Online Appendix for

"Bid Takers or Market Makers? The Effect of Auctioneers on Auction Outcomes"

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A1. Bayesian shrinkage correction

A potential challenge in estimating the size of the auctioneer effects is that even if there is no meaningful underlying heterogeneity in auctioneer ability, we would still expect random sampling variation to generate some degree of dispersion in our regression estimates. This would especially be an issue if our effects were being estimated out of a smaller sample size. We therefore also performed analyses using a Bayesian shrinkage procedure that corrects for sampling variation and has been used in many other settings such as evaluating differences in teacher quality and organizational productivity.[1] Specifically, we calculated:

$$\hat{\beta}_{norm-shrink,k} = \frac{\theta}{\theta+\sigma_k^2}\hat{\beta}_{norm,k} + \left(1 - \frac{\theta}{\theta+\sigma_k^2}\right)\frac{1}{M}\sum_{j=1}^{M}\hat{\beta}_{norm,j} \text{ for each } k=1, \ldots 60, \qquad \text{(A1)}$$

where θ is the variance of the 60 normalized estimates and σ_k^2 is the square of the estimated standard error of each $\hat{\beta}_{norm,k}$. Because the effects are normalized, note that $\sum_{j=1}^{M}\hat{\beta}_{norm,j} = 0$ by construction; thus the shrinkage estimator reduces to $\hat{\beta}_{norm-shrink,k} = \frac{\theta}{\theta+\sigma_k^2}\hat{\beta}_{norm,k}$ for each k. The standard deviation that we find for Specification 8 of the probability of sale regressions after applying this procedure is .0220, compared to .0228 without the shrinkage procedure (see Table 2). Sampling variation can explain 20-25% of the variation in the residual price effects. Specifically, the standard deviation for Specification 8 with Bayesian Shrinkage applied is $31.99 (compared to $41.78 without the shrinkage). The standard deviation for Specification 8 with Bayesian Shrinkage for high bid is $84 (compared to $87.94 without shrinkage). The time effects are not very affected by sampling variation with a standard deviation of 5.87 once shrinkage is applied (compared to 6.07 without the shrinkage).

A2. Identifying auctioneer effects from shift changes

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[1] See, among others, Chandra, Finkelstein, Sacarny and Syverson (2013); Jacob and Lefgren (2005); and Morris (1983).

In this section, we provide more details of the additional identification strategy that we adopted to help overcome potentially remaining selection issues in our main regressions, using natural variation associated with work shift changes.

On a typical auction date, two auctioneers will be assigned to work on each lane. These two auctioneers will take turns auctioning off cars in that lane. Auctioneers may switch at any time, but we observe that auctioneers typically switch roughly every 30 or 60 minutes in what are regular shift-length norms. In particular, we see very few instances of an auctioneer who is on the block for much longer than 60 minutes at a time (Figure A.5). We can exploit the variation in auctioneers that occurs within a lane on a given day by including lane*day fixed effects when estimating auctioneer ability. By looking within a lane on a given day, we are able to control for additional unobserved factors that may exist (number of buyers at the auction located near a given lane, unobserved characteristics about the cars/sellers assigned to that lane, etc.) when estimating auctioneer fixed effects.

We estimate the model in Equation (1) while controlling for seller, time of day, and 13,687 lane*day fixed effects. Figure A.6 provides scatter plots of the estimates from Specification 8 in Section 3.2 and the estimates using the specification described here for each of the four performance metrics. The estimates that we find are strongly correlated across identification strategies: the t-stats for probability of sale, residual price, high bid, and time on the block are 18.9, 6.51, 3.60, and 15.46 respectively. A common pattern that we find in these results and others to follow is that the results for probability of sale (and also speed) appear to be very robust and stable while the price results (residual price and high bid) are often less stable and robust. This could simply be a result of the price effects being small (and thus the noise to signal ratio is high) or could also be related to the concerns that we discussed above about how the price results may not reflect accurate auctioneer ability. Overall, however, finding similar estimates when looking within a lane*day lends additional credibility to the estimates found in Section 3.2.

A3. Secondary auto auction dataset

In addition to our primary dataset, we had access to auction outcomes for cars sold at three US auction house locations from January 2007 to March 2010 for a different auction company. As with our primary dataset, both dealer cars and fleet/lease cars are sold at these auction houses. Many of the fleet/lease cars are sold through simulcast auctions, in which bidders can view a live video feed and participate online, although the actual auction still takes place physically at the auction house and most bidders are physically present. Data from these simulcast auctions contains additional information not available in our main sample, such as the timing of bids, the opening price called by the auctioneer (referred to as the fish price), and the first price which a bidder was willing to pay (referred to as the start price). This information can be very useful for testing various mechanisms. However, the data has several limitations.

First, auctioneer identities are not necessarily accurately recorded beyond the first auctioneer in a given lane on a given day and hence we restrict the sample to the first hour an auctioneer works for each lane and day. Second, the sample is much smaller; after limiting to the first hour for each auctioneer-by-lane-by-day combination and imposing similar sample restrictions to those in our primary dataset, we restrict the sample to auctioneers selling more than 100 simulcast cars and 100 dealer cars (non-simulcast). This leaves us with 42,597 cars sold by 16 auctioneers in simulcast auctions and 56,323 cars sold by 24 auctioneers in dealer (non-simulcast) auctions. For these reasons, and because simulcast auctions are mostly fleet/lease car sales, this secondary dataset is not as well suited for our initial analysis of heterogeneity in Section 3, but can still provide suggestive evidence about mechanisms.

Table A.1 displays descriptive statistics for our secondary dataset. The dataset consists of two samples: dealer cars, which contain the same three measures as our primary dataset (probability of sale, residual price, and time on block); and simulcast cars, which also contain additional auction-level information.[2] Fish price minus start price is the gap between the price initially called out by the auctioneer (fish price) and the lower price (start price) at which bidders actually begin signaling a willingness to pay. Residual fish price is the fish price less the blue book value. Fishing time is the number of seconds from the calling out of the fish price and the arriving at the start price. Bidding time is the number of seconds between the start price and the final bid. Hammer time is the number of seconds between the final bid and the end of the sale (when the next car rolls in)—i.e. the time in which the auctioneer calls out, "going once… going twice…sold," pounds down the gavel or "hammer," and begins the sale of the next car. Bids, bid speed, and price speed are the total number of bids, bids per second, and the price increase (from the start price to the final bid) per second. In the simulcast sample, 78% of cars sold, a fraction twice as high as in the dealers sample. Simulcast auctions also run over twice as fast as those in the dealer sample. While the two samples in the secondary dataset are mutually exclusive (no car is in both samples), 11 auctioneers sold more than 100 cars in both samples. In order to deal with any mechanical differences which may occur in these measures in auctions which end in a sale vs those which do not, we limit our analysis to cars which actually did sell when examining any variable other than the probability of sale, as is done above with time on block and residual price in our main dataset.

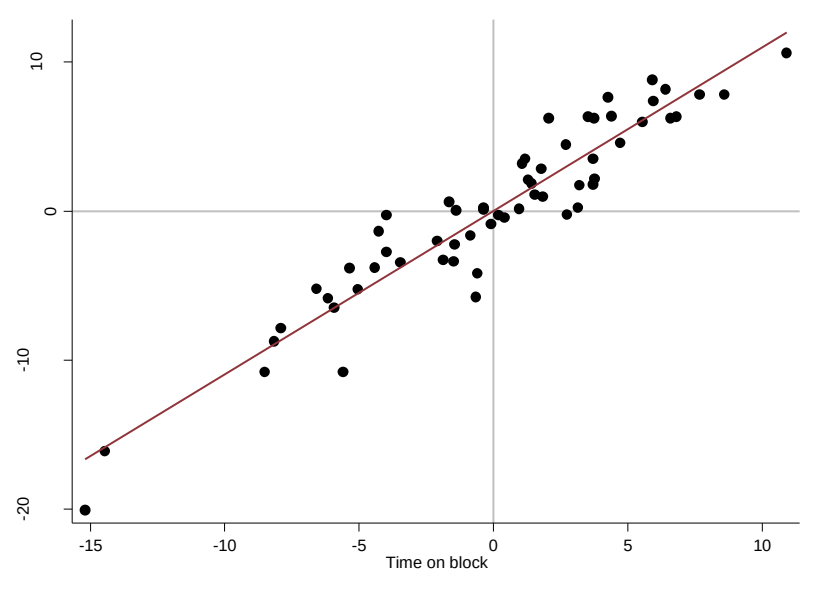
With these measures from our secondary dataset, we attempt to replicate our main results. We once again estimate Equation (1) under each of our specifications and find relatively stable heterogeneity across specifications for each measure once seller fixed effects are taken into account. This is shown in the standard deviations reported in Table A.2. These results provide further evidence of the external validity of the findings of auctioneer heterogeneity in Section 3. In particular, one standard deviation of auctioneer performance in the probability of sale and time on block in the dealer sample is of similar

[2] High bid is not available in this secondary dataset.

magnitude to the measures in our primary dataset. For simulcast cars the standard deviation of auctioneer effects is larger for the probability of sale and smaller for time on the block than for dealer cars. However, as a fraction of the mean probability of sale or time on the block (from Table A.1), the standard deviations of auctioneer effects are relatively similar for dealer and simulcast cars. Also, although not shown in Table A.2, for each outcome we find strong correlations in rankings of auctioneer fixed effects across specifications, just as in Table 2 for the primary dataset.

Figure A.1 - Correlation between time on the block and time on the block for sold cars and unsold cars

A: Time on the block and time on the block for sold cars (t=22.00)



B: Time on the block for sold cars and time on the block for unsold cars (t=10.66)

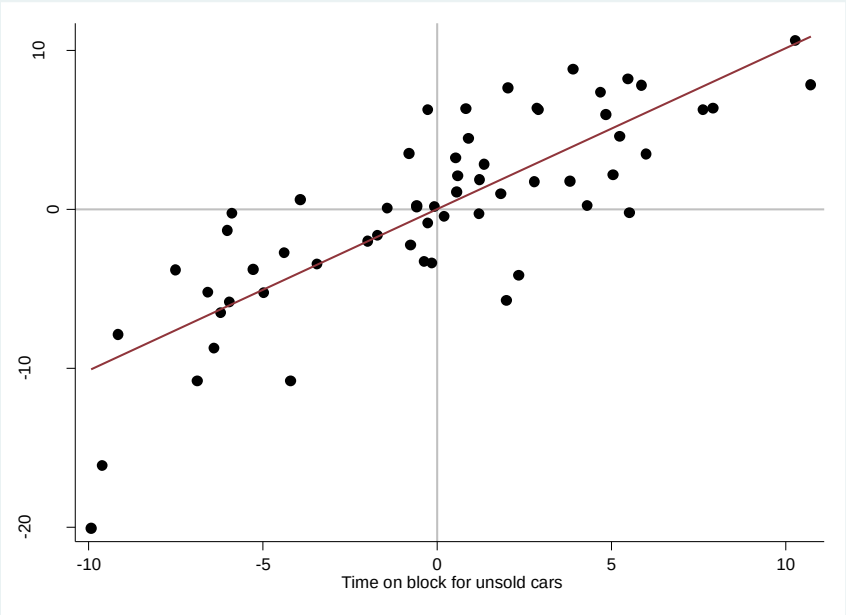
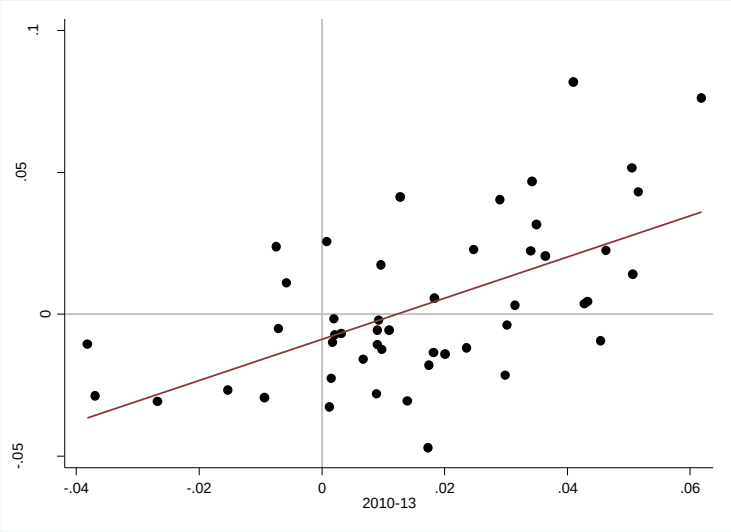
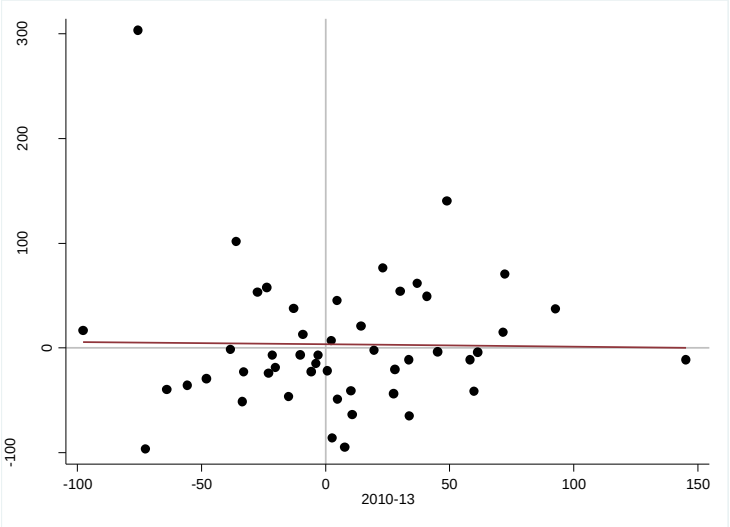

10
0
-10
-20
-10
-5
0
5
10
Time on block for unsold cars

Figure A.2 - Correlation of Fixed Effects between 2007-09 and 2010-13. Using the identification within seller, auction day and time of day, lane, and car types, we estimated auctioneer fixed effects separately using data for 2007-09 and then 2010-13. The panels below provide scatterplots that show the correlation in fixed effects between 2007-09 and 2010-13 for probability of sale (Panel A), residual price of sale (Panel B), high bid (Panel C) and time on the block (Panel D). Fitted lines are reported as well as the t-statistics from univariate linear regressions between the outcomes in the two years for each measure. The analysis here is limited to the 49 auctioneers with at least 2,000 observations in each of the two time periods.

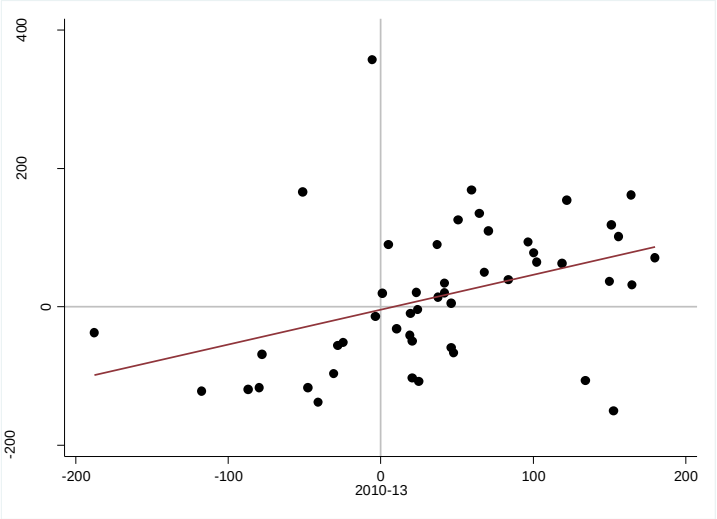
A: Probability of sale (t=4.91)



B: Residual price (t=-0.10)



C. High bid (t=2.90)



D: Time on the block (t=7.32)

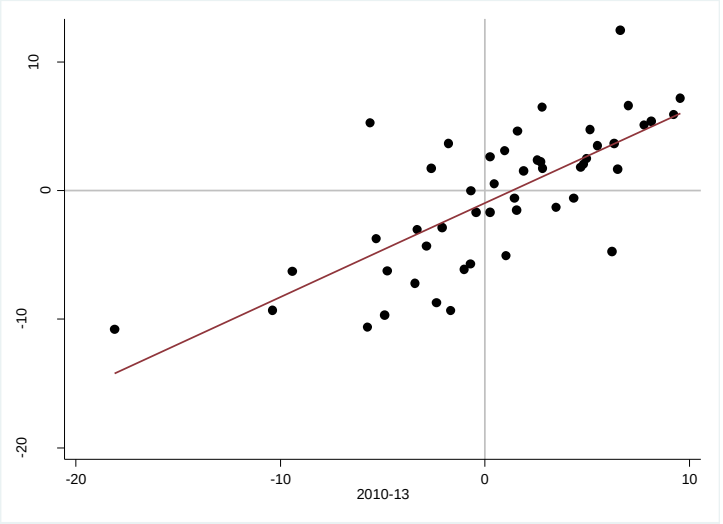
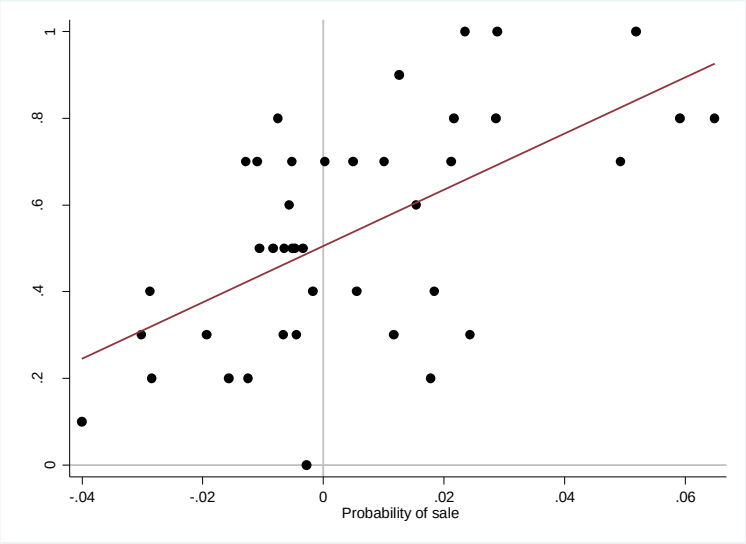
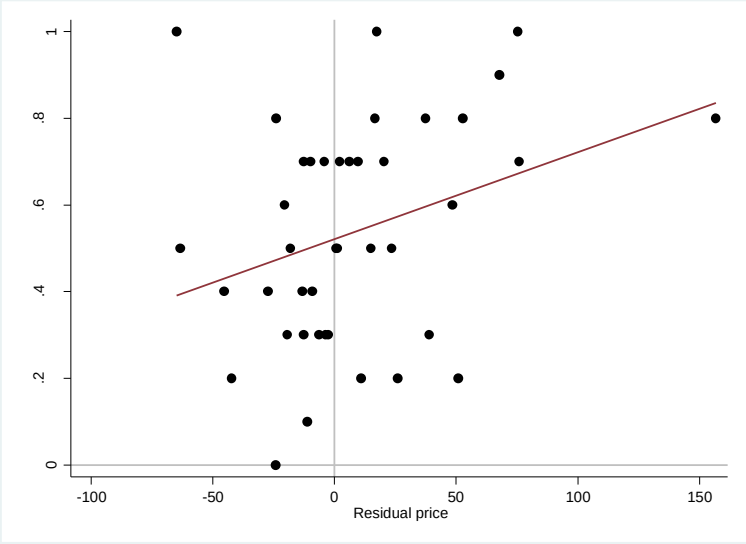


Figure A.3 – Correlation of Performance Measures with Subjective Evaluations. The panels below provide scatterplots that show the correlation in fixed effects for 41 auctioneers between the company's subjective evaluations (on a 0 to 1 scale) and probability of sale, residual price, high bid and time on the block for sold cars. All fixed effects come from the fully specified model within seller, auction day and time of day, lane, and car types. Fitted lines are reported as well as the t-statistic from univariate regressions between the subjective evaluation and each performance measure.

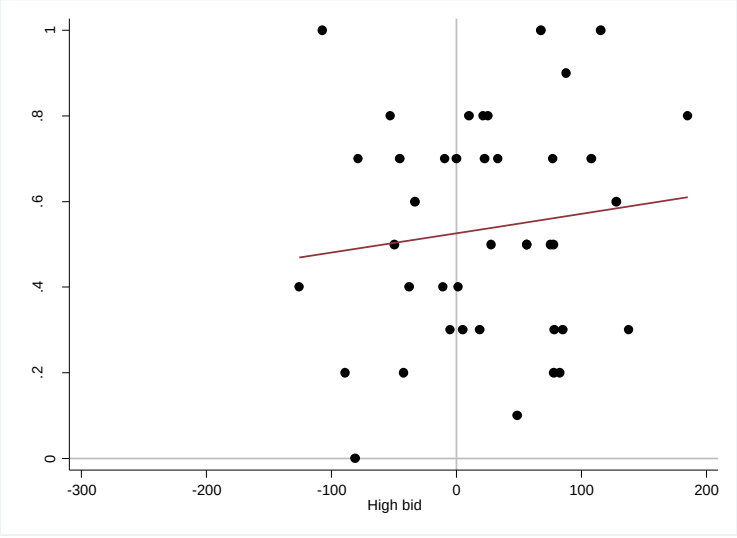
A: Probability of sale (t= 4.62)



B: Residual Price (t= 2.09)



C: High bid (t=0.78)



D: Time on the block for sold cars (t- -2.03)

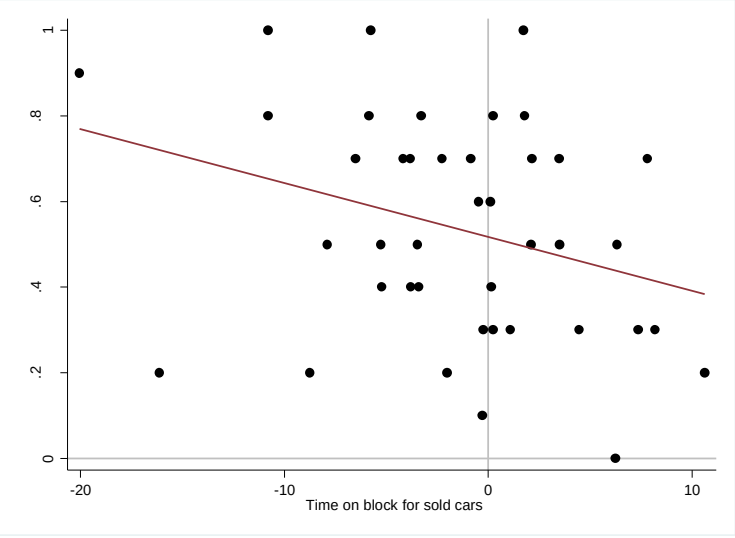
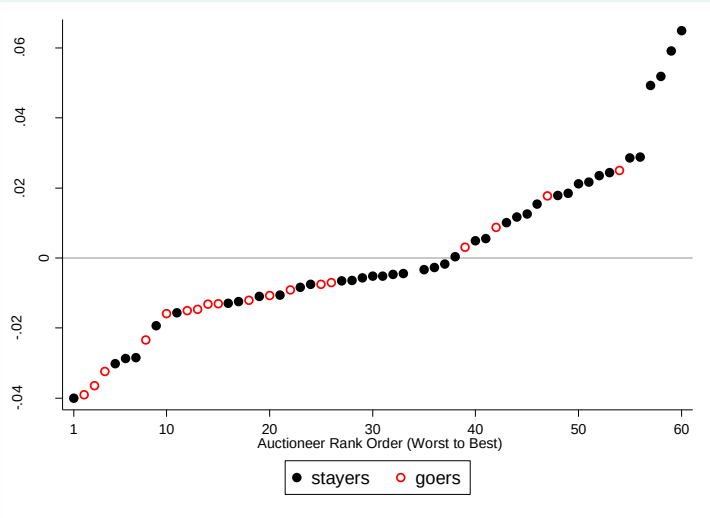
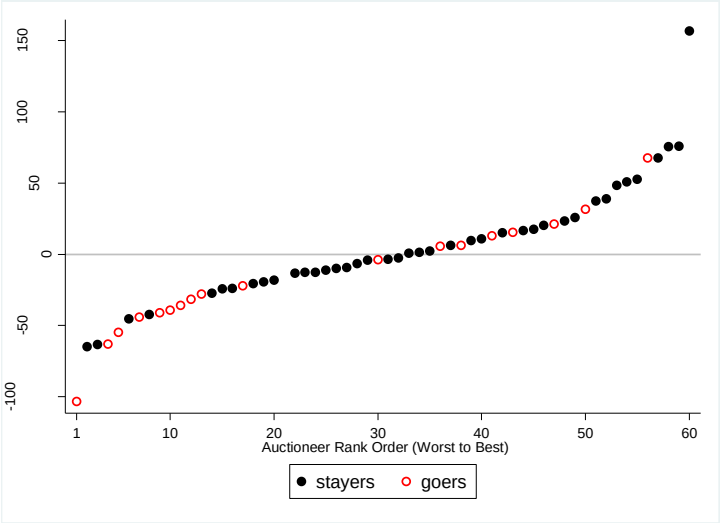


Figure A.4 – Performance rankings for auctioneers still at the company in 2012 and auctioneers who left the company by 2012. The estimated auctioneer fixed effects are obtained from the fully specified regression model with seller fixed effects, auction day and time of day, lane fixed effects, and car type fixed effects, distinguishing between auctioneers who were still at the company by the end of 2012 (Stayers, *N*=41; black filled in dots) and those who left by between the end of 2008 and 2012 (goers, *N*=18, red empty dots).

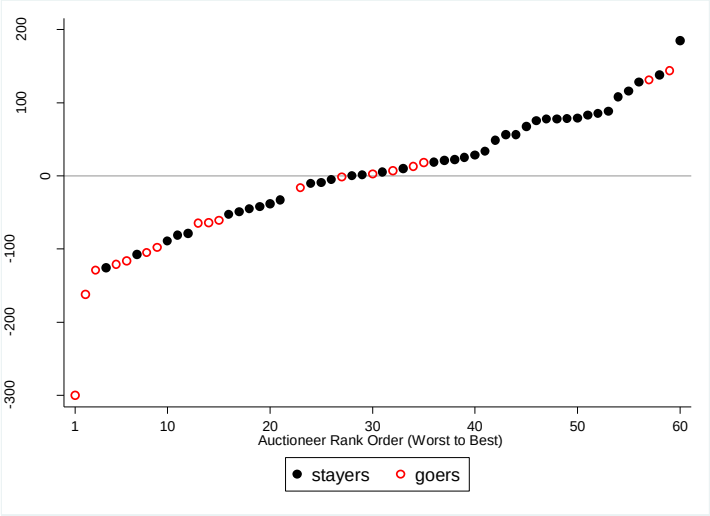
A: Probability of sale



B: Residual Price



C: High bid



D: Time on the block for sold cars

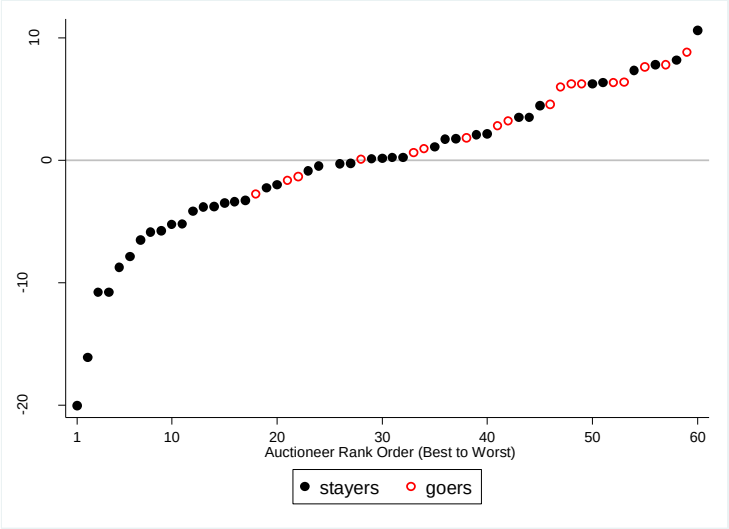


Figure A.5: Distribution of auctioneer shift length on a lane and given day

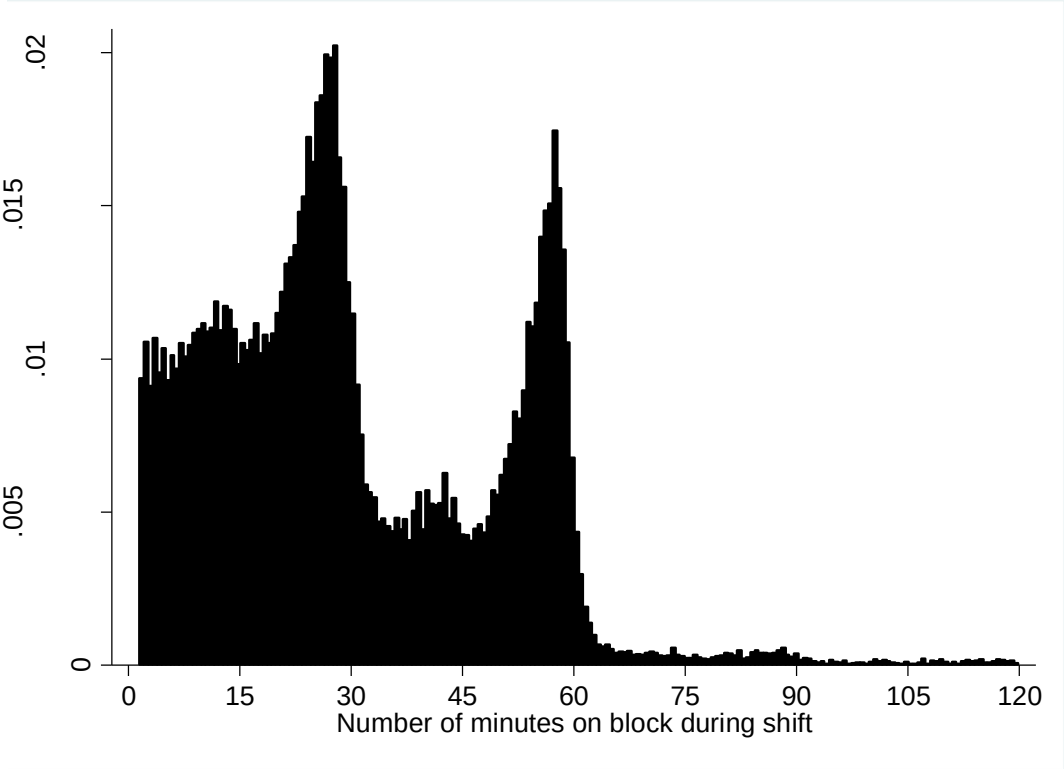
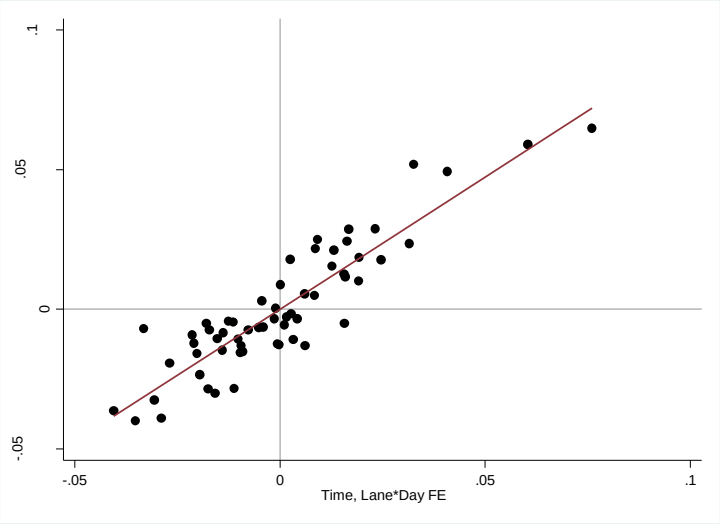
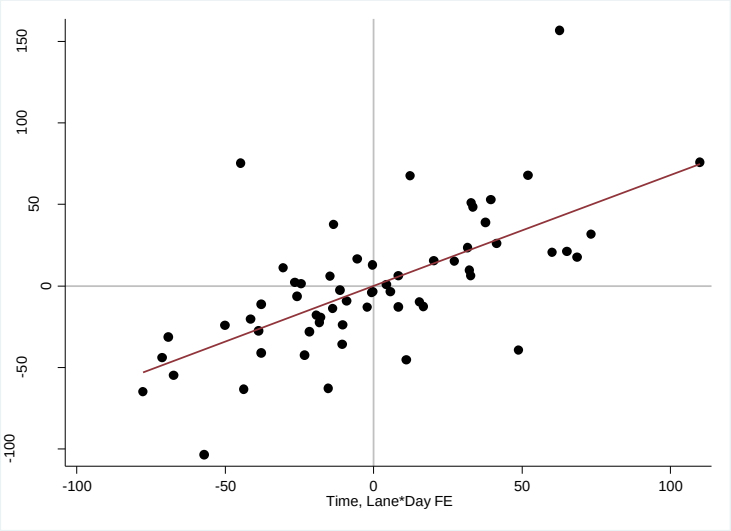


Figure A.6 – Comparison between Identification Strategies. The panels below provide scatterplots that show the correlation in fixed effects for auctioneers based on probability of sale (Panel A), residual price (Panel B), high bid (Panel C) and time on the block (Panel D) between our two different identification strategies: the analysis within seller, auction day and time of day, lane, and car types fixed effects (Specification 8 in Table 2), and the identification based on shifts within a lane (lane*day) (Specification 9). Fitted lines are reported as well as the t-statistics from univariate linear regressions between the auctioneer effect estimates from the two identification approaches.

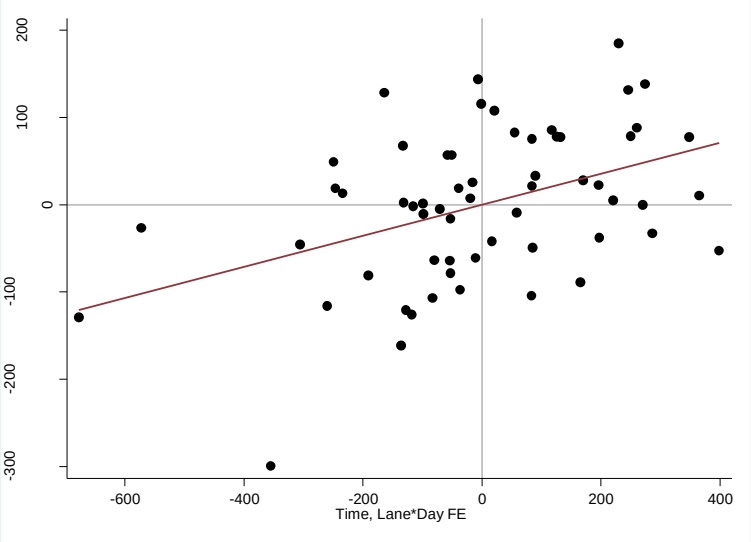
A: Probability of sale (t= 16.15)



B: Residual price (t= 6.51)



C: High bid (t=3.60)



D: Time on the block (t= 15.46)

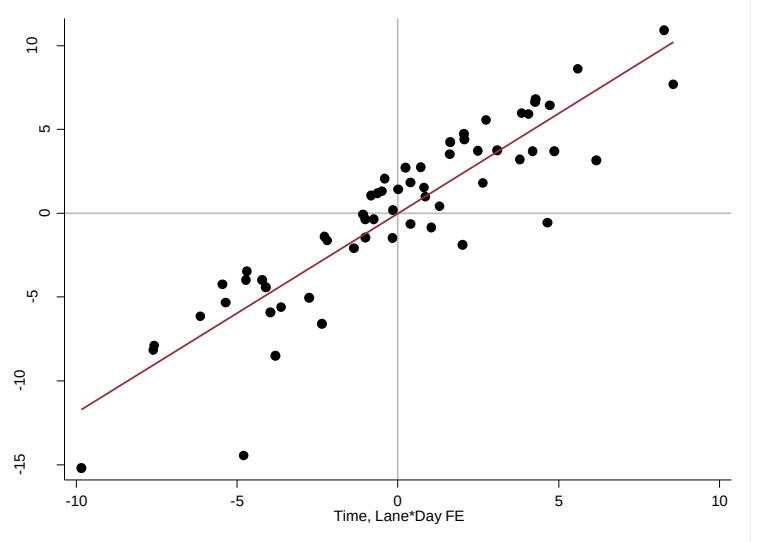


Table A.1 -- Descriptive Statistics for Secondary Dataset This table displays descriptive statistics for dealers and simulcast samples from the secondary dataset. Probability of sale, residual price, and time on block are as defined for the primary dataset and are the only variables observed in the dealers sample. Fish price minus start price is the gap between the price initially called out by the auctioneer (fish price) and the lower price (start price) at which bidders actually began signaling a willingness to pay. Residual fish price is the fish price less the blue book value. Bids, bid speed, and price speed are the total number of bids, bids per second, and the price increase (from the start price to the final bid) per second. Fishing time is the time from the calling out of the fish price and the arriving at the start price. Bidding time is the time between the start price and the final bid. Hammer time is the time between the final bid and the end of the sale. Sample sizes report the number of cars in each sample used in calculating the probability of sale measure. All other measures are reported using only cars which sold (20,738 in the dealers sample and 33,295 in the simulcast sample).

	Dealers sample		**Simulcast sample**	
Panel I.	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**
Probability of sale	0.37	0.48	0.78	0.41
Residual price	-153.10	1754.11	-293.25	1938.38
Time on block	70.74	36.15	33.73	13.46
Fishing time			8.66	7.70
Bidding time			18.14	11.36
Hammer time			6.92	4.92
Fish price minus starting bid			1448.36	1178.79
Residual fish price			-72.72	1994.45
Bids			12.90	8.36
Bid speed (bids per second)			0.39	0.22
Price speed ($ per second)			37.07	28.97
Sample size (number of auctioneers)	56,323 (24)		42,597 (16)	

Table A.2 -- Standard deviations of estimated auctioneer effects with varying controls from secondary dataset. This table displays the effect of a one-standard-deviation increase in auctioneer fixed effects from using various outcome measures from the dealers-only sample of 56,323 observations (24 auctioneers) and the simulcast sample of 42,597 observations (16 auctioneers), both from the secondary dataset. Each cell of the table comes from a separate regression on auctioneer fixed effects and varying degrees of controls as specified.

	Dealers sample			Simulcast sample		
Panel I.	Prob sale	Residual price	Time on block	Prob sale	Residual price	Time on block
1 Raw values	0.130	685.563	7.803	0.137	468.074	2.571
2 Seller FEs	0.049	262.123	8.296	0.087	437.976	2.711
3 Seller, time of day, auction day FEs	0.052	211.332	7.398	0.075	181.305	2.504
4 Seller, time of day, auction day, lane FEs	0.046	287.234	6.362	0.076	205.598	2.245
5 Seller, time of day, auction day, lane, make FEs	0.046	279.375	6.330	0.074	193.111	2.264
6 Seller, time of day, auction day, lane, make*age FEs, miles	0.048	321.191	6.539	0.081	170.332	2.232
7 Seller, time of day, auction day, lane, make*model*age FEs, miles	0.049	276.841	6.429	0.081	165.439	2.370
8 Seller, time of day, auction day, lane, make*model*age*body FEs, miles	0.044	298.093	6.357	0.085	160.529	2.355

Panel II. Simulcast sample	Fishing time	Bidding time	Hammer time	Fish minus start	Residual fish	Bids	Bids per second	$ per second
1 Raw values	1.809	1.665	0.712	336.551	352.578	1.659	0.057	6.082
2 Seller FEs	1.514	1.294	0.720	194.060	514.388	1.264	0.043	4.633
3 Seller, time of day, auction day FEs	1.263	1.434	0.741	170.206	215.531	1.218	0.037	4.102
4 Seller, time of day, auction day, lane FEs	1.135	1.420	0.746	170.684	275.813	1.475	0.041	4.262
5 Seller, time of day, auction day, lane, make FEs	1.137	1.428	0.747	170.925	268.624	1.469	0.041	4.266
6 Seller, time of day, auction day, lane, make*age FEs, miles	1.108	1.469	0.777	161.039	259.774	1.483	0.041	4.231
7 Seller, time of day, auction day, lane, make*model*age FEs, miles	1.101	1.645	0.779	154.207	274.367	1.599	0.042	4.300
8 Seller, time of day, auction day, lane, make*model*age*body FEs, miles	1.200	1.890	0.876	156.058	260.946	1.839	0.045	5.154

Table A.3 -- Correlations between auctioneer measures in secondary dataset: t-statistics. This table displays t-stats from a regression of the auctioneer fixed effects for the probability of sale on the auctioneer fixed effects for other measures. Column 1 uses probability of sale effects measured from the secondary dataset dealers sample and column 2 uses probability of sale effects from the secondary dataset simulcast sample. The first three rows of the table use the dealers sample to measure auctioneer effects for probability of sale, residual price, and time on block. The bottom eleven rows use the simulcast sample to measure auctioneer effects for each of the measures listed.

	(1)	(2)
Regressors in univariate regressions	**Outcome variable: Auctioneer fixed effects for probability of sale -- secondary dataset, dealers sample**	**Outcome variable: Auctioneer fixed effects for probability of sale -- secondary dataset, simulcast sample**
Secondary dataset: Dealer sample		
Auctioneer fixed effects for Probability of sale	---	0.95
Auctioneer fixed effects for Residual price	1.42	1.62
Auctioneer fixed effects for Time on block	0.61	-0.71
Secondary dataset: Simulcast sample		
Auctioneer fixed effects for Probability of sale	1.75	---
Auctioneer fixed effects for Residual price	0.14	1.44
Auctioneer fixed effects for Time on block	-0.90	-0.24
Auctioneer fixed effects for Fishing time	-0.39	-0.32
Auctioneer fixed effects for Bidding time	0.04	0.66
Auctioneer fixed effects for Hammer time	-2.31	-1.79
Auctioneer fixed effects for Fish price minus start price	0.66	0.63
Auctioneer fixed effects for Residual fish price	-0.96	-0.08
Auctioneer fixed effects for Bids	1.34	2.34
Auctioneer fixed effects for Bid speed	2.27	2.74
Auctioneer fixed effects for Price speed	2.82	2.63