Corporate Cash and Employment

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Introduction

Motivation

- During the recent financial crisis:
  - Decline in employment
  - Strong increase in cash in corporate balance sheets

- Raises questions about the relationship between **corporate employment** and **cash holding:**
  - Is the negative relationship specific to the crisis?
  - how to analyze employment and corporate cash decisions in a macro model?

Aim

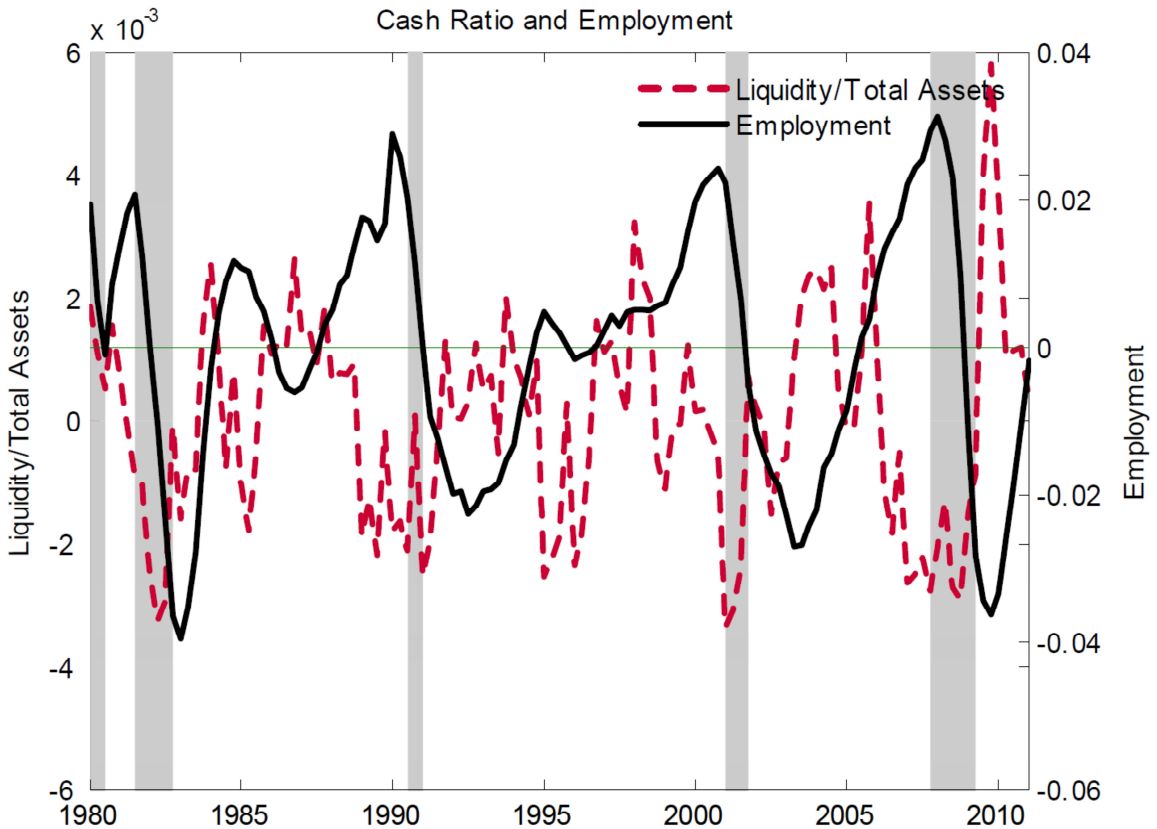
- The contribution is twofold:
  - Stress that there is a **systematic negative correlation** between employment and corporate cash ratio in the US.
    $\rightsquigarrow$ Holds at *aggregate* and *individual* level.
  - Build a tractable theoretical framework with **heterogeneous firms** which incorporates employment and corporate cash management.
    $\rightsquigarrow$ Argue that the negative correlation can be explained by financial shocks, (mostly liquidity shocks).

Related Literature

- **Liquidity needs** have been analyzed in the literature:
  - Woodford (1990) and Holmstrom and Tirole (2011): No link with employment fluctuations.
  - Kyiotaki and Moore (2012), Cui and Radde (2015): Liquidity shock (on re-saleability of equity) affect private investment.
  - Christiano and Eichenbaum (1995), model with working capital but full access to external liquidity.
  - Role of trade credit: Boissay and Gropp (2013), Jacobson and Schedvin (2015).
- Role of **financial frictions on labor market**:
  - Benchmelech et al. (2011): focus on firm's cash flow; Chodorow-Reich (2012): banking sector frictions; Pagano and Pica (2012): financial frictions and labor reallocation; Boeri et al. (2012): focus on leveraged sectors; Monacelli et al. (2011): credit frictions and unemployment.
    $\rightsquigarrow$ No clear focus on corporate cash holding. ▸ More

Stylized Facts

Aggregate Evidence

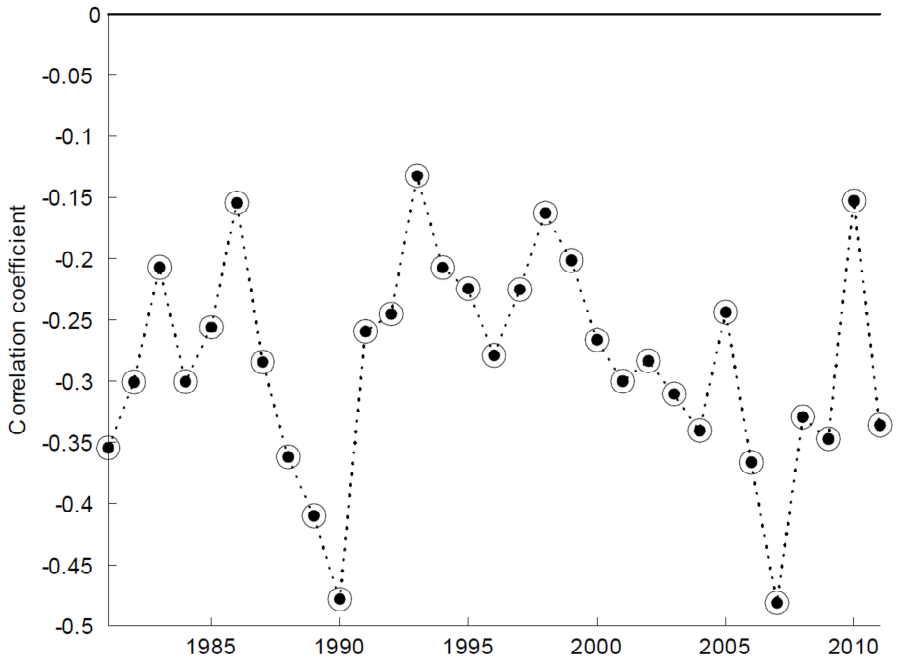


$\Rightarrow$ Negative correlation of -0.41, significant at 1%

▸ data ▸ robust

Firm-level Evidence

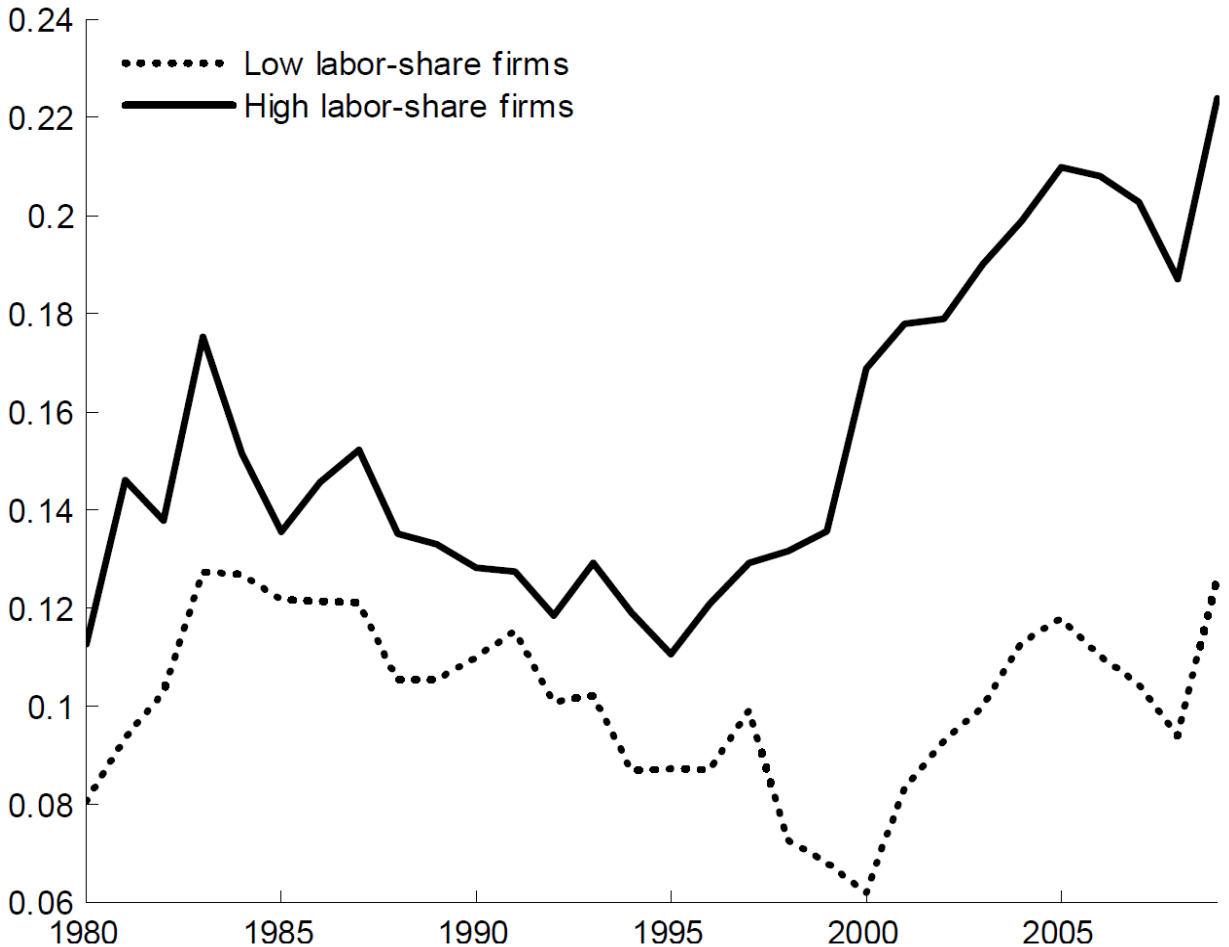
- Compustat dataset: US non-financial firms, 1980-2011.



$\Rightarrow$ On average, cross section correlation between employment and cash ratio is -0.29 (1% significant)

Note: individual linear trends have been removed. robust to OLS with year-fixed effects and standard control variables ▸ data

Wages and cash



▸ More

Model

Modeling cash and employment

- **Employment decisions** modelled in a very simple way: labor demand from standard production function
- But we introduce a **demand for cash**
  - We consider a model with two subperiods, as in Christiano and Eichenbaum (1995)
  - Need for short-term liquidity in the second sub-period: wage bill
  - External source of liquidity
    - e.g., could come from credit lines, trade credits, trade receivables to customers.
  - But constraint on external liquidity may create demand for internal liquidity (cash)

Overview

- Single good economy, infinitively-lived heterogenous entrepreneurs and a representative household.
- Entrepreneurs are credit-constrained (undepreciated capital as collateral) on long-term **and** short-term bonds.
- Technology, credit and liquidity shocks are revealed at BoP.

$\Rightarrow$ In partial equilibrium, model can be solved analytically
$\Rightarrow$ In general equilibrium wages adjust, but interest rate is constant.

Entrepreneurs

- Continuum of **entrepreneurs** indexed by $i \in [0, 1]$. Each entrepreneur i maximizes her flow of utility $E_t \sum_{s=0}^{\infty} \beta^s u(c_{it+s})$.

- Produces Y_{it} using **capital** and **labor**

$$Y_{it} = F(K_{it}, A_{it} l_{it}),$$

where A_{it} is the TFP shock

$$A_{it} = A_t + \epsilon_{it}^A, \qquad A_t = \rho A_{t-1} + \varepsilon_{A,t}, \quad \epsilon_{it}^A \sim \text{Markov process.}$$

Entrepreneurs

- At **beginning-of-period** ('bop'), the budget constraint is

$$\underbrace{Y_{it-1} + (1-\delta)K_{it-1} - rD_{it-1} - r^L L_{it-1}}_{\Omega_{it}} + D_{it} \geq c_{it} + K_{it} + M_{it}$$

D_{it}: one-period illiquid bonds with a gross return $r < 1/\beta$ (subsidized debt)
L_{it-1}: *external liquid funds* with cost r^L
M_{it}: cash or *internal liquid funds*, bearing no interest

- The entrepreneur faces the borrowing constraint

$$rD_{it} \leq \phi_{it}(1-\delta)K_{it}$$

where $\phi_{it} = \phi_t + \epsilon_{it}^{\phi}$ and $\phi_t = \rho\phi_{t-1} + \varepsilon_{\phi,t}$

Entrepreneurs

- At **end-of-period** ('eop'), pay wages using **internal** and **external** liquid funds

$$M_{it} + L_{it} \geq w_t l_{it}$$

  where w_t is the wage rate, liquidity needs is $w_t l_{it}$.
- **External liquid funds**, L_{it}, are assumed to be lower than a shareκ_{it} of undepreciated capital:

$$r^L L_{it} \leq \kappa_{it}(1-\delta)K_{it}$$

- External liquid funds can be provided by:
  - Customers: trade credits
  - Financial intermediaries: credit lines with binding constraint

Liquidity Shocks

- Shocks to κ_{it} are liquidity shocks, e.g., credit line shocks or trade credits shock
- We assume that

$$\kappa_{it} = \kappa_t + \epsilon^{\kappa}_{it} \qquad \kappa_t = \rho\kappa_{t-1} + \varepsilon_{\kappa,t} \qquad \epsilon^{\kappa}_{it} \sim \text{Markov process.}$$

$\Rightarrow$ The demand for cash holdings is directly affected by liquidity shock

Entrepreneurs' problem

- The optimization program of the type-i entrepreneur is given by

$$\max_{c_{it},K_{it},l_{it},D_{it},M_{it}} \quad E_t \sum_{s=0}^{\infty} \beta^s u(c_{it+s})$$

$$\text{st} \quad Y_{it-1}+(1-\delta)K_{it-1}-rD_{it-1}-r^L L_{it-1}+D_{it} \geq c_{it}+K_{it}+M_{it}$$

$$M_{it} + L_{it} \geq w_t l_{it}$$

$$rD_{it} \leq \phi_{it}(1-\delta)K_{it} \qquad r^L L_{it} \leq \kappa_{it}(1-\delta)K_{it}$$

- We consider the case with:
  - Binding credit constraint (through debt subsidy): return of labor ($w^*_{it} \equiv w(A_{it}, \kappa_{it})$) larger than the wage paid by firms (w_t)
  - log utility $\Rightarrow$ consumption is $c_{it} = (1-\beta)\Omega_{it}$.

▸ Policy Functions

Partial Equilibrium Analysis

- Focus on **cash ratio** $m_t \equiv M_t/(M_t + K_t)$:
  - The **liquidity constraint** can be rewritten as

$$\frac{M_{it}}{K_{it}} = \frac{1}{k_{it}} \left[w_t - \kappa_{it} k_{it} \frac{(1-\delta)}{r^L} \right]$$

  - Lower κ_{it} decreases the availability of external liquidity and therefore increases cash intensity in production and hence the cash ratio.
  - Two effects:
    - Direct effect: decrease in κ_{it}
    - Indirect effect: decrease in collateral k_{it} (*collateral effect*)
  - ϕ_{it} and A_{it} also affect the cash ratio but only through the indirect *collateral effect*.

Partial Equilibrium Analysis

- Focus on **employment**:
  - **Labor demand** is characterized by

$$l_{it} = Z_{it}\Omega_{it}, \qquad \text{where } Z_{it} = \frac{\beta}{\left(k_{it} + w_{it} - \frac{D_{it}}{K_{it}} - \frac{L_{it}}{K_{it}}\right)}.$$

  - Lower κ_{it} (or ϕ_{it}) reduce financial opportunities and reduce the scale of production through the *financial multiplier* Z_{it}.
  - Lower A_{it} reduces income Ω_{it} and hence labor.

Partial Equilibrium Analysis

Negative shock:	Direct (m_{it})	Collateral (m_{it})	Financial multiplier (L_{it})
κ	↗	↗	↘
ϕ	–	↗	↘
A	–	↘	↘

Households

- Identical households with linear utility function in consumption and in cash (generate constant interest rates)
- **Labor supply** $l^s(w_t)$ depends positively on the wage rate

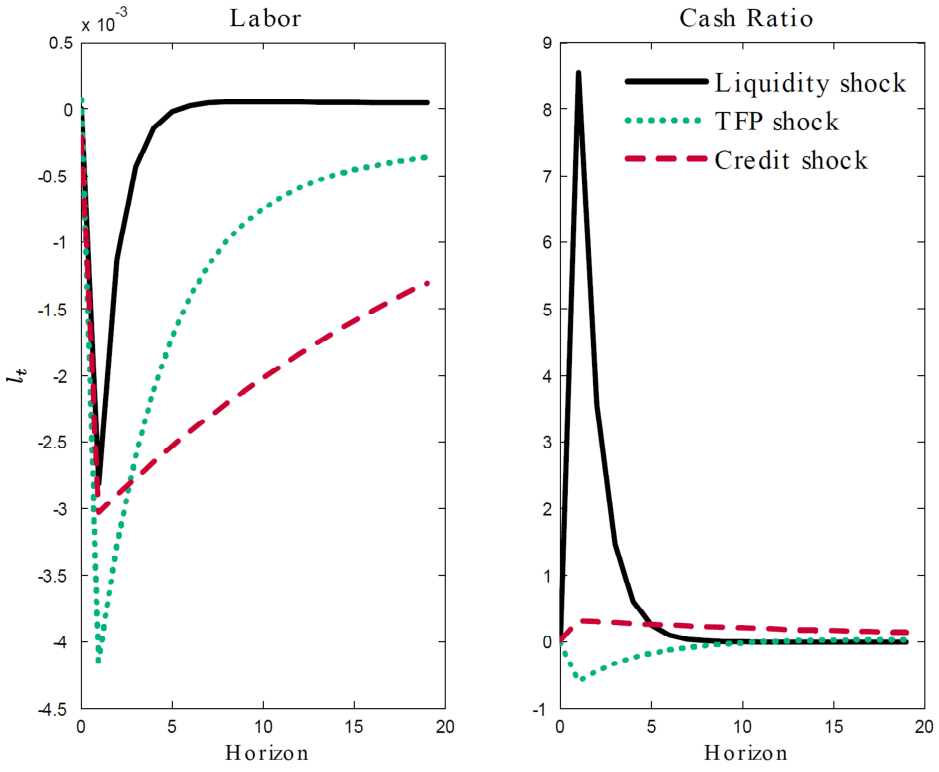
$$l^s(w_t) = (w_t/\bar{w})^\eta$$

- Wage, w_t, is determined such that $l^s(w_t) = \int_0^1 l_{it}\,di$
- **In equilibrium**: A decrease in wage decreases the liquidity needs, which decreases the cash ratio.

▸ More

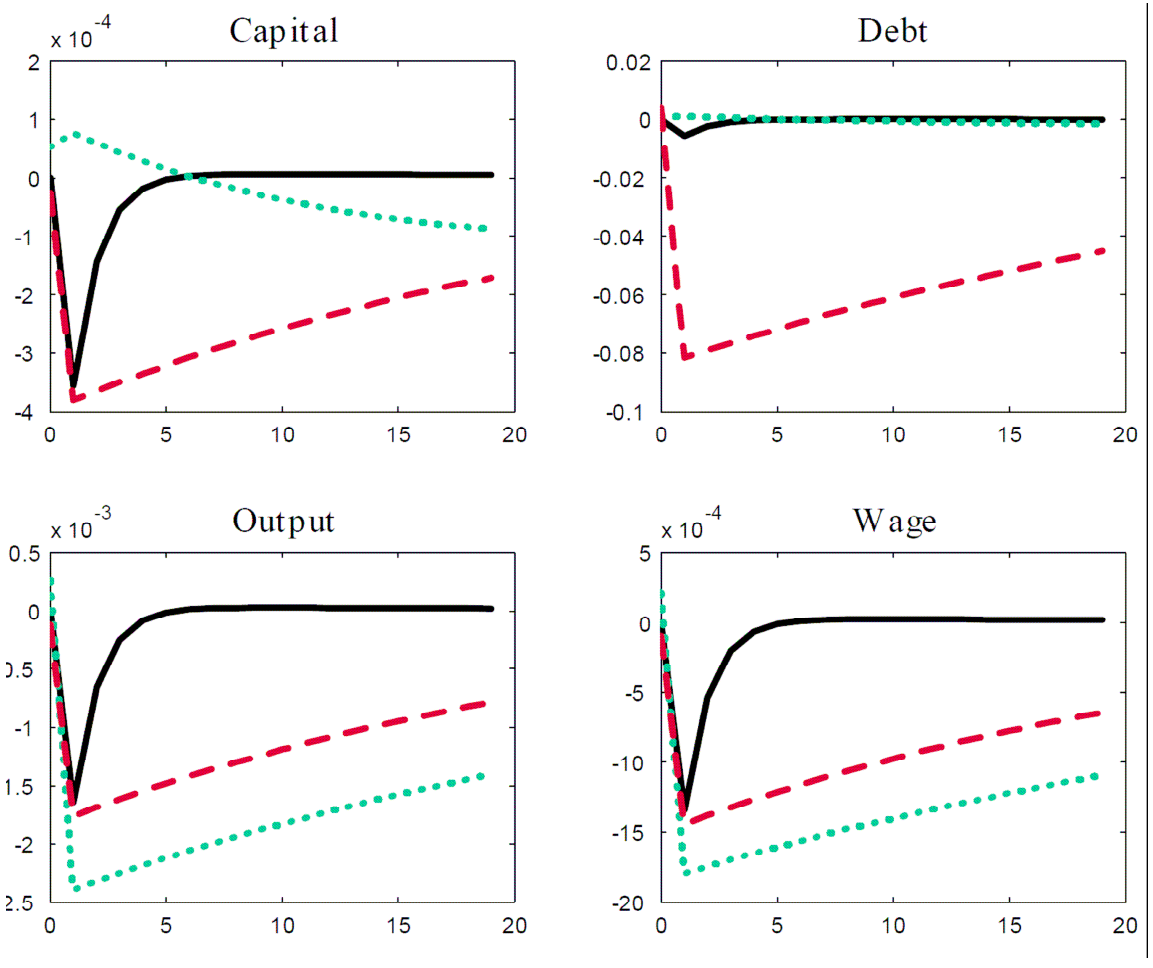
Aggregate Shocks

The Cash Ratio and Employment (IRF)



- Both **financial shocks** $\Rightarrow$ negative co-mouvement between the cash ratio and employment.
- The **liquidity shock** : main driver of the cash ratio.

IRFs (con't)


Capital
x 10^-4
2
1
0
-1
-2
-3
-4
0
5
10
15
20
Debt
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
0
5
10
15
20
Output
x 10^-3
0.5
0
-1
-2
0
5
10
15
20
Wage
x 10^-4
5
0
-5
-10
-15
-20
0
5
10
15
20

Shocks

- Let assume that *all firms are identical* (no heterogeneity in wealth) and face *aggregate shocks*.

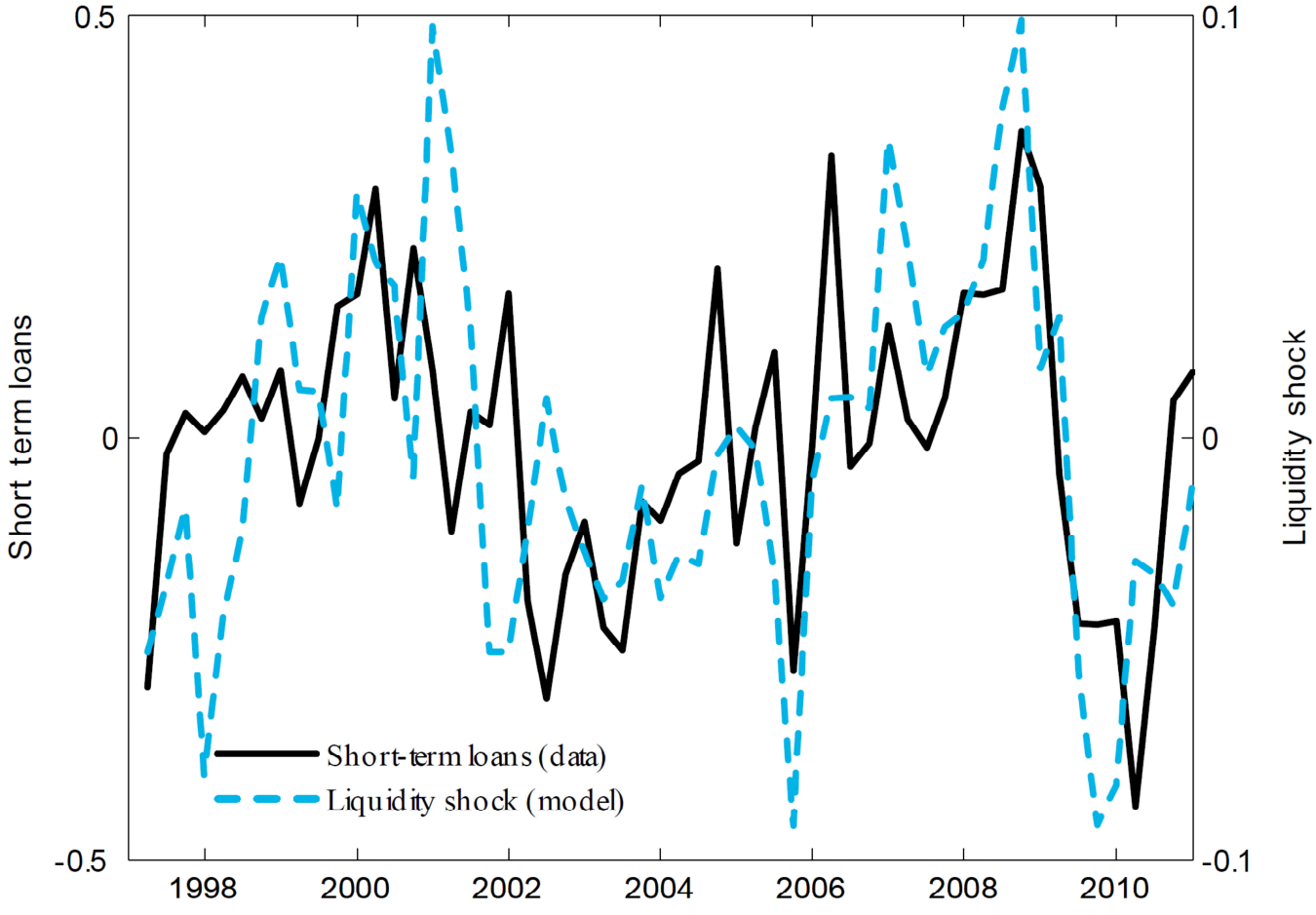
- We use the model's structure to construct **liquidity** series:

$$\hat{\kappa}_t = \left[\frac{wl/Y}{(1-\delta)K/Y}\right]\frac{1}{\kappa}\left(\hat{w}_t + \hat{l}_t\right) - \left[\frac{M/Y}{(1-\delta)K/Y}\right]\frac{1}{\kappa}\hat{M}_t - \hat{K}_t. \tag{1}$$

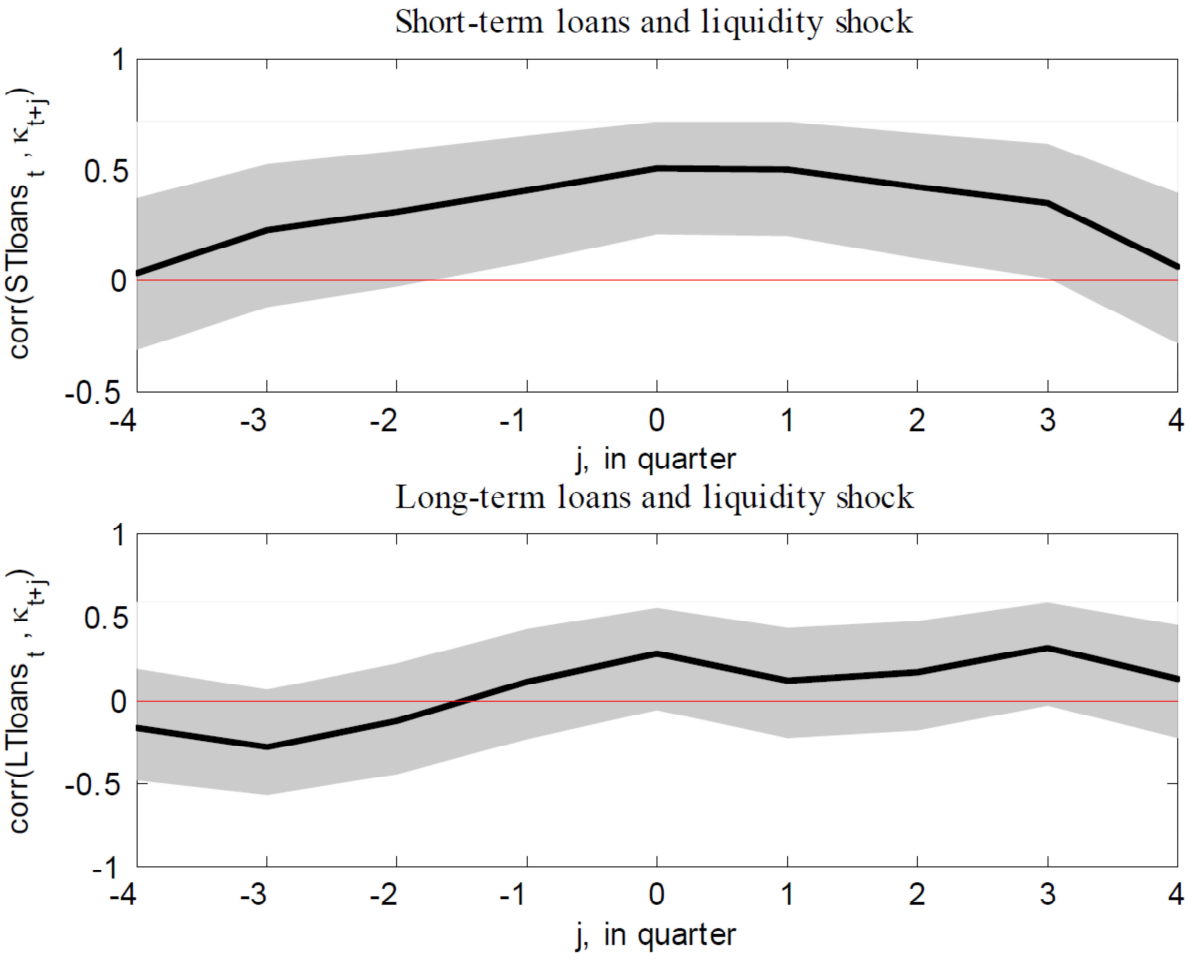
- The Survey of Terms of Business Lending provides measures of banking loans to business firms for different maturities.
  - Distinguish short-term (¡ 1year) and long-term loans
  - Data available from 1997q2 to 2011q4, HP-detrended.

▸ Calibration

Liquidity Shock and Short-Term Loans



Correlation



Cross-firms correlation

Calibration Strategy

- We reintroduce **heterogenous firms** that are hit by idiosyncratic ϵ_{it}^{A} and ϵ_{it}^{κ}:
  - Distributions of A_{it} and κ_{it} target interquartile ratio for cash ratio and employment ($\frac{m_{75\%}}{m_{25\%}}$ and $\frac{\ell_{75\%}}{\ell_{25\%}}$)

- What do we find?
  - Model with a distribution of firms allows us to compute the **cross-firm correlation** between employment and cash ratio (-0.13 versus -0.29 in the data)

▸ Simulation ▸ More

Extensions

- Consider various extensions:
  - **Differing levels of credit constraints across firms**: Firms with more stringent constraints (lower ϕ) exhibit a lower correlation (consistent with data) ▸ More
  - **Unconstrained firms**: Cash and labor are more disconnected than in the benchmark constrained case ▸ More
  - **Liquidity uncertainty**: Impact of higher uncertainty is similar to lower external liquidity if labor is predetermined: firms choose to hold amount of cash for the worse state (low κ) to ensure that their revenue is sufficient ▸ More
  - **Unanticipated productivity shocks**: on impact, there can be unused cash, but if the shock is persistent then the dynamics becomes similar to an anticipated shock. ▸ More

Conclusion

Conclusion

- **Contribution**:
  - Highlight stylized fact: negative comovement between cash ratio and employment
  - Build a tractable model to explain this comovement. Cash holding decisions which depend on external liquidity needs.
- **Results**:
  - Liquidity shocks can generate negative co-movement
  - Liquidity shock consistent with evidence on short-term loans
  - Model is able to reproduce a sizeable negative cross-firms correlation
- **Possible extensions**:
  - upward trend in corporate cash holding (Falato et al. 2013, Gao, 2013).
  - introduce financial intermediaries
  - policy analysis (CPLF)

additional slides

Aggregate Data Evidence

- Data source: Flow of Funds & BLS. Quarterly data, non-farm non-financial corporate sector, 1980Q1-2011Q1.

- Data construction:
  - Liquidity ratio: share of corporate liquidity to total assets. Liquidity: private foreign deposits + checkable deposits and currency + total time and savings deposits + money market mutual fund shares.
  - Employment: log of total number of employees.

- Data transformation: both cash ratio and employment are HP filtered.

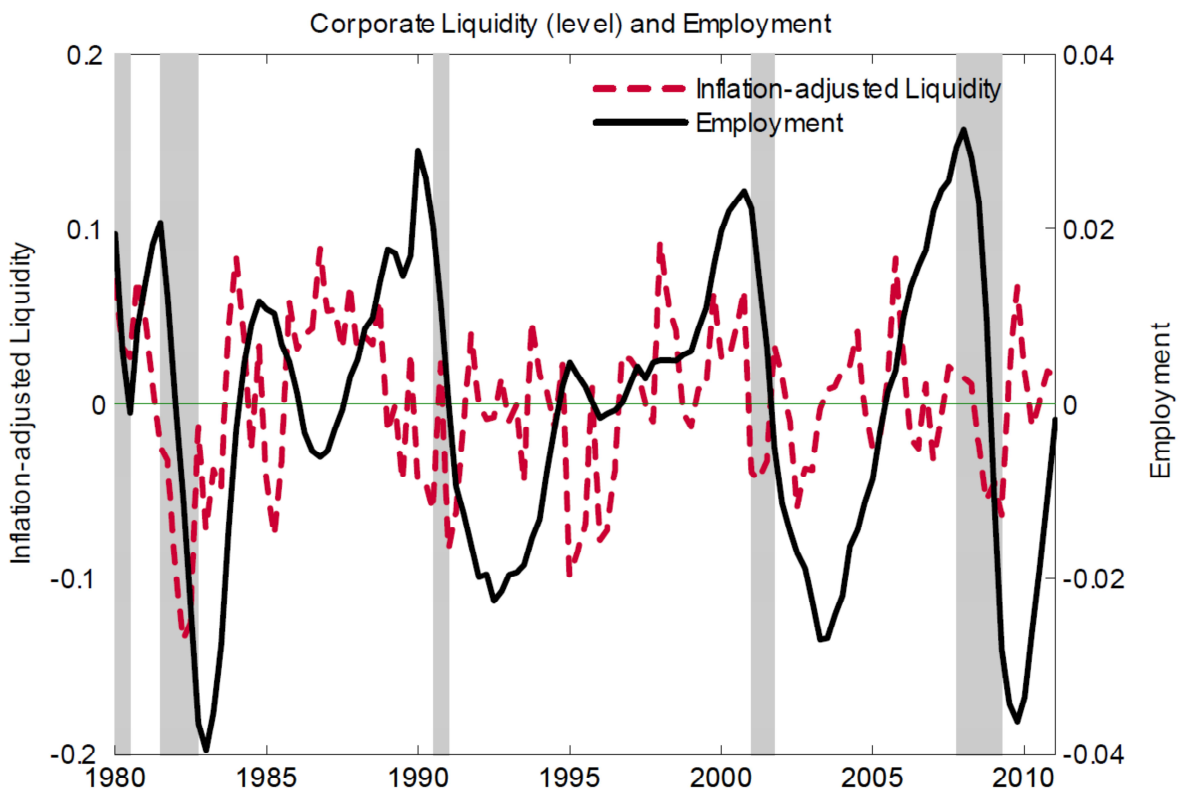
Back

Robustness aggregate results

- Without the financial crisis: -0.18
- Divide cash by last period assets: -0.42
- Annual data: -0.52
- Robust to controlling for interest rate and GDP

Back

Liquidity in Level



Back

Unconstrained Firms

- Baseline framework: firms are always credit-constrained
- Alternative model: firms are not credit-constrained ($r = \frac{1}{\beta}$)
- Result:
  - labor demand is less sensitive to liquidity shock and more sensitive to technology shocks (i.e. decreases by less) since labor productivity is driven by technology.

Back

Liquidity Uncertainty

- Baseline framework: κ_{it} known at the beginning of period t.
- Alternative model: firms only know the distribution of κ_{it}.
- Result:
  - Assume that there are only 2 states for κ: low or high.
  - If labor is predetermined, firms choose to hold amount of cash for the worse case (low κ) to ensure that their revenue is sufficient.
    $\Rightarrow$ firms behave exactly as if their anticipated liquidity shock was κ_t^L.

Back

Unanticipated Productivity Shocks

- Baseline framework: productivity shocks are know at the beginning of period t.
- Alternative model: : productivity shocks are unanticipated
- Result:
  - Firms adjust cash holding with unused cash but once they know that the shock is persistent, they "smooth" the use of this stock and results are similar to an unanticipated shock.

Back

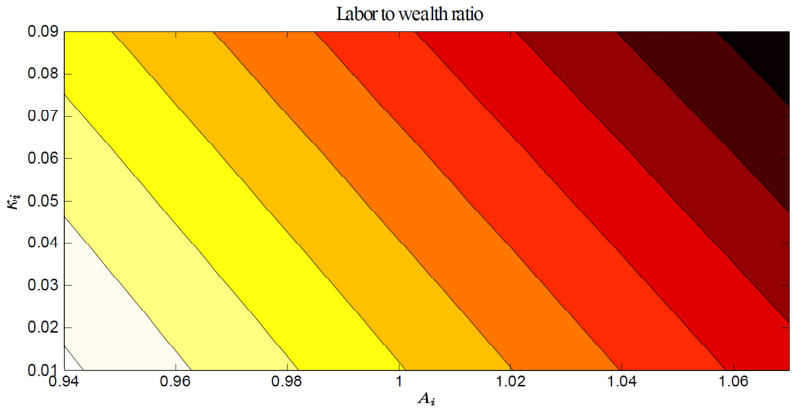
Simulation strategy

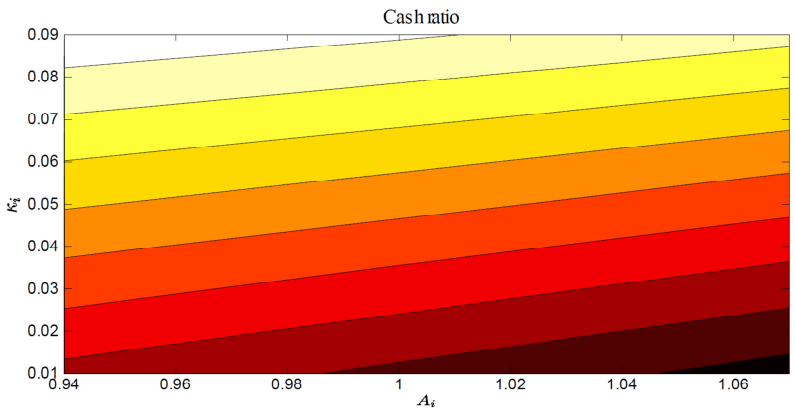
- $\kappa_i \in [0.01; 0.091]$ and $A_i \in [0.94; 1.07]$
- 10 equidistant possible realizations, independent first-order Markov process with transition probability of $\frac{0.25}{9}$

- We compute the **steady-state distribution**:
  - Set initial distribution of wealth $\Omega_{i0} = \{0, 0.9\}_{1000}$ and make an initial guess on w_0.
  - Obtain the optimal decision rule $\Omega_{it+1}(\Omega_{it}, \epsilon^{\kappa}_{it}, \epsilon^{A}_{it}, w_t)$. Using the policy functions, find the distribution of labor demand l_{it+1}. Aggregate labor demand $l_{t+1} = \sum_i \sum_{\kappa,A} l_{it+1} di$, and if $l_{t+1} > l^s(w_t)$, then we update the equilibrium wage w_{t+1} upward.
  - Repeat the step until the equilibrium wage is reached, i.e. when aggregate labor demand is fully satisfied.

Back

Results





- low $\kappa_{it} \Rightarrow$ large m_{it} and low l_{it}, for a given Ω_{it}
- low $A_{it} \Rightarrow$ low m_{it} and low l_{it}, for a given Ω_{it}

Back

Individual policy functions

- For $w_t < w_t^*$, log utility, and Cobb-Douglas production function, the policy functions for K_{it}, M_{it}, I_{it}, D_{it},and Ω_{it+1} satisfy:
  - $I_{it} = Z_{it}\Omega_{it}$
  - $M_{it} = \left[w_t - \kappa_{it}(1-\delta)k_{it}/r^L\right] Z_{it}\Omega_{it}$
  - $D_{it} = \phi_{it}\left[(1-\delta)k_{it}\right] Z_{it}\Omega_{it}/r$
  - $K_{it} = k_t Z_{it}\Omega_{it}$
  - $\Omega_{it+1} = \left[(1-\kappa_{it}-\phi_{it})(1-\delta)k_{it} + A_{it}f(k_{it})\right]Z_{it}\Omega_{it}$

    where $Z_{it} = \frac{\beta r_t}{[k_{it}+w_t]-(\kappa_{it}/r^L+\phi_{it}/r)(1-\delta)k_{it}}$ and $k_{it}=A_{it}\tilde{k}(\tilde{w}_{it}, \phi_{it}, \kappa_{it})$

Back

Households

- Households receive wages at 'eop' in t and consume at 'bop' in $t+1$.

- **Supply of assets**:
  - Infinitely elastic supply of cash, at rate 1.
  - Infinitely elastic supply of illiquid funds D_t to firms at interest rate $R = 1/\beta$, where $r = \tau R$ (R, rate before tax).
  - Supply liquid funds L_t at 'eop', at rate $r^L = 1/\psi$ (ψ, HH's discount factor between 'eop' and 'bop').

Back

Labor market

- **Labor supply** $l^s(w_t)$ depends positively on the wage rate:

$$l^s(w_t) = (w_t/\bar{w})^\eta$$

where $\eta > 0$ is the Frisch elasticity of labor supply and $\bar{w}$ is a positive constant.

- **Wage**, w_t, is determined such that $l^s(w_t) = \int_0^1 l_{it} di$. This yields:

$$l^s(w_t) = \int_0^1 l(w_t, A_{it}, \kappa_{it}, \phi_{it}, \Omega_{it}) di.$$

Calibration

Table 1. Calibration Strategy

		Value
β	Discount factor	0.9825
r	Gross interest rate on bonds	1.012
r_L	Liquidity cost	1.01
η	Frisch parameter	1
α	Elasticity of output wrt capital	0.36
ϕ	Collateral share for debt	$0.0605 \Rightarrow \frac{D}{Y} = 0.50$
κ	Collateral share for liquidity	$0.0409 \Rightarrow m = 0.033$
A	Steady-state productivity shock	1.00

Aggregate Shocks Series

- Output, $\hat{Y}_t$: gross value added in the business sector from NIPA.
- Wage bill, $\hat{w}_t + \hat{\ell}_t$, hourly compensation index $\times$ hours worked in the nonfarm business sector from BLS.
- Debt series, $\hat{D}_t$, credit market instruments (liabilities) from the non-financial corporate business sector from Flow of Funds.
- Capital, $\hat{K}_t$, constructed through total capital expenditures and consumption of fixed capital of non-financial corporate business sector from Flow of Funds

$$K_{t+1} = K_t - CFC_t + TCE_t. \tag{2}$$

K_0 is chosen so that the capital-output ratio does not display any trend during the sample 1952-2004, see Jermann and Quadrini (2012).

Back

Related literature

- The **corporate finance literature** is vast.... Some papers looking at corporate cash holding:
  - Bolton et al. (2013); Hugonnier et al. (2013): worsening external funding conditions increase cash holding and depresses investment.
  - Eisfeld and Muir (2013): focus on cash accumulation (and external finance).
  - Boileau and Moyen (2012): funding risk on liquidity.
  - Falato et al. (2013); Gao (2013): explain upward trend in corporate cash

$\Rightarrow$ Our model is tractable and it captures the general equilibrium effects. In addition, cash is not modeled as a negative debt.

▸ Back

Robustness aggregate results

- Without recession: -0.30*.
- Divide cash by last period assets: -0.33*.
- Quarterly data: -0.44*.
- Euro area, quarterly, 1999q1-2013q3: -0.32*.

Back

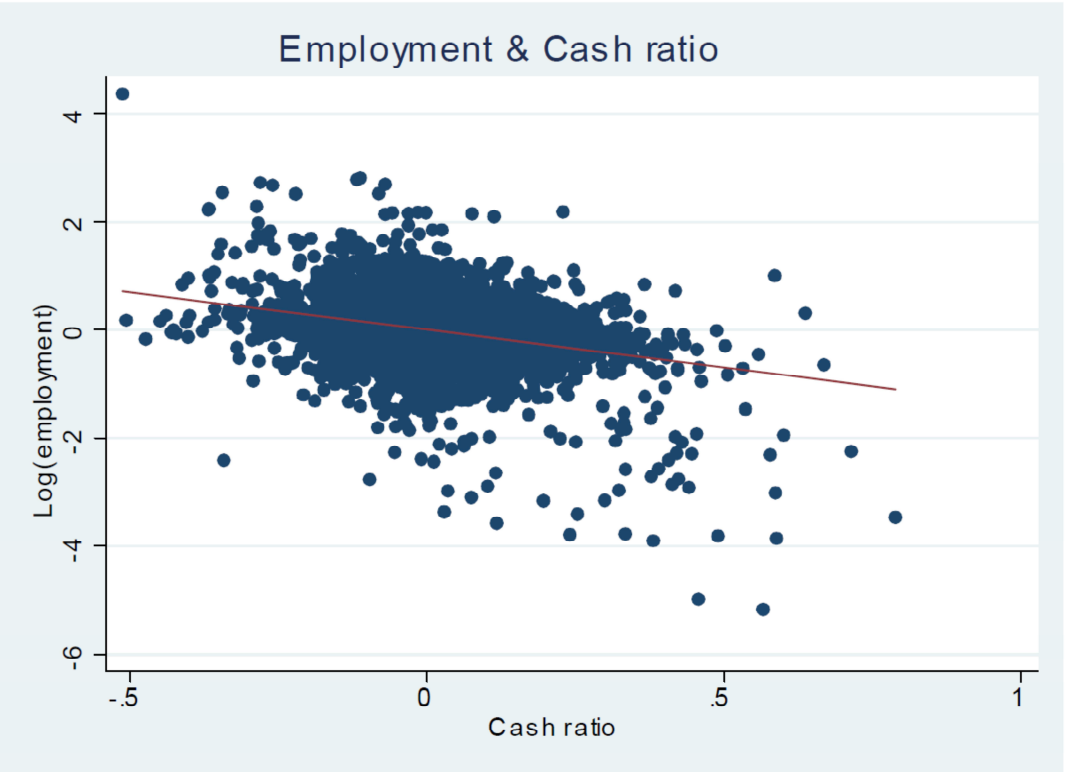
Firm-level data

- Compustat dataset: US non-financial firms, 1980-2011.
- Data construction:
  - Cash ratio: ratio between cash and short term investment and total assets
  - Employment: number of employees.
- Data selection:
  - Firms active over the whole sample,
  - Drop 10% largest firms (Covas and Den Haan, 2011),
  - exclude: firms not incorporated in US market, engaged in major mergers, negative or missing values for total assets, sales, cash and employees.
  - Remove firm-specific linear trend.

Back

Firm-level data

Figure: **Employment (in log) and cash ratio: firm-level data**



Back

Firm-level data

Table 2. Employment and Cash Ratio

Dependant Variable: $\log(EMP_{it})$	(1)	(2)	(3)	(4)
$\left(\frac{CHE}{AT}\right)_{it}$	−1.356** (0.181)	−1.127** (0.147)	−1.127** (0..149)	−0.984** (0..138)
$\log(AT)_{it}$		0.656** (0.021)	0.662** (0.021)	0.566** (0.020)
$CFLOW_{it}$			−0.023* (0.013)	−0.036 (0.030)
LEV_{it}				−0.017 (0.016)
$\log(CAPX)_{it}$				0.088** (0.014)
R-squared	0.09	0.48	0.49	0.51
Firm fixed effects	yes	yes	yes	yes
Time fixed effects	yes	yes	yes	yes
Observations	14 651	14 651	14 627	14 430

Back

Wage and Cash Relationship

- Compustat: "staff expense", salaries, wages, pension costs, profit sharing and incentive compensation, payroll taxes and other employee benefits (include 10% largest firms).
  - Firms hold 18% of its staff expenses in cash (median value)
  - Positive relationship between cash holding and the future amount of staff expense $\Rightarrow$ firms holds more cash prior to a rise in staff expenses.
  - Positive relationship is robust to the presence of firms-fixed effects and holds both at the firm and industry level.

Back

Different ϕs

- Assume 2 different states for $\phi_i = \{\phi_L, \phi_H\}$, where $\phi_L < \phi_H$: replicate interquartile debt/sales ratio.

- What are the effects of **credit constraints** on the cross-firms correlation?
  - Financially constrained firms (ϕ_L) exhibit a correlation closer to zero.
  - Larger financial multiplier for less financially-constrained firms. $\Rightarrow$ labor more sensitive to shocks, while m_t not affected by ϕ_i.
- Consistent with data when compare correlation for firms with high and low debt/sales ratio.

Back