Carvana 101 – Carvana Finance Platform and Loan Performance

At our recent Analyst Day on November 29, 2018, we discussed our view that increased monetization of our finance platform represents one of our most exciting long-term GPU opportunities. We believe this long-term opportunity comes down to a simple principle: Better Model → Better Loans. In this document, we provide additional details on the historical performance of our loans by score and over time.

The takeaway in our view is twofold. First, automotive finance is a large, mature, and profitable market for market participants doing business in the traditional way. Second, Carvana's vertically-integrated model, proprietary technology, and differentiated customer offering unlock significant incremental profit opportunities above and beyond the traditional model.

1. Background on the Carvana Finance Platform

Carvana's goal is to provide customers with a seamless vehicle purchase and financing experience while earning a fair economic profit on each transaction. To accomplish this goal, we have built a technology platform to originate auto loans on our website. This platform is most easily understood in the context of the broader automotive finance market, which we describe briefly below.

Three Primary Players in the Automotive Finance Market
There are three primary players in the automotive finance market: dealers, lenders, and investors.

- <u>Dealers</u> acquire the customer, ensure vehicle quality, and collect loan information and documentation for lenders.
- <u>Lenders</u> underwrite each loan with proprietary credit scoring, pricing, and verifications algorithms and arrange servicing, creating a commoditized loan asset for investors. Typical lenders include banks, credit unions, in-house finance companies, and outsourced finance companies.
- <u>Investors</u> hold loan instruments and earn a risk-adjusted return for holding them. Typical investors include banks, credit unions, insurance companies, mutual funds, pension funds, private equity funds, and hedge funds. In many cases, lenders may play the role of investors by holding their loans until maturity, as is often the case with banks and credit unions. In other cases, lenders may retain a portion of the loans they sell to investors, making them partial investors themselves.

Three Lending Models[1]
The three primary players interact to originate auto loans using at least three lending models: the indirect model, the hybrid model, and the vertically-integrated model.

- In the <u>indirect model</u>, the dealer outsources the work associated with originating loans to external lenders. This model is used by the vast majority of dealers.

[1] A fourth model is the direct model. In the direct model, the lender acquires the customer and collects loan information directly, rather than through the dealer. This model is less relevant for the current discussion, since dealers typically don't have visibility into the credit attributes or performance of directly originated loans.

- In the hybrid model, the dealer originates some loans using an in-house finance company and outsources the work associated with originating the remaining loans to external lenders. This model is used by CarMax.
- In the vertically-integrated dealer-lender model, the dealer does the work of both the dealer and lender, and therefore has the opportunity to capture economics for performing both roles.

Division of Economics

Most of the economics of a used vehicle transaction are divided between the three players.

- Dealers typically capture profit on the retail sale of the vehicle, as well as profits from ancillary products such as vehicle service contracts and GAP coverage. The profit the dealer earns on the loan depends on the characteristics of the loan and the required return and cost structure of the lender. In most cases, dealers capture profit on the loan because the value of the loan is sufficient to generate excess profits for the lender even after paying investors and overhead costs. In other cases, the dealer may pay the lender to ensure the lender earns a profit because it allows the dealer to earn retail and ancillary product profit on the transaction. This payment from dealer to lender is eliminated in the integrated dealer-lender model, where each loan is optimized for the combined profit of the two players.
- Lenders typically earn the largest share of profit on an auto loan.[2] Lender profits are generated from the work required to originate and commoditize a profitable auto loan, including investments in technology, people, processes, dealer relationships, investor relationships, and a long performance history. These profits are often significant, even after paying loan origination expenses, dealer sales and relationship management expenses, and corporate overhead expenses.
- Investors earn a risk-adjusted return that depends on several factors that impact returns in fixed income markets, including prevailing interest rates, ratings, credit risk, liquidity, and duration.

The Carvana Model

Carvana's financing model vertically-integrates the key aspects of retail and lending roles by using proprietary technology to provide a seamless customer experience and strong loan economics. When a customer visits our website, he or she can get prequalified for a loan by filling out a short credit inquiry form. Our technology then goes to work. We connect to a variety of consumer data sources and use our proprietary algorithms to nearly instantaneously generate a credit score and affordable risk-adjusted pricing options for the customer. These algorithms utilize state-of-the-art machine learning techniques supported by years of industry experience and academic research. We provide transparency and control to the customer by presenting a wide range of deal options for every car in our inventory. After the customer chooses his or her desired vehicle and terms, we complete the sale and originate the loan. We then typically sell our loans to our finance partners following the completion of the 7-day return policy.

[2] To size the profits earned by each player, we researched profits earned by different players originating similar loans across multiple lending models, including the profits of securitization market participants with and without retained residual interests. For example, investor share of profits can be estimated using securitization market data on cost of debt and publicly reported estimates of cost of equity from large issuers, and lender share of profits can be estimated using this data, additional publicly available data on loan characteristics, and public company filings.

Comparison of Automotive Lending Models

	Typical Player	Carvana (Integrated Dealer-Lender)	CarMax Auto Finance (Hybrid – Integrated)	CarMax Tier 2&3 (Hybrid – Indirect)	Typical Dealer (Indirect)
Customer acquisition	Dealer	Yes	Yes	Yes	Yes
Vehicle sale and quality assurance	Dealer	Yes	Yes	Yes	Yes
Customer data collection	Dealer	Yes	Yes	Yes	Yes
Credit scoring	Lender	Yes	Yes	Outsourced	Outsourced
Pricing and deal Structuring	Lender	Yes	Yes	Outsourced	Outsourced
Income and other verifications	Lender	Yes	Yes	Outsourced	Outsourced
Capital markets partnerships	Lender	Yes	Yes	Outsourced	Outsourced
Loan servicing	Lender	Outsourced	Yes	Outsourced	Outsourced
Investment in loans	Investor	Outsourced	Partial	Outsourced	Outsourced

Benefits of Vertical Integration

We believe integration of the dealer and lender roles offers several benefits versus the traditional indirect model. First, vertical integration enables lower lender costs by eliminating dealer relationship management costs, reducing overhead, and facilitating automation of underwriting tasks due to a shared technology platform. Second, we believe vertical integration enables stronger loan performance by providing visibility and control over vehicle quality, increased visibility into customer attributes, and a controlled environment that eliminates adverse selection and facilitates pricing optimization.

Benefits of the Online Retail Model

We also believe the online retail model enables structural benefits for financing versus the traditional brick-and-mortar model. In particular, based on internal and third-party data sources, our vehicle prices are significantly below average compared to traditional dealers. Lower prices feed back into the financing model in multiple ways. First, lower prices lead to lower loan-to-value (LTV) ratios, which is a positive indicator of loan performance because lower LTVs lead to higher recoveries in the event of default, all other things being equal. Second, lower prices lead to either lower payments on the same vehicle or a better vehicle (e.g., lower mileage, newer year) for the same payment, both of which are positive indicators of loan performance, all other things being equal.

Other aspects of our online sales model may also lead to better performance. For example, we believe our reconditioning process consistently enables us to sell high quality vehicles, which is a positive indicator of loan performance, and our vertical integration ensures visibility and control over customer and vehicle data, which enables more robust underwriting. We also deliver a memorable and transparent retail and finance experience, which we believe can have positive effects on loan performance, all other things being equal. While the precise impact of these benefits is difficult to quantify, we believe they are borne out in our performance data, which is provided below.

2. Carvana Loan Performance

Carvana's vertically-integrated model, proprietary technology, and differentiated customer offering have led to historical loan performance that is meaningfully better than traditional securitization market issuers. To provide detailed insight into this performance, we present cumulative net loss (CNL) curves for our historical loan originations by Carvana's proprietary Deal Score Band and by year of origination.

Carvana's proprietary Deal Score is an internal score designed to predict performance of each loan at the time of origination. The score is built using machine learning algorithms and data on numerous credit attributes from a variety of consumer data sources and deal attributes based on the specific vehicle and terms selected by the customer. Higher deal scores are associated with better expected performance.

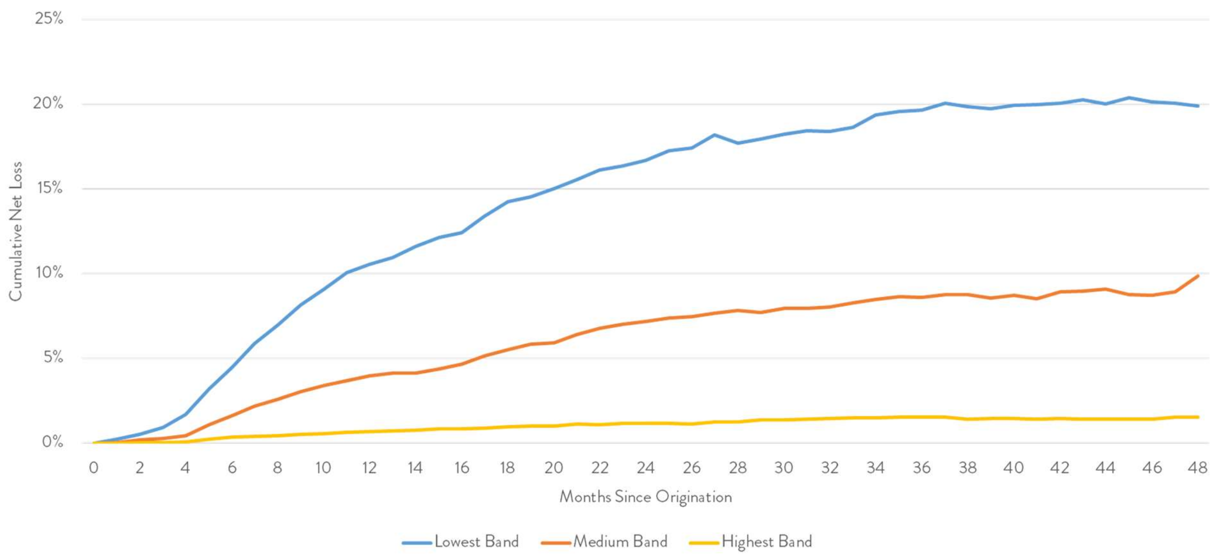
Table 1: Carvana 2018 Originations by Deal Score Band

	Highest Band	Medium Band	Lowest Band
2018 Share	53%	37%	10%
2018 W.A. FICO	702	567	508
Historical CNL Curve	Yellow	Orange	Blue

Table 1 shows the distribution of loans originated in 2018 by Carvana's proprietary Deal Score band. The bands are based on a continuous grouping of deal scores designed to align with broad credit distributions represented in market securitizations. The first row of the table shows the share of 2018 originations within each score band based on original principal balance. The second row shows the average FICO within each score band weighted by original principal balance. Deal Score is correlated with FICO but is significantly more predictive of future performance due to its customized sample, data, and methodology.

Figure 1 shows the historical cumulative net loss (CNL) performance of loans originated in each Deal Score band. Cumulative net loss is a key measure of loan performance and driver of loan value. Following standard industry methodology, CNL in each period is calculated by dividing the total cumulative charged-off principal balance through the end of that period, net of recoveries, by the total original principal balance of the pool. Other things being equal, lower cumulative net losses lead to more profitable loans than higher cumulative net losses.

Figure 1: Carvana Historical Loan Performance by Deal Score Band[3]



The data shows that Carvana Deal Score is a strong predictor of loan performance. Loans in the highest Deal Score band (yellow) have the lowest historical CNL while the other Deal Score bands (orange and blue) have historical CNLs that increase sequentially with lower Deal Scores. Historical CNLs tend to increase early in the life of the loans and then flatten as the loans age, consistent with typical auto loan pools, allowing some insight into life-of-loan performance.[4] That said, it is worth noting that given our status as a young company, the curves include relatively small samples in the outer years, especially months 37 through 48, which are based on a single year of origination data.

[3] The CNL curves in Figure 1 are computed using historical data through the month ending 12/31/18 for annual cohorts with a full year of performance data, which includes loans originated by Carvana from 2014 through 2017. Loans originated in 2018, which have only a partial year of data, are performing similarly 2017 loans. CNL is measured from the time of origination and does not include a seasoning benefit (i.e., unlike many securitization pools, the curves include loans that became delinquent on the first, second, or third payment). The curves include only historical data and do not include projections. Annual cohorts of loans are combined into a single curve when the cohort is complete and historical data is available. For example, months 37 through 48 include data from loans originated in 2014, months 25 through 36 include data from loans originated in 2014 and 2015, and so on. We provide CNL curves segmented by annual cohort in Figure 2.

[4] Cumulative net loss curves in the auto loan market typically flatten as the portfolio ages for several reasons. The first is selection. Borrowers who default early are typically riskier than average, leading to positive selection on the borrowers who remain, particularly in higher loss pools. The second is amortization. As the borrower makes payments, the outstanding balance on the loan decreases, which means other things being equal, a smaller lost balance in the event of default. The third is equity. As the borrower makes payments, the loan eventually reaches positive equity (i.e., the balance on the loan becomes less than the value of the underlying vehicle), meaning higher recovery rates in the event of default other things being equal.

3. Loan Performance of Securitization Market Issuers

For additional context on our historical CNL curves, Table 2 provides data on five large lenders who fund fixed pools of auto loans in the securitization market. CarMax Auto Finance (CAF) is CarMax's in-house finance company, and Westlake Financial, Santander Consumer USA, Exeter Financial, and American Credit Acceptance are external lending partners that participate in CarMax's Tier 2 or Tier 3 lending programs. To the best of our knowledge, CarMax does not disclose the volume of loans sold to each of these partners, the premium or discount paid to each of the partners, or the underlying credit attributes or performance of loans held by these partners. However, since the partners participate in the securitization market, we are able to view some of their data. It's worth noting that these partners also work with many dealers via the indirect lending model (see Section 1), not just CarMax, but their loss performance provides useful insight into the performance of auto loans across the credit spectrum.

Table 2: Auto Loan Securitization Pool Statistics[5]

	CarMax Auto Finance (CAF)	Westlake Financial	Santander Consumer USA (SDART)	Exeter Financial	Santander Consumer USA (DRIVE)	American Credit Acceptance
Deal	CARMX 2018-3	WLAKE 2018-3	SDART 2018-3	EART 2018-3	DRIVE 2018-3	ACAR 2018-3
Original Pool Balance	$1,440M	$924M	$1,304M	$567M	$1,643M	$280M
W.A. FICO	706	601	609	568	581	545
Rating agency CNL midpoint	2.25%	13.25%	16.1%	21.0%	27.0%	27.5%
Historical CNL range	2 - 2.2%	12%+	12%+	18%+	20%+	25%+

The table shows that expected CNL, as measured using publicly available data on the midpoint of rating agency expected CNL range and observed historical CNLs, is highly correlated with weighted-average FICO. Rating agency expected CNLs range from 2.25% for CarMax Auto Finance, which has the highest weighted average FICO, to 27.5% for American Credit Acceptance, which has the lowest.

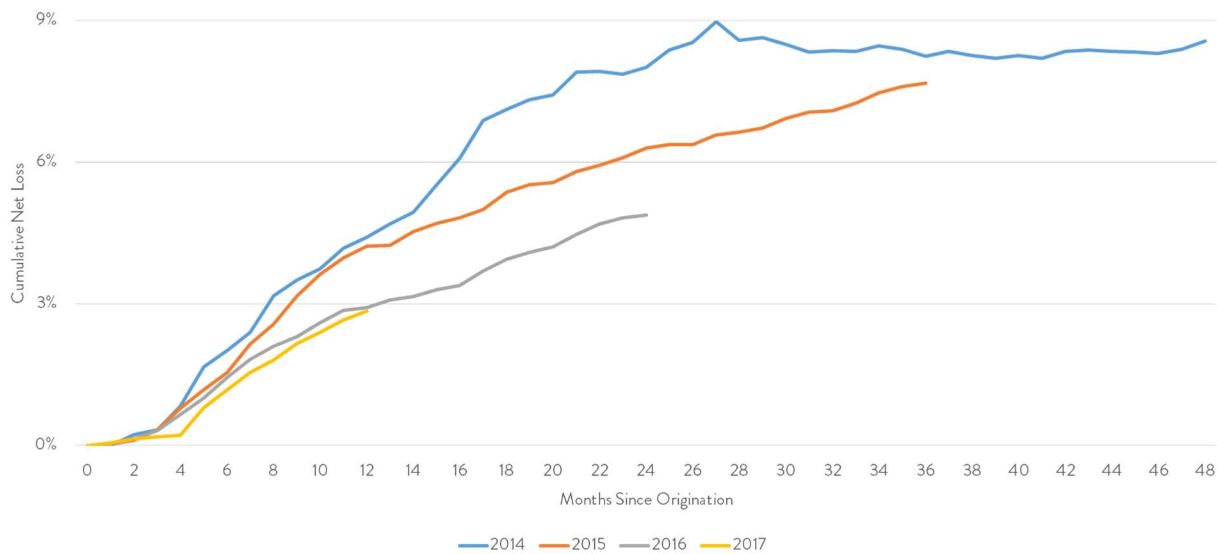
4. Carvana Loan Performance Over Time

In addition to demonstrating strong performance relative to securitization market issuers conditional on credit, our loan pools have exhibited improving performance over time throughout a phase of rapid growth. This differs from many historical examples of fast growing finance companies who, because they must compete for the loan, lowered standards or signed up new, unknown dealers over time. In contrast, we primarily compete for the vehicle sale, and once we get the sale, we operate in our own controlled environment for the loan.

[5] For ease of presentation, the table shows a single recent securitization market pool for each issuer; however; the key metrics are consistent across many pools for each issuer. For example, across pools funded in 2017 and 2018, CarMax Auto Finance's rating agency CNL midpoint ranged from 2.2% to 2.25%, Westlake's ranged from 13.25% to 13.5%, Santander SDART's ranged from 15.8% to 16.1%, Exeter's ranged from 20.25% to 21%, Santander Drive's ranged from 27% to 27.5%, and American Credit Acceptance's ranged from 27.25% to 29%.

Figure 2 shows realized cumulative net loss curves for annual cohorts of loans based on the calendar year of origination. Each CNL curve includes all loans originated in a given calendar year and includes data for all months in which a complete annual cohort was available. Loans originated in 2018 only have a partial year available and thus are not shown, but are performing similarly to 2017 loans.

Figure 2: Loan Performance by Year of Origination



The figure shows that the performance of our loan pools has improved over time during a phase of rapid growth (from 2,105 vehicles sold in 2014 to 94,108 in 2018). We attribute this to improvement in our proprietary technology and processes, as our customer FICO has remained broadly consistent throughout this period.

Looking forward, we expect loan performance over time to be impacted by several factors, including improvements in our scoring algorithms, macroeconomic factors, and our strategy. For example, if we lowered customer interest rates, we would expect to see higher sales and lower CNLs (due to payment size and selection effects), but lower loan values due to the lower rates, all other things being equal. On the other hand, if we lowered required down payments, we would also expect to see higher sales but higher CNLs and lower loan values, all other things being equal. While these and other strategies could move our CNL rates up or down over time, our platform grants significant flexibility, and we would generally pursue these strategies only if we believed they increased the overall value of our business.

In sum, we are excited about the opportunities that our finance platform holds for our business and our customers, particularly since we do not believe our loans need to continue outperforming to this degree for us to achieve our financial goals. We believe our results to date demonstrate the value of our loans, the quality and sustainability of our platform, and our ability to continue to scale over time.

Forward Looking Statements

This document contains forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995. These forward-looking statements reflect Carvana's current expectations and projections with respect to, among other things, its financial condition, results of operations, plans, objectives, future performance, and business. These statements may be preceded by, followed by or include the words "on track," "well-positioned," "believe," "expect," "projection," "continued," the negatives thereof and other words and terms of similar meaning. Forward-looking statements include all statements that are not historical facts. Such forward-looking statements are subject to various risks and uncertainties. Accordingly, there are or will be important factors that could cause actual outcomes or results to differ materially from those indicated in these statements. Among these factors are risks related to the "Risk Factors" identified in our Annual Report on Form 10-K for 2018. There is no assurance that any forward-looking statements will materialize. You are cautioned not to place undue reliance on forward-looking statements, which reflect expectations only as of this date. Carvana does not undertake any obligation to publicly update or review any forward-looking statement, whether as a result of new information, future developments, or otherwise.