Innovative Capability and Financing Constraints for Innovation: More Money, More Innovation?

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- **Keywords:** Innovation,
  Financing constraints,
  Innovative capability,
  Multivariate probit models

Part I Introduction

- Economic theory stresses that financing constraints may occur due to **imperfections** on capital markets.

- **Information asymmetries** may affect investments in innovation projects.

- Financing innovation externally may be more costly compared to other investment. and internal funds are not inexhaustible.

- Financing constraints may **not affect all firms to the same extent** in innovation projects.

- **which firms face** financing constraints in innovation?

1) previous empirical (indirectly): sensitivity of R&D investment to changes in internal funds etc.

2)This paper takes **a direct approach** based on the idea of an ideal test by Hall (2008) .

The survey test:firms were asked to imagine that they receive additional cash exogenously and to indicate how they would spend it.

If invest in innovation project all or partly ,then it is financially constrained.

- **What factors effect** the financing constraints for firm's investments in innovation projects?

  1) the availability of internal funds and the costs of external funds etc.

  2) **innovative capability** (for increasing resource requirements).

- This paper's **contributions** to the literature in three aspects:

1) employ a **direct indicator** derived from survey .

2）**account for the firm's choice** between alternative uses of the money in econometric analysis，and get some interesting results .

3） introduce **innovative capability** and find financial constraints **are driven by it** through increasing resource requirements.

Part II Literature review

1、Theoretical arguments for financing constraints:

- imperfect markets and information asymmetries influence lending and investment decisions, the cost of different kinds of capital may vary by type of investment (Meyer and Kuh 1957,Leland and Pyle 1977, Myers and Majluf 1984).

- Investment in innovation get higher degree of asymmetric information,and few reveal details to potential investors for competition (Stiglitz and Weiss 1981, Greenwald, Stiglitz and Weiss 1984, Bhattacharya and Ritter 1983, Anton and Yao 2002).so the cost is higher.

1、Theoretical arguments for financing constraints:

- Poduct' intangible nature, investment sunk and not redeployed, not immediately lead to success etc make external fund more costly for innovation projects than for other types of investment.(Alderson and Betker 1996,Hall 1990, 2002)

- Firms indeed first use internal funds to finance innovation projects(Leland and Pyle 1977, Hall 1992, Himmelberg and Peterson 1994, Bougheas,Görg and Strobl 2003, Czarnitzki and Hottenrott 2009)

- Consequently,the extent to which financial constraints are binding depends on the firms' ability to raise external or internal funds

2、 Empirical Evidence

- Measuring and identifying

1） Since Fazzari, Hubbard and Petersen (1988) ,econometric studies have tried to detect financial constraints by analyzing **investments' sensitivities to changes in available financial resources**(cash-flow).

2）Furthermore,researchers usually **split** their sample or focus on a **particular group of firms** in order to observe more than an average effect. Some factors such as:firm size、age (Himmelberg and Peterson 1994, Czarnitzki 2006, Hottenrott 2009)、 governance structures (Czarnitzki and Kraft 2004), industry patterns (Hall 1992, Bloch 2005) ……

2、 Empirical Evidence

- Some results

1)A **positive** relationship between R&D activity and cash flow (Hall 1992,Himmelberg 1994……).

2)Bond et al. (2006) detect cash flow **determines** whether a UK firm does R&D, but not how much, and not find for Germany.

3）A **negative** association between debt and R&D activity for US not Japanese, (Bhagat and Welch 1995),yet, not observe any relationship between cash flow and R&D for US and UK firms.

4)Other finding: older and bigger companies are less restricted（Berger and Udell 2002，Müller and Zimmermann 2006）; higher financing constraints on innovation for firms in high-tech sectors and for smaller firms (Canepa and Stoneman 2002)……

2、 Empirical Evidence

- Limitations

1) data availability.

2) conceptual set-up.

whether the relationship between cash flow and investment is a suffcient indication of financial constraints（Fazzari et al. 2000 and Aydogan 2003）

Investigate access to external funds by credit（Czarnitzki 2006,Piga 2007)

3）survey data

adopt more direct approaches(Canepa and Stoneman 2002, Savignac 2008, Tiwari, Mohnen, Palm etc 2007).

neglect the competion between alternative options.

4） none of the empirical studies consider the role of innovative capability

Part III Theoretical Framework and Hypotheses

- **Theoretical model:**

draw from a simple model by Howe al (1976) and Hall al (2000,2008),and use it explore how innovative capability affects financing constraints for innovation.

Define $\{IC_i,\ D_i,\ I_i,\ X_i\ ;\ R_i^{e,o},\ IF_i\ ,\ W_i\}$

Assume: ① in each period firm i has a certain set of ideas for innovation.

② firm ranks projects according to their ERR in descending order.(D)

③ a pecking order

$$\mathbf{MRR_i = f\ (\ I_i,\ IC_i,\ X_i)}$$

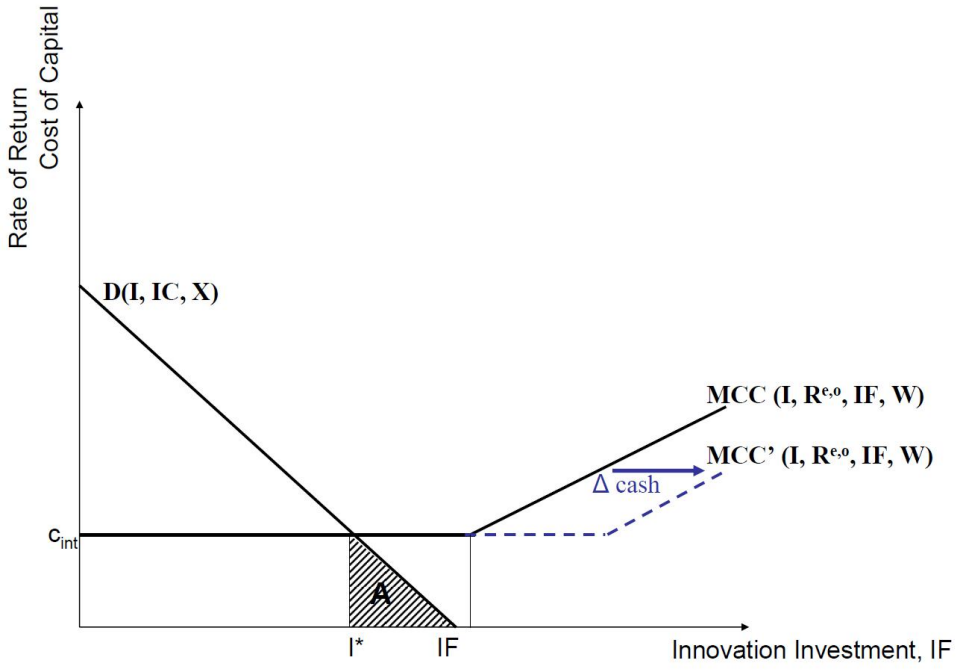
$$\mathbf{MCC\ i = f(\ I_i\ ,R_i^{e,o}\ ,\ IF_i\ ,W_i\ )}$$

Equating MRR_i and MCC_i yields reduced form for **optimal investment** (I_i^*)

$$\mathbf{I^* = h\ (IC_i\ ,R_i^{e,o}\ ,IF_i\ ,\ X_i\ ,W_i\ ).}$$

Prove the assume:

Invesing the addition cash to innovation means firm is financially constrained.



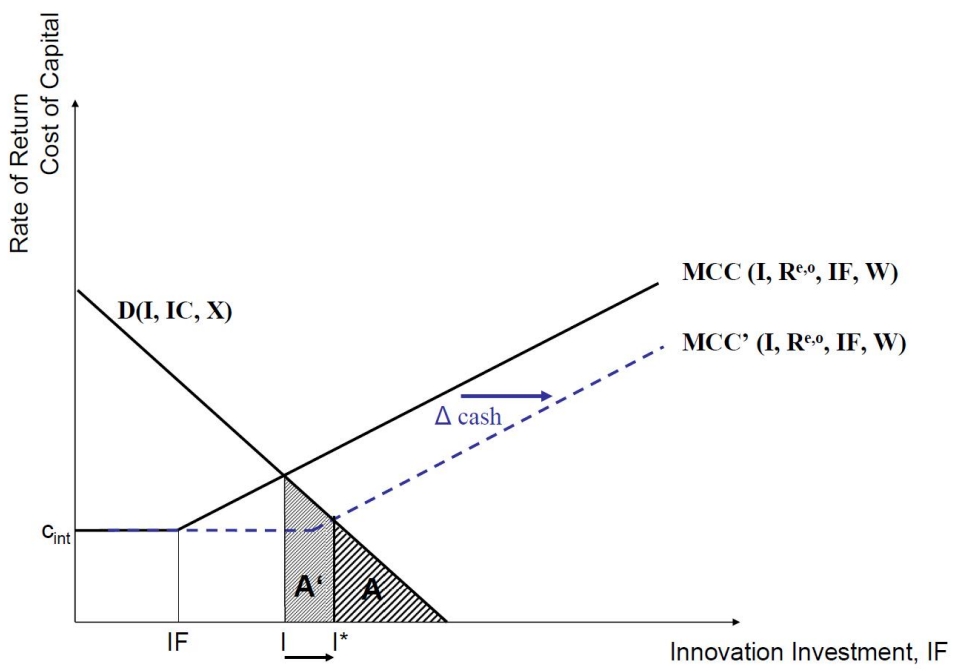


Figure1: Unconstrained vs constrained firm

Show:

Would **innovative capability** affect financial constraints for innovation?

$IC_A < IC_B \Longrightarrow D_A < D_B$

$IF_A = IF_B$

$MCC_A = MCC_B$

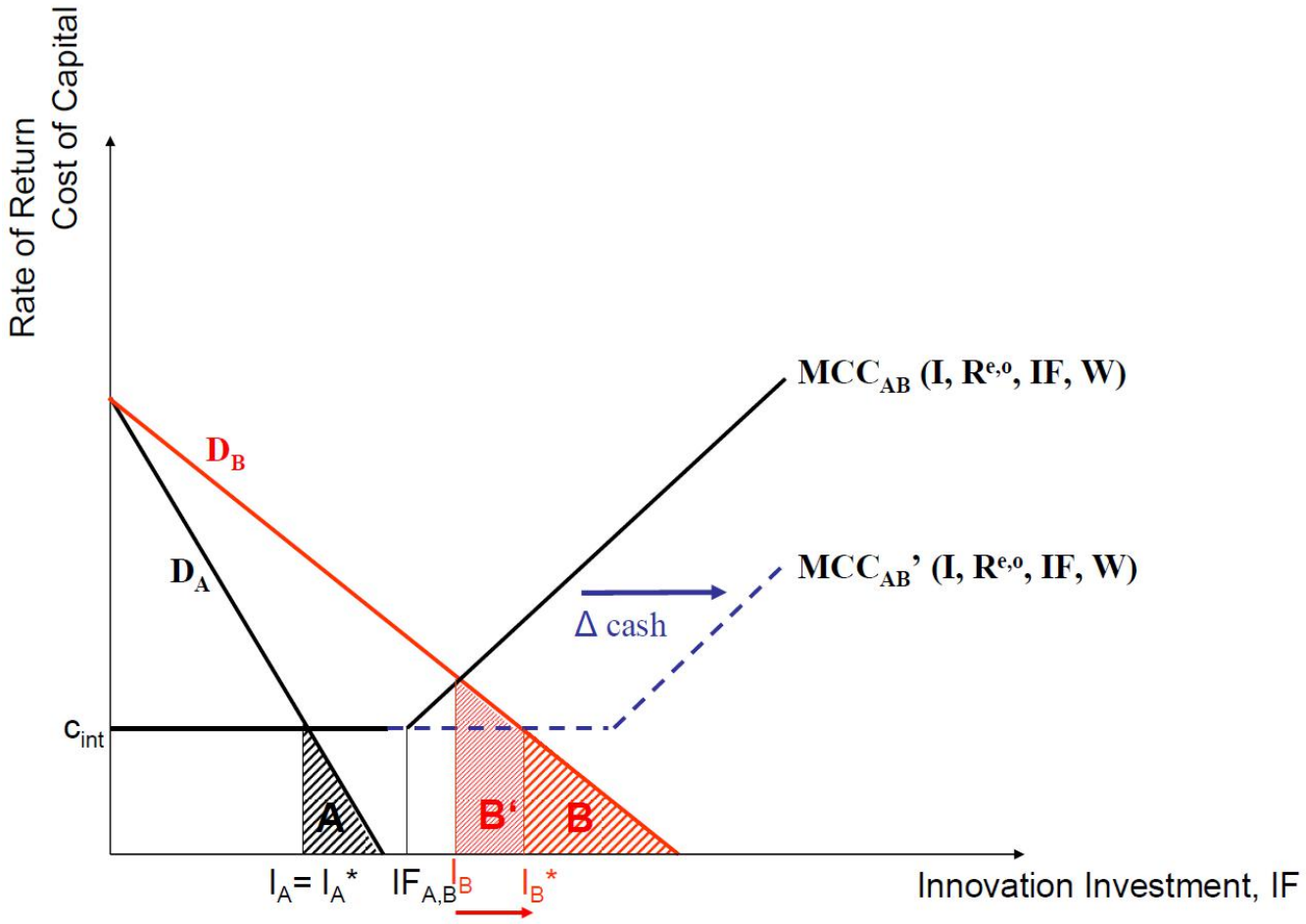


Figure 2(a): B constrained and A unconstrained

Show:

The effection from different innovative capability lead to financial constraints for innovation.

$IC_A < IC_B \Longrightarrow D_A < D_B$

$IF_A = IF_B$

$MCC_A = MCC_B$

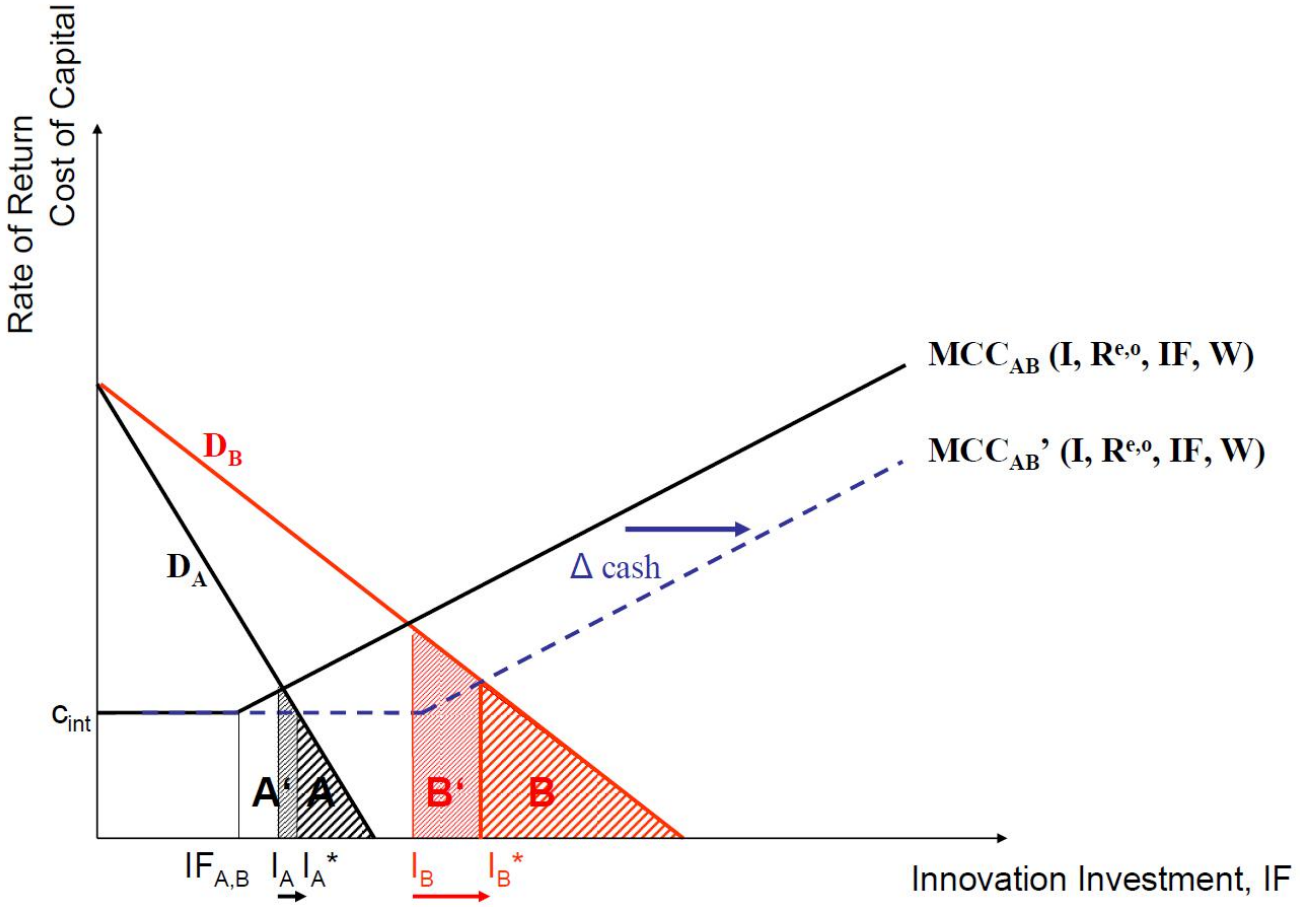


Figure 2(b) :Both constrained

Show:

How **internal financing** affect the financing constraints in innovation?

$IC_A = IC_B$, $D_A = D_B$

$IF_A < IF_B$ ⟹

$MCC_A > MCC_B$

$\Delta CASH_A = \Delta CASH_B$

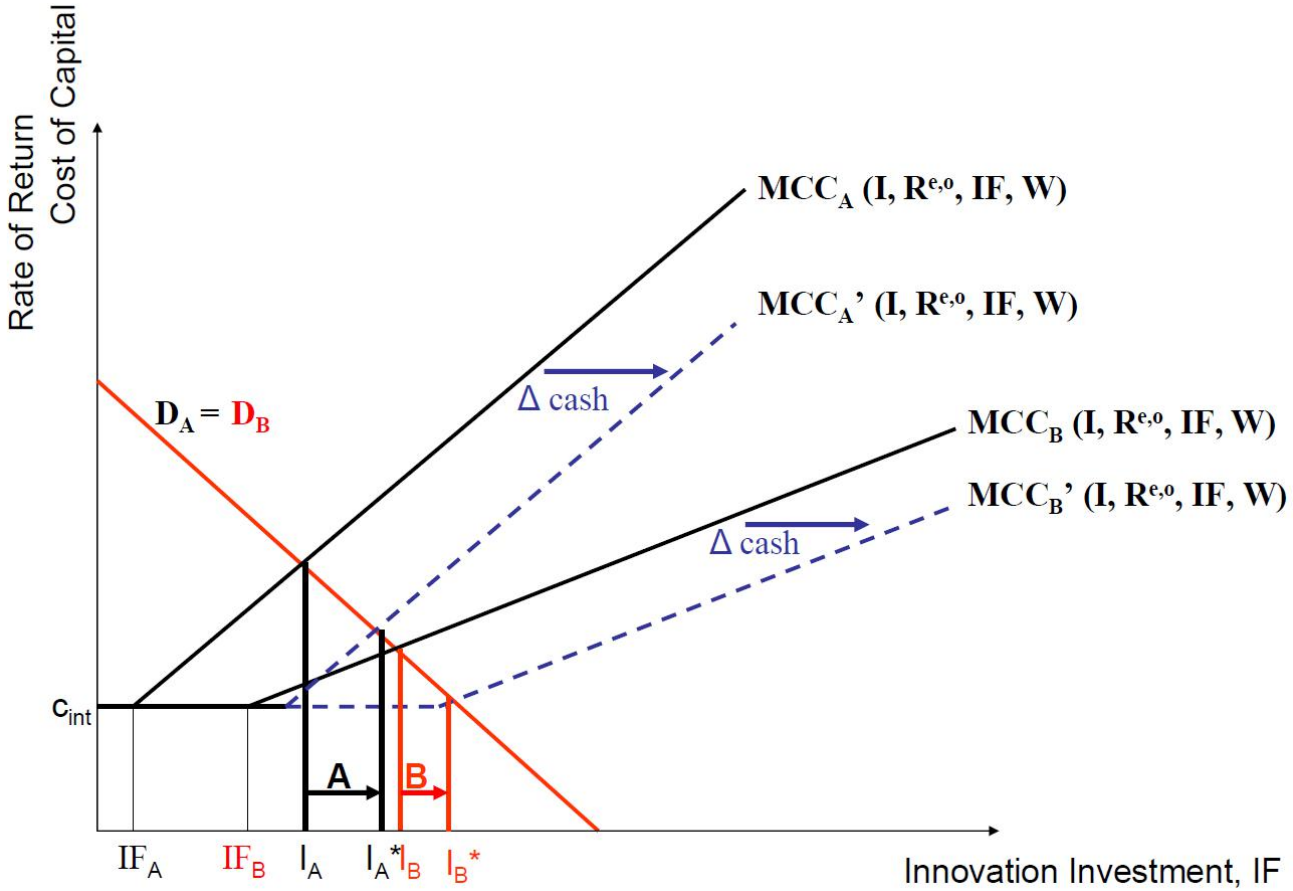


Figure 3(a)： Both constrained

Show:

The degree of financingn constraints for firms faced different gap between C_{int} and C_{ext}?

$IC_A = IC_B$, $D_A = D_B$

$IF_A = IF_B$

$W_A < W_B$ ⟹

$MCC_A > MCC_B$

$\Delta CASH_A = \Delta CASH_B$

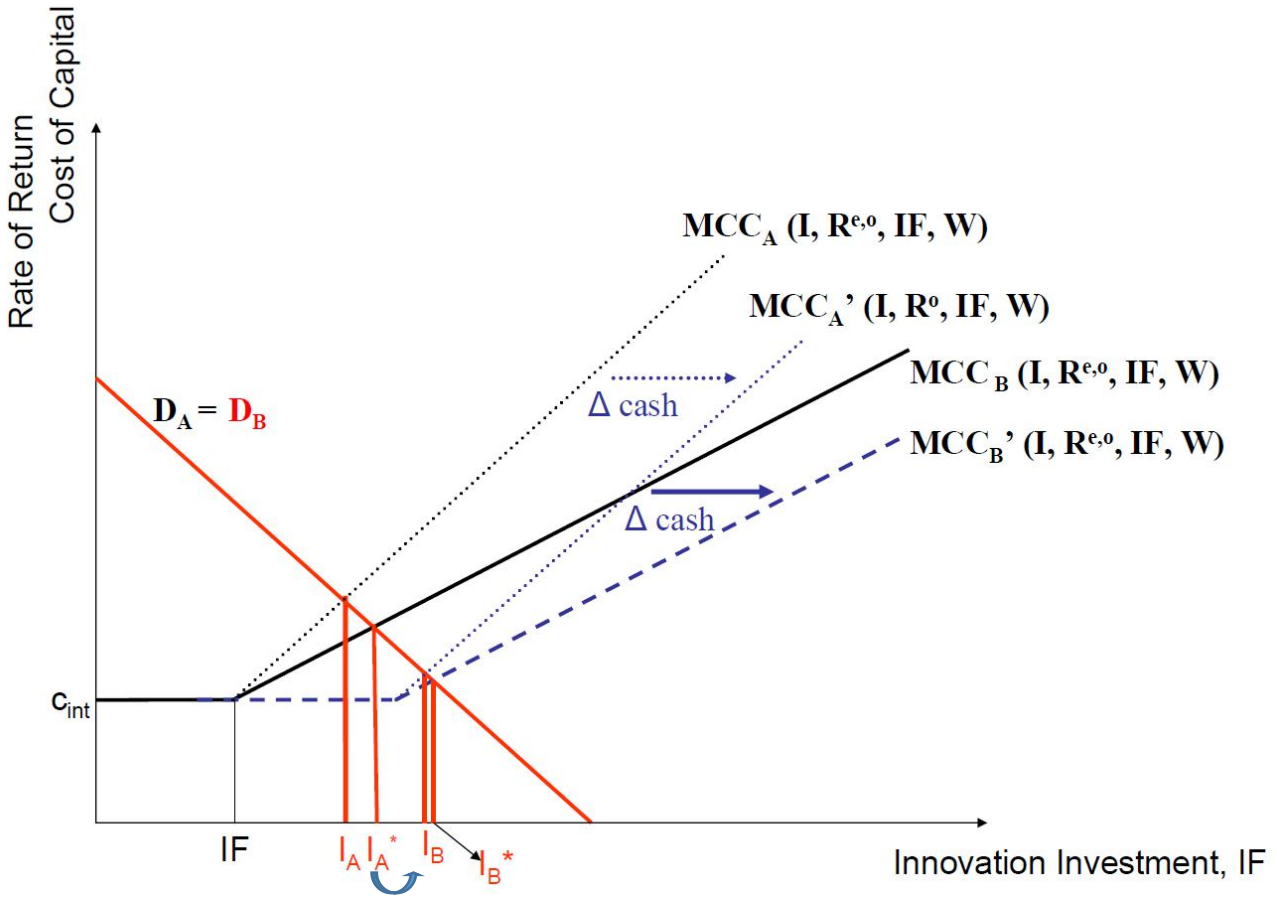


Figure 3(b)： Both constrained

Hypotheses

- Hypothesis 1: Given the same level of internal funds, firms with **higher innovative capability** should be more likely to be constrained than firms with lower innovative capability.

- Hypothesis 2: Given the same level of innovative capability, firms with **lower financial resources** should be more likely to be constrained.

- Hypothesis 3: Firms that face **a larger gap between C_{int} and C_{ext} ,** should be more likely to be financially constrained.

Part IV Empirical

1、Data and Sample

- **Data：** from 2007 wave of the Mannheim Innovation Panel (**MIP**)

- **Sample：** 2,468 firms in manufacturing industries (divided into 15 industries) which with at least 5 employees in the German business sector.

2、Measuring financing constraints

- Δ**CASH** amount to 10% of the firms last year's turnover.
- **Six response options**: investment projects、 innovation projects、 reserves、 payout to shareholders、repayment of debt.

- **Main dependent variable : CON and TYPE**

1) A firm is considered to be financially constrained if it would invest additional funds in innovation projects (CON = 1, otherwise CON = 0).

2) If the firm not invest in additional innovation projects.(TYPE = 0)

partly invest (TYPE = 1)

exclusively invest (TYPE = 2)

3、Innovative Capability and Lack of Financing

- **Define:** firm liquidity (M ~Money) and innovative capability (B ~ Brain)

1) IF the share of highly qualified personnel or the expenditure on training per employee is larger than the 80th percentile,then it is $\mathbf{B_H}$, otherwise $\mathbf{B_L}$.

Other studies by firm's R&D expenditure or past innovation success.（ robustness test）

2) Use profit margin (r) measure the availability of internal funds.

$\mathbf{M_L}$(r < 0)、 $\mathbf{M_M}$(0 < r < 7%)、$\mathbf{M_H}$(7% < r)

Get **6 groups** of firms that differ in their Resource Endowments.

Innovative Capability \ Financial Resources	*high*	*medium*	*low*
high	$B_H M_H$	$B_H M_M$	$B_H M_L$
low	$B_L M_H$	$B_L M_M$	$B_L M_L$

4、Control Variables

Variable	Var. type	Description
main control variables:		
SIZE	continuous	headcount
AGE	continuous	years
CASH	continuous	mio.€
FAMCOM	dummy	[0/1]
GROUP	dummy	[0/1]
KAPINT	continuous	mio.€/ empl.
RATING	continuous	[1-6] (1 = best)
PLC	continuous	years
EAST	dummy	[0/1]
CEO	dummy	[0/1]
R&D_DEP	dummy	[0/1]
FIN_DEP	dummy	[0/1]
SALES_DEP	dummy	[0/1]
OTHER_DEP	dummy	[0/1]
PRIVATE	dummy	[0/1]
PUBLIC	dummy	[0/1]
LIMITED	dummy	[0/1]

Capital intensity is measured by the value of firms' assets per employee (KAPINT)

5、Descriptive Statistics

Table 1: Summary statistic

Variable	Var. type	Description	Mean	Std. Dev.	$CON=0$ Mean	$CON=1$ Mean	t-test
dependent variables:							
CON	dummy	[0/1]	0.360	0.480			
$TYPE$	categorical	[0/1/2]	0.378	0.521			
resource endowment indicators:							
$B_H M_L$	dummy	[0/1]	0.039	0.193	0.030	0.054	***
$B_H M_M$	dummy	[0/1]	0.179	0.383	0.159	0.213	***
$B_H M_H$	dummy	[0/1]	0.111	0.315	0.092	0.145	***
$B_L M_L$	dummy	[0/1]	0.071	0.257	0.073	0.068	
$B_L M_M$	dummy	[0/1]	0.425	0.494	0.460	0.363	***
$B_L M_H$	dummy	[0/1]	0.175	0.380	0.185	0.157	*

Part V Econometric Analysis

- $y^* = \beta_0 + \beta_1 B_H M_L + \beta_2 B_H M_M + \beta_3 B_H M_H + \beta_4 B_L M_L + \beta_5 B_L M_M$

  $+\beta_6 B_L M_H + \sum \beta_k Z_k + \varepsilon$

Z includes the control variables defined before and a set of 14 industry dummies.

- 1）Estimate the likelihood of being financially constrained by using a **probit model**

$$P(CON = 1|X = x) = f(x) = \Phi(x'\beta)$$

2）Next, proxy the degree of constraints by (TYPE) and estimate **ordered Probit models** (Greene 2003, 737-738)

3) Finally, account for the firm's choice between alternatives uses , simultaneously estimate **multi-equation Probit models**

1、Probit Model

	Model 1		Model 2		Model 3		Model 4	
Variable	dF/dx	(Std.Err.*)	dF/dx	(Std.Err.*)	dF/dx	(Std.Err.*)	dF/dx	(Std.Err.*)
$B_H M_L$	0.200***	(0.062)	0.208***	(0.059)	0.213***	(0.059)	0.218***	(0.061)
$B_H M_M$	0.098***	(0.036)	0.100***	(0.035)	0.096***	(0.035)	0.095***	(0.035)
$B_H M_H$	0.138***	(0.052)	0.138***	(0.052)	0.129***	(0.052)	0.137***	(0.052)
$B_L M_L$	0.024	(0.049)	0.030	(0.050)	0.037	(0.051)	0.033	(0.051)
$B_L M_M$	-0.034	(0.023)	-0.033	(0.024)	-0.033	(0.024)	-0.036	(0.024)
$ln(SIZE)$	0.048***	(0.006)	0.048***	(0.005)	0.004	(0.019)	0.014	(0.014)
$ln(AGE)$	0.003	(0.014)	0.002	(0.013)	-0.001	(0.013)	-0.001	(0.013)
$FAMCOM$	0.043**	(0.019)	0.039**	(0.019)	0.045**	(0.019)	0.039**	(0.019)
$ln(PLC)$	-0.015	(0.013)	-0.015	(0.013)	-0.016	(0.013)	-0.014	(0.013)
$EAST$	-0.034*	(0.019)	-0.031	(0.020)	-0.019	(0.020)	-0.023	(0.021)
FIN_DEP	-0.100***	(0.024)	-0.098***	(0.024)	-0.101***	(0.024)	-0.102***	(0.024)
$R\&D\_DEP$	0.048	(0.042)	0.051	(0.041)	0.050	(0.040)	0.060	(0.040)
$SALES\_DEP$	-0.080	(0.072)	-0.083	(0.073)	-0.086	(0.072)	-0.057	(0.074)
$OTHER\_DEP$	-0.034	(0.038)	-0.035	(0.038)	-0.034	(0.038)	-0.037	(0.038)
$COMP$	0.000	(0.001)	0.001	(0.001)	0.001	(0.001)	0.001	(0.001)
$GROUP$			-0.012	(0.031)	-0.028	(0.033)	-0.030	(0.034)
$KAPINT$			-0.118**	(0.056)	-0.140**	(0.059)	-0.137**	(0.058)
$RATING$			-0.018	(0.015)	-0.012	(0.015)	-0.012	(0.015)
$ln(CASH)$					0.042***	(0.015)		
$ln(CASH)_c\_2$							0.100**	(0.041)
$ln(CASH)_c\_3$							0.101**	(0.043)
$ln(CASH)_c\_4$							0.206***	(0.053)
$ln(CASH)_c\_5$							0.218***	(0.074)
Log-likelihood	-1494.638		-1492.843		-1492.526		-1484.023	
McFadden's R^2 / Count R^2	0.073/0.661		0.074/0.656		0.076/0.659		0.079/0.662	
McKelvey & Zavoina's R^2	0.152		0.161		0.168		0.173	
AIC / BIC	1.236/-16041.174		1.237/-16034.496		1.234/-16034.240		1.233/-16054.340	
z-Test of $B_H M_L \leq B_H M_M$	$p = 0.019^{**}$		$p = 0.018^{**}$		$p = 0.013^{**}$		$p = 0.012^{**}$	
z-Test of $B_H M_L \leq B_H M_H$	$p = 0.087^{*}$		$p = 0.082^{*}$		$p = 0.048^{**}$		$p = 0.067^{*}$	
z-Test of $B_H M_M \leq B_H M_H$	$p = 0.833$		$p = 0.807$		$p = 0.775$		$p = 0.834$	
Joint significance of industry dummies	$\chi^2(14) = 391.51^{***}$		$\chi^2(14) = 419.51^{***}$		$\chi^2(14) = 397.82^{***}$		$\chi^2(14) = 425.44^{***}$	

2、Ordered Probit Model

	Model		Outcome 0		Outcome 1		Outcome 2	
Variable	Coef.	(Std.Err.)	dF/dx	(Std.Err.)	dF/dx	(Std.Err.)	dF/dx	(Std.Err.)
$B_H M_L$	0.554***	(0.119)	-0.216***	(0.047)	0.186***	(0.037)	0.030***	(0.011)
$B_H M_M$	0.275***	(0.079)	-0.104***	(0.031)	0.094***	(0.027)	0.010***	(0.004)
$B_H M_H$	0.383***	(0.109)	-0.147***	(0.043)	0.131***	(0.037)	0.016**	(0.006)
$B_L M_L$	0.079	(0.125)	-0.030	(0.047)	0.027	(0.043)	0.003	(0.004)
$B_L M_M$	-0.073	(0.060)	0.027	(0.022)	-0.025	(0.020)	-0.002	(0.002)
$ln(SIZE)$	-0.029	(0.053)	0.011	(0.019)	-0.010	(0.018)	-0.001	(0.002)
$ln(AGE)$	0.010	(0.037)	-0.004	(0.014)	0.003	(0.013)	0.001	(0.001)
$FAMCOM$	0.110**	(0.052)	-0.040**	(0.019)	0.037**	(0.017)	0.003**	(0.001)
$ln(PLC)$	-0.042	(0.033)	0.016	(0.012)	-0.014	(0.011)	-0.001	(0.001)
$EAST$	-0.068	(0.057)	0.025	(0.021)	-0.023	(0.019)	-0.002	(0.002)
FIN_DEP	-0.306***	(0.070)	0.107***	(0.023)	-0.100***	(0.022)	-0.007***	(0.002)
$R\&D\_DEP$	0.101	(0.087)	-0.038	(0.033)	0.035	(0.030)	0.003	(0.003)
$SALES\_DEP$	-0.225	(0.215)	0.079	(0.071)	-0.073	(0.067)	-0.005	(0.004)
$OTHER\_DEP$	-0.057	(0.107)	0.021	(0.039)	-0.019	(0.036)	-0.002	(0.003)
$COMP$	-0.001	(0.001)	0.001	(0.001)	-0.001	(0.001)	-0.001	(0.001)
$GROUP$	-0.023	(0.077)	0.009	(0.028)	-0.008	(0.026)	-0.001	(0.002)
$KAPINT$	-0.431**	(0.075)	0.068**	(0.027)	-0.062**	(0.025)	-0.006**	(0.003)
$RATING$	-0.015	(0.040)	0.006	(0.015)	-0.005	(0.014)	-0.001	(0.001)
$ln(CASH)$	0.130***	(0.043)	-0.048***	(0.016)	0.044***	(0.015)	0.004***	(0.001)
μ_1	0.772	(0.363)						
μ_2	2.644	(0.360)						
Log-likelihood	-1661.572							
McFadden's R^2 / Count R^2	0.072/0.656							
McKelvey & Zavoina's R^2	0.163							
AIC / BIC	1.375/-15681.417							
z-Test of $B_H M_L \leq B_H M_M$	$p = 0.009^{***}$							
z-Test of $B_H M_L \leq B_H M_H$	$p = 0.086^{*}$							
z-Test of $B_H M_M \leq B_H M_H$	$p = 0.888$							
Joint significance of industry dummies	$\chi^2(14) = 267.31^{***}$							

3、Multivariate Probit Model

	Equ. 1 Investment		Equ. 2 Innovation		Equ. 3 Reserves		Equ. 4 Payout		Equ. 5 Serv. Debt	
Variable	dF/dx	(Std.Err.)	dF/dx	(Std.Err.)	dF/dx	(Std.Err.)	dF/dx	(Std.Err.)	dF/dx	(Std.Err.)
$B_H M_L$	-0.001	(0.053)	0.218***	(0.060)	-0.169***	(0.053)	-0.099***	(0.031)	0.162***	(0.058)
$B_H M_M$	0.005	(0.033)	0.099***	(0.036)	0.126***	(0.035)	-0.101***	(0.022)	0.067*	(0.036)
$B_H M_H$	-0.015	(0.037)	0.139***	(0.042)	0.081**	(0.040)	-0.070***	(0.026)	-0.030	(0.041)
$B_L M_L$	0.072*	(0.039)	0.031	(0.046)	0.002	(0.046)	-0.062**	(0.029)	0.247***	(0.043)
$B_L M_M$	0.050*	(0.027)	-0.035	(0.029)	0.056*	(0.029)	-0.069***	(0.022)	0.109***	(0.030)
$ln(SIZE)$	0.053***	(0.017)	0.008	(0.018)	-0.004	(0.018)	-0.030**	(0.014)	0.050***	(0.019)
$ln(AGE)$	-0.010	(0.013)	-0.001	(0.014)	-0.014	(0.014)	-0.016	(0.011)	-0.004	(0.015)
$FAMCOM$	0.028	(0.023)	0.043*	(0.023)	0.033	(0.024)	-0.036*	(0.020)	0.036	(0.024)
$ln(PLC)$	-0.011	(0.011)	-0.015	(0.011)	-0.001	(0.011)	0.011	(0.009)	0.017	(0.011)
$EAST$	0.083	(0.021)	-0.015	(0.023)	-0.040*	(0.024)	-0.080***	(0.018)	0.018	(0.024)
$GROUP$	-0.085***	(0.025)	-0.032	(0.025)	-0.017	(0.026)	0.109***	(0.023)	-0.071***	(0.026)
$KAPINT$	-0.063	(0.040)	-0.164*	(0.079)	-0.098**	(0.051)	0.033	(0.031)	0.088**	(0.038)
$RATING$	-0.027*	(0.015)	-0.015	(0.017)	-0.023	(0.017)	-0.017	(0.014)	0.069***	(0.018)
$ln(CASH)$	-0.016	(0.014)	0.039**	(0.015)	0.005	(0.016)	0.018	(0.012)	-0.036**	(0.016)
$PUBLIC$	-0.122*	(0.066)	-0.047	(0.061)	0.157**	(0.064)	0.271***	(0.074)	-0.007	(0.065)
$LIMITED$	-0.068**	(0.029)	0.056*	(0.032)	0.086***	(0.032)	0.145***	(0.020)	-0.105***	(0.034)
FIN_DEP	-0.021	(0.029)	-0.101***	(0.027)	-0.014	(0.030)	0.050*	(0.026)	0.055*	(0.031)
$R\&D\_DEP$	0.018	(0.041)	0.051	(0.044)	-0.035	(0.044)	0.066*	(0.039)	-0.051	(0.044)
$SALES\_DEP$	-0.045	(0.091)	-0.072	(0.082)	0.037	(0.093)	0.063	(0.080)	-0.075	(0.095)
$OTHER\_DEP$	0.018	(0.040)	-0.032	(0.040)	-0.109***	(0.041)	0.038	(0.036)	0.014	(0.043)
$COMP$	0.001**	(0.001)	-0.001	(0.001)	-0.001	(0.001)	0.001	(0.001)	-0.001	(0.001)
Log-likelihood					-7154.03					
Joint sign. industry dummies					$\chi^2(70) = 178.21$***					

4、 Robustness Checks

- Employ alternative proxies for innovative capability.

  1) use different cut-off-points .

  2) using the share of R&D employees.

  3)based on successful innovation projects in the past (observe if the firm has introduced at least one new product to the market in the pre-survey period)

4、Robustness Checks

Variable	High Qual. Employees dF/dx	(Std.Err.*)	R&D Employees dF/dx	(Std.Err.*)	Past Inno. Success dF/dx	(Std.Err.*)
$B_H M_L$	0.253***	(0.077)	0.358***	(0.075)	0.353***	(0.053)
$B_H M_M$	0.086**	(0.035)	0.172***	(0.043)	0.183***	(0.034)
$B_H M_H$	0.177***	(0.050)	0.262***	(0.081)	0.208***	(0.043)
$B_L M_L$	0.031	(0.045)	0.043	(0.044)	0.028	(0.050)
$B_L M_M$	-0.022	(0.020)	-0.016	(0.024)	-0.028	(0.021)
$ln(SIZE)$	0.002	(0.019)	-0.003	(0.018)	-0.022	(0.018)
$ln(AGE)$	0.001	(0.013)	0.009	(0.013)	0.001	(0.013)
$FAMCOM$	0.048**	(0.019)	0.051***	(0.019)	0.037**	(0.018)
$ln(PLC)$	-0.016	(0.013)	-0.010	(0.014)	-0.011	(0.013)
$EAST$	-0.019	(0.020)	-0.018	(0.020)	-0.001	(0.021)
FIN_DEP	-0.106***	(0.024)	-0.096***	(0.026)	-0.087***	(0.027)
$R\&D\_DEP$	0.049	(0.040)	0.042	(0.041)	0.052	(0.043)
$SALES\_DEP$	-0.100	(0.068)	-0.077	(0.074)	-0.053	(0.088)
$OTHER\_DEP$	-0.037	(0.038)	-0.033	(0.038)	-0.025	(0.037)
$COMP$	-0.001	(0.001)	-0.001	(0.001)	0.001	(0.001)
$GROUP$	-0.027	(0.033)	-0.018	(0.033)	-0.025	(0.032)
$KAPINT$	-0.152***	(0.058)	-0.154***	(0.056)	-0.149**	(0.059)
$RATING$	-0.011	(0.014)	-0.010	(0.016)	-0.016	(0.016)
$ln(CASH)$	0.043***	(0.015)	0.046***	(0.015)	0.048***	(0.014)
Log-likelihood	-1491.200		-1471.750		-1462.884	
McFadden's R^2 / Count R^2	0.075/0.662		0.087/0.673		0.092/0.686	
McKelvey & Zavoina's R^2	0.165		0.185		0.189	
AIC / BIC	1.236/-16029.972		1.220/-16068.871		1.213/-16086.604	
z-Test of $B_H M_L \leq B_H M_M$	$p = 0.009^{***}$		$p = 0.016^{**}$		$p = 0.003^{***}$	
z-Test of $B_H M_L \leq B_H M_H$	$p = 0.119$		$p = 0.102$		$p = 0.005^{***}$	
z-Test of $B_H M_M \leq B_H M_H$	$p = 0.971$		$p = 0.920$		$p = 0.729$	
Joint significance of industry dummies	$\chi^2(14) = 526.59^{***}$		$\chi^2(14) = 630.89^{***}$		$\chi^2(14) = 360.91^{***}$	

4、 Robustness Checks

- The quasi-experiment depend on the fact whether a firm was already engaged in innovation activities.
- Estimate a **two-stage selection model** for both CON and TY PE.

stage 1: firms' export intensity (EXINT) and the diversification of its product portfolio (DIV ERS)

But,the likelihood-ratio-test does not reject the hypothesis of independence of stage. Thus, selectivity does not seem to play a role .

Part VI Conclusion

From theoritical framework and empirical :

1）Firms with **higher innovative capability** are more likely to befinancing constrainted;

2）Firms with high innovative capability and **low levels of internal funds** are more likely to be constrained in their innovation activities than their more liquid counterparts；

3）Firms faced **a larger gap between internal and external cost** of capital should be more likely to be financially constrained.

- From a policy point of view:

1）A significant portion of firms is financially constrained, particularly firms with high innovation capability.;

Policy should **stimulate** the provision of risk-taking **external capital** and provide **public funding**.

2）Innovative capability would drive financing constraints in innovative investment.

Policy should regard **innovative capability** as an important criterion for supporting private investment in innovation.

Thanks for Listening.