Discussion of
'Equilibrium Credit Spreads and the Macroeconomy'
by J. Gomes and L. Schmid

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GS introduce long-term loans with endogenous default into a DSGE model with production and capital accumulation.

They argue that not only does their framework explain observed credit spreads in a model with production, but that it improves upon the canonical equilibrium business cycle model.

Credit market spreads, essentially the difference between borrowing rates and the return on savings, affect the cost of capital.

This affects the real economy and leads to strong correlation between credit spreads and aggregate quantities.

In particular, their model generates asymmetric business cycles with amplified recessions.

A macroeconomist's perspective

The authors focus their paper on recent business cycles.

> *The Great Recession of 2008-2009 offers a primary example of the important role that fluctuations in credit risk play in the aggregate economy. Unfortunately these developments also exposed the current need for new state of the art models suitable to understand the joint behaviour of credit risk, financial prices, and the key macroeconomic aggregates. (page 2, paragraph 1)*

This is my license to offer a macroeconomists' perspective.

Production

$$y = z\varepsilon k$$

z aggregate shock

ε idiosyncratic shock

k parameter

$$\pi(z, \varepsilon, b, k) = (z\varepsilon - b - \delta)\, k.$$

δk required investment

bk debt payment per period

aggregate state $s = (z, \mu)$

$$
\begin{aligned}
Q(\varepsilon, s; b) \quad &= \quad \max\Big\{0, (1-\tau)(1-\lambda)\left(z\varepsilon - b - \delta\right) \\
&\quad + \int d(s, s')\, Q(\varepsilon', s'; b)\, F^{\varepsilon}(\varepsilon, d\varepsilon')\, \Gamma(s, ds')\Big\},
\end{aligned}
$$

$\lambda = 0$ when $z\varepsilon - b - \delta \geq 0$. Firms default by choice when $\varepsilon \in E(b, s)$,

$$
E(b, s) = \{\varepsilon \in \mathbf{R}_+ \,|\, Q(\varepsilon, s; b) = 0\}
$$

Let $\bar{\varepsilon}(b, s) = \sup E(b, s)$. An important insight is that if d is constant, $\bar{\varepsilon}(b, s)$ is proportional to z. However, when $d(s, s')$ is a stochastic discount factor, it moves with z and, in this instance, $\bar{\varepsilon}(b, s)$ responds differently to positive and negative shocks. (See also Chen, Collin-Dufresne and Goldstein 2009).

$$B(\varepsilon, s; b) = \left(b + \int d(s, s') B(\varepsilon', s'; b) F^{\varepsilon}(\varepsilon, d\varepsilon') \Gamma(s, ds')\right)\left(1 - \chi_{E(b,s)}(\varepsilon)\right) + (1 - \phi)(1 - \delta + z\varepsilon) \chi_{E(b,s)}(\varepsilon)$$

The yield on corporate debt is $y_b(\varepsilon, s) = \frac{b}{B(\varepsilon, s; b)}$, and the credit spread is $y_b(\varepsilon, s) - y_b^f(\varepsilon, s)$. Debt, $\int B(\varepsilon, s; b) G(d\varepsilon)$, is determined by b,

$$A(s) = \max_b \int \left[Q(\varepsilon, s; b) + B(\varepsilon, s; b)\right] G(d\varepsilon).$$

Given random costs of entry, e, potential firms are introduced if

$$e \le A_0(s).$$

Abstraction from firm-level factor adjustment

1. Young firms tend to be smaller, higher failure rates.
2. Conditional on survival, they grow faster.
   1. Dunne, Roberts and Samuelson 1989
   2. Jovanovic 1982, Hopenhayn 1992
3. On average it takes 10 years for an entrant to reach the size of the typical entrant (collateral constraints). Do new firms issue corporate bonds?

Age and size dynamics show ongoing firm-level investment

	$\sigma_{\frac{i}{k}}$	$\rho\left(\frac{i_0}{k}, \frac{i_{-1}}{k}\right)$
firm	0.139	0.4
plant	0.337	0.058

Firm data (COMPUSTAT) from Bloom 2009, table 3, bottom panel. Plant data (LRD) from Cooper and Haltiwanger 2006.

Implication of firm-level investment and Calibration

The average annual investment rate across establishments is 0.122.

In GS model, there is no capital adjustment in firms. This makes firm value less sensitive to idiosyncratic shocks, and somewhat less sensitive to aggregate shocks. It follows that any generalisation that addresses the data on firm-level investment is likely to change $Q(\varepsilon, s; b)$, therefore $E(s, b)$, and thus credit spreads.

Perhaps more important is that the model is not calibrated. (σ_z, ρ_z) is chosen to match GDP moments, and $(\sigma_\varepsilon, \rho_\varepsilon)$ is chosen to match credit spreads. The upper bound on the distribution of firm creation costs, h, varies with the aggregate shock.

1. The GS model predicts that default is strongly countercyclical. This raises credit spreads in recessions, lowering the value of entry.
2. Asymmetric business cycles are driven by countercyclical entry.
    1. Model predictions for entry would be useful to evaluate this mechanism
    2. Default in the model is associated with exit.
3. Aggregate investment, given a fixed scale in firms, involves time-varying movements in entry.

entry rate	exit rate
0.22	-0.351

source: Campbell (1998)

- Clementi and Palazzo (2010) reproduce entry and exit in a model consistent with age and size dynamics.

Mechanics of credit spreads and default

- Default rises with the marginal rate of substitution, in recessions. This drives large credit spreads.

- **Model** with z shocks has strongly countercyclical default: $\rho\,(\text{GDP,default}) = -0.81$.

- **DATA** has weakly countercyclical default: $\rho\,(\text{GDP,default}) = -0.33$.
  - model inconsistent with data when TFP shocks are the sole source of aggregate fluctuations.

- Importantly, credit spreads remain high with two shocks: z and ϕ.
  - Default rates are no longer implausibly countercyclical: $\rho\,(\text{GDP,default}) = -0.59$.

Importance of credit shocks

- GS assume credit shocks $\phi \in \{0.25, 0.75\}$

$$\begin{aligned}\Pr\{\phi = 0.25 \mid \phi = 0.25\} &= 0.98 \\ \Pr\{\phi = 0.75 \mid \phi = 0.75\} &= 0.5\end{aligned}$$

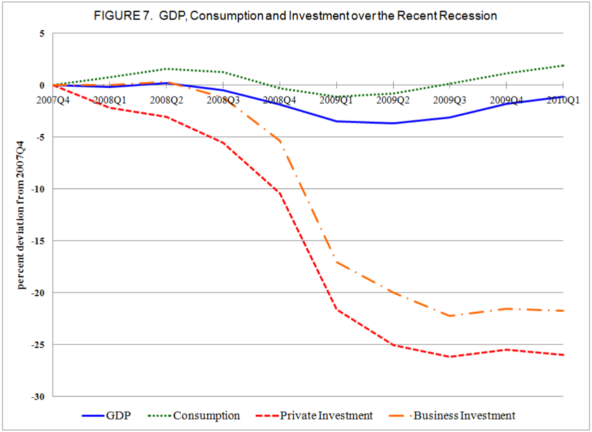
- As credit shocks reconcile large credit spreads with weakly countercyclical default, their measurement appears important.
- Jermann and Quadrini (2009), Khan and Thomas (2010)
- Credit shocks to collateral constraints can increase dispersion.
  - Dispersion of firm growth rates is countercyclical (Bloom 2009 and Arellano, Bai and Kehoe 2010).
  - Difficult to implement in a model without variable inputs.

Credit shocks and the recent recession

- Unanticipated shock to ϕ, changing from 0.75 to 0.25.
  - Essentially monotone response in GDP and investment (fig. 5).
  - Recovery in default is $(1-\phi)(1-\delta+z\varepsilon)$.

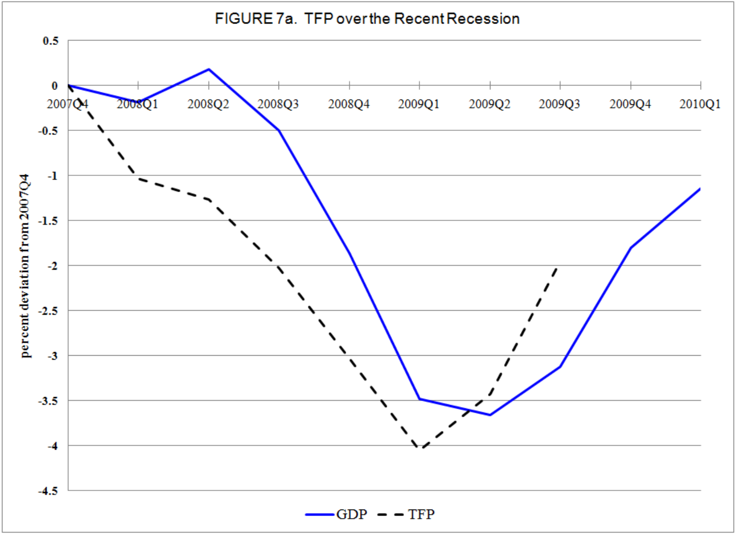
- The variability of investment relative to GDP appears large.
  - Consumption must fall with the credit shock.
  - Response is similar to a persistent shock to TFP.

- Lack of employment hampers quantitative analysis. Authors show that economy with leverage propagates technology shock relative to only equity model. Ordinarily, employment propagates technology shock.



Recent recession had a gradual, non-monotone response.

Total Factor Productivity in the recent recession



Credit shocks in a model with production heterogeneity

Khan and Thomas (2010)

- competitive firms (k, b, ε): $y = z\varepsilon F(k, n)$
  - labor from households (real wage ω)
  - one-period debt with face value $b' \in R$ (relative price q^{-1})

- 2 frictions influencing choices of k', b', and D
  - specificity of capital: $\theta_k \in (0, 1)$ from each unit uninstalled
  - collateralized debt limit: $b' \leq \theta_b [\theta_k k]$

- An unanticipated shock to θ_b shifts the distribution of production towards larger, relatively unproductive firms.
  - Future TFP falls and GDP starts to gradually fall
  - Consumption shows an initial rise

Credit crisis in Khan and Thomas (2010)

An unanticipated reduction in the value of collateral