Web Appendix to
Nested logit or random coefficients logit?
A comparison of alternative discrete choice models of product differentiation

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January 2013

B Web Appendix

In this Appendix we present additional results related to section 2.2 (Monte Carlo experiments), section 3.4 (Parameter estimates), section 3.5 (Substitution patterns), section 4.1 (Market definition) and section 4.2 (Merger simulation).

B.1 Monte Carlo experiments

True model is RC model for discrete characteristic Table B.1 and B.2 present detailed estimation results related to set-up 1: a correctly specified RC model for a discrete characteristic compared with misspecified logit and NL models. There are 2 designs: $\sigma_d = 1$ and $\sigma_d = 5$. Table 1 of the paper already provided a summary of selected parameters (β_{x^1}, ρ and σ_d).

Table B.1: Monte Carlo results set-up 1: RC model for discrete characteristic; low heterogeneity

Coefficients	True parameter	Logit	NL	RC
β_0	-1	-1.01	-0.88	-1.00
		(0.04)	(0.12)	(0.04)
β_d	-0.5	-0.33	-0.34	-0.51
		(0.05)	(0.05)	(0.12)
β_{x^1}	-2	-2.00	-1.83	-2.00
		(0.03)	(0.05)	(0.03)
ρ	n/a	n/a	0.09	n/a
			(0.08)	
σ_d	1	n/a	n/a	1.00
				(0.36)
Own elasticity		-2.607	-2.610	-2.607
		(0.404)	(0.405)	(0.405)
Cross elasticity same seg		0.037	0.042	0.043
		(0.009)	(0.012)	(0.011)
Cross elasticity differ seg		0.037	0.034	0.032
		(0.010)	(0.009)	(0.008)
Model selection criteria				
AIC		1	263	736
BIC		2	262	736

The table reports the empirical means and standard deviations (in parentheses) of selected parameters, the implied price elasticities for $T = 1$, and two information criteria, GMM-BIC and GMM-AIC. The estimates are based on 1,000 random samples of 50 markets and 25 products. The true model is the RC model of set-up 1 with $\sigma_d = 1$.

Table B.2: Monte Carlo results set-up 1: RC model for discrete characteristic; high heterogeneity

Coefficients	True parameter	Logit	NL	RC
β_0	-1	-1.03	-0.41	-1.00
		(0.05)	(0.18)	(0.04)
β_d	-0.5	0.23	0.22	-0.50
		(0.07)	(0.04)	(0.10)
β_{x^1}	-2	-1.98	-1.16	-2.00
		(0.03)	(0.04)	(0.03)
ρ	n/a	n/a	0.42	n/a
			(0.12)	
σ_d	5	n/a	n/a	5.05
				(0.45)
Own elasticity		-2.579	-2.599	-2.582
		(0.400)	(0.404)	(0.404)
Cross elasticity same seg		0.037	0.052	0.056
		(0.009)	(0.014)	(0.014)
Cross elasticity differ seg		0.038	0.028	0.021
		(0.010)	(0.008)	(0.005)
Model selection criteria				
AIC		0	6	994
BIC		0	6	994

The table reports the empirical means and standard deviations (in parentheses) of selected parameters, the implied price elasticities for $T = 1$, and two information criteria, GMM-BIC and GMM-AIC. The estimates are based on 1,000 random samples of 50 markets and 25 products. The true model is the RC model of set-up 1 with $\sigma_d = 5$.

True model is NL model (reverse of previous case) Table B.3 and B.4 presents detailed estimation results related to the reverse group of experiments: a correctly specified NL model compared with misspecified logit and RC models. There are 2 designs: $\rho = 0.1$ and $\rho = 0.4$.

Table B.3: Monte Carlo results set-up 1: NL model for discrete characteristic; low heterogeneity

Coefficients	True parameter	Logit	NL	RC
β_0	-1	-1.14	-0.99	-1.13
		(0.05)	(0.12)	(0.05)
β_d	-0.5	-0.50	-0.50	-0.77
		(0.06)	(0.06)	(0.23)
β_{x^1}	-2	-2.22	-1.99	-2.22
		(0.03)	(0.06)	(0.03)
ρ	0.1	n/a	0.11	n/a
			(0.08)	
σ_d	n/a	n/a	n/a	1.09
				(0.59)
Own elasticity		-2.897	-2.900	-2.897
		(0.449)	(0.451)	(0.450)
Cross elasticity same seg		0.039	0.045	0.046
		(0.011)	(0.013)	(0.014)
Cross elasticity differ seg		0.039	0.035	0.032
		(0.011)	(0.010)	(0.009)
Model selection criteria				
AIC		7	726	267
BIC		15	718	267
% correctly classified			50.04	

The table reports the empirical means and standard deviations (in parentheses) of selected parameters, the implied price elasticities for $T = 1$, and two information criteria, GMM-BIC and GMM-AIC. The estimates are based on 1,000 random samples of 50 markets and 25 products. The true model is the NL model with $\rho = 0.1$.

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Table B.4: Monte Carlo results set-up 1: NL model for discrete characteristic; high heterogeneity

Coefficients	True parameter	Logit	NL	RC
β_0	-1	-1.57	-1.00	-1.52
		(0.07)	(0.09)	(0.07)
β_d	-0.5	-0.49	-0.50	-2.37
		(0.10)	(0.06)	(0.67)
β_{x^1}	-2	-3.30	-1.99	-3.33
		(0.05)	(0.06)	(0.05)
ρ	0.4	n/a	0.40	n/a
			(0.06)	
σ_d	n/a	n/a	n/a	3.61
				(0.90)
Own elasticity		-4.318	-4.331	-4.326
		(0.672)	(0.675)	(0.677)
Cross elasticity same seg		0.057	0.109	0.103
		(0.020)	(0.037)	(0.035)
Cross elasticity differ seg		0.059	0.029	0.021
		(0.021)	(0.010)	(0.009)
Model selection criteria				
AIC		0	810	190
BIC		0	810	190
% correctly classified			50.04	

The table reports the empirical means and standard deviations (in parentheses) of selected parameters, the implied price elasticities for $T = 1$, and two information criteria, GMM-BIC and GMM-AIC. The estimates are based on 1,000 random samples of 50 markets and 25 products. The true model is the NL model with $\rho = 0.4$.

RCNL model Tables B.5 to B.12 present detailed estimation results related to set-up 2: a correctly specified RCNL model compared with misspecified logit, NL and RC models. There are 8 designs according to three criteria: (i) $\sigma_{x^1} = 1.0, \rho = 0.3$ or $\sigma_{x^1} = 0.5, \rho = 0.5$; (ii) $\gamma = 0$ or $\gamma = 1$); and (iii) $\varsigma_{xd} = 0$ or $\varsigma_{xd} = 0.9$.

The 8 designs are numbered as follows:

1. $\sigma_{x^1} = 1.0, \rho = 0.3; \varsigma_{xd} = 0.0; d_{jt} = \mathbf{1}_{\{d_{jt}^* > 0\}}$;

2. $\sigma_{x^1} = 0.5, \rho = 0.5; \varsigma_{xd} = 0.0; d_{jt} = \mathbf{1}_{\{d_{jt}^* > 0\}}$;

3. $\sigma_{x^1} = 1.0, \rho = 0.3; \varsigma_{xd} = 0.9; d_{jt} = \mathbf{1}_{\{d_{jt}^* > 0\}}$;

4. $\sigma_{x^1} = 0.5, \rho = 0.5; \varsigma_{xd} = 0.9; d_{jt} = \mathbf{1}_{\{d_{jt}^* > 0\}}$;

5. $\sigma_{x^1} = 1.0, \rho = 0.3; \varsigma_{xd} = 0.0; d_{jt} = \mathbf{1}_{\{d_{jt}^* > 1\}}$;

6. $\sigma_{x^1} = 0.5, \rho = 0.5; \varsigma_{xd} = 0.0; d_{jt} = \mathbf{1}_{\{d_{jt}^* > 1\}}$;

7. $\sigma_{x^1} = 1.0, \rho = 0.3; \varsigma_{xd} = 0.9; d_{jt} = \mathbf{1}_{\{d_{jt}^* > 1\}}$;

8. $\sigma_{x^1} = 0.5, \rho = 0.5; \varsigma_{xd} = 0.9; d_{jt} = \mathbf{1}_{\{d_{jt}^* > 1\}}$.

Table 2 of the paper already provided a summary of selected parameters for design 7.

Table B.5: Monte Carlo results set-up 2, design 1: RCNL model

Coefficients	True parameter	Logit	NL	RCL	RCNL
			$\gamma = 0, \varsigma_{xd} = 0$		
β_0	-1	-2.75	-0.94	-1.30	-1.00
		(0.07)	(0.16)	(0.10)	(0.10)
β_d	-2	-1.98	-2.00	-2.01	-2.00
		(0.08)	(0.11)	(0.07)	(0.06)
β_{x^1}	-3	-1.79	-0.47	-4.23	-3.00
		(0.05)	(0.12)	(0.17)	(0.29)
ρ	0.3	n/a	0.77	n/a	0.30
			(0.06)		(0.06)
σ_{x^1}	1	n/a	n/a	1.39	1.00
				(0.07)	(0.09)
Own elasticity		-2.355	-2.598	-5.412	-5.410
		(0.366)	(0.415)	(0.860)	(0.858)
Cross elasticity same seg		0.020	0.064	0.086	0.123
		(0.007)	(0.020)	(0.026)	(0.032)
Cross elasticity differ seg		0.021	0.005	0.090	0.063
		(0.007)	(0.002)	(0.026)	(0.019)
Model selection criteria					
AIC		0	0	0	1000
BIC		0	0	0	1000
% correctly classified			50.04		

The table reports the empirical means and standard deviations (in parentheses) of the parameters, the implied price elasticities for $T = 1$, and two information criteria, GMM-BIC and GMM-AIC. The estimates are based on 1,000 random samples of 50 markets and 25 products. The true model is the RCNL model of set-up 2 with design 1: $\sigma_{x^1} = 1.0$ and $\rho = 0.3$; $\varsigma_{xd} = 0$; $\gamma = 0$.

Table B.6: Monte Carlo results set-up 2, design 2: RCNL model

Coefficients	True parameter	Logit	NL	RCL	RCNL
			$\gamma = 0$, $\varsigma_{xd} = 0$		
β_0	-1	-2.34	-1.24	-1.44	-1.00
		(0.10)	(0.12)	(0.13)	(0.08)
β_d	-2	-1.99	-2.00	-1.99	-2.00
		(0.14)	(0.08)	(0.14)	(0.06)
β_{x^1}	-3	-4.38	-1.59	-5.86	-2.99
		(0.06)	(0.28)	(0.18)	(0.25)
ρ	0.5	n/a	0.65	n/a	0.50
			(0.06)		(0.04)
σ_{x^1}	0.5	n/a	n/a	0.94	0.50
				(0.06)	(0.05)
Own elasticity		-5.761	-5.838	-7.694	-7.797
		(0.894)	(0.907)	(1.220)	(1.236)
Cross elasticity same seg		0.041	0.113	0.071	0.144
		(0.017)	(0.038)	(0.026)	(0.044)
Cross elasticity differ seg		0.043	0.015	0.073	0.035
		(0.018)	(0.007)	(0.028)	(0.013)
Model selection criteria					
AIC		0	0	0	1000
BIC		0	0	0	1000
% correctly classified			50.04		

The table reports the empirical means and standard deviations (in parentheses) of the parameters, the implied price elasticities for $T = 1$, and two information criteria, GMM-BIC and GMM-AIC. The estimates are based on 1,000 random samples of 50 markets and 25 products. The true model is the RCNL model of set-up 2 with design 2: $\sigma_{x^1} = 0.5$ and $\rho = 0.5$; $\varsigma_{xd} = 0$; $\gamma = 0$.

Table B.7: Monte Carlo results set-up 2, design 3: RCNL model

Coefficients	True parameter	Logit	NL	RCL	RCNL
		$\gamma = 0$, $\varsigma_{xd} = 0.9$			
β_0	-1	-2.87	-0.50	-1.48	-1.00
		(0.05)	(0.19)	(0.10)	(0.13)
β_d	-2	-2.22	-3.58	-1.33	-2.00
		(0.11)	(0.17)	(0.11)	(0.19)
β_{x^1}	-3	-1.55	-0.40	-4.22	-3.00
		(0.07)	(0.11)	(0.19)	(0.31)
ρ	0.3	n/a	0.79	n/a	0.30
			(0.06)		(0.07)
σ_{x^1}	1	n/a	n/a	1.33	1.00
				(0.06)	(0.09)
Own elasticity		-2.025	-2.383	-5.411	-5.411
		(0.319)	(0.406)	(0.866)	(0.875)
Cross elasticity same seg		0.017	0.096	0.088	0.145
		(0.006)	(0.028)	(0.022)	(0.034)
Cross elasticity differ seg		0.018	0.005	0.068	0.049
		(0.006)	(0.002)	(0.025)	(0.017)
Model selection criteria					
AIC		0	0	0	1000
BIC		0	0	0	1000
% correctly classified			84.05		

The table reports the empirical means and standard deviations (in parentheses) of the parameters, the implied price elasticities for $T = 1$, and two information criteria, GMM-BIC and GMM-AIC. The estimates are based on 1,000 random samples of 50 markets and 25 products. The true model is the RCNL model of set-up 2 with design 3: $\sigma_{x^1} = 0.3$ and $\rho = 1$; $\varsigma_{xd} = 0.9$; $\gamma = 0$.

Table B.8: Monte Carlo results set-up 2, design 4: RCNL model

Coefficients	True parameter	Logit	NL	RCL	RCNL
		$\gamma = 0,\ \varsigma_{xd} = 0.9$			
β_0	-1	-2.65	-1.21	-1.86	-1.00
		(0.08)	(0.15)	(0.12)	(0.10)
β_d	-2	-0.62	-2.63	-0.05	-2.00
		(0.16)	(0.23)	(0.18)	(0.18)
β_{x^1}	-3	-4.34	-1.90	-5.87	-3.00
		(0.09)	(0.26)	(0.24)	(0.24)
ρ	0.5	n/a	0.57	n/a	0.50
			(0.06)		(0.04)
σ_{x^1}	0.5	n/a	n/a	0.90	0.50
				(0.07)	(0.04)
Own elasticity		-5.685	-5.745	-7.691	-7.721
		(0.875)	(0.894)	(1.232)	(1.243)
Cross elasticity same seg		0.043	0.156	0.067	0.200
		(0.017)	(0.042)	(0.022)	(0.050)
Cross elasticity differ seg		0.045	0.020	0.075	0.037
		(0.018)	(0.008)	(0.031)	(0.015)
Model selection criteria					
AIC		0	0	0	1000
BIC		0	0	0	1000
% correctly classified			84.05		

The table reports the empirical means and standard deviations (in parentheses) of the parameters, the implied price elasticities for $T = 1$, and two information criteria, GMM-BIC and GMM-AIC. The estimates are based on 1,000 random samples of 50 markets and 25 products. The true model is the RCNL model of set-up 2 with design 4: $\sigma_{x^1} = 0.5$ and $\rho = 0.5$; $\varsigma_{xd} = 0.9$; $\gamma = 0$.

Table B.9: Monte Carlo results set-up 2, design 5: RCNL model

Coefficients	True parameter	Logit	NL	RCL	RCNL
		$\gamma = 1,\ \varsigma_{xd} = 0$			
β_0	-1	-2.93	-0.62	-1.49	-1.00
		(0.06)	(0.27)	(0.09)	(0.14)
β_d	-2	-1.37	-3.11	-1.38	-2.00
		(0.10)	(0.25)	(0.09)	(0.16)
β_{x^1}	-3	-1.83	-0.48	-4.21	-3.00
		(0.05)	(0.17)	(0.17)	(0.29)
ρ	0.3	n/a	0.77	n/a	0.30
			(0.09)		(0.07)
σ_{x^1}	1	n/a	n/a	1.39	1.00
				(0.07)	(0.10)
Own elasticity		-2.396	-2.729	-5.380	-5.408
		(0.372)	(0.962)	(0.850)	(0.858)
Cross elasticity same seg		0.025	0.048	0.099	0.114
		(0.007)	(0.026)	(0.025)	(0.029)
Cross elasticity differ seg		0.016	0.004	0.065	0.044
		(0.005)	(0.002)	(0.026)	(0.017)
Model selection criteria					
AIC		0	0	1	999
BIC		0	0	1	999
% correctly classified			84.21		

The table reports the empirical means and standard deviations (in parentheses) of the parameters, the implied price elasticities for $T = 1$, and two information criteria, GMM-BIC and GMM-AIC. The estimates are based on 1,000 random samples of 50 markets and 25 products. The true model is the RCNL model of set-up 2 with design 5: $\sigma_{x^1} = 1$ and $\rho = 0.3$; $\varsigma_{xd} = 0$; $\gamma = 1$.

Table B.10: Monte Carlo results set-up 2, design 6: RCNL model

Coefficients	True parameter	Logit	NL	RCL	RCNL
			$\gamma = 1$, $\varsigma_{xd} = 0$		
β_0	-1	-2.74	-1.25	-1.85	-1.00
		(0.09)	(0.13)	(0.11)	(0.09)
β_d	-2	-0.55	-2.32	-0.55	-2.00
		(0.18)	(0.17)	(0.18)	(0.13)
β_{x^1}	-3	-4.37	-1.84	-5.82	-3.00
		(0.06)	(0.24)	(0.18)	(0.20)
ρ	0.5	n/a	0.59	n/a	0.50
			(0.05)		(0.03)
σ_{x^1}	0.5	n/a	n/a	0.94	0.50
				(0.06)	(0.04)
Own elasticity		-5.747	-5.818	-7.645	-7.780
		(0.891)	(0.900)	(1.207)	(1.239)
Cross elasticity same seg		0.050	0.080	0.082	0.113
		(0.019)	(0.030)	(0.028)	(0.039)
Cross elasticity differ seg		0.033	0.014	0.056	0.027
		(0.014)	(0.006)	(0.024)	(0.011)
Model selection criteria					
AIC		0	0	0	1000
BIC		0	0	0	1000
% correctly classified			84.21		

The table reports the empirical means and standard deviations (in parentheses) of the parameters, the implied price elasticities for $T = 1$, and two information criteria, GMM-BIC and GMM-AIC. The estimates are based on 1,000 random samples of 50 markets and 25 products. The true model is the RCNL model of set-up 2 with design 6: $\sigma_{x^1} = 0.5$ and $\rho = 0.5$; $\varsigma_{xd} = 0$; $\gamma = 1$.

Table B.11: Monte Carlo results set-up 2, design 7: RCNL model

Coefficients	True parameter	Logit	NL	RCL	RCNL
			$\gamma = 1, \varsigma_{xd} = 0.9$		
β_0	-1	-2.89	-0.16	-1.60	-1.00
		(0.06)	(0.20)	(0.09)	(0.16)
β_d	-2	-0.44	-5.66	-0.86	-2.01
		(0.15)	(0.46)	(0.12)	(0.30)
β_{x^1}	-3	-1.94	-0.31	-4.06	-2.99
		(0.06)	(0.13)	(0.16)	(0.27)
ρ	0.3	n/a	0.88	n/a	0.30
			(0.07)		(0.07)
σ_{x^1}	1	n/a	n/a	1.30	1.00
				(0.06)	(0.08)
Own elasticity		-2.545	-3.347	-5.205	-5.344
		(0.397)	(1.513)	(0.820)	(0.860)
Cross elasticity same seg		0.028	0.093	0.083	0.112
		(0.007)	(0.058)	(0.020)	(0.032)
Cross elasticity differ seg		0.015	0.002	0.082	0.057
		(0.004)	(0.001)	(0.024)	(0.017)
Model selection criteria					
AIC		0	0	0	1000
BIC		0	0	0	1000
% correctly classified			88.41		

The table reports the empirical means and standard deviations (in parentheses) of the parameters, the implied price elasticities for $T = 1$, and two information criteria, GMM-BIC and GMM-AIC. The estimates are based on 1,000 random samples of 50 markets and 25 products. The true model is the RCNL model of set-up 2 with design 7: $\sigma_{x^1} = 1$ and $\rho = 0.3$; $\varsigma_{xd} = 0.9$; $\gamma = 1$.

Table B.12: Monte Carlo results set-up 2, design 8: RCNL model

Coefficients	True parameter	Logit	NL	RCL	RCNL
		$\gamma = 1, \varsigma_{xd} = 0.9$			
β_0	-1	-2.76	-1.34	-1.90	-1.00
		(0.08)	(0.10)	(0.13)	(0.09)
β_d	-2	2.66	-2.60	2.41	-2.01
		(0.27)	(0.38)	(0.24)	(0.27)
β_{x^1}	-3	-4.49	-2.22	-5.88	-2.99
		(0.08)	(0.16)	(0.22)	(0.16)
ρ	0.5	n/a	0.52	n/a	0.50
			(0.03)		(0.03)
σ_{x^1}	0.5	n/a	n/a	0.94	0.50
				(0.08)	(0.04)
Own elasticity		-5.887	-5.879	-7.699	-7.573
		(0.907)	(0.928)	(1.218)	(1.227)
Cross elasticity same seg		0.054	0.106	0.083	0.141
		(0.018)	(0.040)	(0.026)	(0.052)
Cross elasticity differ seg		0.029	0.014	0.060	0.025
		(0.010)	(0.005)	(0.021)	(0.009)
Model selection criteria					
AIC		0	0	0	1000
BIC		0	0	0	1000
% correctly classified			88.41		

The table reports the empirical means and standard deviations (in parentheses) of the parameters, the implied price elasticities for $T = 1$, and two information criteria, GMM-BIC and GMM-AIC. The estimates are based on 1,000 random samples of 50 markets and 25 products. The true model is the RCNL model of set-up 2 with design 8: $\sigma_{x^1} = 0.5$ and $\rho = 0.5$; $\varsigma_{xd} = 0.9$; $\gamma = 1$.

RC with two random coefficients

Table B.13: Monte Carlo results RC model with random coefficients on discrete and continuous characteristics

Coefficients	True parameter	RC I	RC II
β_0	-1	-0.99	-1.00
		(0.10)	(0.07)
β_d	-2	2.41	-2.04
		(0.11)	(0.49)
β_{x^1}	-3	-2.93	-3.00
		(0.14)	(0.11)
σ_d	5	n/a	5.03
			(0.36)
σ_{x^1}	1	0.99	1.00
		(0.08)	(0.06)
One Own Elasticity		-3.739	-3.686
		(0.602)	(0.594)
Cross elasticity same seg		0.066	0.090
		(0.018)	(0.029)
Cross elasticity differ seg		0.113	0.035
		(0.047)	(0.012)
Model selection criteria			
AIC		0	1000
BIC		0	1000
% correctly classified	88.41		

The table reports the empirical means and standard deviations (in parentheses) of the parameters, the implied price elasticities for $T = 1$, and two information criteria, GMM-BIC and GMM-AIC. The estimates are based on 1,000 random samples of 50 markets and 25 products. The true model is the RC model with two random coefficients (RC II), on the discrete (σ_d) and on the continous characteristics (σ_{x^1}): $\sigma_d = 5$ and $\sigma_{x^1} = 1$; $\varsigma_{xd} = 0.9$; $\gamma = 1$.

B.2 Empirical analysis

Parameter estimates

Table B.14: Parameter Estimates for Constrained One-Level RCNL model

	Constrained One-Level RCNL	
	Param.	St. Er.
Mean valuations for the characteristics in x_{jt} (β)		
Price/income	-2.73	0.06
Horsepower (kW/100)	1.20	0.29
Fuel (€/10,000 km)	-0.45	0.03
Width (cm/100)	0.12	0.01
Height (cm/100)	0.20	0.01
Foreign (0/1)	-0.67	0.03
Standard deviations of valuations for the characteristics in x_{jt} (σ)		
Horsepower (kW/100)	0.50	0.23
Fuel (€/10,000 km)	-1.49	0.19
Width (cm/100)	n/a	
Height (cm/100)	n/a	
Foreign (0/1)	0.55	0.05
Constant	n/a	
Nesting parameters ($\rho_1 = \rho_2$)		
Segment ρ_1	0.56	0.01
Model fixed effects	Yes	
Market fixed effects	Yes	
Income distribution	Yes	
Random coefficients	Yes	
# inelastic demands	0	

This table shows the parameter estimates and standard errors for a constrained version of the RCNL of Table 6 in the main text. We constrain $\rho_1 = \rho_2$ (so there is only one level of nesting) and the standard deviations for the valuations of width, height, and the constant are set equal to 0. The total number of observations (models/markets) is 18,643, where markets refer to the 9 countries and 9 years.

Table B.15: Parameter Estimates for Alternative Demand Models, Excluding Height

	Logit		Nested Logit		RC Logit		RC Nested Logit	
	Param.	St. Er.	Param.	St. Er.	Param.	St. Er.	Param.	St. Er.
Mean valuations for the characteristics in x_{jt} (β)								
Price/income	-1.76	0.17	-1.00	0.03	-5.56	0.73	-2.77	0.16
Horsepower (kW/100)	2.30	0.24	1.34	0.08	-1.40	1.93	0.69	0.58
Fuel (€/10,000 km)	-11.48	1.43	-6.13	0.52	-20.29	3.89	-4.74	0.68
Width (cm/100)	2.51	0.55	-0.10	0.29	3.00	0.83	1.26	0.34
Height (cm/100)	3.46	0.35	1.17	0.19	5.86	0.57	2.13	0.21
Foreign (0/1)	-1.21	0.03	-0.47	0.04	-4.70	0.43	-0.56	0.16
Standard deviations of valuations for the characteristics in x_{jt} (σ)								
Horsepower (kW/100)	n/a		n/a		3.34	0.91	0.86	0.34
Fuel (€/10,000 km)	n/a		n/a		1.10	4.05	1.63	0.39
Width (cm/100)	n/a		n/a		1.46	0.69	0.09	1.05
Height (cm/100)	n/a		n/a		n/a		n/a	
Foreign (0/1)	n/a		n/a		5.32	0.58	0.16	1.26
Constant	n/a		n/a		3.29	1.42	0.37	1.00
Nesting parameters (ρ_1 and ρ_2)								
Subsegment ρ_1	n/a		0.65	0.03	n/a		0.57	0.03
Segment ρ_2	n/a		0.48	0.03	n/a		0.46	0.07
Model fixed effects	Yes		Yes		Yes		Yes	
Market fixed effects	Yes		Yes		Yes		Yes	
Income distribution	No		No		Yes		Yes	
Random coefficients	No		No		Yes		Yes	
# inelastic demands	3514		556		0		0	
χ^2 test $\rho_1 = \rho_2$	n/a		83.04		n/a		2.50	
Prob.$>\chi^2$	n/a		(0.00)		n/a		(0.11)	

The table shows the parameter estimates and standard errors for the different demand models, excluding consumer heterogeneity for height. The logit and NL models assume equal income ($-\alpha/\overline{y}_t$), the RC and RCNL models allow for heterogeneous income ($-\alpha/y_i$). The total number of observations (models/markets) is 18,643, where markets refer to the 9 countries and 9 years.

Table B.16: Parameter Estimates for Alternative Demand Models, Including Weight

	Logit		Nested Logit		RC Logit		RC Nested Logit	
	Param.	St. Er.	Param.	St. Er.	Param.	St. Er.	Param.	St. Er.
Mean valuations for the characteristics in x_{jt} (β)								
Price/income	-1.62	0.16	-0.98	0.03	-5.37	0.57	-2.63	0.12
Horsepower (kW/100)	2.06	0.22	1.29	0.08	2.86	0.27	1.13	0.44
Fuel (€/10,000 km)	-10.56	1.37	-6.06	0.51	-16.37	1.91	-5.16	0.59
Width (cm/100)	2.40	0.53	-0.15	0.29	2.90	0.55	0.71	0.43
Height (cm/100)	3.29	0.34	1.04	0.19	5.82	0.46	1.94	0.21
Weight (kg/10,000)	3.67	1.46	2.19	0.75	-5.79	1.36	-0.03	0.06
Foreign (0/1)	-1.22	0.03	-0.47	0.03	-4.16	0.51	-0.55	0.07
Standard deviations of valuations for the characteristics in x_{jt} (σ)								
Horsepower (kW/100)	n/a		n/a		0.01	0.29	0.55	0.40
Fuel (€/10,000 km)	n/a		n/a		3.65	0.12	1.85	0.48
Width (cm/100)	n/a		n/a		0.80	0.30	0.49	0.34
Height (cm/100)	n/a		n/a		0.31	0.22	0.02	0.46
Weight (kg/10,000)	n/a		n/a		4.22	0.62	0.82	0.34
Foreign (0/1)	n/a		n/a		4.98	0.45	0.18	0.41
Constant	n/a		n/a		1.58	0.49	1.08	0.42
Nesting parameters (ρ_1 and ρ_2)								
Subsegment ρ_1	n/a		0.66	0.03	n/a		0.59	0.04
Segment ρ_2	n/a		0.49	0.03	n/a		0.49	0.08
Model fixed effects	Yes		Yes		Yes		Yes	
Market fixed effects	Yes		Yes		Yes		Yes	
Income distribution	No		No		Yes		Yes	
Random coefficients	No		No		Yes		Yes	
# inelastic demands	4377		548		0		0	
χ^2 test $\rho_1 = \rho_2$	n/a		80.50		n/a		1.00	
Prob.$>\chi^2$	n/a		(0.00)		n/a		(0.32)	

The table shows the parameter estimates and standard errors for the different demand models, including a random coefficient for weight. The logit and NL models assume equal income ($-\alpha/\overline{y}_t$), the RC and RCNL models allow for heterogeneous income ($-\alpha/y_i$). The total number of observations (models/markets) is 18,643, where markets refer to the 9 countries and 9 years.

Table B.17: Parameter Estimates for Alternative Demand Models Using PCA

	Logit		RC Logit	
	Param.	St. Er.	Param.	St. Er.
Mean valuations for the characteristics in $x_{jt}(\beta)$				
Price/income	-2.81	0.27	-6.55	1.35
Principal Component 1	0.50	0/05	-0.64	0.24
Principal Component 2	-0.07	0.04	-0.66	0.15
Foreign	-1.14	0.04	-1.63	0.62
Standard deviations of the valuations for the characteristics in $x_{jt}(\sigma)$				
Principal Component 1	n/a		1.18	0.16
Principal Component 2	n/a		0.39	0.34
Foreign (0/1)	n/a		1.31	0.89
Constant	n/a		-0.58	1.08
Market fixed effects	Yes		Yes	
Income distribution	No		Yes	
Random coefficients	No		Yes	
# inelastic demands	595		0	

The table shows the parameter estimates and standard errors for the different demand models using the principal component analysis for ten continuous variables: horsepower, fuel consumption, width, height, cylinder (displacement), weight, length, speed and acceleration. We select the first two principal components as they contribute to most of the variance of the variables. The first principal component is mainly related to performance (horsepower, speed) and size (width, length). The second is mainly related to the sports aspect (acceleration, height). The total number of observations (models/markets) is 18,643, where markets refer to the 9 countries and 9 years.

Substitution patterns

Table B.18:   Product-level Price Elasticities in France for Alternative Demand Models

Segment	Own-	Cross-price elasticity same subseg	same seg	differ seg
Logit				
Subcompact	-0.73	<0.01	<0.01	<0.01
Compact	-1.14	<0.01	<0.01	<0.01
Intermediate	-1.39	<0.01	<0.01	<0.01
Standard	-1.94	<0.01	<0.01	<0.01
Luxury	-2.97	<0.01	<0.01	<0.01
SUV	-2.22	<0.01	<0.01	<0.01
Sports	-2.15	<0.01	<0.01	<0.01
Nested Logit				
Subcompact	-1.18	0.02	0.01	<0.01
Compact	-1.81	0.04	0.03	<0.01
Intermediate	-2.21	0.06	0.04	<0.01
Standard	-3.08	0.11	0.11	<0.01
Luxury	-4.63	0.19	0.09	<0.01
SUV	-3.59	0.06	0.06	<0.01
Sports	-3.43	0.07	0.05	<0.01
RC Logit				
Subcompact	-2.99	0.05	<0.01	<0.01
Compact	-3.64	0.03	<0.01	0.01
Intermediate	-4.11	0.02	<0.01	0.01
Standard	-5.33	0.03	0.03	0.01
Luxury	-5.52	0.05	0.03	0.01
SUV	-4.55	0.03	0.03	0.01
Sports	-5.20	<0.01	<0.01	0.02
RC Nested Logit				
Subcompact	-2.48	0.03	0.03	<0.01
Compact	-3.43	0.06	0.07	<0.01
Intermediate	-4.02	0.09	0.09	<0.01
Standard	-5.08	0.17	0.17	<0.01
Luxury	-6.73	0.23	0.16	<0.01
SUV	-5.61	0.09	0.09	<0.01
Sports	-5.21	0.10	0.09	<0.01

The table reports product-level own- and cross-price elasticities, based on the parameter estimates of Table 6 in the main text. Elasticities are averages by segment, similar to Table 8 in the main text but now for France instead of Germany.

Market definition

Table B.19: Ten closest competitors of a VW Golf hatchback in Germany (compact segment)

Logit	Nested Logit	RC Logit	RC Nested Logit
VW Passat (Inter)	Audi A3 (Comp)	VW Polo (Subc)	Audi A3 (Comp)
Audi A4 (Stand)	Mercedes A Class (Comp)	Ford Fiesta (Subc)	Mercedes A Class (Comp)
Audi A6 (Lux)	BMW 1 (Comp)	VW Passat (Inter)	BMW 1 (Comp)
Mercedes E class (Lux)	GM Astra wagon (Comp)	Mercedes A Class (Comp)	GM Astra wagon (Comp)
BMW 3 wagon (Stand)	GM Astra (Comp)	Audi A3 (Comp)	GM Astra (Comp)
BMW 3 sedan (Stand)	Ford Focus wagon (Comp)	GM Corsa (Subc)	Ford Focus wagon (Comp)
Audi A3 (Comp)	Ford Focus sedan (Comp)	GM Meriva (Subc)	Ford Focus sedan (Comp)
Mercedes A Class (Comp)	VW Golf wagon (Comp)	GM Astra (Comp)	VW Golf wagon (Comp)
BMW 1 (Comp)	VW Golf sedan (Comp)	GM Astra wagon (Comp)	VW Golf sedan (Comp)
VW Polo (Subc)	GM Astra cabrio (Comp)	BMW 1 (Comp)	Mazda 3 (Comp)

The table reports the 10 closest competitors of a VW Golf hatchback in Germany in 2006. The results of the SSNIP test applied to a candidate relevant market formed by a VW Golf and these 10 closest competitors are reported in Table 10 (Panel B) in the main text.

Table B.20: Relevant Market Definition in France and Germany, Excluding Height in Demand Specification

Segment	Logit		Nested Logit		RC Logit		RC Nested Logit	
	France	Germany	France	Germany	France	Germany	France	Germany
Subcompact	-0.11	-0.20	5.04	6.70	1.40	2.64	8.84	10.98
Compact	-0.61	-0.54	7.21	8.71	-4.95	-1.53	10.84	12.59
Intermediate	-1.02	-1.01	7.40	8.38	-9.75	-4.64	10.42	10.42
Standard	-1.62	-1.47	13.49	11.09	-5.79	-5.32	16.19	13.23
Luxury	-3.39	-3.16	16.15	14.97	-10.54	-6.30	16.53	15.07
SUV	-2.43	-2.58	16.49	15.70	2.94	-5.52	17.91	15.95
Sports	-1.44	-2.35	10.14	13.91	-9.58	-8.67	12.59	14.09

The table reports percentage profit increases implied by a joint 10% price increase of all products in the same segment, based on the parameter estimates in Table B.15 and assuming marginal costs implied by multiproduct Bertrand competition. The effects refer to France and Germany in 2006.

Table B.21: Relevant Market Definition in France and Germany, Including Weight in Demand Specification

Segment	Logit		Nested Logit		RC Logit		RC Nested Logit	
	France	Germany	France	Germany	France	Germany	France	Germany
Subcompact	-0.1	-0.2	5.2	6.8	1.2	1.9	9.9	12.4
Compact	-0.5	-0.5	7.4	8.9	-4.6	-2.1	11.7	14.1
Intermediate	-0.9	-0.9	7.6	8.6	-8.3	-5.5	11.1	11.3
Standard	-1.4	-1.3	13.8	11.3	-6.9	-6.1	17.4	14.4
Luxury	-2.9	-2.7	16.6	15.3	-12.3	-7.6	17.7	16.3
SUV	-2.1	-2.2	16.9	16.1	3.0	-3.7	20.4	17.6
Sports	-1.3	-2.0	10.4	14.2	-9.9	-8.5	13.2	15.1

The table reports percentage profit increases implied by a joint 10% price increase of all products in the same segment, based on the parameter estimates in Table B.16 and assuming marginal costs implied by multiproduct Bertrand competition. The effects refer to France and Germany in 2006.

Table B.22:   Relevant Market Definition in France and Germany, potential market divided by two

Segment	Logit		Nested Logit		RC Logit		RC Nested Logit	
	France	Germany	France	Germany	France	Germany	France	Germany
Subcompact	0.0	-0.1	5.2	6.8	1.4	2.2	8.0	9.8
Compact	-0.6	-0.5	7.2	8.8	-5.0	-2.1	9.6	11.2
Intermediate	-1.1	-1.1	7.4	8.4	-8.9	-6.2	9.3	9.2
Standard	-1.7	-1.5	13.6	11.1	-8.5	-6.8	14.1	11.5
Luxury	-3.5	-3.3	16.1	15.0	-12.4	-7.9	14.8	13.0
SUV	-2.4	-2.6	16.6	15.8	-2.4	-6.8	15.3	13.9
Sports	-1.6	-2.4	10.1	13.9	-10.4	-9.8	11.1	12.4

The table reports percentage profit increases implied by a joint 10% price increase of all products in the same segment, based on base demand specification in the text, but with potential market divided by 2; and assuming marginal costs implied by multiproduct Bertrand competition. The effects refer to France and Germany in 2006.

Merger simulation

Table B.23: The Effects of Two Hypothetical Mergers in France and Germany - Foreign Market

France	All	Subc	Comp	Interm	Stand	Lux	SUV	Sport
	BMW–VW merger in France							
	Foreign market shares (in percent)							
BMW	3.1	0.9	2.7	-	29.2	15.8	7.9	5.6
VW	11.8	7.8	16.1	20.2	28.3	19.4	5.6	11.3
	Predicted foreign price increase (in percent)							
Logit	0.0	0.0	0.1	0.0	0.2	0.1	0.0	0.0
Nested Logit	0.6	0.2	0.6	0.0	4.7	1.5	0.2	0.6
RC Logit	0.5	0.3	0.5	0.4	1.8	1.0	0.6	0.5
RC Nested Logit	0.4	0.2	0.5	0.1	2.7	1.1	0.2	0.4

Germany	PSA-Renault merger in Germany							
	Foreign market shares (in percent)							
PSA	6.1	11.3	4.3	5.7	-	0.9	-	13.8
Renault	4.2	8.3	4.1	2.3	-	0.2	-	5.0
	Predicted foreign price increase (in percent)							
Logit	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Nested Logit	0.4	1.5	0.4	0.2	0.0	0.0	0.0	0.6
RC Logit	0.2	0.9	0.2	0.1	-0.0	0.0	-0.0	0.2
RC Nested Logit	0.2	0.6	0.2	0.1	0.0	0.0	0.0	0.3

Parallel to Table 11 in the main text, this table reports percentage price increases for two hypothetical mergers, BMW–VW and PSA–Renault, but now in their respective foreign markets, France and Germany, instead of the domestic markets. The results are based on the parameter estimates in Table 6 in the main text, and assuming multiproduct Bertrand competition. The effects refer to France and Germany in 2006. Subc=subcompact, Comp=compact, Interm=intermediate, Stand=standard, Lux=Luxury, SUV=Sport Utility Vehicle.

Table B.24: The Effects of Two Hypothetical Mergers in France and Germany - Confidence Intervals

France	All	Subc	Comp	Interm	Stand	Lux	SUV	Sport
	PSA–Renault merger in France							
	Domestic market shares (in percent)							
PSA	33.4	35.3	38.8	46.0	-	19.1	-	37.3
Renault	22.7	29.8	20.9	17.8	-	9.5	-	13.5
	95 % Confidence Interval for predicted domestic price increase							
Logit	0.7;1.8	1.3;1.9	0.7;1.1	0.6;0.9	0.0;0.0	0.1;0.2	0.0;0.0	0.4;0.6
Nested Logit	12.5;18.3	24.9;37.2	11.1;15.9	10.2;15.4	0.0;0.0	1.5;2.7	0.0;0.0	5.3;8.6
RC Logit	14.6;27.2	28.3;48.7	15.6;31.2	14.8;35.3	0.3;0.9	2.9;7.3	0.0;0.3	9.8;19.0
RC Nested Logit	5.4;15.7	10.2;30.7	5.2;16.1	5.3;16.7	-0.3;0.0	0.9;3.04	-0.2;0.0	2.8;9.3

Germany	All	Subc	Comp	Interm	Stand	Lux	SUV	Sport
	VW-BMW merger in Germany							
	Domestic market shares (in percent)							
BMW	10.6	2.1	7.9	-	39.6	25.3	15.2	10.8
VW	30.8	23.1	36.3	53.8	31.3	32.4	12.0	21.4
	95 % Confidence Interval for predicted domestic price increase							
Logit	0.3;0.4	0.2;0.3	0.3;0.5	0.2;0.3	0.5;0.8	0.3;0.4	0.2;0.2	0.2;0.2
Nested Logit	2.7;3.0	0.5;0.6	2.6;3.0	0.1;0.1	9.5;10.5	4.1;4.5	1.3;1.7	1.0;1.2
RC Logit	1.9;2.5	0.5;0.8	1.7;2.4	1.6;2.1	4.2;5.8	2.7;3.8	1.5;2.0	1.3;1.8
RC Nested Logit	1.6;2.4	0.4;0.8	1.4;2.3	0.2;0.8	5.0;7.0	2.6;3.6	0.8;1.6	0.7;1.1

The table reports the 95 percent confidence intervals for the percentage price increases reported in Table 11 in the main text, for two hypothetical mergers, PSA–Renault and BMW–VW, in their domestic markets France and Germany. The 95% confidence intervals are based on a bootstrapping procedure. Subc=subcompact, Comp=compact, Interm=intermediate, Stand=standard, Lux=Luxury, SUV=Sport Utility Vehicle.

Table B.25: The Effects of Two Hypothetical Mergers in France and Germany, Excluding Height in Demand Specification

France	All	Subc	Comp	Interm	Stand	Lux	SUV	Sport
	PSA–Renault merger in France							
	Domestic market shares (in percent)							
PSA	33.4	35.3	38.8	46.0	-	19.1	-	37.3
Renault	22.7	29.8	20.9	17.8	-	9.5	-	13.5
	Predicted domestic price increase (in percent)							
Logit	0.9	1.6	0.9	0.8	0.0	0.2	0.0	0.5
Nested Logit	15.5	31.2	13.5	12.8	0.0	2.1	0.0	7.0
RC Logit	9.4	17.2	10.0	9.7	-0.2	1.8	-0.2	6.0
RC Nested Logit	5.8	7.5	5.8	6.2	1.1	3.5	1.2	4.6
Germany	VW-BMW merger in Germany							
	Domestic market shares (in percent)							
BMW	10.6	2.1	7.9	-	39.6	25.3	15.2	10.8
VW	30.8	23.1	36.3	53.8	31.3	32.4	12.0	21.4
	Predicted domestic price increase (in percent)							
Logit	0.3	0.3	0.4	0.3	0.6	0.3	0.2	0.2
Nested Logit	2.9	0.5	2.8	0.1	10.0	4.3	1.6	1.1
RC Logit	2.1	0.7	2.1	1.7	4.6	3.0	1.5	1.5
RC Nested Logit	1.6	0.3	1.4	0.2	5.2	2.6	0.8	0.7

The table reports percentage price increases for two hypothetical mergers, PSA–Renault and BMW–VW, in their domestic markets France and Germany. This is based on the parameter estimates in Table B.15 (which excludes a random coefficient for height), and assuming multiproduct Bertrand competition. The effects refer to France and Germany in 2006. Subc=subcompact, Comp=compact, Interm=intermediate, Stand=standard, Lux=Luxury, SUV=Sport Utility Vehicle.

Table B.26: The Effects of Two Hypothetical Mergers in France and Germany, Including Weight in the Demand Specification

France	All	Subc	Comp	Interm	Stand	Lux	SUV	Sport
	PSA–Renault merger in France							
	Domestic market shares (in percent)							
PSA	33.4	35.3	38.8	46.0	-	19.1	-	37.3
Renault	22.7	29.8	20.9	17.8	-	9.5	-	13.5
	Predicted domestic price increase (in percent)							
Logit	1.0	1.7	1.0	0.8	0.0	0.2	0.0	0.6
Nested Logit	15.5	37.6	16.6	15.8	0.0	2.6	0.0	8.9
RC Logit	9.9	21.1	13.6	14.1	-0.2	3.7	-0.3	9.3
RC Nested Logit	6.1	11.8	5.6	5.7	0.0	1.0	0.0	3.0
Germany	VW-BMW merger in Germany							
	Domestic market shares (in percent)							
BMW	10.6	2.1	7.9	-	39.6	25.3	15.2	10.8
VW	30.8	23.1	36.3	53.8	31.3	32.4	12.0	21.4
	Predicted domestic price increase (in percent)							
Logit	0.8	0.3	0.4	0.3	0.7	0.3	0.2	0.2
Nested Logit	2.9	0.6	2.9	0.1	10.2	4.4	1.6	1.1
RC Logit	2.3	1.1	2.8	2.0	5.5	3.4	2.3	1.6
RC Nested Logit	1.8	0.4	1.6	0.3	5.6	2.9	1.0	0.8

The table reports percentage price increases for two hypothetical mergers, PSA–Renault and BMW–VW, in their domestic markets France and Germany, based on the parameter estimates in Table B.16 (which includes a random coefficient for weight), and assuming multiproduct Bertrand competition. The effects refer to France and Germany in 2006. Subc=subcompact, Comp=compact, Interm=intermediate, Stand=standard, Lux=Luxury, SUV=Sport Utility Vehicle.