Working Capital, Trade and Macro Fluctuations

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Working Capital

Stylized corporate balance sheet

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash</td>
<td>Equity</td>
</tr>
<tr>
<td>Inventories</td>
<td>Short term debt</td>
</tr>
<tr>
<td>Receivables</td>
<td>Payables</td>
</tr>
<tr>
<td>Long-term assets</td>
<td>Long-term liabilities</td>
</tr>
</tbody>
</table>

(Net) working capital = Inventories + Receivables − Payables
### Time Dimension of Production

**Figure 1.** Date 3 balance sheet of firm with three production stages. Older vintages of inventories reflect greater inputs and hence greater financing needs.
Boundary of the Firm

- When the production chain crosses the boundary of the firm, working capital needs are reflected in receivables and payables.

- Inventories are known to be procyclical.

- Receivables and payables are also procyclical and reflect financial conditions.
Figure 2. Trade receivables, trade payables and inventories of the US non-financial corporate business sector
(Source: Federal Reserve Flow of Funds, Table F102)
Treasury and Baa Spread

Baa-10 yr Treasury Spread

Percent

Jan-86
Jan-89
Jan-92
Jan-95
Jan-98
Jan-01
Jan-04
Jan-07
Jan-10
Jul-87
Jul-90
Jul-93
Jul-96
Jul-99
Jul-02
Jul-05
Jul-08
Jul-01

1.0
2.0
3.0
4.0
5.0
6.0
7.0
Panel regressions with firm fixed effects

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable</td>
<td>dln(receivables)</td>
<td>dln(inventory)</td>
<td>dln(payables)</td>
</tr>
<tr>
<td>dln(sales)</td>
<td>0.8645***</td>
<td>0.7344***</td>
<td>0.5321***</td>
</tr>
<tr>
<td></td>
<td>(87.76)</td>
<td>(62.69)</td>
<td>(53.12)</td>
</tr>
<tr>
<td>dln(BD leverage)</td>
<td>0.0510***</td>
<td>0.0452***</td>
<td>0.0354*</td>
</tr>
<tr>
<td></td>
<td>(3.04)</td>
<td>(2.91)</td>
<td>(1.94)</td>
</tr>
<tr>
<td>constant</td>
<td>-0.00686</td>
<td>0.0020**</td>
<td>0.02264***</td>
</tr>
<tr>
<td></td>
<td>(-0.0)</td>
<td>(2.14)</td>
<td>(29.89)</td>
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<tr>
<td>Observations</td>
<td>61484</td>
<td>60169</td>
<td>64886</td>
</tr>
<tr>
<td>Firms</td>
<td>6377</td>
<td>6192</td>
<td>6583</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.5423</td>
<td>0.5156</td>
<td>0.3674</td>
</tr>
</tbody>
</table>

(Compustat US manufacturing firms, 1990 - 2012)

dln(BD leverage) = annual log difference of US broker dealer leverage

Clustered standard errors at firm level, t-statistic in parantheses
Figure 3. US manufacturing sales to value-added ratio and the ratio of manufacturing value-added to GDP (Source: US Census Bureau)
Outline

- Model of production chain without offshoring (no financial sector)
- Model of production chain due to offshoring (no financial sector)
- Close the model with financial sector
Production Chain without Offshoring

• No fixed capital

• No savings decision

• No labor supply decision

• No distortions to product or labor markets

• Only “friction” on real side of economy is that production takes time

Financial shocks impact output and productivity through cost of working capital
**Time and Working Capital**

<table>
<thead>
<tr>
<th>Date</th>
<th>Production stages</th>
<th>cumulative cashflow</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>$-w$</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$n-1$</td>
<td></td>
<td>$-w$</td>
</tr>
<tr>
<td>$n$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$n+1$</td>
<td>$y(n)-w$</td>
<td></td>
</tr>
<tr>
<td>:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Wage cost $w$ cannot be deferred (workers cannot be lenders to firm)

Cash transfer upstream is instantaneous

Constant hazard rate $\varepsilon$ of chain’s failure after date $n+1$
Lender Cash Flow as Function of $n$

Figure 4. Lender cash flow as function of $n$
Model

$L$ workers/firms

Chain length $n$

Number of chains $= \frac{L}{n}$

Output per chain (of length $n$) $= y(n)$

Output per firm (= output per worker)

$$\frac{y(n)}{n} = n^\alpha \quad (0 < \alpha < 1)$$
An Austrian Theme

“Roundabout production” and the temporal dimension of production

“[t]he indirect method entails a sacrifice of time but gains the advantage of an increase in the quantity of the product. Successive prolongations of the roundabout method of production yield further quantitative increases though in diminishing proportion.”

[Böhm-Bawerk (1884) *Capital and Interest*]
Aggregate Credit Demand

Firms finance working capital (inventories and net accounts receivable) with credit

Aggregate credit demand:

\[ K = \frac{1}{2}n (n + 1) w \times \frac{L}{n} \]

\[ = \frac{n + 1}{2} wL \]
Joint Profit Maximization

Abstract from incentive/bargaining within the chain

Solution as upper bound to joint payoffs with incentive problems

Ex ante, choose $n$ to maximize

$$\sum_{t=n+1}^{\infty} (1 - \varepsilon)^{t-n} \left(n^\alpha L - wL - rK\right)$$

Equivalently, maximize per-period profit

$$\Pi = n^\alpha L - wL - rK$$

$$= n^\alpha L - wL \left(1 + \frac{r(n+1)}{2}\right)$$
First-order condition:

\[ n = \left( \frac{2\alpha}{wr} \right)^{\frac{1}{1-\alpha}} \]

\( w \) determined by zero profit condition:

\[ n^\alpha = w \left( 1 + \frac{r(n+1)}{2} \right) \]
\[
K = \left( \frac{\alpha}{1 - \alpha} \right)^\alpha \left( 1 + \frac{2}{r} \right)^\alpha \left( \frac{\alpha}{r} + \frac{1 - \alpha}{2 + r} \right) L 
\]

\[ (K) \]

\[
n = \frac{\alpha}{1 - \alpha} \left( 1 + \frac{2}{r} \right) 
\]

\[ (n) \]

\[
w = 2 \left( \frac{\alpha}{r} \right)^\alpha \left( \frac{1 - \alpha}{2 + r} \right)^{1-\alpha} 
\]

\[ (w) \]

\[
Y = \left( \frac{\alpha}{1 - \alpha} \right)^\alpha \left( 1 + \frac{2}{r} \right)^\alpha L 
\]

\[ (Y) \]

\[
\frac{K}{Y} = \frac{\alpha}{r} + \frac{1 - \alpha}{2 + r} 
\]

\[ (K/Y) \]
Ratio of Sales to Value-Added

\[ p_k = \text{sale by firm } k \]

\[ p_n = w + rwn \]

\[ p_{n-1} = w + rw(n - 1) + p_n \]

\[ \vdots \]

\[ p_1 = w + rw + p_2 \]

\[ p_n = w(1 + rn) \]

\[ p_{n-1} = 2w(1 + rn) - wr \]

\[ \vdots \]

\[ p_1 = nw(1 + rn) - wr(1 + 2 + \cdots + (n - 1)) \]
Sales to value-added ratio:

\[
\frac{\sum_{k=1}^{n} p_k}{p_1} = (n + 1) \frac{\frac{1}{3}r + \frac{2}{3}nr + 1}{r + nr + 2} = \frac{(r + 2\alpha)(r + \alpha(1 + r) + 3)}{3r(1 - \alpha)(r + 2)}
\]

Figure 5. Sales to value-added ratio (\(\alpha = 0.033\))
Figure 6. US manufacturing sales to value-added ratio and the ratio of manufacturing value-added to GDP (Source: US Census Bureau)
Productivity

\[ Y/L \]
Wage
Credit Demand

\[ K/L \]

\[ r \]
Working Capital and Fixed Capital Analogy

\[ Y(K, L) = n^\alpha L \]
\[ = \left( \frac{2K}{wL} - 1 \right)^\alpha L \]
\[ = \left( \frac{2}{w} - \frac{L}{K} \right)^\alpha K^\alpha L^{1-\alpha} \]

If working capital (e.g. inventories) is treated as factor of production (Ramey (1989)), then TFP term has endogenous variables.
Working Capital and Fixed Capital Analogy

\[ Y(K, L) = \left( \frac{2}{w} - \frac{L}{K} \right)^{\alpha} K^\alpha L^{1-\alpha} \]

Plot of TFP term in production function for \( \alpha = 0.033 \)
Three Approaches to Trade

Technological  Spatial

Temporal

Temporal dimension implies role for **financial conditions**
Figure 7. Left hand panel illustrates the inventories needed in a three-stage production process. The right hand panel illustrates increased inventories from offshoring the second stage.
Offshoring entails greater working capital need

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</tr>
<tr>
<td>Inventories (1 period old) x 1</td>
<td></td>
</tr>
<tr>
<td>Inventories (2 periods old) x 2</td>
<td>Short-term Debt</td>
</tr>
<tr>
<td>Inventories (3 periods old) x 3</td>
<td></td>
</tr>
<tr>
<td>Receivables</td>
<td>Payables</td>
</tr>
<tr>
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<tr>
<td>Inventories (1 period old) x 1</td>
<td></td>
</tr>
<tr>
<td>Inventories (outward bound) x 2</td>
<td></td>
</tr>
<tr>
<td>Inventories (3 periods old) x 3</td>
<td></td>
</tr>
<tr>
<td>Inventories (inward bound) x 4</td>
<td>Short-term Debt</td>
</tr>
<tr>
<td>Inventories (5 periods old) x 5</td>
<td></td>
</tr>
<tr>
<td>Receivables</td>
<td>Payables</td>
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Inventories are not buffer stock

“When our grandfathers owned shops, inventory was what was in the back room. Now it is a box two hours away on a package car, or it might be hundreds more crossing the country by rail or jet, and you have thousands more crossing the ocean”

[Chief Executive Officer of UPS quoted in Thomas Friedman, The World is Flat]
“On-shoring” or “Re-shoring”

Figure 8. Cover page from Accenture (2011) Manufacturing’s Secret Shift: Gaining Competitive Advantage by Getting Closer to the Customer
“On-shoring” or “Re-shoring”

“Companies are beginning to realize that having offshored much of their manufacturing and supply operations away from their demand locations, they hurt their ability to meet their customers’ expectations across a wide spectrum of areas, such as being able to rapidly meet increasing customer desires for unique products, continuing to maintain rapid delivery/response times, as well as maintaining low inventories and competitive total costs.”

[Accenture (2011) Manufacturing’s Secret Shift: Gaining Competitive Advantage by Getting Closer to the Customer]
Production Chain due to Offshoring

\( \bar{n} \) stages to the production chain and \( \bar{n} \) locations

Multinational firms with operations in all \( \bar{n} \) locations

Each location has absolute advantage in precisely one stage of the production

Output of multinational firm (production chain) is

\[
\left( \sum_{i=1}^{\bar{n}} x_i \right)^\alpha \quad (0 < \alpha < 1)
\]

with

\[
x_i = \begin{cases} 
1 + b & \text{if stage } i \text{ is at high productivity location} \\
1 & \text{otherwise}
\end{cases}
\]
Output to offshoring $s$ stages of the production chain to location with absolute advantage

$$y(s) = (\bar{n} + bs)^\alpha$$

Offshoring entails

- wage cost $w$
- time cost of 1 period added to production time

If offshoring takes place $s$ times, the production process takes $\bar{n} + s$ periods.
World credit demand $K$ is

$$K = \frac{1}{2}(\bar{n} + s)(\bar{n} + s + 1)w \times \frac{L}{(n + s)}$$

$$= \frac{\bar{n} + s + 1}{2}wL$$

Profit of multinational firm is

$$\Pi = (\bar{n} + bs)^{\alpha}zL - wzL - rzK$$

$$= (\bar{n} + bs)^{\alpha}zL - wzL \left(1 + \frac{r(\bar{n} + s + 1)}{2}\right)$$

$z$ is the proportion of the world workforce employed by firm
Firm’s Offshoring Decision

Optimal offshoring is

\[ s = \frac{\alpha}{1 - b\alpha} \left( 1 + \bar{n} \left( 1 - \frac{1}{b} \right) + \frac{2}{r} \right) - \frac{\bar{n}}{b} \]

Wage rate determined by zero profit condition

\[ w = \frac{2b\alpha}{r} \left( \frac{1 - b\alpha}{2 + r \left( 1 + \bar{n} \left( 1 - \frac{1}{b} \right) \right)} \right)^{1-\alpha} \]

⇒ Trade volumes, output and productivity decline with financing cost \( r \)
Value of International Trade

Total sales (as $\varepsilon \to 0$)

$$S = \frac{1}{6} \left( r(1 + 2(\bar{n} + s)) + 3 \right) (\bar{n} + s + 1) wL$$

Value of international trade is

$$T = \frac{s}{(\bar{n} + s)} S$$

$$= Y \left( \frac{s (\bar{n} + s + 1) \frac{1}{3} r + \frac{2}{3} (\bar{n} + s)r + 1}{(\bar{n} + s) r + (\bar{n} + s)r + 2} \right)$$

$\Rightarrow$ Ratio of trade to output $T/Y$ is declining in risk premium $r$
Two Sector Model

- Two sectors.

- Sector 1 is $b_L = 0$. Sector 2 benefits more from offshoring as its $b$ is $b_H > 0$.

- Price $p$ for the output of Sector 2 in terms of sector 1 good

- Take first-order condition for $s_1$ and $s_2$ and impose zero profit condition for both sectors
  - Labor takes all the surplus
  - Labor is fully mobile, so that single wage rate $w$ applies to both sectors
From zero profit conditions for the two sectors,

\[
w = \frac{\bar{n}^\alpha}{1 + \frac{r}{2}(1 + \bar{n})} \quad \text{(sector 1)}
\]

(1)

\[
w = \frac{p(\bar{n} + b_H s_2)^\alpha}{(1 + \frac{r}{2}(1 + \bar{n}) + \frac{r}{2}s_2)} \quad \text{(sector 2)}
\]

Then

\[
p = \frac{\bar{n}^\alpha r}{(2 + r(1 + \bar{n}))b_H \alpha} \left( \bar{n} + \frac{b_H \alpha}{1 - \alpha} \left( 1 + \frac{2}{r} + \bar{n}(1 - \frac{1}{b_H \alpha}) \right) \right)^{1-\alpha}
\]
Proposition. Productivity of sector 2 (value of output per worker) is decreasing in $r$

\[ py2 = \frac{1}{1 - \alpha} \tilde{n}^\alpha \left( 1 - \frac{1}{\tilde{n} \left( \frac{1}{r} + \frac{1}{1 + \tilde{n}} \right)} \right) \]
Global Output

Cobb-Douglas preferences \( u(c_1, c_2) = \xi \ln c_1 + (1 - \xi) \ln c_2 \)

Relative value of output of the two sectors is

\[
\frac{y_1 L_1}{p y_2 L_2} = \frac{\xi}{1 - \xi}
\]

Then

\[
L_2 = \frac{(1 - \xi)y_1}{\xi p y_2 + (1 - \xi)y_1} L
\]

\[
L_1 = \frac{\xi p y_2}{\xi p y_2 + (1 - \xi)y_1} L
\]
Global output is:

\[
Y = \frac{y_1 y_2}{\xi y_2 + (1 - \xi) y_1} L
\]

Since \(py_2\) is decreasing in \(r\), we have

**Proposition.** Global output is declining in risk premium \(r\).
Trade Growth Accounting

Notation:

\[ Y \quad \text{GDP} \]
\[ Y_D \quad \text{Domestic manufacturing value-added} \]
\[ S_D \quad \text{Domestic manufacturing sales} \]
\[ M \quad \text{Imports} \]

Suppose that

\[ S_D = \beta \times \left( \begin{array}{c} \text{imported} \\ \text{intermediate goods} \end{array} \right) + \gamma \times \left( \begin{array}{c} \text{domestically produced} \\ \text{intermediate goods} \end{array} \right) \]
\[ M = \gamma \times \left( \begin{array}{c} \text{imported} \\ \text{intermediate goods} \end{array} \right) \]
Offshoring measure defined as:

\[ q \equiv \frac{\text{imported intermediate goods}}{\text{imported intermediate goods} + \text{domestically produced intermediate goods}} \]

Then

\[ M = q \times S_D \times \frac{\gamma}{\beta} = q \times \frac{S_D}{Y_D} \times \frac{Y_D}{Y} \times Y \times \frac{\gamma}{\beta} \]
So, import/GDP ratio is

\[
\frac{M}{Y} = q \times \frac{S_D}{Y_D} \times \frac{Y_D}{Y} \times \frac{\gamma}{\beta}
\]

Growth of offshoring can be obtained as

\[
g(q) = g\left(\frac{M}{Y}\right) - g\left(\frac{S_D}{Y_D}\right) - g\left(\frac{Y_D}{Y}\right)
\]

In long hand

\[
\text{Offshoring growth} = \text{Growth of Imports/GDP} - \text{Growth of mfg sales/value-added} - \text{Growth of mfg/GDP}
\]
Figure 9. US manufacturing sales to value-added and share of manufacturing in GDP
Figure 10. Annual growth rates of offshoring, imports/GDP, manufacturing sales to value-added and share of manufacturing in GDP
Closing the Model with Credit Supply

Banks provide credit. Each chain defaults with probability $\varepsilon$. Loans rolled over every period.

Correlated defaults across chains, but bank can diversify away idiosyncratic risk (Vasicek (2002) credit risk model)

Chain $j$ repays when $\hat{Z}_j > 0$, where $\Phi(\cdot)$ is standard normal cdf

$$\hat{Z}_j = -\Phi^{-1}(\varepsilon) + \sqrt{\rho}Y + \sqrt{1 - \rho}X_j$$

$$\Pr\left(\hat{Z}_j < 0\right) = \Pr\left(\sqrt{\rho}Y + \sqrt{1 - \rho}X_j < \Phi^{-1}(\varepsilon)\right)$$

$$= \Phi\left(\Phi^{-1}(\varepsilon)\right) = \varepsilon$$
Notation for Bank Balance Sheet

\[
\begin{array}{c}
1 + r \\
\end{array}
\]

\[
\begin{array}{c}
C \\
E \\
1 + f \\
L \\
\end{array}
\]
Bank diversifies away idiosyncratic risk

Conditional on $Y$, defaults are independent.

Diversify across many borrowers and eliminate idiosyncratic risk. Realized value of assets is function of $Y$ only

$$w(Y) \equiv (1 + r) C \cdot \Pr \left( \hat{Z}_j \geq 0 | Y \right)$$

$$= (1 + r) C \cdot \Pr \left( \sqrt{\rho Y} + \sqrt{1 - \rho} X_j \geq \Phi^{-1}(\varepsilon) | Y \right)$$

$$= (1 + r) C \cdot \Phi \left( \frac{Y \sqrt{\rho - \Phi^{-1}(\varepsilon)}}{\sqrt{1 - \rho}} \right) \quad (*)$$
Figure 11. The two charts plot the densities over realized assets when $C \left(1 + r\right) = 1$. The left hand charts plots the density over asset realizations of the bank when $\rho = 0.1$ and $\varepsilon$ is varied from 0.1 to 0.3. The right hand chart plots the asset realization density when $\varepsilon = 0.2$ and $\rho$ varies from 0.01 to 0.3.
Contracting Problem between Bank and Depositors

Bank chooses portfolio of loans between:

- Good portfolio has probability of default $\varepsilon > 0$, $\rho_G = 0$. Outcome distribution (normalized) is

$$F_G(z) = \begin{cases} 
0 & \text{if } z < 1 - \varepsilon \\
1 & \text{if } z \geq 1 - \varepsilon 
\end{cases}$$

(2)

- Bad portfolio has probability of default $\varepsilon + k$, with $k > 0$, and $\rho_B = \rho > 0$. Outcome distribution is

$$F_B(z) = \Phi \left( \frac{\Phi^{-1}(\varepsilon + k) + \sqrt{1 - \rho} \Phi^{-1}(z)}{\sqrt{\rho}} \right)$$

(3)
**Bank default point** $\phi$

Define $\phi = (1 + f) L / (1 + r) C$.

$\phi$ is (1) (normalized) notional debt of bank and (2) strike price of embedded put option from limited liability (Merton (1974)).

Bank chooses $C$ to maximize marked-to-market equity $E(\hat{w}) - [\phi - \pi(\phi)]$ subject to IC constraint:

$$E_G(\hat{w}) - [\phi - \pi_G(\phi)] \geq E_B(\hat{w}) - [\phi - \pi_B(\phi)] \quad (4)$$

**Lemma 1.** *There is a unique solution $\phi^*$, where $\phi^* < 1 - \varepsilon$.*

**Corollary 2.** *Bank borrows at the risk-free rate*
State price density is second derivative of the option price with respect to its strike price (Breeden and Litzenberger (1978)). Given risk-neutrality,

$$\Delta \pi (\varphi) = \int_0^\varphi [F_B (s) - F_G (s)] ds$$

or

$$\Delta \pi (\varphi) = \begin{cases} 
\int_0^\varphi F_B (s) ds & \text{if } \varphi < 1 - \varepsilon \\
\int_0^{1-\varepsilon} F_B (s) ds - \int_{1-\varepsilon}^\varphi [1 - F_B (s)] ds & \text{if } \varphi \geq 1 - \varepsilon 
\end{cases}$$

(5)
Thus $\Delta\pi(\varphi)$ is single-peaked, reaching its maximum at $\varphi = 1 - \varepsilon$.

\[
\int_0^1 [F_B(s) - F_G(s)] \, ds = \int_0^1 [1 - F_G(s)] \, ds - \int_0^1 [1 - F_B(s)] \, ds = E_G(\hat{w}) - E_B(\hat{w}) = k
\]

so $\Delta\pi(\varphi)$ approaches $k$ from above as $\varphi \to 1$.

$\varphi < 1$ for any bank with positive notional equity. So, we have a unique solution to $\Delta\pi(\varphi) = k$ where the solution is in the range where $\Delta\pi(\varphi)$ is increasing.

Therefore $\varphi^* < 1 - \varepsilon$. 
Supply of Credit by Bank

Credit supply $C'$ obtained from $\varphi^* = (1 + f) L / (1 + r) C'$ and balance sheet identity $C = E + L$

$$C' = \frac{E}{1 - \frac{1+r}{1+f} \cdot \varphi^*}$$

Funding rate $f$ is risk-free rate

Lending rate $r$ determined as equilibrium in credit market

$$C = K$$
Main Result

**Proposition.** Tighter bank credit conditions result in

1. an increase in the borrowing rate $r$
2. fall in output $Y$
3. fall in productivity per worker
4. fall in the wage $w$
5. fall in the offshoring activity of firms.

**Corollary.** Tighter credit conditions result in decline in trade volumes. Decline is larger with more advanced vertical specialization.

(Bems, Johnson and Yi (2011))
Avenues for Future Research (1)

• Quantitative effects
  – “Finance is statistically significant, but not economically significant”
    Need more sophisticated model for quantitative predictions
  – Spreads do the damage, even if credit quantity decline is small
    (Gilchrist and Zakrajsek (2011), Adrian, Colla and Shin (2012))

• Boundary of firm determines allocation between inventories and net accounts receivable
  – Contracting approach
    (Antras and Chor (2011))
  – Details of the financing arrangements are important
    (Antras and Foley (2011))
Avenues for Future Research (2)

- Connections with macro literature
  - Can shocks to TFP be financial shocks, after all?
  - Inventory cycles
    (Blinder and Maccini (1991), Ramey and West (1999))
  - Trade and inventories
    (Alessandria, Kaboski and Midrigan (2009, 2010))
  - Manufacturing demand and durables
    (Eaton, Kortum, Neiman and Romalis (2010))

- Empirics of working capital over the cycle
  - Literature on emerging market crises (Calvo et al.)
  - Panel analysis of firm working capital
    (Kalemli-Ozcan, Kim, Shin, Sorensen and Yesiltas (in progress))
How Does Leverage Affect Real Economy?

- Kahle and Stulz (2012)\(^1\) for 2007-9 crisis
  - Firms with no debt cut capital expenditure as much (sometimes more) as firms with debt

- Adrian, Colla and Shin (2012)\(^2\)
  - Sharp contraction in \textit{supply of intermediated credit}
  - Shortfall made up by increase in \textit{direct credit}
  - Cost of both types of financing rise sharply

\(^1\)Kahle and Stulz (2012) “Access to Capital, Investment and the Financial Crisis”
Figure 12. Credit to US non-financial corporate sector (US Flow of Funds, table L102)
Figure 13. Changes in outstanding corporate bonds and loans to US non-financial corporate sector. Loans are defined as sum of mortgages, bank loans not elsewhere classified (n.e.c.) and other loans (US Flow of Funds, table F102)
Figure 14. Credit to US non-corporate business sector (US Flow of Funds, table L103)
Figure 15. Risk premium versus expected default probability (Source: Egon Zakrajsek, based on Gilchrist and Zakrajsek (2012))
Figure 16. Bank and bond credit supply before crisis
Figure 17. Bank and bond credit supply following deleveraging by banking sector
Figure 18. Bank and bond credit supply following deleveraging by banking sector
Figure 19. **Evidence from UK**: Cumulative gross issuance of bonds by UK private non-financial corporations (Source: Bank of England Asset Purchase Facility Quarterly Report, 2012 Q3)
**How Does Leverage Affect Real Economy?**

- Total quantity of credit (bank and bond) may not be good indicator of financial conditions

- *Composition* of credit matters - i.e. relative size of banking sector to bond market
  - Bank deleveraging leads to spike in lending rates in both bank loans and bonds
  - Spike in spreads is followed by economic downturn (Gilchrist and Zakrajsek (2012))
Meanwhile in Europe

- Bond markets have thawed
- But credit conditions faced by SME borrowers in Europe are still tight
- Conjunction of the two explained by subdued banks
Figure 20. Non-financial corporate lending rates (source: IMF document on Banking Union in Europe)