ESG and corporate credit spreads

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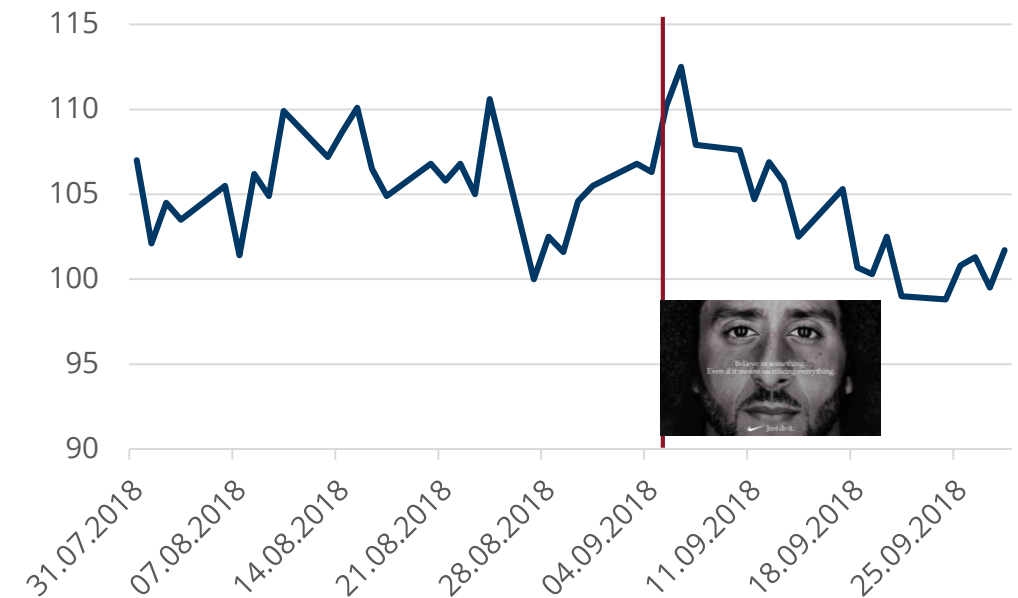**JRC CoPiFR Summer School on Sustainable Finance**

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ESG risks and opportunites in fixed-income


Volkswagen 5y CDS spreads (bp)

Z-spreads of Nike 3.625% MAY-2043 fixed coupon bond (bp)

ESG awareness changes stakeholder behavior affecting future expected cash flows and credit risks

ESG, firm value and credit risk

- **Merton model (1974): Value of firm's debt depends on**
  - risk-free loan and
  - short put option on firm's assets with loan's nominal as strike price

- **Risk-mitigation view**
  - Lower recruiting costs (Albuquerque et al., 2018), less risks stemming from natural disasters or regulatory changes (Renneboog et al., 2008), customer loyalty, higher product prices, etc.
  - ESG investments reduce ESG risks → higher/less volatile cash flows → lower put value → lower credit spread

- **Over-investment view**
  - Agency conflicts between management and shareholders (Goss & Roberts, 2011), costly maintenance of stakeholders relationships (Perez-Batres et al., 2012), ESG to distract from corporate misbehavior (Kim et al., 2014)
  - ESG investments are a waste of scarce resources → lower cash flows → higher put value → higher credit spread
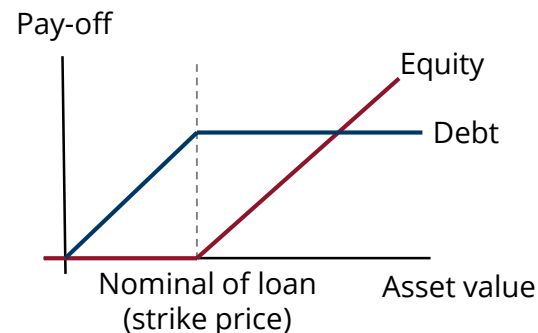
Research questions and contribution

1. **Is ESG a determinant of credit spreads in the cross-section of firms?**

2. **Is the time-varying market valuation of ESG a determinant of CDS spread changes?**

➡️ **Determinants of CDS spreads and CDS spread changes** (Ericsson et al., 2009 & Galil et al., 2014)

➡️ **New insights regarding ESG and credit risk in Europe**

Literature on ESG and tradable corporate debt securities

Authors	Data	Period	Region	ESG pillar	Risk mitigation vs. overinvestment
Oikonomou et al. (2014)	Corporate bonds and credit ratings	1993-2008	U.S.	ESG	Risk mitigation
Ge and Liu (2015)	Corporate bonds and credit ratings	1992-2009	U.S.	ESG	Risk mitigation
Jiraporn et al. (2014)	Credit ratings	1995-2007	U.S.	ESG	Risk mitigation
Graham et al. (2001)	Credit ratings	1986-1997	U.S.	E	Risk mitigation
Bauer and Hann (2010)	Corporate bonds	1995-2006	U.S.	E	Risk mitigation
Schneider (2011)	Corporate bonds	1994-2004	U.S.	E	Risk mitigation
Bauer et al. (2009)	Corporate bonds and credit ratings	1995-2006	U.S.	S	Risk mitigation
Chen et al. (2012)	Corporate bonds	1973-1998	U.S.	S	Risk mitigation
Klock et al. (2005)	Corporate bonds	1990-2000	U.S.	G	Risk mitigation
Ashbaugh-Skaife et al. (2006)	Credit Ratings	2002-2003	U.S.	G	Risk mitigation
Bradley et al. (2007)	Corporate bonds and credit ratings	2001-2007	U.S.	G	Risk mitigation
Cremers et al. (2007)	Corporate bonds and credit ratings	1990-1997	U.S.	G	Risk mitigation
Menz (2010)	Corporate bonds	2004-2007	**Europe**	**ESG**	Overinvestment (weak evidence)
Stellner et al. (2015)	Corporate bonds	2006-2012	**Eurozone**	**ESG**	Risk mitigation (weak evidence)
Akdogu and Alp (2016)	**CDS (Bloomberg)**	2001-2006	U.S.	G	Risk mitigation
Switzer et al. (2018)	**CDS of financials (Markit)**	2010-2012	**World ex U.S.**	G	Risk mitigation

➡️ Compared to bonds, **CDS** are more frequently **traded**, **standardized** and a precise **measure of credit risk**
(Ericsson et al., 2009, Ederington et al., 2015, Norden & Weber, 2009, Finnerty et al., 2013)

➡️ **Relationship between CDS spreads and E-, S- and G-ratings of European firms**

Data

- **All data from Thomson Reuters EIKON for the period 31.07.2009 – 31.12.2016**

- **CDS spreads of Eurozone-firms**
  - Month-end mid spreads of 5y single-name CDS, denominated in EUR, senior unsecured debt
  - Filter: Financial firms and spreads > 2.000 bp (Zhang et al., 2009)

- **Firm characteristics**
  - Credit ratings: S&P, Moody's and Fitch (last updated), Filter: defaulted firms
  - Monthly stock returns, 180d-rolling-volatilities of stock returns
  - Leverage ratios:

$$\frac{\text{Book value of debt}_{i,t}}{\text{Equity market value}_{i,t} + \text{Book value of debt}_{i,t}}$$

Data

- **Thomson Reuters ESG ratings**
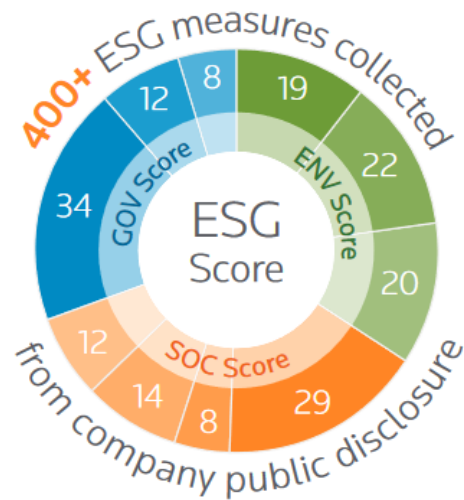
- Percentile ratings
  - E- and S-ratings industry-benchmarked
  - G-ratings country-benchmarked
- Updated on 1st Jan each year
- No changes in methodology during sample period

Research questions

1. **Is ESG a determinant of credit spreads in the cross-section of firms?**

   - Apply ESG ratings to explain credit spreads → Fama-MacBeth regressions

   - Consideration of 10 ESG category scores and subperiods

2. **Is the time-varying market valuation of ESG a determinant of CDS spread changes?**

   - Fama and French-style ESG factors to capture time-varying market valuation of ESG impact on credit risk

   - Time-series regressions of spread changes explained by ESG factors and controls

Fama-MacBeth regressions with ESG dummy variables

- For each t: $S_{i,t} = \alpha_t + \beta_t X_{i,t} + \boldsymbol{\beta_t ESGtop_{i,t}} + \boldsymbol{\beta_t ESGbottom_{i,t}} + \varepsilon_{i,t}$

	M1-ENV	M2-SOC	M3-CGV	M4-ESG
Intercept	-165.55	-167.99	-160.06	-177.67
	(-8.39)	**(-8.8)**	**(-8.28)**	**(-8.21)**
Rat D^2	-10.27	-13.34	-8.00	-10.42
	(-1.19)	(-1.31)	(-.99)	(-1.21)
Rat D^3	4.85	12.91	10.19	10.94
	(.61)	**(1.84)**	**(1.7)**	(1.58)
Rat D^4	9.61	18.73	15.67	17.28
	(1.48)	**(2.77)**	**(2.96)**	**(2.51)**
Rat D^5	104.65	115.85	111.32	115.82
	(4.78)	**(5.24)**	**(5.57)**	**(4.77)**
Vol	113.01	115.00	111.89	112.61
	(5.91)	**(6.38)**	**(5.92)**	**(6.05)**
Ret	-0.64	-0.67	-0.61	-0.65
	(-1.4)	(-1.48)	(-1.43)	(-1.47)
Lev	1.73	1.58	1.63	1.67
	(2.32)	**(2.43)**	**(2.25)**	**(2.28)**

	M1-ENV	M2-SOC	M3-CGV	M4-ESG
ESG variables				
ENV top	4.32			0.19
	(.65)			(.02)
ENV bottom	25.77			28.43
	(3.18)			**(3.58)**
SOC top		22.47		24.06
		(4.77)		**(4.58)**
SOC bottom		1.96		-6.11
		(.21)		(-.7)
CGV top			8.34	8.82
			(1.46)	(1.61)
CGV bottom			7.51	7.34
			(1.07)	(1.24)
N	8,287	8,287	8,287	8,287
Adj. R^2	0.7567	0.7576	0.7549	0.7568

- Firms in **worst ENV quartile** show **28bp higher spreads** compared to average firms → **Risk-mitigation**

- Firms in **best SOC quartile** show **24bp higher spreads** compared to average firms → **Overinvestment**

# Materiality of E- and S-category scores in Fama-MacBeth regressions

- For each t: $S_{i,t} = \alpha_t + \beta_t X_{i,t} + \sum_{k=1}^{K} \beta_{t,k} ESG\_cat\_top_{i,t,k} + + \sum_{k=1}^{K} \beta_{t,k} ESG\_cat\_bot_{i,t,k} + \varepsilon_{i,t}$

ENV Categories	M5	M6	M7	M8
Resource Use top	-11.44			-13.14
	(-1.27)			(-1.47)
Resource Use bot	-1.18			1.78
	(-.18)			(.32)
Emissions top		-9.86		-6.78
		(-2.34)		(-1.58)
Emissions bot		-8.56		-13.33
		(-1.27)		**(-1.96)**
Innovation top			-2.16	-0.65
			(-.37)	(-.11)
Innovation bot			25.79	31.54
			(2.37)	**(2.86)**
Adj. R^2	0.7560	0.7559	0.7592	0.7576

SOC Categories	M9	M10	M11	M12	M13
Workforce top	-0.91				-2.83
	(-.16)				(-.4)
Workforce bot	8.42				7.13
	(1.04)				(.87)
Human Rights top		21.51			21.59
		(3.33)			**(3.48)**
Human Rights bot		7.73			11.96
		(1.07)			(1.41)
Community top			2.56		1.57
			(.57)		(.38)
Community bot			-15.96		-16.32
			(-1.37)		(-1.32)
Product Resp. top					17.40
					(4.17)
Product Resp. bot					-13.10
					(-1.4)
Adj. R^2	0.7544	0.7574	0.7611		0.7592

- Higher spreads for lower ENV firms driven by **Innovation Score**

- Higher spreads for higher SOC firms driven by **Product Responsibility** and **Humans Rights Scores**

Did the Eurozone crisis in 2011 affect markets' sustainability awareness?

Mean monthly CDS spreads
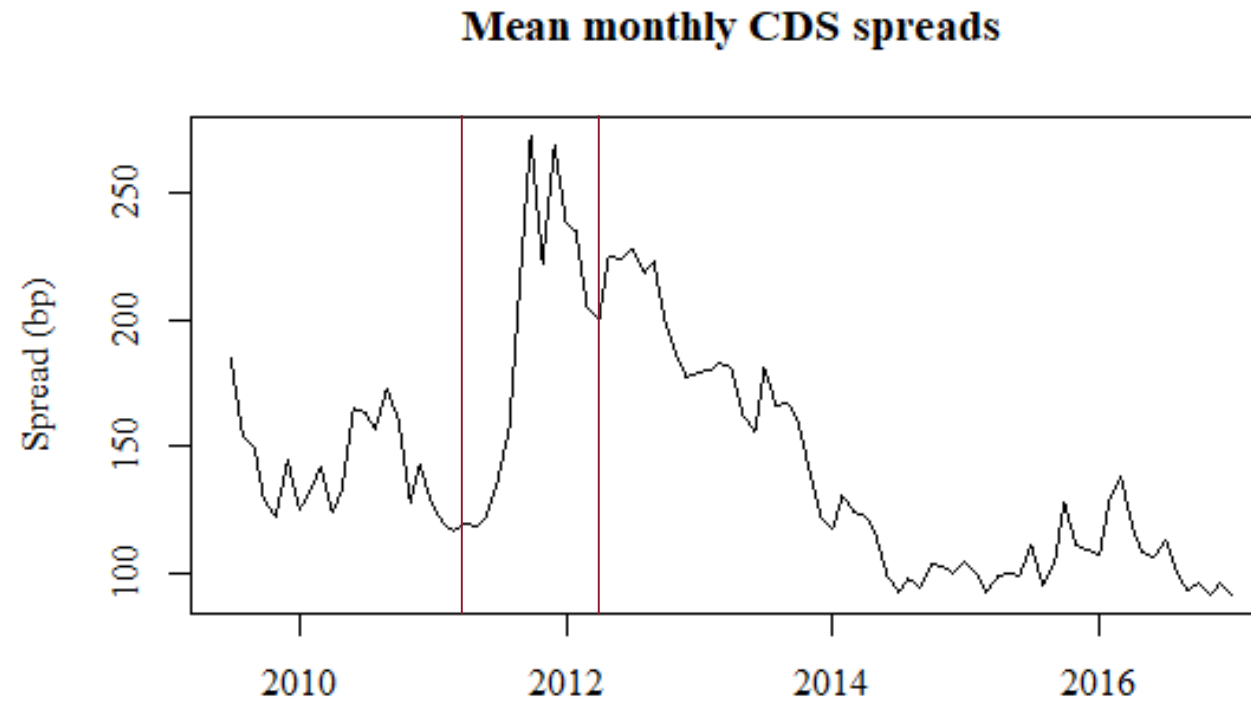
Subperiods – Fama-MacBeth regressions with ESG dummy variables

07/2009-05/2011

	M1-ENV	M2-SOC	M3-CGV	M4-ESG
Vol	92.07	98.01	91.14	92.42
	(5.62)	**(6.03)**	**(5.44)**	**(5.)**
Ret	-0.47	-0.51	-0.42	-0.56
	(-1.92)	**(-2.07)**	(-1.58)	**(-2.21)**
Lev	2.74	2.36	2.52	2.62
	(6.27)	**(5.45)**	**(7.27)**	**(5.88)**
ENV top	29.08			29.19
	(2.96)			**(2.86)**
ENV bot	35.56			33.33
	(6.19)			**(10.59)**
SOC top		35.51		34.65
		(1.55)		**(1.75)**
SOC bot		17.51		14.54
		(1.59)		(1.37)
CGV top			12.48	16.64
			(2.96)	**(4.69)**
CGV bot			1.87	3.04
			(.17)	(.31)
N	1,941	1,941	1,941	1,941
Adj. R^2	0.7814	0.7846	0.7795	0.7849

03/2012-12/2016

	M1-ENV	M2-SOC	M3-CGV	M4-ESG
Vol	126.40	125.91	125.01	125.39
	(3.98)	**(3.9)**	**(4.05)**	**(4.08)**
Ret	0.01	-0.02	-0.02	0.00
	(.03)	(-.06)	(-.06)	(-.01)
Lev	0.90	0.88	0.86	0.84
	(3.2)	**(3.19)**	**(3.03)**	**(3.23)**
ENV top	-7.14			-13.16
	(-2.49)			**(-4.17)**
ENV bot	17.47			21.15
	(1.45)			**(2.11)**
SOC top		18.95		21.61
		(5.88)		**(5.39)**
SOC bot		-0.47		-10.43
		(-.03)		(-.84)
CGV top			5.38	8.20
			(.89)	(1.24)
CGV bot			13.69	12.54
			(1.7)	**(1.96)**
N	5,541	5,541	5,541	5,541
Adj. R^2	0.7463	0.7469	0.7444	0.7449

> Differences in results between subperiods point to time-varying market valuation of ESG

Research questions and contribution

1. **Is ESG a determinant of credit spreads in the cross-section of firms?**

   - Apply ESG ratings to explain credit spreads → Fama-MacBeth regressions

   - Consideration of subperiods and potential non-linearities (Barnett & Salomon, 2006; Lee et al., 2010; Mama et al., 2017)
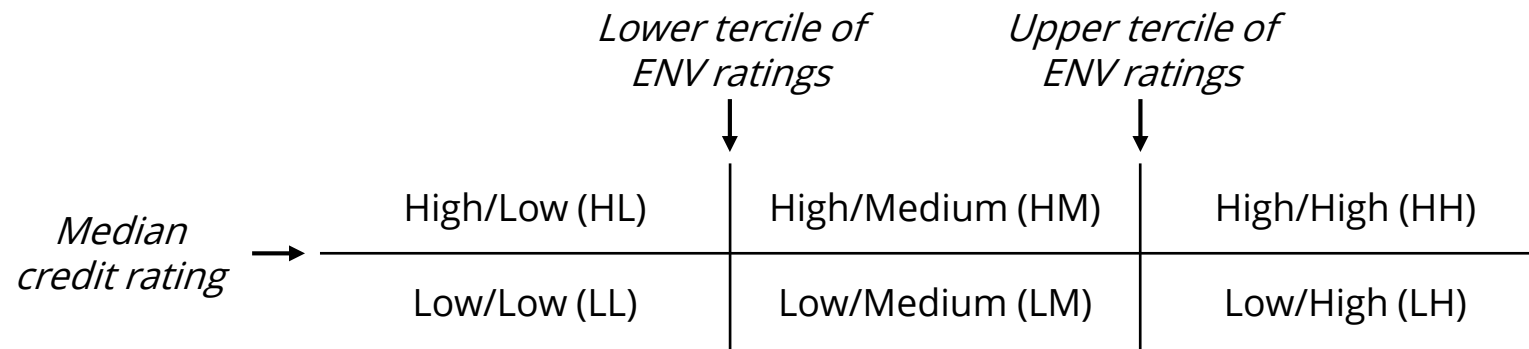
2. **Is the time-varying market valuation of ESG a determinant of CDS spread changes?**

   - Fama and French-style ESG factors to capture time-varying market valuation of ESG impact on credit risk

   - Time-series regressions of spread changes explained by ESG factors and controls

Construction of ESG factors following Fama/French (1993, 2015)

- **ENV-factor related to environmental pillar:**

  1. Assignment of firms to six equal-weighted portfolios (monthly update and rebalancing):


  Lower tercile of ENV ratings   Upper tercile of ENV ratings

  Median credit rating →

	High/Low (HL)	High/Medium (HM)	High/High (HH)
	Low/Low (LL)	Low/Medium (LM)	Low/High (LH)

  2. Calculate ENV factor as returns on long-short portfolio, long in low ENV and short in high ENV firms:

$$ENV_t = 0{,}5(HH_t + LH_t) - 0.5(HL_t + LL_t)$$

- SOC_t and $CGV_t =$ **factors related to social and governance**

Cumulative ESG factors over time
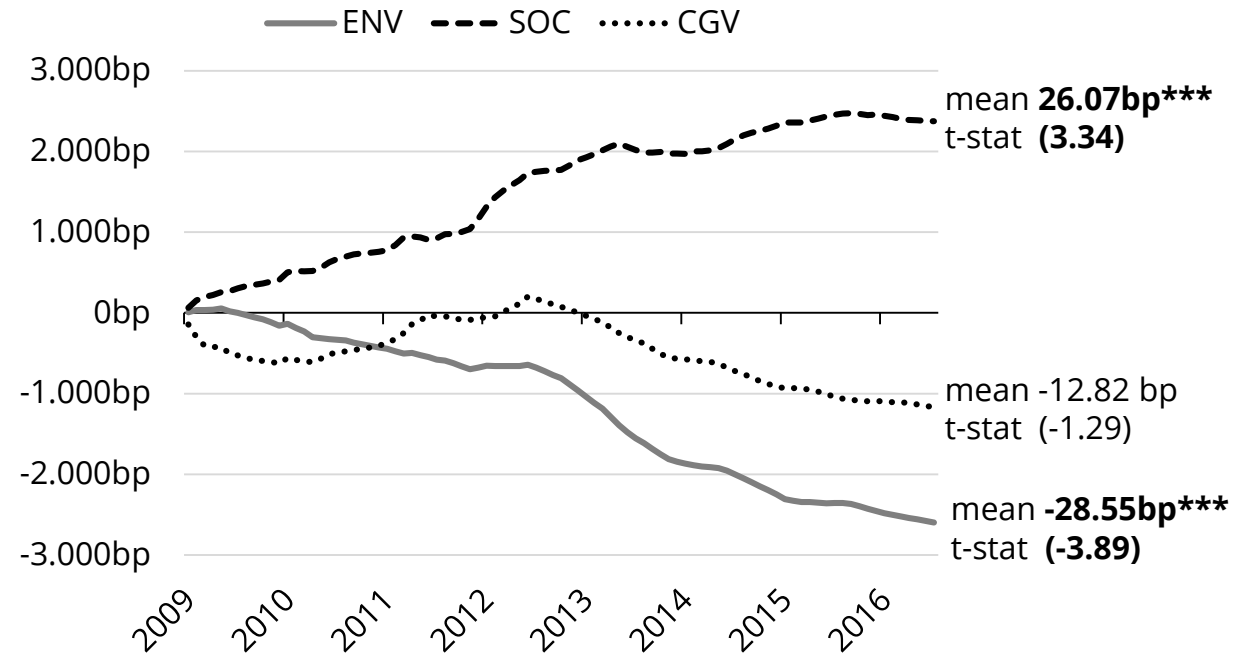
ESG factors are intended to cover market valuation of market-perceived ESG impact on credit risks over time

Time-series analysis – ENV factor explaining spread changes

- **Two estimations for each firm *i***

$$\text{4F-M:} \quad \Delta S_{i,t} = \alpha_i + \beta_i^{RET} RET_{i,t} + \beta_i^{VOL} \Delta VOL_{i,t} + \beta_i^{HML} HML_t + \beta_i^{MRI} \Delta MRI_{i,t} + \varepsilon_{i,t}$$

$$\text{5F-ENV:} \quad \Delta S_{i,t} = \alpha_i + \beta_i^{RET} RET_{i,t} + \beta_i^{VOL} \Delta VOL_{i,t} + \beta_i^{HML} HML_t + \beta_i^{MRI} \Delta MRI_{i,t} + \boxed{\beta_i^{ENV} \Delta ENV_t} + \varepsilon_{i,t}$$

- **Sort firms into quintiles based on their exposures to the ENV factor** β_i^{ENV}

- **Calculate average changes in R²** between 4F-M and 5F-ESG indicate **explanatory power of time-varying market-perception of ESG** regarding **changes in credit spreads**

Time-series regressions: Portfolio descriptives and results on ENV factor

	Q1 (low exp.)	Q2	Q3	Q4	Q5 (high exp.)
		ENV exposure quintiles			
MRI	0,51	0,53	0,64	0,44	1,05
	(5,22)	(21,91)	(7,59)	(9,25)	(12,32)
adj. R2 (without ENV, %)	42,69	50,31	47,00	45,97	48,80
MRI	0,56	0,53	0,63	0,46	1,15
	(7,45)	(21,93)	(7,61)	(9,71)	(11,73)
ENV	-0,44	0,01	0,07	0,17	0,64
	(-2,44)	(4,7)	(26,01)	(20,48)	(7,54)
adj. R2 (with ENV, %)	44,00	49,86	47,71	48,18	53,80
chg adj. R2	**1,32*****	-0,46	**0,71***	**2,21*****	**5,00*****

- **Significant increases in R^2** → ENV factor adds explanatory power regarding changes in credit spreads
- **Green** firms (Q5) exhibit **decreases** in spreads that **cannot** be explained by common factors
- Rather: ENV factor explains decreases → consistent with markets' rising awareness of environmental risks

Summary

1. **Is ESG a determinant of credit spreads in the cross-section of firms?**

   - **Yes**

   - **28bp** higher spreads for firms with **lowest E-rating → Risk-mitigation →** environmental innovation capacity

   - **24bp** higher spreads for firms with **highest S-rating → Overinvestment →** Human Rights + Product Responsiblity

2. **Is the time-varying market valuation of ESG a determinant of CDS spread changes?**

   - **Yes**

   - **ESG factors** intend to cover market valuation of market-perceived ESG impact on credit risks over time

   - ENV factor **increases explanatory power** of standard models explaining credit spread changes pointing to **some credit spread varation** being **driven by time-varying market valuation of ENV risks**

Outlook

- **Update of data (ongoing):** Markit CDS spreads (available from 2002) and MSCI ESG ratings

- **Term structure and slope of credit curve?**

- **Impact of ECB's QE program?** Robust results when leaving out 04/2016+

- **ESG as indicator for future changes of credit risk?** Changes in ESG to explain subsequent changes in credit spreads

- **Which components of spreads are affected by ESG?** Credit, liquidity or both components of CDS spreads?