Environmental Regulation, Eco-Competitiveness, and Financial Competitiveness in the Auto Sector

William Masket ‘07 Senior Thesis,
Center for Environmental Studies

Background

"If the US had strong regulations and Japan had weak ones, Toyota would be GM and GM would be Toyota"

Marc Brammer, Research Director, Innovest Strategic Value Advisors

Overview of Presentation

- Research Question
- Hypotheses
- Variables
- Data & Results
- Conclusions

Research Question & My Hypothesis

- Research Question: Do more stringent national environmental regulations make automobile companies more financially competitive?

- Hypothesis: Through the mechanism of eco-competitiveness, auto companies operating under more stringent environmental regulatory regimes will perform better financially.
  - Eco-competitiveness: A company's capacity to convert environmental challenges into strategic profit opportunities.

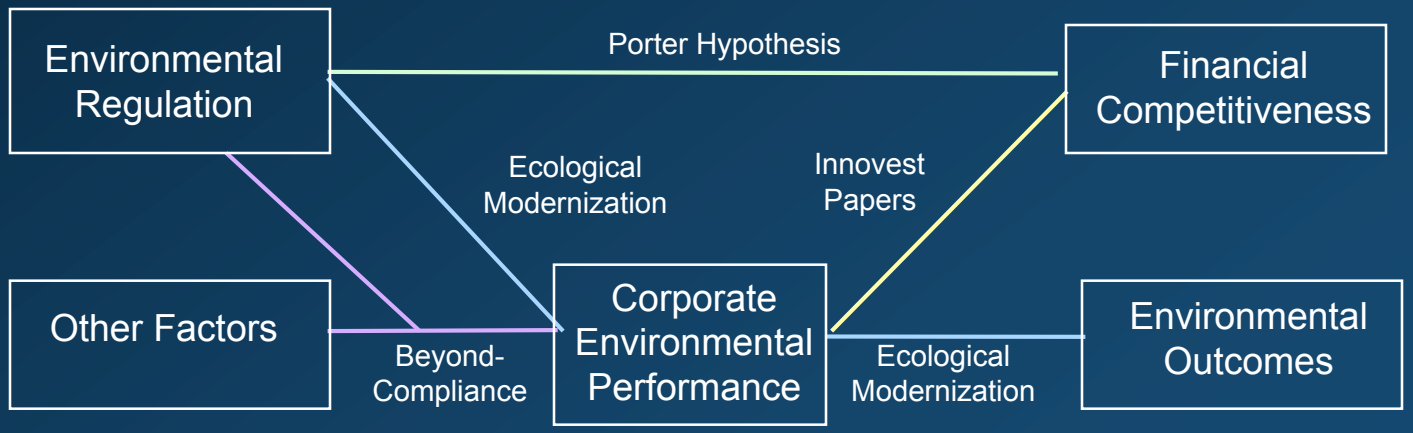
The Automobile Sector

- Why Autos?
  - Dominated by multi-national corporations
  - High environmental impact
  - Heavily regulated
- Selected 12 Companies
- Fuzzy set methods to test hypotheses due to small number of cases

Primary Hypothesis & Literature Review

My Hypothesis

Literature Review



Hypotheses: Linking Causal Factors with Eco-Competitiveness

	Hypotheses & Causal Factors
H1	More stringent environmental regulations lead to more ecocompetitive auto companies
H2	Market opportunities lead to more ecocompetitive auto companies
H3	Stakeholder pressure leads to more ecocompetitive auto companies
H4	Internal Factors lead to more ecocompetitive auto companies

Dependent Variables

	Eco-Competitiveness Measure	ROA
Honda	AAA	6.059
Toyota	AAA	5.034
Renault	AA	5.261
Volkswagen	AA	1.737
Peugeot	AA	2.533
Fiat	BBB	2.121
Nissan	BBB	5.704
BMW	BBB	3.822
Hyundai	BBB	4.534
DaimlerChrysler	BB	1.773
Ford	BB	2.187
GM	BB	0.882

Return on Assets (ROA): A measure of profitability that shows how efficiently a company uses its assets to produce income

Innovest Strategic Value Advisors

- Rates companies based on approximately 120 key performance indicators
- Focus on mitigating risks and seizing opportunities related to sustainability mega-trends
- Two Ratings: EV'21 (environmental) and IVA (social)
- EV'21 Components:
  - Risk Factors
  - Environmental Management Capacity
  - Opportunity Factors

Independent Variables

Operationalize variables using multiple indicators

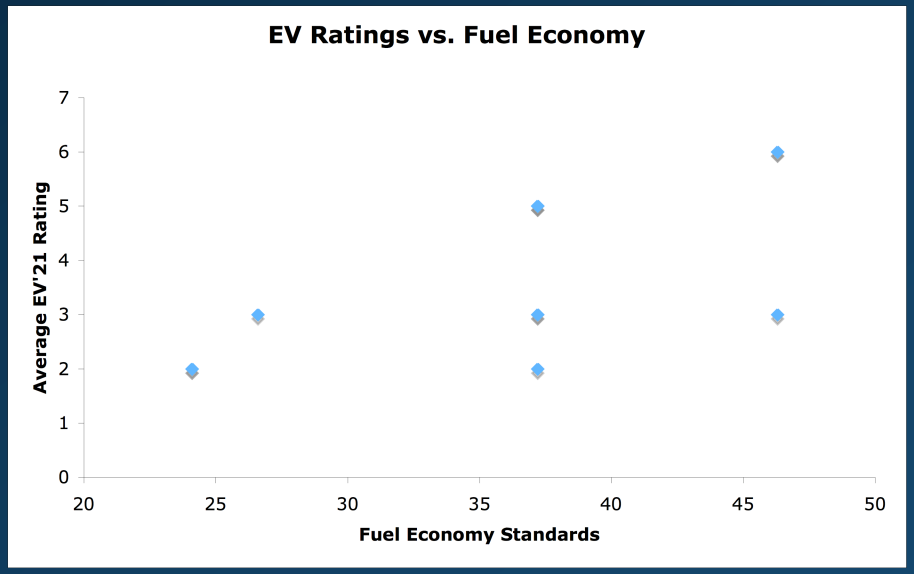
	Causal Factors	Indicators
H1	Environmental Regulations	Fuel Economy Standards, Fuel Taxes
H2	Market Opportunities	CO2 Emissions, Recycling, Organic Food, Renewable Energy
H3	Stakeholder Pressure	IUCN Organizations
H4	Internal Factors	Size (# employees & Net Sales), R&D, Multi-Nationality

Fuzzy Sets

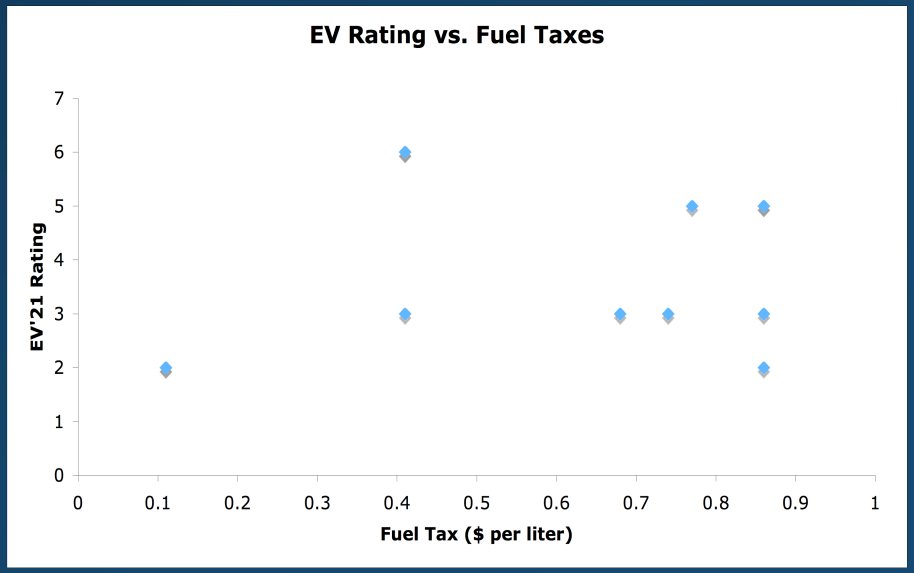
- Method for connecting Causal Factors with Outcomes
- Necessary/Sufficient Conditions vs. Regression Analysis
- Probabilistic vs. Veristic outcomes
  - 1 as veristic – every case shows relationship
  - .8 as “almost always” – 80% of cases show relationship, etc.
  - **.65 as “usually”**
  - .5 as “more often than not”
- Process:
  - Coding data as “fuzzy data” based on ideal type & set membership
  - Comparing each causal factor with the outcome factor to determine if it is a necessary or sufficient condition (or neither)

Data & Results: Environmental Regulations (H1)

	Raw Data	
	Fuel Economy Standards (MPG)	**Fuel Tax ($/liter)**
France	37.2	$0.77
Germany	37.2	$0.86
Italy	37.2	$0.74
Japan	46.3	$0.41
Korea	26.6	$0.68
United States	24.1	$0.11

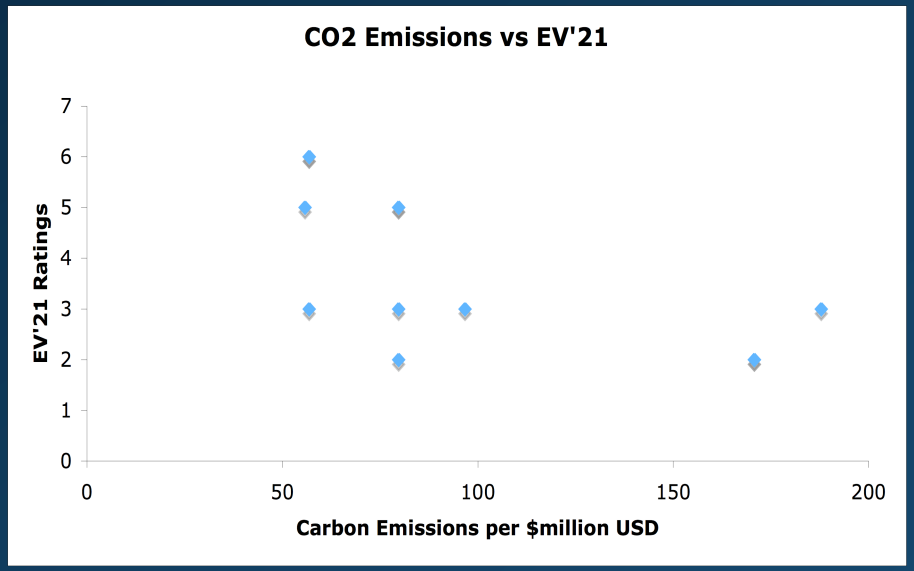


Fuzzy Set Analysis		
Causal Factor	**Proportion of Cases: Cause ≥ EV'21 Rating (Necessary Condition Test)**	**Proportion of Cases: Cause ≤ EV'21 Rating (Sufficient Condition Test)**
Fuel Economy	0.9167(**)	0.5556
~ Fuel Economy	0.4167	0.5556
Fuel Tax	0.8333(*)	0.3000
~Fuel Tax	0.4167	0.6667

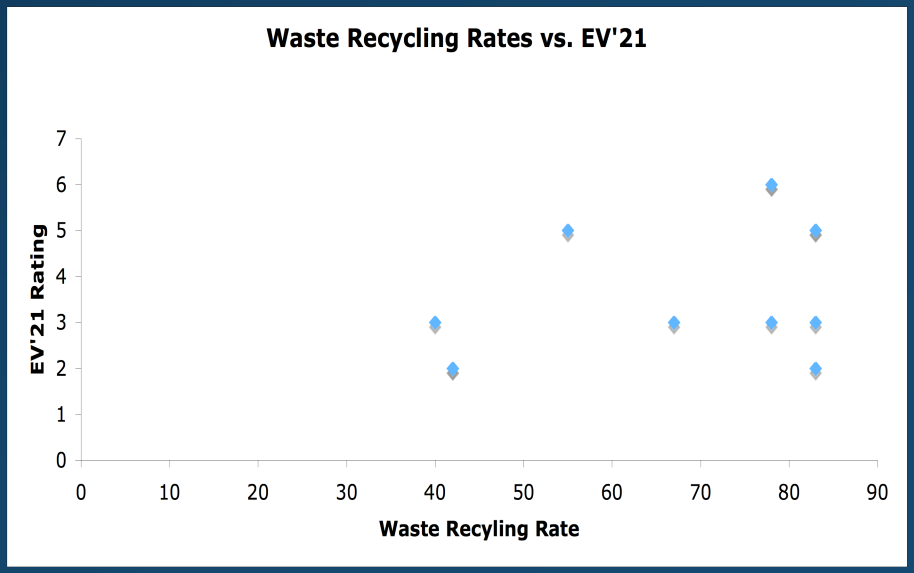


Data & Results: Market Opportunities (H2)

	Raw Data	
	CO2 emissions per million US dollars GDP	Waste recycling Rates
France	55.81	55
Germany	79.76	83
Italy	96.74	40
Japan	56.88	78
Korea	187.84	67
United States	170.72	42

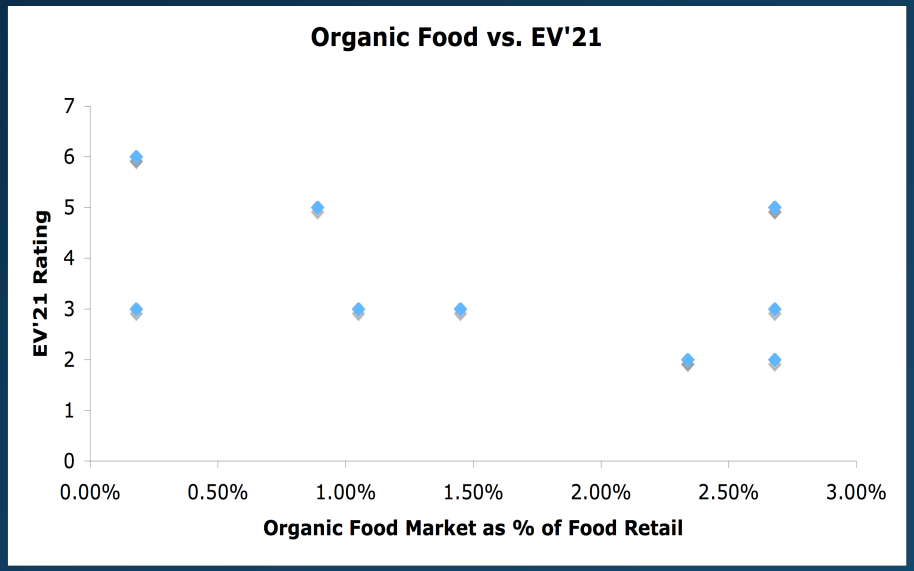


Fuzzy Set Analysis		
Causal Factor	Proportion of Cases: Cause ≥ EV'21 Rating (Necessary Condition Test)	Proportion of Cases: Cause ≤ EV'21 Rating (Sufficient Condition Test)
CO2 Emissions	.9167(**)	0.3333
~CO2 Emissions	0.4167	0.3750
Recycling	0.7500	0.4167
~Recycling	0.4167	0.6000

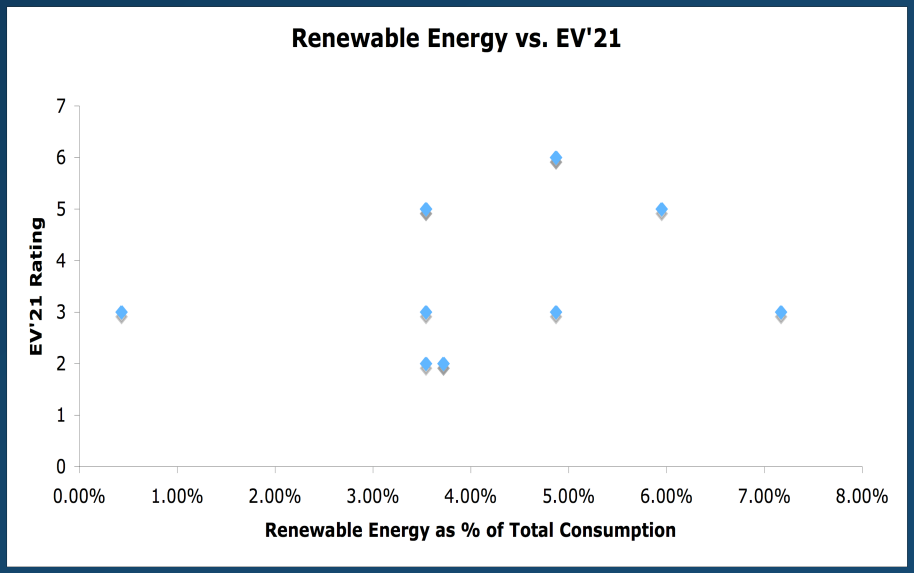


Data & Results: Market Opportunities (H2 cont'd)

	Raw Data	
	Organic Food Market as % of Food Retail Sector	Renewable Energy production as % of Total Consumption
France	0.89%	5.95
Germany	2.68%	3.54
Italy	1.45%	7.17
Japan	0.18%	4.87
Korea	1.05%	0.43
United States	2.34%	3.72

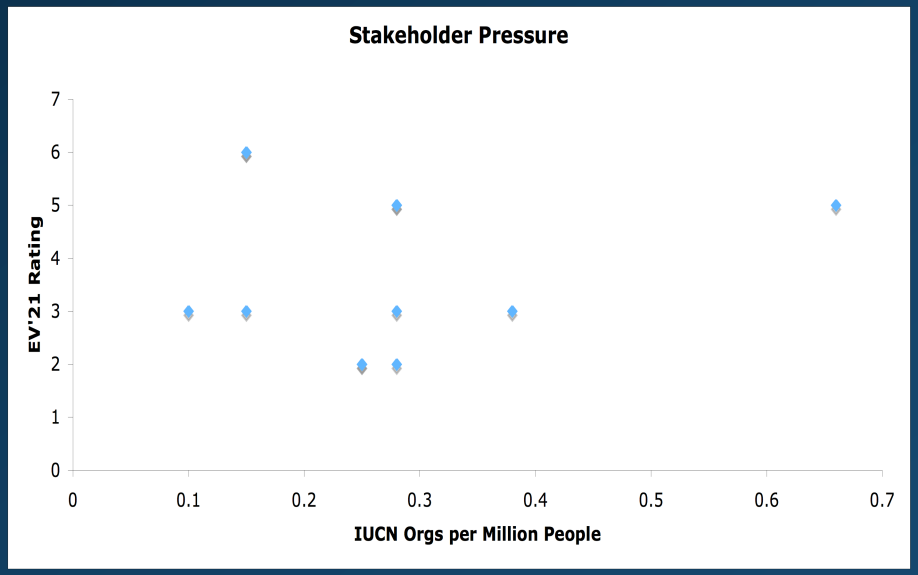


Fuzzy Set Analysis		
Causal Factor	**Proportion of Cases: Cause ≥ EV'21 Rating (Necessary Condition Test)**	**Proportion of Cases: Cause ≤ EV'21 Rating (Sufficient Condition Test)**
Organic Food	0.5833	0.4444
~Organic Food	.8333(*)	0.8333
Renewables	0.6667	0.3636
~Renewables	0.5000	0.4000



Data & Results - Stakeholder Pressure (H3)

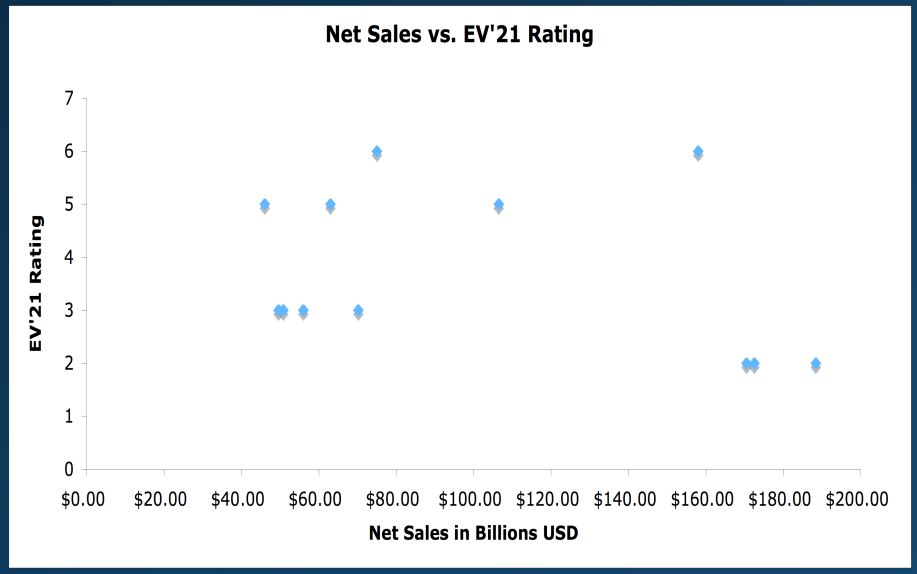
	Raw Data
	IUCN Member Orgs per million population
France	0.66
Germany	0.28
Italy	0.38
Japan	0.15
Korea	0.1
United States	0.25



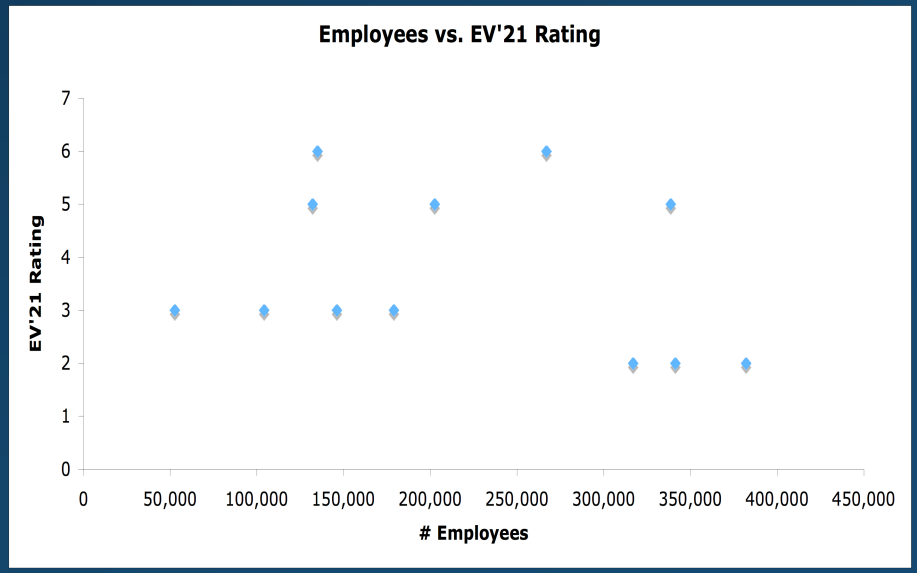
Fuzzy Set Analysis		
Causal Factor	Proportion of Cases: Cause ≥ EV'21 Rating (Necessary Condition Test)	Proportion of Cases: Cause ≤ EV'21 Rating (Sufficient Condition Test)
IUCN	0.5833	0.3750
~IUCN	.8333(*)	0.3636

Data & Results - Internal Factors (H4)

	Raw Data	
	Net Sales (bil USD)	**Employees**
DaimlerChrysler	$170.52	382,125
GM	$188.43	341,333
Volkswagen	$106.46	338,588
Ford	$172.54	316,928
Toyota	$158.03	266,950
Peugeot	$62.96	202,508
Fiat	$56.00	178,988
Nissan	$70.17	146,088
Honda	$75.01	134,941
Renault	$46.02	132,190
BMW	$50.81	104,157
Hyundai	$49.53	52,616



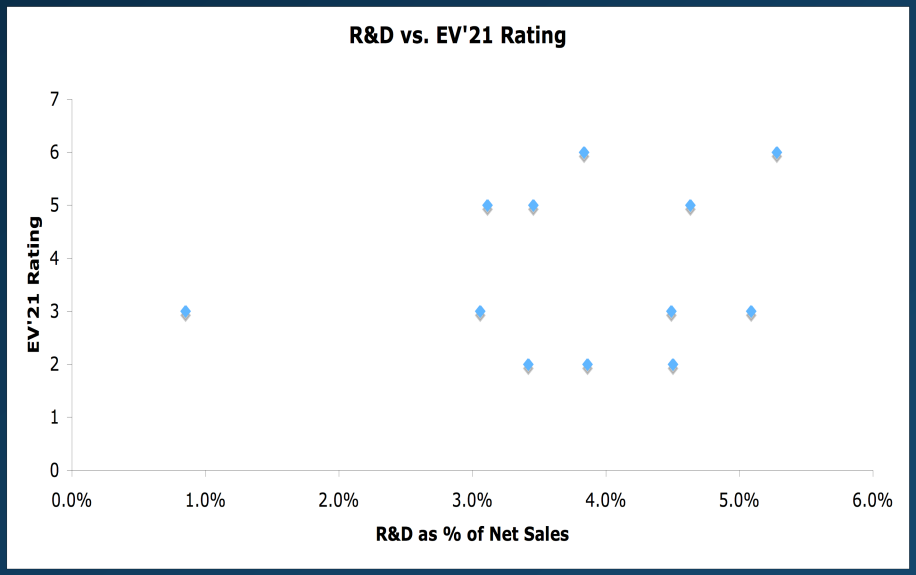
Fuzzy Set Analysis		
Causal Factor	**Proportion of Cases: Cause ≥ EV'21 Rating (Necessary Condition Test)**	**Proportion of Cases: Cause ≤ EV'21 Rating (Sufficient Condition Test)**
Net Sales	0.6667	0.7500
~Net Sales	0.7500	0.6250
Employees	0.7500	0.6364
~Employees	0.6667	0.7143

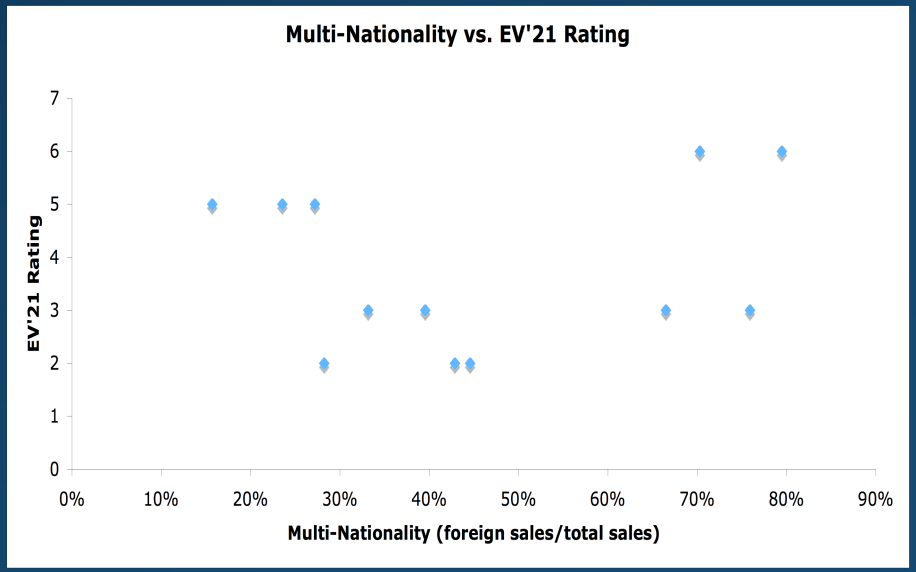


Data & Results - Internal Factors (H4 cont'd)

	Raw Data	
	R&D as % of Net Sales	Multi-Nationality
Honda	5.3%	79%
Nissan	4.5%	76%
Toyota	3.8%	70%
Hyundai	0.9%	67%
Ford	4.5%	45%
GM	3.4%	43%
BMW	5.1%	40%
Fiat	3.1%	33%
DaimlerChrysler	3.9%	28%
Volkswagen	3.1%	27%
Peugeot	3.5%	24%
Renault	4.6%	16%

Fuzzy Set Analysis		
Causal Factor	Proportion of Cases: Cause ≥ EV'21 Rating (Necessary Condition Test)	Proportion of Cases: Cause ≤ EV'21 Rating (Sufficient Condition Test)
R&D	0.5833	0.5455
~R&D	0.5000	0.5000
Multi-Nationality	0.6667	0.4545
~Multi-Nationality	0.7500	0.3333





Conclusions

- Fuzzy set analysis supports:
  - Fuel economy standards & CO_2 emissions as "usually necessary" and significant at .05 level
  - Fuel taxes as "usually necessary" but narrowly missing significance
  - Absence of stakeholder pressure and large organic food market as "usually necessary" but not significant
- Limited direct policy implications
- Implications for other product-based regulation

Creating A Fuzzy Rating

Company	EV'21 Total	Fuzzy EV'21
Honda	79	1
Toyota	77	1
Renault	69	0.75
Volkswagen	67	0.75
Peugeot	65	0.75
Fiat	58	0.5
Nissan	58	0.5
BMW	56	0.25
Hyundai	55	0.25
DaimlerChrysler	49	0
Ford	45	0
General Motors	42	0

Conducting Fuzzy Analysis: Necessary Condition Test for Fuel Economy

Company	ev21	fueleconomy	
BMW	0.25	0.75	1
DaimlerChrysler	0	0.75	1
Fiat	0.5	0.75	1
Ford	0	0	1
General Motors	0	0	1
Honda	1	1	1
Hyundai	0.25	0	0
Nissan	0.5	1	1
Peugeot	0.75	0.75	1
Renault	0.75	0.75	1
Toyota	1	1	1
Volkswagen	0.75	0.75	1
Total			11
Percentage			91.67%