Intermediaries in a Decentralized Economy: Evidence from Used-Car Markets

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What do car dealers do?

- reduce (spatial) search friction
- select "good" product
- create surplus

What do they also do?

- charge high price
- crowd out private transaction
- extract and redistribute surplus

Goal: Characterize welfare implications of used car dealers.

We build and estimate a spatial bargaining-and-search model to

- quantify and decompose used-car dealers' welfare effects
  - selective acquisition of cars
  - superior matching technology
  - bargaining power
- evaluate the impacts of spatial search frictions in the market

Results

Car dealers are important: e.g., 10% drop in dealer capacity leads to

- buyer's value decreases by $1432, seller's increases by $1554, and dealer's increases by $3943

Dealer have advantages in bargaining and matching. Reducing each leads to

- less dealer participation, more direct trade, and longer search time
- ambiguous price effect, but often cause price higher, hurt buyers and benefit sellers

Distance and co-existence of direct and intermediated trade matter. Reducing spatial friction

- leads to more direct trade and less intermediated trade
- increases prices and hurts buyers in contrast to conventional wisdom

Intermediary, Alleviate Search Friction

- **Theory**: Rubinstein and Wolinsky (1987), Gehrig (1993), Spulber (1996), Hall and Rust (2000), Johri and Leach (2002), Shevchenko (2004), Duffie et.al (2005), Rhodes et al. (2018), Hugonnier et al. (2020)...
- **Empirics**: Gavazza (2016), Allen et al. (2014, 2023), Donna et al. (2022), Salz (2022)...

Intermediary, Product Selection

- **Theory**: Biglaiser (1993), Lizzeri (1999), Glode and Opp (2016) ...
- **Empirics**: Biglaiser et al. (2020), Claudia Robles (2019), Gavazza and Lizzeri (2021)...

Used-Car Market

- Bond (1982, 83), Genesove (1993), Adams et al (2011), Gavazza et al. (2014), Peterson and Schneider (2014), Murry and Schneider (2016), Murry and Zhou (2020), Larsen (2021), Gillingham et al. (2022), Li et al. (2024)...

Empirical Labor Search

- Flinn and Heckman (1982), Eckstein and Wolplin (1995), Flinn (2006), Eckstein and Van den Berg (2007), Flabbi (2010), Flabbi and Moro (2012), Todd and Zhang (2024)...

Market, Data, and Motivating Facts

Used Car Markets

- big market in US: $\geq$ 40 million cars (\$500 billion) sold per year, $\geq$ 2x new cars sold
- used cars are heterogeneous: brand, made, car age, unobservable characteristics...
- frictional market: it takes weeks to trade, location matters for search friction
- transaction prices determined by bargaining, price dispersion 5x new car market's
- dealers are active: 2/3 through dealers, and 1/3 through direct trade

DMV transaction data
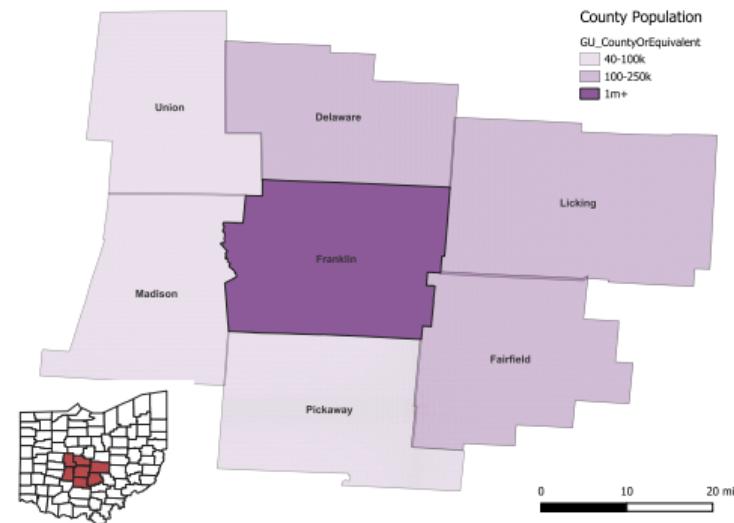
- date, price, car characteristics and VIN
- seller, buyer, dealer's location, dealer identity

Cars.com dealer inventory data

- online platform for listing inventories
- details about cars including VIN
- large fixed cost and minimal marginal cost

Sample construction

- Columbus area 7 counties
- non-luxury four-door sedan 4–13 years old
- 18,355 transactions in 2017

Fact (product selection)
Dealers primarily sell relatively young cars, whereas private sellers tend to sell old ones. `▸ detail`

Fact (price premium)
The average price of intermediated transactions is substantially higher than that of direct transactions, and this price premium decreases in car age. `▸ detail`

| Car Age (years)	Private Seller		Independent Dealer		Franchised Dealer		CarMax	
	price ($1,000)	weeks on market	price ($1,000)	weeks on market	price ($1,000)	weeks on market	price ($1,000)	weeks on market
4-5	9.028	-	11.872	6.621	13.367	4.774	15.724	3.144
6-7	6.199	-	9.250	6.071	10.191	4.170	12.421	2.986
8-9	4.455	-	6.767	6.455	8.230	3.547	10.998	2.581
10-11	2.945	-	4.656	5.450	6.293	2.962	-	-
12-13	2.093	-	3.098	5.372	4.910	2.663	-	-
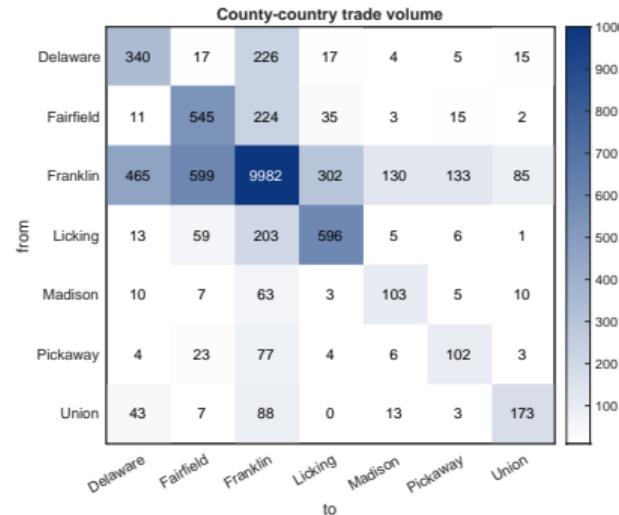
Fact
*The **time on the market** of dealers' cars varies in car age and dealer type. Roughly speaking, old cars are sold faster.*

Fact
*Used car transactions are spatially imbalanced, exhibiting a **core-periphery** pattern. Most transactions happen either within county or between core and periphery, and trade flows are **asymmetric**.* ▸ capacity

County-country trade volume

Fact
Cars in the core county are sold faster. ▸ time on the market

Model

Car characteristics $x = (y, z)$

- y: observable, age, $\{1, ..., 5\}$
- z: unobservable to economists, H or L

Agents are distributed in locations $l \in \{1, ..., 7\}$:

- buyer: unit demand, payoff

$$\delta^y u_z + \epsilon - p \quad \text{with} \epsilon \sim \text{Logistic}(0, \sigma(y))$$

  seller: each draws $x \sim F(x)$

- dealer: unit slot, type-dependent inv. cost, fixed total mass $\forall$ type and location.

Time is continuous and lasts forever

- agents **search**, form **random** bilateral match
- meeting rate depends on agents' types
- same-location agents are more likely to meet than cross-location ones
- matched agents see x, ϵ and **bargain**
- bargaining power depends on agent type
- buyer/seller leaves the market after trade

New buyers and sellers constantly enter locations. Look for a steady-state equilibrium

Limited capacity gives rise to dealer's **product selection** under symmetric information!
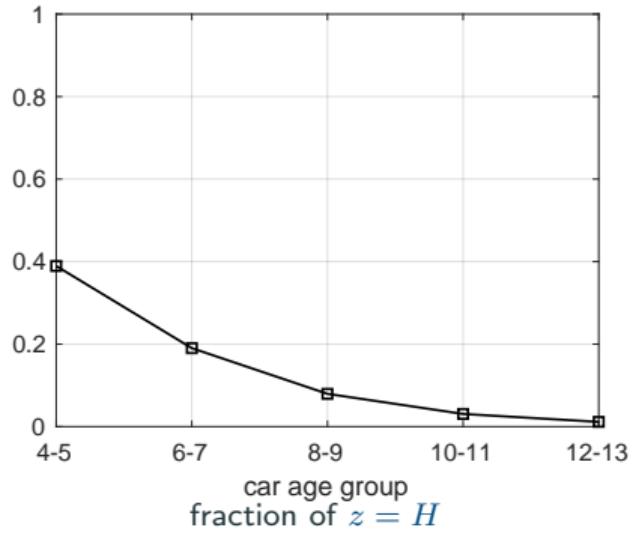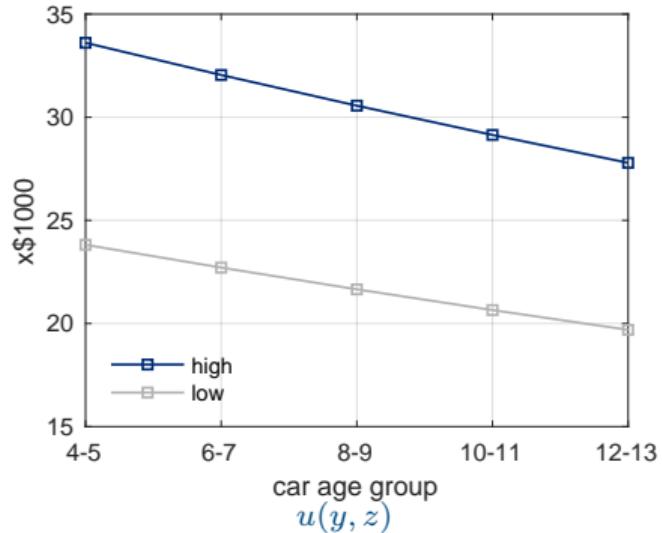
Car Flow

Estimation
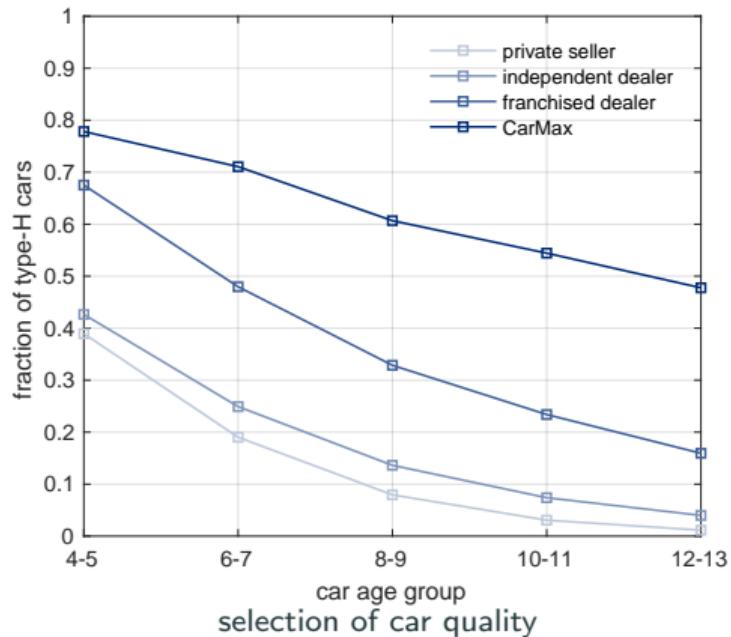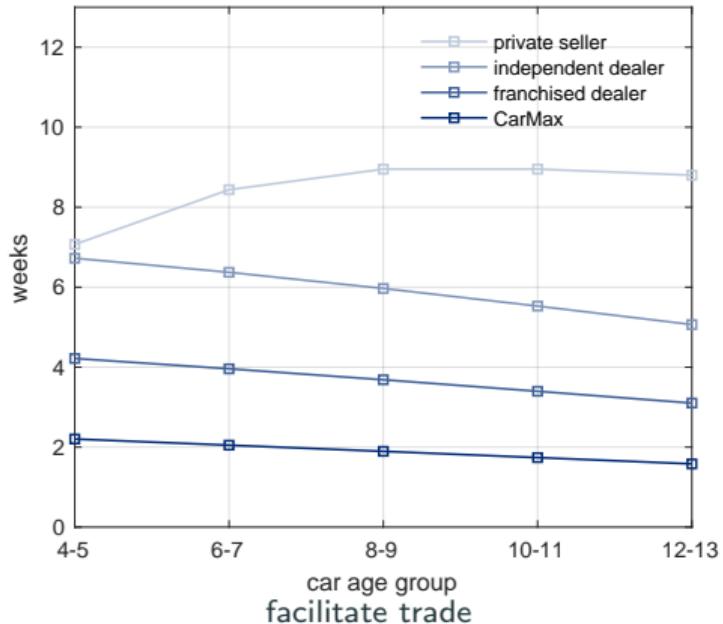
Buyer utility function $u(y,z) = \delta^y u_z$ and quality distribution of cars held by sellers by age group.

Estimates of bargaining and matching parameters

		Bargaining power	Retail matching rate ($\times 10^{-3}$)	
			within-county	across-county
seller - buyer (SB)		0.639	0.159	0.122
dealer - buyer (DB)	independent dealer	0.656	0.291	0.267
	franchised dealer	0.760	0.455	0.446
	CarMax	0.989	1.068	0.531

facilitate trade

selection of car quality

Counterfactuals

Using the estimates, we conduct two sets of counterfactual analysis
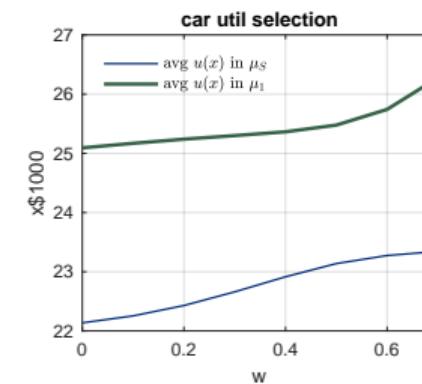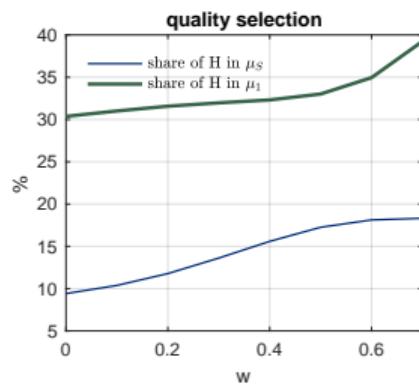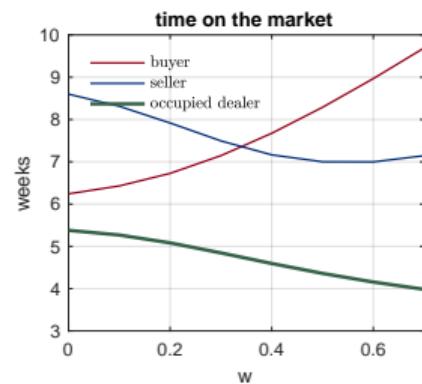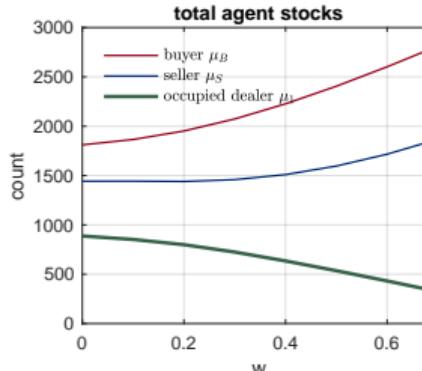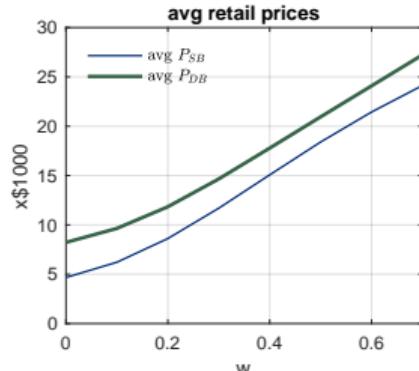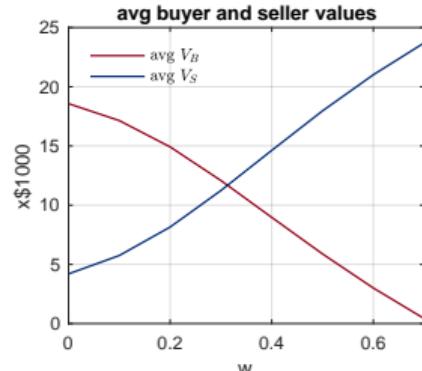
Quantify and decomposition of dealers' welfare impacts

1. reducing dealer slots
2. reducing dealer bargaining power
3. reducing dealer matching efficiency

Reducing spatial search friction in two steps
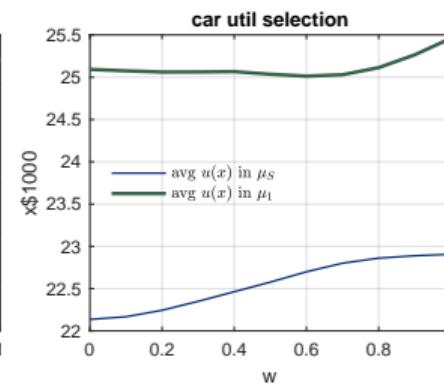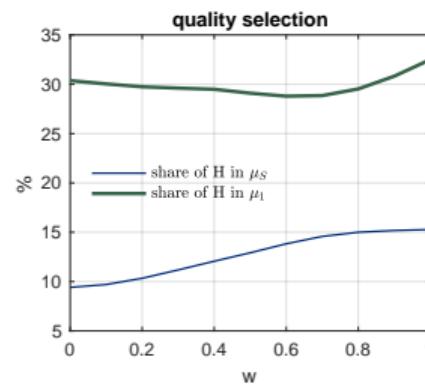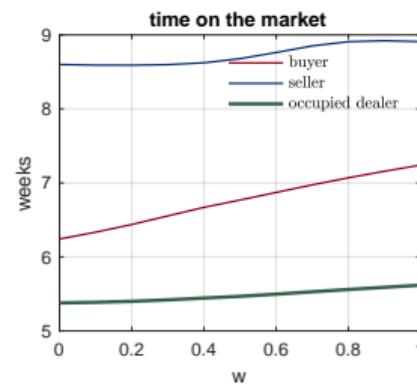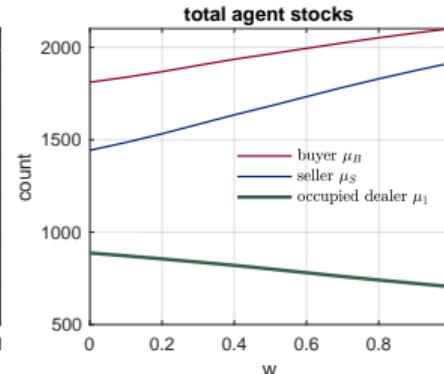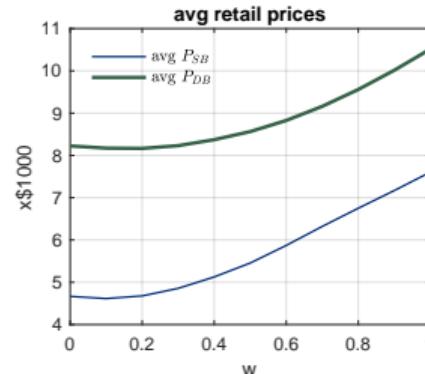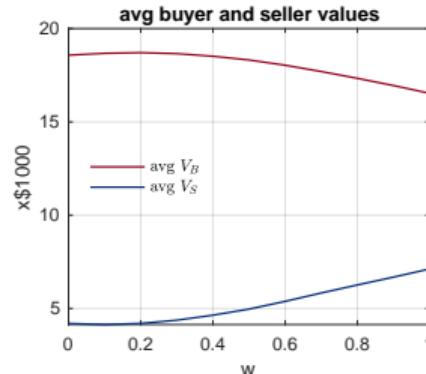
1. reducing dealer's across-location search friction
2. reducing seller's across-location search friction as well
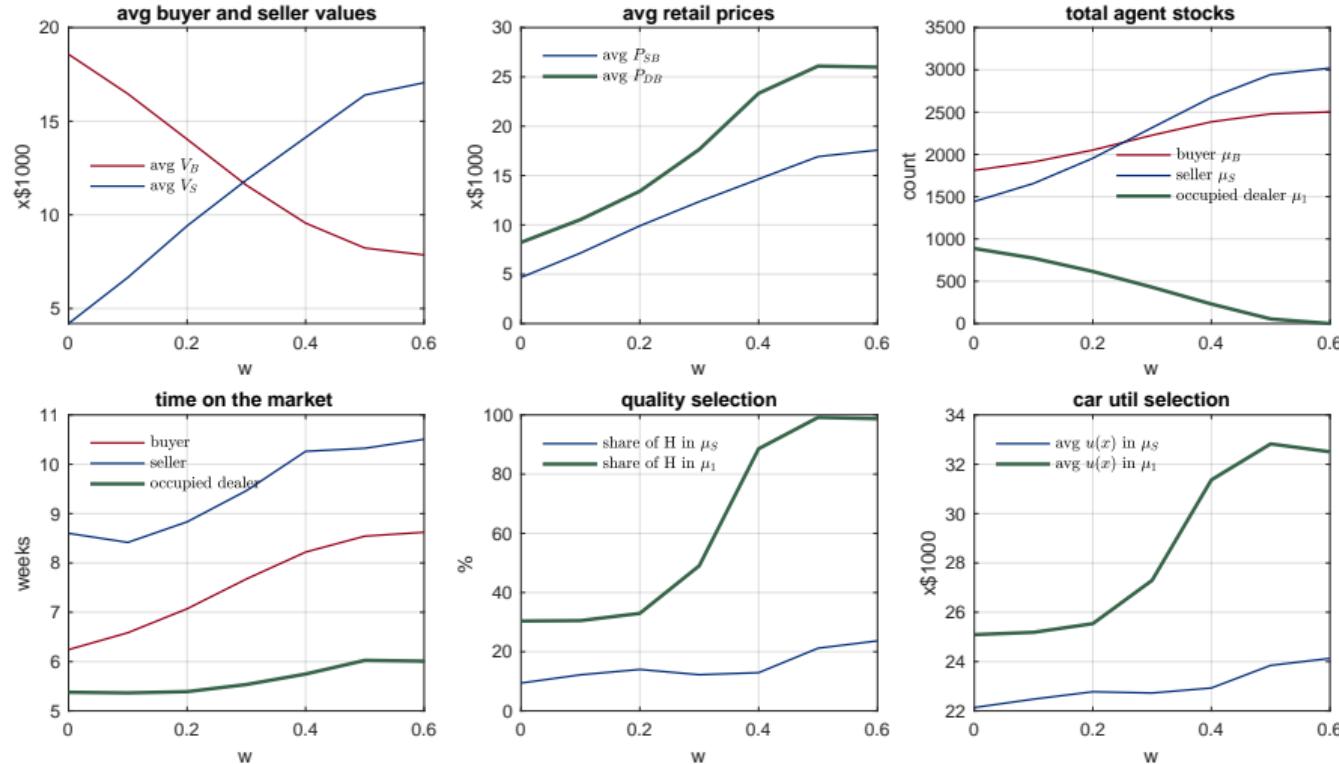
Note. The x-axis shows the fraction w of dealer capacity reduced, such that $m^{\text{counterfactual}}(d, l; w) = (1 - w)m(d, l), \forall d, l.$

Note. The x-axis shows the weight w of the counterfactual, such that $\theta_{DB}^{\text{counterfactual}}(d; w) = w\theta_{SB} + (1 - w)\theta_{DB}(d)$.

Matching Advantage

Note. The x-axis shows the weight w of the counterfactual, such that $\lambda_{DB}^{i,\text{counterfactual}}(d;w) = w\lambda_{SB}^{i} + (1-w)\lambda_{DB}^{i}(d)$, for $i = 0$ (within-county trade) and 1 (across-county trade).

Reducing Spatial Search Effect

	values		prices		masses		
	V_B	V_S	P_{DB}	P_{SB}	μ_D	μ_S	μ_B
I. Benchmark	18,574	4,195	8,224	4,666	887	1,443	1,811
II. $\lambda_{DB}^1(d) \uparrow$ by $20\% \times (\lambda_{DB}^0(d) - \lambda_{DB}^1(d))$	18,877	3,865	7,871	4,335	908	1,408	1,798
III. II and $\lambda_{SB}^1 \uparrow$ by $20\% \times (\lambda_{SB}^0 - \lambda_{SB}^1)$	17,240	5,316	10,056	5,779	818	1,551	1,851

- **competition effect**: less friction $\Rightarrow$ intensify competition $\Rightarrow$ retail price $\downarrow$ buyer welfare $\uparrow$
- **reallocation effect**: sellers bypass dealer $\Rightarrow$ dealer inventory$\downarrow$ retail price $\uparrow$ buyer welfare $\downarrow$

Develop and Estimate an equilibrium spatial search-and-bargaining model where

- dealers are better at search-matching and bargaining
- dealers select better products to trade
- spillover between intermediated and direct transactions across locations

Quantify dealers' welfare impacts on buyers and sellers
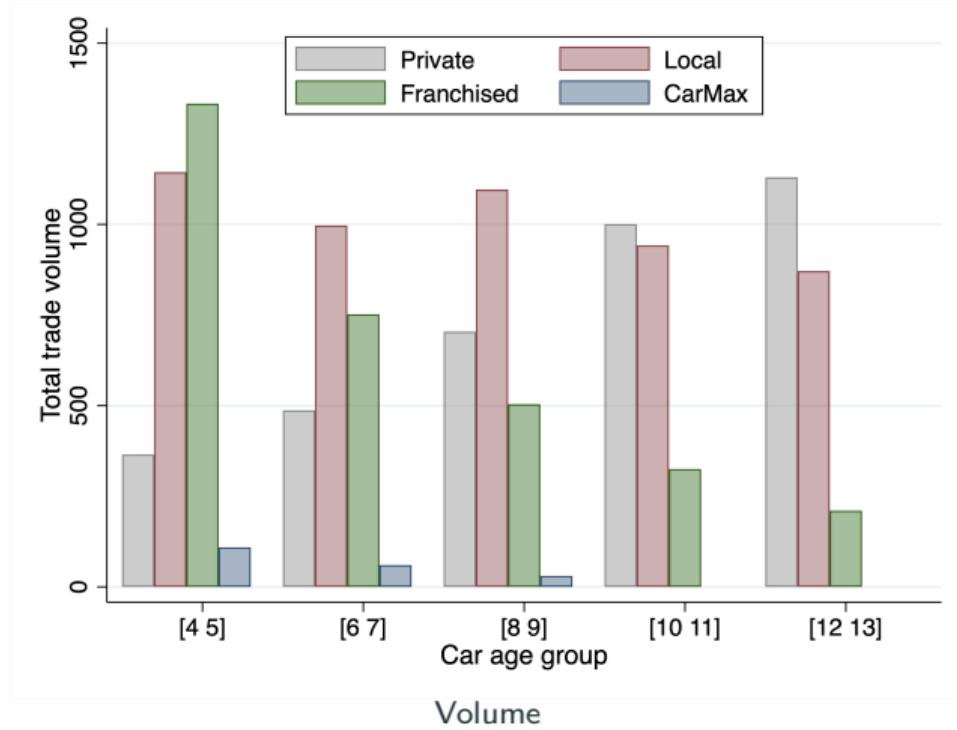
- dealers provide more efficient trade channel but extra surplus
- weakening dealers' bargaining or matching advantage discourages their participation, hurting buyers

Spatial search matters for modeling the used-car market search and matching

When direct and indirect trade co-exist, reducing search friction may hurt consumers

Appendix

Volume

	(I)	(II)	(III)
independent dealer	2.838	2.945	2.943
	(0.061)	(0.060)	(0.061)
Franchised dealer	4.354	4.186	4.171
	(0.072)	(0.071)	(0.072)
CarMax	6.325	6.286	6.276
	(0.205)	(0.200)	(0.200)
Constant	26.150	26.480	26.440
	(0.579)	(0.565)	(0.566)
Car age group dummies			
6-7 years	-2.207	-2.272	-2.266
	(0.079)	(0.078)	(0.078)
8-9 years	-4.017	-4.174	-4.171
	(0.084)	(0.082)	(0.082)
10-11 years	-5.522	-5.749	-5.742
	(0.089)	(0.088)	(0.088)
12-13 years	-6.433	-6.745	-6.745
	(0.093)	(0.092)	(0.092)
log(Mileage)	-1.586	-1.603	-1.599
	(0.052)	(0.051)	(0.051)
Transaction monthly FE	Y	Y	Y
Car model FE	N	Y	Y
Seller county $\times$ buyer county FE	N	N	Y
R^2	0.683	0.699	0.701

Note: The dependent variable is the transaction price measured in $1,000. All specifications include transaction monthly fixed effects. Specification (II) includes monthly and car model fixed effects. Specification (III) includes monthly, car model, and seller county - buyer county fixed effects. ▸ Back

Dealer Capacity

| | (I) Capacity | | |
	independent dealers	Franchised Dealers	CarMax
Delaware	27	19	-
Fairfield	42	28	-
Franklin	591	223	18
Licking	105	27	-
Madison	9	20	-
Pickaway	68	3	
Union	10	23	-

Note: Inventory is the average number of listings by each dealer type in each county average over all weeks in 2017. Capacity is the maximal number of listings by each dealer type in each county over all weeks in 2017.

Weeks on Market of Dealer Cars by Area

County	Independent	Franchised	CarMax
Core	5.941	4.009	3.018
Periphery	6.901	4.430	-