Thailand Watch

The price of rapid BEV adoption

07 February 2024

GEM Economics
Asia | Thailand

Pipat Luengnaruemitchai
Emerging Asia Economist
Kiatnakin Phatra Securities
+66 2 305 9221
pipat.luen@kkpfg.com

Thailand's remarkable BEV adoption

The adoption of Battery Electric Vehicles (BEVs) in Thailand has been remarkable, outpacing expectations, with the sales volume surging from 13,000 in 2022 to 76,000 units in 2023. It now accounts for 9.2% of total new car sales (including pick-up trucks) and 17.6% of total passenger car sales.

Chinese exposure and influence

Most of the new BEV sales were imported from China. This was supported by 0% import tariffs on BEVs through the free trade agreement, generous fiscal subsidies for BEVs, a slow-moving stance from Japanese car manufacturers, and the competitive pricing of Chinese BEVs compared to internal combustion engine (ICE) vehicles.

Auto industry at a crossroads

The rapid transition from ICEs to EVs comes at the expense of ICE sales and production in Thailand. The automotive industry and its long supply chains have been a cornerstone of the Thai manufacturing sector for decades, propelling growth and fostering nearly a million of employment. Currently, the ICE auto sector contributes a significant 10-12% of GDP. The automotive and parts sector stands as the one of the largest export sectors.

Feeling the pain

The early stages of adoption have started to impact existing car manufacturers. Second-tier Japanese manufacturers have witnessed a dramatic 10% loss of market share in the passenger car market. These manufacturers would face low utilization rates of 20%-30%, signaling potential losses and possible production shutdown risks.

Pick-up consolidation is the hope… for now

One-ton pick-up trucks represent nearly half of domestic sales, 60% of car exports, and 60% of total production with high local content. EV adoption in this segment remains slow, given limited EV options, unmatched price points, and distinct functionality. The production of pick-up trucks is expected to be consolidated amid global declining demand and growing BEV adoption.

Disruptive pressure

Thailand's automotive industry is facing a disruptive pressure and the surge in EV adoption could be net negative to the economy. Although Chinese BEV manufacturers are expected to invest in local assembly facilities to fulfill their commitments under the fiscal subsidy program, domestic value added from BEV assembly is expected to be much less than ICE production.

Thailand's Kodak moment

Thailand's automobile industry and its well-established supply chains are at risk of becoming obsolete if the automobile industry moves further away from ICE vehicles. Given the uncertainty in technology, the key challenge for Thailand is to manage the transition and remain competitive as technology shifts.

The price of rapid BEV adoption

Thailand saw a sharp rise in the adoption of battery electric vehicles (BEVs), especially imported Chinese BEVs, boosted by their competitive price points, zero import tariff, and the government's generous subsidy program. This comes at the expense of the internal combustion engine (ICE) vehicles and parts industry, which is one of Thailand's key production industries.

While Chinese BEV manufacturers are expected to invest in local production lines to fulfill the subsidy program, the domestic value added is much lower than ICE vehicles. The key challenge is how to manage the transition and remain competitive as technology shifts.

Thailand's rapid BEV adoption

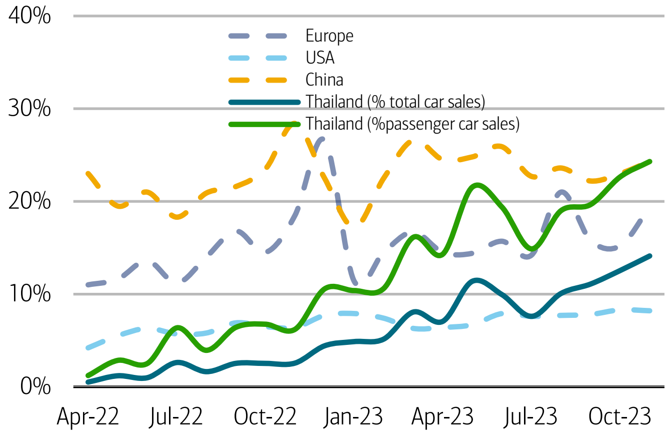
The adoption of BEV in Thailand in 2023 has outpaced expectations, with the sales volume surging from 13,000 in 2022 to 76,000 units in 2023. This accounts for 9.2% of total new car sales (including pick-up trucks) and 17.6% of total passenger car sales.

While the penetration rate is still below 25% of China, the pace of adoption is impressive. Most of the new BEV sales were imported from China. This was supported by 0% import tariffs on BEVs through the free trade agreement between China and ASEAN (Association of Southeast Asian Nations), fiscal subsidies for BEVs, a slow-moving stance from Japanese car manufacturers, and the competitive pricing of Chinese BEVs compared to ICE vehicles.

Thailand emerges as a promising destination for increased investment by Chinese BEV manufacturers, given the excess capacity in auto production within China and rising geopolitical tensions. The influx of Chinese BEVs is poised to escalate competition, ushering in a price war. Consequently, the prices of BEVs are expected to decrease, accompanied by diverse BEV options in the market. Therefore, Thailand's BEV market is anticipated to remain robust in 2024, with expected sales reaching 100,000 units, accounting for 15% of total car sales.

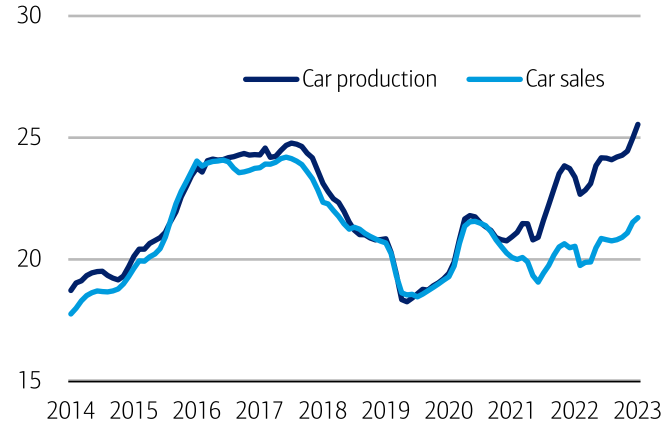
As challenges remain, we expect the BEV adoption to continue but it should plateau at around 30-35% of total car sales. These challenges include the saturating demand of early BEV adoption in Bangkok, primarily due to constraints in installing BEV chargers in high-rise residential buildings. Meanwhile, upcountry sales are still leaning toward pick-ups for their practicality. Moreover, lower BEV resale values and potential brand loyalty concerns favoring Japanese cars over Chinese EVs are identified as key factors shaping the adoption rate.

Exhibit 1: BEV penetration (% of total car sales)
Thailand emerges as one of the leading BEV markets



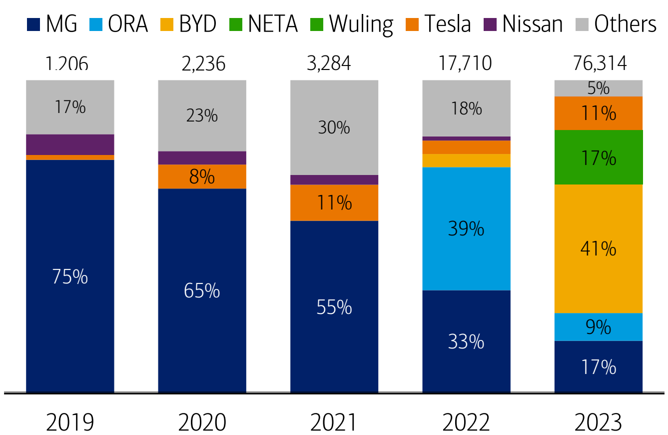
Source: Thailand Automotive intelligence unit, Kiatnakin Phatra Securities
BofA GLOBAL RESEARCH

Exhibit 2: Chinese car production and sales (mn units)
Excess capacity in China leads to BEV exports to ASEAN



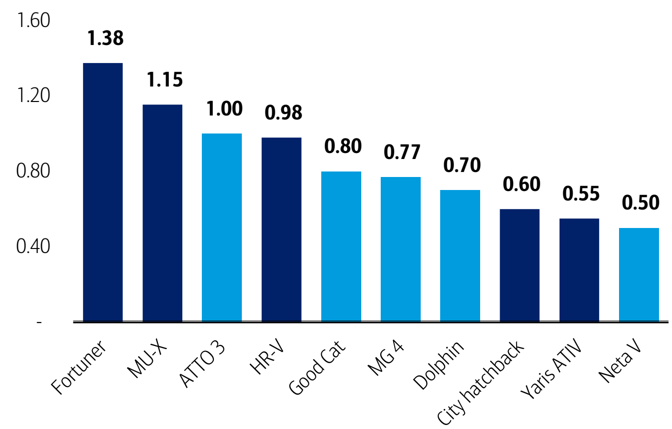
Source: China Passenger Car Association, China Association of Automobile Manufacturers, Kiatnakin Phatra Securities
BofA GLOBAL RESEARCH

Exhibit 3: BEV sales by brand (%share)
Intensified competition between Chinese manufacturers



Source: Thailand Department of Land Transport, Kiatnakin Phatra Securities
BofA GLOBAL RESEARCH

Exhibit 4: Entry price points of the top 5 best-selling EVs and ICEs
BEV price is equivalent to traditional ICE price (million baht)



Source: HeadLight Magazine, Kiatnakin Phatra Securities
BofA GLOBAL RESEARCH

The automobile sector: hardest-hit by EVs

The rapid transition from ICEs to EVs comes at the expense of ICE sales and production in Thailand. The automotive industry and its long supply chains have been a cornerstone of the Thai manufacturing sector for decades, propelling growth and fostering nearly a million of employment. Currently, the ICE auto sector contributes a significant 10-12% of GDP. Ranked as the 11th largest global car producer, the Thai automotive and parts sector stands as the one of the largest export industries, making up 15% of the total export value.

Approximately 850,000 jobs in the auto sector are on the line as a shift from ICE to BEV is expected to reshape the labor market. The supply chain for EVs sees a tenfold reduction from 30,000 components per unit in ICE to about 3,000 in BEV. This could put 40% of auto sector jobs across nearly 1,000 companies at risk, particularly in engines and powertrains. Meanwhile, as Thailand has not been able to produce key BEV components such as batteries, electronic parts, and motors, employment gains for new investment in the BEV sector are unlikely to offset workforce reduction from the ICE industry. Meanwhile, the existing auto supply chain is poised to confront a profit margin squeeze, exacerbated by the influx of cheap Chinese imports.

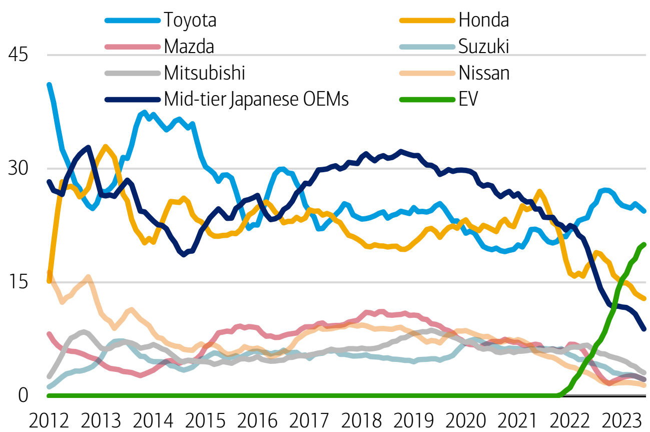
The BEV impact on the Thai auto market is expected to unfold gradually rather than abruptly as the pick-up segment stands as a buffer, dominating half of the share in both the auto and parts markets. However, the impact of BEV disruption is underway, with its initial effects being felt in the passenger car segment.

Passenger cars at a critical point

Second-tier Japanese manufacturers overtaken by Chinese EVs

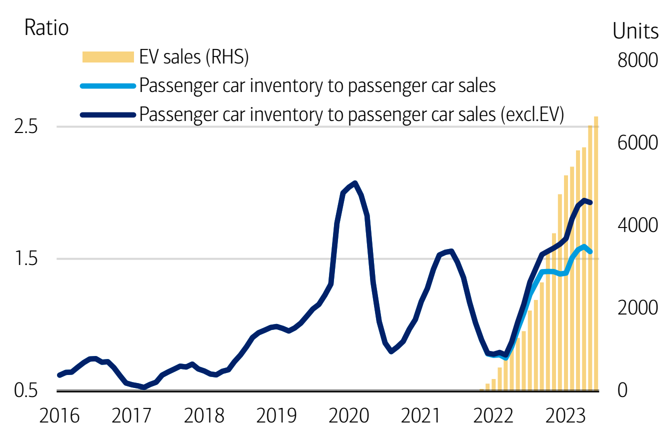
While we do not expect BEV adoption wipe-out of ICE anytime soon, the early stages of adoption have started to impact existing car manufacturers. A wider range of price points of Chinese BEV models have bolstered BEV adoption across all segments. As a result, Japanese ICE manufacturers, which have made Thailand their key production hub and market, have lost their market share to Chinese BEV counterparts, in particular second-tier Japanese manufacturers which have witnessed a dramatic 10% loss of market share in the passenger car market. Meanwhile, first-tier Japanese manufacturers such as Toyota and Honda have faced a significant decline in their share of the D-segment (mid-size sedans/family cars) and SUVs (sports utility vehicle). This transition has exerted substantial pressure on ICE inventories surging to unprecedented levels.

Exhibit 5: Passenger car sales by brand (%share)
Second-tier Japanese manufacturers witnessed a dramatic 10% loss of share



Source: Toyota Motor Thailand, Kiatnakin Phatra Securities
BofA GLOBAL RESEARCH

Exhibit 6: Passenger car inventory to sales and BEV sales ratio
The passenger car inventory has increased significantly after the BEV boom

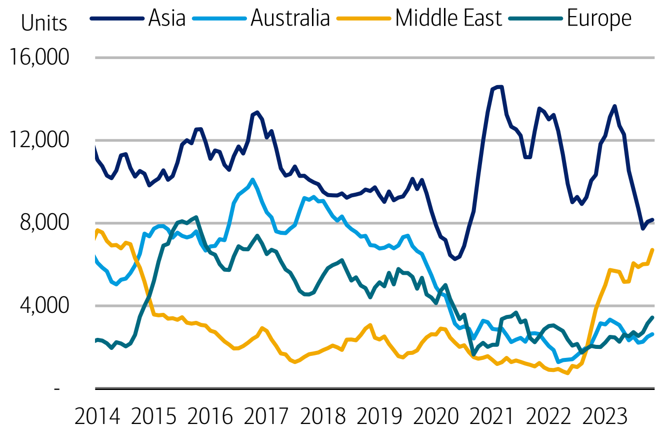


Source: Thailand Office of Industrial Economics, Kiatnakin Phatra Securities
BofA GLOBAL RESEARCH

Thailand also losing ground on exports to China

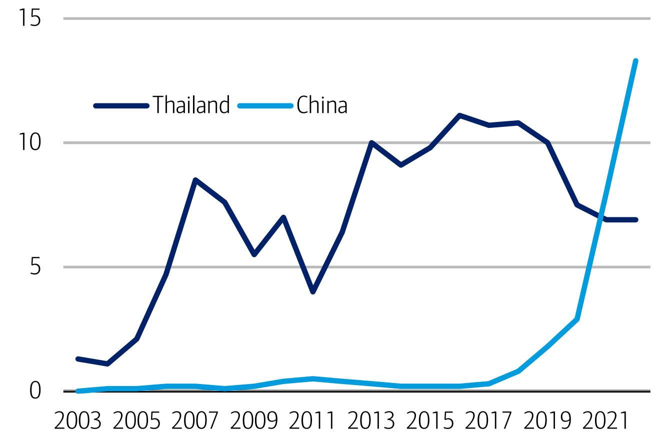
The rapid adoption of BEV in key export markets like Australia and Europe has also led to a significant downturn in passenger car exports from Thailand, resulting in a loss of market share to China. Although there is a shift towards exporting more to the Middle East, it cannot offset the losses in the other key markets. Despite comprising only 35% of total auto export volume, passenger cars drive more than half of the export value for automobiles and parts. This could severely impact export figures and the current account. Moreover, EVs have transformed the export competitive landscape, placing pressure on the goal of Thailand becoming a BEV export hub in ASEAN due to direct competition with China.

Exhibit 7: Top destinations for Thailand's passenger car exports
Car exports to Australia and EU dropped after China exports took off



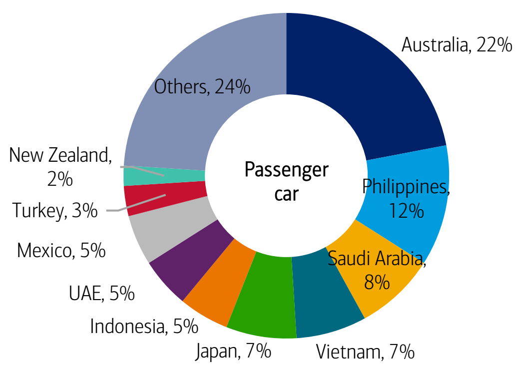
Source: Thailand Automotive Intelligence Unit, Kiatnakin Phatra Securities
BofA GLOBAL RESEARCH

Exhibit 8: Passenger car imports from Australia by exporting country (%share)
Thailand has been losing share in the Australian market to China



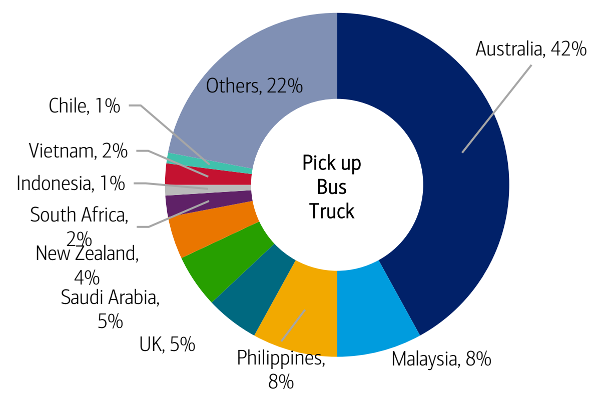
Source: Trademap, Kiatnakin Phatra Securities
BofA GLOBAL RESEARCH

Exhibit 9: Passenger car export market (%share)
Australia is a key passenger car export market



Source: Federation of Thai Industries (FTI), Kiatnakin Phatra Securities
BofA GLOBAL RESEARCH

Exhibit 10: Pick-up export market (%share)
Australia is a key pick-up export market

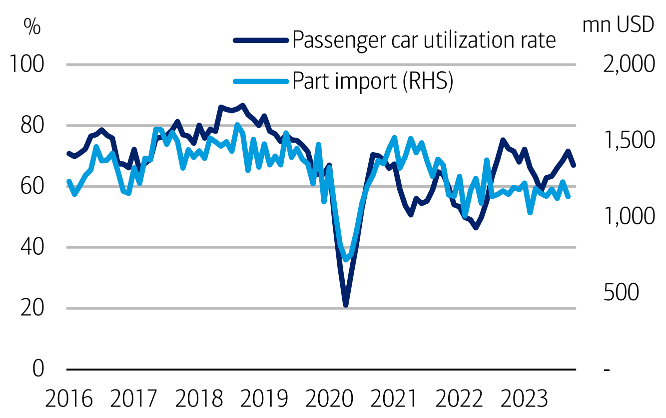


Source: Federation of Thai Industries (FTI), Kiatnakin Phatra Securities
BofA GLOBAL RESEARCH

Impending production shutdown as utilization rates hit dangerous lows

Japanese manufacturers struggle with dwindling sales both domestically and in the export markets, prompting production cuts to facilitate inventory drawdown. Despite a slight decline in overall passenger car production, second-tier manufacturers face low utilization rates of 20%-30%, signaling potential losses and shutdown risks.

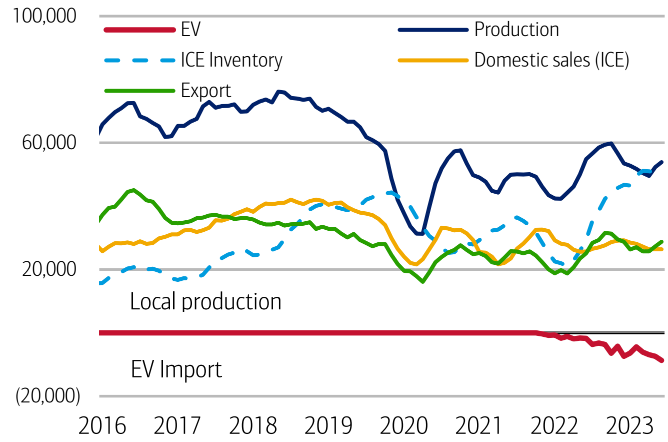
Exhibit 11: Passenger car capacity utilization rate and parts imports
Passenger car production continuously declines



Source: Thailand Automotive Intelligence Unit, Thailand Office of Industrial Economics, Kiatnakin Phatra Securities

BofA GLOBAL RESEARCH

Exhibit 12: Passenger car segment in Thailand (units)
The faster the BEV adoption, the higher the ICE inventory level



Source: Federation of Thai Industries (FTI), Thailand Office of Industrial Economics, Toyota Motor Thailand, Thailand Automotive Intelligence Unit, Kiatnakin Phatra Securities

BofA GLOBAL RESEARCH

Pick-up consolidation is the hope… for now

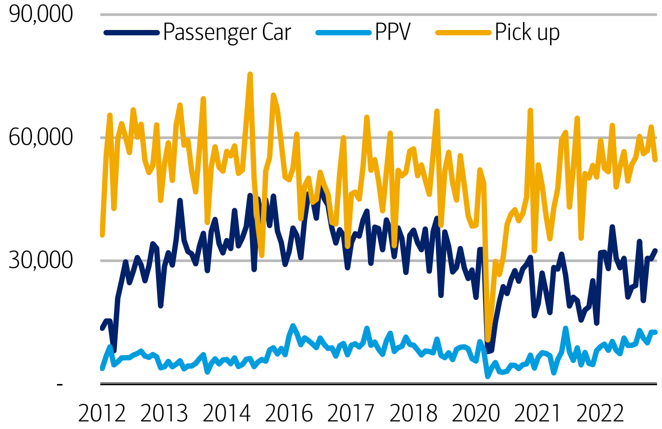
In contrast to passenger cars, the one-ton pick-up segment is unlikely to face disruption from EVs in the near term, owing to its unmatched price point and distinct functionality. Dominating the auto sector in Thailand, pick-up trucks represent nearly half of domestic sales, 60% of car exports, and 60% of total production. Additionally, local suppliers predominantly serve the pick-up market with a high local content ratio of 90%, while passenger cars only have a 30% local content ratio. The substantial pick-up linkages could delay the extent of impact from EVs in the short run.

The consolidation of Japanese 1-ton pick-up production in Thailand is anticipated amid declining demand and growing BEV adoption globally. Thailand stands out as the optimal choice, distinguished by its prominence in 1-ton pick-up sales and production. Consequently, pick-up exports benefit from this consolidation, gaining the market share of 1-ton pick-ups in key export markets.

While the production of pick-up trucks remains a silver lining for the Thai automobile industry, the inevitable BEV impact looms on the horizon. The pick-up consolidation is expected to demonstrate similarity to the dynamics observed in the hard disk drive market, implying unsustainable growth. Thailand thrives in the sunset industry, as reflected by the global demand slowdown alongside a domestic downturn. The local pick-up demand has gradually weakened from structural challenges, including demographic shifts and deleveraging cycles. Nevertheless, the risk of unemployment and deteriorating income resulting from the potential shutdown of auto production is expected to indirectly intensify the challenges faced by pick-up sales.

Exhibit 13: Total car export by segment (units)

A divergence between car exports, with pick-ups significantly increasing

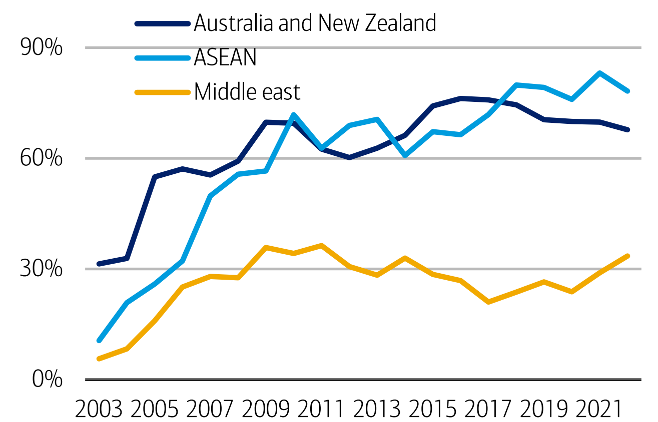


Source: Thailand Automotive Intelligence Unit, Kiatnakin Phatra Securities

BofA GLOBAL RESEARCH

Exhibit 14: Share of pick-up exports from Thailand by key market

In contrast to passenger cars, Thailand has gained more pick-up share in key export markets

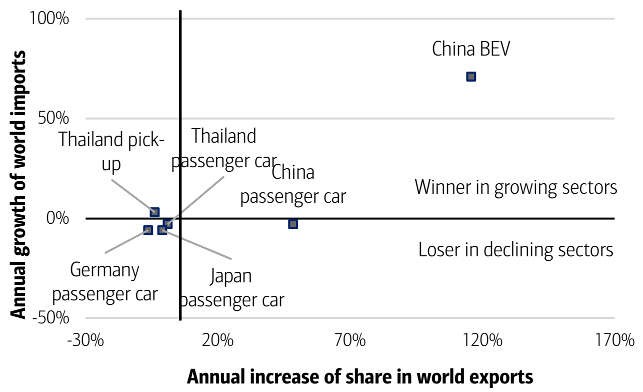


Source: Trademap, Kiatnakin Phatra Securities

BofA GLOBAL RESEARCH

Exhibit 15: National supply and global demand (%CAGR 2018-2023)

Despite consolidation, demand for pick-up trucks has slowed globally

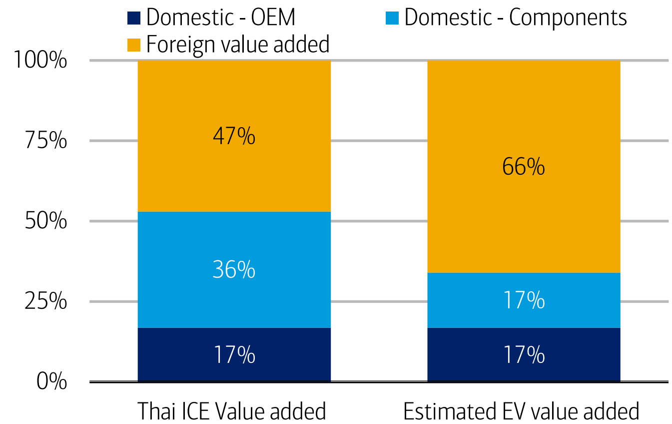


Source: Trademap, Kiatnakin Phatra Securities

BofA GLOBAL RESEARCH

Exhibit 16: Car value breakdown (% of total car value)

Estimated value added decelerates from 53% to 34%



Source: Kiatnakin Phatra Securities estimates

BofA GLOBAL RESEARCH

EV adoption poses challenges to the Thai economy

With a quick BEV adoption, the automotive industry is facing disruptive pressure, posing diminished growth prospects for the Thai economy in the long term. Although Chinese BEV manufacturers are expected to invest in assembly plants in Thailand to fulfill their commitment under the fiscal subsidies, which require local production of 1-2 cars for every car that receives rebates and subsidies during the program, the domestic value added from BEV manufacturing is expected to be much less compared to ICE production.

Also, BEVs require fewer parts and thus have lower domestic value added. According to estimates, the domestic value added of ICE production is 53% of the total value, compared to about a maximum of 34% for EVs as one-third of auto parts are becoming obsolete and batteries make up a large proportion of the value added. The domestic value added would be much less if Chinese manufacturers rely on the supply chain from China. Thailand is expected to import batteries and electronic parts due to a shortage of local materials and a lack of economies of scale compared to China.

In addition, although Chinese manufacturers are investing in local assembly facilities in Thailand, it is unclear whether with lower scale and efficiency, locally-produced cars would be as competitive as cars produced in China and whether Thailand can establish itself as a production hub for BEV exports. Due to an increased reliance on imports coupled with declining exports, the current account balance is anticipated to be under pressure, thereby amplifying the risk to the currency in the medium term.

Nevertheless, the uncertainty over the future technology of automobiles continues to pose additional risk in the industry itself. Japanese manufacturers are focusing on hybrid cars, while continuing to develop hydrogen fuel cells and solid-state batteries. These uncertainties could hinder the adoption and investment in important infrastructure. Nevertheless, the move away from ICE seems to be a global trend. The key challenge for Thailand is to manage the transition and remain competitive as technology shifts.

Disclosures

Important Disclosures

BofA Global Research personnel (including the analyst(s) responsible for this report) receive compensation based upon, among other factors, the overall profitability of Bank of America Corporation, including profits derived from investment banking. The analyst(s) responsible for this report may also receive compensation based upon, among other factors, the overall profitability of the Bank's sales and trading businesses relating to the class of securities or financial instruments for which such analyst is responsible.

Other Important Disclosures

Prices are indicative and for information purposes only. Except as otherwise stated in the report, for any recommendation in relation to an equity security, the price referenced is the publicly traded price of the security as of close of business on the day prior to the date of the report or, if the report is published during intraday trading, the price referenced is indicative of the traded price as of the date and time of the report and in relation to a debt security (including equity preferred and CDS), prices are indicative as of the date and time of the report and are from various sources including BofA Securities trading desks.

The date and time of completion of the production of any recommendation in this report shall be the date and time of dissemination of this report as recorded in the report timestamp.

Recipients who are not institutional investors or market professionals should seek the advice of their independent financial advisor before considering information in this report in connection with any investment decision, or for a necessary explanation of its contents.

Officers of BofAS or one or more of its affiliates (other than research analysts) may have a financial interest in securities of the issuer(s) or in related investments.

Individuals identified as economists do not function as research analysts under U.S. law and reports prepared by them are not research reports under applicable U.S. rules and regulations. Macroeconomic analysis is considered investment research for purposes of distribution in the U.K. under the rules of the Financial Conduct Authority.

Refer to BofA Global Research policies relating to conflicts of interest.

"BofA Securities" includes BofA Securities, Inc. ("BofAS") and its affiliates. Investors should contact their BofA Securities representative or Merrill Global Wealth Management financial advisor if they have questions concerning this report or concerning the appropriateness of any investment idea described herein for such investor. "BofA Securities" is a global brand for BofA Global Research.

Information relating to Non-US affiliates of BofA Securities and Distribution of Affiliate Research Reports:

BofAS and/or Merrill Lynch, Pierce, Fenner & Smith Incorporated ("MLPF&S") may in the future distribute, information of the following non-US affiliates in the US (short name: legal name, regulator): Merrill Lynch (South Africa): Merrill Lynch South Africa (Pty) Ltd., regulated by The Financial Service Board; MLI (UK): Merrill Lynch International, regulated by the Financial Conduct Authority (FCA) and the Prudential Regulation Authority (PRA); BofASE (France): BofA Securities Europe SA is authorized by the Autorité de Contrôle Prudentiel et de Résolution (ACPR) and regulated by the ACPR and the Autorité des Marchés Financiers (AMF). BofA Securities Europe SA ("BofASE") with registered address at 51, rue La Boétie, 75008 Paris is registered under no 842 602 690 RCS Paris. In accordance with the provisions of French Code Monétaire et Financier (Monetary and Financial Code), BofASE is an établissement de crédit et d'investissement (credit and investment institution) that is authorised and supervised by the European Central Bank and the Autorité de Contrôle Prudentiel et de Résolution (ACPR) and regulated by the ACPR and the Autorité des Marchés Financiers. BofASE's share capital can be found at www.bofaml.com/BofASEdisclaimer; BofA Europe (Milan): Bank of America Europe Designated Activity Company, Milan Branch, regulated by the Bank of Italy, the European Central Bank (ECB) and the Central Bank of Ireland (CBI); BofA Europe (Frankfurt): Bank of America Europe Designated Activity Company, Frankfurt Branch regulated by BaFin, the ECB and the CBI; BofA Europe (Madrid): Bank of America Europe Designated Activity Company, Sucursal en España, regulated by the Bank of Spain, the ECB and the CBI; Merrill Lynch (Australia): Merrill Lynch Equities (Australia) Limited, regulated by the Australian Securities and Investments Commission; Merrill Lynch (Hong Kong): Merrill Lynch (Asia Pacific) Limited, regulated by the Hong Kong Securities and Futures Commission (HKSFC); Merrill Lynch (Singapore): Merrill Lynch (Singapore) Pte Ltd, regulated by the Monetary Authority of Singapore (MAS); Merrill Lynch (Canada): Merrill Lynch Canada Inc, regulated by the Canadian Investment Regulatory Organization; Merrill Lynch (Mexico): Merrill Lynch Mexico, SA de CV, Casa de Bolsa, regulated by the Comisión Nacional Bancaria y de Valores; Merrill Lynch (Argentina): Merrill Lynch Argentina SA, regulated by Comisión Nacional de Valores; BofAS Japan: BofA Securities Japan Co., Ltd., regulated by the Financial Services Agency; Merrill Lynch (Seoul): Merrill Lynch International, LLC Seoul Branch, regulated by the Financial Supervisory Service; Merrill Lynch (Taiwan): Merrill Lynch Securities (Taiwan) Ltd., regulated by the Securities and Futures Bureau; BofAS India: BofA Securities India Limited, regulated by the Securities and Exchange Board of India (SEBI); Merrill Lynch (Israel): Merrill Lynch Israel Limited, regulated by Israel Securities Authority; Merrill Lynch (DIFC): Merrill Lynch International (DIFC Branch), regulated by the Dubai Financial Services Authority (DFSA); Merrill Lynch (Brazil): Merrill Lynch S.A. Corretora de Títulos e Valores Mobiliários, regulated by Comissão de Valores Mobiliários; Merrill Lynch KSA Company: Merrill Lynch Kingdom of Saudi Arabia Company, regulated by the Capital Market Authority.

This information: has been approved for publication and is distributed in the United Kingdom (UK) to professional clients and eligible counterparties (as each is defined in the rules of the FCA and the PRA) by MLI (UK), which is authorized by the PRA and regulated by the FCA and the PRA - details about the extent of our regulation by the FCA and PRA are available from us on request; has been approved for publication and is distributed in the European Economic Area (EEA) by BofASE (France), which is authorized by the ACPR and regulated by the ACPR and the AMF; has been considered and distributed in Japan by BofAS Japan, a registered securities dealer under the Financial Instruments and Exchange Act in Japan, or its permitted affiliates; is issued and distributed in Hong Kong by Merrill Lynch (Hong Kong) which is regulated by HKSFC; is issued and distributed in Taiwan by Merrill Lynch (Taiwan); is issued and distributed in India by BofAS India; and is issued and distributed in Singapore to institutional investors and/or accredited investors (each as defined under the Financial Advisers Regulations) by Merrill Lynch (Singapore) (Company Registration No 198602883D). Merrill Lynch (Singapore) is regulated by MAS. Merrill Lynch Equities (Australia) Limited (ABN 65 006 276 795), AFS License 235132 (MLEA) distributes this information in Australia only to 'Wholesale' clients as defined by s.761G of the Corporations Act 2001. With the exception of Bank of America N.A., Australia Branch, neither MLEA nor any of its affiliates involved in preparing this information is an Authorised Deposit-Taking Institution under the Banking Act 1959 nor regulated by the Australian Prudential Regulation Authority. No approval is required for publication or distribution of this information in Brazil and its local distribution is by Merrill Lynch (Brazil) in accordance with applicable regulations. Merrill Lynch (DIFC) is authorized and regulated by the DFSA. Information prepared and issued by Merrill Lynch (DIFC) is done so in accordance with the requirements of the DFSA conduct of business rules. BofA Europe (Frankfurt) distributes this information in Germany and is regulated by BaFin, the ECB and the CBI. BofA Securities entities, including BofA Europe and BofASE (France), may outsource/delegate the marketing and/or provision of certain research services or aspects of research services to other branches or members of the BofA Securities group. You may be contacted by a different BofA Securities entity acting for and on behalf of your service provider where permitted by applicable law. This does not change your service provider. Please refer to the Electronic Communications Disclaimers for further information.

This information has been prepared and issued by BofAS and/or one or more of its non-US affiliates. The author(s) of this information may not be licensed to carry on regulated activities in your jurisdiction and, if not licensed, do not hold themselves out as being able to do so. BofAS and/or MLPF&S is the distributor of this information in the US and accepts full responsibility for information distributed to BofAS and/or MLPF&S clients in the US by its non-US affiliates. Any US person receiving this information and wishing to effect any transaction in any security discussed herein should do so through BofAS and/or MLPF&S and not such foreign affiliates. Hong Kong recipients of this information should contact Merrill Lynch (Asia Pacific) Limited in respect of any matters relating to dealing in securities or provision of specific advice on securities or any other matters arising from, or in connection with, this information. Singapore recipients of this information should contact Merrill Lynch (Singapore) Pte Ltd in respect of any matters arising from, or in connection with, this information. For clients that are not accredited investors, expert investors or institutional investors Merrill Lynch (Singapore) Pte Ltd accepts full responsibility for the contents of this information distributed to such clients in Singapore.

General Investment Related Disclosures:

Taiwan Readers: Neither the information nor any opinion expressed herein constitutes an offer or a solicitation of an offer to transact in any securities or other financial instrument. No part of this report may be used or reproduced or quoted in any manner whatsoever in Taiwan by the press or any other person without the express written consent of BofA Securities.

This document provides general information only, and has been prepared for, and is intended for general distribution to, BofA Securities clients. Neither the information nor any opinion expressed constitutes an offer or an invitation to make an offer, to buy or sell any securities or other financial instrument or any derivative related to such securities or instruments (e.g., options, futures, warrants, and contracts for differences). This document is not intended to provide personal investment advice and it does not take into account the specific investment objectives, financial situation and the particular needs of, and is not directed to, any specific person(s). This document and its content do not constitute, and should not be considered to constitute, investment advice for purposes of ERISA, the US tax code, the Investment Advisers Act or otherwise. Investors should seek financial advice regarding the appropriateness of investing in financial instruments and implementing investment strategies discussed or recommended in this document and should understand that statements regarding future prospects may not be realized. Any decision to purchase or subscribe for securities in any offering must be based solely on existing public information on such security or the information in the prospectus or other offering document issued in connection with such offering, and not on this document.

Securities and other financial instruments referred to herein, or recommended, offered or sold by BofA Securities, are not insured by the Federal Deposit Insurance Corporation and are not deposits or other obligations of any insured depository institution (including, Bank of America, N.A.). Investments in general and, derivatives, in particular, involve numerous risks, including, among others, market risk, counterparty default risk and liquidity risk. No security, financial instrument or derivative is suitable for all investors. Digital assets are extremely speculative, volatile and are largely unregulated. In some cases, securities and other financial instruments may be difficult to value or sell and reliable information about the value or risks related to the security or financial instrument may be difficult to obtain. Investors should note that income from such securities and other financial instruments, if any, may fluctuate and that price or value of such securities and instruments may rise or fall and, in some cases, investors may lose their entire principal investment. Past performance is not necessarily a guide to future performance. Levels and basis for taxation may change.

BofA Securities is aware that the implementation of the ideas expressed in this report may depend upon an investor's ability to "short" securities or other financial instruments and that such action may be limited by regulations prohibiting or restricting "shortselling" in many jurisdictions. Investors are urged to seek advice regarding the applicability of such regulations prior to executing any short idea contained in this report.

Certain investment strategies and financial instruments discussed herein may only be appropriate for consideration in accounts qualified for high risk investment.

Foreign currency rates of exchange may adversely affect the value, price or income of any security or financial instrument mentioned in this report. Investors in such securities and instruments effectively assume currency risk.

BofAS or one of its affiliates is a regular issuer of traded financial instruments linked to securities that may have been recommended in this report. BofAS or one of its affiliates may, at any time, hold a trading position (long or short) in the securities and financial instruments discussed in this report.

BofA Securities, through business units other than BofA Global Research, may have issued and may in the future issue trading ideas or recommendations that are inconsistent with, and reach different conclusions from, the information presented herein. Such ideas or recommendations may reflect different time frames, assumptions, views and analytical methods of the persons who prepared them, and BofA Securities is under no obligation to ensure that such other trading ideas or recommendations are brought to the attention of any recipient of this information.

In the event that the recipient received this information pursuant to a contract between the recipient and BofAS for the provision of research services for a separate fee, and in connection therewith BofAS may be deemed to be acting as an investment adviser, such status relates, if at all, solely to the person with whom BofAS has contracted directly and does not extend beyond the delivery of this report (unless otherwise agreed specifically in writing by BofAS). If such recipient uses the services of BofAS in connection with the sale or purchase of a security referred to herein, BofAS may act as principal for its own account or as agent for another person. BofAS is and continues to act solely as a broker-dealer in connection with the execution of any transactions, including transactions in any securities referred to herein.

Copyright and General Information:

Materials prepared by BofA Global Research personnel are based on public information. Facts and views presented in this material have not been reviewed by, and may not reflect information known to, professionals in other business areas of BofA Securities, including investment banking personnel. BofA Securities has established information barriers between BofA Global Research and certain business groups. As a result, BofA Securities does not disclose certain client relationships with, or compensation received from, such issuers. To the extent this material discusses any legal proceeding or issues, it has not been prepared as nor is it intended to express any legal conclusion, opinion or advice. Investors should consult their own legal advisers as to issues of law relating to the subject matter of this material. BofA Global Research personnel's knowledge of legal proceedings in which any BofA Securities entity and/or its directors, officers and employees may be plaintiffs, defendants, co-defendants or co-plaintiffs with or involving issuers mentioned in this material is based on public information. Facts and views presented in this material that relate to any such proceedings have not been reviewed by, discussed with, and may not reflect information known to, professionals in other business areas of BofA Securities in connection with the legal proceedings or matters relevant to such proceedings.

This information has been prepared independently of any issuer of securities mentioned herein and not in connection with any proposed offering of securities or as agent of any issuer of any securities. None of BofAS any of its affiliates or their research analysts has any authority whatsoever to make any representation or warranty on behalf of the issuer(s). BofA Global Research policy prohibits research personnel from disclosing a recommendation, investment rating, or investment thesis for review by an issuer prior to the publication of a research report containing such rating, recommendation or investment thesis.

Any information relating to the tax status of financial instruments discussed herein is not intended to provide tax advice or to be used by anyone to provide tax advice. Investors are urged to seek tax advice based on their particular circumstances from an independent tax professional.

The information herein (other than disclosure information relating to BofA Securities and its affiliates) was obtained from various sources and we do not guarantee its accuracy. This information may contain links to third-party websites. BofA Securities is not responsible for the content of any third-party website or any linked content contained in a third-party website. Content contained on such third-party websites is not part of this information and is not incorporated by reference. The inclusion of a link does not imply any endorsement by or any affiliation with BofA Securities. Access to any third-party website is at your own risk, and you should always review the terms and privacy policies at third-party websites before submitting any personal information to them. BofA Securities is not responsible for such terms and privacy policies and expressly disclaims any liability for them.

All opinions, projections and estimates constitute the judgment of the author as of the date of publication and are subject to change without notice. Prices also are subject to change without notice. BofA Securities is under no obligation to update this information and BofA Securities ability to publish information on the subject issuer(s) in the future is subject to applicable quiet periods. You should therefore assume that BofA Securities will not update any fact, circumstance or opinion contained herein.

Certain outstanding reports or investment opinions relating to securities, financial instruments and/or issuers may no longer be current. Always refer to the most recent research report relating to an issuer prior to making an investment decision.

In some cases, an issuer may be classified as Restricted or may be Under Review or Extended Review. In each case, investors should consider any investment opinion relating to such issuer (or its security and/or financial instruments) to be suspended or withdrawn and should not rely on the analyses and investment opinion(s) pertaining to such issuer (or its securities and/or financial instruments) nor should the analyses or opinion(s) be considered a solicitation of any kind. Sales persons and financial advisors affiliated with BofAS or any of its affiliates may not solicit purchases of securities or financial instruments that are Restricted or Under Review and may only solicit securities under Extended Review in accordance with firm policies.

Neither BofA Securities nor any officer or employee of BofA Securities accepts any liability whatsoever for any direct, indirect or consequential damages or losses arising from any use of this information.