Do ESG investors care about carbon emissions? Evidence from securitized auto loans

Christian Kontz
Stanford GSB

GRASFI Singapore

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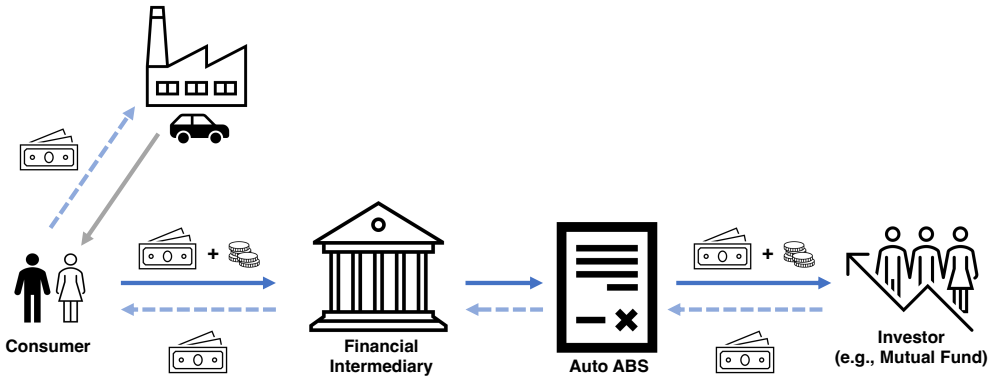
Does ESG investing raise the cost of emitting CO_2?



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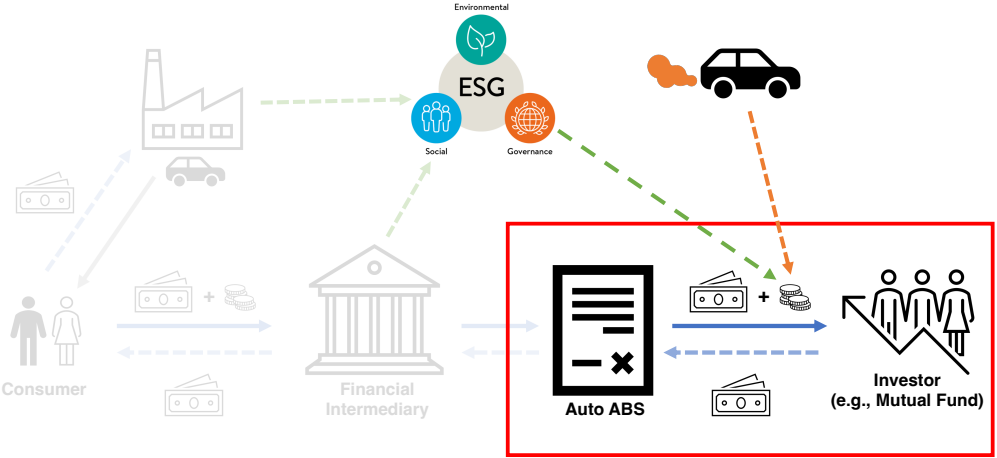

1. Measure influence of **greenness** (CO_2 vs. ESG) on **cost of capital** of auto ABS

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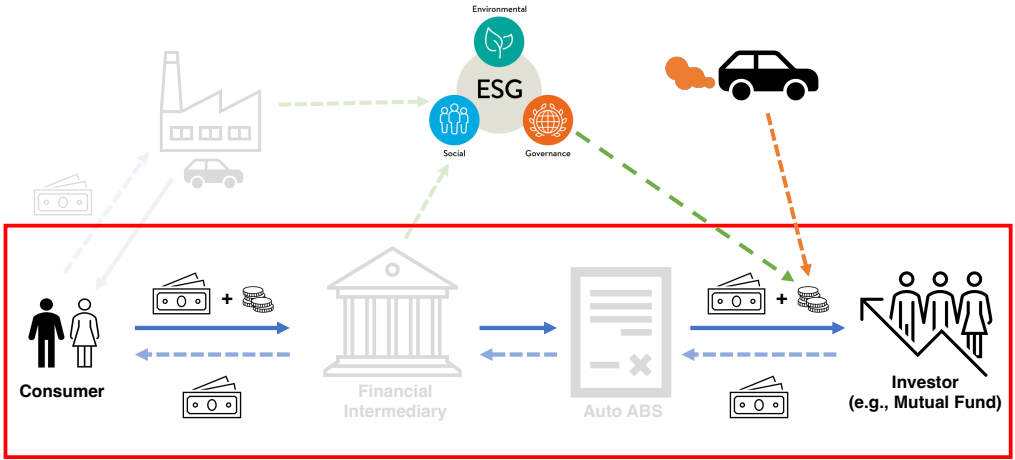

1. Measure influence of **greenness** (CO_2 vs. ESG) on **cost of capital** of auto ABS
2. Measure **pass-through** of **greenium** to **consumer rates** and **credit demand**

Preview of Results

- High firm-level ESG scores lower the cost of capital of auto loan securitizations
  - Flows into ESG funds drive differences in cost of capital: \$200m $\rightarrow$ -3 bps
  - ESG convenience yield quadrupled from 0.12% in 2017 to 0.46% in 2022

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- Consumers financing vehicles with captive lenders benefit from ESG convenience yield
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➠ Measure pass-through to consumer rates and real effects of ESG investing

- Market's focus on issuer ESG scores *lowers* cost of capital for high-emissions vehicles
  - ESG funds invest more in high-emissions deals
  - Positive correlation of CO_2 and ESG leads to CO_2 subsidy

➠ Test assumption that *green* premium increases cost of CO_2 emissions

Data Sources

- **Auto ABS with detailed loan-level information:** new regulatory filings from SEC
  - 281 auto ABS deals of 22 originators from 2017 to 2022
  - 17.7m vehicle loans originated from 2010 to 2022

▸ Deal Summary Statistics ▸ Loan Summary Statistics

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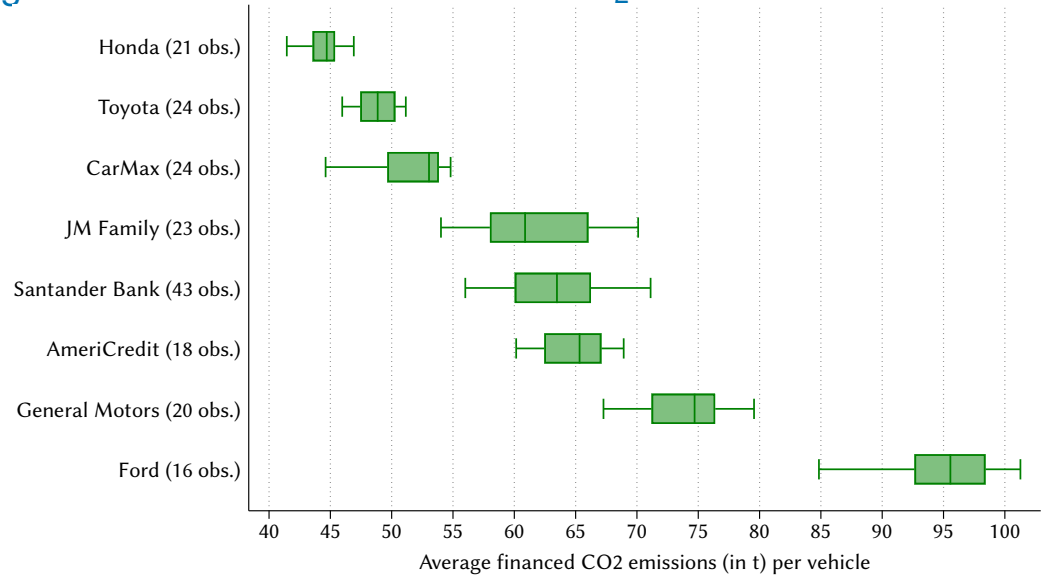
- **Firm-level ESG scores of issuers:** Refinitiv, Sustainalytics, S&P
  - ESG scores are *firm*-level not *security*-level
  - Additional data on firm-level CO_2 emissions from TruCost

▸ Deal Summary Statistics ▸ Loan Summary Statistics

Large cross-sectional differences in CO_2 content across issuers



▸ Calculation of carbon emissions ▸ tCO2 per vehicle incl. production ▸ tCO2 per USD vehicle incl. production

Do Green assets have a lower cost of capital?

Simple asset pricing framework with green convenience yields

- Euler equation with green convenience yield λ_t

$$\mathbb{E}_t \left[M_{t+1} R^i_{t+1} \right] = \exp\left(-\beta^i \lambda_t \right)$$

- Asset *i*'s greenness is $\beta^i \in [0, 1]$ where $\beta^{\text{Green}} > \beta^{\text{Brown}}$

- Use Campbell-Shiller approximation and log-normality to express yield as

$$\text{Yield}^i = -\beta^i \lambda_t + \text{risk premium} - \text{cash flow growth}$$

- For green and brown asset with similar risk premium and cash flow growth

$$\text{Yield}^{\text{Green}} - \text{Yield}^{\text{Brown}} = -(\beta^{\text{Green}} - \beta^{\text{Brown}})\, \lambda_t$$

▸ Detailed identification strategy

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- **Identification in a nutshell:** AAA-rated senior tranches + security design + prepayment

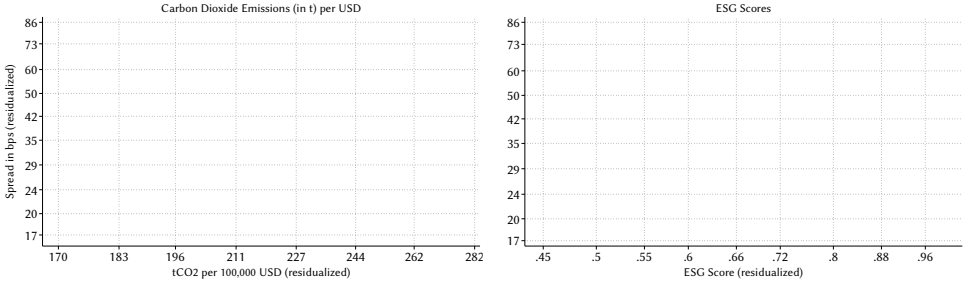
▸ Detailed identification strategy

Test of identification strategy: neither CO_2 nor ESG predict prepayment or default

(in σ units)	Δ Realized to Assumed Prepayment				Realized % Delinquent Loans (30d+)			
Financed tCO2 per USD	0.073				0.025			
	(0.139)				(0.029)			
Financed tCO2 per Vehicle		-0.023				-0.030		
		(0.133)				(0.024)		
Refinitiv ESG Score			-0.031				0.077	
			(0.152)				(0.081)	
S&P ESG Score				0.044				0.127
				(0.153)				(0.099)
Subprime FE					✓	✓	✓	✓
Adj. R^2	0.005	0.001	0.001	0.002	0.899	0.899	0.902	0.905
Observations	281	281	243	243	281	281	243	243

$$\text{Prepayment}_i/\text{Default}_i = \beta_0 + \beta_1 \times \text{CO2}_i/\text{ESG}_i + \varepsilon_i$$

Naive Model



Issuance Spread $=$ Green $+$ Market Conditions $+ \varepsilon$

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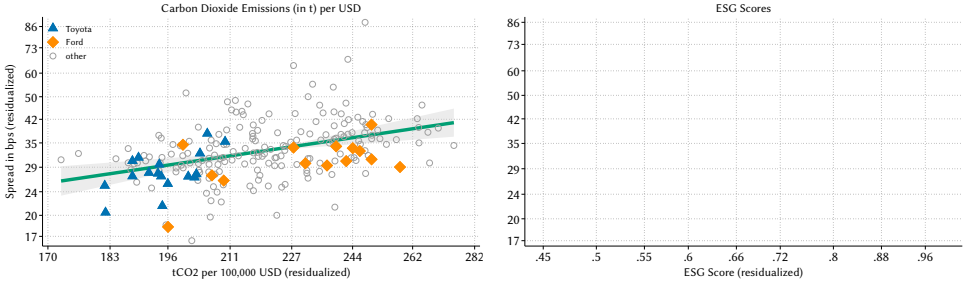

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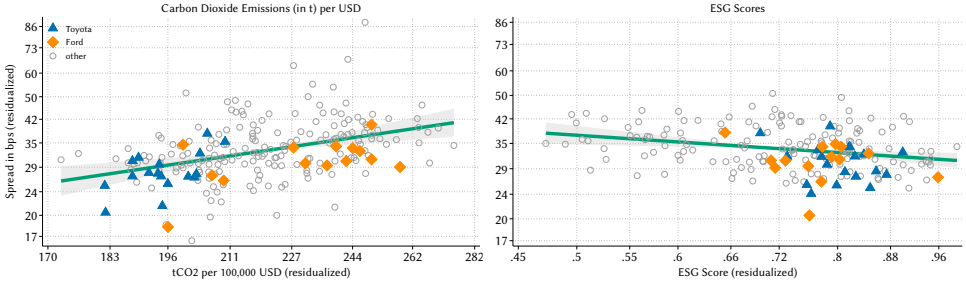

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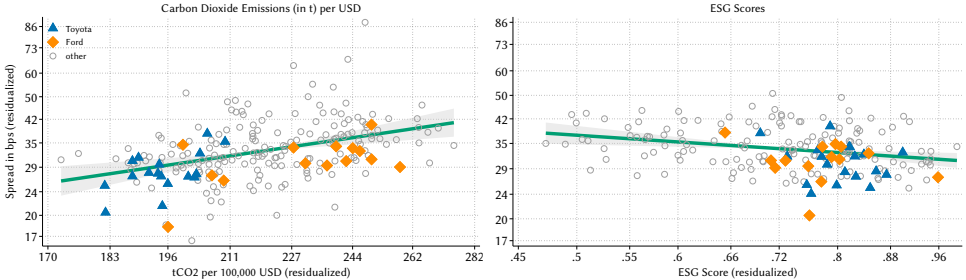
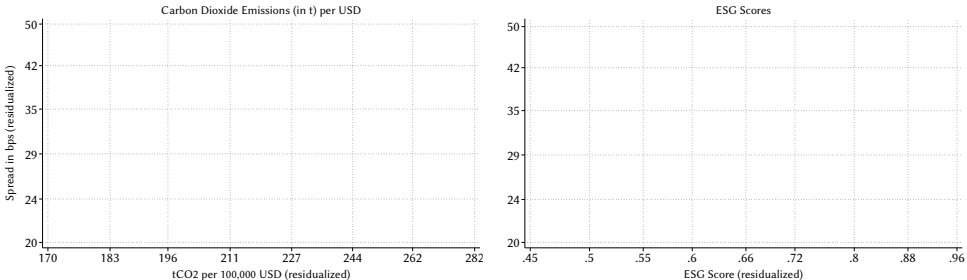


$$\text{Issuance Spread} = \text{Green} + \text{Market Conditions} + \text{Security Design} + \text{Prepayment} + \varepsilon$$

Risk-adjusted Model



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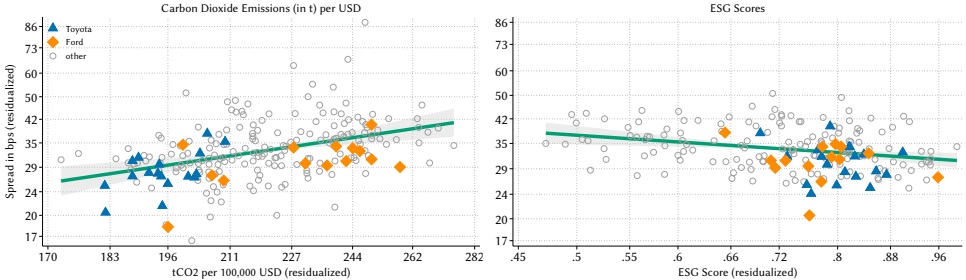

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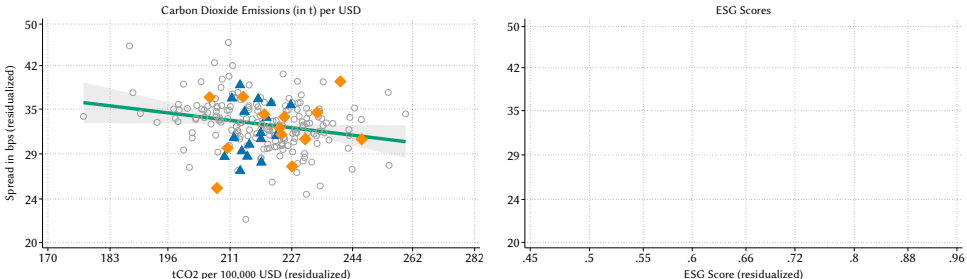

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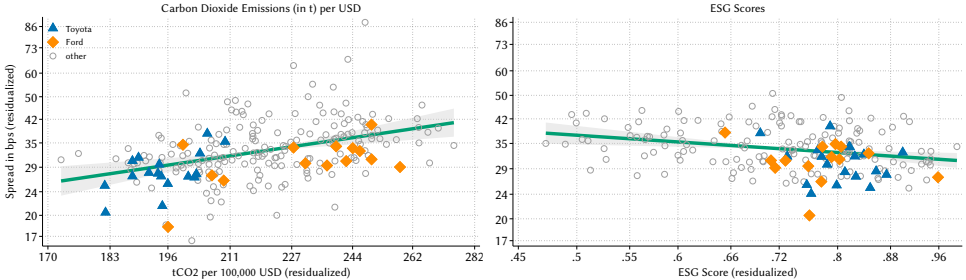

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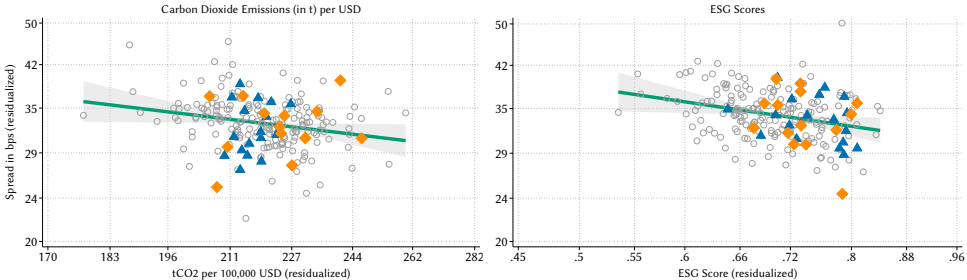
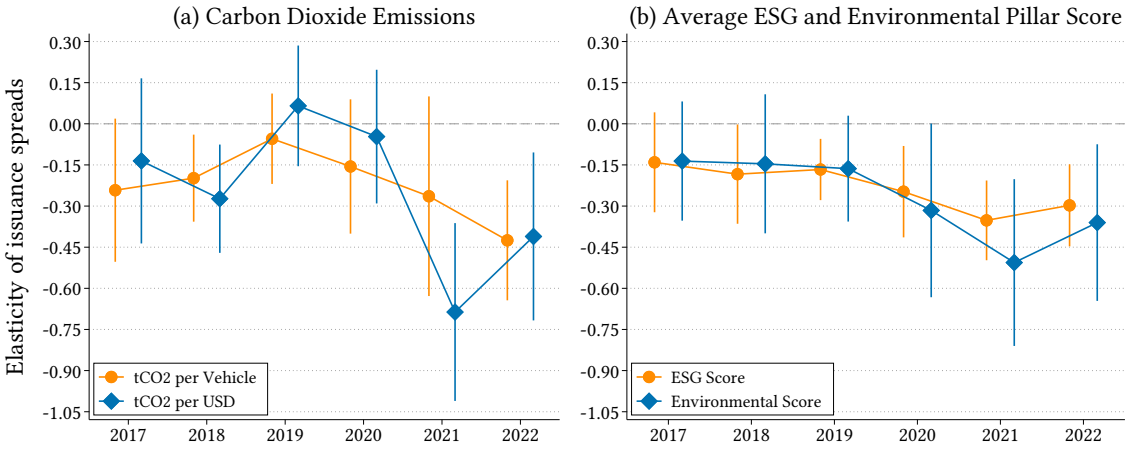


Pricing of CO_2 and ESG follow similar time trends



$$\text{Spread} = \textbf{CO2} \times \text{Year} + \ldots + \varepsilon$$

$$\text{Spread} = \textbf{ESG} \times \text{Year} + \ldots + \varepsilon$$

ESG scores win horse race over CO_2 in pricing ABS

	Dependent variable: Issuance Spread							
Financed **tCO2** per Vehicle	-0.237**				-0.113		-0.0842	
	(0.072)				(0.069)		(0.093)	
Financed **tCO2** per USD		-0.204+				-0.0843		-0.146
		(0.116)				(0.111)		(0.123)
S&P **issuer ESG** Score			-0.145**		**-0.118***	**-0.139****		
			(0.048)		**(0.047)**	**(0.047)**		
Refinitiv **issuer ESG** Score				-0.341**			**-0.297***	**-0.350*****
				(0.106)			**(0.128)**	**(0.101)**
Year-month FE, daily market controls	✓	✓	✓	✓	✓	✓	✓	✓
Prepayment speed FE, tranche controls	✓	✓	✓	✓	✓	✓	✓	✓
Ex-ante prepayment controls	✓	✓	✓	✓	✓	✓	✓	✓
Ex-post prepayment controls	✓	✓	✓	✓	✓	✓	✓	✓
Observations	276	276	235	235	235	235	235	235

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001. Standard errors in parentheses are clustered at issuance year-month level. All variables in logs.

$$\text{Spread} = \textbf{CO2} + \textbf{Issuer ESG} + \text{Market Conditions} + \text{Sec. Design} + \text{Prepayment} + \varepsilon$$

▸ Robustness

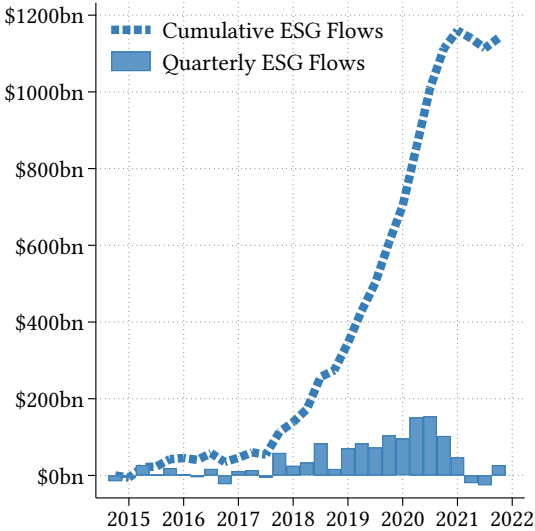
Firm-level ESG scores positively correlate with CO_2 of auto ABS

	Refinitiv ESG score	**S&P ESG score**	Financed tCO2/Vehicle	Financed tCO2/USD	Avg. MPG	GHG Rating
Refinitiv ESG Rating	1.00					
S&P ESG Rating	0.85	1.00				
Fin. tCO2/Vehicle	**0.50**	**0.41**	1.00			
Fin. tCO2/USD	**0.36**	**0.34**	0.55	1.00		
Avg. MPG $\times(-1)$	0.32	0.25	0.83	0.42	1.00	
EPA GHG Rating $\times(-1)$	0.27	0.15	0.75	0.19	0.86	1.00

MPG and GHG Rating are multiplied by (-1) such that higher values are environmentally worse. N = 235

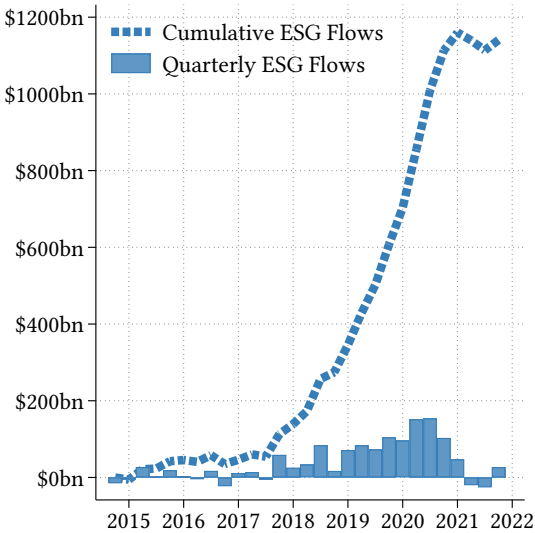
▸ Firm-level CO2 emissions and ESG scores ▸ Under the hood of ESG scores

Flows into ESG funds drive differences in cost of capital



- Flow data from Van der Beck (2023)

Flows into ESG funds drive differences in cost of capital: $200bn → -3 bps



- Flow data from Van der Beck (2023)

	Dependent variable: Issuance Spread			
Average ESG Score	-0.241*	-0.043		
	(0.101)	(0.130)		
ESG Flow ($100bn) × Average ESG Score	**-0.050***			
	(0.022)			
Cum. ESG Flow ($100bn) × Avg. ESG Score		**-0.023***		
		(0.009)		
Average Environmental Score			-0.260	-0.135
			(0.185)	(0.191)
ESG Flow ($100bn) × Avg. Env. Score			**-0.077***	
			(0.033)	
Cum. ESG Flow ($100bn) × Avg. Env. Score				**-0.034****
				(0.012)
Year-month FE, daily market controls	✓	✓	✓	✓
Prepayment speed FE, tranche controls	✓	✓	✓	✓
Ex-ante prepayment controls	✓	✓	✓	✓
Ex-post prepayment controls	✓	✓	✓	✓
Adj. R^2	0.956	0.956	0.954	0.955
Observations	194	194	194	194

$$\text{Spread} = \text{ESG} \times \text{Flows into ESG Fund} + \ldots + \varepsilon$$

Lower cost of capital for brown auto ABS with high ESG is robust

- **Magnitudes:** moving from 20th to 80th percentile
  - ESG subsidy $\approx$ 10 bps (0.31 sd)
  - CO_2 subsidy $\approx$ 6 bps (0.20 sd)

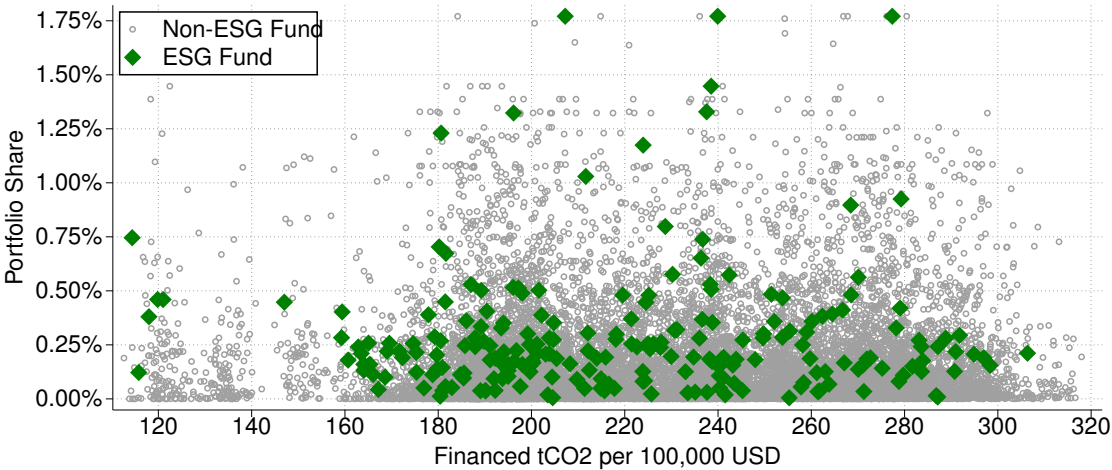
- **Robustness:**

  Different samples and measures
  - Other measures of Greenness ‣ Results
  - Prime auto ABS only ‣ Results
  - Other senior tranches ‣ Results

  Different estimators
  - Propensity score matching ‣ Results
  - Double-Lasso estimator ‣ Results
  - Leave-one-out estimates ‣ Results

Do ESG funds hold greener assets?

ESG funds do not discriminate between low and high CO_2 auto ABS



ESG funds focus on ESG scores instead of environmental impact

*"When **evaluating securitized debt** securities, the Adviser generally considers the **issuer's ESG score** along with ESG factors related to the underlying pool of assets, such as energy efficiency and **environmental impact** of the **underlying assets**"*

(in σ units)	Dependent var.: Portfolio Share		
ESG Fund=1 $\times$ Financed tCO2 per vehicle	0.154*		0.107
	(0.069)		(0.084)
ESG Fund=1 $\times$ ESG score of issuer		0.157**	0.145**
		(0.060)	(0.059)
Fund FE, ABS Deal FE	✓	✓	✓
Issuer $\times$ Year-Quarter FE	✓	✓	✓
Adj. R^2	0.821	0.821	0.821
Observations	10,111	10,111	10,111

Standard errors in parentheses clustered at fund-level. * p<0.05, ** p<0.01, *** p<0.001.

$$\text{Portfolio Share} = \text{ESG Fund} \times \text{Green} + \text{Fund FE} + \text{ABS FE} + \text{Issuer} \times \text{Quarter FE} + \varepsilon$$

▸ Identification strategy ▸ Data

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Impact of ESG investing on consumer loan demand

Can ESG investing "move the needle" in financing clean vehicles?

$$\partial \log \text{Loan demand} = \underbrace{\frac{\partial \log \text{Loan demand}}{\partial \log \text{Consumer rate}}}_{\text{Price Elasticity}} \times \underbrace{\frac{\partial \log \text{Consumer rate}}{\Delta \text{ ABS spread}}}_{\text{Pass-thru Elasticity}} \times \underbrace{\Delta \text{ ABS spread}}_{= -10 \text{ bps}}$$

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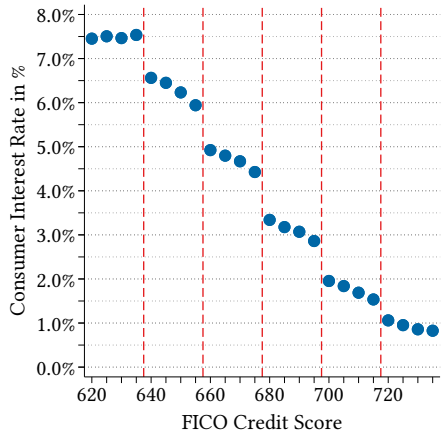
- How does loan demand respond to changes in consumer rate?

$$q_i = \alpha + \epsilon \times \hat{r}_i + \ldots + \nu_i$$

- $\dfrac{\partial \log \text{Loan demand}}{\partial \log \text{Consumer rate}} \approx -0.3$

- Similar to estimates in literature
  - Argyle et al ('20) ≈ -0.18
  - Lukas ('17) ≈ -0.34



Other issuers' discontinuities

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- How do consumer rates react to ABS spreads?

$$\log \text{Consumer rate}_i = \varepsilon \times \widehat{\text{ABS Spread}}_{o,t-1} + FE + \nu_i$$

$$FE : \text{Originator}/\text{Time} \times \left\{ \begin{array}{c} \text{state} \times \text{vehicle type} \times \text{LTV} \times \text{loan term} \\ \times \text{ credit score bin} \times \text{warehousing time} \end{array} \right\}$$

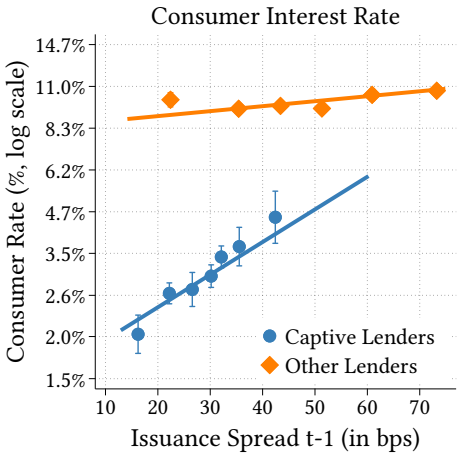
Instrument for ABS spread: corporate AAA bond spread

- Heterogeneous pass-thru elasticities

  Low: Bank lenders $\varepsilon \approx 0.1$

  High: Captive lenders $\varepsilon \approx 0.9$

teaser/subvented rates



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Price Elasticity

Pass-thru Elasticity

$\partial \log$ Loan demand

Δ Loan demand in USD

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Price Elasticity	-0.18 (Argyle et al. '20)	-0.34 (Lukas '17)
Pass-thru Elasticity		
$\partial \log$ Loan demand		
Δ Loan demand in USD		

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Price Elasticity	-0.18 (Argyle et al. '20)		-0.34 (Lukas '17)	
Pass-thru Elasticity (captive lenders)	0.80	1.06	0.80	1.06
$\partial \log$ Loan demand				
Δ Loan demand in USD				

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Pass-thru Elasticity (captive lenders)	0.80	1.06	0.80	1.06
$\partial \log$ Loan demand	2.1%	3.3%	2.72%	4.0%
Δ Loan demand in USD	\$729	\$1,072	\$898	\$1,320

Conclusion

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- Higher issuer ESG lower the cost of capital of auto ABS
  - ESG captial flows drive results: \$200bn $\rightarrow$ -3bps
  - ESG convenience yield quadrupled from 0.12% in 2017 to 0.46% in 2022

- Consumers benefit from ESG convenience yield
  - High pass-thru by captive auto lenders -27 bps
  - Implied change in loan demand of approx. \$900

- ESG scores do not capture large differences in CO_2
  - e.g., Ford ABS 2x CO_2 content of Honda ABS
  - ESG scores positively correlated with CO_2

- Focus on ESG scores of issuers leads to CO_2 subsidy
  - Brown auto ABS deals have lower cost of capital
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Appendix

Loan level data allows us to calculate CO_2 emissions of auto ABS

- We know make and model of car loan, i, in bond, b, and thus amount of CO_2 financed

$$\mathbb{E}_t\left[\text{Financed } CO_2 \text{ Emissions}\right]_b = \sum_{i \in b} CO_2 \text{ Emissions}_i \times \mathbb{E}_t\left[\text{Survival Weighted Miles}\right]_i \times \text{LTV}_{0,i} \times \text{Outstanding Balance Share}_{it}$$

- e.g., new 2022 Toyota Camry Hybrid
  - 124 gCO_2/km $\times$ 21000km/year $\times$ 12 years $\times$ 90% $\times$ 90% $\approx 25t$ of CO_2
- e.g., new 2022 Ford F-150 Truck
  - 295 gCO_2/km $\times$ 25000km/year $\times$ 15 years $\times$ 90% $\times$ 90% $\approx 90t$ of CO_2

back

Summary statistics of A-2 tranches from 2017 to 2022

back

	Mean	SD	Median	Min	Max	N
Total Deal Size ($ m)	1,234.93	344.47	1,250.00	367.31	2,663.82	281
Tranche Size	366.71	131.99	362.00	42.40	746.94	281
Weight. Avg. Life	0.98	0.32	1.01	0.37	3.50	281
Spread (bps)	41.68	29.10	32.29	6.13	194.22	281
Coupon (%)	1.91	1.30	1.86	0.14	5.81	281
Subprime ABS	0.28	0.45	0.00	0.00	1.00	281
Captive Lender	0.38	0.49	0.00	0.00	1.00	281
Number of Loans	66,952	25,499	66,011	15,212	180,352	281
Used Vehicles Share	0.42	0.34	0.30	0.02	1.00	281
Mean Credit Score	706.20	74.85	738.43	564.98	788.46	281
Expected tCO2 per $100,000	292.83	51.42	296.31	161.51	456.16	281
Financed tCO2 per $100,000	219.58	40.08	211.15	107.10	311.78	281
Average Exp. tCO2 per Vehicle	70.51	15.55	67.61	42.94	125.73	281
Average Financed tCO2 per Vehicle	58.01	12.76	54.49	40.54	101.27	281

Summary statistics of auto loans in ABS pools

back

	Mean	SD	Median	Min	Max	Obs.
Original Interest Rate	7.84	7.00	5.25	0.00	30.00	17,823,551
Original Loan Amount ($)	25,822.58	12,251.91	23,650.84	518.03	248,681.95	17,823,552
Original Loan Term (months)	67.65	8.59	72.00	7.00	96.00	17,823,552
Credit Score	708.64	101.70	719.00	250.00	900.00	17,143,023
Payment-to-Income Share	0.08	0.05	0.08	0.00	0.79	17,700,290
Income Verified	0.09	0.29	0.00	0.00	1.00	17,823,552
Loan-to-Value	0.90	0.16	1.00	0.01	1.00	17,822,211
Outstanding Balance Share	0.83	0.24	0.93	0.00	1.00	17,823,548
Vehicle Value Amount ($)	27,341.46	13,177.32	24,998.00	0.00	1,084,455.00	17,823,549
Vehicle Age (Years)	2.74	2.56	2.00	0.00	35.00	17,823,552
Used Vehicle	0.48	0.50	0.00	0.00	1.00	17,823,552
SVM, Financed	161,660.73	40,008.49	171,346.10	254.15	240,728.61	17,823,552
SVM, Total	202,834.40	16,986.18	207,738.97	189,173.82	240,728.61	17,823,552
tCO2, total Lifetime	78.28	30.61	72.45	0.00	538.75	17,823,552
tCO2, remaining Lifetime	62.12	29.51	56.48	0.00	538.75	17,823,552
tCO2, financed remaining Lifetime	46.57	27.79	44.58	0.00	538.75	17,822,207

Identification strategy for green yield spread

back

- Identify effects of Green preferences from variation across bond pools

$$\text{Spread} = \text{Green} + \varepsilon$$

- Identifying assumption: assignment of Green uncorr. with ε conditional on risk factors

Identification strategy for green yield spread

back

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$$\text{Spread} = \text{Green} + \varepsilon$$

- Identifying assumption: assignment of Green uncorr. with ε conditional on risk factors
  - Credit risk $\rightarrow$ focus only on the safest AAA-rated senior tranches
  - Prepayment risk $\rightarrow$ control for borrower and loan characteristics

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- Prepayment Risk
  - Ex-ante predictors: interest rate, credit score, LTV, outstanding balance, warehousing time
  - Ex-post realizations: difference to assumed prepayment speed, realized delinquency rate (30d+)

Identification strategy for green yield spread

back

- Identify effects of Green preferences from variation across bond pools

$$\text{Spread} = \text{Green} + \text{Prepayment Risk} + \text{Market Conditions} + \text{Security Design} + \varepsilon$$

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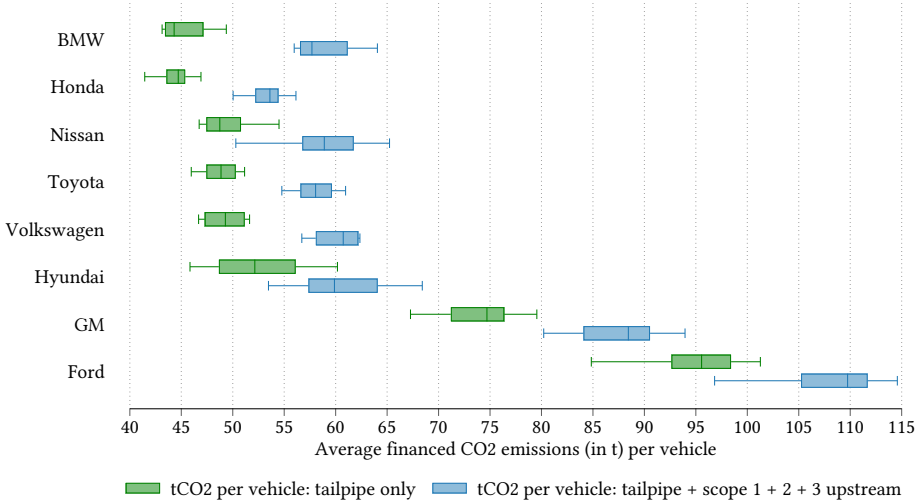
  - Ex-ante predictors: interest rate, credit score, LTV, outstanding balance, warehousing time
  - Ex-post realizations: difference to assumed prepayment speed, realized delinquency rate (30d+)

Even within-issuer lower cost of capital for high-ESG issuers

	(1) Issuance Spread	(2) Issuance Spread	(3) Issuance Spread	(4) Issuance Spread	(5) Issuance Spread	(6) Issuance Spread
High ESG (score>p50)	-0.0694	-0.0617				
	(0.0429)	(0.0393)				
Refinitiv ESG Score			-0.238	-0.212		
			(0.197)	(0.176)		
S&P ESG Score					-0.0847^{+}	-0.108*
					(0.0500)	(0.0496)
Issuer FE	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Year-month FE, daily market controls	Yes	Yes	Yes	Yes	Yes	Yes
Assumed prepayment speed FE	Yes	Yes	Yes	Yes	Yes	Yes
Other tranche characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Ex-ante prepayment controls	Yes	Yes	Yes	Yes	Yes	Yes
Ex-post prepayment controls	No	Yes	No	Yes	No	Yes
Adj. R^2	0.979	0.981	0.979	0.981	0.947	0.949
Within R^2	0.330	0.397	0.316	0.387	0.416	0.429

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Accounting for production does not change ranking



back

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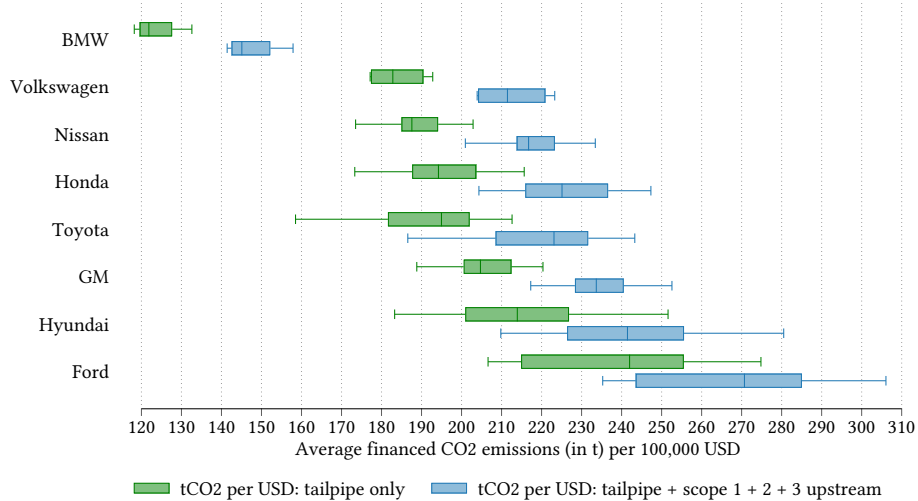

back

Even at firm-level ESG score are at best uninformative about CO_2

- Do ESG scores reflect environmental impact of production?

$$\text{Issuer ESG score}_{it} = \beta \times (\text{Issuer Scope 1 + 2 Emissions})_{it} + \varepsilon_{it}$$

	(1) S&P ESG	(2) Refinitiv ESG	(3) S&P Env.	(4) Refinitiv Env.	(5) S&P ESG	(6) Refinitiv ESG	(7) S&P Env.	(8) Refinitiv Env.
Issuer Scope 1+2/Revenue	0.373	0.307	0.391	0.398				
	(0.289)	(0.249)	(0.279)	(0.258)				
Issuer Scope 1+2 in level					0.309	0.370^{+}	0.377	0.427^{+}
					(0.236)	(0.210)	(0.229)	(0.221)
Adj. R^2	0.138	0.0937	0.152	0.157	0.0957	0.137	0.142	0.182
Observations	99	99	99	99	99	99	99	99

Standard errors are clustered at issuer-level. + p<0.10, * p<0.05, ** p<0.01, *** p<0.001. Coefficients are standardized to unit variances.

back

Emissions make up only 2% to 10% of ESG score depending on industry

back

Refinitiv ESG Score (FY2017 weights)

- **Automobile and auto parts**
  - ESG = $0.10 \times$Emissions + $0.08 \times$Resource use + $0.16 \times$Innovation+ $0.42 \times$S + $0.24 \times$G
- **Banking Services**
  - ESG = $0.02 \times$Emissions + $0.02 \times$Resource use + $0.10 \times$Innovation + $0.50 \times$S + $0.36 \times$G

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- *"The emission reduction score measures a company's commitment and effectiveness towards reducing environmental emissions in its production and operational processes."*

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- *"The resource use score reflects a company's performance and capacity to reduce the use of materials, energy or water, and to find more eco-efficient solutions by improving supply chain management."*

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	Emissions Score			
tCO2 Emissions per USD	0.243			
	(0.204)			
tCO2 Emissions per vehicle		0.288		
		(0.170)		
Avg. MPG×(−1)			0.169	
			(0.273)	
Avg. GHG Rating×(−1)				0.0604
				(0.134)
Manufacturer=1	0.286**	0.238**	0.239*	0.224*
	(0.0897)	(0.0760)	(0.0839)	(0.0845)
P-value $\beta < 0$	0.125	0.055	0.272	0.329
Adj. R^2	0.379	0.430	0.347	0.316
Observations	243	243	243	215

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  - ESG = 0.10×Emissions + 0.08×Resource use + 0.16×Innovation+ 0.42×S + 0.24×G
- **Banking Services**
  - ESG = 0.02×Emissions + 0.02×Resource use + 0.10×Innovation + 0.50×S + 0.36×G

	Resource use Score			
tCO2 Emissions per USD	0.236			
	(0.215)			
tCO2 Emissions per vehicle		0.391^{+}		
		(0.189)		
Avg. MPG×(−1)			0.424	
			(0.299)	
Avg. GHG Rating×(−1)				0.292
				(0.185)
Manufacturer=1	0.233^{+}	0.188^{+}	0.197^{+}	0.179
	(0.112)	(0.0896)	(0.0981)	(0.103)
P-value $\beta < 0$	0.144	0.027	0.088	0.067
Adj. R^2	0.215	0.330	0.225	0.199
Observations	243	243	243	215

Consumer ABS that finance high-emissions vehicles have lower cost of capital

	(1) Issuance Spread	(2) Issuance Spread	(3) Issuance Spread	(4) Issuance Spread	(5) Issuance Spread	(6) Issuance Spread	(7) Issuance Spread	(8) Issuance Spread	(9) Issuance Spread	(10) Issuance Spread
Expected tCO2 per USD	-0.211^{+}	-0.266*								
	(0.112)	(0.110)								
Financed tCO2 per Vehicle			-0.214**	-0.256**						
			(0.0726)	(0.0762)						
Avg. MPG $\times$ (-1)					-0.202	-0.280*				
					(0.128)	(0.133)				
Avg. Share of Trucks							-0.215^{+}	-0.276*		
							(0.109)	(0.128)		
Avg. GHG Rating (KBRA) $\times$ (-1)									-0.131	-0.228^{+}
									(0.122)	(0.134)
Year-month FE, daily market controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Prepayment speed FE, tranche controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ex-ante prepayment controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ex-post prepayment controls		✓		✓		✓		✓		✓
Adj. R^2	0.947	0.954	0.949	0.955	0.947	0.953	0.947	0.953	0.938	0.949
Observations	276	276	276	276	276	276	276	276	243	243

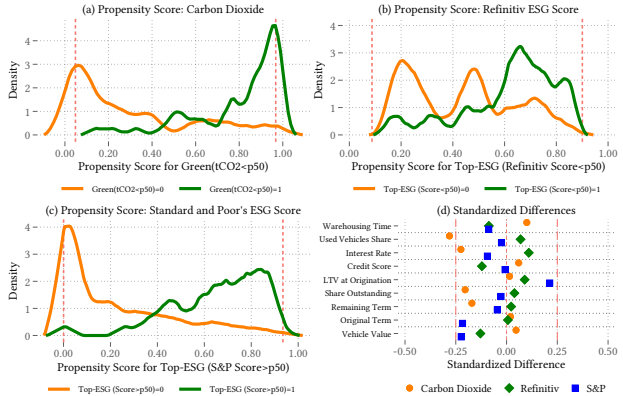
$$\text{Spread} = \text{Environmental Impact} + \text{Prepayment Risk} + \text{Time FE} + \text{Deal Features} + \varepsilon$$

▸ back

Propensity Score Matching delivers similar results

	Issuance Spread	Issuance Spread	Issuance Spread
Green (tCO2<p50)	0.236***		
	(0.0616)		
Top-ESG (Refinitiv Score>p50)		-0.136*	
		(0.0590)	
Top-ESG (S&P Score>p50)			-0.128*
			(0.0563)
Time, Subprime, APS FE	Yes	Yes	Yes
Observations	84	174	198
Treated	50	93	77
Control	34	81	121
# Nearest Neighbors	2	2	2

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001



back to robustness

Prime auto loans only

	(1) Issuance Spread	(2) Issuance Spread	(3) Issuance Spread	(4) Issuance Spread	(5) Issuance Spread	(6) Issuance Spread	(7) Issuance Spread	(8) Issuance Spread
Financed tCO2 per USD	-0.160	-0.180						
	(0.107)	(0.111)						
Expected tCO2 per USD			-0.191^{+}	-0.205^{+}				
			(0.104)	(0.107)				
Financed tCO2 per Vehicle					-0.164*	-0.214**		
					(0.066)	(0.071)		
Financed tCO2 per Vehicle							-0.166*	-0.219**
							(0.066)	(0.071)
Year-month FE, daily market controls	✓	✓	✓	✓	✓	✓	✓	✓
Prepayment speed FE, tranche controls	✓	✓	✓	✓	✓	✓	✓	✓
Ex-ante prepayment controls	✓	✓	✓	✓	✓	✓	✓	✓
Ex-post prepayment controls		✓		✓		✓		✓
Adj. R^2	0.955	0.955	0.956	0.955	0.956	0.956	0.956	0.956
Observations	190	190	190	190	190	190	190	190

back

Other tranches

	(1) Issuance Spread	(2) Issuance Spread	(3) Issuance Spread	(4) Issuance Spread	(5) Issuance Spread	(6) Issuance Spread	(7) Issuance Spread	(8) Issuance Spread
	A-3 Tranche				A-4 Tranche			
Financed tCO2 per USD	-0.197*	-0.212*			-0.255***	-0.267***		
	(0.084)	(0.087)			(0.070)	(0.070)		
Financed tCO2 per Vehicle			-0.120*	-0.179*			-0.077	-0.132*
			(0.054)	(0.073)			(0.051)	(0.061)
Year-month FE, daily market controls	✓	✓	✓	✓	✓	✓	✓	✓
Prepayment speed FE, tranche controls	✓	✓	✓	✓	✓	✓	✓	✓
Ex-ante prepayment controls	✓	✓	✓	✓	✓	✓	✓	✓
Ex-post prepayment controls		✓		✓		✓		✓
Adj. R^2	0.948	0.947	0.948	0.947	0.965	0.965	0.963	0.963
Observations	272	272	272	272	190	190	190	190

back

Mutual Funds and Auto ABS

- Mutual Fund holdings data from SEC Form N-PORT
  - Sample from 2019-Q1 to 2022-Q4
  - Observe 266 auto ABS deals
  - on average 24% of total issuance land on MF balance sheets
  - up to 85% for some senior tranches

- Identify ESG funds by their names: 25% ESG-bond funds buy auto ABS
  - Name $\in$ {ESG, Climate, Green, etc.}
  - List of ESG mutual funds from the US Sustainable Investing Forum
  - 35 ESG-bond funds and 787 non-ESG funds

back

Are ESG mutual funds greener than non-ESG funds?

- ESG fund prospectus provide details about their approach to ABS:

  *"When **evaluating securitized debt** securities, the Adviser generally considers the **issuer's ESG score** along with ESG factors related to the underlying pool of assets, such as **energy efficiency** and **environmental impact** of the **underlying assets**"*

back

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- Identify preferences from variation in ABS holdings of ESG funds relative to non-ESG

$$\log(\text{Portfolio Share})_{itrb} = \alpha(\text{ESG Fund}_i \times \text{Green}_b) + \gamma_i + \gamma_b + \gamma_r + \zeta' X_t + \varepsilon_{itrb}$$

- where Green $\in$ {issuer ESG score, MPG, CO2 per vehicle}

- Fixed effects:
  - γ_i - Mutual fund
  - γ_b - ABS deal
  - γ_r - Reporting year-quarter

- Tranche controls X_t:
  - Yield, size, maturity

back

Investors earn an convenience yields on ESG assets of 0.28% p.a.

- ESG convenience yield generates seigniorage to issuers of ESG assets

$$\text{ESG convenience yield} = \lambda_t = -\frac{y_t^{\text{Green}} - y_t^{\text{Brown}}}{\beta_t^{\text{Green}} - \beta_t^{\text{Brown}}} \approx \overline{0.28\% \text{ p.a.}}$$

- Comparable against other convenience yields
  - $\approx$ 0.50% p.a. for ESG stocks (Avramov et al. '23)
  - $\approx$ 0.78% p.a. for US Treasurys (Krishnamurthy, Vissing-Jorgensen '12)

back

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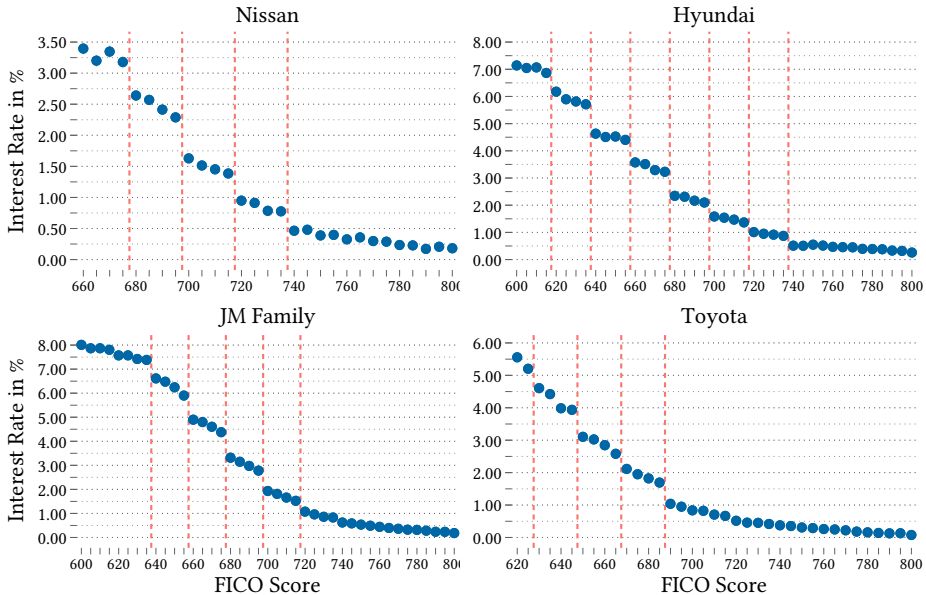
- ESG convenience yield nearly tripled from 2017 to 2022

		2017	2018	2019	2020	2021	**2022**	All
Δ ESG score:	$\beta_t^{\text{Green}} - \beta_t^{\text{Brown}}$	0.29	0.18	0.20	0.15	0.43	0.31	0.32
ESG basis spread (bps):	$y_t^{\text{Green}} - y_t^{\text{Brown}}$	-4	-2	-2	-5	-11	-12	-9
ESG convenience yield (bps):	λ_t	**14**	11	10	34	26	**39**	28
Avg. spread of A-2 tranches (bps):		40	38	31	47	22	72	41

Notes: Estimates of ESG spread using Refinitiv and yearly elasticity from risk-adjusted model. Δ ESG scores between 20th and 80th pctile.

back

Discontinuous pricing rules allows us to back out price elasticity



Probability of “teaser” interest rate depends on the issuance spreads