 > l = 0.71$

With calibrated elasticity, LSAPs have a large impact

back

$$\frac{\partial \log p_0}{\partial \lambda} \simeq \left(\frac{\partial \log q_0}{-\partial \log p_0} \right)^{-1} = \begin{cases} 1 & \text{pre-shock, } l = 0.71 \\ \frac{1}{0.56} & \text{post-shock, } \frac{l}{p_0 z_0} = 0.77 \end{cases}$$



- LSAPs reduce range of z_0 with unique bad equilibrium ($p^h = 0.6$)

Debt overhang: Asset prices affect firm insolvencies

- Firm ν manages capital. Initial debt $b(\nu)$ where $\int_{\nu} b(\nu)\, dF(\nu) = 0$
- Insolvent firms become unproductive. Solvency condition:

$$y_0(\nu) + z_0 p_0 \geq b(\nu).$$

- **Fraction of solvent firms is increasing in the asset price:**

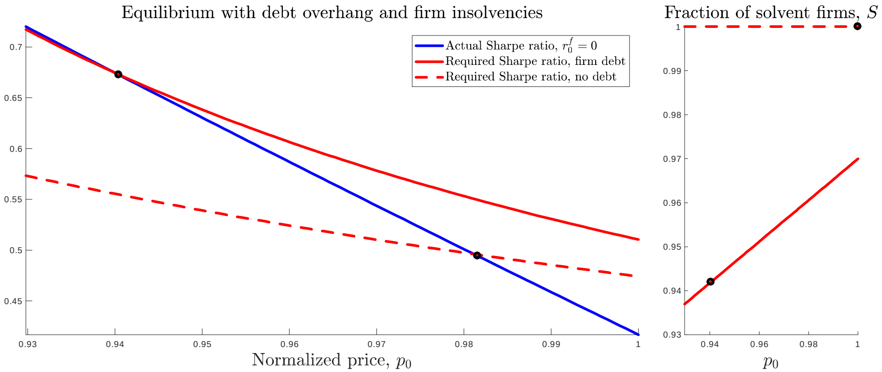
$$\overline{S}(z_0 p_0) \equiv F\left(\frac{z_0 P_0}{e^{-\rho}}\right).$$

- This leads to a **stronger output-asset price relation**
- And a **stronger risk tolerance-asset price relation**

$$\tau_0\left(\overline{S}(z_0 p_0)\, z_0 p_0\right).$$

Debt overhang: Amplifies spirals (strengthens LSAPs)

back



$$\frac{\sigma}{\tau_0\left(\overline{S}\left(p_0\right) z_0 p_0\right)} = \frac{\rho + g - \log\left(p_0\right) - r_0^f}{\sigma}.$$