

Arthur D Little

Material efficiency

Automotive case study

June, 2017



Automotive case study based on open data

		Open availability	Comments
Use Less	Buy-to-use		Data available at car manufacturers
	Product weight		Fully available
	End-of-life recycling		Data monitored for a EU Directive
Use Longer	Product lifetime		Data collection to be improved by governments & manufacturers
	Resale price		Fully available
Use Smart	Overall product usage		To be determined next year
	New & recycled materials		Data available at car manufacturers
	Product performance vs. weight		Fully available

Source: Arthur D. Little analysis

Openly available Not openly available

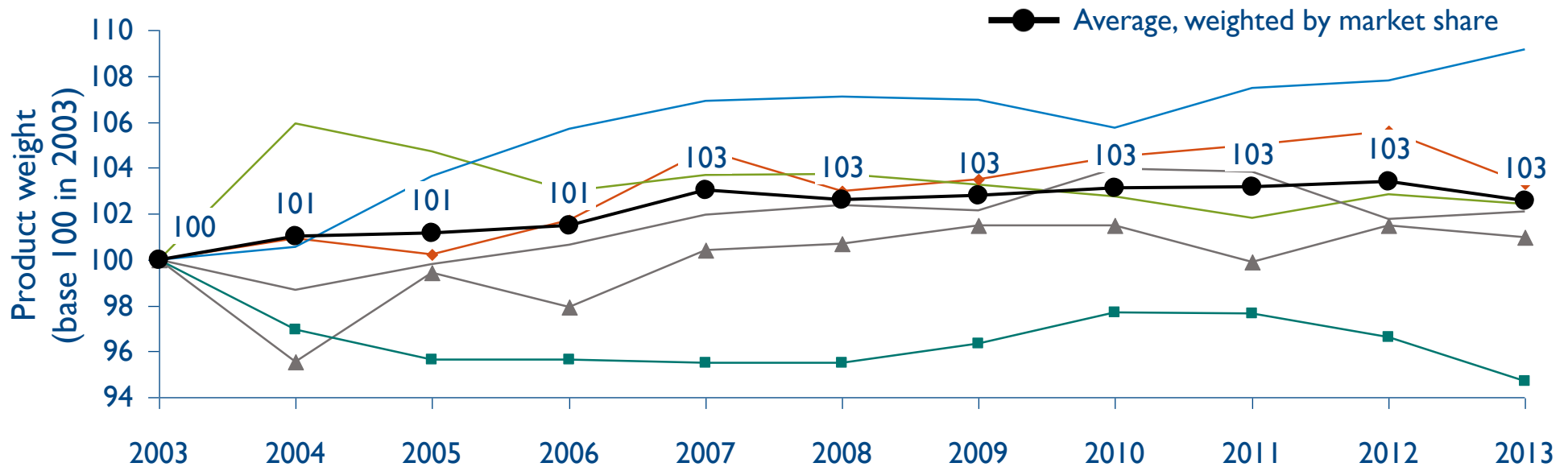
Description of the study

	Formula	Unit	Source
Product weight	Car weight (empty)	kg	<ul style="list-style-type: none"> Data were sourced from L'argus The study was focused on 73 car models sold in the French market Years of the study: 2003 to 2013 (in order to have the Resale Price in 2016)
Resale price	$\frac{\text{Used car}^1 \text{ price year Y+3}}{\text{New car price year Y}}$	%	
Product performance vs. weight	$\frac{\text{Consumption} * 1000}{\text{Car weight (empty)}}$	l/t.100km	
End-of-life recycling	$\frac{\text{Recycled weight}}{\text{Car weight}}$	%	

Source: Arthur D. Little analysis, L'Argus
¹ Kilometrage for used cars: 54,000km

Car weight has been stable since 2007 even though many functionalities have been added (HMI & safety)

Product weight
All cars sold on French market



▲ Segment A (~10% market share) – e.g. 107/108, C1, Twingo

◆ Segment B (~35% market share) – e.g. Clio, Fiesta, Yaris

■ Segment C (~25% market share) – e.g. 307/308, Golf, I-Series

■ Segment MI (~10% m. share) – e.g. Zafira, Prius, Touran

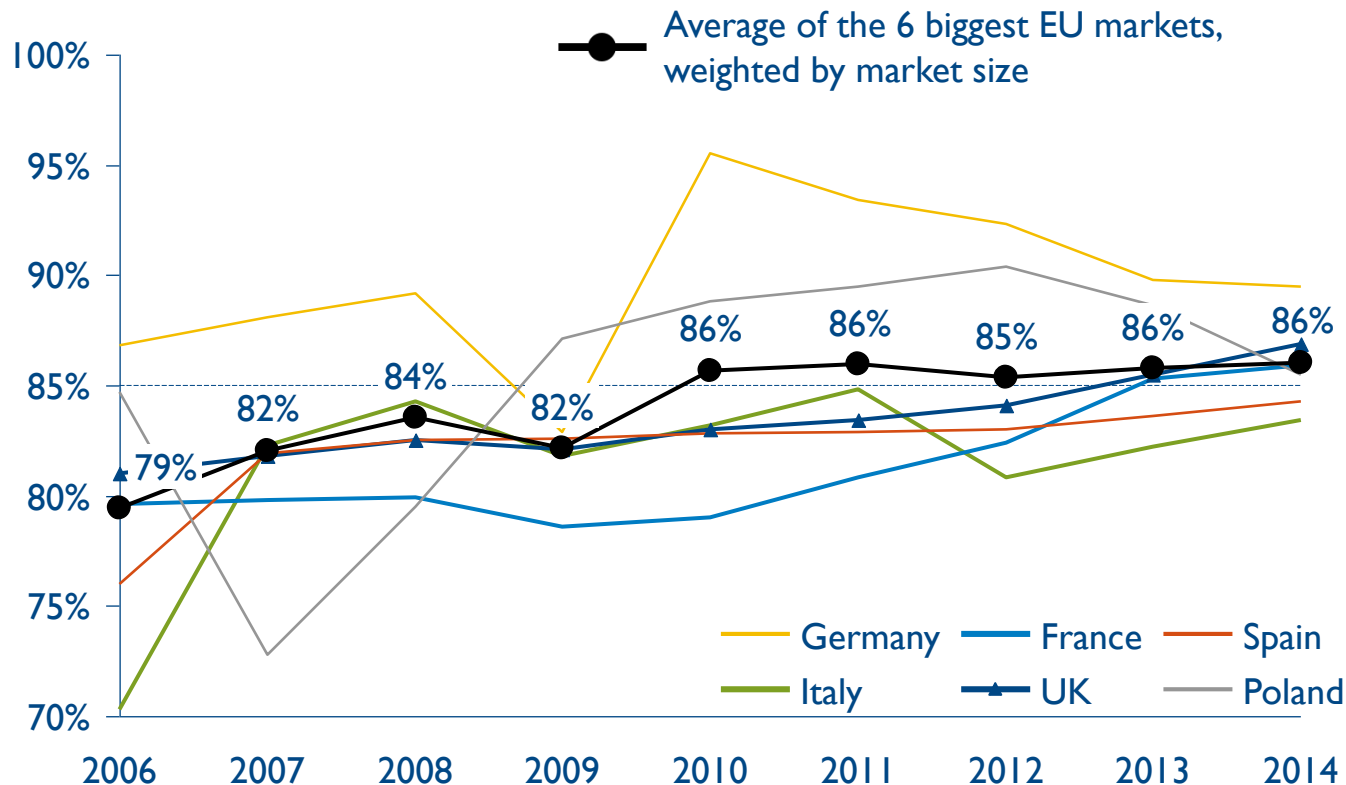
■ Segment D+E (~10% m. share) – e.g. A4, C-Class, Passat

■ Segment SUV (~10% m. share) – e.g. Land Cruiser, Touareg, X-Trail

Source: Arthur D. Little analysis, L'Argus

End-of-life recycling is now above 85% in average for the biggest EU markets

End-of-life recycling
6 biggest EU market



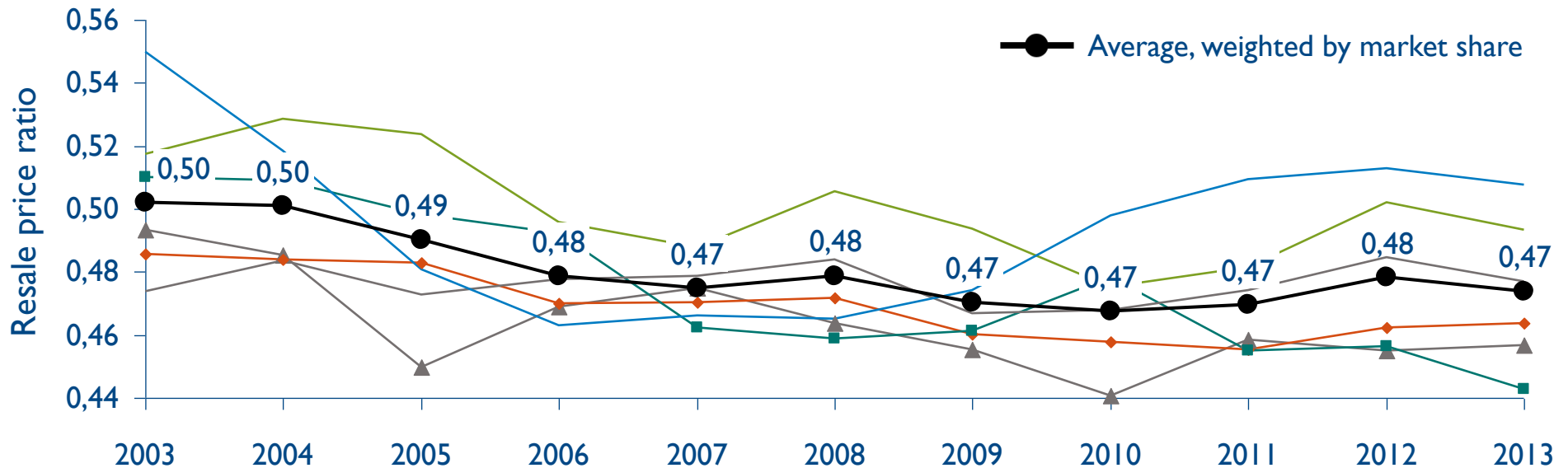
■ EU Directive 2000/53/EC sets the end-of-life recycling/reuse target at 85% of weight in 2015

- By car manufacturers:
- PSA: 88.6% effective (2014 in France)
 - Ford: 86% effective (2015 in North America)
 - FCA: 82% effective (2015 in Italy)
 - Renault: 85% recyclability (2016)
 - VW: 85% recyclability (2015)
 - BMW: 85% recyclability (2016)
 - Volvo: 85% recyclability (2015)

Source: Arthur D. Little analysis, Eurostat, Renault, PSA, Volkswagen, BMW, FCA, Ford, Volvo

Resale price ratio is relatively stable since 2006

3-year resale price
All cars sold on French market



▲ Segment A (~10% market share) – e.g. I07/I08, C1, Twingo

◆ Segment B (~35% market share) – e.g. Clio, Fiesta, Yaris

■ Segment C (~25% market share) – e.g. 307/308, Golf, I-Series

■ Segment M1 (~10% m. share) – e.g. Zafira, Prius, Touran

■ Segment D+E (~10% m. share) – e.g. A4, C-Class, Passat

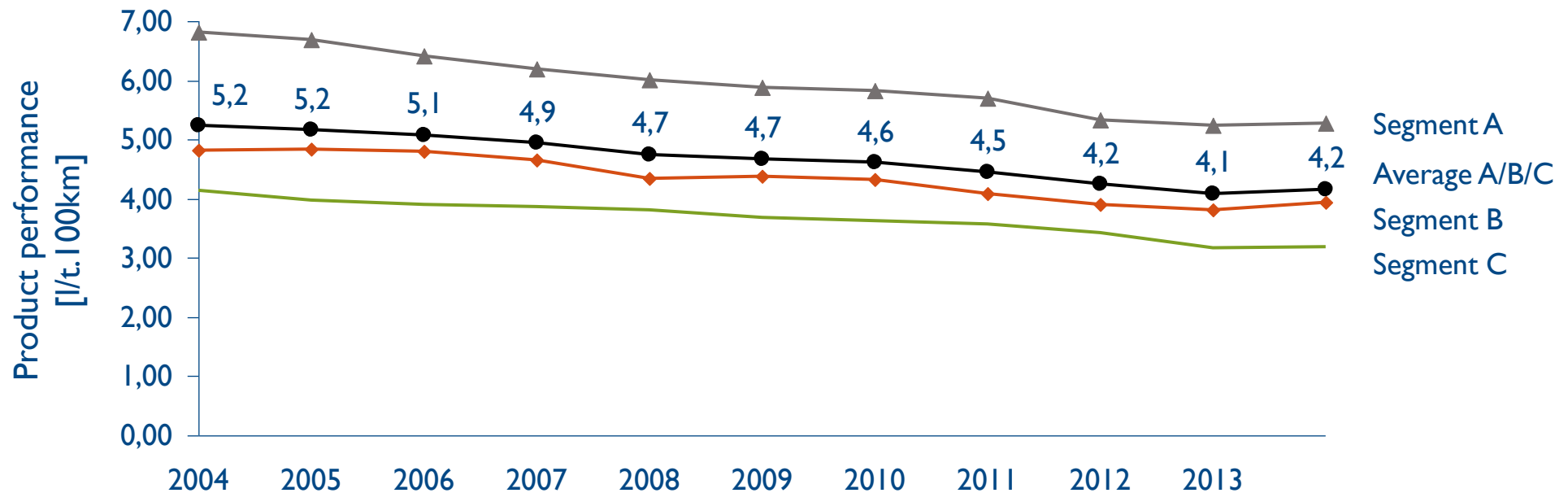
■ Segment SUV (~10% m. share) – e.g. Land Cruiser, Touareg, X-Trail

Source: Arthur D. Little analysis, L'Argus

Product performance vs. weight has been regularly improved over the past decade (fuel required to carry 1t of car weight for 100km)

Product performance vs. weight

Cars sold on French market (segments A, B & C: ~70% of the market)



- ▲ Segment A (~10% market share) – e.g. 107/108, C1, Twingo
- ◆ Segment B (~35% market share) – e.g. Clio, Fiesta, Yaris
- Segment C (~25% market share) – e.g. 307/308, Golf, I-Series

Source: Arthur D. Little analysis, L'Argus