Securing the Future: International Evidence on Climate Change Strategy and Firm Value

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Introduction

- The climate change issue created significant challenges and Climate Change Strategy (CCS) has become a strategic issue for corporations.
- We quantify the quality of firms' CCS and examine the impacts of it on firm value, and find that firms with better quality CCS are more likely to have higher value.
- We examine the reasons for this value increasing effects of CCS and find that firms with better CCS can identify potential climate change-related business opportunities and risks.

Introduction (cont'd)

- We also find that better quality CCS reduces the volatility of firms' future cashflow and profitability, and CCS also attenuates the negative effects of emission on firm value.
- Finally, we document that firms with better CCS engage in higher levels of environmental disclosure, potentially reducing the information gap between the firms and their shareholders.
- Overall, our findings establish the importance of an effective CCS for creating firm value in the context of global warming and climate change.

CCS (Climate Change Strategy)

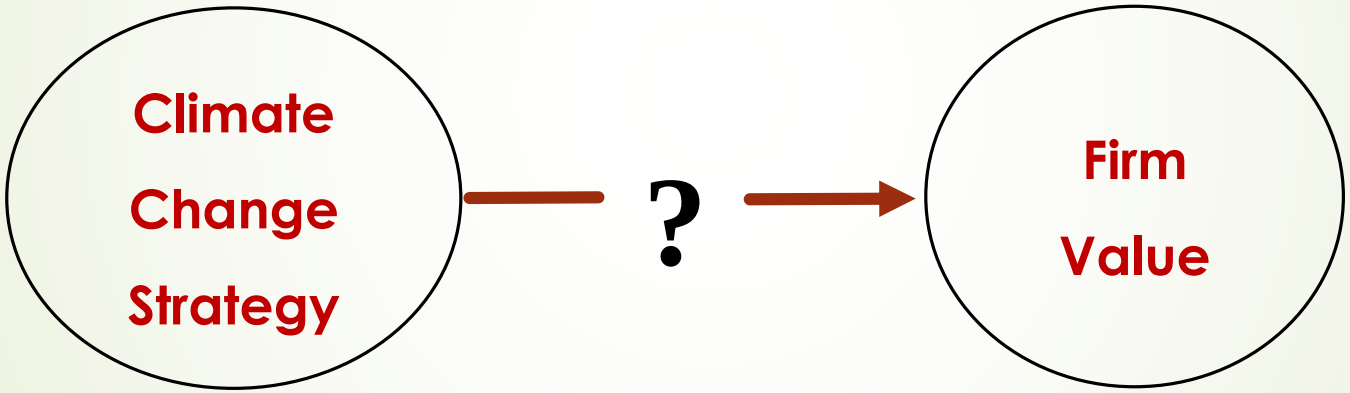
- CCS refers to a firm's commitment and systematically adopted strategic responses to climate change-related risks and opportunities and manage its impacts on core business operations. A CCS incorporates:
  - environmental governance
  - carbon emission management
  - delegation of authority and responsibility related to climate risks
  - aligning executive incentives
  - integrating climate change risks and opportunities into firms' core business strategies

Literature Review

- Reactive (environmental followers) vs. Proactive (innovators) **(Clarkson, 1995; Winn and Angel, 2000)**
- Firms adopting carbon strategies are more likely to have better governance (larger board, greater independence, environmental committee) **(Yunus et al, 2016), more capable to** reduce emissions **(Doda et al, 2016)**
- Investors penalize firms with heavy direct emissions higher carbon tax **(Luo and Tang, 2016)**

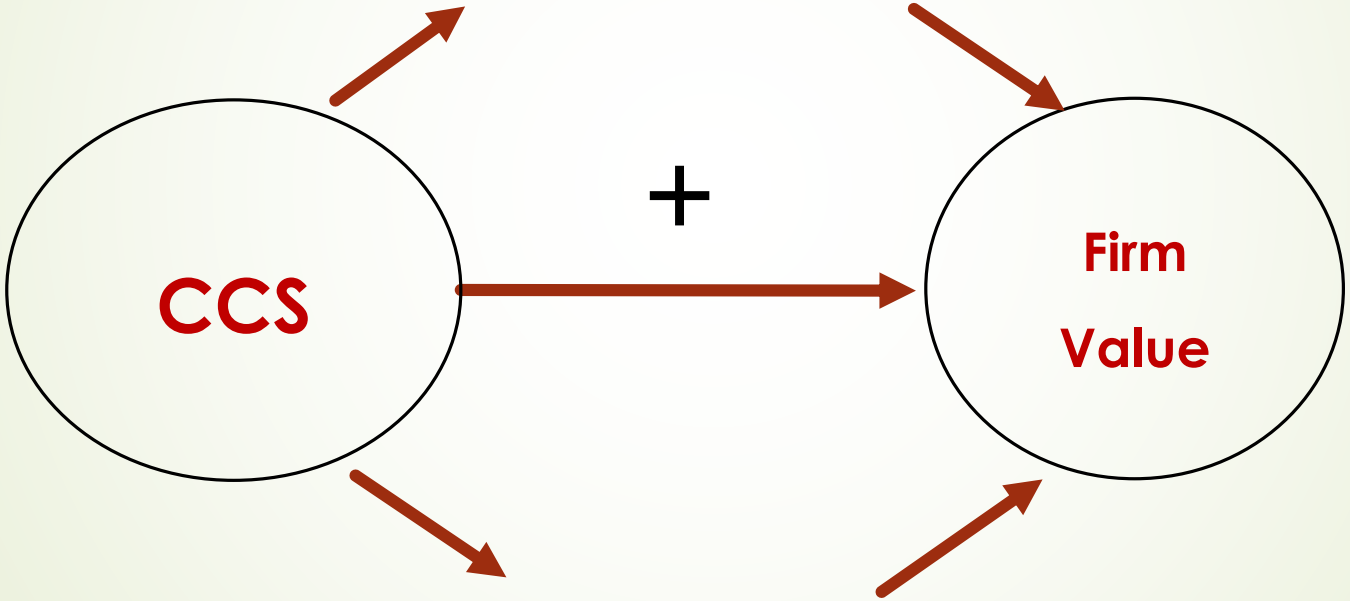
Research Questions

- RQ: **Examine whether CCS affects firm value**



RQ : Role of CCS on Firm Value

- Identify risks and opportunities
- Environmental Disclosures



- Reduction in emission
- Reduction is future cashflow variability

Hypothesis Development

- **CCS encourages emission disclosures**
- **Disclosures provide economic benefits**
  - efficient resource allocations (**Healy and Palepu, 2001**)
  - increase current and future financial performance (**Platonova, 2016; Sing, 2014**)
  - Reduces information asymmetry and riskiness (**Dhaliwal et al., 2011**)
- **CCS involves initiatives to reduce carbon emissions.**
  - Firm value is negatively associated with carbon emissions (**Matsumura et al., 2014**)
- **CCS identifies climate changes related business risks and opportunities**
- **Identifying climate risks and opportunities and incorporating into business operations can ensure stables future cashflows.**

H1: The quality of CCS is positively associated with firm value.

Empirical Model : Role of CCS on Firm Value

$$Value_{i,t+1} = \alpha + \beta_i CCS_{i,t} + \gamma_i Control\ Variables_{i,t} + \sum \delta_j Year_{Dummy} + \sum \pi_k Industry_{Dummy} + \sum \vartheta_L Country_{Dummy} + \varepsilon_t \dots\dots (1)$$

Dependent Variable: ***Firm Value*** *(market capitalization and Tobin's Q)*

- **Independent Variables:**
  - ***CCS Index:*** *Scores constructed using the responses of the CDP*
  - *CC Governance*
  - *Executive Incentives*
  - *Integration of CC into core business operations*
  - *Emission Targets and Initiatives*
  - *Emission reduction process*
- **Control Variables:**
  - *ROA*
  - *Leverage*
  - *Firm size*
  - *Tangibility*
  - *R&D*
  - *Sales Growth*
  - *Monthly Stock Returns*
  - *Stock returns Volatility*
  - *Foreign Operation*
  - *Big 4*
  - *Local Accounting Standards*
  - *Reg. Quality of the Country*
  - *GDP Growth*
  - *Trade Openness*
  - *Market Size*
  - *Year/Industry/ Country Effects*

Data Collection and Sample Selection

- ***CDP's Climate Change Survey:*** **CCS Index Factors**
- ***Worldscope:*** **Firms' Financial Information**
- ***World Development Indicator (WDI):*** **GDP, Trade, Market Size**

- **Final Sample:**

6,319 firm-year observations

43 countries

2012 to 2015

Sample Distribution by Year

Year	Number of Observations	%	Cumulative Percentage
2012	1,493	23.63	23.63
2013	1,586	25.10	48.73
2014	1,616	25.57	74.30
2015	1,624	25.70	100.00
Total	6,319	100%	

Sample Distribution by Country

Country	%	CCS	Firm value	Country	%	CCS	Firm value
Australia	4.11	7.82	22.17	Greece	0.18	7.75	22.01
Chile	0.15	7.40	21.90	Hong Kong	0.68	8.84	22.80
Hungary	0.11	9.00	21.73	Ireland	0.62	8.40	22.96
India	2.65	7.91	22.33	Japan	9.45	9.06	22.49
Israel	0.14	7.56	23.56	Malaysia	0.09	7.83	23.46
Italy	1.94	7.74	22.08	Mexico	0.43	7.14	22.87
Luxembourg	0.12	5.00	23.36	Peru	0.12	4.75	23.07
Russia	0.15	7.40	22.73	Poland	0.08	7.60	21.81
Singapore	0.28	7.56	22.89	South Africa	4.26	8.11	21.52
Spain	2.00	9.07	22.67	South Korea	4.03	8.18	21.92
Sweden	2.49	8.26	22.30	Switzerland	2.86	7.68	22.59
USA	21.07	7.81	23.46	Taiwan	1.74	8.01	21.59

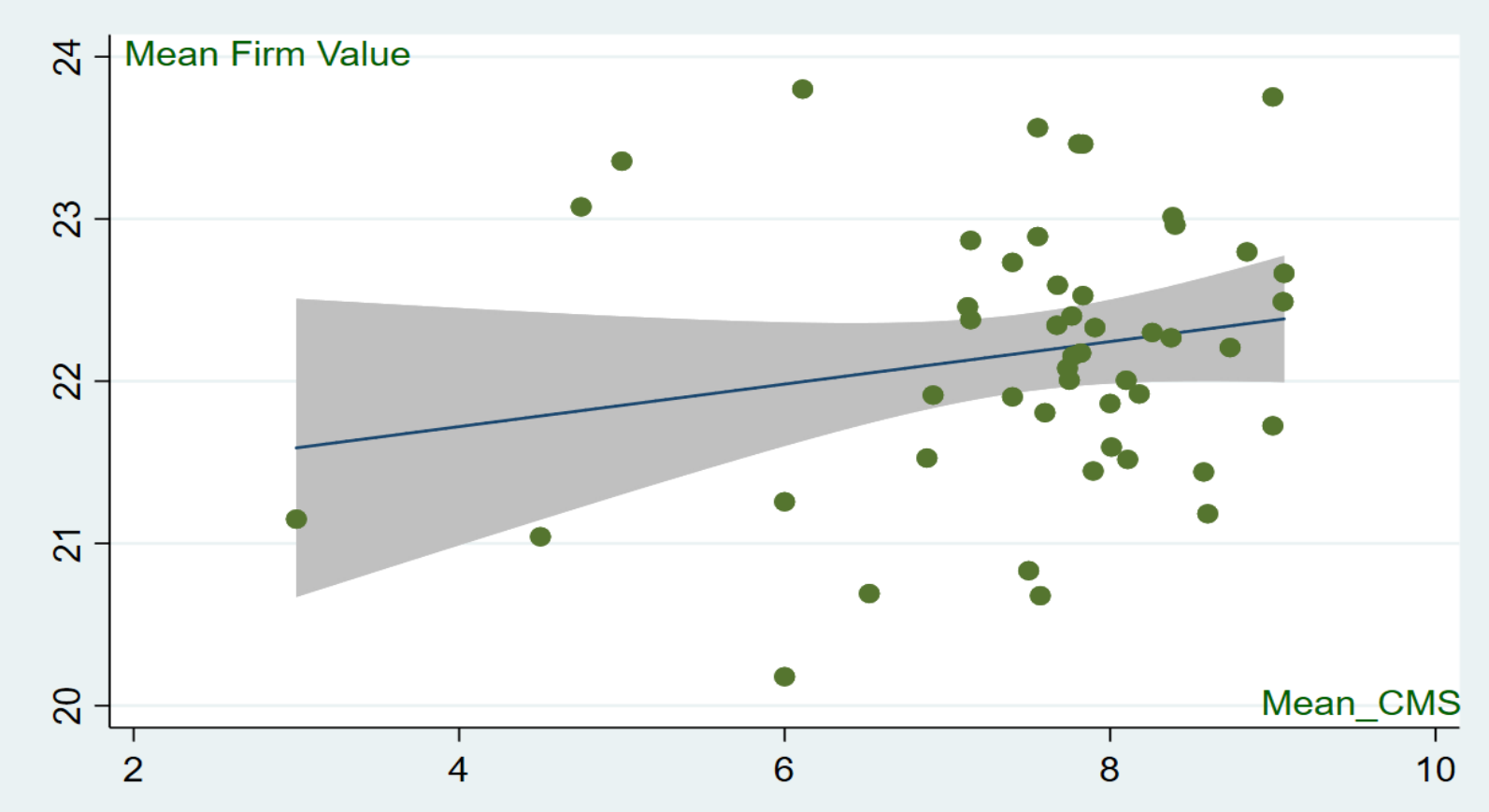
Sample Distribution by Country

United Kingdom	12.41	8.10	22.01	**Brazil**	2.82	6.91	21.91
Austria	0.63	8.00	21.86	**Netherlands**	1.52	8.74	22.21
Belgium	0.55	7.83	22.53	**New Zealand**	0.74	6.52	20.69
Bermuda	0.12	6.88	21.53	**Norway**	1.63	7.90	21.45
Canada	5.71	7.14	22.38	**Portugal**	0.62	8.60	21.18
Colombia	0.26	7.77	22.40	**Thailand**	0.37	7.13	22.46
Denmark	1.28	7.77	22.16	**Turkey**	1.19	7.57	20.68
Finland	1.74	8.58	21.44	**China**	0.42	6.11	23.80
France	3.91	8.39	23.01	**Philippines**	0.12	8.38	22.27
Germany	3.96	7.67	22.35				

Descriptive Statistics

Variables	N	Mean	5%	Median	95%	STDEV	SKEW
CCS	6319	7.994	4.000	9.000	10.000	1.968	-1.820
MKTCAP	6319	22.443	19.766	22.495	25.045	1.600	-0.223
MKTCAP (Mil. $)	6319	17558.11	383.923	5879.115	75354.8	35840.01	5.598
TOBIN's Q	6205	2.654	0.589	1.761	7.840	2.754	3.099
ROA	6204	0.069	-0.010	0.059	0.197	0.066	0.864
LEV	6204	0.250	0.004	0.239	0.545	0.164	0.525
FSIZE	6289	24.135	20.340	23.701	29.193	2.702	0.656
FSIZE (Mil. $)	6289	61128.250	594.191	8456.133	250799.000	224653.700	7.513
TANGIBILITY	6184	22.134	17.586	21.995	27.516	3.299	-1.057
RND	6319	0.018	0.000	0.000	0.110	0.041	3.275
SALESGR	6158	5.242	-7.651	4.102	23.127	9.550	0.930
RET	6319	0.108	-0.407	0.074	0.582	1.607	72.295
RETVOL	6319	0.082	0.032	0.067	0.154	0.386	77.332
FOREIGN	6319	0.364	0.000	0.000	1.000	0.481	0.566
BIG4	6319	0.852	0.000	1.000	1.000	0.355	-1.985
LOCAL_STAND	6319	0.132	0.000	0.000	1.000	0.338	2.175
REGQUAL	6319	85.416	54.502	87.678	98.558	13.928	-1.815
GDPGR	6319	2.125	-0.286	2.052	6.086	2.036	2.783
OPENNESS	6319	61.410	27.890	58.500	123.682	41.320	3.513
MARKETSIZE	6319	111.513	30.007	106.480	229.031	96.043	7.450
CO2_PERCAP	6319	0.260	0.105	0.243	0.611	0.132	1.570

Mean CCS score and mean firm value



Multivariate Regression: Effects of CCS on Firm Value

Dependent variable: Market Value of Equity

	$MKTCAP_{t+1}$				$MKTCAP_{t+2}$	$MKTCAP_{t+3}$	$MKTCAP_{t+3,\ t+5}$
	(1)	(2)	(4)	(5)	(6)	(7)	(8)
CCS	**0.043*** **	**0.032*** **	**0.031*** **	**0.033*** **	**0.018*** **	**0.019** **	**0.021*** **
	(5.19)	**(4.92)**	**(4.92)**	**(5.38)**	**(2.67)**	**(2.27)**	**(2.91)**
ROA		4.812***	4.805***	4.666***	3.407***	2.533***	1.809***
		(15.61)	(15.61)	(15.59)	(12.30)	(8.38)	(6.32)
LEV		-0.908***	-0.911***	-0.865***	-0.680***	-0.407***	-0.472***
		(-8.47)	(-8.52)	(-8.28)	(-5.88)	(-2.86)	(-3.11)
SIZE		0.518***	0.521***	0.514***	0.488***	0.438***	0.303***
		(18.05)	(18.71)	(18.30)	(17.60)	(14.13)	(9.60)
R-square	**0.282**	**0.812**	**0.814**	**0.814**	**0.779**	**0.719**	**0.670**
Year/Ind./ County	No	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6319	6140	6140	6140	5941	5675	4585

Multivariate Regression: Effects of CCS on Firm Value

Dependent variable: Tobin's Q (Alternate measure of Frim Value)

	(1)	(2)	(3)	(4)
CCS	0.073***	0.046**	0.045**	0.047**
	(3.67)	(2.26)	(2.22)	(2.38)
R-square	0.220	0.416	0.417	0.416
Firm- & Country-level controls	No	Firm-controls	Country-controls	Both
Year/Ind./County fixed-effects	Yes	Yes	Yes	Yes
Observations	6274	6098	6098	6098

Multivariate Regression: Effects of CCS on Firm Value

Addressing Sample Selection Bias:

- Heckman sample selection process

	All firms (2)	High MKTCAP (3)	Low MKTCAP (4)	Non_US, UK, JAP (5)
CCS	0.019***	0.013**	0.024***	0.024***
	(3.60)	(2.23)	(3.43)	(3.39)

Multivariate Regression: Effects of CCS on Firm Value

Addressing Sample Selection Bias:

- Firm-fixed effect model

	(1)	(2)	(3)	(4)
CCS	0.019***	0.021***	0.020***	0.010*
	(2.98)	(3.55)	(3.50)	(1.86)

- Propensity score matching regression

	(1)	(2)	(3)	(4)
CCS	0.041***	0.022***	0.022***	0.024***
	(3.80)	(3.10)	(3.13)	(3.46)

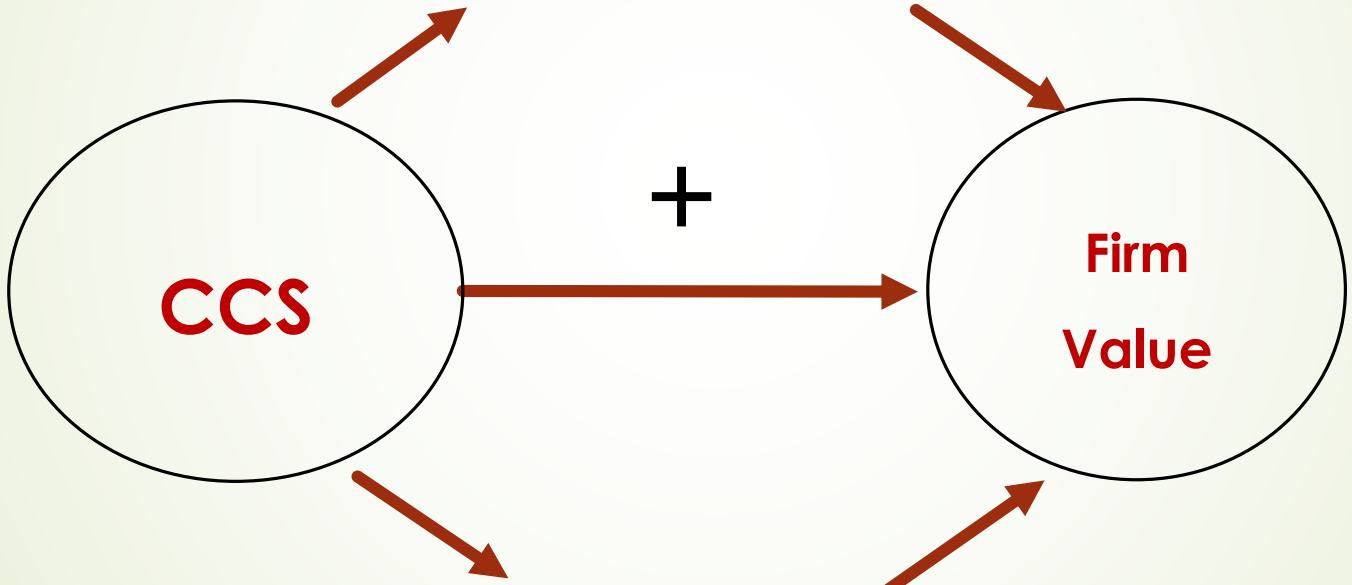
Components of CCS and Firm Values

Dependent variable: Components of CCS and Firm Value

	(1)	(2)	(3)	(4)	(5)
RES_INCT	0.047***				
	(3.69)				
PRO_STR_INTEG		0.055***			
		(4.27)			
TAR_PRO			0.026***		
			(3.57)		
ABS_ TAR_PRO				0.051***	
				(3.46)	
INT_ TAR_PRO					0.040***
					(3.67)

Economic Mechanism: CCS and Firm Value

- Identify risks and opportunities
- Environmental Disclosures



- Reduction in emission
- Reduction is future cashflow variability

Climate Change Opportunities and Risks, and Firm Value

Dependent Variable: Climate change business opportunities (CC_OPP) and risk (CC_RISK)

	CC_OPP		CC_RISK	
	(1)	(2)	(3)	(4)
CCS	**0.439*** **	**0.391*** **	**0.379*** **	**0.376*** **
	(16.47)	**(11.46)**	**(13.52)**	**(10.05)**
Firm and Country level Controls	No	Yes	No	Yes
Pseudo R-square	0.222	0.233	0.213	0.251
Year/Ind./County effects	Yes	Yes	Yes	Yes
Observations	6319	5198	6127	5033

CCS and Environmental Disclosures

Dependent Variable: Voluntary, Regulatory and Financial Disclosures

Dependent Variable	VOL_DIS	REG_ DIS	FS_ DIS
	(1)	(2)	(3)
CCS	**0.241*** **	**0.049*** **	**0.193*** **
	(15.57)	**(3.01)**	**(12.50)**
Firm and Country level controls	Yes	Yes	Yes
Pseudo R-square	0.202	0.102	0.237
Year/Ind./County effects	Yes	Yes	Yes
Observations	6151	6064	6155

CCS, Co2 Emission and Firm Value

Dependent Variable: Co2 Emissions (reg. 1 and 2) Firm Value (reg. 3 to 5)

Dependent Variable	Co2 Emission		$MKTCAP_{t+1}$		
	(1)	(2)	(3)	(4)	(5)
CCS_INC	**-0.216*** **				
	(-3.53)				
CCS _DEC		**0.177*** **			
		(2.61)			
CO2			-0.069*	-0.008	-0.632***
			(-1.87)	(-0.24)	(-2.74)
CO2* CCS					**0.082*** **
					(3.06)
CCS			0.050***	0.045***	0.016***
			(8.18)	(7.88)	(3.40)
Firm and Country Controls	Yes	Yes	No	Yes	Yes
R-square	0.588	0.587	0.467	0.533	0.865
Year/Ind./County effects	Yes	Yes	Yes	Yes	Yes
Observations	4963	4963	5576	5574	5574

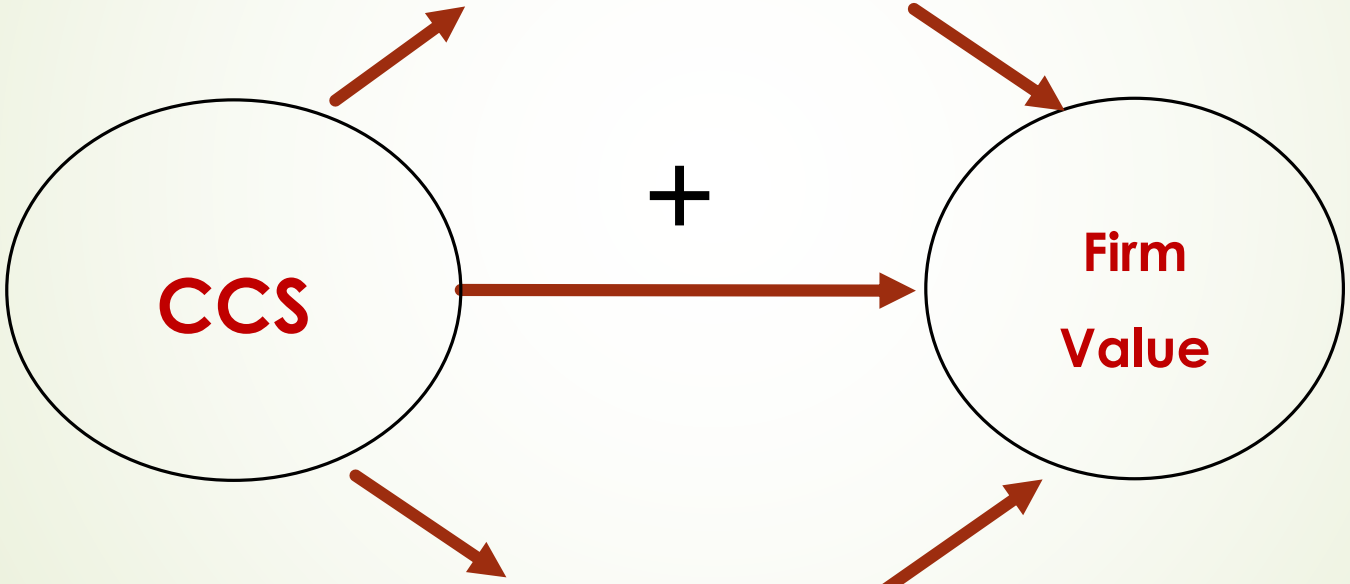
CCS and Uncertainty of Future Cash Flows and Profitability

Dependent Variable: Volatilities of Cash Flows and Profits in the future

	(1)	(2)
CCS	-0.040**	-0.001**
	(-2.38)	(-2.00)
R-square	0.282	0.290
Firm and country level controls	Yes	Yes
Year/Ind./County effects	Yes	Yes
Observations	5103	5108

Economic Mechanism: CCS and Firm Value

- Identify risks and opportunities
- Environmental Disclosures



- Reduction in emission
- Reduction is future cashflow variability

Conclusion

- **Summary of our Novel Findings:** Firm value increase with the quality of the CCS
- Our study extends the CCS and environmental literature. It documents the first empirical evidence of the importance of CCS in terms of firm value. Our study also explores the reasons for value-enhancing impacts of CCS documenting how CCS helps firms to identify climate change related opportunities and risks.
- We also find that CCS increases environmental disclosures of a firm, reduces Co2 emissions and attenuates the negative impacts of emissions on firms value.
- The inclusion of climate change issues into corporate strategy beyond what is required by regulation could be viewed as a means to improve a company's alignment with the growing climate change concerns and expectations of its stakeholders (Buysse and Verbeke, 2003)