When Manufacturers Become Resellers: Evidence from Automaker Involvement in the Secondary Market on Resale Value and New Car Pricing

Hong Lee

Business Economics & Public Policy
Kelley School of Business
Indiana University

Cannibalization vs. Resale Value

Markets for secondhand goods diverts potential sales away from the primary market

- Active secondary market decreases manufacturers' profit by 35% (Chen et al. 2013)

Durable goods manufacturers take actions to impede the functioning of secondary market

- Planned obsolescence: textbook, phones, automobile (Lizuka 2007)
- Reducing durability: Phoebus cartel in the 1920s (Rust 1986, Liebowitz 1982)
- Digital rights management: eBook, e-Ticket (Johnson 2011)

The Challenge

Consumers are drawn to products with a lower net cost of ownership

- Intel's 12th CPU hardware incompatible (motherboard) $\rightarrow$ AMD (same socket)

The Opportunity

Secondary markets raise willingness to pay for new goods by providing resale value

- The higher the value of the used good a customer can recoup via resale, the lower the net cost of the new product becomes (Oraiopoulos et al. 2012)

Research Questions

- How do manufacturers of durable goods engage in the secondary market to leverage resale value of their products?
- What impact does their engagement in the secondary market have on the primary market?

Overview of Paper

Context: The repeal of used car sales ban in South Korea followed by Hyundai's entry in October 2023 as a policy shock

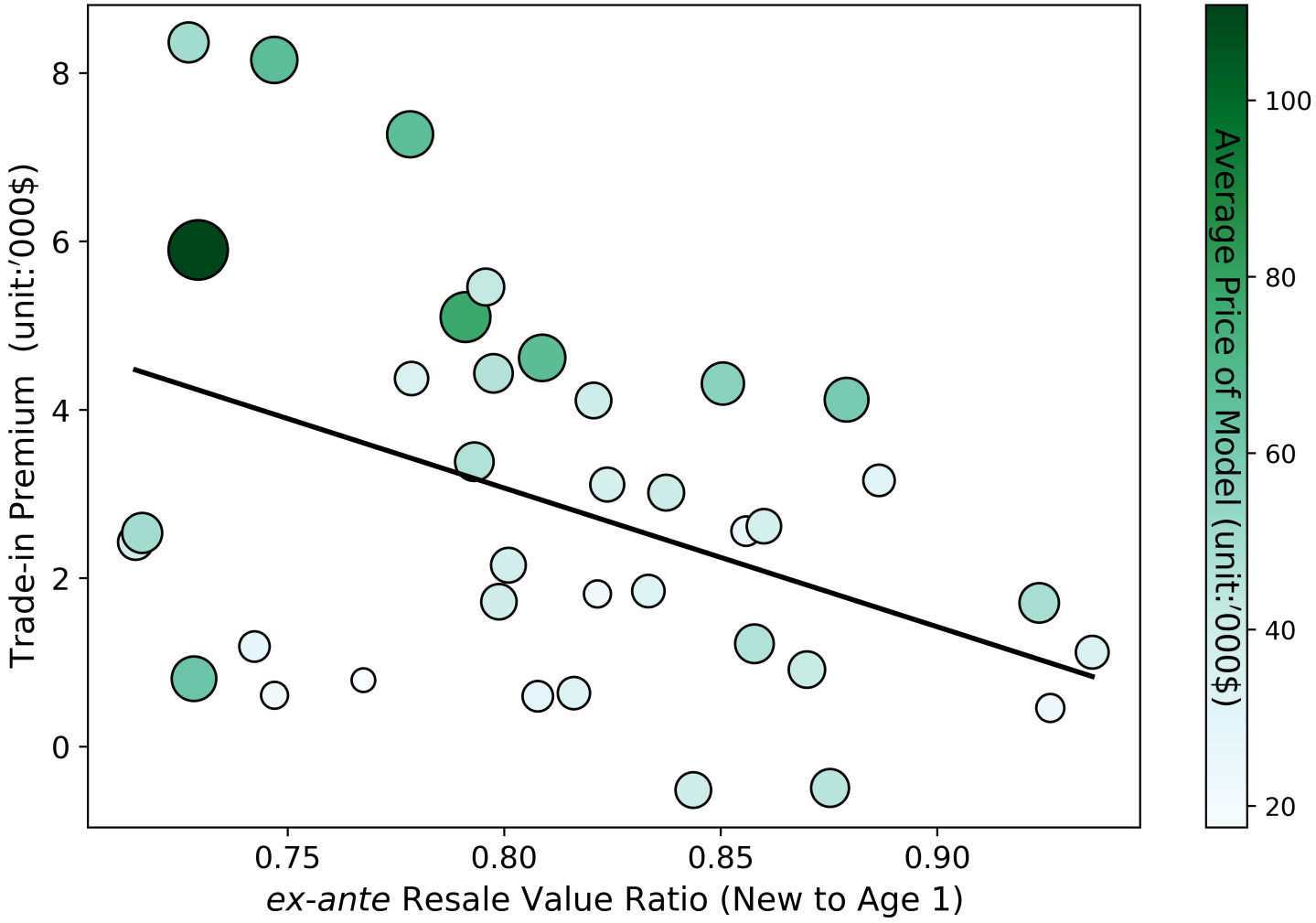
- Hyundai can buy used cars when consumers trade-in their used unit for buying new car
- Hyundai is permitted to sell used cars $<$5 years and $<$100,000km

Data: Use VIN level administrative microdata for all new and used cars registered 2017-2024

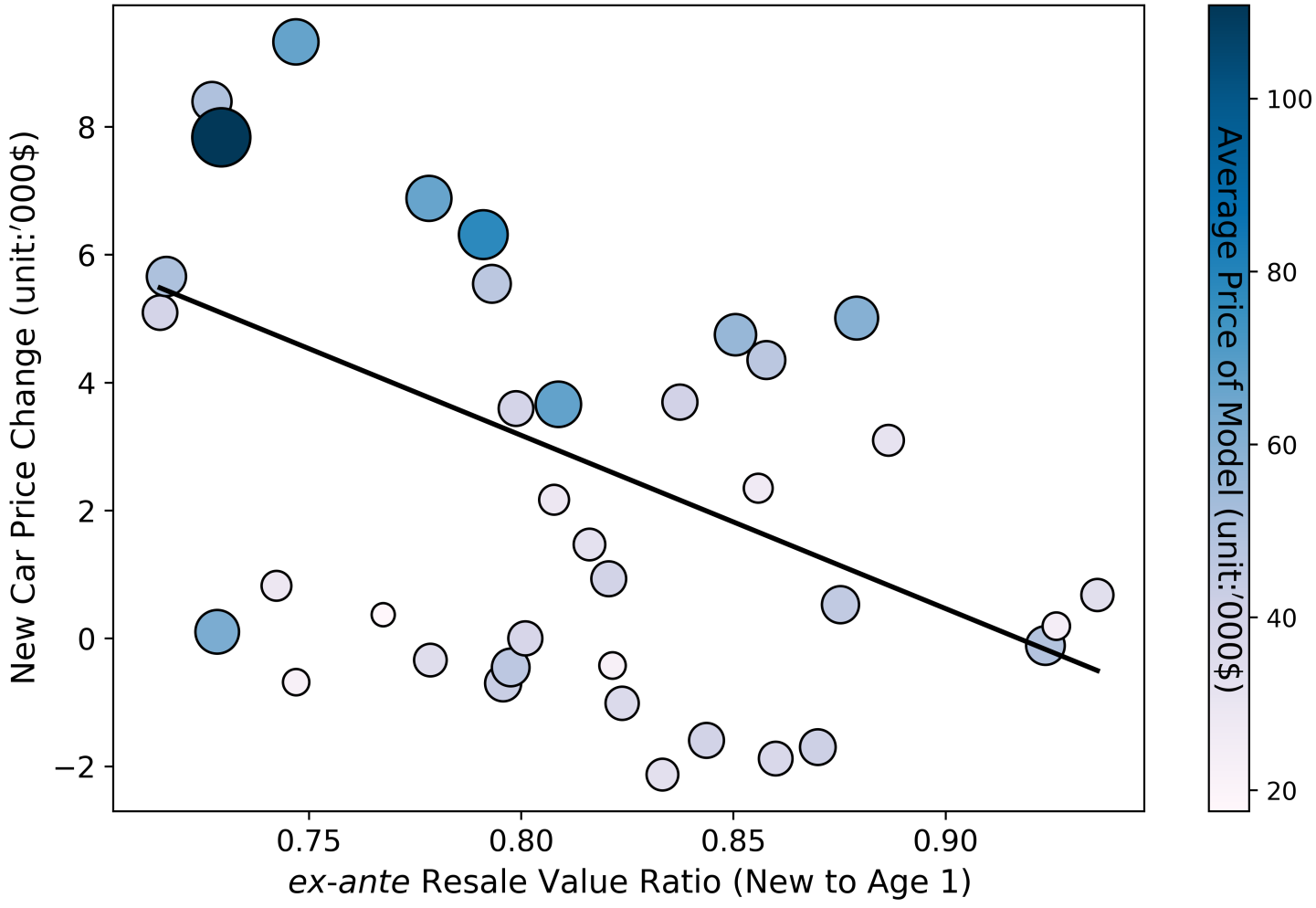
Quantify: *ex-ante* depreciation rate $\Rightarrow$ plausibly exogenous

- Compute Hyundai's trade-in prices compared to dealers' prices in a competitive market across various model of *ex-ante* depreciation rate

Preview of Finding



Preview of Finding



Data

- Vehicle registration (new and used) microdata from DoT in Korea (2017 - 2024)
  - VIN(last 10 digits masked)-month level observations (new: 10.1m / used: 21.6m)
  - Make(e.g., Honda), model(e.g., Civic), model year(e.g., 2021), fuel type(e.g. Gasoline), mile, owner&previous owner's demographics, price/new price
  - **Owner address/usage address (Headquarter/CPO center)** ▸ Seocho
- Price is CPI-adjusted to 2020 level
  - New car price: Total cost to consumer (including all taxes)
  - Used car price: Net proceeds to car owner (excluding buyer's taxes) ▸ Doc

New Car Prices and Market Shares (2017-2024)

	New Car Prices (unit: '000$)					Sales	
	Mean	**SD**	**p10**	**p50**	**p90**	**Count**	**Share**
Hyundai Motor Group							
Kia	34.07	13.44	16.38	33.91	49.89	3,306,280	31.73%
Hyundai	34.50	12.18	20.03	33.55	50.11	3,290,109	31.58%
Genesis	69.76	18.87	50.43	65.54	94.25	683,825	6.56%
Subtotal						7,280,214	69.87%
Other Domestic							
Renault Korea	30.12	4.94	23.78	30.29	36.04	442,505	4.25%
GM Korea	22.01	7.52	13.39	21.73	32.23	395,188	3.79%
KG Mobility	30.31	8.68	21.49	27.37	43.86	382,811	3.67%
Subtotal						1,220,504	11.71%
Germany							
Mercedes-Benz	98.22	51.18	56.92	81.52	173.05	520,511	5.00%
BMW Group	74.98	42.35	40.69	67.75	124.02	512,976	4.92%
Volkswagen	84.15	61.14	38.15	61.02	167.01	251,925	2.42%
Subtotal						1,285,412	12.34%
Other Foreign							
Toyota Group	58.60	19.83	37.16	58.56	75.32	144,591	1.39%
Geely Holding	69.87	16.93	52.48	69.85	95.80	87,335	0.84%
Stellantis	56.64	31.20	33.06	45.67	88.74	84,936	0.82%
Ford Group	65.17	26.45	51.14	61.20	88.64	61,407	0.59%
Renault-Nissan	28.84	9.60	20.61	25.98	42.50	57,169	0.55%
Tata Group	103.32	56.13	55.62	79.99	198.50	55,259	0.53%
GM	58.20	33.15	35.43	52.85	86.79	53,775	0.52%
Tesla	77.86	23.25	61.53	71.43	92.66	52,475	0.50%
Honda	44.24	9.28	34.83	44.11	57.83	36,898	0.35%
Subtotal						633,845	6.08%
Total	43.94	29.96	19.39	36.79	72.45	10,419,975	100%

Pre-Entry Resale Value Ratio (New to Age 1) by Model-Year-Fuel Level

	Mean	SD	p10	Median	p90	Count
Hyundai Motor Group						
Hyundai	0.837	0.139	0.714	0.838	0.969	169
Kia	0.817	0.118	0.709	0.824	0.933	195
Genesis	0.793	0.095	0.699	0.799	0.886	54
Other Domestic						
GM_Korea	0.775	0.156	0.636	0.764	0.868	46
KG_Mobility	0.750	0.068	0.678	0.744	0.823	42
Renault_Korea	0.698	0.135	0.527	0.726	0.836	36
Germany						
Mercedes-Benz	0.811	0.062	0.744	0.807	0.881	142
BMW Group	0.806	0.126	0.714	0.801	0.896	254
Volkswagen	0.819	0.068	0.754	0.822	0.900	107
Other foreign						
Geely Holding	0.831	0.068	0.738	0.826	0.896	27
Tesla	0.804	0.078	0.673	0.831	0.911	8
Honda	0.797	0.062	0.716	0.793	0.877	27
Toyota Group	0.778	0.079	0.684	0.789	0.876	54
Tata Group	0.755	0.042	0.712	0.749	0.807	32
Stellantis	0.740	0.073	0.637	0.747	0.827	62
Ford_Group	0.727	0.124	0.640	0.732	0.829	44
GM	0.717	0.091	0.575	0.731	0.806	38
Renault Nissan	0.673	0.146	0.317	0.709	0.812	18
Total	0.797	0.114	0.688	0.798	0.906	1,355

Impact of *ex-ante* Depreciation Rate on Premiums

Among cars purchased by Hyundai Motor Group in Oct 2023 - Mar 2024,

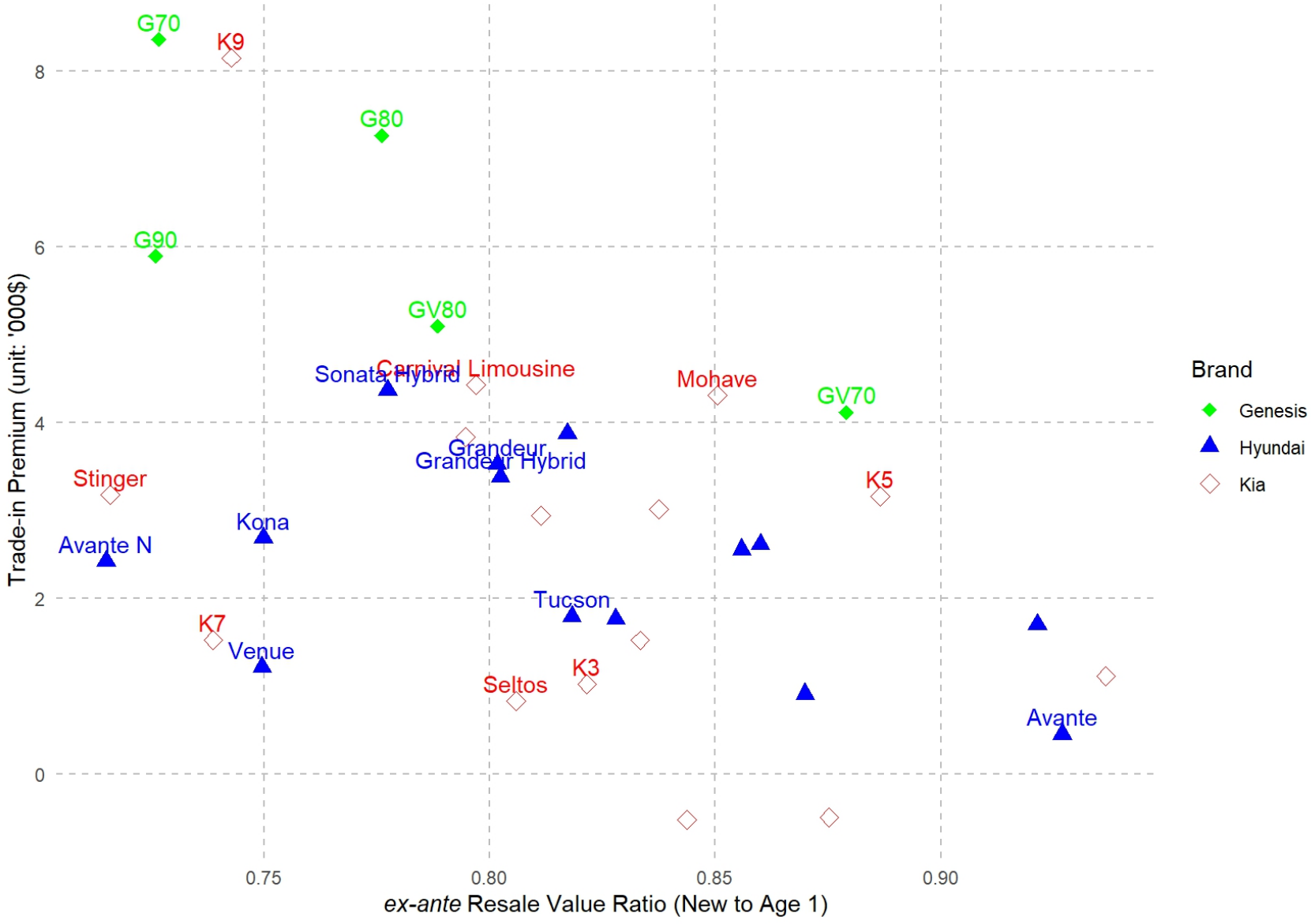
$$w_{it}^{H} - w_{j(i)t}^{D} = \beta\left(1 - \hat{\delta}_{j(i)}^{1}\right) + \underbrace{Size_{j(i)t} + CC_{j(i)t} + Weight_{j(i)t} + Fuel_{j(i)t}}_{X'_{j(i)t}}$$
$$+ \underbrace{Mile_{it} + Age_{it} + 1(\text{Gender}) \times 1(\text{Age}) \times 1(\text{Firm})}_{W'_{it}} + \tau_t + \varepsilon_{it}$$

- w_{it}^{H} is the resale price of a used car i paid by Hyundai at time t
- $w_{j(i)t}^{D}$ is average resale price of a model-fuel j paid by dealers at time t
- $\hat{\delta}_{j(i)}^{1}$ is *ex-ante* first year depreciation rate of a model-fuel j at time t
- $X'_{j(i)t}$ is a model-fuel j specific characteristics
- W'_{it} is a car i specific characteristics
- $1(\text{Gender}) \times 1(\text{Age}) \times 1(\text{Firm})$ are saturated fixed effects
- ε_{it} clustered by model-fuel

Results

	Dependent Variable: Hyundai's Trade-in Premium ($= w_{it}^H - w_{j(i)t}^D$) (unit: '000$)					
	Full sample			Without outliers		
	(1)	(2)	(3)	(4)	(5)	(6)
$1 - \hat{\delta}_j^1$: 1st year RVR	-14.944***	-15.407***	-16.484***	-12.938***	-13.517***	-14.587***
	(5.223)	(4.884)	(5.151)	(4.490)	(4.279)	(4.467)
Odometer ('000 mile)	-0.122***	-0.133***	-0.120***	-0.109***	-0.122***	-0.107***
	(0.014)	(0.014)	(0.014)	(0.010)	(0.010)	(0.010)
Age	-1.953***	-1.897***	-1.954***	-1.685***	-1.627***	-1.681***
	(0.234)	(0.231)	(0.234)	(0.189)	(0.188)	(0.190)
Displacement (cm^3)	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Weight (kg)	0.005***	0.005***	0.005***	0.005**	0.005**	0.004*
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Size raw (m^3)	-0.780**	-0.716**	-0.736**	-0.689*	-0.624*	-0.648*
	(0.294)	(0.295)	(0.298)	(0.353)	(0.359)	(0.357)
Fuel type						
(Baseline: Diesel)						
EV	-6.262***	-6.196***	-6.312***	-5.495***	-5.458***	-5.614***
	(1.663)	(1.780)	(1.639)	(1.592)	(1.758)	(1.600)
Gasoline	0.709	0.735	0.639	0.837	0.886	0.790
	(0.600)	(0.656)	(0.620)	(0.651)	(0.711)	(0.668)
Hybrid	-0.968	-0.909	-1.067	-0.937	-0.864	-1.040
	(0.787)	(0.795)	(0.786)	(0.689)	(0.717)	(0.691)
Size Type						
(Baseline: Compact)						
Large	7.176***	6.384***	7.023***	6.753***	5.863***	6.596***
	(1.440)	(1.502)	(1.458)	(1.390)	(1.462)	(1.399)
Medium	5.643***	5.044***	5.541***	5.035***	4.378***	4.936***
	(1.114)	(1.131)	(1.112)	(1.019)	(1.030)	(1.008)
Constant	17.500***	19.102***	20.425***	14.330***	16.385***	17.367***
	(4.262)	(3.649)	(4.177)	(3.262)	(2.947)	(3.279)
Fixed Effects						
Month		✓	✓		✓	✓
Demographics	✓		✓	✓		✓
N	2,742	2,742	2,742	2,688	2,688	2,688
R-sq	0.530	0.527	0.541	0.564	0.556	0.578
adj. R-sq	0.526	0.524	0.536	0.559	0.553	0.573

Premium by Models



Qualitative Evidence

- Hyundai's operating profit really outperformed in 2023. One reason for this is the success of Genesis. Typically, in manufacturing sector, the profit-cost margin isn't that high. Excluding some SUV models, Hyundai car's margin is about 2-5%. However, in the case of Genesis, the margin exceeds 20%.

  Anonymous Hyundai's employee (Aug 25, 2023)

- The one of the most important things for auto-companies is to justify the retail value [of their car]. That way, people who have already bought the car won't complain about their purchases. Hyundai's current main [sales] target is the retail value of Genesis. They're trying to elevate the Genesis brand image up to the level of foreign brands. The BMW 5 series' prices range from $60,000 to $80,000, and Genesis has almost caught up to that range.

  Hyundo Shin, the CEO of Youcar (Jan 12, 2023)

Impact on New Car Prices

	Dependent Variable: p_{it}					
Sample	Full	Domestic	Hyundai	Full	Domestic	Hyundai
	(1)	(2)	(3)	(4)	(5)	(6)
Post	-2.669	1.148	1.494			
	(2.155)	(0.961)	(1.089)			
Post×Hyundai				1.962	0.888	1.260
				(1.391)	(0.566)	(0.944)
Post×Kia				1.936	0.974	1.327
				(1.342)	(0.586)	(0.984)
Post×Genesis				3.325**	3.310***	3.703**
				(1.323)	(0.575)	(0.925)
Control Variables						
Product Characteristics	✓	✓	✓	✓	✓	✓
Demographics	✓	✓	✓	✓	✓	✓
Brand Fixed Effects	✓	✓	✓	✓	✓	✓
Month Fixed Effects	✓	✓	✓	✓	✓	✓
N	1,741,861	1,487,706	1,365,042	1,741,861	1,487,706	1,365,042
R-sq	0.788	0.829	0.825	0.789	0.830	0.826
adj. R-sq	0.788	0.829	0.825	0.789	0.830	0.826

Alternative Mechanism

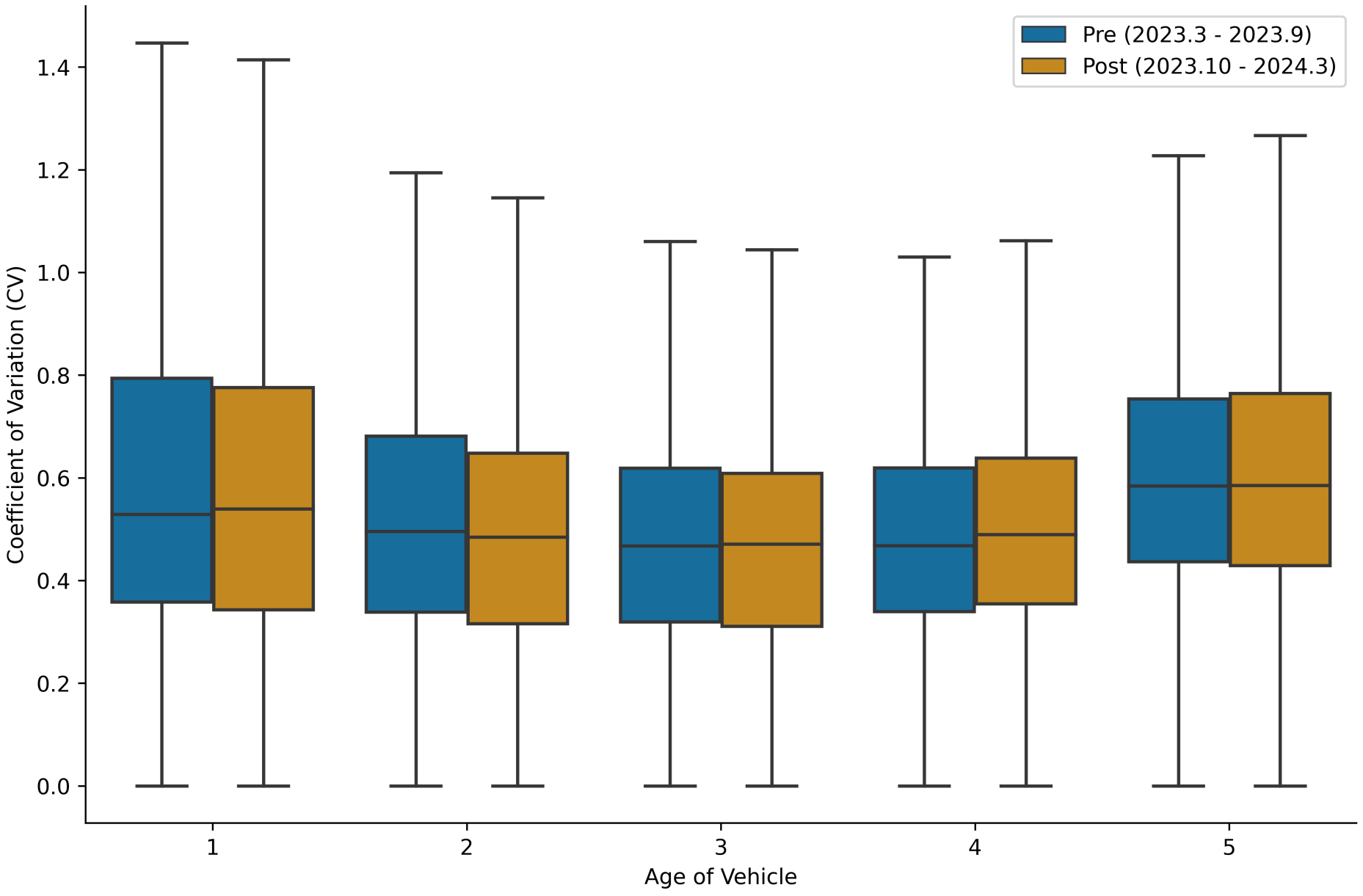
Selection Bias via Information Advantage

- Hyundai may have superior information than dealers about each car, and suggest different prices based on unobservable quality

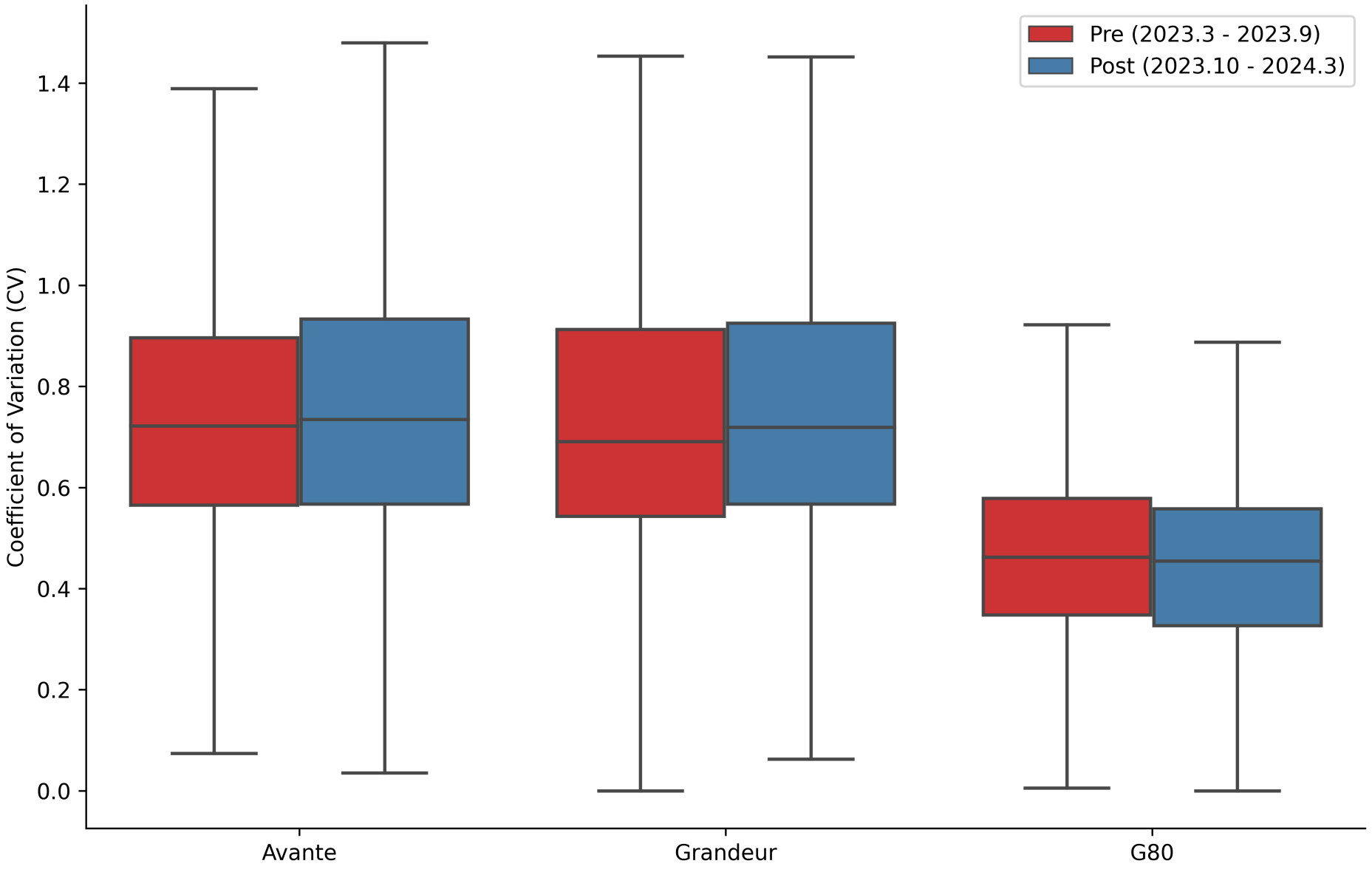
		Observables	Unobservables	Dealer Offer	Hyundai Offer
Pre	$\mathbb{A}$	15,000 km / 2 years	Smoker / 3 dogs / no oil change	\$10,000	-
	$\mathbb{B}$	15,000 km / 2 years	Non-smoker / no dogs / frequent oil change	\$10,000	-
Post (S1)	$\mathbb{A}$	15,000 km / 2 years	Smoker / 3 dogs / no oil change	\$10,000	\$9,000
	$\mathbb{B}$	15,000 km / 2 years	Non-smoker / no dogs / frequent oil change	\$10,000	\$11,000
Post (S2)	$\mathbb{A}$	15,000 km / 2 years	Smoker / 3 dogs / no oil change	\$10,000	\$11,000
	$\mathbb{B}$	15,000 km / 2 years	Non-smoker / no dogs / frequent oil change	\$10,000	\$11,000

- Create "cells" by Mile(80) $\times$ Age(24) $\times$ Fuel(4) $\times$ Model(270)
  - E.g., Mile (1-5,000km) - Age (year 1) - Fuel (Gasoline) - Model (Grandeur)
  - Compute μ and σ for each cell, and get the coefficient of variation (CV) $= \frac{\sigma}{\mu}$
  - Compare the distribution of CV b/a six months of Hyundai entry

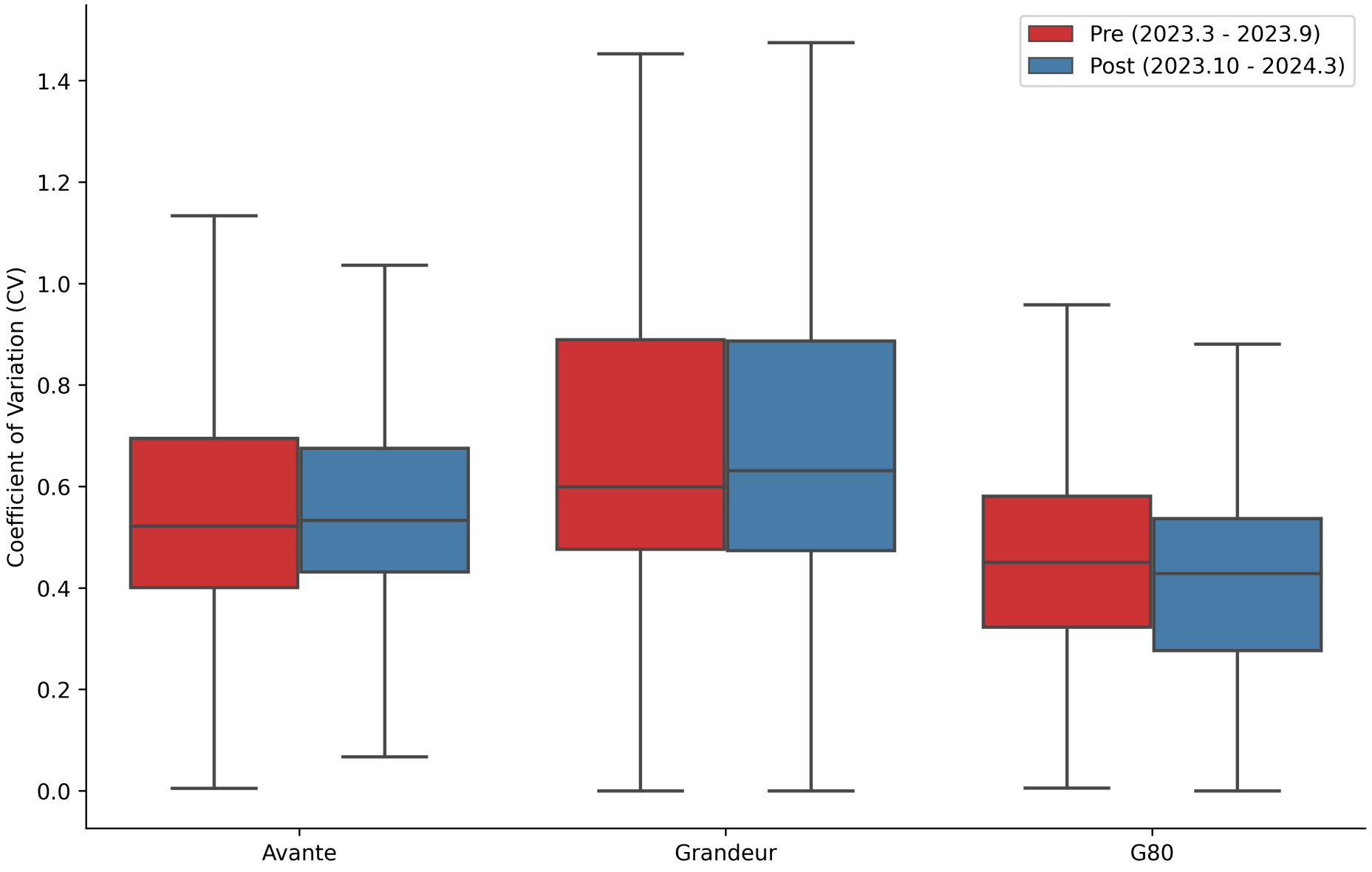
Distribution of CV by Ages



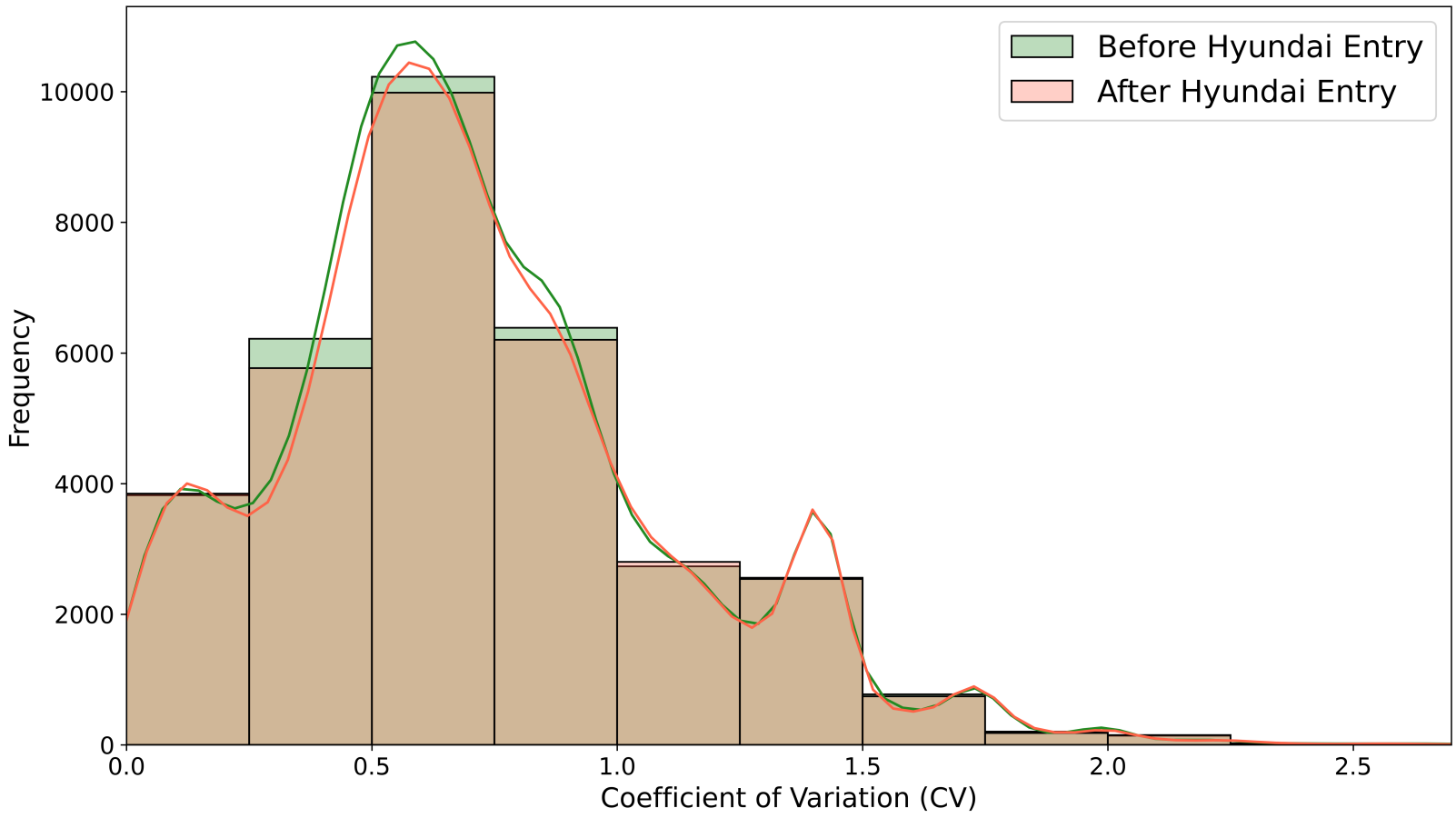
Distribution of CV by Models (Full Sample)



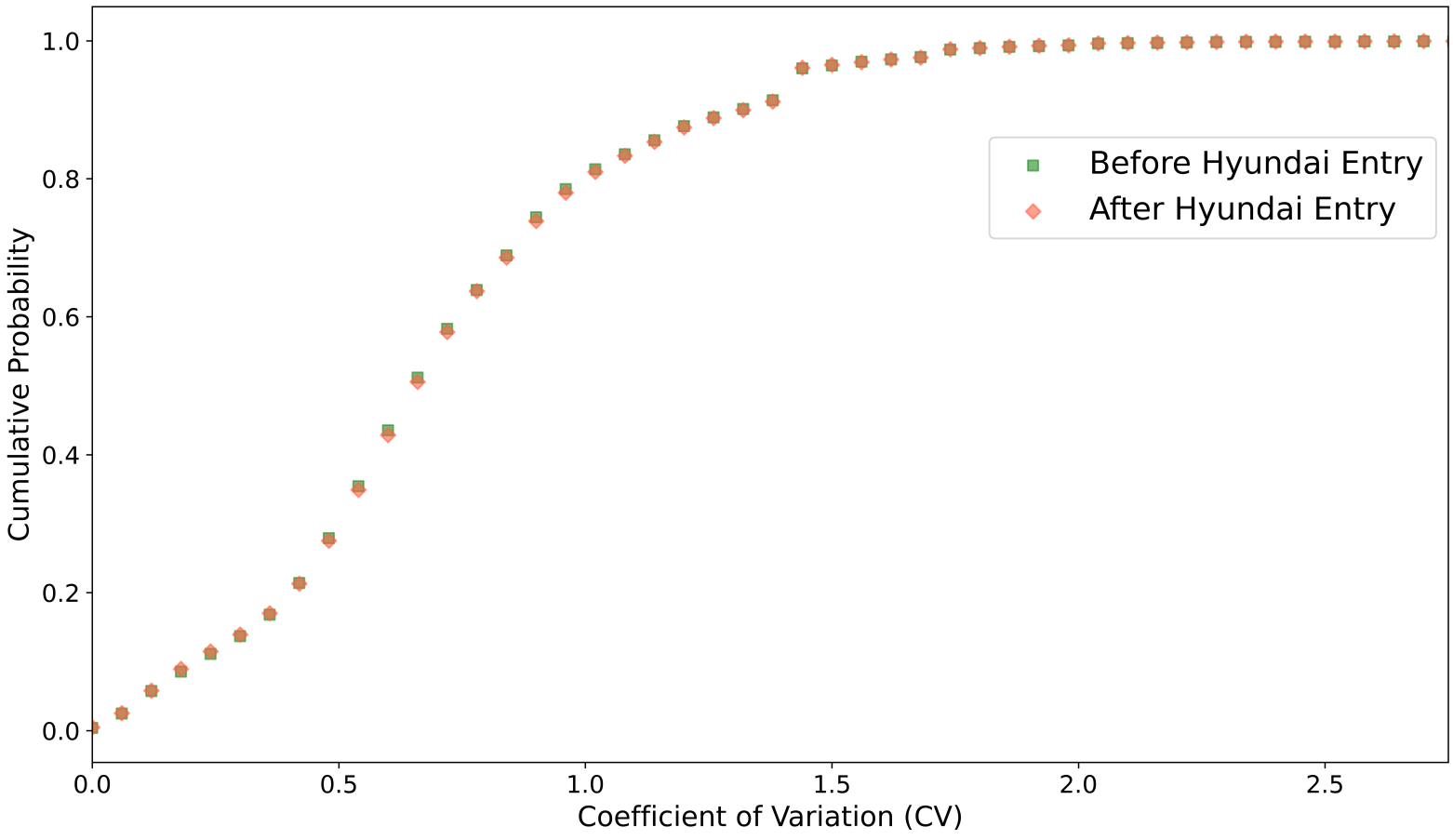
Distribution of CV by Models (Age < 5)



Comparison of PDF



Comparision of CDF



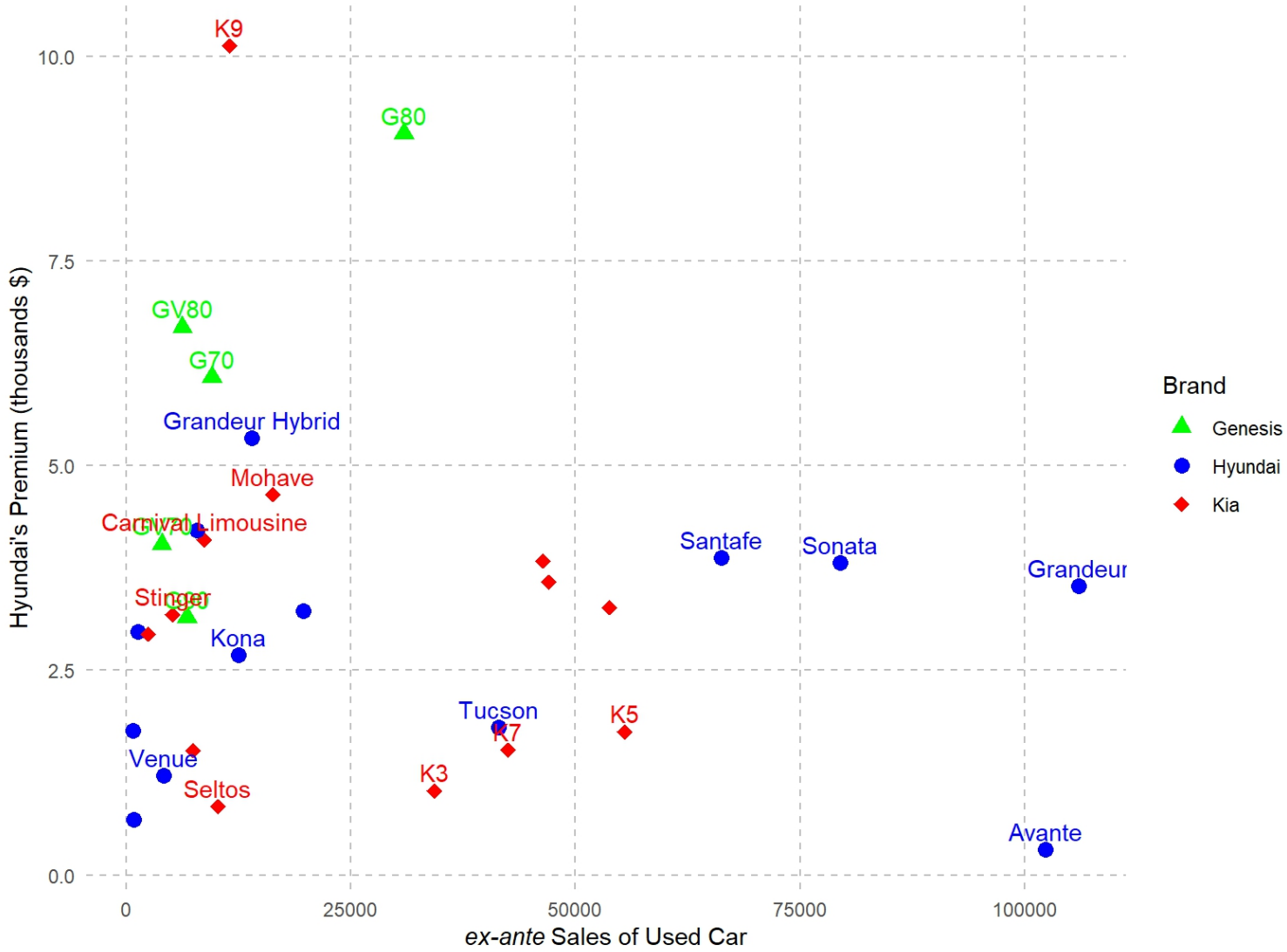
Test Statistics

Test Name	Statistic	p-value
Kolmogorov-Smirnov (KS) test	0.0074	0.3359
Mann-Whitney U test	5.32E+08	0.2562
Median Test (Mood's test)	2.3024	0.1291
Mean test (T-test)	-0.6875	0.4917
Variance test (Levene's test)	0.5041	0.4776

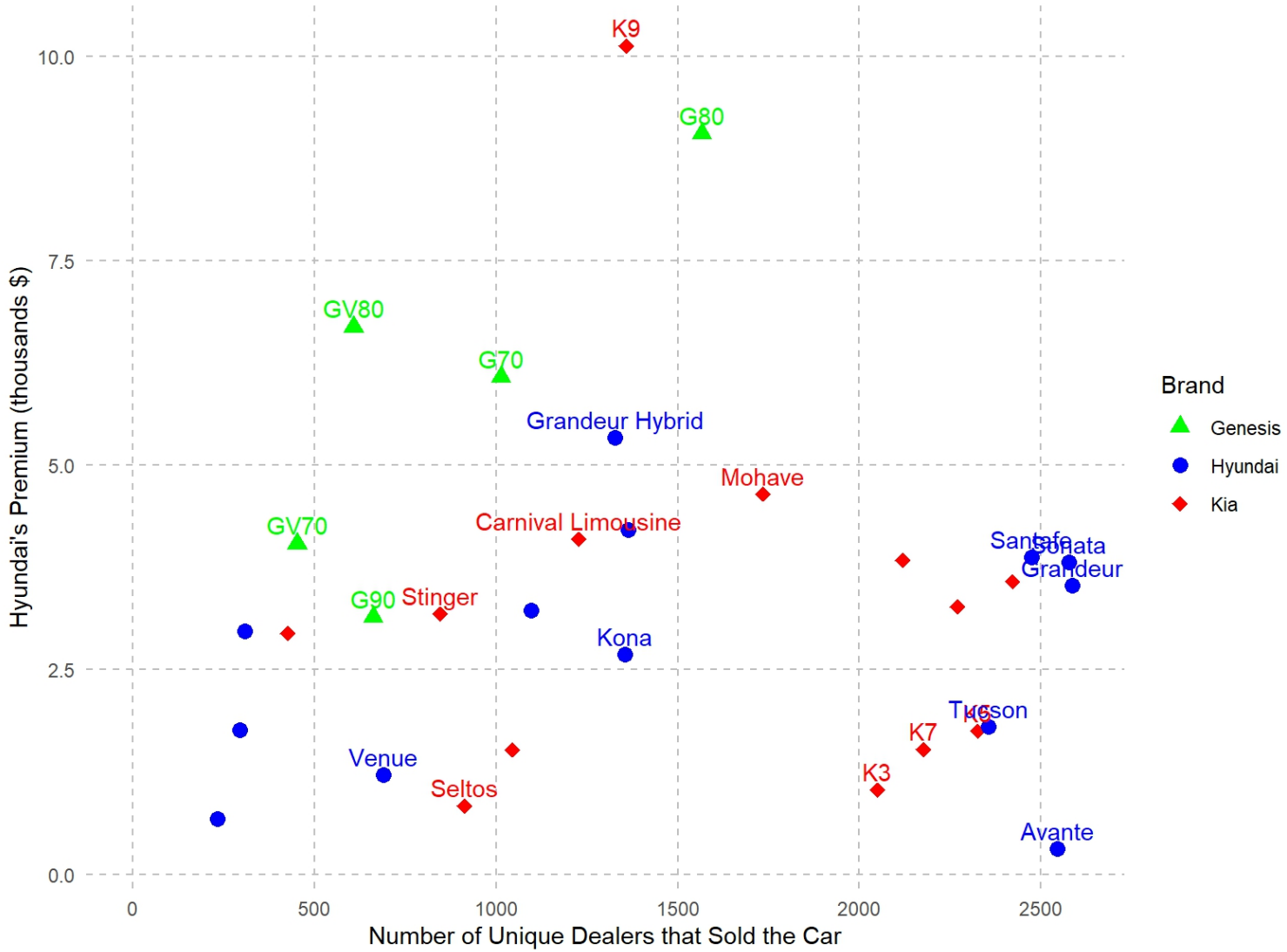
Alternative Mechanism 2: Predatory Pricing

- Used car industry is known for financial constraints because they should finance their wide selection of cars
  - Hyundai might have incentive to conduct predatory pricing by paying higher wholesale prices in order to expel small dealers

Premium vs. Q_{used}



Premium vs. Number of Dealers



Conclusion

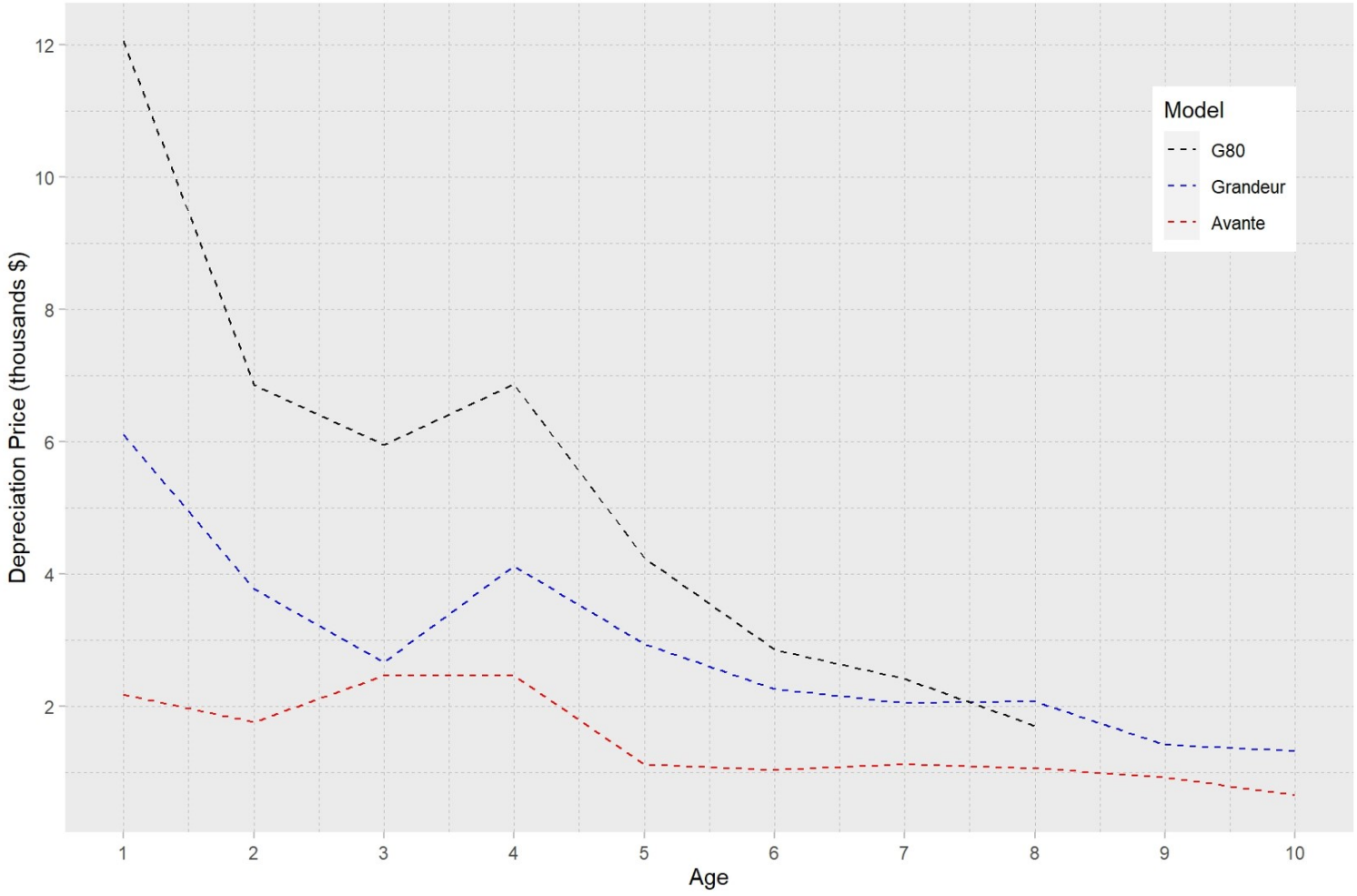
- I provide novel evidence how primary market firms leverage secondary markets not as a challenge but as a opportunity
  - Firms offer $1,648 higher trade-in prices for their cars with a 10% lower *ex-ante* first-year resale value ratio in the secondary market
  - This strategy allows firms to charge 5.94% higher prices on average for new cars, exclusively for models they offered higher trade-in prices

- Policy makers need to consider this unforeseen interplay between secondary and primary markets

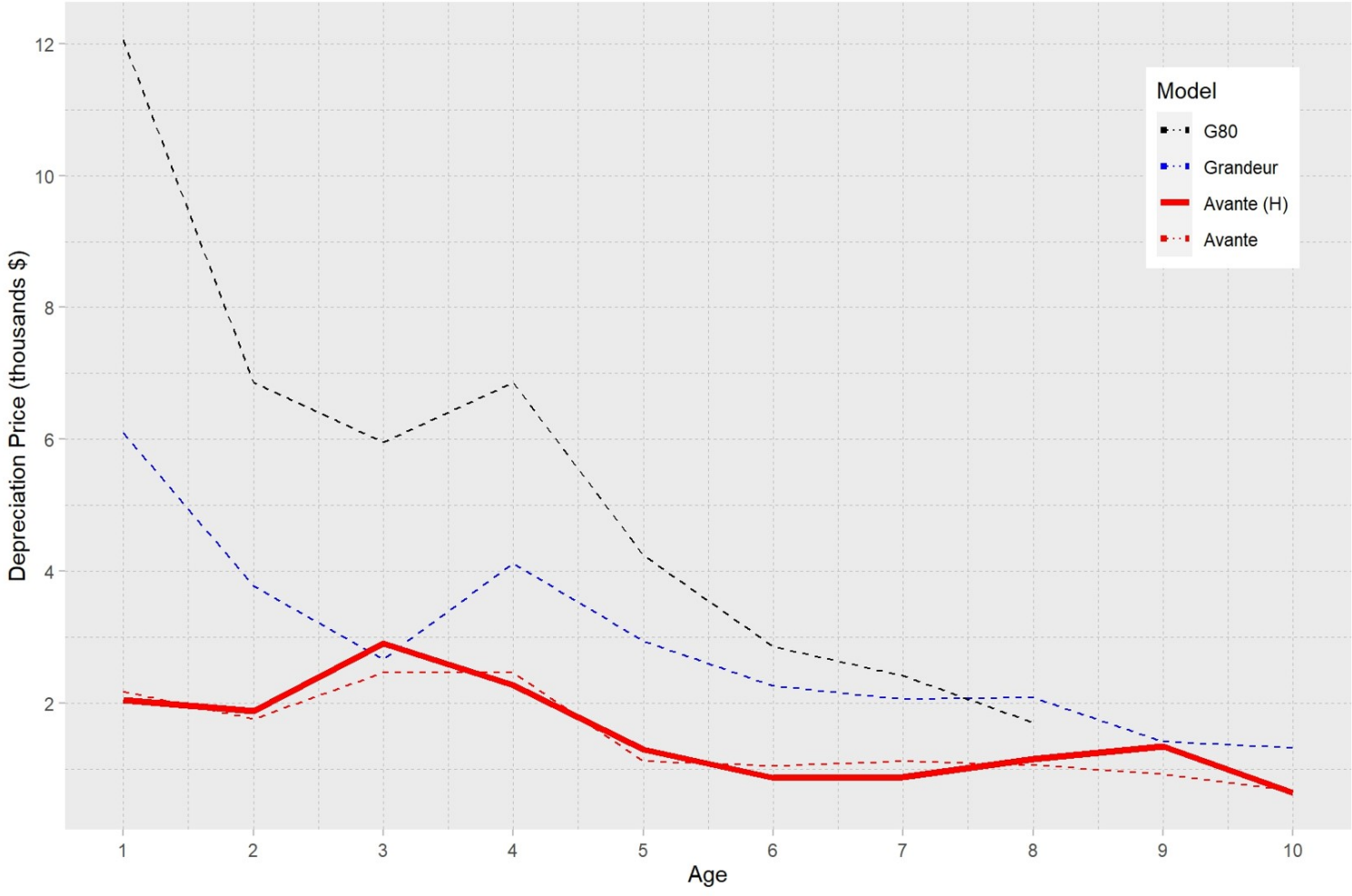
Thank you!

Appendix

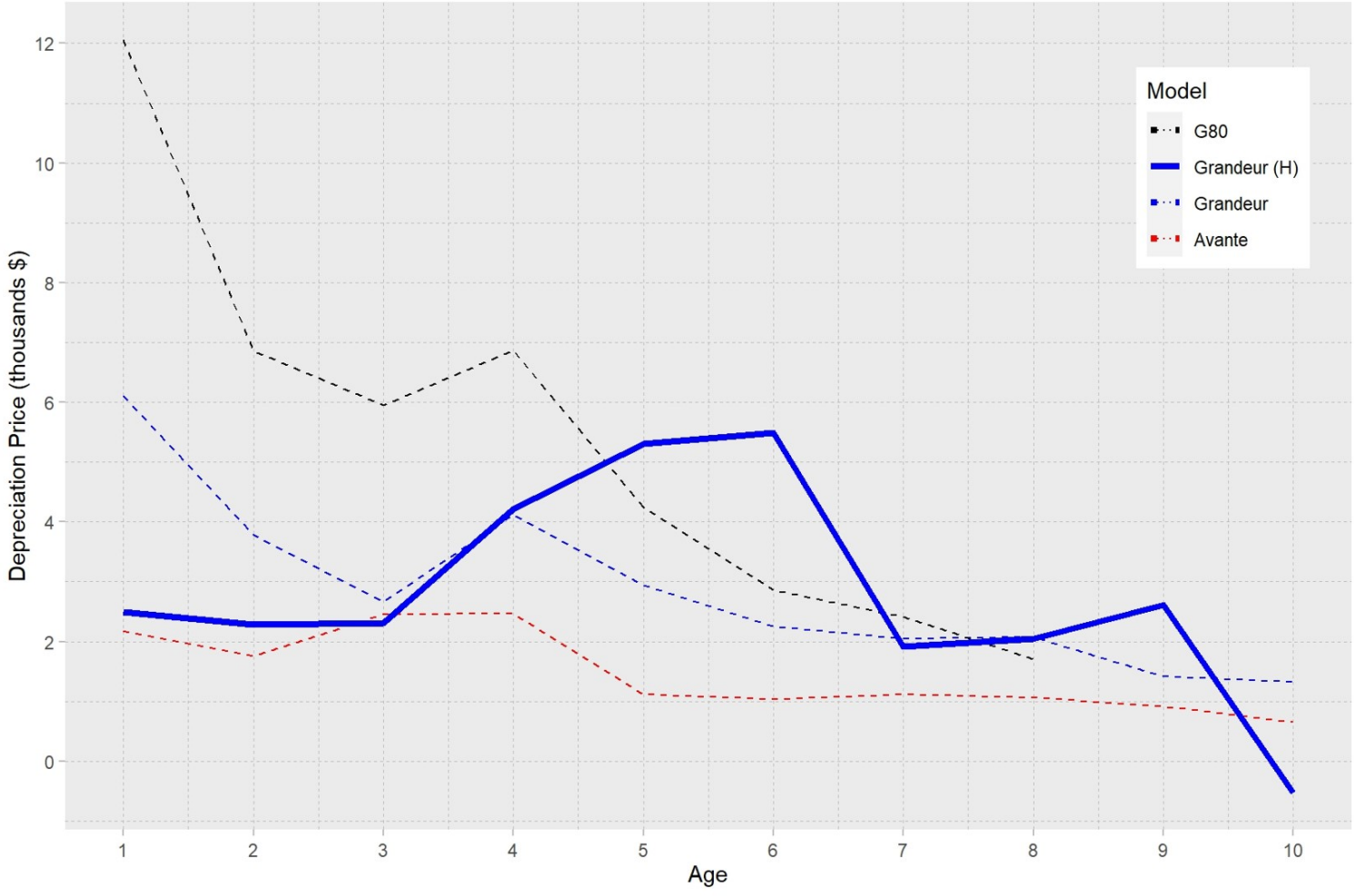
Depreciation Price vs. Age



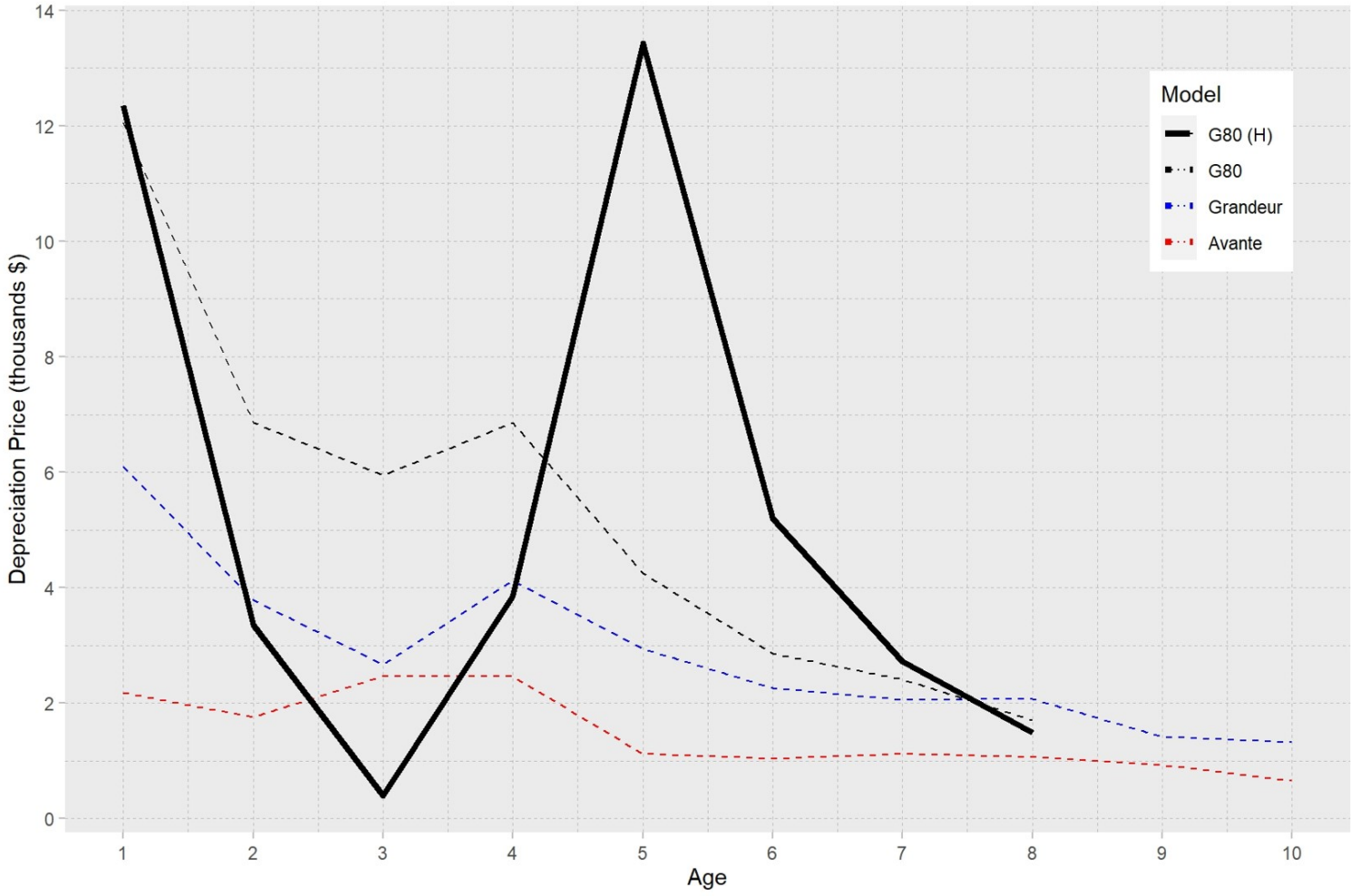
Depreciation Price vs. Age - Avante



Depreciation vs. Age - Grandeur

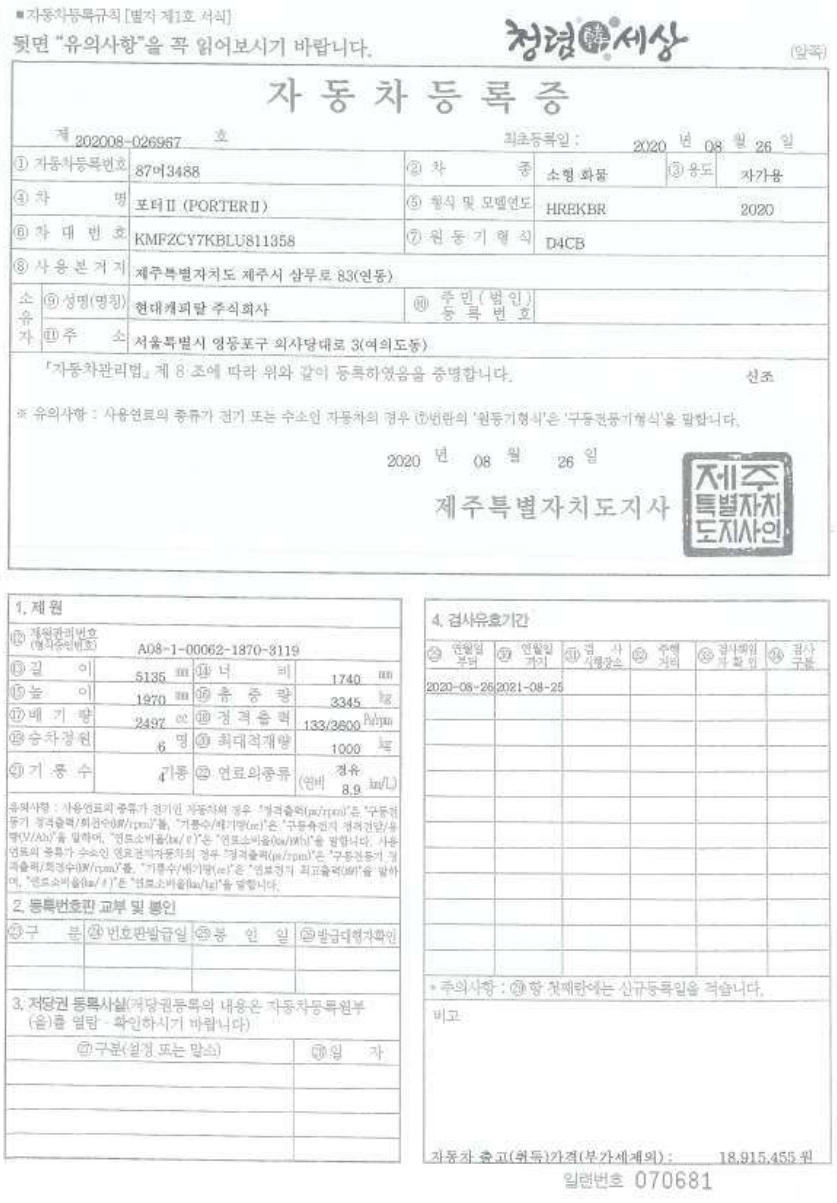


Depreciation Value vs. Age - G80



Vehicle Registration Document

Data



■자동차등록규칙 [별지 제1호 서식]

뒷면 "유의사항"을 꼭 읽어보시기 바랍니다.

청렴세상

(앞쪽)

자 동 차 등 록 증

제 202008-026967 호 최초등록일 : 2020 년 08 월 26 일

① 자동차등록번호	87머3488	② 차 종	소형 화물	③ 용도	자가용
④ 차 명	포터Ⅱ (PORTERⅡ)	⑤ 형식 및 모델연도	HREKBR		2020
⑥ 차 대 번 호	KMFZCY7KBLU811358	⑦ 원 동 기 형 식	D4CB		
⑧ 사 용 본 거 지	제주특별자치도 제주시 삼무로 83(연동)				
소유자 ⑨ 성명(명칭)	현대캐피탈 주식회사	⑩ 주민(법인)등록번호			
소유자 ⑪ 주 소	서울특별시 영등포구 의사당대로 3(여의도동)				

「자동차관리법」 제 8 조에 따라 위와 같이 등록하였음을 증명합니다. 신조

※ 유의사항 : 사용연료의 종류가 전기 또는 수소인 자동차의 경우 ⑰번란의 '원동기형식'은 '구동전동기형식'을 말합니다.

2020 년 08 월 26 일

제주특별자치도지사 제주특별자치도지사인

1. 제원

⑫ 자원관리번호(형식승인번호)	A08-1-00062-1870-3119		
⑬ 길 이	5135 ㎜	⑭ 너 비	1740 ㎜
⑮ 높 이	1970 ㎜	⑯ 총 중 량	3345 ㎏
⑰ 배 기 량	2497 ㏄	⑱ 정 격 출 력	133/3800 ㎾/rpm
⑲ 승차정원	6 명	⑳ 최대적재량	1000 ㎏
㉑ 기 통 수	4 기통	㉒ 연료의종류	(엔비 경유 8.9 ㎞/L)

유의사항 : 사용연료의 종류가 전기인 자동차의 경우 "정격출력(㎾/rpm)"은 "구동전동기 정격출력/최고수의W/rpm)"을, "기통수/배기량(㏄)"은 "구동축전지 정격전압/용량(V/Ah)"을 말하며, "연료소비율(㎞/ℓ)"은 "연료소비율(㎞/Wh)"을 말합니다. 사용연료의 종류가 수소인 연료전지자동차의 경우 "정격출력(㎾/rpm)"은 "구동전동기 정격출력/최고수의W/rpm)"을, "기통수/배기량(㏄)"은 "연료전지 최고출력(㎾)"을 말하며, "연료소비율(㎞/ℓ)"은 "연료소비율(㎞/㎏)"을 말합니다.

2. 등록번호판 교부 및 봉인

㉓ 구 분	㉔ 번호판발급일	㉕ 봉 인 일	㉖ 발급대행자확인

3. 저당권 등록사실(저당권등록의 내용은 자동차등록원부(을)를 열람·확인하시기 바랍니다)

㉗ 구분(설정 또는 말소)	㉘ 일 자

4. 검사유효기간

㉙ 연월일 부터	㉚ 연월일 까지	㉛ 검 사 시행장소	㉜ 주행 거리	㉝ 검사책임자 확 인	㉞ 검사 구분
2020-08-26	2021-08-25				

※ 주의사항 : ㉙항 첫째란에는 신규등록일을 적습니다.

비고

자동차 출고(취득)가격(부가세제외) : 18,915,455 원

일련번호 070681

- Transaction price $= p + 0.1p = 1.1p$
- $18,915,455 \times 1.1 = 20,807,000.5$
- VAT(10%), registration tax(7%), bond purchase tax(1.15%)

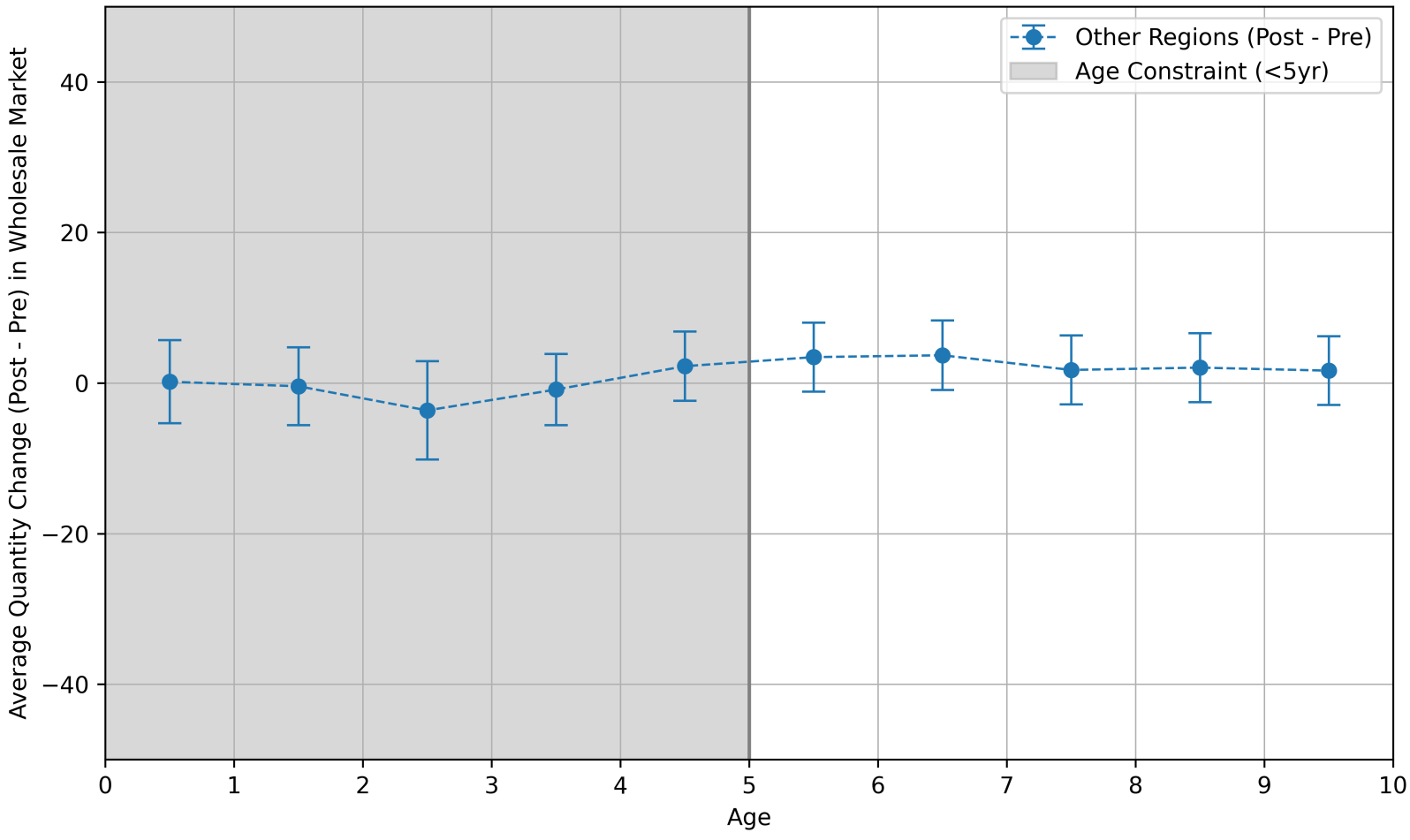
Seocho: Hyundai's Headquarters County

Data

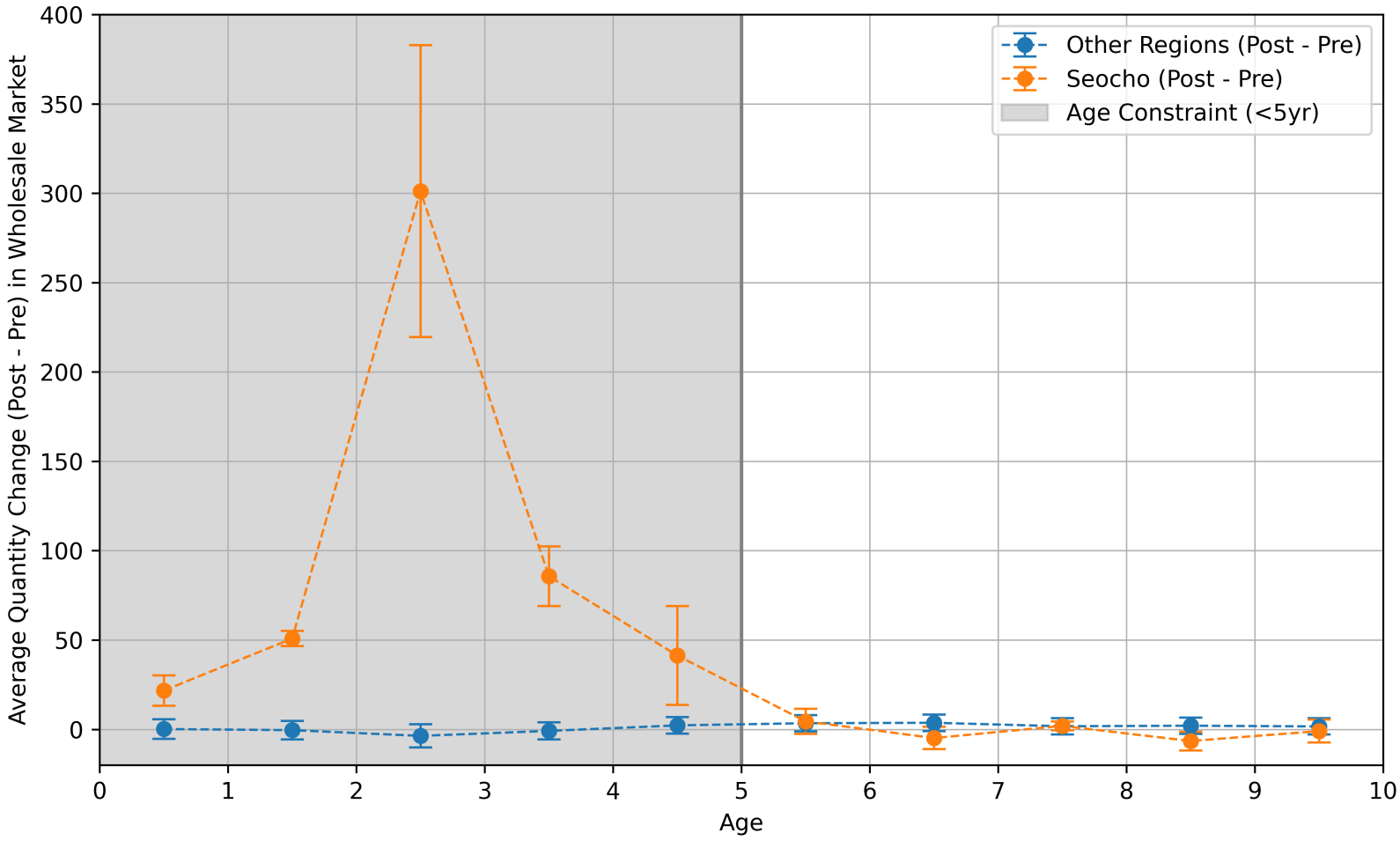
$$q_{Art} = \sum_{A=1}^{10} 1(A) \cdot (\beta_{1A} + \beta_{2A} Seocho_r + \beta_{3A} Post_t + \beta_{4A} Seocho_r \times Post_t) + \gamma_r + \tau_t + \varepsilon_{Art}$$

- q_{Art} is the wholesale quantity purchased **"for-sale"** of used car age A at region r at period t
- $Seocho_r$ is equal to 1 if r is Seocho
- $Post_t$ is equal to 1 if t is post Oct. 2023 inclusive
- γ_r and τ_t are fixed effects

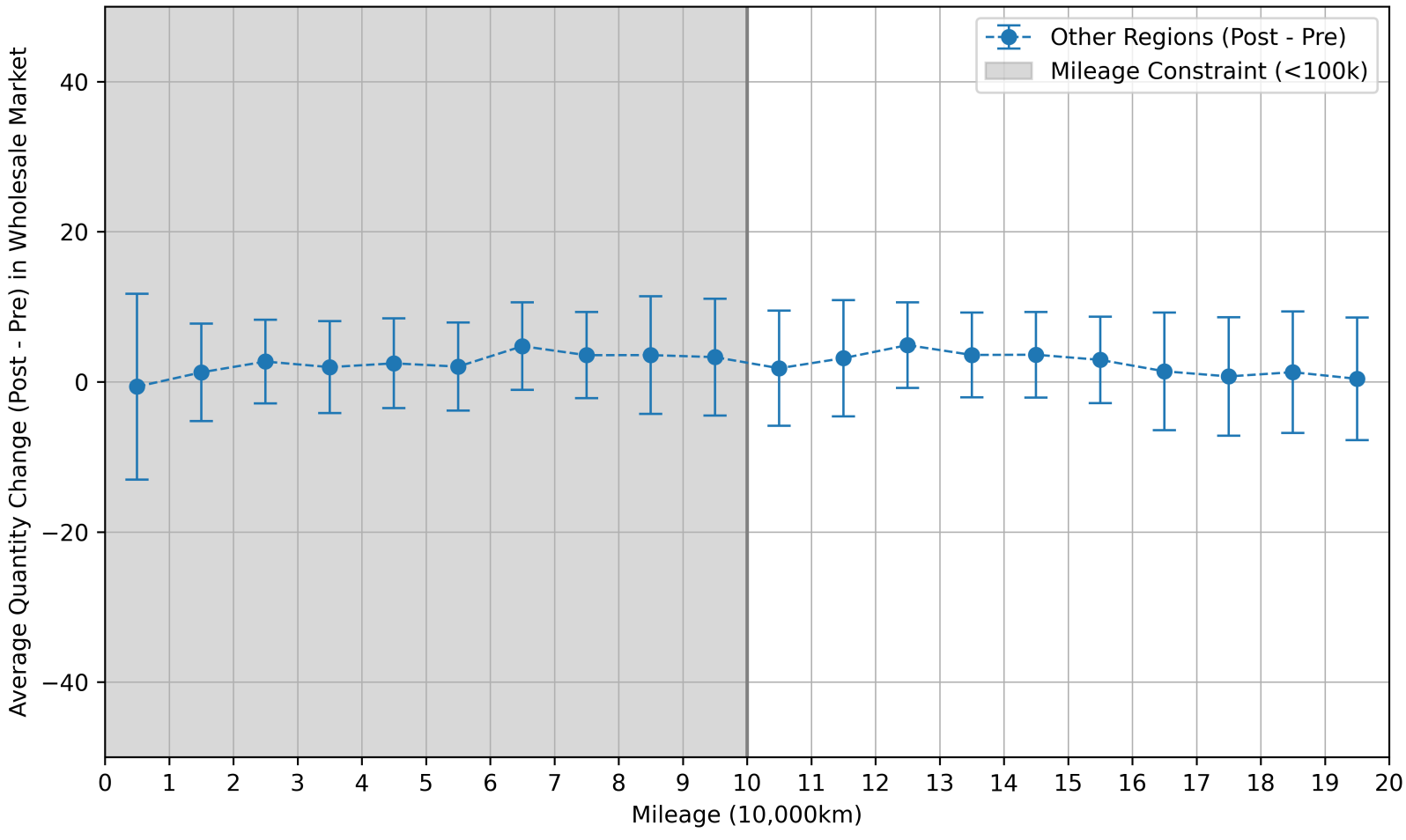
Quantity Changes of Vehicles across Age



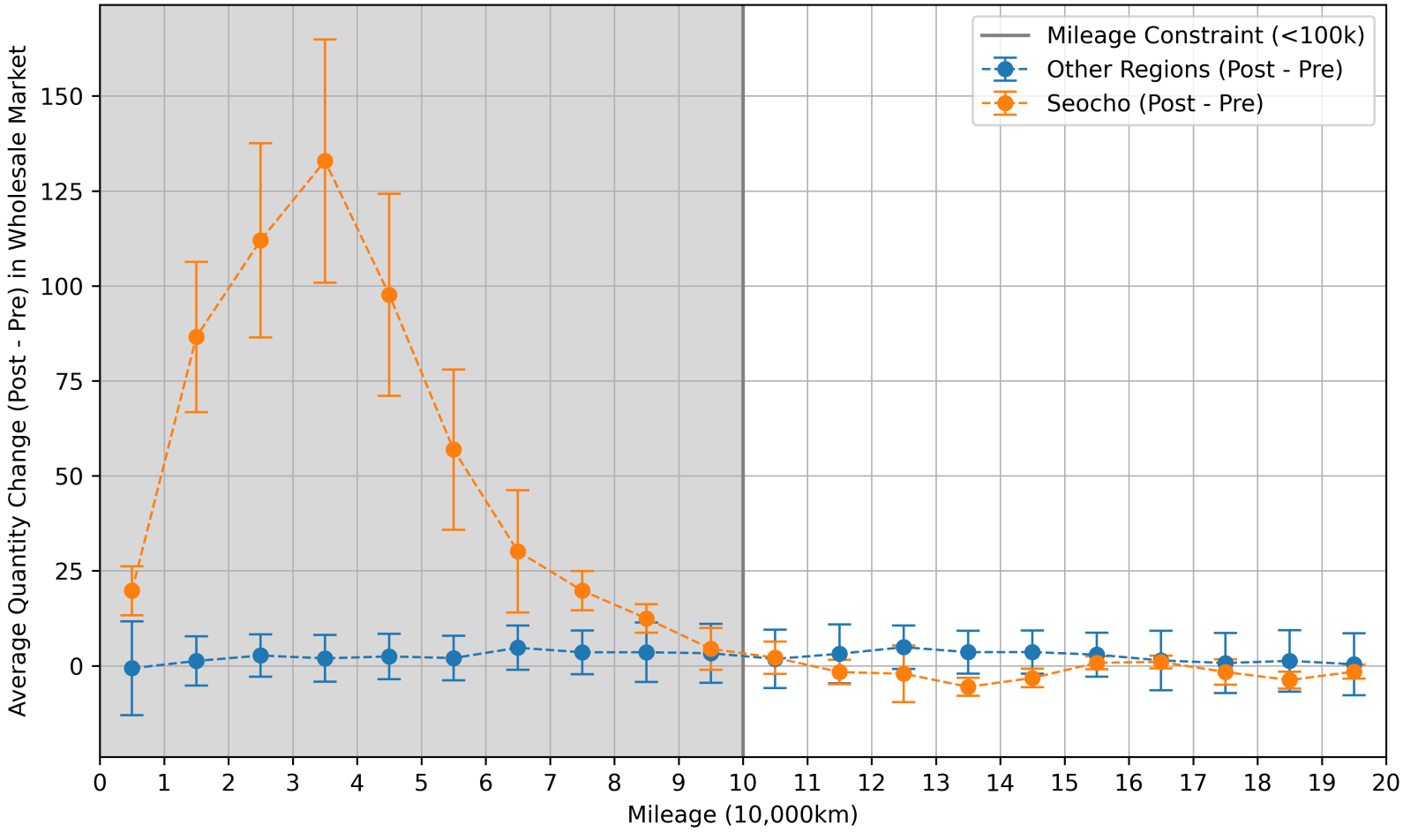
Quantity Difference of Vehicles across Age



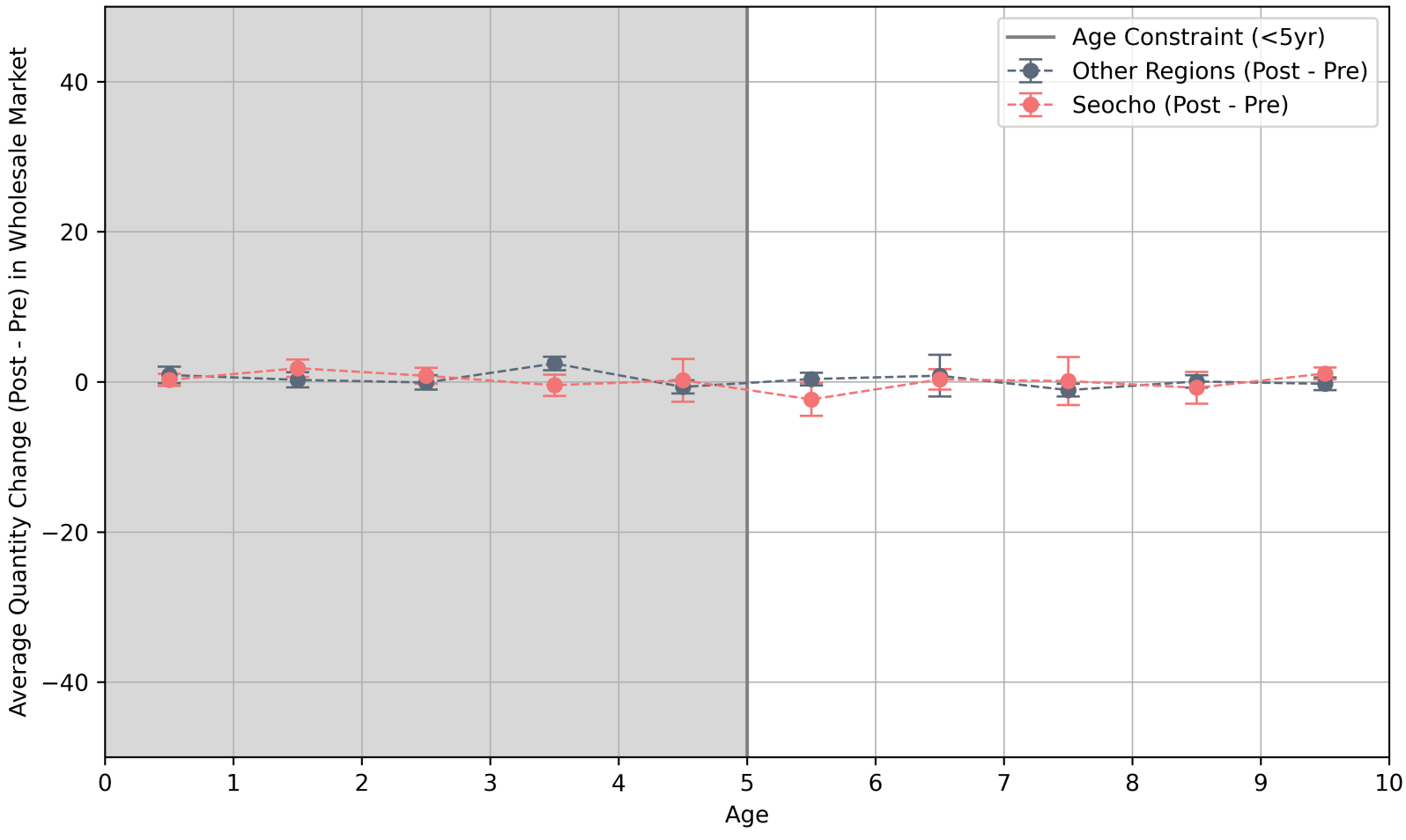
Quantity Difference of Vehicles across Mileages



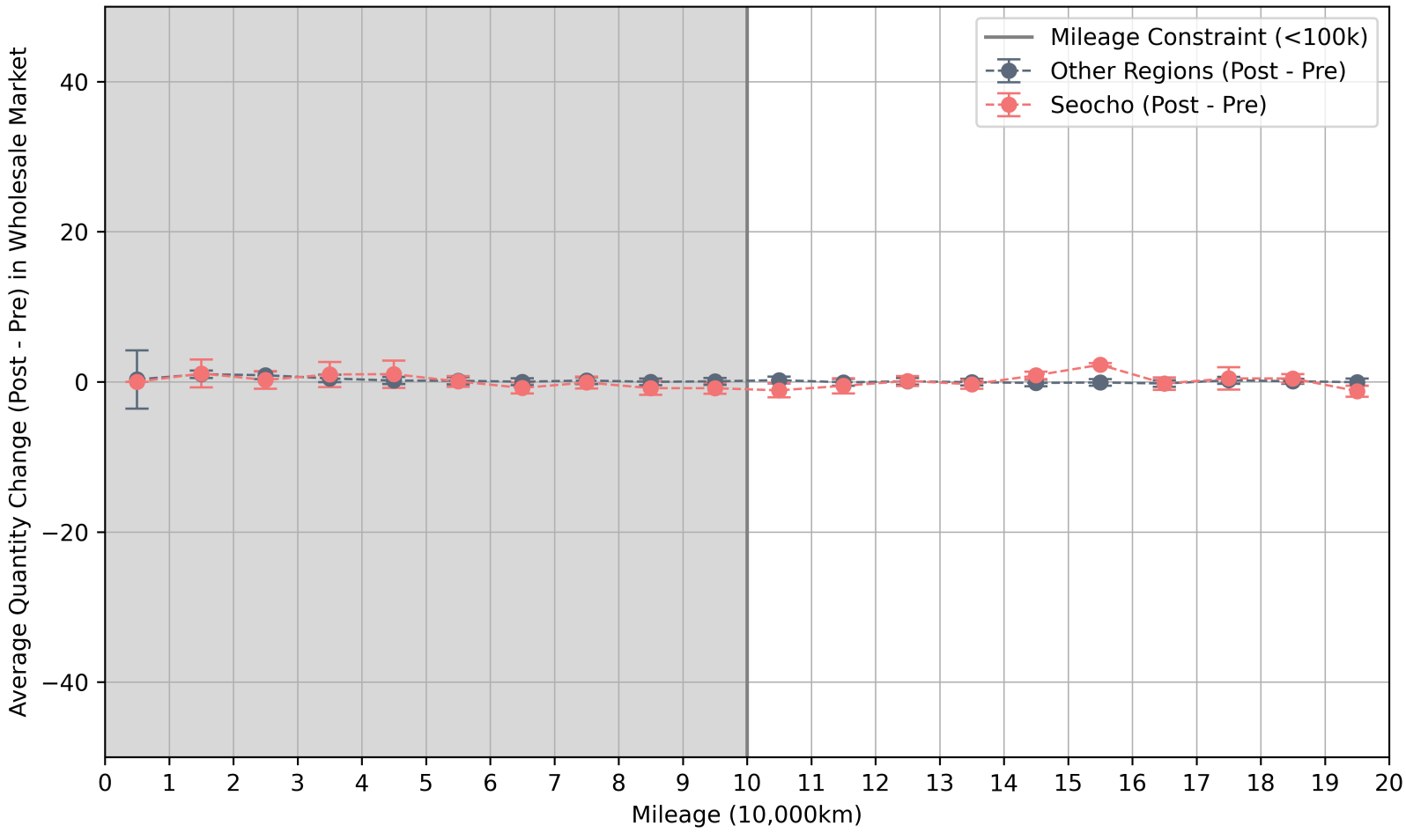
Quantity Difference of Cars Mileages $<$ 100k



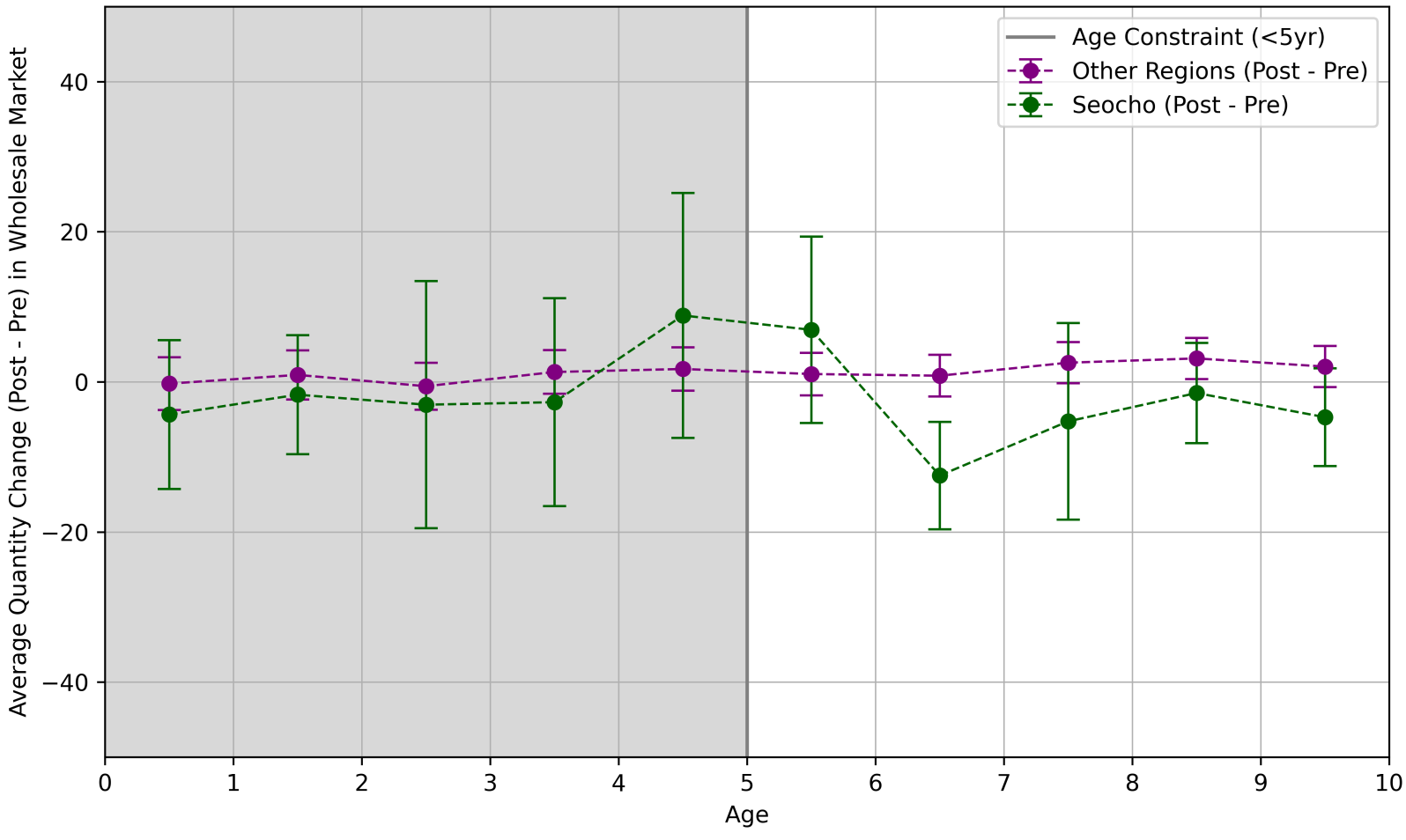
Falsification Test: Hyundai's Freight Cars



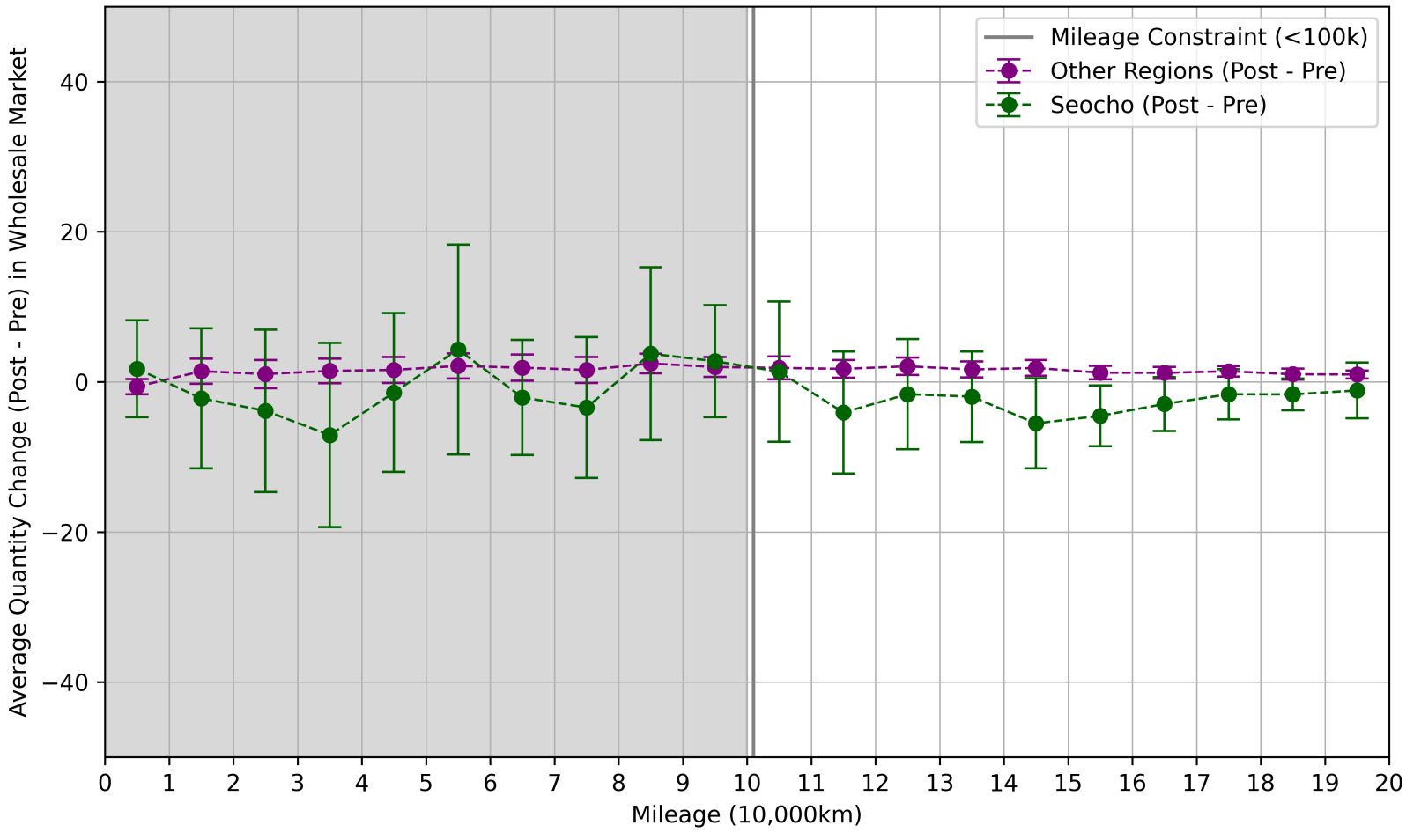
Falsification Test: Hyundai's Freight Cars



Falsification Test: Non-Hyundai's Passenger Cars



Falsification Test: Non-Hyundai's Passenger Cars



Among Seocho: Usage Address

Data