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# Unlocking ESG Premium from Options

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# Motivation

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Importance of ESG has grown over time.

So have ESG-related risks.

Some studies document that risks are higher for poor ESG firms.

Limited research on the 'pricing' of these risks.

We study the pricing of this uncertainty via option markets.

# ESG related uncertainty

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Poor ESG performance increases risks in areas such as litigation, regulation, reputation, supply chain, etc.

- E.g., US Customs and Border Protection has issued “withhold release orders” to exclude merchandise under Section 307 of the Tariff Act of 1930, which prohibits import of merchandise mined, produced or manufactured by forced or indentured labor.

The content and timing of regulation changes are hard to predict.

Damages due to reputation risk are difficult to assess.

# Pricing of ESG related risks

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It is unclear when ESG risks will materialize or how severe they will be.

The directional impact of ESG uncertainty could even be positive (Cohen, Gurun, and Nguyen (2021)).

We conjecture that investors may be willing to pay to hedge against this uncertainty.

Option markets are a natural place for us to uncover these insurance premia.

- Similar to the pricing of political risks in Kelly, Pástor, and Veronesi (2016) and Pástor and Veronesi (2013).

# What we do and do not do?

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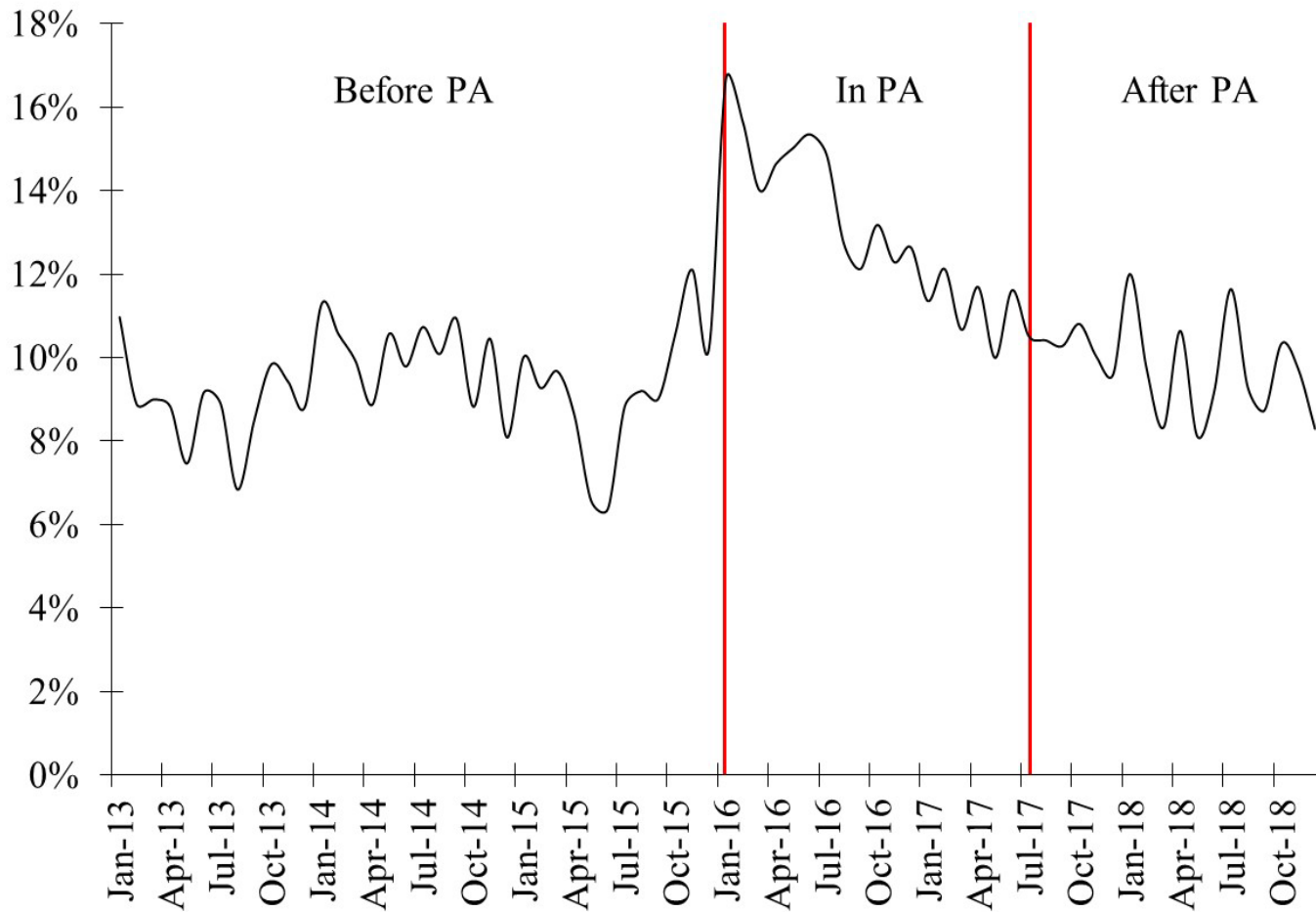
We are not interested in studying ESG risks per se.

We are not interested in studying the pricing of ESG risks in stock/bond markets.

We study the pricing of ESG risks in the option markets. Therefore, our study is about the analysis of “variance risk premia” in the options markets.

# Preliminary evidence (1)

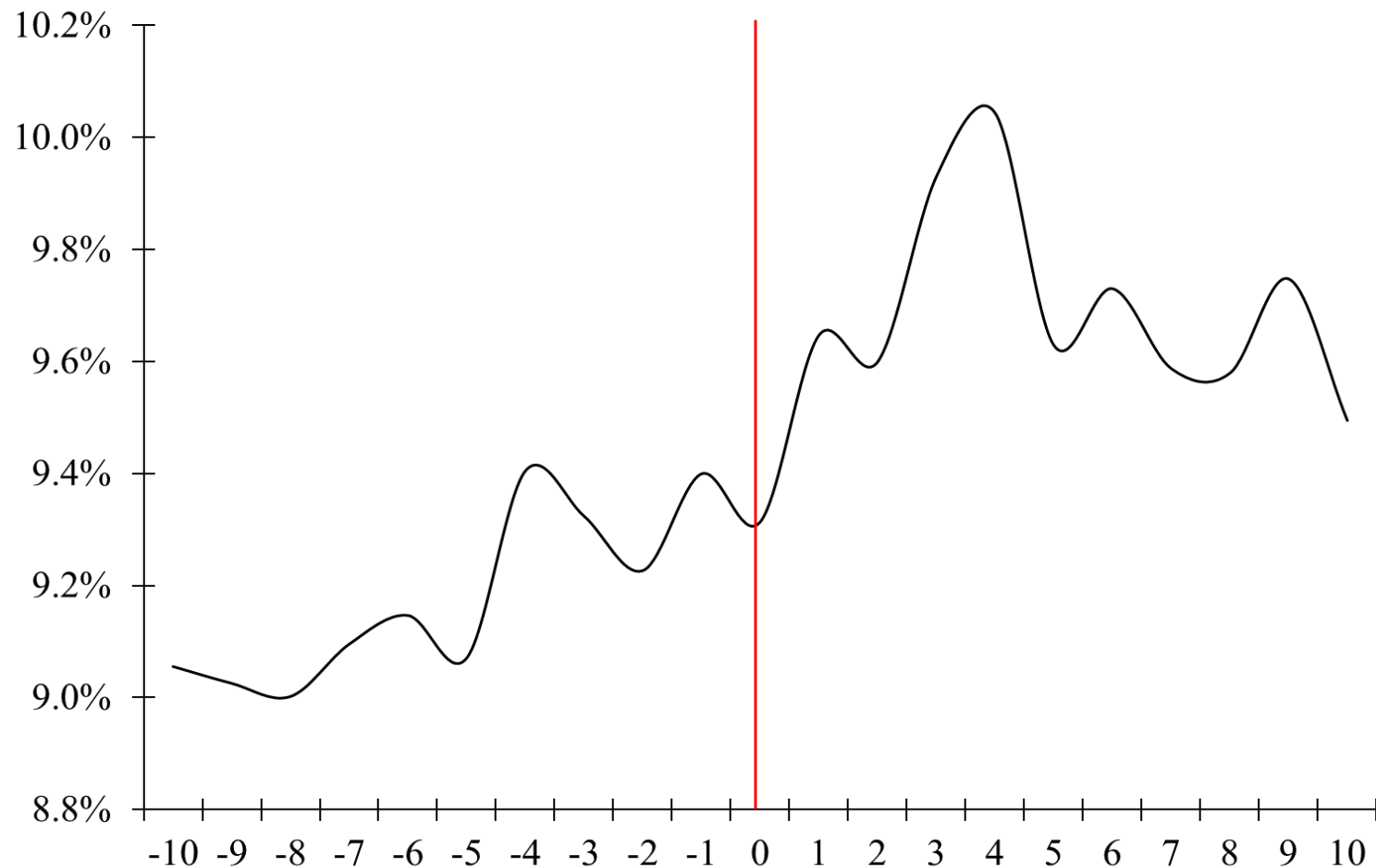
Implied volatility difference between low-ESG and high-ESG stocks around the Paris Agreement (PA).



# Preliminary evidence (2)

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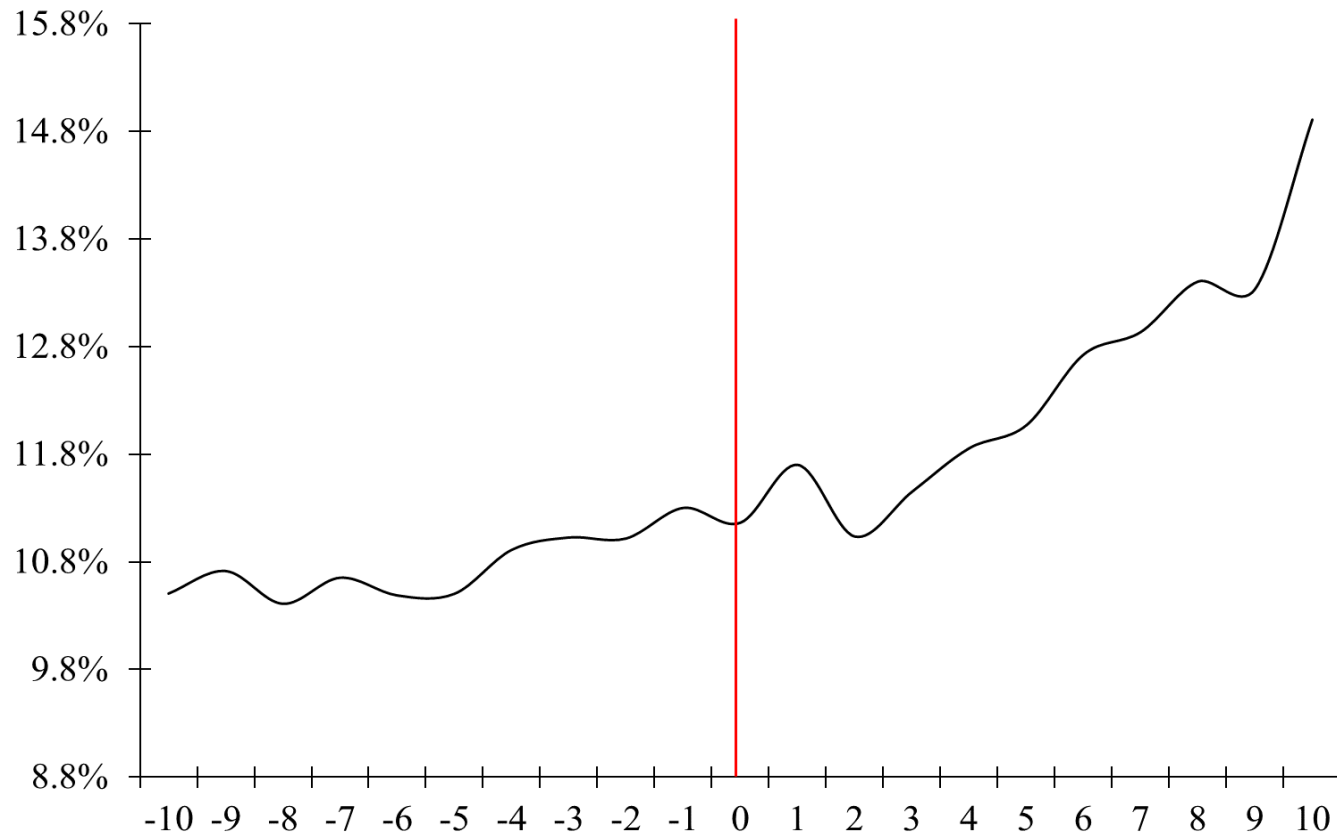
Implied volatility difference between low-ESG and high-ESG stocks around ten of Greta Thunberg's speeches.



# Preliminary evidence (3)

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Implied volatility difference between low-ESG and high-ESG stocks around Oct 15<sup>th</sup>, 2017 (launch of the Me-Too movement).





# Data

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## ESG data:

- Thomson Reuters Asset4 ESG.
  - S&P 500 at the beginning and expanded to Russell 1000 index later.
  - Monthly updated.

## Option data:

- Option-Metrics.
  - Portfolios are rebalanced monthly.
  - A pair of ATM call and put options.
  - Options have  $\sim 50$  days to expiration at the initiation of the position (and  $\sim 20$  days to expiration at the termination of the position).

# Measures

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## Main measure:

- Daily rebalanced delta-hedged option returns.
  - We buy one call option, rebalanced daily, delta-hedged call option gain is:

$$\Pi_{t,t+\tau} = C_{t+\tau} - C_t - \sum_{n=0}^{N-1} \Delta_{c,t_n} (S_{t_{n+1}} - S_{t_n}) - \sum_{n=0}^{N-1} \frac{a_n r_{t_n}}{365} (C_{t_n} - \Delta_{c,t_n} S_{t_n})$$

- $\Delta_{c,t_n}$  is the call delta of the call option on date  $t_n$ ,
- $r_{t_n}$  is the annualized risk-free rate on date  $t_n$ ,
- and  $a_n$  is the number of calendar days between  $t_n$  and  $t_{n+1}$ 
  - To make it comparable across stocks, scale by  $\Delta_{c,t} S_t - C_t$
- Buy-and-hold returns with delta at initiation; zero-beta straddle returns.

# Sample

	Mean	STD	Q1	Median	Q3
Panel A: Call options (51,691 observations)					
<i>Delta-hedged gain until month-end / (<math>\Delta_c \times S - C</math>)</i>	-0.57	2.65	-1.82	-0.72	0.43
<i>Moneyness</i>	1.00	0.03	0.99	1.00	1.01
<i>Days to maturity</i>	50	2	49	50	51
<i>Option bid-ask spread</i>	0.15	0.14	0.06	0.11	0.19
Panel B: Put options (51,691 observations)					
<i>Delta-hedged gain until month-end / (<math>P - \Delta_p \times S</math>)</i>	-0.49	2.38	-1.65	-0.64	0.41
<i>Moneyness</i>	1.00	0.03	0.99	1.00	1.01
<i>Days to maturity</i>	50	2	49	50	51
<i>Option bid-ask spread</i>	0.16	0.14	0.07	0.12	0.20
Panel C: Stock characteristics summary					
	Mean	STD	Q1	Median	Q3
<i>ESG score</i>	0.61	0.26	0.39	0.62	0.85
<i>Ln(ME)</i>	9.04	1.15	8.21	8.89	9.74
<i>Ln(BM)</i>	-1.00	0.78	-1.45	-0.95	-0.46
<i>IVOL</i>	0.24	0.14	0.15	0.21	0.29
<i>Institutional ownership</i>	0.77	0.16	0.68	0.78	0.86
<i>Analyst coverage</i>	16.32	7.39	10.89	15.78	21.00

# Magnitude of ESG premium (1)

## Portfolio sorts: FF 6-factor+zero-beta straddle return

ESG score rank	Low	2	3	4	High	H-L
Panel A. Daily rebalanced delta-hedged option returns						
Call options						
Average return	-0.71 (-5.67)	-0.62 (-5.33)	-0.54 (-4.70)	-0.49 (-4.39)	-0.43 (-4.26)	0.28 (6.12)
6-factor alpha	-0.68 (-6.07)	-0.60 (-5.98)	-0.51 (-5.49)	-0.46 (-5.05)	-0.41 (-5.02)	0.26 (5.23)
7-factor alpha	-0.51 (-3.90)	-0.43 (-4.06)	-0.38 (-3.44)	-0.31 (-2.90)	-0.28 (-2.98)	0.23 (4.09)
Put options						
Average return	-0.66 (-5.49)	-0.53 (-4.42)	-0.44 (-3.78)	-0.40 (-3.46)	-0.34 (-3.34)	0.32 (8.05)
6-factor alpha	-0.64 (-5.99)	-0.50 (-4.81)	-0.42 (-4.33)	-0.36 (-3.87)	-0.32 (-3.86)	0.32 (6.72)
7-factor alpha	-0.47 (-4.05)	-0.34 (-3.05)	-0.29 (-2.62)	-0.22 (-2.04)	-0.19 (-2.04)	0.29 (5.59)

# Magnitude of ESG premium (2)

## Portfolio sorts:

ESG score rank	Low	2	3	4	High	H-L
Panel B. Buy-and-hold delta-hedged option returns						
Call options						
Average return	-2.59 (-17.88)	-2.45 (-17.50)	-2.27 (-17.14)	-2.18 (-17.09)	-1.85 (-15.95)	0.73 (10.70)
6-factor alpha	-2.61 (-18.95)	-2.51 (-19.04)	-2.31 (-18.18)	-2.21 (-18.40)	-1.90 (-16.24)	0.71 (9.70)
7-factor alpha	-2.39 (-19.96)	-2.30 (-20.10)	-2.09 (-19.99)	-1.97 (-18.46)	-1.68 (-16.84)	0.71 (9.59)
Put options						
Average return	-2.17 (-16.75)	-1.97 (-16.41)	-1.83 (-15.77)	-1.76 (-15.22)	-1.47 (-15.06)	0.70 (11.66)
6-factor alpha	-2.19 (-18.60)	-2.02 (-17.97)	-1.86 (-17.60)	-1.78 (-17.30)	-1.51 (-16.04)	0.68 (10.73)
7-factor alpha	-1.98 (-19.83)	-1.81 (-19.47)	-1.66 (-19.52)	-1.55 (-18.54)	-1.30 (-17.45)	0.68 (10.05)

# Magnitude of ESG premium (3)

## Portfolio sorts:

ESG score rank	Low	2	3	4	High	H-L
Panel C. Zero-beta straddle returns						
Average return	-9.93 (-9.28)	-9.55 (-8.50)	-8.17 (-7.26)	-7.80 (-5.98)	-7.59 (-6.33)	2.34 (2.89)
6-factor alpha	-9.12 (-8.23)	-8.75 (-7.65)	-7.65 (-6.53)	-6.68 (-4.91)	-6.94 (-5.26)	2.18 (2.44)
7-factor alpha	-6.07 (-6.42)	-5.55 (-5.57)	-3.77 (-3.81)	-2.25 (-2.04)	-2.57 (-2.99)	3.50 (4.10)

# E, S, or G

Portfolio sorts, daily rebalanced delta-hedged option returns, calls+puts, 7-factor alpha:

Rank	Low	2	3	4	High	H-L
E-score	-0.49 (-3.72)	-0.42 (-4.63)	-0.30 (-2.65)	-0.29 (-2.81)	-0.21 (-2.16)	0.28 (5.06)
S-score	-0.49 (-4.45)	-0.39 (-3.35)	-0.33 (-3.13)	-0.27 (-2.52)	-0.23 (-2.42)	0.26 (6.02)
G-score	-0.40 (-2.93)	-0.40 (-3.83)	-0.34 (-3.17)	-0.30 (-2.90)	-0.27 (-3.12)	0.13 (1.82)

All three aspects matter, although E and S are more important.

# Volatility risk or jump risk

Portfolio sorts, 7-factor alpha

S1: Vega-positive, gamma-neutral (volatility risk sensitive) straddle

S2: Vega-neutral, gamma-positive (jump risk sensitive) straddle

ESG score rank	Low	2	3	4	High	H-L
S1 (vol sensitive)	1.26 (2.01)	0.92 (1.92)	0.37 (0.67)	0.02 (0.02)	0.53 (0.60)	-0.73 (-1.03)
S2 (jump sensitive)	-4.80 (-8.64)	-4.64 (-8.17)	-2.78 (-4.92)	-1.17 (-1.82)	0.32 (0.43)	5.12 (8.80)



# Effect of public ESG awareness

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Time-series variation.

H–L spread, daily rebalanced delta-hedged option returns, 7-factor alpha.

$$H - L \text{ spread} = \alpha_0 + \alpha_1 D_t + \beta' F_t + \varepsilon_t$$

$D_t$  is a time dummy indicating the period of high ESG public awareness.

$\alpha_1$  captures the alpha differences between high and low awareness periods.

# Effect of public ESG awareness

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## Panel A. Impact of Google search index

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ESG score rank

$\alpha_0$

$\alpha_1$

7-factor alpha

0.15  
(1.94)

0.20  
(2.22)

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## Panel B. Impact of Paris Agreement

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7-factor alpha

0.12  
(1.46)

0.39  
(2.52)

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## Panel C. Impact of aggregated ESG news

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7-factor alpha

0.16  
(1.70)

0.23  
(2.10)

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# Confounding effects?

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FM regressions of delta-hedged option returns on ESG score:

$$\text{DeltaHedgedGain}_{it} = \text{ESG}_{it-1} + \text{Controls}_{it-1} + e_{it}.$$

	Call+Put options	
	(1)	(2)
ESG score	0.260 (2.93)	0.178 (2.23)
Average adj-R <sup>2</sup>	0.053	0.073
# observations	96,928	96,920

Control variables: firm size, book to market ratio, idiosyncratic volatility, reversal, momentum, control illiquidity, option open interest, and option bid-ask spread in column (1); further control beta, implied vol, skewness, kurtosis in column (2).

# Alternative measure of ESG?

FM regressions of delta-hedged option returns on ESG score:

$$\text{DeltaHedgedGain}_{it} = \text{ESG}_{it-1} + \text{Controls}_{it-1} + e_{it}$$

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	KLD	MSCI	Sustainalytics	Reprisk	<b>Combined</b>	<b>IV</b>
	(1)	(2)	(3)	(4)	(5)	(6)
ESG score	0.031 (4.04)	0.021 (1.64)	0.511 (2.38)	0.007 (3.71)	0.070 (2.25)	0.147 (2.07)

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- Combined ESG score: rank stocks according to each ESG score, assign the group rank, then take the average.
- IV ESG score: instrument ASSET4 ESG score with alternative ESG scores, use the fitted value as IV ESG score.

# Underlying channels (1)

The role of ESG differs for firms operating in different product markets.

- Private end-consumers show more social concerns in their consumption.
- Firms offering similar products face stronger market competition, have less “cushion,” and are more vulnerable to ESG risk shocks.

Panel A. Product market

	(1)	(2)
CONSUMER×ESG score	0.168 (2.02)	
CONSUMER	-0.180 (-2.60)	
FLUIDITY×ESG score		0.033 (2.13)
FLUIDITY		-0.031 (-2.88)
ESG score	0.066 (1.20)	-0.153 (-1.44)
Controls	Yes	Yes
Avg adj- $R^2$	0.081	0.092
# obs	96,920	94,938

# Underlying channels (2)

The pricing of ESG should be stronger among firms whose investors pay more attention to ESG issues.

- Firms headquartered in blue states.
- Firms with more environment-related questions raised in the conference calls.

Panel B. Attention to ESG		
	(1)	(2)
BLUE×ESG score	0.181 (2.10)	
BLUE	-0.174 (-2.63)	
CONFENV×ESG score		0.029 (1.99)
CONFENV		-0.019 (-2.14)
ESG score	-0.084 (-0.91)	0.109 (1.54)
Controls	Yes	Yes
Avg adj- $R^2$	0.092	0.082
# obs	75,806	91,248

# Underlying channels (3)

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The pricing of ESG should be attenuated if firms actively manage risks.

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Panel C. Firms' hedging activity

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	(1)
HEDGER $\times$ ESG score	-0.145 (-2.48)
HEDGER	0.096 (2.37)
ESG score	0.109 (2.33)
Controls	Yes
Avg adj- $R^2$	0.09
# obs	96,920

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# Conclusion

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Delta-hedged option return is more negative, indicating option prices are more expensive—for firms with poor ESG performance.

All components of ESG contribute to option expensiveness.

We find the magnitude of the ESG premium to be about 0.3% per month.

- This premium mainly derives from jump risks.
- The ESG premium is higher when the public ESG awareness is higher.

The effect is stronger for firms that are closer to end-consumers, facing severer product competition, with higher investors' ESG awareness, and without corporate hedging activity.