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Natural Disasters, Technology Diversity, and Operating Performance

Shu-Cing Peng

Motivation

- Two major disruptions by natural disasters:
  - In 2011, the Great East Japan earthquake and tsunami in March, which seriously harmed many Sendai-based industries.
    - Forcing Toyota to delay its launch of two new Prius models that were originally scheduled for a late April release.
  - In 2012, the Bangkok flooding, which harmed the automobile and hard-drive industries to a great extent.
    - Hard-drive industries in Thailand affected by these natural disasters took approximately a year to fully restore their production lines to normal levels (Fuller, 2011).
    - For Western Digital alone, its losses due to the flooding were estimated at between $225 million and $275 million (Milbourn, 2011).

Motivation

- Economic damage
  - 28 natural disasters were reported in the United States in 2013, and these catastrophes resulted in an estimated 212 deaths and $17.58 billion.
  - The total damage from natural disasters globally was around $118.6 billion in 2013, and the total number of deaths was 21,610.

- Research questions
  - What is the impact of natural disasters on *corporate profitability*?
  - What is the tool firms use to mitigate these impacts?

Main hypotheses

- Technology diversity mitigates natural disaster risks
  - Firms with highly diversified technologies are less subject to operational disruptions
    - Diversify their input sources with respect to production
    - Apply their technologies to different production plans in various scenarios
    - Lower costs to develop recovery solutions
      - Cross-fertilization effects and synergies from multiple technologies further lower the R&D costs

Summary of results

- Sample
  - U.S. public firms in manufacturing industries from 1988 to 2014
- Results
  - Firms with more of their factories located in states that experience natural disasters are associated with lower operating performance.
    - Economic impact = 1.2%
  - Firms with diversified technologies are less subject to the impact of natural disasters.

Contribution

- Firm-level evidence for economics literature
  - Previous empirical studies mainly focus on country-level economic losses and casualties due to natural.
    - Kahn, 2005; Raddatz, 2007; Luechinger & Raschky, 2009
- Economic relevance of innovation strategies
  - Top managers must design and execute innovation strategies that largely determine a given firm's survival and chances for success.

Data

- Natural disasters
  - Spatial Hazard and Loss Database - U.S. natural disaster
  - Major disasters: last for fewer than thirty days and have a total estimated damage of over $1 billion
- Operating performance
  - Compustat database - U.S. public firms' accounting data
  - ROA: income before depreciation in year *t* divided by total assets in year *t* – 1
- Diversified technologies
  - NBER patent database - U.S. public firms' patent data
  - Diversity score: the distribution of technology categories

    (1 minus the sum of the squared percentages of patents in individual technology categories)

A. List of Major Disasters in the U.S. Territory, 1978–2013

Disaster	Year	Type	Number of Affected Factories	Affected Location
Hugo	1989	Hurricane	621	NC, SC, VA
Loma earthquake	1989	Earthquake	656	CA
Bob	1991	Hurricane	780	MA, ME, NC, NH, NY, RI
Oakland Hills Firestorm	1991	Wildfire	621	CA
Andrew	1992	Hurricane	546	AL, FL, LA, MS
Iniki	1992	Hurricane	11	HI
Blizzard	1993	Blizzard	1,773	AL, CT, FL, GA, MA, MD, NJ, OH, SC, VA, VT
Northridge earthquake	1994	Earthquake	488	CA
Alberto	1994	Hurricane	475	AL, FL, GA
Opal	1995	Hurricane	1,153	AL, FL, GA, LA, MS, NC, SC
Blizzard	1996	Blizzard	1,687	CT, DE, IN, KY, MA, MD, NC, NJ, NY, PA, VA, WV
Fran	1996	Hurricane	310	NC, SC, VA, WV
Ice storm	1998	Ice storm	289	ME, NH, NY, VT
Bonnie	1998	Hurricane	452	NC, VA
Georges	1998	Hurricane	604	AL, FL, LA, MS
Floyd	1999	Hurricane	1,724	CT, DC, DE, FL, MD, ME, NC, NH, NJ, NY, PA, SC, VA, VT
Allison	2001	Hurricane	1,825	AL, FL, GA, LA, MS, PA, TX
Isabel	2003	Hurricane	1,326	DE, MD, NC, NJ, NY, PA, RI, VA, VT, WV
Southern California Wildfires	2003	Wildfire	448	CA
Charley	2004	Hurricane	4	FL, GA, NC, SC
Jeanne	2004	Hurricane	550	AL, FL, GA, KY, MD, NC, NY, OH, PA, SC, VA, WV
Ivan	2004	Hurricane	2,011	AL, FL, GA, KY, LA, MA, MD, MS, NC, NH, NJ, NY, PA, SC, TN, WV
Frances	2004	Hurricane	611	DE, FL, GA, MD, NC, NJ, PA, SC, VA
Dennis	2005	Hurricane	442	AL, FL, GA, MS, NC
Katrina	2005	Hurricane	1,795	AL, AR, FL, GA, IN, KY, LA, MI, MS, OH, TN
Rita	2005	Hurricane	283	AL, AR, FL, LA, MS
Wilma	2005	Hurricane	1	FL
Midwest floods	2008	Floods	1,166	IA, IL, IN, MN, MO, NE, WI
Gustav	2008	Hurricane	212	AR, LA, MS
Ike	2008	Hurricane	1,059	AR, LA, MO, TN, TX
Blizzard Groundhog Day	2011	Blizzard	2,536	CT, IA, IL, IN, KS, MA, MO, NJ, NM, NY, OH, OK, PA, TX, WI
Irene	2011	Hurricane	504	CT, MA, MD, NC, NJ, NY, VA, VT
Tropical Storm Lee	2011	Hurricane	1,096	AL, CT, GA, LA, MD, MS, NJ, NY, PA, TN, VA
Isaac	2012	Hurricane	398	FL, LA, MS
Sandy	2012	Hurricane	1,654	CT, DE, MA, MD, NC, NH, NJ, NY, OH, PA, RI, VA, WV
Flooding and Severe Weather-Illinois	2013	Floods	669	IL, IN, MO
Flooding-Colorado	2013	Floods	76	CO

Variable	N	Mean	SD	Min	P25	P50	P75	Max
ROA	16,709	0.16	0.12	−1.57	0.10	0.15	0.20	1.14
HIT_RATIO	16,709	0.16	0.29	0.00	0.00	0.00	0.22	1.00
DIV (Score)	15,342	0.27	0.32	0.00	0.00	0.00	0.58	1.00
SIZE	16,709	6.71	1.91	0.24	5.43	6.64	7.98	13.08
SIZE2	16,709	48.65	26.44	0.06	29.47	44.04	63.60	171.12
AGE	16,709	2.99	0.87	0.69	2.40	3.18	3.71	4.19
PAGE	16,709	2.10	0.67	0.69	1.61	2.20	2.62	3.33
INTANG	16,709	0.23	0.19	0.00	0.08	0.18	0.33	1.00
S_HHI	16,709	0.12	0.30	0.00	0.00	0.00	0.00	1.00
RDC	16,709	0.07	0.13	0.00	0.00	0.03	0.09	5.59
PATENT	14,851	0.04	0.09	0.00	0.00	0.01	0.05	1.81
SGA	16,709	5.49	2.58	0.00	4.42	5.79	7.17	11.55
AD	16,709	1.12	2.15	0.00	0.00	0.00	1.32	10.24
IND_YEAR	16,709	0.08	0.10	−1.29	0.04	0.10	0.14	0.88
STATE_YEAR	16,709	0.06	0.08	−1.54	0.02	0.07	0.11	0.63

Change in ROA: the difference between ROA in year *t* minus ROA in year *t* - 1

B. Changes in Operating Performances

	Change in *ROA*	Observations	*t*-statistic
All hit	−1.43%	4,421	−7.10
Types of disaster			
Hurricanes/floods	−1.89%	2,842	−7.16
Earthquakes	−0.52%	252	−0.74
Wildfires	−1.44%	158	−1.32
Blizzards/ice storms	−0.58%	588	−0.98
Nonhurricanes/floods	−0.70%	998	−1.64

Regression setting

- What is the impact of natural disasters on corporate profitability?
  - Experience lower operating profitability
- Level of operating performance

$$ROA_{i,t} = \beta_0 + \beta_1 HIT\_RATIO_{i,t-1} + \boldsymbol{Xb}_{i,t} + \mu_t + \eta_i + \varepsilon_{it}$$

  - Prediction: $\beta_1 < 0$

Main results

	(1) ROA	(2) ROA	(3) ROA	(4) ROA
Variables	*All Firms*		*Matched Sample*	
HIT_RATIO	−0.009**	−0.012***	−0.024***	−0.020***
	(0.004)	(0.004)	(0.007)	(0.006)
SIZE		0.038**		0.039***
		(0.014)		(0.010)
SIZE2		−0.002*		−0.002***
		(0.001)		(0.001)
AGE		−0.050***		−0.006**
		(0.010)		(0.003)
PAGE		−0.004		−0.007**
		(0.005)		(0.003)
INTANG		−0.078***		−0.079***
		(0.013)		(0.016)
S_HHI		−0.010		−0.008
		(0.007)		(0.006)
RDC		0.040***		0.037
		(0.010)		(0.024)
PATENT		0.079		0.067***
		(0.054)		(0.024)
SGA		−0.003**		−0.002*
		(0.001)		(0.001)
AD		−0.003		0.006***
		(0.002)		(0.001)
IND_YEAR		0.133***		0.032
		(0.027)		(0.034)
STATE_YEAR		0.031		−0.020
		(0.040)		(0.034)
Constant	0.192***	0.166***	0.174***	0.051
	(0.005)	(0.046)	(0.005)	(0.038)
Year fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	No	No
Observations	16,709	14,851	5,814	4,916
Adjusted R^2	0.434	0.465	0.061	0.104

MODERATING ROLE OF TECHNOLOGY DIVERSITY

$$ROA_{i,t} = \beta_0 + \beta_1 HIT\_RATIO_{i,t-1} \times DIV_{i,t-1} + \beta_2 HIT\_RATIO_{i,t-1} + \beta_3 DIV_{i,t-1} + \boldsymbol{Xb_{i,t}} + \mu_t + \eta_i + \varepsilon_{i,t}.$$

	(1) ROA	(2) ROA	(3) ROA
Variables	*ALL*	*Closest 1*	*Closest 2*
*HIT_RATIO*DIV*	0.020***	0.014*	0.017**
	(0.005)	(0.008)	(0.006)
HIT_RATIO	−0.015***	−0.014**	−0.015***
	(0.004)	(0.006)	(0.005)
DIV	−0.008**	−0.006	−0.007
	(0.004)	(0.005)	(0.004)
SIZE	0.038**	0.024	0.019
	(0.015)	(0.022)	(0.024)
SIZE2	−0.002*	−0.002	−0.001
	(0.001)	(0.001)	(0.002)
AGE	−0.050***	−0.038*	−0.046**
	(0.010)	(0.019)	(0.019)
PAGE	−0.004	0.014*	0.006
	(0.005)	(0.007)	(0.007)
INTANG	−0.079***	−0.046**	−0.064***
	(0.013)	(0.021)	(0.023)
S_HHI	−0.010	−0.003	−0.007
	(0.007)	(0.006)	(0.007)
RDC	0.040***	0.023**	0.030**
	(0.010)	(0.009)	(0.012)
PATENT	0.080	0.127***	0.124**
	(0.054)	(0.034)	(0.048)
SGA	−0.003**	−0.002	−0.003*
	(0.001)	(0.001)	(0.002)
AD	−0.003	−0.002*	−0.004*
	(0.002)	(0.001)	(0.002)
IND_YEAR	0.133***	0.148***	0.149***
	(0.027)	(0.036)	(0.026)
STATE_YEAR	0.032	0.032	0.044
	(0.040)	(0.041)	(0.047)
Constant	0.166***	0.193**	0.235***
	(0.046)	(0.077)	(0.070)
Year fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Observations	14,851	5,444	6,975
Adjusted R^2	0.465	0.506	0.48

Conclusion

- This study highlights the role of innovation strategies with respect to corporate sustainability, and our findings point to the advantage of technology diversity to mitigate operational risks.
  - the magnitude of the damage of natural disasters on firms' profitability
  - how firms might use technologies to mitigate the damage.

Commitment to build trust by socially responsible firms: Evidence from cash holdings

Shu-Cing Peng

Motivation

- Existing theories of cash holdings
  - Traditional view: transaction, precautionary, tax, agency
  - Competitor view
  - Stakeholder view: labor and unions, debtholders

Motivation

- Research question
  - Will firms commit more to stakeholders hold more cash?

- What's new?
  - Stakeholders as a whole
  - The role of implicit contracts or commitments (Cornell and Shapiro, 1987)
  - CSR performance as a proxy of stakeholder commitments

Main hypotheses (stakeholder commitments)

- High CSR firms tend to hold more cash
  - CSR practices involve a number of commitments to stakeholders
    - Promises of job security to employees
    - High quality product and continued service to customers
    - Support education and environment
  - Under these commitments, stakeholders are willingly to contribute resources and effort to the firm and may accept less favorable wage or prices
    - Which in turn increase the shareholder wealth
    - Stakeholder theory of Cornell and Shapiro (1987)

Main hypotheses (stakeholder commitments)

- High CSR firms tend to hold more cash
  - These commitments to stakeholders have weak legal standing
    - Firms can default on their commitments without legal recourse from other stakeholders
  - Whether a firm's CSR practices create value for shareholder largely depends on other stakeholders' expectation about how likely the firm will fulfill those implicit commitments
    - Cornell and Shapiro (1987); Maksimovic and Titman (1991)

Main hypotheses (stakeholder commitments)

- High CSR firms tend to hold more cash
  - High CSR firms need to signal their ability to fulfill the implicit commitments with stakeholders
  - Use conservative financial policies to convince stakeholder that they have sufficient liquidity to make payoffs on implicit commitments
    - Pay lower dividend (Holder, Langrehr, and Hexter, 1998)
    - Use lower leverage (Barton, Hill, and Sundaram, 1989)
  - High CSR firms may opt to hold more cash

Alternative hypotheses (transparency)

- High CSR firms tend to hold less cash
  - High CSR firms have better information disclosure and access to capital market
    - Tend to disclose more information by issuing sustainability reports
    - More likely to produce high quality financial reports and reduce earnings management
  - High CSR firms hold less cash because of the low outside financing costs

Summary of results

- Sample
  - U.S. firms in the MSCI ESG STAT (KLD) from 1991 to 2012
- Results (support the stakeholder commitment hypothesis)
  - Firms with better CSR performance hold more cash
    - Economic impact = 8.64%
  - Identification strategies:
    - RDD (IVs: Blue states, natural disaster)
  - Cross-sectional heterogeneity
    - Stronger effect when we only consider CSR practices that requiring current and future cash spending and firms facing greater competition in the product or labor market
  - Cash holdings are more valuable for high CSR firms

Contribution

- Explain why firms hoard cash from the perspective of stakeholders
  - Traditional views
    - Transaction, precautionary, tax, and agency motives
  - Competitor views (Haushalter, Klasa, Maxwell, 2007; Qiu and Wan, 2015)
  - Stakeholder views
    - Labor and Unions (Klassa, Maxwell, and Ortiz-Molina, 2009; Ghaly, Dang, and Stathopoulos, 2015)
    - Debtholders (Liu and Mauer, 2011)
  - Explain why firms hoard more cash after 2000s

Contribution

- Explain how and under what condition CSR practices enhance firm value?
  - Stakeholder view
    - High CSR firms tend to have a stronger reputation to keep their implicit commitments with other stakeholders when outside environment changes (Deng, Kang and Low, 2013)
  - How do high CSR firms build such a strong reputation?
    - Hoard more cash
  - How to know that credible commitments is value enhancing?
    - The value of cash is higher for high CSR firms

Methodology

- CSR ratings
  - MSCI ESG STATS (formerly known as KLD)
  - Tracks the CSR performance for the largest 3,000 publicly traded companies in the U.S.
  - Six categories: environment, communities, human rights, diversity, employee relations, and product
  - Example: Communities

Strengths	Concerns
Charitable Giving*	Investment Controversies
Innovative Giving*	Community Impact (e.g., plant closing)
Support for Housing*	Tax Disputes
Support for Education*	
Non-US Charitable Giving*	
Volunteer Programs	
Community Engagement	

Regression setting

- How do CSR firms signal their commitment to honor implicit contracts with stakeholders?
  - Hoard more cash
- Level of cash holdings

$$CASH_{it} = \beta_0 + \beta_1 CSR_{it} + \beta_2 CF_{it} + \beta_3 NWC_{it} + \beta_4 CAPX_{it} + \beta_5 LEV_{it} + \beta_6 ACQ_{it} + \beta_7 MB_{it} + \beta_8 SIZE_{it} + \beta_9 ICFV_{it} + \beta_{10} RD_{it} + \beta_{11} DV_{it} + \text{Fixed-Effects} + \varepsilon_{it} \quad (1)$$

  - Stakeholder commitment hypothesis: $\beta_1 > 0$
  - Transparency hypothesis: $\beta_1 < 0$

Main results

Model	(1)	(2)	(3)	(4)	(5)
Dep. Var.	$CASH_t$	$CASH_t$	$CASH_t$	$CASH2_t$	$CASH3_t$
SD_CSR_t	0.0518***			0.0355***	0.0382*
	(2.594)			(3.345)	(1.919)
ABS_CSR_t		0.0024***			
		(3.246)			
REL_CSR_t			0.0241**		
			(2.389)		
CF_t	−0.1952***	−0.1953***	−0.1947***	−0.0861***	−0.2081***
	(−7.687)	(−7.696)	(−7.669)	(−7.206)	(−10.578)
NWC_t	−0.3151***	−0.3145***	−0.3154***	−0.1453***	−0.2513***
	(−16.098)	(−16.069)	(−16.112)	(−13.182)	(−12.903)
$CAPX_t$	−0.2390***	−0.2401***	−0.2400***	−0.0972***	−0.1700***
	(−8.676)	(−8.709)	(−8.684)	(−6.655)	(−6.611)
LEV_t	−0.1111***	−0.1104***	−0.1112***	−0.0759***	−0.0245**
	(−9.755)	(−9.697)	(−9.753)	(−12.453)	(−2.388)
MB_t	0.0289***	0.0288***	0.0289***	−0.0153***	−0.0287***
	(14.918)	(14.857)	(14.907)	(−15.068)	(−14.642)
$SIZE_t$	−0.0266***	−0.0271***	−0.0266***	−0.0135***	−0.0125***
	(−14.865)	(−15.047)	(−14.820)	(−14.552)	(−8.048)
CFV_t	0.2597***	0.2596***	0.2600***	0.0008	0.0025
	(4.897)	(4.896)	(4.899)	(0.671)	(0.622)
RD_t	0.0220***	0.0220***	0.0220***	0.0067***	0.0039
	(5.581)	(5.586)	(5.585)	(3.883)	(1.369)
DV_t	−0.0351***	−0.0353***	−0.0350***	−0.0223***	−0.0512***
	(−7.144)	(−7.196)	(−7.142)	(−8.122)	(−10.527)
ACQ_t	−0.0227***	−0.0227***	−0.0227***	−0.0024	−0.0278***
	(−2.837)	(−2.833)	(−2.832)	(−0.611)	(−4.142)
Year FE	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y
N	15,454	15,454	15,454	15,454	15,454
Adj. R^2	0.555	0.555	0.555	0.430	0.356

Other potential devices of commitment

- Bank lines of credit
  - Bank lines of credit provide firms another source of liquidity
    - The use of this external liquidity instrument may be conditional on firms' profitability, corporate governance, or type of hedging needs.
  - Capital IQ - amount of unused credit lines

Other potential devices of stakeholder commitment.

Panel A: Bank credit lines and leverage

Model	(1)	(2)	(3)	(4)
Sample	Whole	$D\_CREDIT = 1$	Whole	$D\_CREDIT = 1$
Dep. var.	$CASH_t$	$CASH_t$	$CREDIT_t$	$CREDIT_t$
SD_CSR_t	0.0837**	0.1459***	0.0105	0.0399
	(2.564)	(2.695)	(0.802)	(0.758)
D_CREDIT_t	−0.0225***			
	(−4.132)			
$CASH_t$			−0.0379***	−0.1583***
			(−4.767)	(−4.230)
Other controls	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y
N	7,318	1,227	7,318	1,227
Adj. R^2	0.551	0.432	0.045	0.161

Other measures of CSR performance

- The effect of cash-related CSR and non-cash related CSR
  - *CSH_CSR*: Strength items that require significant current and future cash spending
    - Charitable giving, and cash profit sharing
    - Cash is more important for fulfilling the commitments
  - *NCSH_CSR:* Strength items not significantly require cash spending
    - The diversity of board of directors, and women and minority contracting

Regression setting

- How to know that credible commitments is value enhancing?
  - The value of cash is higher for high CSR firms
- Value of cash holdings

$$r_{it} - R_{it}^{B} = \beta_0 + \beta_1 \Delta C_{it} + \beta_2 \Delta C_{it} \times CSR_{it} + \beta_3 CSR_{it} + \beta_4 \Delta E_{it} + \beta_5 \Delta NA_{it}$$
$$+ \beta_6 \Delta RD_{it} + \beta_7 \Delta I_{it} + \beta_8 \Delta D_{it} + \beta_9 C_{it-1} + \beta_{10} L_{it} + \beta_{11} NF_{it} \qquad (2)$$
$$+ \beta_{12} \Delta C_{it} \times C_{it-1} + \beta_{13} \Delta C_{it} \times L_{it} + \text{Fixed-Effects} + \varepsilon_{it},$$

  - Stakeholder commitment hypothesis: $\beta_2 > 0$

Effect of CSR performance on value of cash.

Model	(1)	(2)	(3)	(4)	(5)
ΔC_t	1.5680***	1.6096***	1.5898***	1.5981***	1.2142***
	(12.699)	(12.959)	(12.921)	(12.893)	(5.407)
$\Delta C_t \times SD\_CSR_t$		2.1843**			1.7476*
		(2.093)			(1.915)
SD_CSR_t		−0.0894**			−0.1084**
		(−2.384)			(−2.157)
$\Delta C_t \times ABS\_CSR_t$			0.0885**		
			(2.099)		
ABS_CSR_t			−0.0031**		
			(−2.247)		
$\Delta C_t \times REL\_CSR_t$				1.2084**	
				(2.035)	
REL_CSR_t				−0.0543***	
				(−2.822)	
ΔE_t	0.6966***	0.6960***	0.6953***	0.6952***	1.5636***
	(15.081)	(15.127)	(15.125)	(15.101)	(8.144)
ΔNA_t	0.0086	0.0086	0.0087	0.0087	−0.0730*
	(1.190)	(1.196)	(1.201)	(1.203)	(−1.685)
ΔRD_t	0.1865	0.1950	0.1969	0.2037	0.0709
	(0.399)	(0.417)	(0.421)	(0.435)	(0.367)
ΔI_t	−1.2352*	−1.2338*	−1.2436*	−1.2286*	−5.6047***
	(−1.838)	(−1.837)	(−1.850)	(−1.828)	(−4.250)
ΔD_t	0.5586	0.5741	0.5742	0.5698	0.2325***
	(1.194)	(1.235)	(1.234)	(1.225)	(2.799)
L_t	−0.4251***	−0.4290***	−0.4284***	−0.4304***	0.2506***
	(−17.103)	(−17.247)	(−17.271)	(−17.290)	(7.053)
C_{t-1}	0.1583**	0.1546**	0.1531**	0.1545**	−0.0106
	(2.153)	(2.117)	(2.098)	(2.116)	(−1.055)
NF_t	0.0189	0.0155	0.0147	0.0155	−0.4612***
	(0.397)	(0.326)	(0.310)	(0.327)	(−6.337)
$\Delta C_t \times C_{t-1}$	−0.9819***	−0.9550***	−0.9485***	−0.9579***	−1.3006***
	(−3.072)	(−2.997)	(−2.978)	(−3.010)	(−4.270)
$\Delta C_t \times L_t$	−0.9932***	−0.9796***	−0.9883***	−0.9766***	0.4255
	(−3.450)	(−3.421)	(−3.466)	(−3.406)	(1.317)
Year and industry FE	Y	Y	Y	Y	Y
N	15,454	15,454	15,454	15,454	15,454
Adj. R^2	0.211	0.211	0.212	0.212	0.212

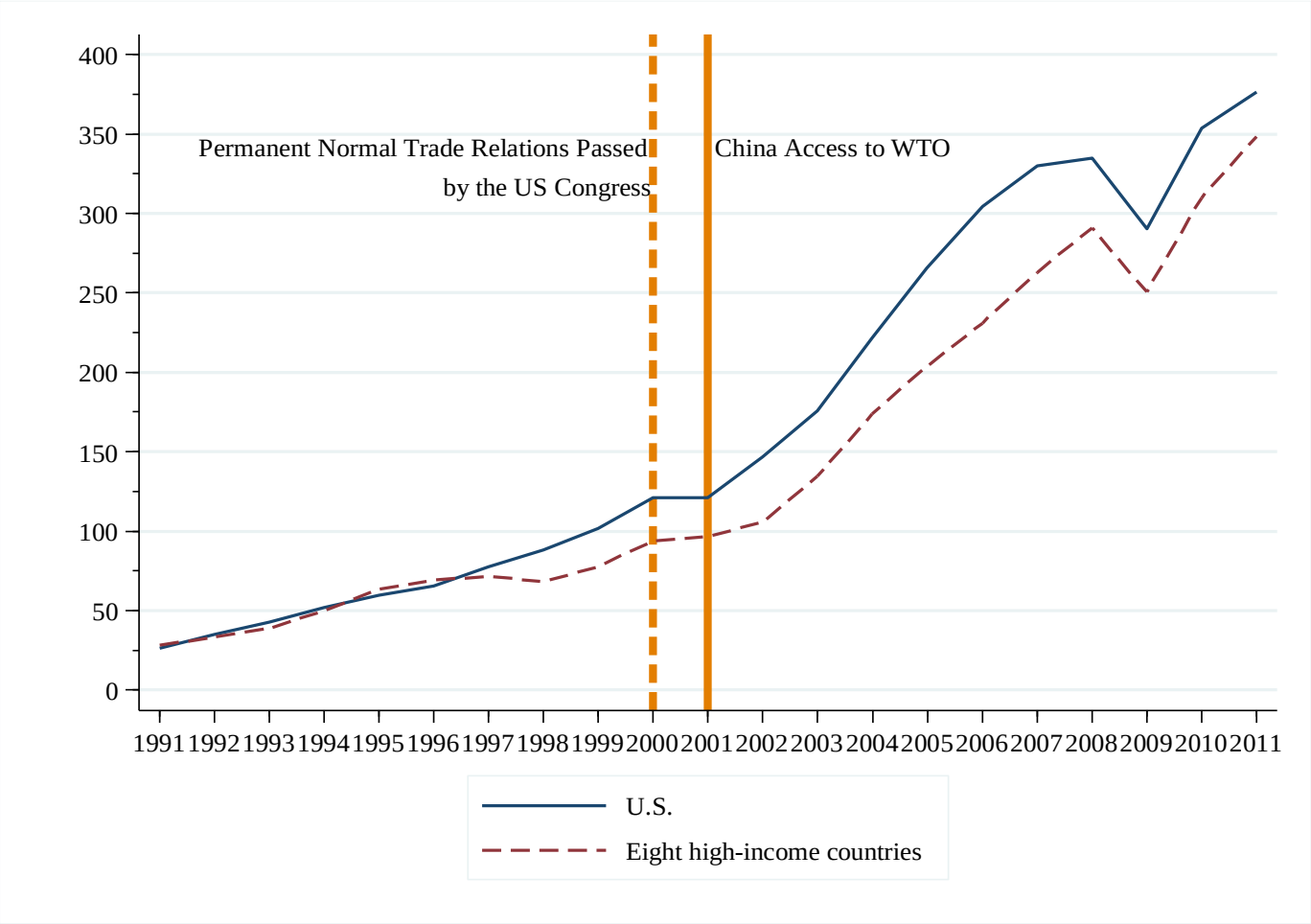
Conclusion

- In support of the stakeholder commitment hypothesis
  - Firms with better CSR performance hold more cash
  - Stronger effect when we only consider CSR practices that requiring current and future cash spending and firms facing greater competition in the product or labor market
  - Cash holdings are more valuable for firms with better CSR performance

Board Structure, Director expertise, and Advisory Role of Outside Directors

Presenter: Shu-Cing Peng (彭淑卿)

Imports from China by manufacturing firms in the U.S. and eight other high-income countries



Hypotheses development-policy background

- Policy background
  - Before the passage of PNTR:
    - Before 1980, U.S. imports from China were subject to **non-NTR tariffs** under the Smoot-Hawley Tariff Act of 1930.
    - In 1980, U.S. President Carter granted low tariff rate to China but only on an **annually renewable** basis, which required approval by U.S. Congress.
    - After the Tiananmen Square incident in 1989, the U.S. House of Representatives passed to **withdraw China's temporary NTR status** in 1990, 1991, and 1992.
  - After the passage of PNTR:
    - In November 1999, U.S.– China finish the agreement that governs China's eventual access to WTO.
    - **In October 2000, U.S. Congress granted PNTR status to China based on the November 1999 U.S.– China agreement.**
    - In December 2001, the PNTR status to China effective upon China's admission to the WTO.
    - The average tariff rate of China decreased from **37%** to **4%** in 1999 after the passage of PNTR.

Hypotheses development-cultural and legal differences

- Facing significant challenges in collecting information about Chinese firms
  - Dissimilarities in language, religion, legal enforcement, political landscapes, and customer preferences
  - Dissimilarities in culture, social norm, and regulatory environment affect investments
    - Kindleberger (1969), Hymer (1976), Grinblatt and Keloharju (2001), La Porta et al. (2004), Guiso, Sapienza, and Zingales (2009), Ahern, Daminelli, and Fracassi (2015)
    - **See "*Why Big American Businesses Fail in China?*"**
  - Benefit from director expertise acquired through ***prior work experience***
    - Adams, Hermalin, and Weisbach (2010), Dass et al. (2014), Field and Mkrtchyan (2017)
    - **See "*Applied Materials Adds Two Members to Board of Directors*"**

Hypotheses

- **Hypothesis 1: The proportion of directors with China experience on the board of a U.S. firm increases after the passage of PNTR in 2000.**

- **Hypothesis 2: Compared to U.S. firms with a lower proportion of directors with China experience, those with a higher proportion of directors with China experience realize higher announcement returns for M&As, JVs, and SAs involving Chinese firms and better post-investment operating performance.**

- Hypothesis 3: Compared to directors without China experience, those with China experience are likely to obtain more directorships in other firms after the passage of PNTR in 2000.

Summary of results

- Sample: publicly traded U.S. manufacturing firms (SIC codes 2000-3999) covered in Compustat, CRSP, RiskMetrics, and BoardEx from 1996 to 2011
  - Manually supplement 1,668 directors' missing biographical information
- Results
  - U.S. firms appoint more outside directors with China-related experience to their boards after the passage of PNTR.
    - Economic impact = 0.21% (full sample: 0.22% in 1999)
    - Instrumental variables approach (IV: Smoot-Hawley-based non-NTR tariff rate)
    - Matching sample approach (treatment group vs control group)
    - Pre-treatment effect test
  - U.S. firms with more China-director realize higher returns around announcements of M&As, joint ventures, or strategic alliances involving Chinese firms than other firms.
    - Controlling for governance variables and board attributes
    - Instrumental variables approach (IV: Chinese immigrants)
    - Placebo test (Investments involving Non-Chinese firms by US firms)
  - Directors with China-related experience gain more board seats after the passage of PNTR.

Contributions

- Trade policy
  - contraction in manufacturing employment (Autor, Dorn, and Hanson (2013), Bloom, Draca, and Van Reenen (2016), Pierce and Schott (2016)), decline in firms' sales growth, profitability, and investment (e.g., Hombert and Matary (2017))
- Board structure
  - Sarbanes–Oxley Act in the U.S. (Linck, Netter, and Yang (2009)), Gender quota law in Norway (Ahern and Dittmar (2012))
- Advisory role of outside directors
  - financial expertise (Huang et al. (2014)), industry experience (Dass et al. (2014)), foreign experience (Giannetti, Liao, and Yu (2015)), acquisition experience (Field and Mkrtchyan (2017)), and legal expertise (Krishnan, Wen, and Zhao (2011))

Methodology

- Measuring the effect of PNTR on industries: *NTR Gap*
  - Pierce and Schott (2016 AER)
- Data source: Peter K. Schott Website
- The impact of PNTR on a four-digit SIC industry ***j*** as the difference between the non-NTR tariff rate and NTR tariff rate,

$$NTR\ Gap_j = Non\ NTR\ Rate_j - NTR\ Rate_j$$

  - Non NTR Rate: tariff rates would have risen if annual renewal had failed
  - NTR Rate: tariff rates were locked in by PNTR

Regression Specification

- DiD tests on board composition:

$$China\text{-}director_{ijt} = \beta_0 + \beta_1 NTR\ gap\ 1999_j \times Post_t + \boldsymbol{\beta}_2' \boldsymbol{X}_{ijt} + \delta_t + \theta_i + \varepsilon_{ijt}$$

  - China-director: the ratio of the number of outside directors who have China-related experience to the total number of directors on the board
  - NTR gap 1999: the difference between the non-NTR tariff rate and the NTR tariff rate in 1999 in a four-digit SIC industry
  - Post: an indicator equal to one for a firm in the 2000-2011 period (i.e., post-PNTR era)

- OLS tests on investment performance:

$$CAR\ (-1, 1)_{ijt} = \beta_0 + \beta_1 China\text{-}director_{ijt\text{-}1} + \boldsymbol{\beta}_2' \boldsymbol{X}_{ijt\text{-}1} + \delta_t + \theta_i + \varepsilon_{ijt}$$

  - CAR: the cumulative abnormal return of U.S. firms from one day before to one day after the announcement date of mergers and acquisitions (M&As), joint ventures (JVs), and strategic alliances (SAs) involving Chinese firms

Summary Statistics

Panel A: NTR Gap 1999		
SIC code	Industry	NTR gap 1999
22	Textile Mill Products	0.5404
23	Apparel, Finished Products from Fabrics & Similar Materials	0.5224
39	Miscellaneous Manufacturing Industries	0.4405
24	Lumber and Wood Products, Except Furniture	0.4322
31	Leather and Leather Products	0.3743
27	Printing, Publishing and Allied Industries	0.3741
38	Measuring, Photographic, Medical, & Optical Goods, & Clocks	0.3683
25	Furniture and Fixtures	0.3622
34	Fabricated Metal Products	0.3489
36	Electronic & Other Electrical Equipment & Components	0.3458
32	Stone, Clay, Glass, and Concrete Products	0.3400
35	Industrial and Commercial Machinery and Computer Equipment	0.3272
37	Transportation Equipment	0.3172
28	Chemicals and Allied Products	0.3146
33	Primary Metal Industries	0.2579
26	Paper and Allied Products	0.2512
30	Rubber and Miscellaneous Plastic Products	0.2467
29	Petroleum Refining and Related Industries	0.2075
21	Tobacco Products	0.1953
20	Food and Kindred Products	0.1304

Summary Statistics

Panel A: Industry Characteristics					
Variable	p25	Median	Mean	p75	S.D.
NTR gap 1999	0.228	0.342	0.324	0.400	0.149
Smoot-Hawley-based non-NTR 1990	0.139	0.341	0.297	0.366	0.124
CIP in the U.S.	0.003	0.021	0.084	0.056	0.171
CIP in eight high-income non-U.S. countries	0.003	0.018	0.064	0.058	0.112
Panel B: Firm Characteristics					
Variable	p25	Median	Mean	p75	S.D.
Proportion of outside directors with China-related experience on the board (China-director)	0	0	0.007	0	0.036
Firms having an outside director with China-related experience (indicator)	0	0	0.047	0	0.213
Firm size ($millions)	58	270	2529	1226	8364
Tobin’ s q	1.215	1.743	2.673	2.88	3.096
Return volatility	0.025	0.035	0.125	0.051	0.773
Diversification (indicator)	0	0	0.397	1	0.489
Leverage	0.001	0.115	0.196	0.276	0.331
ROA	-0.108	0.049	-0.053	0.115	0.282
Foreign sales ratio (foreign sales / total sales)	0	0.199	0.274	0.479	0.290
Board size	6	8	8	9	2.299
Board age	57	60	60	63	4.866
Board independence	0.600	0.750	0.705	0.833	0.170
Board tenure	5.250	7.667	8.390	10.750	4.475

Summary Statistics

Panel C: Director Characteristics									
	Full sample of directors			Subsample of outside directors with China-related experience					
Year	No. of obs. (A)	Mean tenure	Mean age	No. of obs. (B)	Mean tenure	Mean age	Years of China experience	B/A	*China-director* firm-level
1996	2,068	9.68	59.54	4	8.00	61.75	–	0.19%	0.16%
1997	2,311	9.42	59.35	6	6.67	62.17	–	0.26%	0.24%
1998	2,604	9.00	59.31	7	6.14	62.14	–	0.27%	0.20%
1999	2,703	9.07	59.42	7	6.86	63.43	–	0.26%	0.22%
2000	2,835	8.91	59.15	10	5.70	61.50	–	0.35%	0.34%
2001	4,344	8.76	58.60	32	4.94	58.13	11.95	0.74%	0.68%
2002	4,398	8.74	58.83	29	6.17	59.86	11.80	0.66%	0.59%
2003	7,547	8.57	58.59	48	5.35	58.27	12.24	0.64%	0.58%
2004	8,579	8.33	58.67	49	5.67	59.27	11.48	0.57%	0.51%
2005	8,881	8.30	58.99	51	5.10	58.57	12.38	0.57%	0.49%
2006	8,872	8.23	59.24	56	4.79	58.45	12.60	0.63%	0.53%
2007	8,783	8.14	59.44	63	4.10	56.56	12.77	0.72%	0.64%
2008	8,513	8.46	60.01	80	4.08	57.16	13.57	0.94%	0.85%
2009	8,060	8.67	60.51	88	4.26	57.82	12.96	1.09%	0.98%
2010	7,671	8.86	60.80	95	4.07	58.84	12.34	1.24%	1.09%
2011	7,754	8.69	61.02	120	3.58	58.40	11.71	1.55%	1.34%

Effects of the Passage of Permanent Normal Trade Relations (PNTR) on Board Composition: Difference-in-Differences Tests Using the Full Sample

	Full sample period						Subsample period (year − to year +3)	
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
NTR gap 1999 × Post	0.012**	0.012**	0.010*					0.013**
	(2.180)	(2.012)	(1.939)					(2.129)
NTR gap 1990 × Post				0.018***	0.016***	0.013**		
				(2.938)	(2.640)	(2.375)		
CIP in the U.S.							0.012***	
							(5.358)	
Revealed NTR	No	No	Yes	No	No	Yes	No	No
Control variables	No	Yes	Yes	No	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	14,199	13,771	13,771	14,199	13,771	13,771	13,454	2,928
Adj. R^2	0.616	0.616	0.604	0.616	0.616	0.604	0.606	0.687

Economic impact = 0.21% (full sample: 0.22% in 1999)

- from an industry at the 25th NTR gap percentile
  to an industry at the 75th NTR gap percentile
- = $0.012 \times (0.40 - 0.23)$

Effects of Outside Directors with China-Related Experience on Announcement Returns for U.S. Firms that Pursue Investments Involving Chinese Firms

Panel A: OLS Regressions of CARs (−1, 1) for U.S. Firms that Purse M&As, JVs, or SAs in Which the Targets/Partners Are Chinese Firms

	M&As		JVs		SAs		M&As + JVs + SAs	
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
China-director	0.854*	0.710***	0.240*	0.826*	0.246*	0.424**	0.191**	0.221**
	(1.665)	(2.890)	(1.745)	(1.916)	(1.850)	(2.108)	(2.189)	(2.459)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Director experience and quality controls	No	Yes	No	Yes	No	Yes	No	Yes
Corporate governance controls	No	Yes	No	Yes	No	Yes	No	Yes
Year fixed effects	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	No	No	No	Yes	Yes	Yes	Yes
No. of observations	98	41	56	56	80	80	234	234
Adj. R^2	0.209	0.803	0.014	-0.213	0.064	0.131	0.034	0.058

Omitted variable bias:

- More talented people?
- Better corporate governance?
- Significant foreign work experience?

Other supporting evidence

- ***Post-investment long-term operating performance***: is there an improvement in future operating performance after firms with China-director engage in investment in which the partners are Chinese firms?
- ***Investment quality***: is it possible that firms with China-director engage in investment in which the partners are Chinese firms are less likely to have subsequent divestitures?
  - SDC & Capital IQ - We search for "bankruptcy," "discontinued operation/downsizing," and "sell/divest" events in the Key Development of Capital IQ database.
- ***Monitoring role***: is it possible that positive announcement return are due to monitoring role of directors?
- ***Social connection***: is it possible that positive announcement returns are mainly from China-related social connections of directors?

Conclusion

- In this paper, we examine how U.S. firms adjust their board structure in an effort to pursue opportunities in China after the U.S. granted Permanent Normal Trade Relations (PNTR) status to China in 2000.
  - We find that the proportion of outside directors with China-related experience increases significantly more for firms in high-NTR gap industries than for those in low-NTR gap industries after the passage of PNTR.
  - We also find that U.S. firms with a higher proportion of outside directors with China-related experience realize higher announcement returns and long-term operating performance for M&As, joint ventures, and strategic alliances involving Chinese firms.
  - **Overall, our study shows that a change in government policy can affect board functioning and in turn firm value by influencing firms' demand for directors' advisory services.**

Essential Intelligence

TBMC

標普全球市場財智

2021年5月14日

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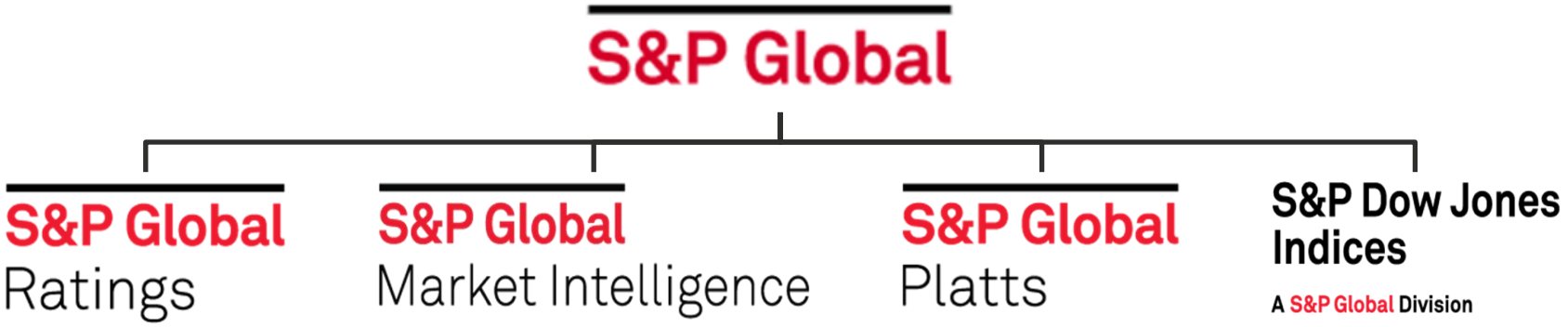

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涉足全球市場並與各大經濟體緊密接軌，獲取最新最完整的市場動態

全球設有34個辦事處，超過一萬名資訊資料搜集，產品開發，技術支援，行業專家，前中後臺人員的優質團隊

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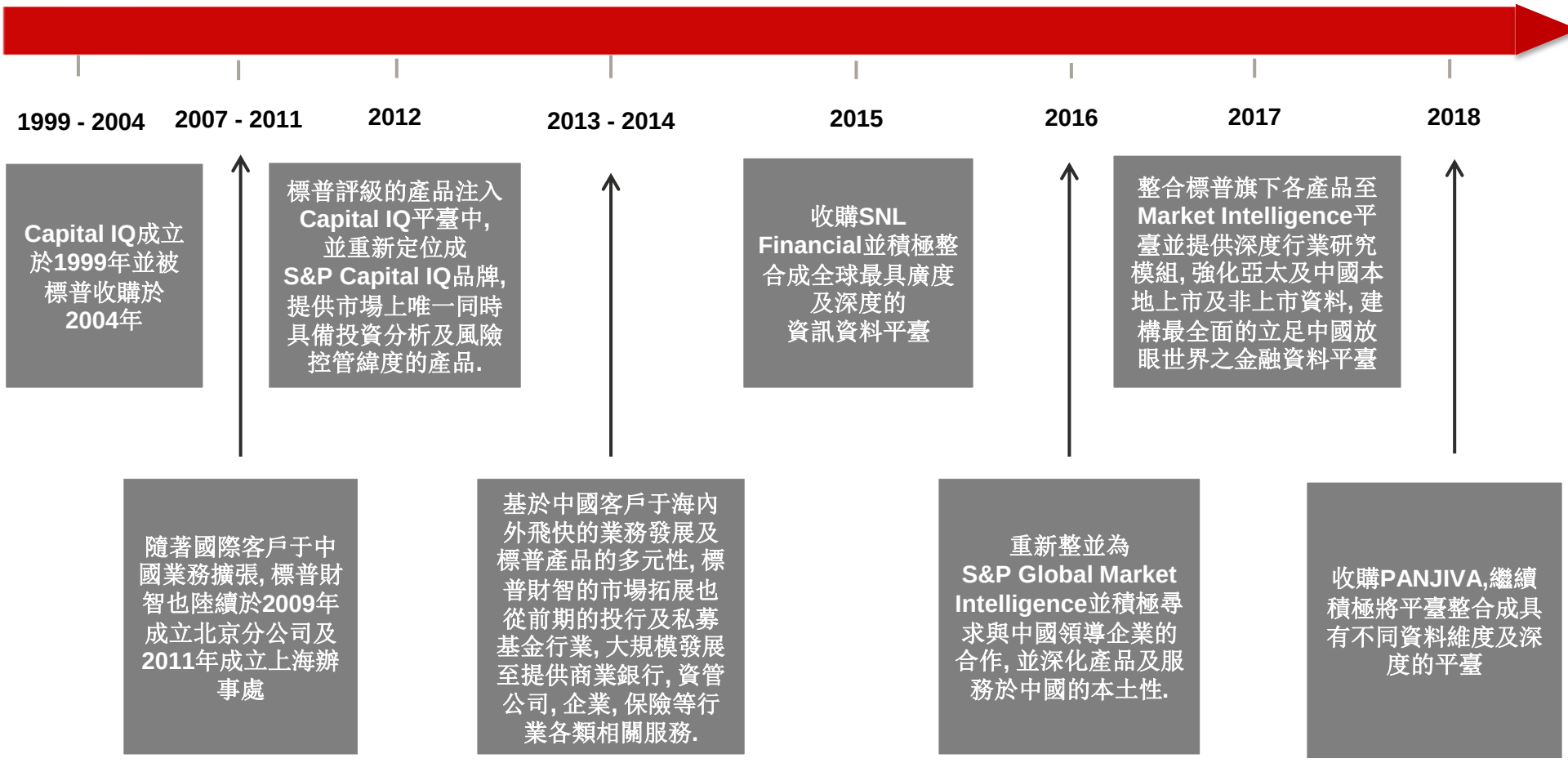

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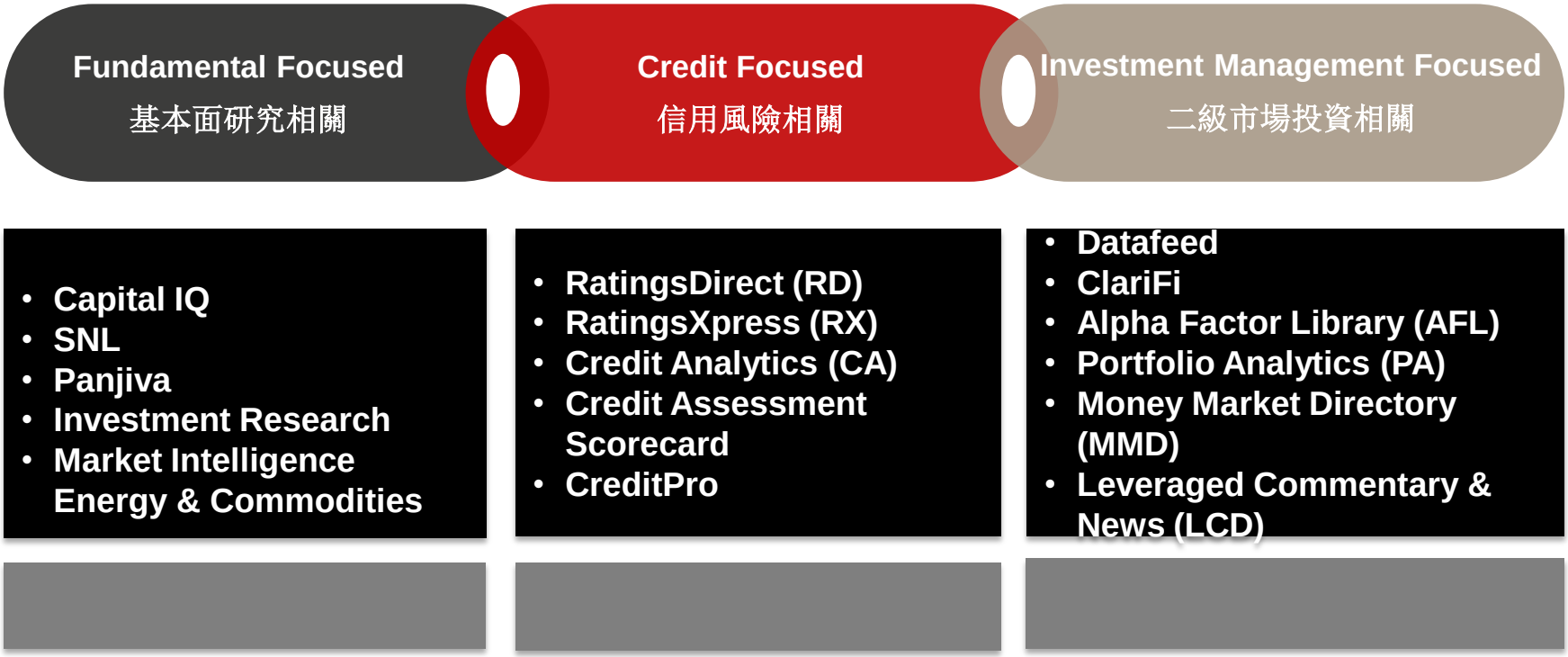

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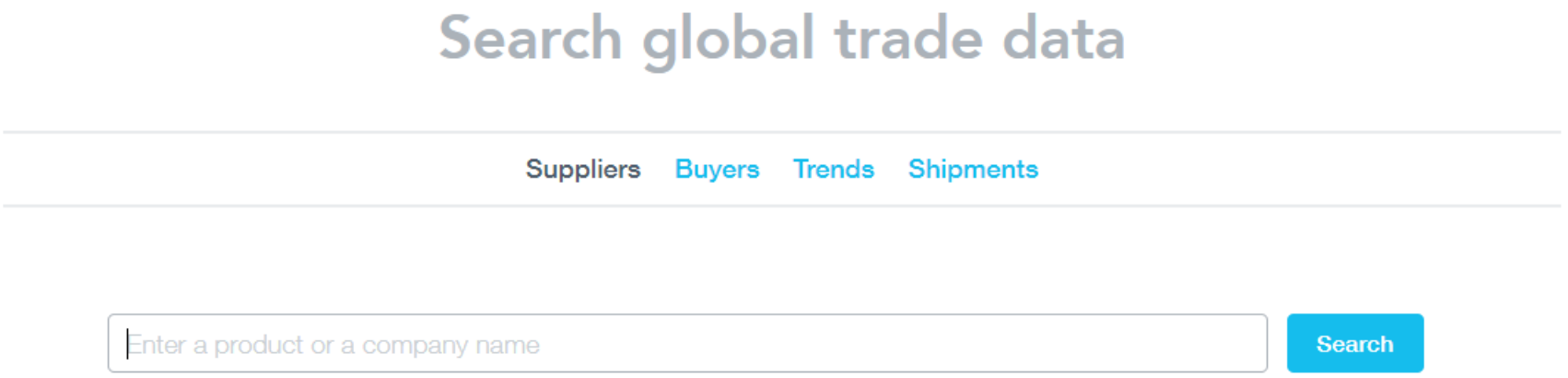
Panjiva是標普全球的供應鏈資料庫，包含跨境商品交易的詳細資訊，如公司名稱、產品描述、價值等。標普將關鍵的供應鏈資訊和公司特定細節與世界一流的技術結合起來，為公司、政府和個人提供幫助，輔助關鍵決策者做出堅定的決策。



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全球貿易資料覆蓋範圍

海關數據

與多個海關及被授權協力廠商合作，提供不同維度的全球貿易資料：按產品（HS 代碼）、裝貨港、卸貨港、買家、賣家等欄位進行分類。提單數據最早可追溯至2007年。

合作海關：

美國	墨西哥	哥斯大黎加	巴拿馬	玻利維亞	巴西
智力	哥倫比亞	厄瓜多爾	巴拉圭	秘魯	烏拉圭
委內瑞拉	中國**	印度	巴基斯坦	斯里蘭卡	菲律賓
印尼					

* 資料來源：各國政府海關及被授權單位
** 中國海關資料終止於2018年3月

宏觀資料

按產品線查看國家一級的宏觀貨運趨勢。美國宏觀貨運資料來自美國 US Census，而非美國資料來自聯合國 United Nations。

研究文章

經驗豐富的研究團隊撰寫的文章幫助大家瞭解最新的行業新聞、趨勢和發展。

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資料管理

技術

專利機器學習技術和**可擴展的自然語言處理技術**清理、組織並說明從混亂的供應鏈資料中提取關鍵見解。

更正	更正錯遲資訊 如: 重量，單位標準化
均化	跨資料來源對欄位和文本進行標準化和分組 如: 公司資訊，港口資訊
估算	通過專有演算法填補缺失的資料 如: HS 代碼, TEU, 金額估值
解析	從自由文本中提取資料 如: HS 代碼，公司名稱，裝船貨物

實體解析（Entity Resolution）

- 超過25種獨特交易數據
- 超過10億不同格式的數據點
- 多個公司數據集，包括每家公司關係網狀圖

傳輸方式

平臺（Desktop）

- 視覺化和報表工具幫助用戶瞭解貿易關係和觀察貿易趨勢，並能共用及下載。
- 能夠設置最新的航運資訊或自訂保存搜索警報。
- 智能搜索：布林邏輯檢索
- 與 Capital IQ 或 Market Intelligence 登錄相通，一次性登錄。

落地數據（Datafeeds）

- 獲取存儲在資料庫中的原始提單數據。
- 公司可以映射到其他標準普爾數據庫，如 Compustat、Capital IQ 和 SNL 。
- 標準普爾專有的 Xpressfeed Loader 引擎能幫助下載，解壓縮，並在客戶的資料庫中存儲數據
- Xpressfeed Loader 支持 MS SQL、PostgreSQL 和 Oracle

各國海關資料欄位概覽（一）

國家	資料歷史	更新頻率	資料延遲	數據細節	運輸方式
美國	2007年7月至今	每天	1-7天延遲	貨運層面	海運
墨西哥	2011年1月至今	每月	1-2個月延遲	貨運和商品層面	所有
哥斯大黎加	2014年1月至今	每月	5-7個月延遲	商品（進口）、貨運層面	所有
巴拿馬	2009年1月至今	每週	2-4周延遲	貨運層面	所有
巴西	2014年7月至今	每月	1-2個月延遲	貨運層面	海運
玻利維亞	2014年1月至2018年9月	歷史資料	歷史資料	貨運層面	所有
智利	2009年7月至今	每月	1-3個月延遲	商品（進口）、貨運層面	所有
哥倫比亞	2007年2月至今	每月	2-3個月延遲	貨運層面	所有
厄瓜多爾	2014年1月至今	每月	2-3個月延遲	貨運層面	海運

各國海關資料欄位概覽（二）

國家	資料歷史	更新頻率	資料延遲	記錄細節	運輸方式
巴拉圭	2014年1月年至今	每月	1-2個月延遲	貨運層面	所有
秘魯	2011年3月至今	每週	1-10天延遲	貨運層面	所有
烏拉圭	2003年1月至今	每天	1-7天延遲	貨運層面	所有
委內瑞拉	2014至2019年	歷史資料	歷史資料	貨運層面	所有
中國	2013年1月至2018年3月	歷史資料	歷史資料	月度加總	所有
印度	2016年1月至今	每月	6週延遲	貨運和商品層面	所有
巴基斯坦	2017年1月至今	每月	1-3個月延遲	貨運層面	所有
斯里蘭卡	2016至2019年	歷史資料	歷史資料	貨運層面	海運、空運
菲律賓	2016至2020年	年度	歷史資料	貨運層面	所有
印尼	2019年2月至今	每月	2-3個月延遲	貨運和商品層面	所有

S&P Trucost 數據介紹

Trucost ESG 數據與服務介紹

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S&P ESG 數據與分析服務

S&P Global Market Intelligence ESG 數據與分析工具幫助客戶加速與全球氣候與可持續發展目標的對齊.

S&P GLOBAL ESG 評分

評估影響公司價值- 如增長率，盈利能力，資本效率和風險敞口等方面的 ESG 因素

環境

評估對自然資源的依賴性和影響

- 碳排放（範圍一，二，三）
- 水依賴
- 空氣，水源污染物
- 廢物處理
- 環境成本

氣候

管理實體和轉型氣候風險與機遇的相互作用

- 碳足跡
- 實體風險
- 轉型風險
- 巴黎協定碳減排對標
- 碳定價風險敞口

影響

識別永續發展風險和創造價值的機會

- 聯合國永續發展目標（UN SDG）
- 歐盟永續金融分類方案

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環境相關數據集和分析

評估全球企業自然資源依賴性和影響

15k
公司

98%
全球市值

170
國家主權債卷

600k
固定收益債卷和綠色債卷

10+
年歷史數據

二氧化碳與氣候
Scope 1、2 和 3 上游和下游、直接 +一級間接排放以及未來排放與轉型途徑

能源
煤炭、石油和天然氣生產以及包括可再生能源在內的千兆瓦時能源來源

水
流域級運營和供應鏈用水

自然資源
運營和供應鏈自然資源使用

土地、空氣、水資源污染
營運和供應鏈污染物釋放

廢棄物
垃圾掩埋、焚燒、核能及回收廢物

靈活的数据傳送

- Xpressfeed™
- 市场財智平台
- ClariFI®
- 投資組合分析投資商數平台
- 足迹報告

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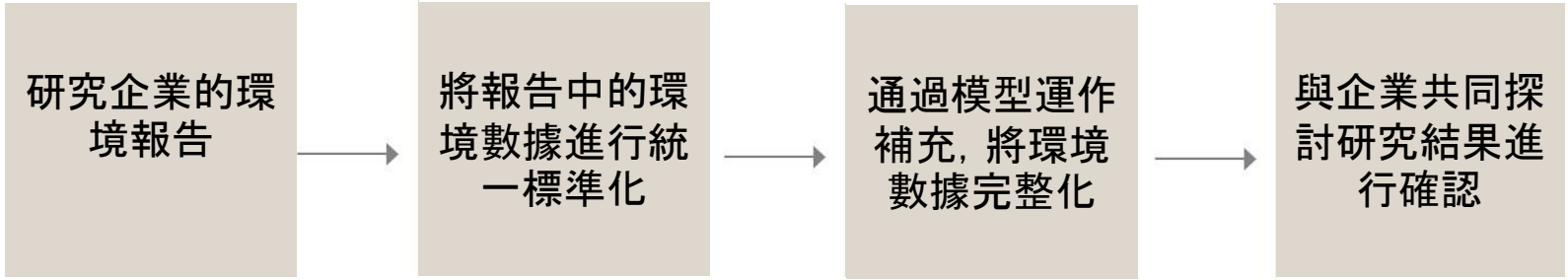
Trucost 標準化研究過程概覽

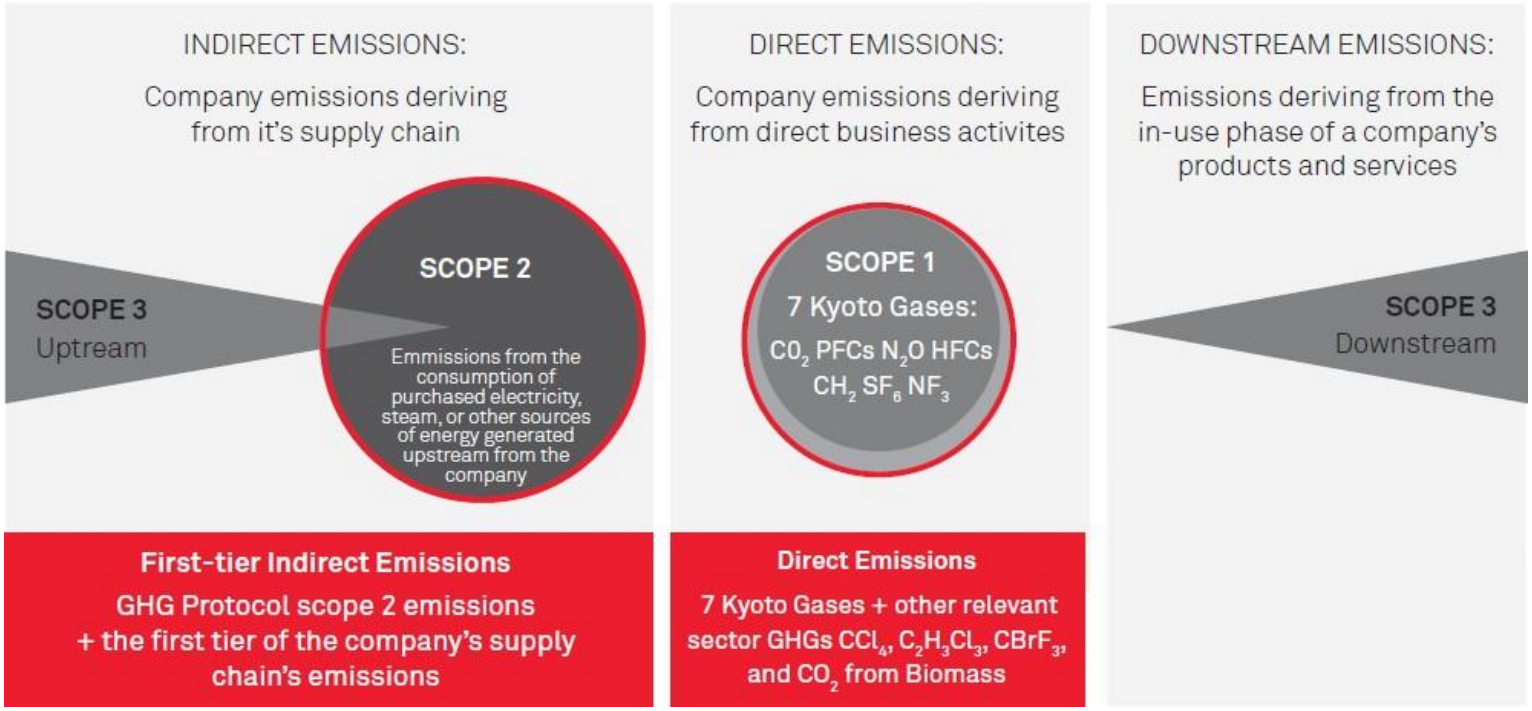


Trucost 的環境擴展輸入-輸出（EEI-O) 模型

- Trucost 的 EEIO是我們核心的環境分析模型，用於評估公司運營和供應鏈上下游對環境的影響，主要射精資環開采，二次加工和最終產品組裝等方面。這個過程可以在缺乏公司自主披露信息的情況下完成。
- Trucost 的 EEIO 模型將其龐大的特定行業環境影響數據庫，與反應不同經濟部門之間商品和服務流動的量化宏觀經濟數據集合在一起。通過这一 模型，我们就能評估公司的運營及這個全球供應鏈對環境的影響，涉及464個行業部門和100 多個環境 KPI。
- 我们的模型涵盖了環境影響的最主要驅動因素：溫室氣體排放、空氣、土地和水的污染，廢物產生，水和其他自然資源使用等。這些環境强度因子源於各種國家級，國際級，和行業數據庫，報告單位為：排放量或資源使用量/每百萬美元經濟產出。Trucost 將這些數據與我們在年度互動計劃期間從公司收集的數千份信息進行對比。適當情况下，Trucost 還會使用特定國家的信息來賦予按產值加權的全球平均强度因子。這種方法使我們能够在全球模型中考慮不同部門排放情況的差異。

Trucost 碳排放的覆蓋範圍

Trucost 'Direct' and 'First Tier Indirect' Emissions vs. GHG Protocol Scopes 1, 2 and 3:



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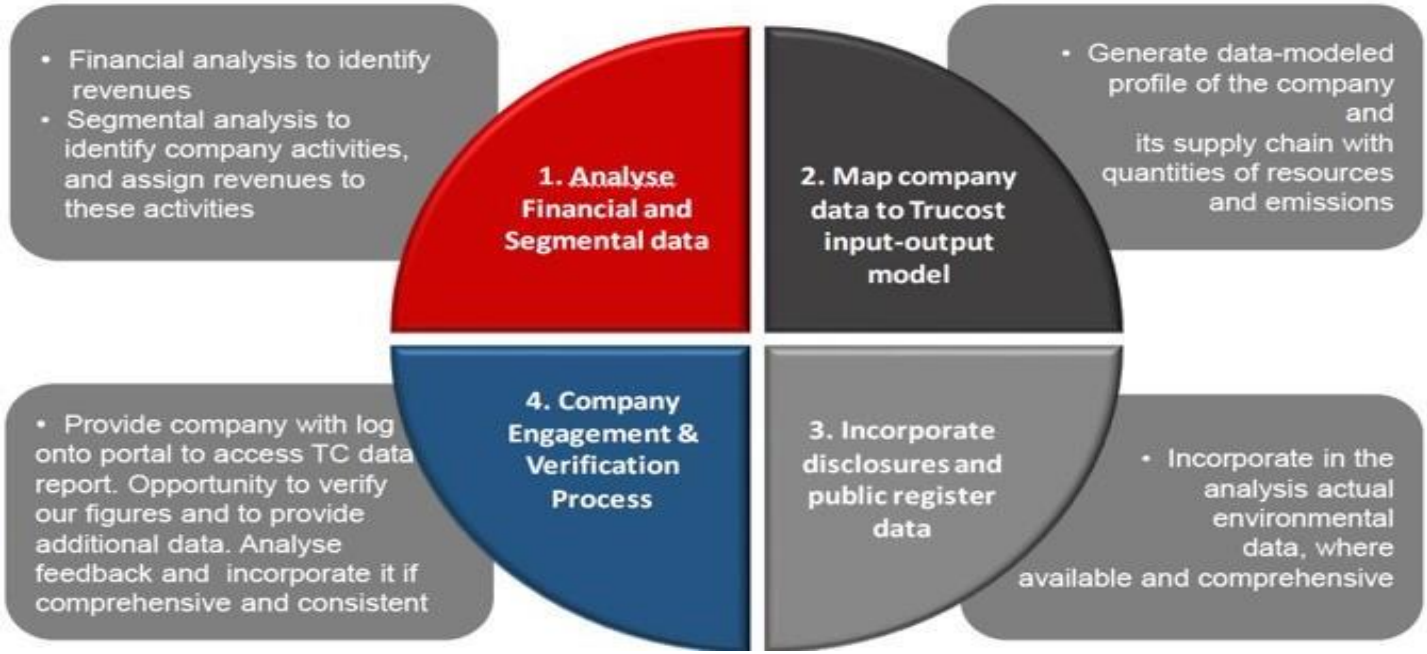
Trucost 環境和碳數據庫標準化研究過程

- Trucost的主要數據庫- Environmental Register覆蓋全球15,000家企業, 涵蓋99% 全球市值
- 每一個財務年度, 我們的分析師會對每一家企業展開研究，通過四個嚴格的步驟來確保數據集的質量



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Trucost 數據優點

- 經常性通過與企業溝通和驗證豐富數據庫
- 可糾正報告中的數據錯誤
- 模型可細化至464種不同行業，即可填補數據空白也可做為判斷披露報告的合理性的檢查機制
- 量化的數據而不是主觀性的評分或評判
- 逾10年的數據可用於歷史回測
- 環境數據指標包括水，廢物，污染物和自然資源的使用
- 通過供應鏈數據可深度瞭解潛在的環境風險
- 70%以上的蒙特婁議定書簽署者使用Trucost 數據
- 自2009年以來作爲標普(S&P)碳效率指數系列的核心依據

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