



PERSPECTIVES

Self-Driving Vehicles: The Race to Get Them on the Road

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Technological advancements over the past two decades have moved the idea of self-driving cars from the realm of science fiction to fact. Recently, Franklin Templeton Investments assembled a panel of professionals to discuss the competition between traditional vehicle manufacturers and technology companies in the race to develop a truly autonomous car.

Listen to our full ["Talking Markets" podcast](#) and hear more on this subject.



TALKING MARKETS WITH FRANKLIN TEMPLETON INVESTMENTS

Here are some highlights of the views of speakers represented in the podcast:

- The introduction of the technological evolution and change that's happening with autonomy have brought down barriers to entry. It's allowed new players to come into the autonomous vehicle arena.
- Cyber security across the entire industrial world is a huge question. There are so many vulnerabilities and that's an area where Silicon Valley needs to be cognizant of partnering with government.
- Some people think by 2020 we're going to have fully autonomous vehicles, and some think it will happen in 2037. The entire business model is going to be shifting and we're not sure when, we're not sure how, but automakers may need to have a lot of cash on their balance sheets to make the transition to whatever the new mobility models are.

The full transcript of the podcast follows.

Host/Richard Banks: Hello and welcome to Talking Markets with Franklin Templeton Investments: exclusive and unique insights from Franklin Templeton.

I'm your host, Richard Banks.

Ahead on this episode, we continue the conversation from a previous episode on the future of self-driving vehicles, and the race to get them on the road.

Host/Richard Banks: Franklin Templeton's James Cross leads the discussion with analysts Aleck Beach, Bobby Stevenson and Robert Rendler.

James: I thought we would just kind of start at the very beginning. What are the advancements or what are the enablers that allow us to talk about mass adoption of autonomous ability?

Bobby: Well, I think the first thing, obviously, is computing power, right? So, there was no ability 20 years ago to crunch the amount of data that's coming into these cars. That data is coming in from suites of sensors that either didn't exist 20 years ago or didn't exist in sort of a form that was applicable to autos. So you have this sort of sensor suite. You've got a camera, a LIDAR [Light Detection and Ranging] sensor, a radar sensor and an ultrasonic sensor, so ultrasonic sensors are probably first. That's the little beeping parking sensor on your car when you're about to hit something. Cameras came next and were initially used to sort of emergency brake or warn you that you should be emergency braking the vehicle. Radar was sort of an early application of sort of that cruise control that sort of controls the distance between you and your car, the car in front of you. LIDAR is relatively new and is the highest-cost sensor and over 50 companies are trying to get the cost of that sensor down to something that can be deployed in an automotive application. So I think it's, you know, the sensors either are being invented or reaching a state where they were cost-effective to be on a car and then getting the computing power together that can crunch all that data coming in.

Aleck: Maybe just to add, the mapping advancements that have come along. Not just to run the GPS navigation within your car from getting from point A to Point B, but as well, what is sort of a sense of a level of redundancy to some of the autonomous driving capability in terms of taking all that sensor data that's coming in to the car and then helping the car through redundancy of mapping to create a perception of where it is, where it needs to go, and make decisions about how to get from point A to point B. So much more than just navigation for us, but the mapping that's a pretty key feature that's sort of more recent development.

James: Robert, same question on batteries. Why are we at the point where we can consider mass adoption of electrification?

Robert: The advancements on the battery chemistry have been pretty phenomenal. I mean, if we were to think about this, you know, 10 years ago, if you were to want a battery for the current Tesla Model 3, the costs were prohibitive. As that industry started to scale, you know, we've seen the costs come down, and, as we hear, an electric vehicle is a lot better enabler for autonomous vehicles. So, that kind of feeds into that loop also.

James: Referencing some World Economic Forum survey data that just came out recently, and so, the US is right in the middle at 52% of folks surveyed said they would be very likely or likely to try autonomous vehicles.

James: Japan responded to be one of the latest adopters, which was surprising to us because Japan has had a history of being a very leading-edge technology developer and the country that surveyed to be the earliest adopter was India—85% of responses.

James: So let's come back to the panel a bit. What should be the incumbent auto OEM [Original Equipment Manufacturer] strategies now as we think about electrification, autonomous and ride sharing? How should they be adjusting their capital-allocation strategies going forward?

Aleck: Sitting here seven years into the economic expansion, we all, of course, have to be mindful of, you know, at some point there is going to be a correction—an economic correction and a downturn in the auto industry. And so, we look back to the last experience, and we are reminded that OEMs can consume tremendous amounts of capital in bad markets. If you look back to 2007, as we were just proceeding into the downturn, you had Ford with \$35 billion in cash, GM [General Motors] with \$27 billion in cash, and over the coming four quarters or so, they each burned about \$20 billion, which was which was pretty stunning and there was a collective sort of "uh-oh" that was heard throughout the capital markets.

Howard: And they currently sit with only \$20-\$30 billion on the balance sheet today, right?

Aleck: GM with \$17 [billion], and Ford is a little better positioned at about \$26 billion in cash.

Bobby: There are a few things the OEMs should be thinking about. I'm not sure they are. Apple generates in a year as much free cash flow as GM and Ford have on their balance sheet combined. So, when you think about, sort of, the tech world that is eyeing this massive pool of profits that exist in the transportation space, it's sort of the last place that a company that is approaching a \$1 trillion market cap can go to move the needle. And so they all want to attack it, and they don't know how, but they have a lot more cash than the autos do to try and make a play. And so, when you think about the playbook from industrial companies, traditionally during these parts of the economic cycle when they are generating free cash flow, they do tend to buy back stock. That may be a mistake going forward. I mean, you probably want to be stockpiling as much cash as you probably possibly can right now because some people think 2020 we're going to have autonomous. Some people think 2037. There are a lot of people who think a lot of things in between and the entire business model is going to be shifting and we're not sure when, we're not sure how. But, if you're going to be competitive against tech companies, you better have a lot of cash on the balance sheet to make the transition to whatever, you know, the new mobility models are.

Aleck: Just to add onto that, a good example is Mobileye, one of the leaders in automotive autonomous platforms, got acquired by Intel for \$15 billion, and that's not something that, you know, an OEM probably could have afforded.

Bobby: The auto world, in general, needs to think about partnering more than maybe they have in the past—partnering with the tech world more than they have in the past—and potentially thinking about the fact that things like billions of dollars of investment in internal combustion engines does not make a ton of sense going forward, especially when eventually you get to a much simpler lower-maintenance power train, potentially lower cost that gets a little bit commoditized over the long time frame. So you probably don't need to make the investments there that you were making initially, and maybe you need to be thinking a little bit more about how you support your brand through the inside of the vehicle—the human-machine interface—and then how you can offer other services like fleet management and things like that. So that may be where the investment should be going as opposed to, developing, you know, the next great V8 engine for a pickup truck.

Robert: The one thing I'd add too is just from what's going on from a regulatory perspective. So, just over the last year, you have seen countries in Europe, countries in Asia really kind of putting the gauntlet down and putting a timeline in terms of when they expect to shift new production vehicles to electric—you know, putting some pretty aggressive timelines out there. So, if you're a Mercedes or a BMW, and you make phenomenal diesel or gasoline engines, your wheelhouse is not in electrification and building great battery packs for the vehicles. I think that's really going to start pushing the OEMs to kind of get caught up, and really kind of force their hand and make more investments there.

Aleck: That's a big point particularly, here, as well as in Europe and in China. Emissions regulations are tightening up substantially. You know, in 2020, 2021, Europe and China are looking at mandating 20%, 30% improvements in carbon dioxide emissions. And so the internal combustion engine is making its advancements in improvements but doesn't fully get you there of course. And so, that's what has brought all the OEMs, over the last year or so, to announce huge electrification of their entire product portfolios over the coming years.

Bobby: One positive out of this potentially for the OEMs is that the way the fuel efficiency or emission standards are structured today—part of the reason people like Ford and GM make smaller, fuel-efficient vehicles is not because they make money on them but because it helps to average the fuel efficiency of their fleet. And so, if you do go to electric power trans [transmissions] across your fleet at some point, it would allow each OEM to actually only build the vehicles that are profitable for them. So you could actually see the industry become a more efficient, more profitable industry if each OEM specializes in the cars that they build that the consumers are willing to pay a price for that allows the OEM to make a good profit. It makes a ton of sense, right? We should all specialize in what we do best. And right now, the auto industry is essentially forced to not specialize just in selling the things that they can sell for a profit.

James: Who is GM and Ford and Toyota's real competition these days?

Aleck: I think the introduction of the technological evolution and change that's happening with autonomy has brought down barriers to entry, and it's allowed new players to come in, certainly. And so you see Google investing in chip companies that are getting a lot more involved in providing the intelligence that's creating all this. And so, I think it basically broadens the competitive landscape, certainly. And the more I look at it and think about this, I think it still is an auto-OEM sort of relevance and as we look to the race to everybody to get to autonomy in 2021, as Ford has said and as others have said as well, as you watch the development, it's still pretty wide open. There doesn't really seem to be a clear lead in terms of who's going to get there first. And so, I think that means there are new competitive entrants, but I think it's also kind of a wide-open landscape that we'll have to watch and see who gets there first and who figures out how to sort of commercialize and monetize this technology once they do get there.

James: I think no matter what happens the industry, we will still be stamping metal to create transportation vehicles of some kind. So, there's still is going to be a specialization in stamping; stamping is you take a flat piece of metal and stamp it into the shape of the hood of the car.

James: By 2035, again referencing this Jefferies report I read, we go from 90 [million] today to 134 million new cars sold in 2035. This particular analyst was estimating that only about 30 million of those would be EVs [electric vehicles] and only about 5 million would be fully autonomous EVs. So, that's still barely a third or 25% of the 135 million cars that may be produced we look out to 2030. So again, the question is definitely when, not if, we do think autonomous and electric vehicles are happening. The question for Robert here: as we look at the adoption of electrification, are the chemical companies just net winners everywhere because of the opportunity for the growth in batteries?

Robert: We do think there are some pretty attractive opportunities, but if you think about where penetration is today—less than 1% penetration of EVs in the fleet—over the next 10 years, could it grow by 10 times? Potentially, yeah, and that starts to really crimp the supply chain quite a bit. So, materials like lithium, cobalt; there's a lot of concern by those customers building the gigafactories, the auto OEMs, of really securing supply for the next five or 10 years. For commodity products, it's kind of mind-boggling to think that companies are asking for 10-year volume commitments, long-term supply for something like lithium, which is, at the end of the day, a commodity. That's an area where we think there are investment opportunities.

If you take a step down the supply chain a little further, and if you look at the companies that are building the battery components that are actually manufacturing the cells, it's a little harder actually to get opportunities there. Take for instance BASF. They are one of the largest component makers of EV batteries, but their goal is for this to be a half-billion-dollar business in five years, and that's a company with \$75 billion in revenue. That's kind of an extreme example, but especially for companies or for investors that will look specifically in the US, it is hard to get exposure to that supply chain outside of some of the raw materials like lithium.

But if you're an investor in Asia, there are actually quite a few opportunities. Some pure plays, some other well-known companies.

Robert: So companies in South Korea, Japan and some that are kind of more emerging in China. And if you take it one step further in terms of their suppliers, a lot of the companies are in that same part of the world. But I'd say there are also companies in Europe that are positioned well there.

But for companies in the US, there's really nothing in terms of that kind of scale. But from, you know, on the venture side, we actually think there's a lot of development going on in terms of companies looking to make that next step in terms of improving the technology and the energy density. So, more from a startup perspective, we actually think that the US will be potentially a leader in that area.

James: As we consider this glorious autonomous, EV future, what are some potential unintended consequences, risks or opportunities that investors may not be appreciating or the popular press may not be appreciating or focusing on right now?

Aleck: Well, I guess Uber has said that they don't necessarily want to own the fleet and that they want to be the platform that enables connection between riders and an autonomous fleet. So, who's going to own that fleet and who's going to manage it? And I don't think we know at this point, but it sort of strikes me that as one advantage that the OEM will continue to have in terms of their finance companies that have always been part of the business in terms of financing retail purchases.

But almost I would argue, more importantly, financing dealer inventory. And that's really kind of the start of that business model, I think, was to take that capital requirement of, you know, the vehicle purchase price and getting it off the balance sheet of the OEM. And that's really the purpose of the Fin Co. [financing company]—to provide that fleet financing. And so, I think that's something that obviously they have a ton of history and a ton of capability, particularly when you think about the asset and the ownership of it, and the depreciation of it, and managing residual value risk and pricing residual value risk. I think that's something that can be a benefit to the OEMs in terms of providing the financing for that fleet and potentially owning the fleet if they if they chose to.

James: That's the paradox for Uber—that if they do get rid of the driver to lower their operating costs, and they have to own their own fleet. Then how do they size that fleet? Their whole model is based on responsiveness— instant response. If there's more demand, they get more drivers to pull their own cars out and go drive people around. So that's the issue versus taxi fleets. Do you optimize for peak? Do you optimize for the middle of the day? Do you optimize for cash efficiency?

Aleck: So in the flash-forward sort of scenario that we're talking about of an autonomous ride-hailing fleet, that fleet is now a captively owned asset of somebody. And so it brings to my mind a question of—okay, the network effect that an Uber and Lyft have now makes a ton of sense, but how can that change and evolve over time when you get into an environment of an autonomous fleet that's owned by somebody? And now you don't have quite the need on the supply side to manage that supply of drivers and vehicles to meet the demand.

Bobby: When we talk about deployment of autonomous vehicles in an urban environment, particularly in the ride-sharing capacity, and people are throwing out sort of that 2020, 2021 timeframe, if you sort of look under the hood, a lot of them, I think, believe that they will actually manage those fleets in those urban environments without a driver in the car by basically having all those cars connected back to a control center. And, if that car gets in trouble, there will essentially be someone sitting on a computer that can see what that car is dealing with and can take over the car and sort of steer it out of trouble so the question becomes is that really autonomous. I mean it is most of the time, but again, those edge use cases will remain very difficult to deal with.

James: What are some other areas of unintended consequences, danger, or opportunity?

Bobby: There's a lot of question around what happens to auto sales, particularly, in dense or urban environments. I think everyone kind of agrees that in less-dense environments, you probably continue to sell cars in a similar way to what's happening today. But in urban environments, if people choose to own fewer cars, theoretically you need fewer car dealerships to support that. But, you get back to this question of, if you have this fleet running around that's owned by this corporation, where do those cars go to charge, where do they go to get service, where do they go to get managed. And so, that's a potential place where car dealerships could move to in order to supplement sort of the sales of new cars that could be declining. And, you know, frankly, I think most auto dealerships would tell you that selling a new car is their least profitable activity anyway. So you could actually see the profitability of dealerships change dramatically. And I would also say that even the big public companies that are rolling up auto dealerships around the country own a low single digit percentage of the total dealerships around the country. So there could be potential opportunities to sort of further consolidate that industry and to have it be a much more profitable business than it is today.

Bobby: You do start to get into other questions. If all the autonomous cars drive perfectly, what happens to the insurance industry? What happens to the insurance industry anyway if less people are getting a driver's license period? What happens to property values, in terms of, potentially living in urban centers actually becomes more attractive, but maybe living in suburbs becomes less attractive because people are paying this premium to not be in the city but be close enough to it to get to work or to get there if they want to go out? But maybe the value of exurbs, way out there, goes up quite a bit because people are willing to jump in a car and ride somewhere for 45 minutes or an hour to go out at night for dinner, or to get to the office, because they're not the ones driving, and that's actually productive time for them.

James: I think about cyber security when the car companies want to talk about the connected car and the connected fleet. Also, when we think about ride handling in autonomous, it brings up weaponization or terrorism, essentially. Autonomous ride-handling cars are going to have to have a sensor suite on the inside to be able to guarantee what is inside that car, and they need to be able to sense volatile organic compounds. They'll need to be able to sense for nuclear radiation. You hate to bring up these dark thoughts, but it's just how the world works. We spend a lot of time in [Washington] D.C. meeting with various leaders on Capitol Hill [in the United States] and on the staffs of the of the relevant committees, and these are the questions they're talking about.

James: Cyber security across the entire industrial world is a huge question. There are so many vulnerabilities because the installed base is almost completely analog, and the industrial world is trying to go from analog to digital to digitized to fully virtualized in many areas. And so, each of those steps opens up new security and vulnerabilities in their business model.

Bobby: That's a place where Silicon Valley needs to be very cognizant of partnering with Washington D.C. and this goes back to the driver issue with "driver" being such an important job in this country.

It's very hard for regulators to stand in the way of technological progress if the stated purpose is to keep people working that technology is trying to displace. It's easier if they position that as an issue of safety. And so, Silicon Valley could potentially put a car out in 2020. Silicon Valley could be there and the regulators could very easily say, "no." And so, really this alignment between sort of the industrial technology world and Silicon Valley and Washington D.C. is going to need to be strengthened whether Silicon Valley likes it or not.

Bobby: And that's one reason why we [the United States] risk losing the lead on a lot of this stuff because there are certainly countries and governments in other parts of the world that will lean into this process a little bit more than our government will. So, as a country, we have to be cognizant of that because if you lose the lead on these commercial things, that can lead to losing your technological edge.

Host/Richard Banks: I'm afraid that's all we've got time for on this episode of Talking Markets with Franklin Templeton. If you'd like to hear more about autonomous vehicles and the technology that's driving them, do check out our earlier self-driving cars podcast. You can find that and an archive of conversations on a variety of investment topics on iTunes, GooglePlay or just about any other major podcast provider.

So until next time, when we uncover more insights from our on-the-ground investment professionals, goodbye.

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