The Impact of the Financial Crisis on the Innovation and Growth: Evidence from Technology R&D

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Background and Motivation

- Do turbulences in the financial system lead to a downturn in the real economy?

- How much growth and development of the real economy is forgone during the financial crises?

- These questions have been discussed intensively, but the conclusions are still contradictory.

Background and Motivation

- How are the shocks in financial sector connected to the performance of non-financial firms?

- Understanding the transmission channels between the financial and "real" sectors of the economy is critically important when assessing financial stability.

Purpose of our Research:

- To investigate how the real economy were affected during the financial crisis 2007-2009.

- We analyse the impact of the crisis on research and development (R&D) expenditures of high-tech American firms;

- In particular we explore the effect of financial constraints and distress on firms' R&D investments.

Why Research and Development?

- According to endogenous growth theory, investment in R&D provides new knowledge and increases productivity (Romer, 1990);

- R&D spending has a long-term effect on economic growth.

- The average R&D expenditures are more than double compared to average capital expenditures;

- U.S. R&D growth outpaced GDP growth in the past 20 years.
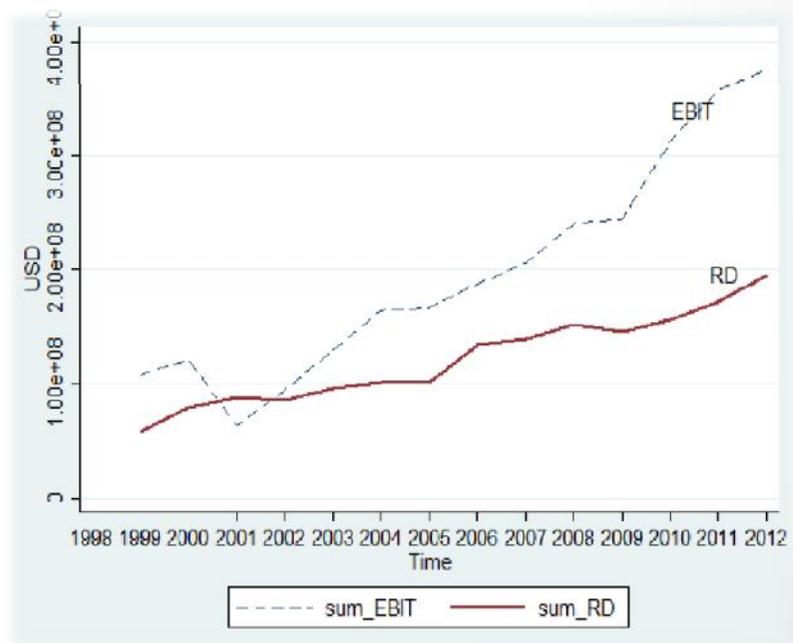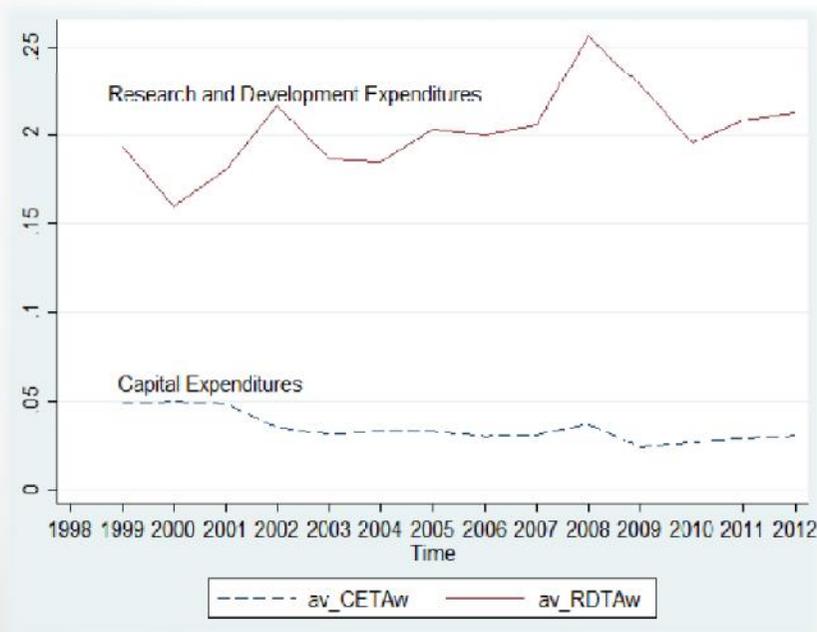
- Investment can be funded from internal and external funds;

- In theory, negative shocks to the supply of external finance might hamper investment if firms lack sufficient financial slack;

- Such effects should be particularly severe in firms that face relatively greater costs in raising external capital or a relatively greater need to do so.

Ambiguous results in the literature on how the investments are affected:

- Duchin et al. (2010), Almeida et al. (2012)and Campello et al. (2010) argue that firms reduce their investments due to the negative shocks to credit supply;

- Kahle and Stulz (2013) and Hetland and Mjos (2012) find evidence that the lending supply shock is not necessarily the dominant causal factor for financial and investment policies during the crisis.

Channels through which crisis affects investment:

- bank lending supply shock;

- supply of credit in general;

- the demand shock;

- collateral channel or balance sheet multiplier effect.

Empirical Approach

- As a basic model we use the structural investment equation of Bond and Meghir (1994);

$$RD^{i,t} = \alpha^i + \alpha_1 RD^{i,t-1} + \alpha_2 RD^{2}_{i,t-1} + \alpha_3 CF^{i,t-1} + \alpha_4 Sales^{i,t-1} + d^t + \epsilon^{it}$$

- We want to test if

  o the financial crisis drives economically weak firms out of business (Schumpeterian idea of creative destruction) or

  o financial constraints during the crisis prevent realizing viable investments projects.

Empirical Approach

- We measure financial constraints by Whited and Wu (2006) index of financial constraints:

$$-0{,}091 CF^{it} - 0{,}062 DIVPOS^{it} + 0{,}021 TLTD^{it} - 0{,}044 LNTA^{it} + 0{,}102 ISG^{it} - 0{,}035 SG_{it}{}^{it}$$

- the firms categorized as "constrained" exhibit characteristics typically associated with exposure to external finance;

- firms deemed constrained by this index are small, underinvest, have low analyst coverage, and do not have bond ratings.

Empirical Approach

- We determine if a firm is distressed by Altman's Z-score:

$$Z = 0,012\, WC^{it} + 0,014\, RE^{it} + 0,033\, EBIT^{it} + 0,006\, MVTL^{it} + 0,999\, SA^{it}$$

- We include Altman's Z-score (FC) and the Whited and Wu (FD) index in the investment equation.

Empirical Approach

- Our final empirical specification looks as follows:

$$RD^{i,t} = \alpha^i + \alpha_1 RD_{i,t-1} + \alpha_2 RD_{i,t-1}^2$$
$$+ \alpha_3 CF_{i,t-1} + \alpha_4 Sales_{i,t-1} + \alpha_5 Sales_t + \alpha_6 Dum_{Crisis}$$
$$+ \gamma FD_{it-1} + \gamma_1 Dum_{Crisis} FD_{it-1} + \beta FC_{it-1}$$
$$+ \beta_1 Dum_{Crisis} FC_{it-1} + ind_j + \epsilon_{it}$$

- We include industry dummies (ind_j) to control for industry-specific changes in technological opportunities;

- Contemporaneous sales ($Sales_t$) to control for demand;

- All variables except of the constraint/distress measures are scaled by total assets.

Data and Descriptive Statistics

- Annual data from the COMPUSTAT U.S. database from 1998 to 2012;

- Sample comprises 1,569 firms for seven high-tech industries: drugs, office equipment and computers, electronic components, communication equipment, scientific instruments, medical instruments and software.

Data and Descriptive Statistics
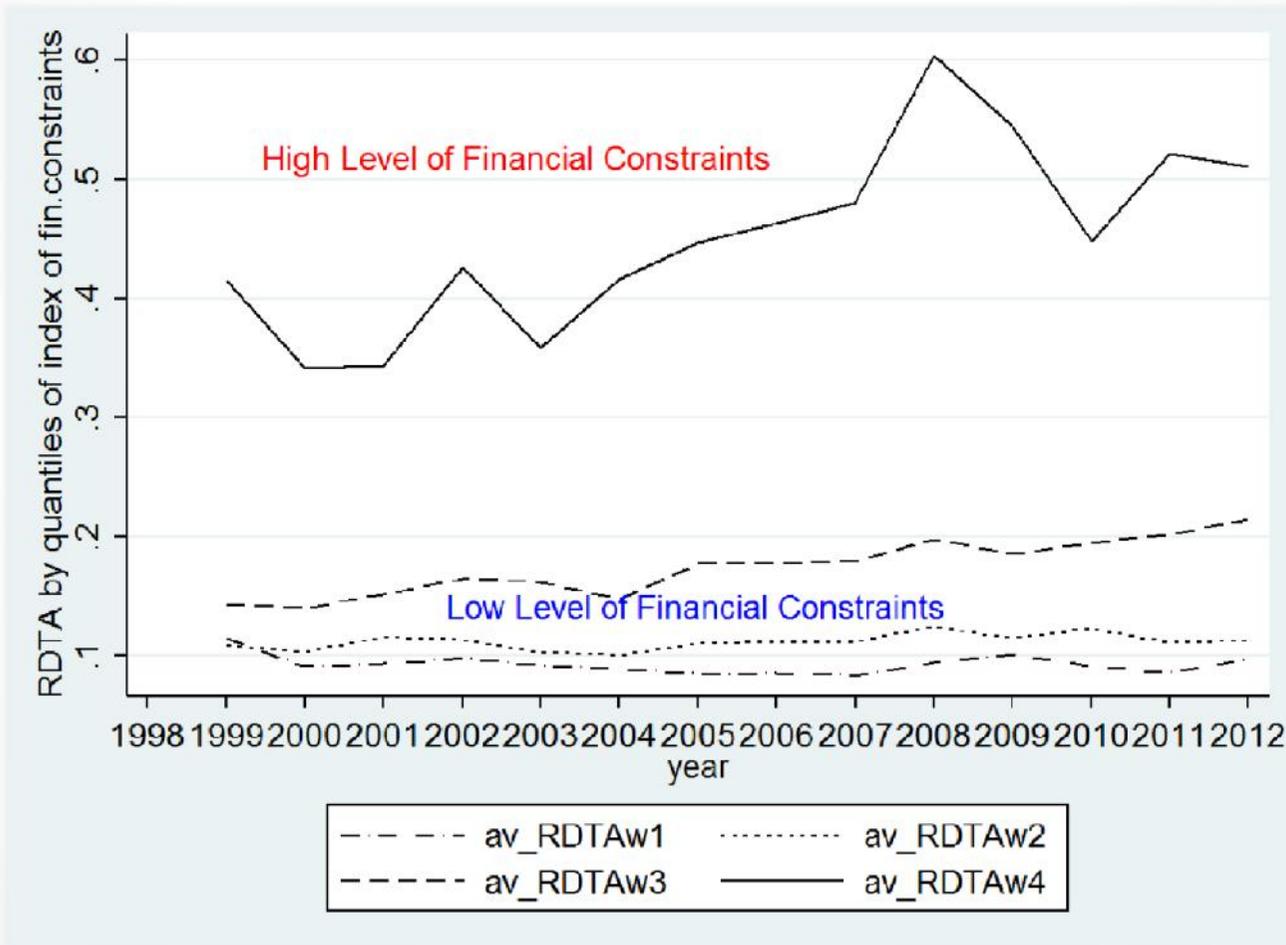
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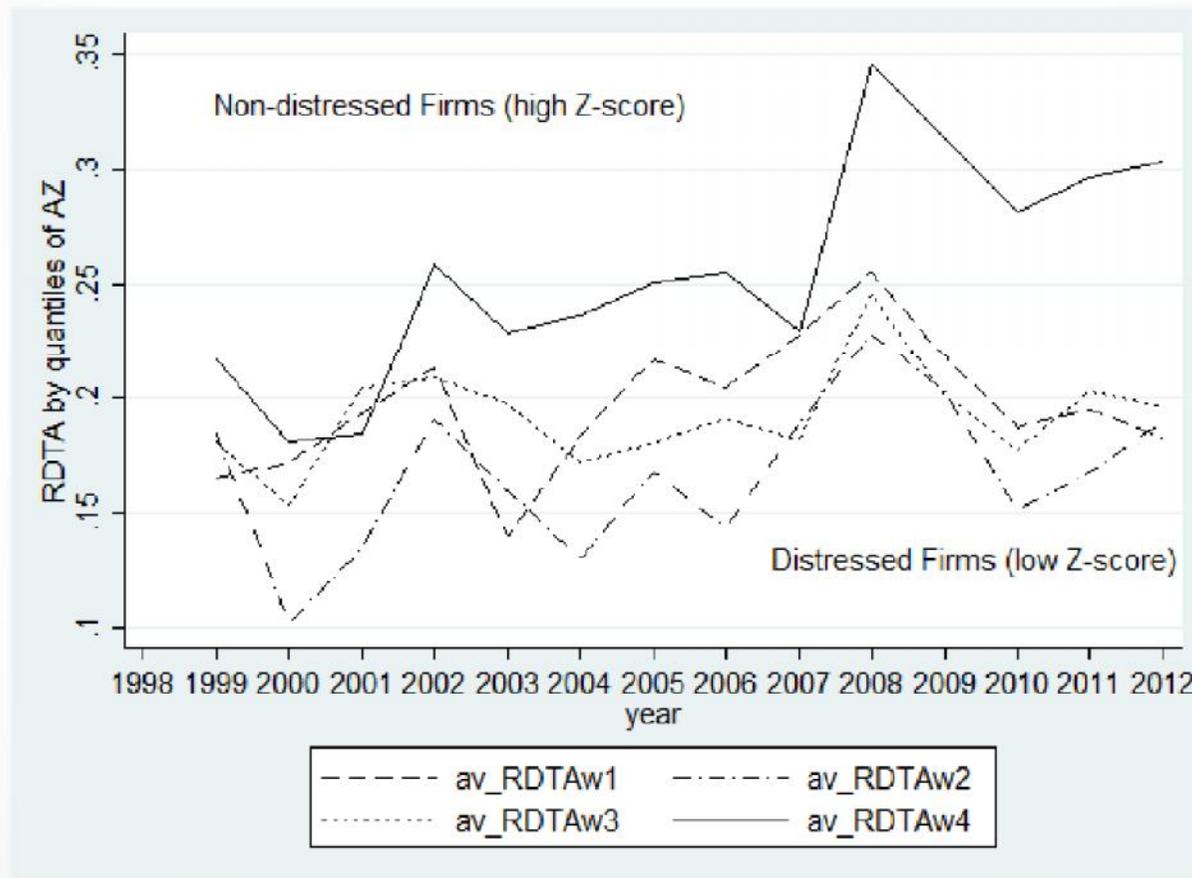
Panel Data Estimation

- We apply Arellano and Bover (1995) system GMM fixed effect OLS;

- We use the third lag as instruments in all specifications.

	OLS – Fixed Effects	AB-Dynamic Part Instrumented	AB-All Instrumented
RD_{t-1}	0.690***	1.086***	1.226***
RD_{t-1}^2	-0.175***	-0.294**	-0.274***
Dum_{Crisis}	0.027***	0.028**	0.022***
FD_{t-1}	-0.0004	-0.001*	-0.0003
$FD_{t-1} * Dum_{Crisis}$	0.0002	0.001**	0.001**
FC_{t-1}	-0.091	-0.103	-0.118
$FC_{t-1}*Dum_{Crisis}$	0.022***	0.028***	0.031***
$Sales_{t-1}$	-0.073***	-0.181***	-0.127***
$Sales_t$	0.138***	0.274***	0.149***
CF_{t-1}	-0.002	0.002	-0.027
_cons	-0.044	0.109	-0.084
Observations	11410	11410	11410
Instruments		69	145
Hansen(p-value)		0.024	0.003

Robustness

- Using capital expenditures instead of R&D

- Extend the crisis period

- Exclude pharmaceuticals (might drive results)

- Main results remain unchanged

Conclusions

- Result is consistent with the observation that average R&D expenditures were increasing during the financial crisis.

- The outcome is consistent with the findings of Kahle and Stulz (2012) and Hetland and Mjos (2012) that question whether firms´ investment behavior is affected via a supply side shock during the financial crisis.

- Possible explanation is that constrained firms are more experienced overcoming financial constraints compared to non-constrained firms.

Conclusions

- Findings are evidence that there is not much long-term damage of the financial crisis for innovation and future growth proxied by R&D expenditures.

- Results support the argumentation that the financial crisis transmits rather through a demand-side shock than through a supply-side shock.

Discussion.