A Model of Asset Price Spirals and Aggregate Demand Amplification of a "Covid-19" Shock

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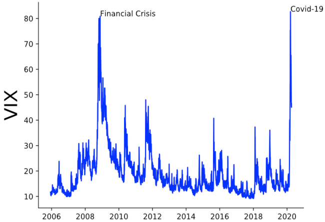
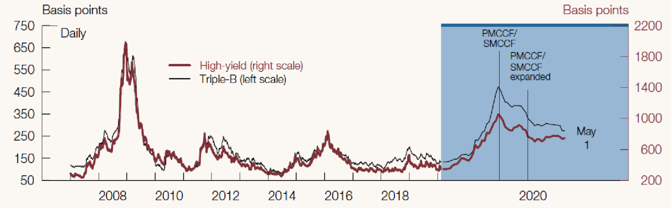


Widespread reaction:
S&P500 declined by 30% in weeks

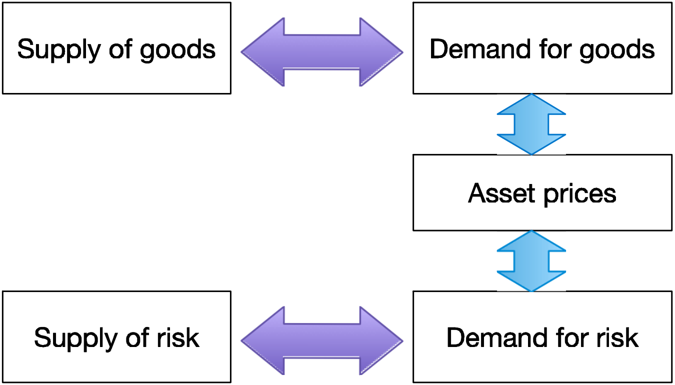
Massive policy intervention:
Fed pledged 20% of US GDP

Figure F. Corporate Bond Spreads to 10-Year Treasury



This paper: **Risk-centric** amplification via **demand**. Policy implications

How to absorb goods and risks? Problems are linked



Heterogeneous valuations:
Risk tolerant and intolerant investors
Optimists and pessimists (speculation)

...

A three equation model to analyze the "Covid" shock

Output (aggregate demand)-asset price relation

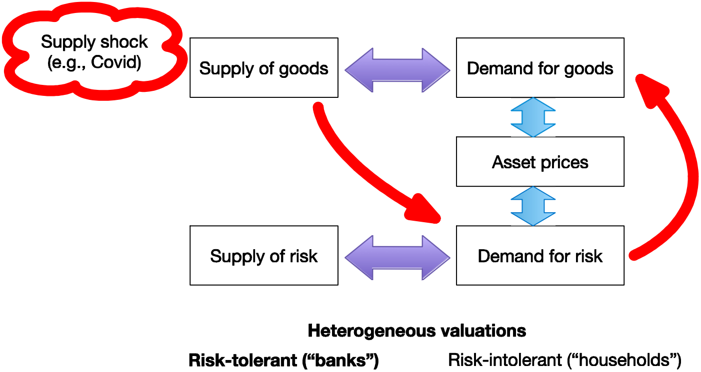
Risk balance condition: Asset price given risk, tolerance, policy rate...

Endogenous risk tolerance via heterogenous risk attitudes:
risk-tolerant ("banks") and **risk-intolerant** ("households") investors

- **"Covid"** shock: **Non-financial**—supply (demand shocks extension)...

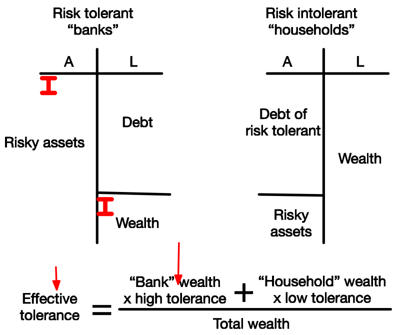
Main results: Financial amplification of the "Covid" shock

- **Endogenous risk tolerance** can amplify "real" shocks via **demand**



- **"Large-scale asset purchases (LSAPs)"** can **mitigate** the damage

Key mechanism –"Bank" losses reduce risk tolerance



- The supply shock reduces asset prices. **Lowers "bank" wealth**
- This lowers risk tolerance and asset prices & aggregate demand
- With high leverage or a sufficiently large (or persistent) shock:
  Asset prices & demand decline more than the decline in supply

Summary of the (simplified) model

- Single factor, capital. Potential output z_t. Actual output y_t
- Two periods $0, 1$
  - Future output = potential. Risk: $y_1 = z_1 \sim LN\left(z_0(1+g) - \frac{\sigma^2}{2}, \sigma^2\right)$
  - Current output y_0 determined by **demand** (fully sticky prices)
- Two assets
  - Market portfolio with (ex-dividend) price $z_0 Q_0$. Return r^m
  - Risk-free asset (zero net supply) with return r^f
- Two agents b, h with Epstein-Zin preferences:
  - EIS=1 (similar to log)
  - "Banks" are more risk tolerant, $\tau^b > \tau^h$
  - "Banks" start with initial leverage, $l_0 \in (0, 1)$
- Central bank: $r^f = \max\left(0, r^{f*}\right)$ where r^{f*} replicates $y_0 = z_0$

The model has three key equations

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

$$y_0 = z_0 Q_0 \quad \Longrightarrow \quad Q_0^* = 1.$$

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

$$\sigma = \tau_0 \frac{r^m\left(\frac{z_0(1+g)}{z_0 Q_0}\right) - r^f}{\sigma}.$$

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

$$\tau_0\left(z_0 Q_0\right) = \tau^h + \underbrace{\alpha_0\left(z_0 Q_0\right)}_{\text{banks' wealth share } \left(1-\frac{l_0}{z_0 Q_0}\right)\kappa_0} \left(\tau^b - \tau^h\right).$$

Supply shock can reduce AD and "rstar"

$$\overbrace{\frac{\sigma}{\tau_0 \left(z_0 Q_0 \right)}}^{\text{Required Sharpe ratio}} = \frac{\overbrace{r^m \left(\frac{z_0(1+g)}{z_0 Q_0} \right) - r^f}^{\text{Actual Sharpe ratio}}}{\sigma}$$

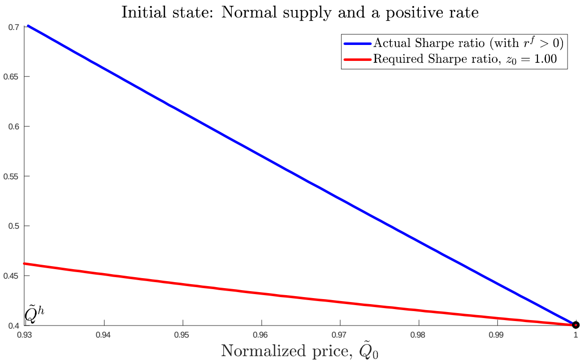
- **Covid shock:** A decline in z_0.
- Efficient benchmark $Q_0 = Q_0^* = 1$:

$$r^{f*} = r^m \left(\frac{z_0(1+g)}{z_0 Q_0^*} \right) - \underbrace{\frac{\sigma^2}{\tau_0 \left(z_0 Q_0^* \right)}}_{\text{lower risk tolerance}} .$$

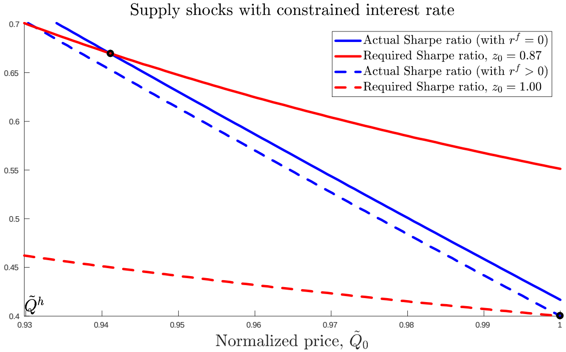
- Risk tolerance effect is worse with high l_0 or low z_0.

Conventional monetary policy

$$\overbrace{\frac{\sigma}{\tau_0\left(z_0 Q_0\right)}}^{\textbf{Required Sharpe ratio}} = \overbrace{\frac{r^m\left(\frac{z_0(1+g)}{z_0 Q_0}\right) - r^f}{\sigma}}^{\textbf{Actual Sharpe ratio}}$$



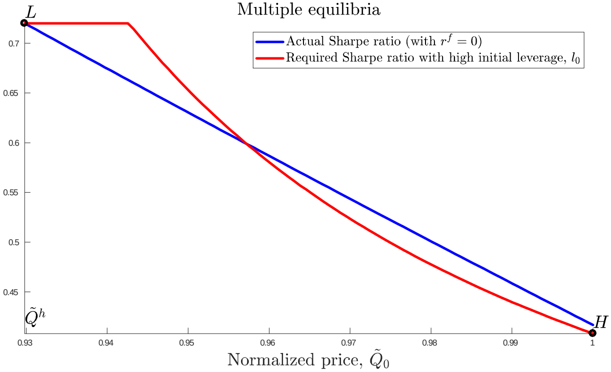
A productivity shock can trigger an asset price spiral



$$\frac{\sigma}{\tau_0\left(z_0 Q_0\right)} = \frac{r^m\left(\frac{z_0(1+g)}{z_0 Q_0}\right) - r^f}{\sigma}$$

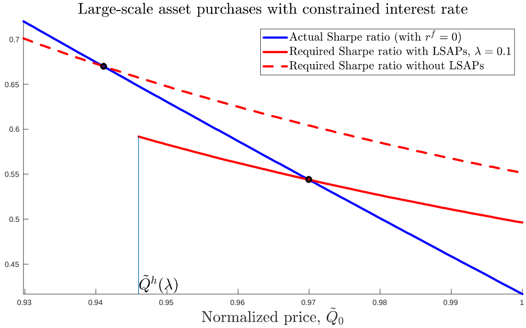
A steeper red-line (high l_0, low z_0) means a more powerful amplification

With high leverage, there are multiple equilibria



$$\frac{\sigma}{\tau_0\left(z_0 Q_0\right)} = \frac{r^m\left(\frac{z_0(1+g)}{z_0 Q_0}\right) - r^f}{\sigma}$$

LSAPs increase asset prices and mitigate the spiral



$$\frac{\sigma(1-\lambda)}{\tau_0\left(z_0 Q_0\right)} = \frac{r^m\left(\frac{z_0(1+g)}{z_0 Q_0}\right) - r^f}{\sigma}$$

Note: A steeper red-line (high l_0, low z_0) means a more powerful policy

Optimal LSAP: Increasing with severity of downward spiral

$$\underbrace{\text{gov's marginal cost from adding risk (relative to market)}} = \overbrace{\frac{\tilde{Q}_0'(\lambda)}{\tilde{Q}_0(\lambda)}}^{\textbf{benefit from output gap}}$$

- More LSAP with greater fiscal capacity
- More LSAP with greater leverage or worse recession
  - *A steeper red line makes the policy more desirable*

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**
- Other risk-centric policies
  - Loosening capital requirements
  - Offering public guarantees ("put policies")
- **Debt overhang:** Supply is a function of $z_0 Q_0$, which increases τ'

Appendix: large-scale asset purchases (LSAPs)

Government Balance Sheet
Before LSAP

A	L
Future tax revenues (claims on future generation) η^g units of m	Government wealth (spending, transfers to future generation) $\eta^g z_0 Q_0$

After LSAP

A	L
λ units of m	$\lambda z_0 Q_0$ units of f
η^g units of m	$\eta^g z_0 Q_0$

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

$$\frac{\sigma(1-\lambda)}{\tau_0(z_0 Q_0)} = \frac{r^m\left(\frac{z_0(1+g)}{z_0 Q_0}\right) - r^f}{\sigma}$$

Appendix: 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:

$$y_0(\nu) + z_0 Q_0 \geq b(\nu).$$

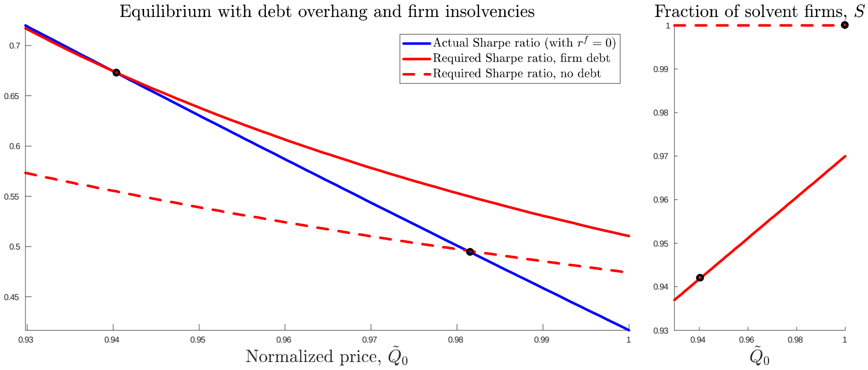
- **Fraction of solvent firms is increasing in the asset price:**

$$\overline{S}(z_0 Q_0) \equiv F(2 z_0 Q_0).$$

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

$$\tau_0\left(\overline{S}(z_0 Q_0)\, z_0 Q_0\right).$$

Appendix: Debt overhang– Amplifies spirals (strengthens LSAPs)



$$\frac{\sigma}{\tau_0\left(\overline{S}\left(Q_0\right) z_0 Q_0\right)} = \frac{r^m\left(\frac{z_0(1+g)}{z_0 Q_0}\right) - r^f}{\sigma}.$$