

ANALYSIS

NOVEMBER 2020

Prepared by

Michael Brisson  
[Michael.Brisson@moodys.com](mailto:Michael.Brisson@moodys.com)  
Senior Economist

Jonathan Smoke  
[Jonathan.Smoke@coxautoinc.com](mailto:Jonathan.Smoke@coxautoinc.com)  
Chief Economist, Cox Automotive Inc.

Contact Us

Email  
[helpeconomy@moodys.com](mailto:helpeconomy@moodys.com)

U.S./Canada  
+1.866.275.3266

EMEA  
+44.20.7772.5454 (London)  
+420.234.747.505 (Prague)

Asia/Pacific  
+852.3551.3077

All Others  
+1.610.235.5299

Web  
[www.economy.com](http://www.economy.com)  
[www.moodysanalytics.com](http://www.moodysanalytics.com)

## Introducing the Cox Automotive/ Moody's Analytics Vehicle Affordability Index

Cox Automotive and Moody's Analytics have partnered to develop an affordability index for new vehicles. The Cox Automotive/Moody's Analytics Vehicle Affordability Index measures the ability of a household earning the median income to afford the purchase of an average-priced automobile. Updated monthly, using the latest data from multiple government and industry sources, this unique indicator calculates the number of weeks of median household income needed to purchase an average new vehicle.

# Introducing the Cox Automotive/Moody's Analytics Vehicle Affordability Index

BY MICHAEL BRISSON AND JONATHAN SMOKE

**C**ox Automotive and Moody's Analytics have partnered to develop an affordability index for new vehicles. The Cox Automotive/Moody's Analytics Vehicle Affordability Index measures the ability of a household earning the median income to afford the purchase of an average-priced automobile. Updated monthly, using the latest data from multiple government and industry sources, this unique indicator calculates the number of weeks of median household income needed to purchase an average new vehicle.

## Jump start

As new-vehicle MSRPs continue to reach record highs, demand has increased for an average new-vehicle affordability index. Price increases in 2018 and 2019 for an average new vehicle caused many industry experts to predict a drastic movement away from new-vehicle sales and toward the used-vehicle market. The shift was not drastic, but rather a marginal movement toward used vehicles. Such a miscalculation can be partially attributed to a lack of visibility into consumers' spending power from income and interest rate changes relative to the movement of new-vehicle prices.

The Cox Automotive/Moody's Analytics Vehicle Affordability Index addresses market needs by providing an easy-to-use metric to track the affordability of new vehicles, accounting for movements in transaction prices, income and interest rates.

This paper describes the underlying data sources, methodology, and some reasoning as to why each decision was made.

## Under the hood

The Cox Automotive/Moody's Analytics Vehicle Affordability Index is driven by the consumer's vehicle transaction prices, the income of the consumer, amount financed by the consumer, and the interest rate provided

by the lender. Let us look at each of these inputs more closely.

First, the consumer's vehicle transaction price is determined by the new vehicle's price, how much the dealer loses in gross margin through negotiations, and price decreases from factory/dealer incentives. This information is sourced from Kelley Blue Book and Motor Intelligence and is used to derive the weighted average of actual consumer transaction prices.

The decision to use the average consumer transaction price on all vehicles sold rather than average price of cars but not trucks or SUVs was made to increase representativeness of the index. An argument can be made that affordability should consider only cars because smaller vehicles are the first place a marginal buyer will look. However, this thought is out of tune with the purchasing habits of the average American. Moreover, the average vehicle purchased today and for the foreseeable future is a light truck or specifically an SUV, and the ability of a consumer to afford this purchase is exactly what the index is intended to measure.

The second major input to the index is income of the consumer. Government sources for income are significantly lagged. In order to have current income estimates, the index utilizes the Moody's Analytics baseline eco-

nomic scenario forecast for median household income. Additionally, median income is used rather than average income because average incomes are skewed as a result of income inequality in the U.S. This makes median income a better gauge of typical consumer spending power.

A harder decision comes from whether to use median family income or median household income. Median family income includes only individuals who are related through marriage or birth, and household includes everyone living in the home. Our index uses the Moody's Analytics baseline scenario forecast of household income rather than median family income. The average household owns more than one vehicle. Therefore, the typical household tends to purchase multiple vehicles. If there are nonfamily members living together, the purchase of multiple vehicles will likely increase. This goes against traditional home affordability indexes, which use the family income as a measure because it is more likely for a single-family unit to be the buyer of a home. Qualitatively speaking, if there is someone outside a family unit living in the household (owner's siblings, friends) they likely will have or want to have their own vehicle. Given this, the median income by household is more representative for the average car buyer than family income.

The third major input is the interest rate paid by the consumer. Our preferred value for this input would be the average interest rate of a 72-month, fixed-rate new-vehicle loan. However, this rate is not readily available for a longer time series. What we do have available is the interest rate for new vehicles on a 60-month loan from finance companies and credit unions and the shorter time series of the 72-month loans. Using these series, we were able to estimate the risk spread from an extra year on the books. This risk spread is added to the movements of the 60-month rate from the Federal Reserve and Moody's Analytics to inform our interest rate assumptions. These rates were checked against Cox Automotive's anonymized industry data for accuracy to further our confidence in this value.

Two final input decisions were required to round out the equation. First, what percentage of original transaction price is financed. For this, we assume a flat rate of 10% down payment. This decision was made after reviewing several years of recent vehicle sales and finance detail from Dealertrack, a Cox Automotive company that provides a credit application platform for thousands of dealers in the U.S. as well as title, econtract, and Dealer Management System services. This platform provides a very large sample of actual finance details of new-vehicle transactions. Our review of auto loans revealed that down-payment percentages are inversely correlated by loan term, with longer loans seeing much less put down at purchase and shorter terms having much higher percentages. The analysis conducted by Cox Automotive revealed that a typical

down payment on a 72-month loan has averaged approximately 9% for the most recent years. As a result, the team concluded that a 10% down payment rate is a likely conservative estimate for a 72-month loan and utilizing a flat 10% down payment assumption would fairly represent the most typical new-vehicle transaction.

Second, as for term length, it was initially thought we could use the average term for new vehicles from finance companies provided by the U.S. Federal Reserve. However, the average term length in this value is biased lower by older loans on the books. A more appropriate measure would be loans that are being originated right now. Given the limited availability of this information, the next best measure is the most popular loan term length that was made available through Cox Automotive based on the Dealertrack platform.

The term analysis revealed that 72-month terms are the most popular new-vehicle loans currently. A separate analysis using Equifax data from Moody's Analytics Creditforecast.com confirmed that terms of 72 months or longer represent the majority of the most recent auto loan originations. Utilizing 72-month loans with the 10% down-payment assumption ensures that the affordability index is tracking the most typical current new-vehicle purchase.

### Horsepower

With the index at our disposal (see Chart 1), some initial insights can be drawn. Surprisingly, despite all-time highs for average transaction prices, as have been reported, the index dropped for 2019. The decreased number of weeks needed to purchase a new

vehicle was a significant turnaround from the growth experienced from the second half of 2018 through the first part of 2019 (see Chart 2). An important note when interpreting the charts is that affordability rises as the number of weeks needed to pay off the loan drops. That is, as the line lowers, the share of consumer's income needed for the purchase drops, making new cars more affordable.

In the second half of 2019, dealers and manufacturers increased incentives to move inventory, at the same time that wage growth continued to rise and interest rates dropped. However, without all these inputs being considered, the rise in new-vehicle prices, and at the same time continuing strength in new-vehicle sales, would seem at odds.

The index was able to pick up the 2018 decrease and then subsequent increase in new-vehicle affordability. It also shows that unaffordability has not risen to the levels reached at the end of 2013. Consumers were able to pay off the new vehicle 5.7% faster in 2019 compared with 2013, a time when slow wage growth kept consumers' ability to pay low. The ability to account for recent index movements in context with previous periods makes the index even more valuable.

### Finish line

Using the number of weeks needed for a median income household to pay off a new vehicle gives a straightforward unit that captures affordability. The calculation eliminates the need to incorporate rules on what percentage of a buyer's income should be spent or how long the buyer's payment schedule should last. Additionally, by using the number of weeks, the

## Chart 1: Vehicle Affordability Index

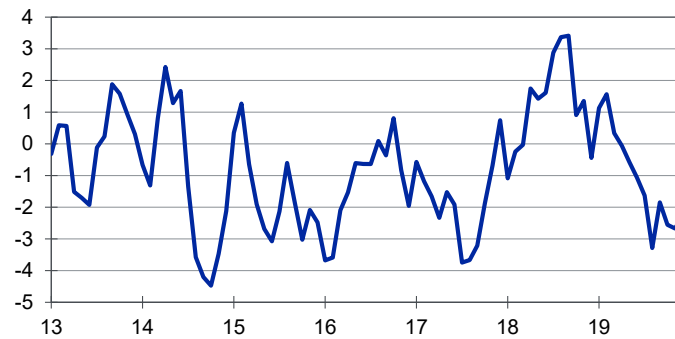
Wks needed to purchase (new light vehicle), #, NSA



Sources: Cox Automotive, Moody's Analytics

## Chart 2: Fewer Weeks Needed in 2019

Wks needed to purchase (new light vehicle), % change yr ago



Sources: Cox Automotive, Moody's Analytics

index does not need to be anchored to a year to be understood. Rather, the index looks across time to determine past and present trends.

The Cox Automotive/Moody's Analytics Vehicle Affordability Index provides unique insights that inform industry experts and consumers if the prices being paid for ve-

hicles are getting out of reach or becoming more affordable. The guessing and prognosis based on disparate indicators can finally be put to rest.

## About the Authors

[Michael Brisson](#) is a senior economist and associate director at Moody's Analytics. He is the lead auto economist working as a member of the Economic Research group in West Chester PA. Mike works at developing new, empirically driven auto-related products and services. Prior to leading the Moody's Analytics auto research team, Mike built loan and vintage-level CECL, CCAR, and stress-testing models of consumer loan performance as a member of the Business Analytics group at Moody's Analytics. Additionally, Mike has spent time developing econometric models used by U.S. states and local governments for tax/revenue projections. Mike holds a PhD in applied economics from Northeastern University.

[Jonathan Smoke](#) is chief economist for Cox Automotive. Smoke leads Cox Automotive's economic industry insights team, which tracks new- and used-vehicle sales, supply, prices, retail and fleet demand, consumer credit and auto financing, and dealer sentiment to understand the key trends impacting both the wholesale and retail markets for vehicles informed by the proprietary data from all of the company's businesses and platforms including Manheim, Autotrader, Kelley Blue Book, and Dealertrack. For more than 24 years, Smoke has focused on translating data and trends into relevant, actionable insights for the industries that represent the biggest purchases that consumers make in their lifetimes: real estate and automotive.

Prior to joining Cox Automotive, Smoke served as Realtor.com's chief economist. Before that, he was the chief economist for Hanley Wood, a media and market intelligence company, and also served in a variety of roles at Beazer Homes, including senior vice president of strategy and innovation.

Smoke is an executive member of the board for the Atlanta Economics Club and is a member of the Conference of Business Economists, Harvard Industrial Economists and the National Association of Business Economists. He has spoken at major industry conferences such as the NADA and NIADA conventions, Automotive News World Congress, and Used Car Week. His views on the economy and the auto industry are featured regularly in industry and national news outlets such as Automotive News, Auto Remarketing, The Wall Street Journal, USA Today, Bloomberg, and CNBC. Follow him on Twitter @SmokeonCars to keep up with the latest industry insights.

Smoke holds a bachelor's degree in economics and religious studies from Rhodes College and a master's degree in business from The University of Texas at Austin.

## About Moody's Analytics

Moody's Analytics provides financial intelligence and analytical tools supporting our clients' growth, efficiency and risk management objectives. The combination of our unparalleled expertise in risk, expansive information resources, and innovative application of technology helps today's business leaders confidently navigate an evolving marketplace. We are recognized for our industry-leading solutions, comprising research, data, software and professional services, assembled to deliver a seamless customer experience. Thousands of organizations worldwide have made us their trusted partner because of our uncompromising commitment to quality, client service, and integrity.

Concise and timely economic research by Moody's Analytics supports firms and policymakers in strategic planning, product and sales forecasting, credit risk and sensitivity management, and investment research. Our economic research publications provide in-depth analysis of the global economy, including the U.S. and all of its state and metropolitan areas, all European countries and their subnational areas, Asia, and the Americas. We track and forecast economic growth and cover specialized topics such as labor markets, housing, consumer spending and credit, output and income, mortgage activity, demographics, central bank behavior, and prices. We also provide real-time monitoring of macroeconomic indicators and analysis on timely topics such as monetary policy and sovereign risk. Our clients include multinational corporations, governments at all levels, central banks, financial regulators, retailers, mutual funds, financial institutions, utilities, residential and commercial real estate firms, insurance companies, and professional investors.

Moody's Analytics added the economic forecasting firm Economy.com to its portfolio in 2005. This unit is based in West Chester PA, a suburb of Philadelphia, with offices in London, Prague and Sydney. More information is available at [www.economy.com](http://www.economy.com).

Moody's Analytics is a subsidiary of Moody's Corporation (NYSE: MCO). Further information is available at [www.moodyanalytics.com](http://www.moodyanalytics.com).

DISCLAIMER: Moody's Analytics, a unit of Moody's Corporation, provides economic analysis, credit risk data and insight, as well as risk management solutions. Research authored by Moody's Analytics does not reflect the opinions of Moody's Investors Service, the credit rating agency. To avoid confusion, please use the full company name "Moody's Analytics", when citing views from Moody's Analytics.

## About Moody's Corporation

Moody's Analytics is a subsidiary of Moody's Corporation (NYSE: MCO). MCO reported revenue of \$4.8 billion in 2019, employs more than 11,000 people worldwide and maintains a presence in more than 40 countries. Further information about Moody's Analytics is available at [www.moodyanalytics.com](http://www.moodyanalytics.com).

**CREDIT RATINGS ISSUED BY MOODY'S INVESTORS SERVICE, INC. AND ITS RATINGS AFFILIATES ("MIS") ARE MOODY'S CURRENT OPINIONS OF THE RELATIVE FUTURE CREDIT RISK OF ENTITIES, CREDIT COMMITMENTS, OR DEBT OR DEBT-LIKE SECURITIES, AND MOODY'S PUBLICATIONS MAY INCLUDE MOODY'S CURRENT OPINIONS OF THE RELATIVE FUTURE CREDIT RISK OF ENTITIES, CREDIT COMMITMENTS, OR DEBT OR DEBT-LIKE SECURITIES. MOODY'S DEFINES CREDIT RISK AS THE RISK THAT AN ENTITY MAY NOT MEET ITS CONTRACTUAL, FINANCIAL OBLIGATIONS AS THEY COME DUE AND ANY ESTIMATED FINANCIAL LOSS IN THE EVENT OF DEFAULT. CREDIT RATINGS DO NOT ADDRESS ANY OTHER RISK, INCLUDING BUT NOT LIMITED TO: LIQUIDITY RISK, MARKET VALUE RISK, OR PRICE VOLATILITY. CREDIT RATINGS AND MOODY'S OPINIONS INCLUDED IN MOODY'S PUBLICATIONS ARE NOT STATEMENTS OF CURRENT OR HISTORICAL FACT. MOODY'S PUBLICATIONS MAY ALSO INCLUDE QUANTITATIVE MODEL-BASED ESTIMATES OF CREDIT RISK AND RELATED OPINIONS OR COMMENTARY PUBLISHED BY MOODY'S ANALYTICS, INC. CREDIT RATINGS AND MOODY'S PUBLICATIONS DO NOT CONSTITUTE OR PROVIDE INVESTMENT OR FINANCIAL ADVICE, AND CREDIT RATINGS AND MOODY'S PUBLICATIONS ARE NOT AND DO NOT PROVIDE RECOMMENDATIONS TO PURCHASE, SELL, OR HOLD PARTICULAR SECURITIES. NEITHER CREDIT RATINGS NOR MOODY'S PUBLICATIONS COMMENT ON THE SUITABILITY OF AN INVESTMENT FOR ANY PARTICULAR INVESTOR. MOODY'S ISSUES ITS CREDIT RATINGS AND PUBLISHES MOODY'S PUBLICATIONS WITH THE EXPECTATION AND UNDERSTANDING THAT EACH INVESTOR WILL, WITH DUE CARE, MAKE ITS OWN STUDY AND EVALUATION OF EACH SECURITY THAT IS UNDER CONSIDERATION FOR PURCHASE, HOLDING, OR SALE.**

MOODY'S CREDIT RATINGS AND MOODY'S PUBLICATIONS ARE NOT INTENDED FOR USE BY RETAIL INVESTORS AND IT WOULD BE RECKLESS AND INAPPROPRIATE FOR RETAIL INVESTORS TO USE MOODY'S CREDIT RATINGS OR MOODY'S PUBLICATIONS WHEN MAKING AN INVESTMENT DECISION. IF IN DOUBT YOU SHOULD CONTACT YOUR FINANCIAL OR OTHER PROFESSIONAL ADVISER.

ALL INFORMATION CONTAINED HEREIN IS PROTECTED BY LAW, INCLUDING BUT NOT LIMITED TO, COPYRIGHT LAW, AND NONE OF SUCH INFORMATION MAY BE COPIED OR OTHERWISE REPRODUCED, REPACKAGED, FURTHER TRANSMITTED, TRANSFERRED, DISSEMINATED, REDISTRIBUTED OR RESOLD, OR STORED FOR SUBSEQUENT USE FOR ANY SUCH PURPOSE, IN WHOLE OR IN PART, IN ANY FORM OR MANNER OR BY ANY MEANS WHATSOEVER, BY ANY PERSON WITHOUT MOODY'S PRIOR WRITTEN CONSENT.

All information contained herein is obtained by MOODY'S from sources believed by it to be accurate and reliable. Because of the possibility of human or mechanical error as well as other factors, however, all information contained herein is provided "AS IS" without warranty of any kind. MOODY'S adopts all necessary measures so that the information it uses in assigning a credit rating is of sufficient quality and from sources MOODY'S considers to be reliable including, when appropriate, independent third-party sources. However, MOODY'S is not an auditor and cannot in every instance independently verify or validate information received in the rating process or in preparing the Moody's publications.

To the extent permitted by law, MOODY'S and its directors, officers, employees, agents, representatives, licensors and suppliers disclaim liability to any person or entity for any indirect, special, consequential, or incidental losses or damages whatsoever arising from or in connection with the information contained herein or the use of or inability to use any such information, even if MOODY'S or any of its directors, officers, employees, agents, representatives, licensors or suppliers is advised in advance of the possibility of such losses or damages, including but not limited to: (a) any loss of present or prospective profits or (b) any loss or damage arising where the relevant financial instrument is not the subject of a particular credit rating assigned by MOODY'S.

To the extent permitted by law, MOODY'S and its directors, officers, employees, agents, representatives, licensors and suppliers disclaim liability for any direct or compensatory losses or damages caused to any person or entity, including but not limited to by any negligence (but excluding fraud, willful misconduct or any other type of liability that, for the avoidance of doubt, by law cannot be excluded) on the part of, or any contingency within or beyond the control of, MOODY'S or any of its directors, officers, employees, agents, representatives, licensors or suppliers, arising from or in connection with the information contained herein or the use of or inability to use any such information.

NO WARRANTY, EXPRESS OR IMPLIED, AS TO THE ACCURACY, TIMELINESS, COMPLETENESS, MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OF ANY SUCH RATING OR OTHER OPINION OR INFORMATION IS GIVEN OR MADE BY MOODY'S IN ANY FORM OR MANNER WHATSOEVER.

Moody's Investors Service, Inc., a wholly-owned credit rating agency subsidiary of Moody's Corporation ("MCO"), hereby discloses that most issuers of debt securities (including corporate and municipal bonds, debentures, notes and commercial paper) and preferred stock rated by Moody's Investors Service, Inc. have, prior to assignment of any rating, agreed to pay to Moody's Investors Service, Inc. for appraisal and rating services rendered by it fees ranging from \$1,000 to approximately \$2,700,000. MCO and MIS also maintain policies and procedures to address the independence of MIS's ratings and rating processes. Information regarding certain affiliations that may exist between directors of MCO and rated entities, and between entities who hold ratings from MIS and have also publicly reported to the SEC an ownership interest in MCO of more than 5%, is posted annually at [www.moody's.com](http://www.moody's.com) under the heading "Investor Relations — Corporate Governance — Director and Shareholder Affiliation Policy."

Additional terms for Australia only: Any publication into Australia of this document is pursuant to the Australian Financial Services License of MOODY'S affiliate, Moody's Investors Service Pty Limited ABN 61 003 399 657 AFSL 336969 and/or Moody's Analytics Australia Pty Ltd ABN 94 105 136 972 AFSL 383569 (as applicable). This document is intended to be provided only to "wholesale clients" within the meaning of section 761G of the Corporations Act 2001. By continuing to access this document from within Australia, you represent to MOODY'S that you are, or are accessing the document as a representative of, a "wholesale client" and that neither you nor the entity you represent will directly or indirectly disseminate this document or its contents to "retail clients" within the meaning of section 761G of the Corporations Act 2001. MOODY'S credit rating is an opinion as to the creditworthiness of a debt obligation of the issuer, not on the equity securities of the issuer or any form of security that is available to retail investors. It would be reckless and inappropriate for retail investors to use MOODY'S credit ratings or publications when making an investment decision. If in doubt you should contact your financial or other professional adviser.

Additional terms for Japan only: Moody's Japan K.K. ("MJKK") is a wholly-owned credit rating agency subsidiary of Moody's Group Japan G.K., which is wholly-owned by Moody's Overseas Holdings Inc., a wholly-owned subsidiary of MCO. Moody's SF Japan K.K. ("MSFJ") is a wholly-owned credit rating agency subsidiary of MJKK. MSFJ is not a Nationally Recognized Statistical Rating Organization ("NRSRO"). Therefore, credit ratings assigned by MSFJ are Non-NRSRO Credit Ratings. Non-NRSRO Credit Ratings are assigned by an entity that is not a NRSRO and, consequently, the rated obligation will not qualify for certain types of treatment under U.S. laws. MJKK and MSFJ are credit rating agencies registered with the Japan Financial Services Agency and their registration numbers are FSA Commissioner (Ratings) No. 2 and 3 respectively.

MJKK or MSFJ (as applicable) hereby disclose that most issuers of debt securities (including corporate and municipal bonds, debentures, notes and commercial paper) and preferred stock rated by MJKK or MSFJ (as applicable) have, prior to assignment of any rating, agreed to pay to MJKK or MSFJ (as applicable) for appraisal and rating services rendered by it fees ranging from JPY125,000 to approximately JPY250,000,000.

MJKK and MSFJ also maintain policies and procedures to address Japanese regulatory requirements.