

How Vehicle Information Informs Credit Risk Measures

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Presenters



Tony Hughes is a Managing Director with Moody's Analytics. As the head of specialized modeling, he leads a team of high caliber modelers to develop innovative solutions that serve the financial services industry.



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Agenda

1. Can Vehicle Information Inform Probability of Defaults?
2. Data and Approach
3. Sizing Up: Ranking Brand and Makes
4. Summary
5. Q&A

Can Vehicle Information Inform Probability of Defaults (PD) for Auto Loans?

Scenario:

- » Two borrowers, both with the same:
 - credit score
 - down payment
 - size loan
- » One is buying an F150, the other is buying an Audi A4.

Does knowing this help us in classifying the borrowers?

We ask two separate questions:

1. Can we use out-of-time residual value forecasts to lift statistics* for credit scores?
2. Can we further use static vehicle information to lift statistics*?

*Kolmogorov-Smirnov statistics

About the Data Source for this Study

- » EDGAR Online: Covers loan level data on all securitized loans and leases in the U.S.
 - Includes basic vehicle information – make, model, model year – and full info on loan performance.
 - We also know whether the vehicle was new at the time of origination.
 - History: January-November 2017. This covers ~16 million separate observations.
- » We use data from January-August to estimate our models and then September-November as a validation sample.
- » We take residual forecasts from AutoCycle. We employ the August run of the model so true out-of-time, out-of-sample residual forecasts are used in all instances.

About our Approach and Method

Universe of securitized auto loans is over-represented by captives and subprime lenders and under-represented by banks.

We use a straightforward logistic regression model:

- » We control for issuer to reflect that different issuers may have different lending standards/practices.
- » We predict monthly conditional default/delinquency probabilities.
 - *Main focus on 60+DPD delinquency rates*
 - *The model includes a nonlinear lifecycle modeled using splines*
- » We control for credit score and key loan parameters.
- » We predict default during the September-November period.
- » We then assess rank ordering ability using Kolmogorov-Smirnov statistics.

Vehicle Information Boosts Rank Ordering Ability

Kolmogorov-Smirnov statistics expressed as a percentage

Days Past Due	FICO Score + Lifecycle + Issuer Dummies	FICO Score + Lifecycle + Issuer Dummies + Residual Forecasts	FICO Score + Lifecycle + Issuer Dummies + Static Vehicle Characteristics	FICO Score + Lifecycle + Issuer Dummies + Residual Forecasts + Static Characteristics
60+	59.61	59.79	60.00	60.07
0+	44.95	45.08	44.99	45.20

Sources: NADA, EDGAR Online, Moody's Analytics

Economic Significance

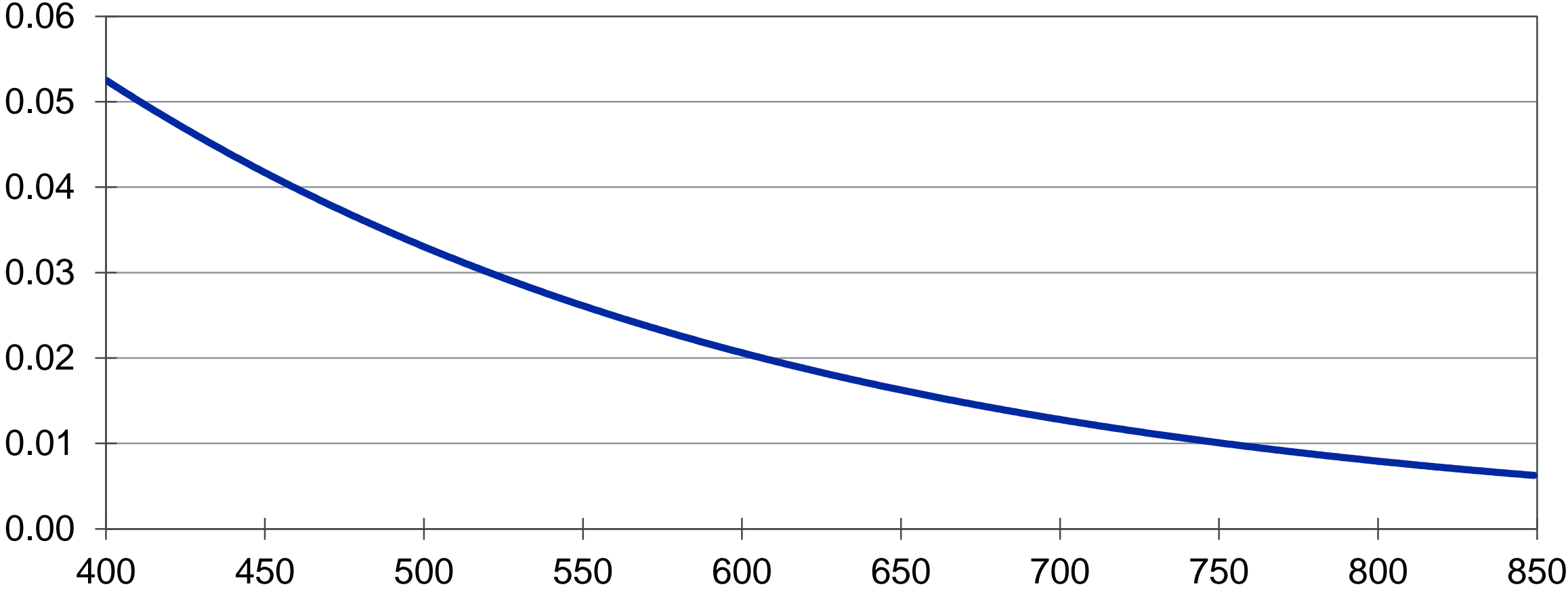
We identify a small but statistically significant “lift” in rank ordering ability.

How meaningful is the lift provided?

- » We choose a subprime issuer and estimate a mapping curve between FICO and estimated PD.
- » We then use our more complex models to calculate PD for different vehicles.
- » We convert this into scores using the mapping curve:
 - A 600 FICO borrower with a 2012 Nissan Leaf has an estimated November PD of 3.6%.
 - A 600 FICO borrower with a 2014 Ford F150 has an estimated November PD of 1.3%.
 - A 3.6% PD maps to a 490 FICO, whereas a 1.3% PD maps to a 697 FICO.

Converting PDs Into Equivalent Credit Scores

Mapping from FICO (x-axis) to 60+ estimated delinquency rate (y-axis)



Sources: NADA, EDGAR Online, Moody's Analytics

In 2017, Compacts Fared Worse Than Trucks

Rankings based on marginal effect in model of 60+ day delinquency

NADA Segment	Coefficient	t-stat	NADA Segment	Coefficient	t-stat
Large Van	-0.22	-1.11	Ultra Luxury/Exotic	0.37	0.94
Luxury Compact Utility	-0.18	-1.02	Sport	0.38	6.63
Mid-Size Van	-0.06	-0.92	Large Car	0.40	8.34
Luxury Large Truck	-0.01	-0.09	Intermediate Subcompact	0.40	10.33
Compact Utility**	0.00		Intermediate Mid-Size	0.42	13.18
Large SUV	0.02	0.25	Upper Compact	0.44	4.64
Mid-Size Utility	0.07	2.12	Intermediate Compact	0.46	14.42
Luxury Sport	0.08	0.47	Luxury Mid-Size	0.50	3.84
Luxury Mid-Size Utility	0.09	0.65	Entry Subcompact	0.66	14.12
Large Pickup	0.09	2.11			

Sources: NADA, EDGAR Online, Moody's Analytics

Japanese Brands Perform Best in Terms of PD

Make	Coefficient	t-stat	Make	Coefficient	t-stat
SUBARU	-0.30	-1.56	FIAT	0.24	1.46
LEXUS	-0.08	-0.59	KIA	0.25	1.75
HONDA	-0.04	-0.31	GMC LIGHT DUTY	0.28	1.85
ACURA**	0.00		LINCOLN	0.29	1.88
SMART	0.03	0.1	FORD	0.29	2.03
MINI	0.03	0.16	CHRYSLER	0.38	2.59
TOYOTA	0.08	0.59	NISSAN	0.40	2.83
FORD TRUCK	0.11	0.75	AUDI	0.41	2.57
CHEVROLET	0.14	0.96	DODGE	0.41	2.89
HYUNDAI	0.15	1.04	DODGE TRUCK	0.44	3.02
VOLVO	0.16	0.78	MERCEDES-BENZ	0.45	3.47
BUICK	0.16	1.14	BMW	0.51	4.02
INFINITI	0.17	0.99	SUZUKI	0.54	2.54
MAZDA	0.18	1.15	JAGUAR	0.58	2.42
JEEP	0.22	1.48	PORSCHE	0.62	2.36
CADILLAC	0.22	1.66	MITSUBISHI	0.63	4.19
VOLKSWAGEN	0.23	1.52	LAND ROVER	0.95	4.52
CHEVROLET TRUCK	0.24	1.66			

Sources: NADA, EDGAR Online, Moody's Analytics

Make Rankings Are Fairly Consistent Over Time

Make	Rank: Jan-Aug	Rank: Sep-Nov	Make	Rank: Jan-Aug	Rank: Sep-Nov
SUBARU	1	3	FIAT	19	16
LEXUS	2	9	KIA	20	21
HONDA	3	1	GMC LIGHT DUTY	21	10
ACURA**	4	6	LINCOLN	22	22
SMART	5	5	FORD	23	18
MINI	6	4	CHRYSLER	24	25
TOYOTA	7	14	NISSAN	25	27
FORD TRUCK	8	19	AUDI	26	30
CHEVROLET	9	8	DODGE	27	32
HYUNDAI	10	17	DODGE TRUCK	28	35
VOLVO	11	2	MERCEDES-BENZ	29	24
BUICK	12	7	BMW	30	26
INFINITI	13	33	SUZUKI	31	29
MAZDA	14	11	JAGUAR	32	23
JEEP	15	28	PORSCHE	33	15
CADILLAC	16	12	MITSUBISHI	34	31
VOLKSWAGEN	17	13	LAND ROVER	35	34
CHEVROLET TRUCK	18	20			

Sources: NADA, EDGAR Online, Moody's Analytics

Future Research

- » Early research demonstrates the potential for this type of analysis.
- » Small but consistent improvements in analytical performance.
- » Shows that out-of-time residual forecasts help lift classification power of credit scores.
- » Potential to show similar improvements in underlying PD prediction.
- » EDGAR-Pro data only available from Jan 2017 until now.
- » Longer time series will yield greater forecasting potential.
- » Objective: Match the default definition to that used in standard credit scores and develop a vehicle-specific score adjustment.

Q&A

Additional questions?

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