

Comparative Analysis of US Vehicle Listings Platforms

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I. OVERVIEW AND SCOPE

Millions of new and used passenger vehicles and light trucks are sold in the United States each month. The vast majority are sold by car dealerships, either franchised, which sell both new and used vehicles, or independent, which sell used vehicles only.

Vehicle inventory listing platforms facilitate the process of matching potential car buyers with sellers. These platforms, which appeared shortly after the emergence of the internet, serve as one of the largest sources of car shoppers and buyers, attracting tens of millions of unique visitors each month. Vehicle listing sites lower search costs by allowing consumers to quickly identify vehicles that match characteristics they want, such as make, model, model year, trim, options, mileage, price, and distance from the consumer. Some of the listing platforms also provide their own proprietary assessments of the prices advertised by sellers in an attempt to help consumers make informed purchasing decisions.

In this paper, we analyze three listing platforms: Autotrader, CarGurus, and Cars.com.¹ Autotrader and Cars.com were both founded in the late 1990s.² Autotrader was later acquired by Cox Automotive, which also owns Kelley Blue Book.³ CarGurus is a relatively newer platform, founded in 2006.⁴

The data used in our analysis were collected from the websites operated by the three platforms. Information on vehicles listed on the CarGurus and Cars.com websites was collected daily over the 12-month period December 2018 through November 2019, and information on listings on the Autotrader website was collected on one day each month during the 7-month period May 2019 through November 2019. The information on each vehicle includes its unique vehicle identification number (VIN), make, model, year, characteristics (e.g., color, engine type, transmission type, drivetrain), whether the vehicle is new or used, its mileage if used, and its sale price if used or MSRP if new. The data also include information about the listing dealer, such as the dealer's ID, which is specific to each website, and the dealer's name and address.

While CarGurus has expanded its services outside the United States in recent years, the results presented in this paper are based on US listings only. Our analysis is also limited to vehicles listed by commercial dealers. That is, vehicles listed by private individuals are excluded from our analysis.⁵

II. VEHICLE INVENTORY

We begin our analysis by considering the relative standing of each platform from the consumer perspective. In particular, we focus on the size of the listed vehicle inventory. For Autotrader, we calculated the number of distinct VINs in each of the monthly data collections. For CarGurus and Cars.com, where data are available daily, we calculated the median number of distinct VINs in each of the daily data collections by month and platform. Figure 1 shows the results of our calculations. To compare the relative sizes of the three platforms, we indexed all calculated vehicle inventory numbers in such a way that the inventory numbers for Cars.com average 100 over the course of the year. An index value of 140 should thus be interpreted as 40% higher than Cars.com on average.

Our results show that CarGurus is the clear leader in terms of overall vehicle inventory relative to Autotrader and Cars.com. As mentioned above, our analysis excludes listings by private individuals. The number of private listings is, however, small compared to the number of listings by commercial dealers, and including private listings

¹ The work on this paper was sponsored by CarGurus.

² Autotrader, "Important Facts about Autotrader," accessed March 23, 2020, <http://press.autotrader.com/fact-sheet>; Cars.com, "About Cars.com," accessed March 23, 2020, <https://www.cars.com/about/>.

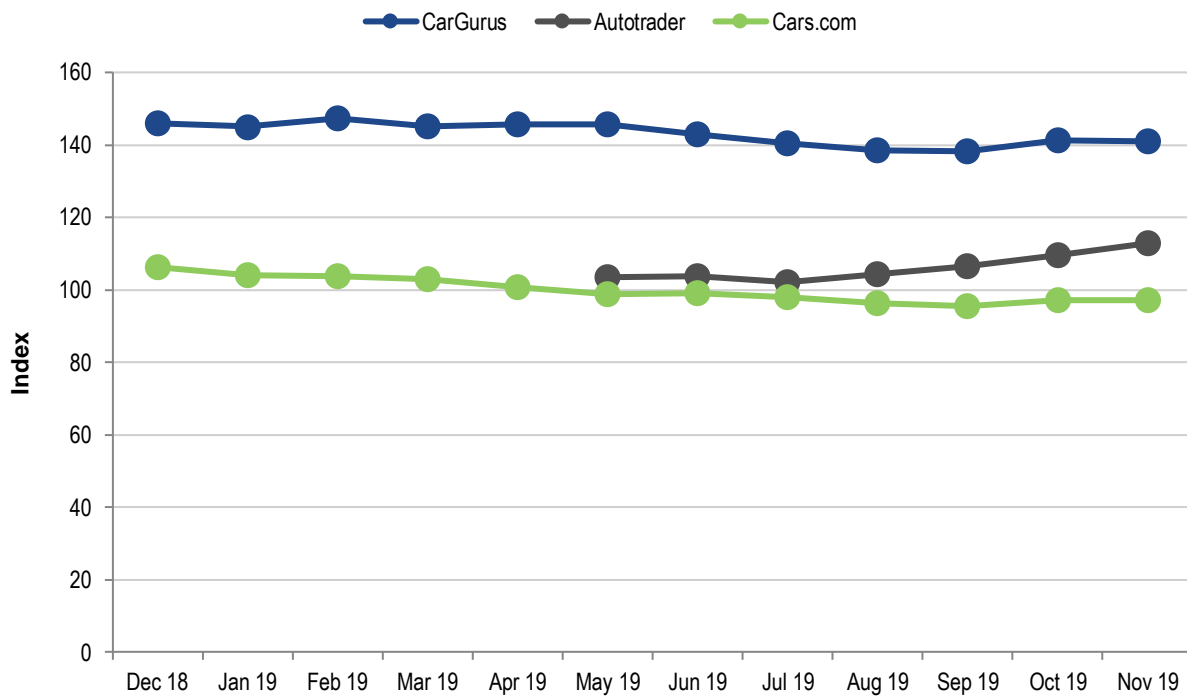
³ PR Newswire, "Cox Enterprises Acquires 25 Percent Stake in AutoTrader Group from Providence Equity Partners," Jan. 3, 2014, <https://www.prnewswire.com/news-releases/cox-enterprises-acquires-25-percent-stake-in-autotrader-group-from-providence-equity-partners-238576531.html>; Autotrader, "Important Facts about Autotrader," accessed March 23, 2020, <http://press.autotrader.com/fact-sheet>.

⁴ CarGurus, "Building the World's Most Trusted and Transparent Automotive Marketplace," accessed March 23, 2020, <https://www.cargurus.com/Cars/aboutCargurus.html>.

⁵ Listings by private individuals account for a negligible percentage of all listings.

in our analysis would not materially change the result—that CarGurus has the largest vehicle inventory by a considerable margin.

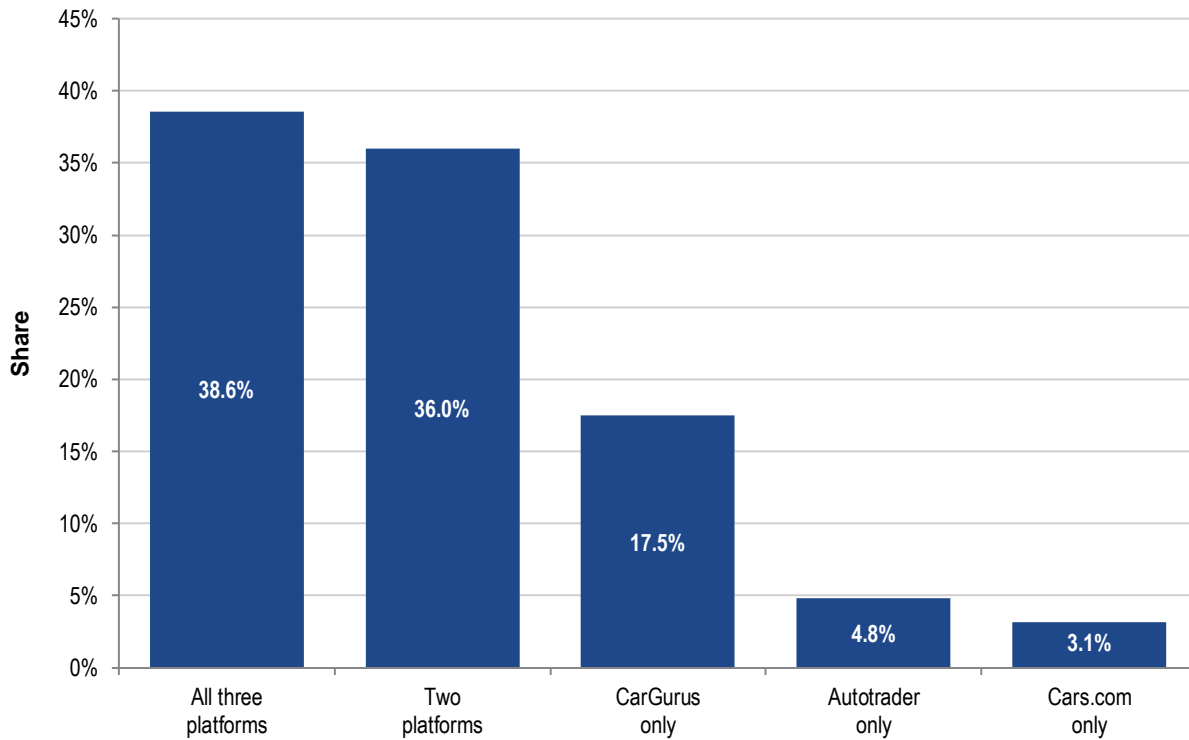
Figure 1: Total vehicle inventory by platform



It is not unusual for the same vehicle to be listed on more than one platform. Because a VIN uniquely identifies a vehicle, it is possible to identify vehicles that are listed on all three platforms, vehicles that are listed on two of them but not the third, and vehicles that are unique to each platform.⁶ Figure 2 presents the distribution of vehicles across the three platforms. Close to 40% of all vehicles are listed on all three platforms, indicating that dealers view each of these platforms as a source of leads. About another 35% of all vehicles are listed on only two of them, with listings on the CarGurus and Cars.com combination and the CarGurus and Autotrader combination accounting for the vast majority of the listings in this category and listings on the Cars.com and Autotrader combination accounting for a small minority. The remaining 25% of all vehicles are listed on only one platform. CarGurus is again the clear market leader in terms of these unique listings. It has about twice as many unique listings as Cars.com and Autotrader combined.

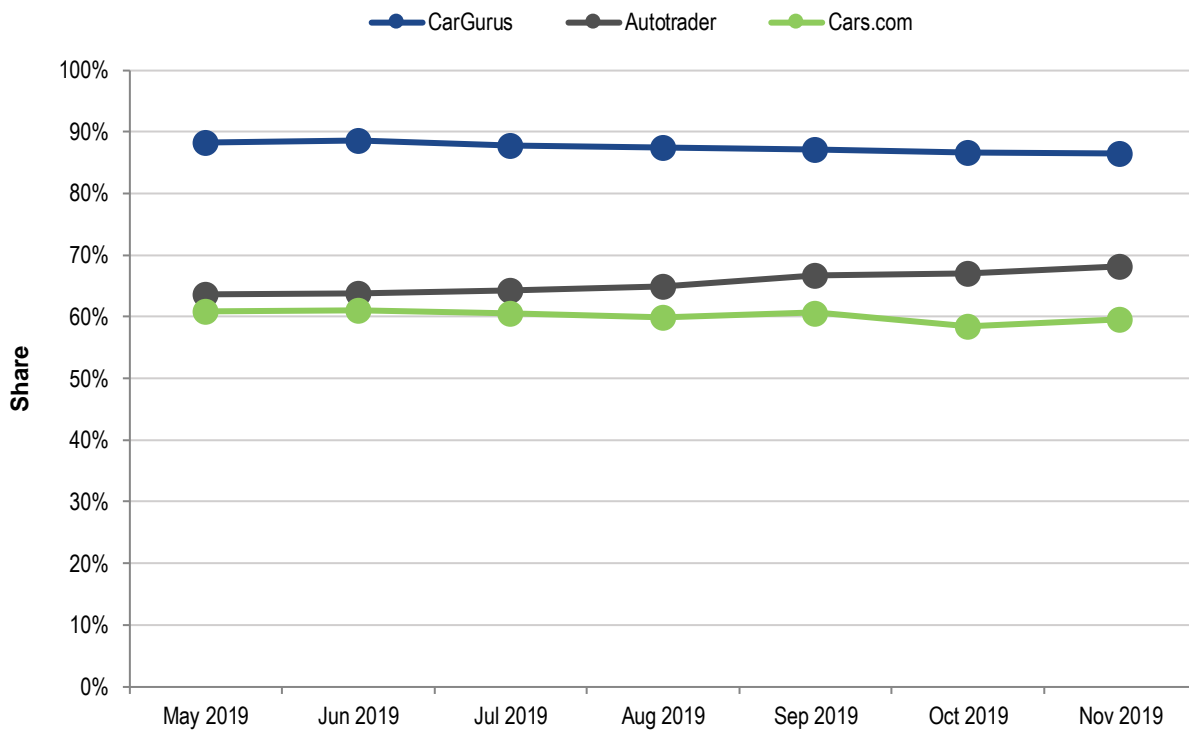
⁶ For this analysis, we used the daily data collection for CarGurus and Cars.com from the day on which data was collected from the Autotrader website.

Figure 2: Allocation of vehicle inventory across platforms



Given the fairly large inventory overlap across multiple platforms, CarGurus' advantage can be put into perspective by asking the following question: if a consumer were to search for vehicles on only one platform, what percentage of the total inventory listed on all three platforms would the consumer have access to? Figure 3 provides the answer to this question. CarGurus' listings account for nearly 90% of the total inventory, meaning that a customer who searches on CarGurus would experience a relatively small benefit from additionally also searching on Cars.com and/or Autotrader. In contrast, a consumer who searches on either Cars.com or Autotrader is exposed to only about 60%–70% of the total vehicle inventory and would considerably benefit from also searching on CarGurus.

Figure 3: Share of total inventory listed on each platform



In what follows, we examine whether CarGurus' leadership in terms of overall vehicle inventory arises because of a particularly large advantage in some specific segment of the market. Figure 4 and Figure 5 disaggregate the overall inventory into new and used vehicles. They show that CarGurus has a sustained advantage in both segments, with a slightly bigger advantage in used vehicles.

Figure 4: Total vehicle inventory by platform, limited to new vehicles

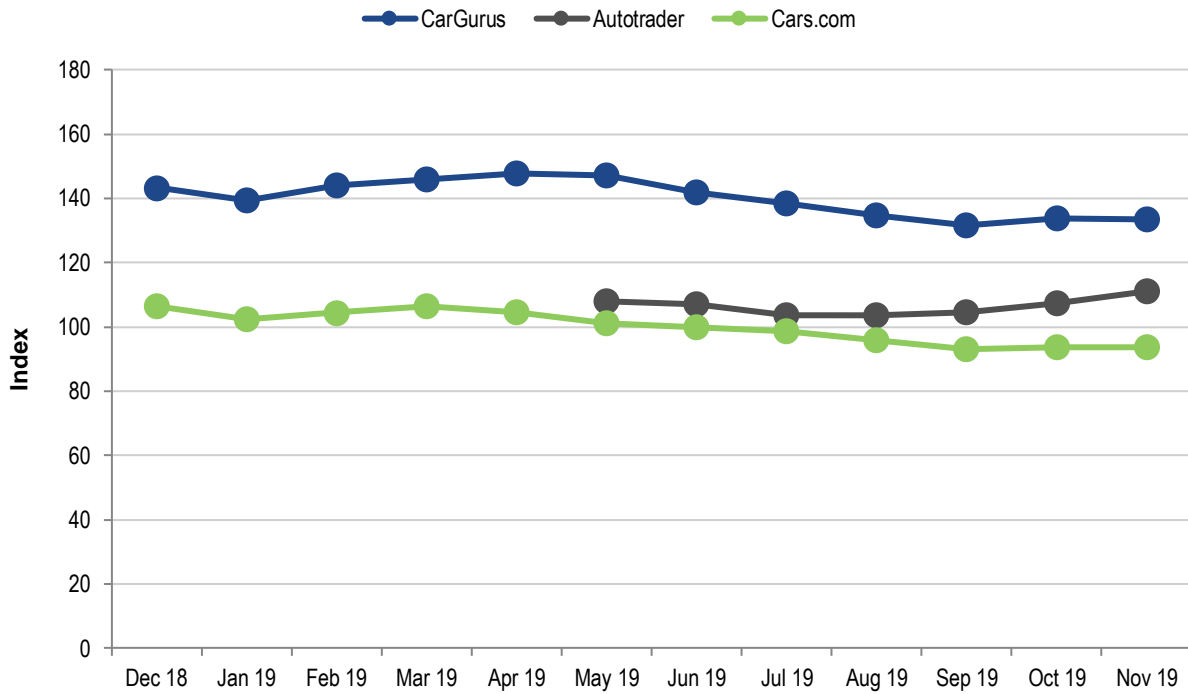
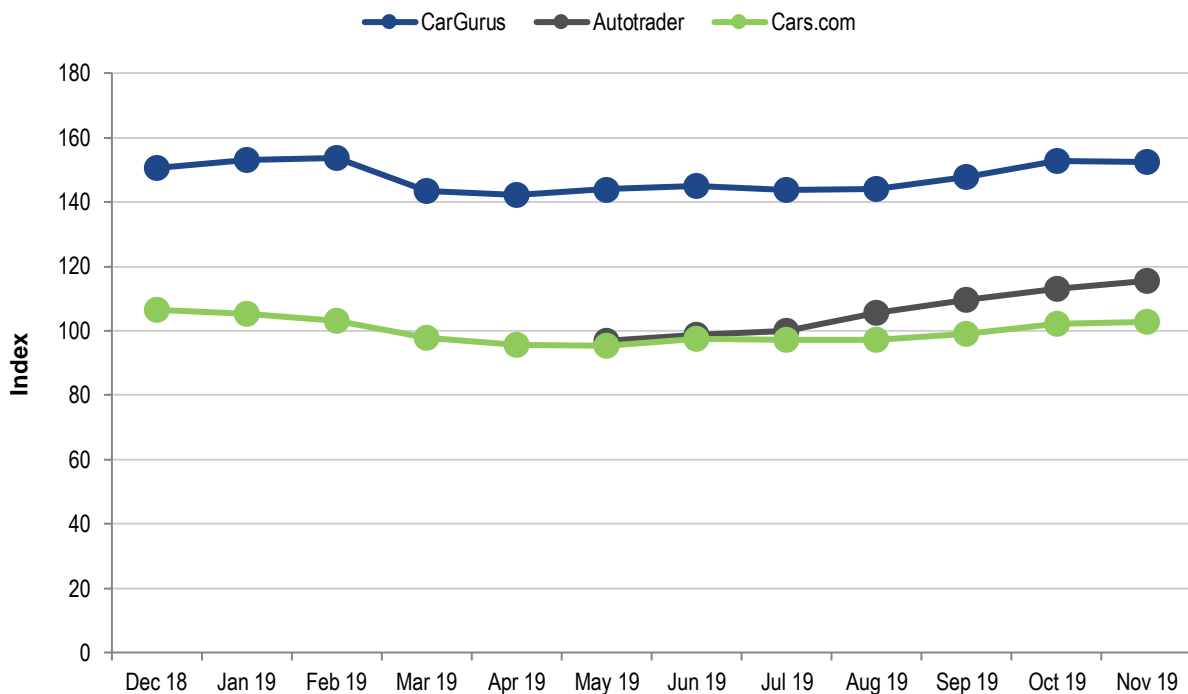


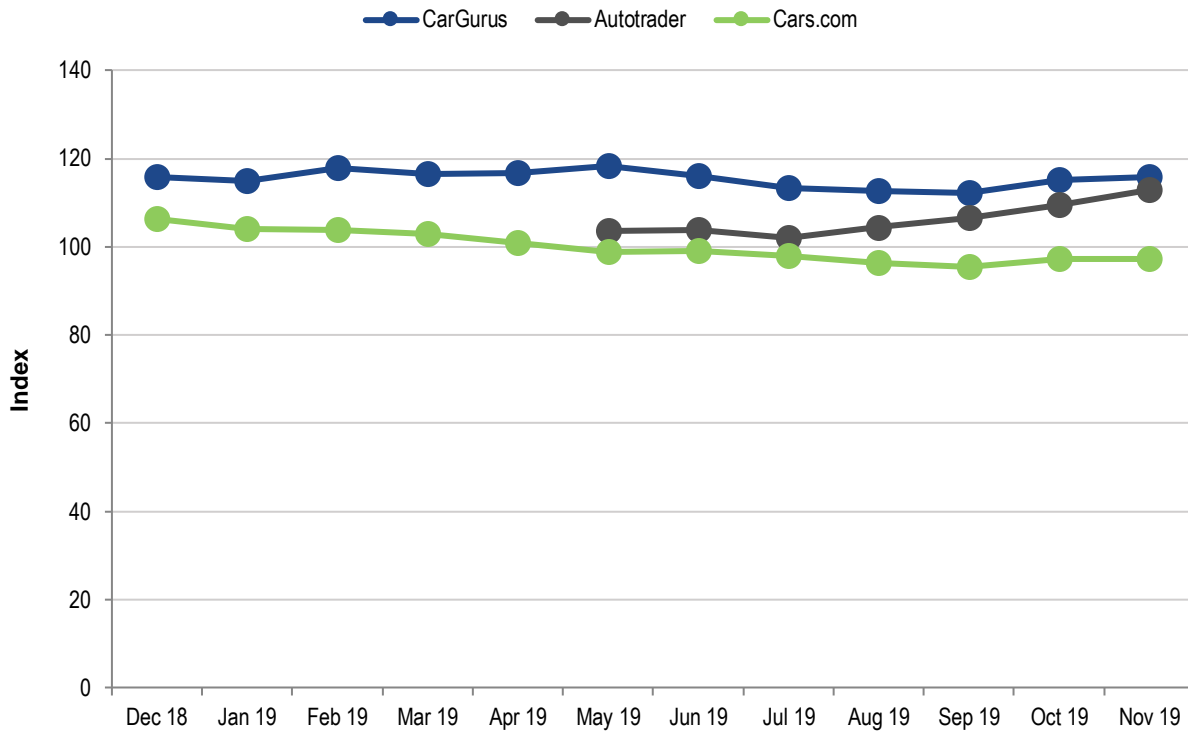
Figure 5: Total vehicle inventory by platform, limited to used vehicles



Some of the vehicles on CarGurus’ website are listed by non-paying dealers (under the so-called “freemium” model that allows dealerships to list their inventory for free). These listings explain some but not all of CarGurus’ advantage. As shown in Figure 6: Total vehicle inventory by platform, limited to paying dealers, CarGurus’

advantage over Cars.com and Autotrader remains when listings by non-paying dealers are removed from the analysis and only paying dealers are considered.⁷ We show below that this is in part due to the fact that CarGurus has the largest number of paying dealers of the three platforms.

Figure 6: Total vehicle inventory by platform, limited to paying dealers



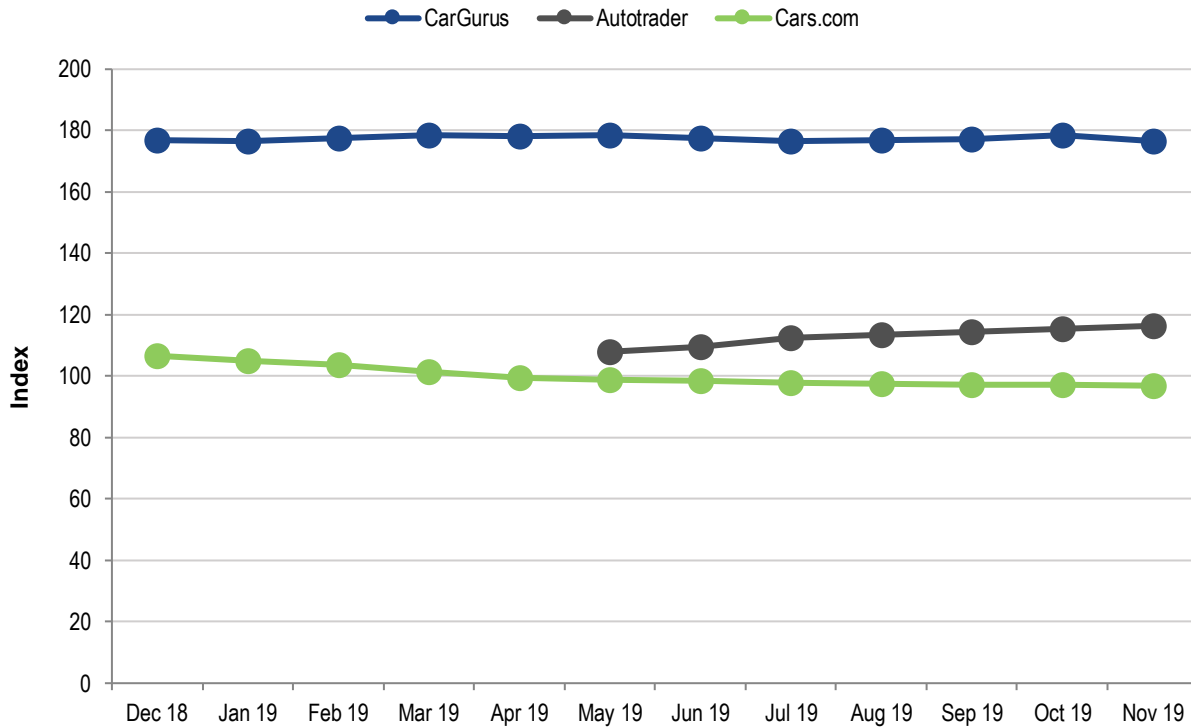
The overall conclusion from the above analysis is that CarGurus has a material lead over Autotrader and Cars.com in terms of listed vehicle inventory.

⁷ A given dealer may sometimes be identified in the data as both paying and non-paying on the same day. For example, a dealer may list 50 vehicles on a given day and appear as paying for 49 of those vehicles but as non-paying for 1 of them. We classified a dealer as paying on a given day if the majority of its listings from that day indicate that the dealer is paying.

III. DEALERS

We next show that CarGurus' advantage in the number of listings can be traced to the company's success in attracting dealers. Figure 7 quantifies the number of distinct dealers, as identified by dealer ID in the collected data, listing on each platform.^{8,9} It shows that CarGurus has a significant lead in terms of the total number of dealers. Its percentage lead in the number of dealers is considerably higher than its percentage lead in the number of listings, which indicates that CarGurus has been particularly successful in signing up smaller dealers to create as comprehensive a listing platform as possible.

Figure 7: Dealers by platform

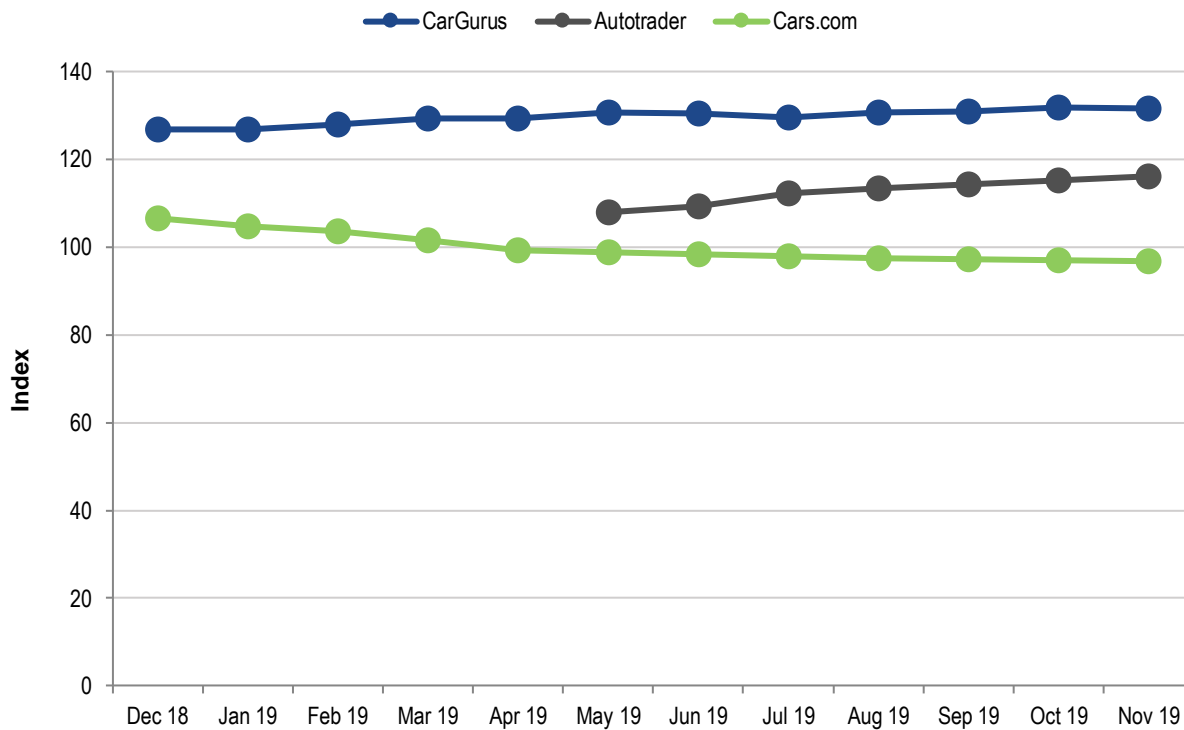


The above result is not entirely surprising, considering the fact that CarGurus is unique among the three platforms in allowing non-paying dealers to list their vehicle inventory. One would expect the “freemium” model to be attractive to dealers. A more informative comparison about CarGurus' business success would focus on paying dealers. This comparison is provided in Figure 8: Dealers by platform, limited to paying dealers. It shows that CarGurus also maintains a sizable lead in paying dealers over Autotrader and Cars.com. Importantly, together with Figure 6: Total vehicle inventory by platform, limited to paying dealers above, this analysis also shows that CarGurus' success in attracting smaller dealers is not limited to its “freemium” model, but extends to its paying model as well.

⁸ Similar to vehicle listings, the values for CarGurus and Cars.com represent the median of the daily values within each month.

⁹ We count certain national, online dealers (Carvana, Vroom, TRED, and Shift) as one dealer, despite being associated with multiple dealer IDs.

Figure 8: Dealers by platform, limited to paying dealers



We conclude that, consistent with its advantage in the number of vehicle listings, CarGurus also has a material advantage over Autotrader and Cars.com in terms of dealers advertising on its website.

IV. DEAL RATINGS

Each of the three platforms provides potential buyers with deal ratings: proprietary assessments of the prices advertised by dealers to help buyers make informed purchasing decisions and avoid overpaying. These assessments are only available for used vehicle listings; all new vehicle listings feature manufacturer-suggested retail prices. Because the rating schemes employed differ across the three platforms and deal ratings are based on proprietary algorithms, the same listing available on multiple platforms need not necessarily be rated identically across them, and indeed, they often are not.

Using the available data, we calculated the frequency distribution of the ratings appearing on each platform. The calculation was performed by first computing the distribution of ratings associated with each VIN over the life of that VIN, and then aggregating these VIN-specific distributions into a single distribution that includes all VINs.¹⁰ This method avoids over-weighting ratings associated with vehicles that are listed for a long time or underweighting ratings associated with vehicles that sell quickly. Each VIN is given an equal weight in the calculation, irrespective of how many days or months a VIN was listed.

Figure 9 presents the distribution of ratings for used vehicles listed on CarGurus. The platform provides a rating for about 80% of its used vehicle listings. The ratings are centered on “fair deal,” with a smaller percentage characterized as “good deals” and an even smaller percentage as “great deals.” A similar pattern is evident in the other direction, showing that CarGurus does not shy away from characterizing a portion of its listings as “high price” and even “overpriced.” The fact that some listings are not rated is not entirely surprising because the

¹⁰ The analysis for Autotrader was limited to the period August 2019 through November 2019 because deal ratings become available in the Autotrader data starting in August 2019.

characteristics of used vehicles can exhibit substantial heterogeneity. In cases where CarGurus does not assign a rating, there are too few comparable vehicles listed.

Figure 9: Relative frequency of deal ratings provided by CarGurus

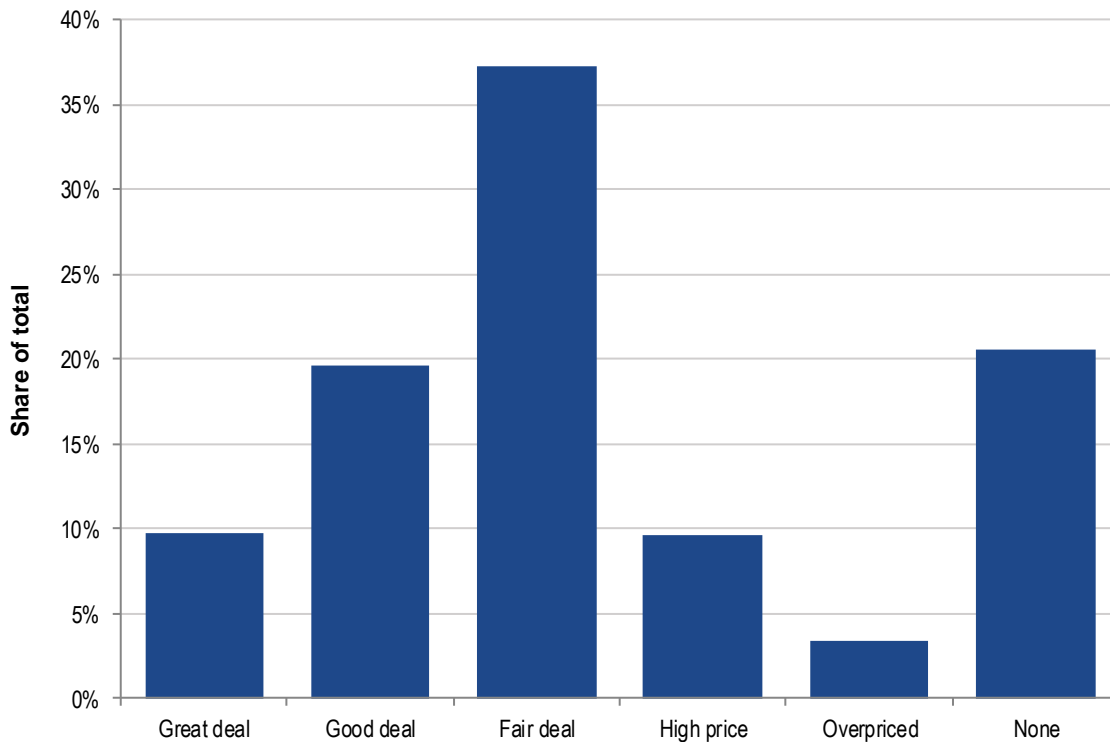
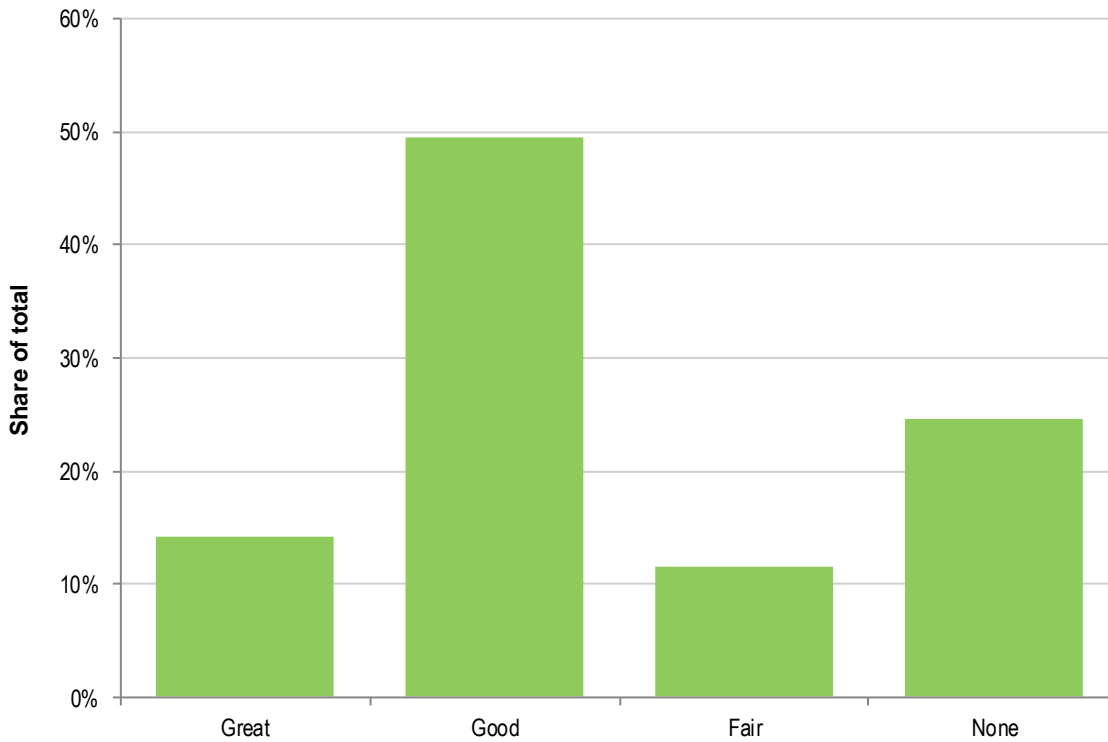


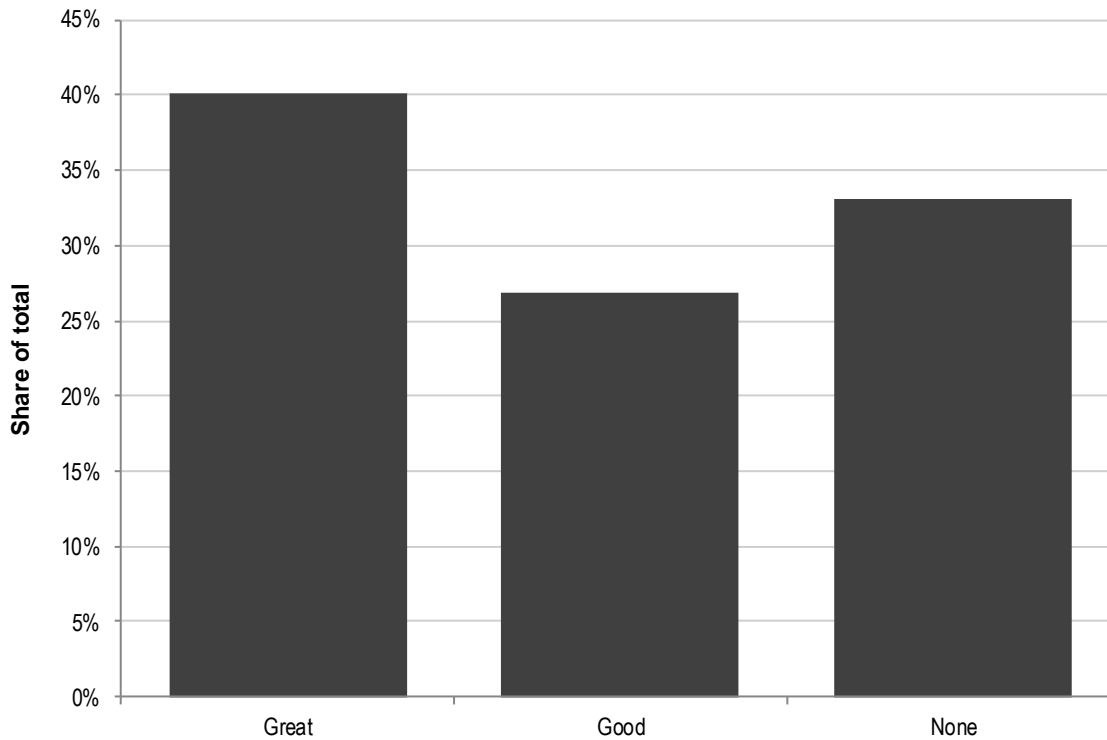
Figure 10 shows the distribution of ratings for Cars.com. Ratings are available for a slightly lower percentage of listings, about 75%. The distribution is centered on “good” deals, with a smaller percentage of listings characterized as “great” deals and about an equal percentage characterized as “fair” deals. Having three rather than five distinct categories, Cars.com’s rating scheme is not as fine or nuanced as CarGurus’. One consequence of this less precise scheme is that nearly half of Cars.com’s listings receives the highest-frequency rating of “good.” Cars.com’s choice to label its highest-frequency rating “good” may lead certain car buyers to overestimate the value of an average deal if they associate the word “good” with “better than average.” To the extent that this is the connotation that buyers have in mind when searching for used vehicles, our results suggest that those buyers stand a better chance of making an informed purchasing decision on CarGurus than on Cars.com.

Figure 10: Relative frequency of deal ratings provided by Cars.com



As shown in Figure 11, Autotrader does not provide a rating for one third of used vehicles listed on its website. For the listings that have a rating on Autotrader, the most frequently used category is “great,” with the only other category being “good.” A rating scheme that does not allow at least some prices to be characterized using a word that indicates a below average deal is unlikely to support informed purchasing decisions and is clearly inferior to the scheme used by CarGurus.

Figure 11: Relative frequency of deal ratings provided by Autotrader



The tabulations of the relative frequencies above are helpful for a general understanding of the rating labels used by each platform. To account for potential differences in the inventory listed on each platform, we conducted an additional analysis in which we restricted the vehicles to those listed on two platforms. If both platforms provided a rating for the vehicle, we compared the platforms' respective ratings.

Figure 12: Comparison of CarGurus ratings with respect to Cars presents the comparison for vehicles listed by both CarGurus and Cars.com. Each cell in the figure reports the percentage of vehicles analyzed that CarGurus rated as indicated in the row and Cars.com rated as indicated in the column (i.e., the joint distribution). The ratings for the two platforms agree for 28.4% of analyzed vehicles, as indicated by the cells shaded in grey. CarGurus assigns a lower rating than Cars.com for 62.1% of vehicles (green cells), and CarGurus' rating is higher than Cars.com's for the remaining 9.5% of vehicles (yellow cells). For instance, for 40.7% of rated inventory, Cars.com assigned a "good" or "great" rating but CarGurus assigned a "fair deal" rating. Conversely, in just 2.8% of cases, Cars.com assigned a "fair" rating but CarGurus assigned a "good deal" or "great deal" rating.

Figure 12: Comparison of CarGurus ratings with respect to Cars.com

		Cars.com		
		Great	Good	Fair
CarGurus	Great deal	4.7%	6.7%	0.7%
	Good deal	6.4%	17.0%	2.1%
	Fair deal	6.6%	34.1%	6.7%
	High price	0.7%	7.4%	3.3%
	Overpriced	0.1%	1.8%	1.7%

Figure 13 presents an analogous comparison for vehicles listed by both CarGurus and Autotrader. The ratings for the two platforms agree for 23.1% of analyzed vehicles, CarGurus assigns a lower rating than Autotrader's rating

for 75.3% of vehicles, and a higher rating than Autotrader’s rating for the remaining 1.6% of vehicles. For instance, listings rated by Autotrader as “good” or “great” but rated by CarGurus as a “fair deal” account for 45.8% of rated inventory.

Figure 13: Comparison of CarGurus ratings with respect to Autotrader

		Autotrader	
		Great	Good
CarGurus	Great deal	14.1%	1.6%
	Good deal	22.9%	9.0%
	Fair deal	19.9%	25.9%
	High price	1.3%	4.6%
	Overpriced	0.1%	0.6%

Our analysis shows that the CarGurus ratings are systematically more precise than the ratings of both Autotrader and Cars.com. Therefore, we would expect buyers using CarGurus to be in a better position to make informed purchasing decisions than those using Cars.com and Autotrader.

V. INVENTORY TURNOVER

Inventory turnover is an important indicator of both vehicle sales and profitability for a dealership. In this section, we analyze inventory turnover for dealers that list vehicles on only one of the platforms. Such dealers are difficult to identify in the data, because unlike a VIN, which is unique to each vehicle, a dealer ID is specific to each platform. Whether a given dealer with a specific ID on one platform also lists on other platforms thus cannot be determined by examining the presence of that dealer ID on other platforms. We were asked to use the following methodology developed by YipitData to identify dealers that list on only one platform:¹¹

1. Identify all VINs associated with that dealer’s platform-specific ID that appear on that platform on a particular date.
2. Examine whether any of these VINs are also listed on another platform.
3. If none of them are, the dealer is classified as listing only on that platform. If at least one VIN also appears on another platform, the dealer is classified as listing on multiple platforms.

We calculated inventory turnover by comparing a snapshot of VINs that appear on a platform on a particular date (the “initial snapshot”) with a second snapshot of the VINs that appear on that platform one month later (the “follow-up snapshot”). Turnover is defined as the percentage of VINs in the initial snapshot that no longer appear in the follow-up snapshot.

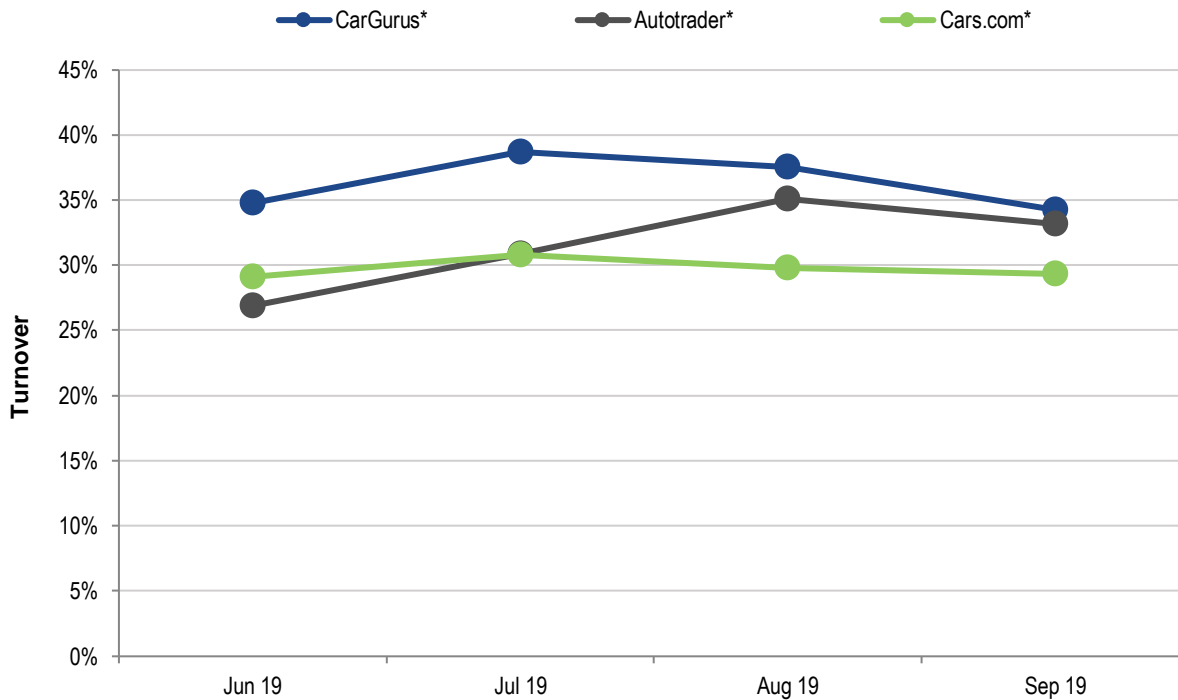
Given that CarGurus allows non-paying dealers to list on their platform while the other platforms do not, we limited the snapshots to vehicles listed by paying dealers. We also limited the snapshots to used vehicles and dealers classified as listing on only one platform in both snapshots using the procedure described above.¹² In addition, we removed dealers that no longer list any VINs in the follow-up snapshot. This last removal is meant to exclude dealers that have stopped listing their inventory on the specific platform altogether, rather than treating their inventory as having been sold in its entirety. Figure 14 provides the turnover results for each month between June 2019 and September 2019, with the horizontal axis indicating the month of the follow-up snapshot.

¹¹ YipitData is a provider of alternative data. See <https://www.yipitdata.com/corporates>.

¹² VINs are sometimes cross-listed by multiple dealers at the same time. To the extent that a cross-listed VIN is listed on multiple platforms, the dealer classification procedure excludes all of the dealers associated with that VIN. This leads to a significant number of dealers and corresponding VINs being excluded from the analysis. Additionally, if a dealer lists a single VIN on multiple platforms but the rest of its VINs on only one platform, all of that dealer’s VINs are excluded from the calculation.

The results show that the specific CarGurus-only VINs included in the calculation experience a faster turnover than the specific Cars.com-only and Autotrader-only VINs for these months. On average across these months, inventory turnover on CarGurus was 16% greater than Autotrader and 22% greater than Cars.com.

Figure 14: Inventory turnover by platform



* VINs included in calculation subject to restrictions described above.

VI. DAYS ON MARKET

Another important indicator of vehicle sales and profitability for dealers is the average age of their inventory. In this section, we calculate the average days on market for three different dealer groups: dealers that list only on CarGurus, dealers that list on CarGurus and one other platform, and dealers that list on all three platforms. To identify these three groups, we were asked to use the following methodology developed by YipitData:

1. For each CarGurus paying dealer, identify all VINs listed by that dealer in a given month.¹³
2. Examine whether any of these VINs are also listed on another platform or platforms.
3. Classify the dealer as CarGurus only if none of the VINs are listed on any other platform, as listing on 1 additional platform if at least one VIN is also listed on either Autotrader or Cars.com, and as listing on 2 additional platforms if at least one VIN is also listed on both Autotrader and Cars.com.¹⁴

For each dealer in a given group, we calculated the average days on market (between the listing date and the data collection date) across all VIN-days for the month.¹⁵ We then averaged the days on market for all dealers in that group (CarGurus only, CarGurus plus 1 additional platform, CarGurus plus 2 additional platforms).

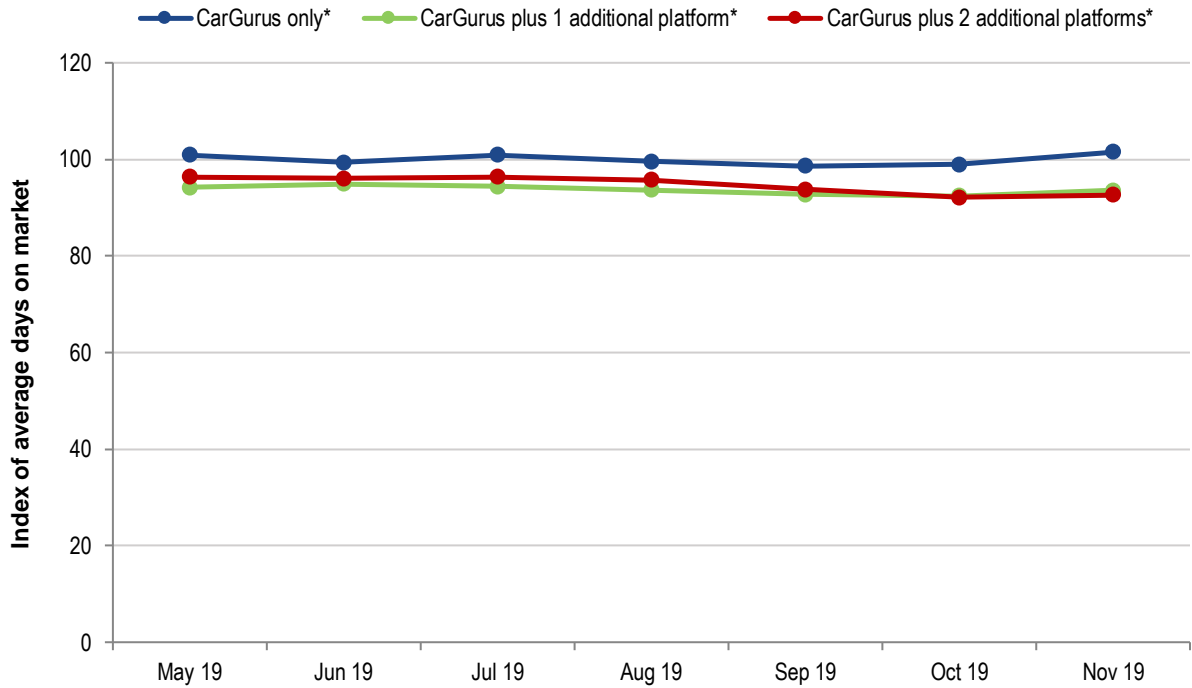
¹³ A dealer was classified as paying in a given month if it had at least one paid listing in that month.

¹⁴ For example, a dealer that lists virtually all of its VINs on only CarGurus but a handful of its VINs on one other platform will be classified as a dealer that lists on two platforms.

¹⁵ This means that a specific VIN is included in the calculation of the dealer-specific average as many times as it is listed during a month.

Figure 15: Average days on market provides the results for these calculations. Similarly to above, we indexed all numbers in such a way that the average days on market for “CarGurus only” averages 100 over the period shown. As apparent from the figure, the differences in the average days on market across the three groups of dealers are relatively small.

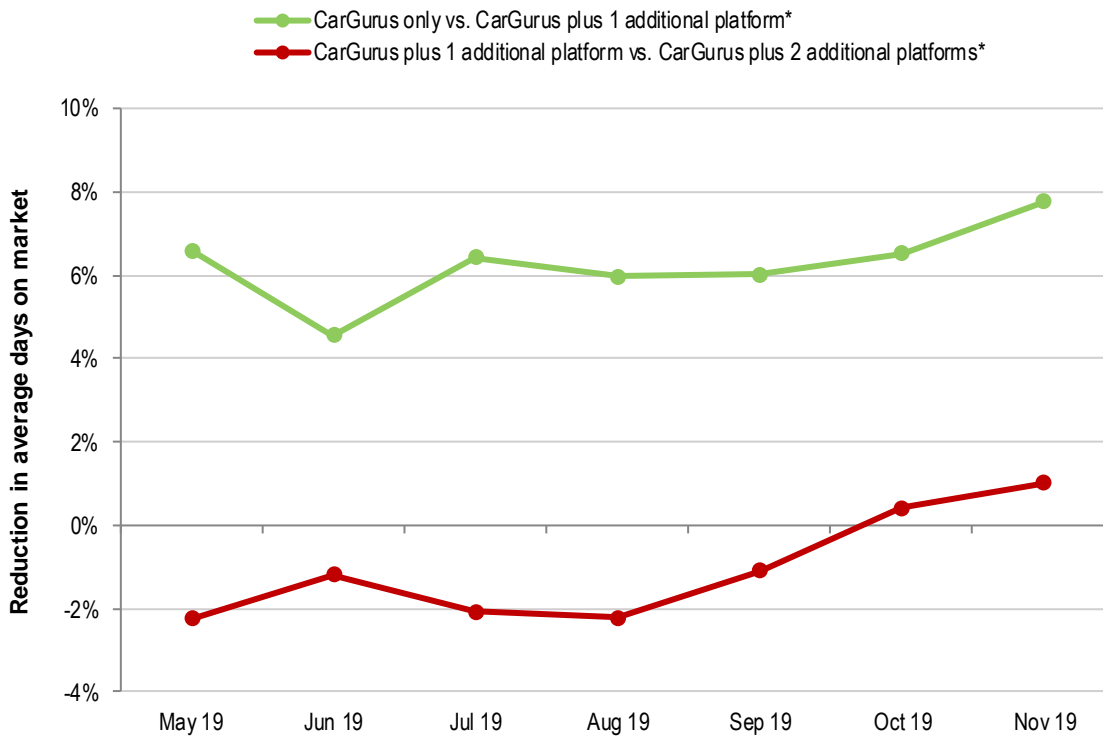
Figure 15: Average days on market by dealer group



* VINs included in calculation subject to restrictions described above.

To visually aid the comparison, Figure 16 below shows the percentage difference in days on market for dealers that list on CarGurus only and those that list on CarGurus plus 1 additional platform and the same for dealers that list on CarGurus plus 1 additional platform and CarGurus plus 2 additional platforms.

Figure 16: Comparison of average days on market across dealer groups



* VINs included in calculation subject to restrictions described above.

The reduction in the average days on market between dealers that list only on CarGurus and those that list on CarGurus and one additional platform is about 6%. For example, if the average age of the inventory for a dealer that lists on CarGurus only were 100 days and the dealer experienced a 6% reduction by adding a second platform, then the average age of its inventory would drop to 94 days. The reduction in the average days on market between dealers that list on CarGurus and one additional platform and those that list on CarGurus and two additional platforms is actually negative 1% on average, meaning that dealers that list on all three platforms have a slightly higher average age of their inventory (closer to 95 days) than dealers that list only on CarGurus and one other platform. These results suggest that there may be a relatively small incremental benefit to listing on two platforms and virtually no additional incremental benefit to listing on three platforms.



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