WHAT GETS MEASURED GETS MANAGED: INVESTMENT AND THE COST OF CAPITAL

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MOTIVATION

- **COST OF CAPITAL & CAPITAL BUDGETING**
  - Cost of capital and capital budgeting: core of corporate finance
  - Consequences of potentially non-market based cost of capital
- **CAPITAL ALLOCATION EFFICIENCY**
  - Hsieh and Klenow (2009): treat the firm as the operating entity
  - But it is managers who decide investment. Evaluation and/or compensation schemes matter
- **EXTENSIVE LITERATURE ON MANAGER INCENTIVES AND FIRM BEHAVIORS**
  - We provide causal evidence on the impact of manager incentive on firm behaviors and performance
- **IN THE CONTEXT OF CHINA**
  - Same separation of ownership and control even in U.S.---so can China fix it by the EVA reform?
    - Some preliminary results, potentially evaluating a "policy" that aims to correct for other policies

INSTITUTIONAL BACKGROUND

- **SASAC ESTABLISHED IN 2003**
  - Appoint auditors and board of directors; report SOEs' performance to government; conduct performance evaluations of SOE managers
- **EVALUATION SCHEME TO SOES**
  - An objective score based on four performance measures
    - One of them being ROE, the target of the **EVA** reform

Measures	Base Points	Performance-based Adjustment Range
ROE	40	[-8, 8]
EBT	30	[-6, 6]
Elective 1	15	[-3, 3]
Elective 2	15	[-3, 3]

THE EVA REFORM

- In 2010, the central SASAC replaced ROE by "EVA" – **Economic Value Added**
  - Most provincial SASACs followed and adopted the same or very similar policies
- **The key: (post tax) cost of capital fixed at 5.5%**

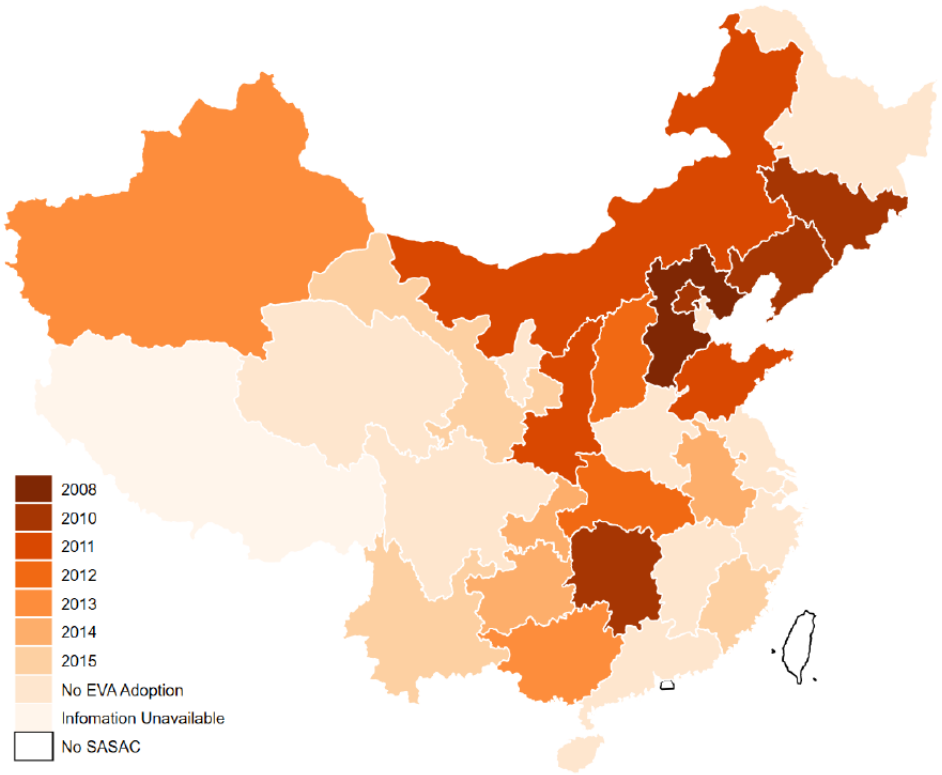
EVA = Net Operating Profit − Adjusted Capital × Cost of Capital

Net Operating Profit	Net Income + 0.75 × (Interest + R&D Expense − 0.5 × Non-Recurrent Income)
Adjusted Capital	Owner's Equity + Total Liabilities − Interest-Free Current Liability − Construction in Progress (in defined core businesses)
Cost of Capital	5.5% in principle 4.1% percent for SOEs in the following industries: military, research, electric power, and construction; 6.0% for manufacturing (non-manufacturing) SOEs with a leverage ratio larger than 0.75 (0.80)

We exclude those firms with stipulated cost of capital different from 5.5%

YEARS OF EVA ADOPTION

- Staggered adoptions



- **ADOPTION MAY BE ENDOGENOUS:**
  - First, no correlation between the timing of adoption and local political economy or business cycle factors
  - Province*Year fixed effects. Locally operated firms but supervised by the central SASAC or another SASAC. For example, Yaxing Coach, a bus manufacturer based in Jiangsu province, is controlled by Shandong SASAC

A SIMPLE ECONOMIC FRAMEWORK

- **PRODUCTION FUNCTIONS AND FINANCING**
  - Producition function $F(K)$ with $K = E + D$, EBIT (Earnings Before Interests and Taxes)
  - $F'(K) > 0, F''(K) < 0$
- **OUTPUT WEDGE τ_Y**
  - The firm only gets $(1 - \tau_Y)F(K)$
  - τ_Y includes standard corporate tax $\pi = 25\%$, but could differ due to different distortions
- **BEFORE EVA**
  - An SOE is maximizing $ROE = \frac{(1-\tau_Y)F(E+D)-(1-0.25)r_D \cdot D}{E}$
- **AFTER EVA**
  - An SOE is maximizing EVA

$$EVA = (1-\tau_Y)F(D+E) - 5.5\% \cdot (D+E)$$

A KEY ASSUMPTION

- Key assumption: debt is the margin to adjust

Year	External Equity Financing / Lagged Assets	Rights Issues / Lagged Assets	Private Equity Placements/ Lagged Assets	Non-rights public equity offerings / Lagged Assets
2004	0.42%	0.19%	0.00%	0.11%
2005	0.00%	0.00%	0.00%	0.00%
2006	1.48%	0.00%	1.40%	0.00%
2007	5.59%	0.00%	4.93%	0.09%
2008	3.99%	0.12%	3.46%	0.23%
2009	4.40%	0.00%	4.06%	0.00%
2010	2.85%	0.00%	2.63%	0.00%
2011	6.16%	0.13%	5.93%	0.00%
2012	3.47%	0.00%	3.22%	0.00%
2013	3.94%	0.25%	3.54%	0.00%
2014	4.28%	0.00%	4.16%	0.00%
2015	5.85%	0.00%	5.85%	0.00%
Mean	3.60%	0.06%	3.33%	0.03%

EMPIRICAL PREDICTIONS (1)

- **IMPACT ON INVESTMENT INCENTIVES:**
  - Before EVA, FOC: $(1-\tau_Y)F'(E+D) = 0.75r_D$
    - Investment negatively related with r_D before EVA adoption
  - After EVA, FOC: $(1-\tau_Y)F'(E+D) = 5.5\%$
    - And this negative relationship should weaken after EVA adoption
  - The critical value $= 7.33\%$ $(\tau = 25\%)$

- **A DIFF-IN-DIFF-DIFF TEST**

$$Capex_{i,j(i),t} = \beta_1 InterestRate_{i,t-1} + \beta_2 Post_{i,t} + \beta_3 InterestRate_{i,t-1} \times Post_{i,t} + \gamma X_{i,t} + \varepsilon_{i,t}$$

  - Key prediction: $\beta_3 > 0$; and $\beta_1 < 0$
  - Firm i, year t, $X_{i,t}$ includes standard firm characteristics and various fixed effects: SASAC (various locals and central), industry, province, year, etc.

EMPIRICAL PREDICTIONS (2)

- **IMPACT ON ROE:**
  - Hurting ROE on both sides of the critical $r_D = 7.33\%$
- **DIFF-IN-DIFF FOR DIFFERENT INTEREST RATE GROUPS**

$$ROE_{i,j(i),t} = \sum_{g=1}^{6} \beta_g \, \mathbf{1}_{i \in g, t-1} \times Post_{i,t} + \alpha_i + \alpha_t + \gamma X_{i,t} + \varepsilon_{i,t}$$

  - β_g captures the impact of EVA policy on ROE of a particular interest rate group relative to control firms
  - *g=1:* $r_D < 3.5\%$, *g=2:* $r_D \in (3.5\%, 5\%)$; *g=3:* $r_D \in (5\%, 6.5\%)$; *g=4:* $r_D \in (6.5\%, 8\%)$; *g=5:* $r_D \in (8\%, 9.5\%)$; *g=6:* $r_D > 9.5\%$
  - Prediction: $\{\beta_g\}$ should be hump shaped; β_4 should be the highest

DATA (1)

- **CHINA STOCK MARKET & ACCOUNTING RESEARCH (CSMAR) DATABASE**
- **SAMPLE PERIOD: 2004 (THE FIRST YEAR OF SASAC) TO 2015**
  - From 2016, the central SASAC changed its evaluation policy but did not disclose the details.
- **SOES ARE DEFINED BY ULTIMATE CONTROLLING PARTY (CSMAR)**
  - Manually collect identity of the controlling SASAC
  - Exclude SOEs:
    - Not controlled by central or provincial SASACs (e.g., by other ministries or lower level governments)
    - With a stipulated cost of capital that is different from 5.5%
    - Several provinces: Hebei, Anhui, Gansu, Shaanxi, and Tibet (no information)

DATA (2)

- **MEASUREMENT OF INTEREST RATE**
  - Interest expenses divided by the average of total interest-bearing debts at all quarters
    - Quarterly data to better calculate the average amount of debt used over a year period
  - Widely used in the finance and accounting literature (Francis, LaFond, Olsson, and Schipper, 2005; Frank and Shen, 2016)
  - *Interest-bearing debts vs. total debt*
  - Average, not marginal

- **SASACS EVALUATE SOES AT THE GROUP LEVEL**
  - Most listed SOEs are not the groups, but their subsidiaries
  - The EVA metric is additive….maximizing the group-level EVA is equivalent to maximizing each of them separately
  - We also collected some group-level data with similar results

SUMMARY STATISTICS

Panel A: Mean, median, standard deviation, and percentiles

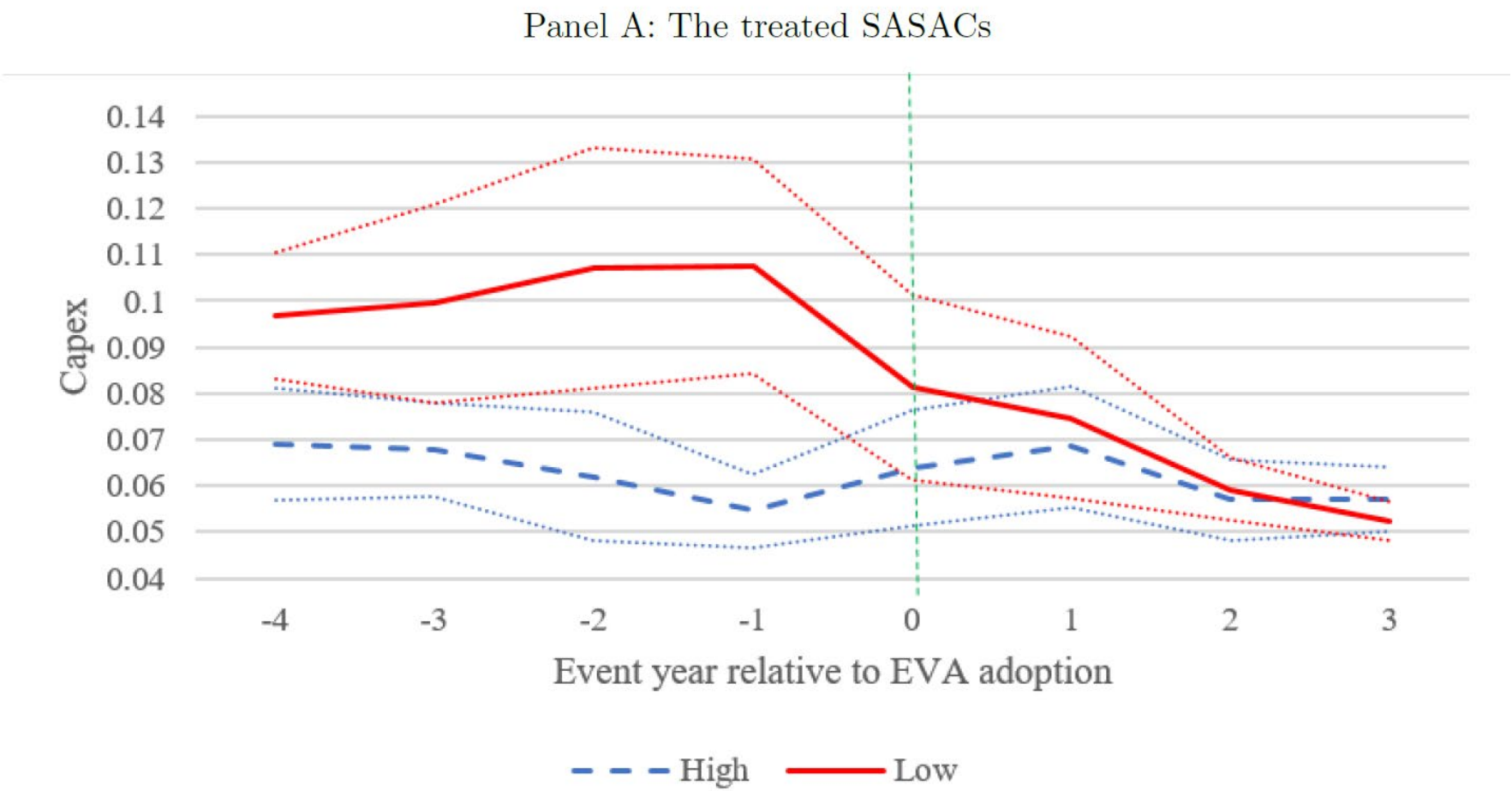
	N	Mean	Median	Std. Dev.	P25	P75
Capex	4716	0.071	0.046	0.080	0.018	0.094
InterestRate	4716	0.058	0.054	0.033	0.042	0.066
Tobin's Q	4716	1.976	1.597	1.239	1.206	2.268
CashFlow	4716	0.056	0.051	0.097	0.006	0.102
Log(Assets)	4716	22.256	22.030	1.416	21.222	23.099
Leverage	4716	0.530	0.533	0.192	0.390	0.662
CEOOwnership (%)	4698	0.046	0	0.527	0	0.001
PoliticalConnection	4716	0.335	0	0.472	0	1

- Corr(Interest rate, leverage)=3%, insignificant

EMPIRICAL PREDICTIONS

	Investment	ROE
r_D=5.5%	Not affected	Not affected
r_D>5.5%	Increase investment	Decrease
r_D<5.5%	Decrease investment	Decrease

EMPIRICAL PATTERN IN THE RAW DATA: TREATED



BASELINE REGRESSIONS

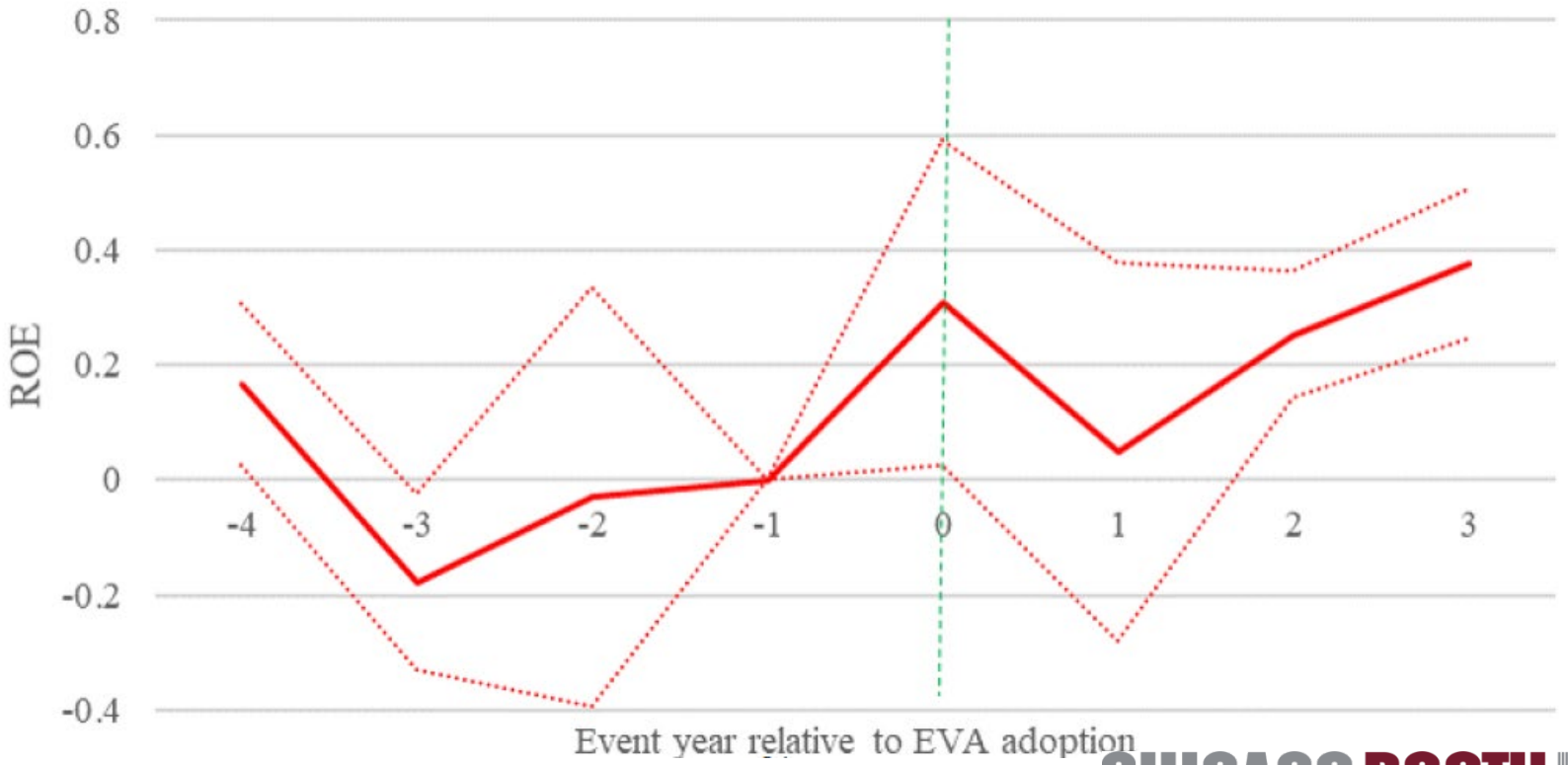
Dep. Variable: Capex/Assets (%)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Post × InterestRate	0.256***	0.233***	0.240***	0.186***	0.175***	0.179***	0.190***
	(2.71)	(2.68)	(2.62)	(4.13)	(4.31)	(3.37)	(3.17)
Post	-0.032***	-0.026***	-0.030**	-0.005			
	(-3.13)	(-2.76)	(-2.54)	(-0.99)			
InterestRate	-0.368***	-0.357***	-0.321***	-0.196***	-0.156***	-0.183**	-0.170**
	(-4.16)	(-4.20)	(-4.60)	(-4.46)	(-2.92)	(-2.90)	(-2.88)
Tobin's Q		0.003***	0.004***	0.007***	0.006***	0.005**	0.004**
		(3.22)	(4.27)	(4.21)	(3.77)	(2.93)	(2.24)
CashFlow		0.232***	0.215***	0.106***	0.101***	0.087***	0.078***
		(10.26)	(7.63)	(5.57)	(5.32)	(7.29)	(6.77)
Log(Assets)			0.005*	-0.016***	-0.017**	-0.021*	-0.027**
			(1.84)	(-2.82)	(-2.76)	(-2.02)	(-2.83)
Leverage			-0.036**	-0.058***	-0.048**	-0.039*	-0.028
			(-2.46)	(-3.13)	(-2.53)	(-2.14)	(-1.73)
Observations	4,716	4,716	4,716	4,682	4,648	4,628	4,616
R-squared	0.025	0.107	0.118	0.471	0.514	0.549	0.591
Firm FE	NO	NO	NO	YES	YES	YES	YES
Year FE	NO	NO	NO	YES	NO	NO	NO
SASAC*Year FE	NO	NO	NO	NO	YES	YES	YES
Industry*Year FE	NO	NO	NO	NO	NO	YES	YES
Province*Year FE	NO	NO	NO	NO	NO	NO	YES

DYNAMIC DID ESTIMATION

$$CAPEX^{j}_{i,t} = \beta_1 \cdot InterestRate^{j}_{i,t} + \sum_{s \neq -1} \beta_{2s} \cdot Post^{j}_{i,t,s} + \sum_{s \neq -1} \beta_{3s} \cdot InterestRate^{j}_{i,t} \times Post^{j}_{i,t,s} + \gamma' \boldsymbol{X}_{i,t} + \epsilon_{i,t}$$

Panel B: With the province*year fixed effects



GROUP LEVEL

Dep. Variable: Capex/Assets (%)

	(1)	(2)	(3)	(4)
Post × InterestRate	0.320***	0.337**	0.363***	0.396***
	(3.30)	(3.23)	(3.47)	(3.65)
Post	-0.012			
	(-1.70)			
InterestRate	-0.173***	-0.177**	-0.174**	-0.173**
	(-3.76)	(-3.13)	(-2.66)	(-2.51)
CashFlow	0.065**	0.074**	0.065**	0.057**
	(2.55)	(2.81)	(2.98)	(2.81)
Log(Assets)	-0.017	-0.022*	-0.029**	-0.028**
	(-1.83)	(-2.03)	(-2.44)	(-2.31)
Leverage	-0.107**	-0.107**	-0.092*	-0.105**
	(-3.10)	(-2.82)	(-2.08)	(-2.48)
Observations	2,459	2,438	2,417	2,404
R-squared	0.636	0.692	0.724	0.734
Firm FE	YES	YES	YES	YES
Year FE	YES	NO	NO	NO
SASAC*Year FE	NO	YES	YES	YES
Industry*Year FE	NO	NO	YES	YES
Province*Year FE	NO	NO	NO	YES

PLACEBO: NON-SOES

Dep. Variable: Capex/Assets (%)

	(1)	(2)	(3)	(4)	(5)	(6)
Post × InterestRate	-0.086	-0.095*	-0.112**	-0.049	-0.029	-0.040
	(-1.57)	(-1.78)	(-2.01)	(-1.12)	(-0.75)	(-0.96)
Post	0.005	0.007	0.006	0.001		
	(0.61)	(0.94)	(0.82)	(0.11)		
InterestRate	-0.057	-0.069	-0.064	-0.008	-0.012	-0.014
	(-1.19)	(-1.57)	(-1.57)	(-0.23)	(-0.38)	(-0.52)
Tobin's Q		0.002**	0.005***	0.005**	0.005**	0.005**
		(2.20)	(4.29)	(2.76)	(2.75)	(2.70)
CashFlow		0.148***	0.136***	0.059**	0.061**	0.057**
		(9.75)	(9.98)	(2.95)	(2.96)	(2.88)
Log(Assets)			0.001	-0.017***	-0.018***	-0.021***
			(0.22)	(-4.01)	(-3.95)	(-5.01)
Leverage			-0.030***	-0.024**	-0.024**	-0.022**
			(-4.34)	(-2.84)	(-2.84)	(-2.89)
Observations	6,459	6,459	6,459	6,343	6,334	6,326
R-squared	0.003	0.044	0.073	0.486	0.533	0.566
Firm FE	NO	NO	NO	YES	YES	YES
Year FE	NO	NO	NO	YES	NO	NO
Province*Year FE	NO	NO	NO	NO	YES	YES
Industry*Year FE	NO	NO	NO	NO	NO	YES

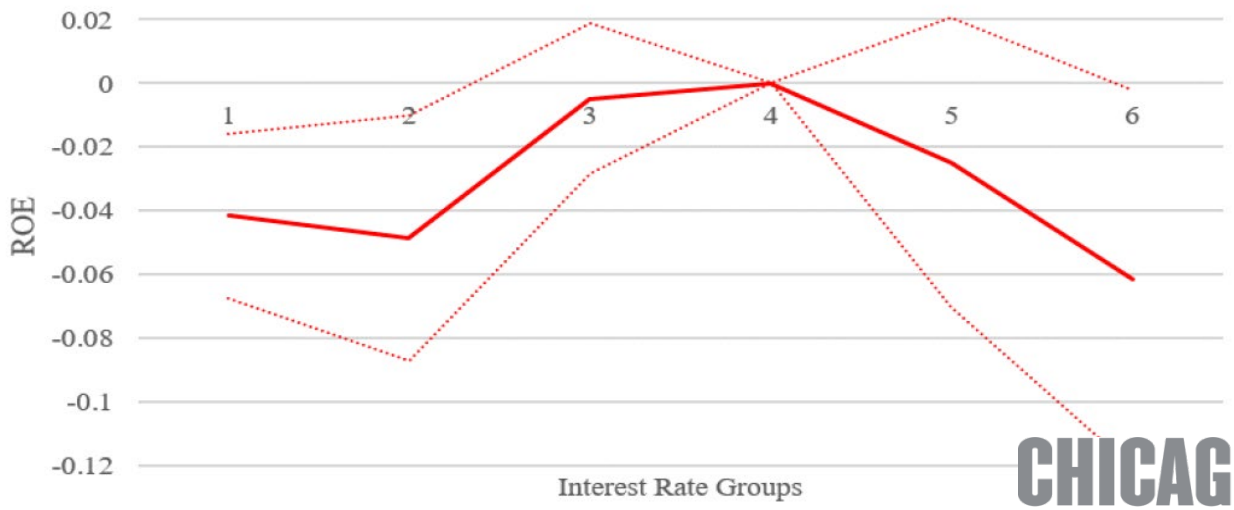
IMPACT ON ROE

Empirical predictions

- From shareholders' perspective, firms r>5.5% overinvest while those with r< 5.5% underinvest
- 5.5% is after-tax, pre-tax is 7.73%
- Firms loses more when r is further away from 7.33%

$$ROE_{i,j(i),t} = \sum_{g=1}^{6} \beta_g \, \mathbf{1}_{i \in g, t-1} \times Post_{i,t} + \alpha_i + \alpha_t + \gamma X_{i,t} + \varepsilon_{i,t}$$

Panel B: with the province*year fixed effects



POTENTIAL ECONOMIC MECHANISMS

The EVA policy on CEO turnover and compensation

- After the EVA adoption, EVA started to affect CEO turnover with demotions, and the impact of ROE reduced
- Weak evidence on compensation

Firm heterogeneity: some firms listen to the SASACs more closely than others

- More shareholder-oriented firms (no political connection or managers have equity ownership) are affected less

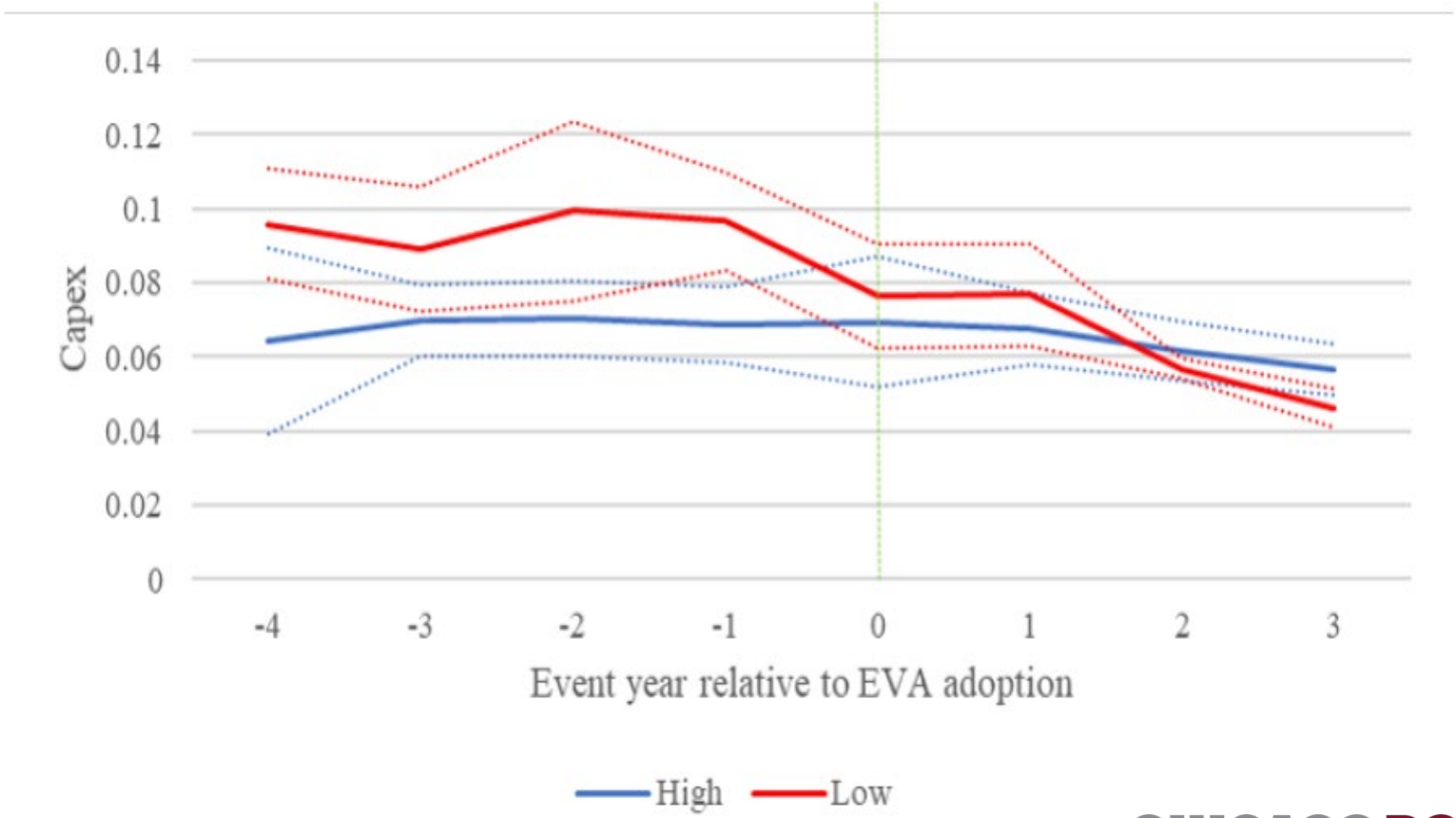
	Panel A. Turnover				Panel B. Compensation			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post × EVA	-0.999*	-1.272**	-0.919*	-1.469**	-0.092	0.176	1.244	4.455*
	(-1.83)	(-2.39)	(-2.03)	(-2.67)	(-0.03)	(0.05)	(0.39)	(1.79)
Post	-0.043				-0.391			
	(-1.28)				(-1.14)			
EVA	-0.029	0.264	0.138	0.408	0.604	0.647	-0.450	-1.514
	(-0.08)	(0.55)	(0.27)	(0.86)	(0.18)	(0.18)	(-0.17)	(-0.58)
Post × ROE	0.478**	0.568***	0.530***	0.663***	0.026	0.215	-0.094	-1.686
	(2.99)	(5.19)	(5.27)	(3.28)	(0.02)	(0.13)	(-0.06)	(-1.46)
ROE	-0.270**	-0.368**	-0.323**	-0.366**	-0.012	-0.149	0.040	1.025
	(-2.28)	(-2.74)	(-2.30)	(-2.26)	(-0.01)	(-0.10)	(0.04)	(1.05)
Tobin's Q	-0.005	-0.006	-0.009	-0.018	-0.103	-0.100	-0.125*	-0.177*
	(-0.30)	(-0.28)	(-0.41)	(-0.86)	(-1.18)	(-1.36)	(-1.92)	(-1.81)
Log(Assets)	-0.074**	-0.072***	-0.082***	-0.109***	0.278	0.287	0.187	0.228
	(-2.75)	(-3.80)	(-3.61)	(-4.13)	(1.36)	(1.16)	(0.86)	(0.83)
Leverage	0.255***	0.320***	0.305***	0.259**	-0.726	-0.162	-0.166	-0.590
	(3.24)	(3.83)	(3.12)	(2.53)	(-0.62)	(-0.14)	(-0.15)	(-0.56)
Log (Age of general manager)	0.319***	0.378***	0.352***	0.327**	-1.946**	-1.645**	-1.793**	-1.851*
	(4.00)	(5.28)	(3.37)	(2.30)	(-3.08)	(-2.60)	(-2.31)	(-2.06)
Log (1 + tenure of general manager)	0.136***	0.139***	0.137***	0.128***	3.066***	3.175***	3.179***	3.166***
	(6.44)	(8.18)	(12.74)	(11.07)	(11.52)	(12.85)	(14.24)	(15.05)
Log (Age of chair)	0.049	0.041	0.055	0.106	2.208*	1.900	1.981*	2.267*
	(0.52)	(0.47)	(0.55)	(1.04)	(2.19)	(1.71)	(2.06)	(2.20)
Log (1 + tenure of chair)	0.136***	0.143***	0.145***	0.146***	-0.837***	-0.824***	-0.855***	-0.861***
	(6.09)	(6.56)	(8.77)	(6.71)	(-8.03)	(-8.29)	(-9.27)	(-7.41)
Observations	3,637	3,594	3,561	3,537	3,675	3,630	3,602	3,577
R-squared	0.248	0.311	0.348	0.426	0.594	0.625	0.646	0.682
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	NO	NO	NO	NO	YES	NO	NO	NO
SASAC * Year FE	YES	YES	YES	YES	NO	YES	YES	YES
Industry * Year FE	NO	NO	YES	YES	NO	NO	YES	YES
Province * Year FE	NO	NO	NO	YES	NO	NO	NO	YES

AGGREGATE CAPITAL ALLOCATION EFFICIENCY

- EVA's welfare implication crucially depends on whether true costs of capital are equal (and, if =5.5%) across firms
  - Good/bad dispersions in actual cost of capital
- Our discussion with an underlying assumption: **firms within an industry has the same true cost of capital**
  - Implicitly assumed in Hsieh-Klenow (2009)

1. While EVA eliminates the bad dispersion within an industry, it kills good dispersion across industries
2. Within-industry vs Cross-industry: Variance decomposition of observable cost of capital
3. SOEs vs non-SOEs: really depends on if 5.5% is high enough

EVA & INVESTMENT BASED ON INDUSTRY AVERAGE COST OF CAPITAL



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COST OF CAPITAL DECOMPOSITION

$$\underbrace{\mathbb{E}\left[(\hat{r}_{ij} - 7.33\%)^2\right]}_{\text{Total Effect}} = \underbrace{\mathbb{E}\left[(\hat{r}_{ij} - \mathbb{E}_j(\hat{r}_{ij}))^2\right]}_{\text{Within-industry Disperson}} + \underbrace{\mathbb{E}\left[(\mathbb{E}_j(\hat{r}_{ij}) - \mathbb{E}(\hat{r}_{ij}))^2\right]}_{\text{Across-industry Disperson}} + \underbrace{(\mathbb{E}(\hat{r}_{ij}) - 7.33\%)^2}_{\text{Wedge b/w EVA policy rate \& } \mathbb{E}(\hat{r}_{ij})},$$

- Actual cost of capital:

$$\text{Cost of Equity} \times (1 - \text{Leverage Ratio}) + \text{Cost of Debt} \times \text{Leverage Ratio},$$

- We also consider cost of debt (interest rate) only

	Within-industry	Across-industry	Wedge b/w EVA rate and sample mean
Panel A. Cost of capital			
market risk premium = 5%	0.499	0.263	0.238
market risk premium = 6%	0.474	0.248	0.279
market risk premium = 6.5%	0.435	0.228	0.336
market risk premium = 7%	0.389	0.206	0.405
market risk premium = 8%	0.305	0.166	0.529
Panel B. Interest rate			
	0.517	0.224	0.259

CAPITAL REALLOCATION BETWEEN SOES AND NON-SOES

- Dependent variable: CAPX/Asset

	(1)	(2)	(3)	(4)
Post × SOE	-0.004	0.004	0.009	0.009
	(-0.49)	(0.32)	(1.01)	(0.98)
Post	0.004			
	(0.76)			
Post × SOE × High				
Tobin's Q	0.008***	0.008***	0.008***	0.008***
	(5.47)	(5.04)	(5.56)	(5.33)
CashFlow	0.060***	0.055***	0.048**	0.048**
	(3.30)	(3.21)	(2.89)	(2.81)
Log(Assets)	-0.015*	-0.018**	-0.020**	-0.019**
	(-2.20)	(-2.36)	(-2.75)	(-2.60)
Leverage	-0.012	-0.015	-0.013	-0.014
	(-1.44)	(-1.62)	(-1.52)	(-1.64)
Observations	3,198	3,198	3,166	3,141
R-squared	0.517	0.556	0.603	0.608
Firm FE	YES	YES	YES	YES
Year FE	YES	NO	NO	NO
SASAC*Year FE	NO	YES	YES	YES
Industry*Year FE	NO	NO	YES	YES
Province*Year FE	NO	NO	NO	YES

MRPK AND EVA POLICY

- Chen and Song (2013), MRPK=log[(Sales – COGS – SG&A + Depreciation)/lagged fixed assets]
  - Within SOEs, CORR(interest rate, MRPK) ≈ 0 – very surprising
- Unit of analysis: SASAC-year, Dispersion of industry-adjusted MRPK. NO impact of EVA policy

	Manufacturing Firms		All Firms	
	(1)	(2)	(3)	(4)
Post	0.009	-0.079	-0.027	-0.024
	(0.10)	(-0.56)	(-0.28)	(-0.24)
Average Log(Assets)		-0.246**		-0.141
		(-2.85)		(-1.24)
Average Leverage		1.360*		-0.270
		(2.11)		(-0.40)
Observations	120	120	198	198
R-squared	0.397	0.452	0.305	0.316
SASAC FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

- Measurement errors of MRPK in listed firms?

CONCLUSION

- **MANAGERIAL INCENTIVES MATTER!**
  - Not that surprising given the literature….
  - But a bit surprising in the context of SOE "reform" in China
- **POLICY AND INTERVENTION ARE THE TWO SIDES OF THE SAME COIN**
  - Great reform effort, but no low-hanging fruit anymore
  - "Blunt" policy on EVA, one-size-fits-all?
    - The preliminary evidence suggest substantial cost of the blunt policy
  - After 2016 "cost of capital" became firm-dependent (publicly unavailable), but not sure about its effectiveness

FORMULA-BASED EVALUATION (1)

- **EVALUATION SCHEME**
  - An objective score, with "letter grading" from A to E, based on four performance measures
    - One of them being ROE, the target of reform
  - Assign points based on whether an SOE exceeds or falls short of performance targets
  - Adjustments
    - Based on "the degree of operating difficulty" factor (between 1 and 1.15) if a target is achieved
      - Say retired employees to total employees, etc.
    - Others: severe safety incidents, financial fraud, acquisitions, etc. ±2 points
- **TARGETS**
  - Negotiated annually; subject to stringent guidelines; subjectivity does not play a significant role