Steve: Sitting across from me is Jim Moore, who heads our solutions effort here at PIMCO. Next to Jim is Ravi Mattu, global head of analytics. To Ravi's right is Jamil Baz, who's the global head of client analytics, and sitting next to Jamil is Helen Guo, who is part of the client analytics team. So Jamil, why don't we start with you? Where did the idea to write this paper come from? Jamil: Well, for years now it would seem that the financial press has come to the conclusion that active underperform passive. And that was mostly due to surveys and analyses in the equity space. So it seemed that the case was done and dusted. And yet all these conclusions did not conform to what we understood from the bond market and to our experience at PIMCO. So we went and looked at the data and we actually looked at the Morningstar data to make sure that there is objectivity in the database. And what we found ended up being radically different. Steve: And so Jamil, what were the main conclusions of the paper? Jamil: Well, here's the main takeaway: The main takeaway is that bonds are different, certainly different from equity. Across time periods, across subsectors, we found a persistent difference between the active bond managers and the active equity manager counterparts. As a general rule, actively managed bond funds have outperformed their median passive peers after fees. So take the ten-year horizon — 68% of active bond managers actually outperformed their passive peers in bond space. Compare that statistic to what we've seen in equity. In equity only 40% or a bit less than that, actually, less than 40% of equity managers outperformed their passive peers. Steve: So Jim, normally when investors compare active managers, they compare it to the performance of a, say a publicly available benchmark. In your paper you compared performance relative to the median passive peer. Why did you take that decision? Jim: In one word, investability. You cannot buy index performance; you have to buy something that actually transacts in the marketplace. And when you transact in the marketplace, you encounter frictions. Bonds are different than stocks in large part because of the frequency of instruments moving in and out of indices. Bonds expire, equities are perpetually [lived] securities. Bonds are also issued more frequently than equities. So because of that, the amount of trades you would see to replicate a bond index is much larger in general than with an equity index. And that, incur, encounters trading frictions. There are also other frictions, particularly when you get outside of the United States if you're dealing in something like emerge, emerging market local, there may be tax considerations, as well. And a third element to consider is if you're comparing the performance of open-ended mutual funds to closed end funds or ETFs, these don't necessarily trade at net asset value; they may trade at a premium or discount to the market, and that affects performance as well. Steve: So, so Ravi, in the paper, you discuss a lot this notion of non-economic investors. Can you talk a little bit about what you mean by that and why that's important? Ravi: Sure. So almost half of the fixed income universe is owned by investors who have motivations that are either policy-oriented or have portfolio constraints driven by regulations, or accounting considerations. To give you just one example of this non- economic investor, the Federal Reserve owns about 30% of US agency mortgages. Now the popular indices exclude government bonds, treasuries owned by the Federal Reserve, but does not exclude mortgages owned by the Federal Reserve. So a pure indexer would be forced to overinvest in mortgages relative to the free float of mortgages. So that's sort of one sense in which fixed income is different from equities. Another important sense, as Jim already emphasized, is the base of new issuance, which is of the order of 20% over the last few years in the most popular fixed income indices in the US. And typically a new issue comes at a significant concession to the existing issue bonds of the same issuer. And that is a discrepancy that can be exploited by active portfolio management. Steve: And why would the fact that there's this price concession for new issues benefit active managers over passive managers? Ravi: So for two reasons: the mechanical reason is that the index includes these issues at the end of a month, typically, and so active investors can buy before the end of the month, on the day on which the bond was actually priced and issued. And the second subtle point is that even a systematic smart, beta strategy would fail to capture this new issue concession, because a typical transaction is oversubscribed and a systematic strategy would end up

being over allocated to those issues that don’t perform well, and we underinvested in issues that perform well. Steve: Okay, great. So let's dig a little bit further into some of the details. So the paper lays out 12 sort of key points describing why bonds are different from equities. So let's take a look at each one of these points in turn. So Helen, let's start with you. And so you compare the actively managed bond funds with ETFs in their median passive peers. What data did you use, and specifically what were the findings? Helen: We used data from Morningstar for US open-end mutual funds and ETFs. Despite a general presumption of underperformance, and more than half of the active bond mutual funds and ETFs outperformed their median passive peers in most categories over the past one, three, five, seven and 10 years, with 63% of them outperforming in the five-year period. Jamil: Actually, these results should come with one caveat: The fact that active bond managers, active bond funds outperform passive bond peers does not mean that all active managers have outperformed passive managers. Remember that in active managers there are two kinds of players: There are the active funds, and then there are all the active players that are essentially motivated by non-economic factors. So take for example central banks. Central banks can buy bonds for quantitative easing purposes. They do that to control the stock market, to control exchange rates, to control interest rates. Commercial banks may be in the mode of buying fixed income to match the duration of their assets to the duration of their liabilities. Insurance companies may be more interested in looking at the book yields than at the total return of their bond portfolios. And so because those constraints exist, as Ravi just pointed out, then it is entirely possible that active funds would beat their passive peers, while active bond managers as a whole don’t do particularly well against the broad universe of passive bond managers. Steve: And is this a key distinguishing feature of the fixed income market relative to say the equity market, the relatively large proportion of non-economic active investors? Jamil: I would say yes, in the sense that we estimated that the proportion of active bond managers with non-economic motives, or call it constrained active bond managers represent roughly 47% of the total universe. So compared to equity, where this percentage is likely much lower, then this becomes a material difference. Steve: In the paper you looked at the performance of active managers versus median passive peers, largely for the reason that Jim alluded to, which is this notion of investability, but we all know that investors also compare performance to publicly available benchmarks, and I know you looked at that in your paper as well. So Helen, if we look at performance versus businesses versus median passive peer, does the story change? Helen: The story does change a bit, but the main conclusion that active fund managers have fared generally better in fixed income than the equities, still holds. Again, more than half of the fund managers outperformed their benchmarks over the past one, three, five, seven years in most categories, with 61% of them outperforming over the past five years. Helen: This stands in strong contrast with equity results, with only 35% of them outperforming their benchmark over the same five-year period. Jamil I think it's important to note that less than half of active bond managers outperform their benchmarks over the ten-year timeframe. Now, this has a lot to do with the global financial crisis, and that's because during the crisis, when lots of markets become less liquid, then it becomes excruciatingly difficult to replicate an index. Actually what we observe in the numbers is that about 40% only of active managers beat their indices over ten years, and yet during the same time period about 66% of active bond managers beat their passive peers. So what does this tell you? This tells you, as Jim Moore just pointed out, that benchmarks are not investable when the bid-ask spread is very wide because benchmarks typically assume that the bid-ask spread is not there. Second thing it tells you is that the benchmark becomes effectively a vacuous concept in times of crisis because they're simply impossible to replicate. Steve: So Helen, based upon this concept of liquidity making a big difference, one might think that you would see a big difference in the high-yield market, where we know that there's much less liquidity. Is that in fact what we see? Helen: Exactly. So our numbers actually show 81% of high-yield category of fund managers outperform their median passive peers, but only 25% of them outperform their benchmarks. Ravi Essentially, what Helen is

saying that the returns on certain indices are not practically achievable because of transaction costs — indices like high-yield loans, high-yield bonds, and emerging markets, where bid-ask spreads are fairly high. And in certain other markets, like emerging market local bonds, withholding tax is paid by investors are not accounted for in the popular benchmarks, which has percentages of funds outperforming median passive peers on the vertical axis, and percentage of funds outperforming benchmarks on the horizontal axis. As a group the red dots for fixed income are up and to the right of the blue dots for equities. Steve: So Jamil, obviously when investors look at track records, ultimately what they're trying to do is, is assess luck from skill. Is a good track record really a result of a manager's skill or did it just happen to be good luck? Jamil: Generally, we don't. This is a very important question, but it's important to understand what we mean by skill. Skill cannot be observed, okay? The best we can do is infer from the performance data some kind of probability distribution on the skill itself. Performance is always a noisy reflection of skill. And so the best we can do is ask a question within the context of statistical significance, how confident can I be that this good performance that I observe is a result or a reflection of true skill rather than noise? And that's not a question you can answer with certainty. You can only say, for example, that with 90% probability, this is the time it takes to figure out whether an active manager is going to outperform the benchmark. Ravi: So, it might be illuminating to use some numbers to reinforce the point that Jamil made. So in the real world what would it take to get to a 90% confidence interval, have that kind of confidence that a manager's performance is due to skill and not sheer luck? So let's start with the example of a reasonably skilled manager with an information ratio of 0.5. The information ratio is the manager's performance relative to the benchmark, divided by his tracking at a volatility. So it's essentially a modified version of the well-known Sharp Ratio. We assume that the benchmark has a volatility of 3.3 percent and the portfolio has a volatility of four percent. The correlation of the portfolio return and the benchmark return was assumed to be 0.9. So turns out with an information ratio of .5 years, the answer is it would take us seven years to have a 90% confidence that this manager has skill. Now, as you can imagine, these statistics are very sensitive to the information ratio we assume. If the manager has an information ration of, of 0.7, we need only three and a half years, but with the information ratio of 0.3 we would need as much as 20 years to have a 90% confidence that the performance is a result of skill. The key point is that we should not rush to judgment quickly on a manager's skill. While it's impractical to expect an investor to be patient for 20 years, a three to five-year horizon is the minimum time needed to judge even a manager with reasonably high skill. Steve: So Ravi, another way to look at this may be to look at the probability of outperformance, let's say the five-year mark, as a function of the information ratio. Ravi: Exactly. That's what's shown on this chart. We fixed the horizon at five years and plotted how the probability of performance changed as a function of the information ratio. As you would expect, the relationship is increasing and concave, but importantly, for reasonable changes of the information ratio, even over a five-year window the probability of outperformance may be greater than 50%, but it's not particularly high. Steve: So this far we've reviewed the performance of active bond managers versus equities, but we really haven't dug in detail into the reasons why we observe this performance within the fixed income space. So Jim, can you talk a little bit about why it is you think that fixed income investors have fared better than their equity counterparts? Jim: Sure, we've touched on a few of these reasons non-economic investors in the bond space, benchmarks, rebalancing, frequency in turnover, and what that means in terms of a cost drag. And Ravi talked about new issue concessions, particularly in the credit markets. But there are a number of other reasons. There are structural tilts that can be very important in fixed income markets. Also, derivatives can play a very meaningful role in the ability to gain access to an exposure more cheaply, more efficiently, or to tailor portfolios to look for mispricing opportunities between derivatives and cash instruments. Also very important particularly when you get into the credit space is that credit analysts can have very different views of the risk-return for credit versus the agency view and what's implied by

the rating, and realize that the ratings are the opinions of the rating agencies, and they're, they are not de facto measures of risk associated with those individual credits. Steve: Great. Now, this notion of non-economic investors seems particularly relevant given the discussion today. So can you talk a little bit more about, Jim, about what specifically we mean by non-economic investors in the bond market? Jim: Let's go back a step and talk about active versus passive: A cornerstone of the active versus passive literature is a paper written by Bill Sharp called "The Arithmetic of Active Management," and what Sharp did was divide the world into two classes: active and passive. And the way the traditional math works, you know the passive, before you take fees into account, should get the benchmark. And you know the active in aggregate 'cause they're everything else, should also get the benchmark. So there are winners and there are losers on the active front. Well, if passive is cheaper than active, therefore after fees you should get a higher percentage of passive outperforming active. The issue that we have with this is that there's not just one monolithic group of active investors in this space. The term non-economic is really referring to a group, really three investor types in the space—central banks, which have been mentioned, insurance companies, and commercial banks, who use fixed income not only to manage against a core benchmark, but use fixed income for a variety of purposes — matching up against liabilities. In the case of central banks they're using it to manage the domestic money supply with their local market holdings. With respect to their foreign market holdings, they may use it to manage currencies. So when you look at the group as a whole, you've got central banks, who are roughly a third of that 47% that was mentioned, really using it for very different reasons than a traditional investor. And when you look at insurance companies and banks, in addition to the asset-liability management issue, they have additional concerns. They can be very concerned about accounting. And so book yield can be very important as opposed to the total return, because when you look at book yield and when you look at an equity analyst who follows the financial sector, they're looking for stable, repeatable earnings as opposed to one-off earnings. Gains and losses are considered one-off earnings, and get a lower multiple than repeated earnings. Also, insurance companies and banks are subject to other regulation. They're levered entities, and therefore they're holding assets, and also they have liabilities against them and need to think about that mismatch. Otherwise, they have to hold capital against that mismatch. So if we think about the group we're talking about as, as non-economic, they represent a continuum. Some have a very strict set of requirements and constraints that they're falling under, and others, they may be more loosely. So if you think about what that means if I say 47% are these non-economic, and then you've got the passive trying to manage a benchmark, and then you've got the truly active, between what the passive's doing to rebalance and what the active non-economic may need to do because of all their constraints, they fall under, there are opportunities created that allow active economic investors to add value in the marketplace. Steve: Great. So Ravi, let's, let's turn to you. You mentioned, you know, the significant difference between the equity market and the fixed income market with respect to rebalancing. So how specifically does the nature of benchmark rebalancing affect investors in fixed income differently than in equities? Ravi: So this may be an obvious point, but bonds essentially mature, while equities are perpetual securities. So let's, for practical purposes, if we look at the Bloomberg Barclays Aggregate Index, over the last couple of years about 20% of new issues have entered into the index every year, both because existing issues mature and the market has been growing. So all of these issues need to be priced by someone, and that someone is an active investor. The opportunity to do this in the bond market comes around very frequently, while in equities the instance of IPO issuance is very rare. So for example, as this chart shows in the US market in equities, about .78 percent of the market cap is new issue every year, while in corporate debt that number is about 17.8%. It takes a combination of credit skills and market judgment about aggregate demand to price these securities. And periodically, some of these securities underperform in the secondary market, while most of them outperform. So that's one major difference. And on the flipside in equities, even if you take broader indices, between IPOs and corporate

action, the turnover is of the order of two percent in the Russell 3000 and up to four percent in S&P 500. So this is a major difference how active managers can have opportunities to add alpha in fixed income space. Steve: So Ravi, within the fixed income space we certainly hear more about this notion of structural tilt, certainly much more than we do in the equity space. Can you talk a little bit about what some of these structural tilts are in fixed income and why they're important? Ravi: Sure, Steve. There are two types of tilts we can have. We can be overweight factor exposures that are in the index, or we can take exposure to factors that are not in the index. To talk about things that are in factors that are in the index, Mihir Worah and I spoke about five structural tilts that at PIMCO we have used over the last 30 years. Those are an overweight to duration, having yield curve steepeners, being long agency mortgages, selling volatility, and having exposure to credit spreads. In addition to that there are off, out of index exposures like emerging market currencies or non-agency bonds. Steve: And are any of these more important than others? Ravi: Over the long horizon, credit spreads have proven to be the most important exposure of active managers. 'Til the crisis they did not perform well, but post-crisis they have had some of the highest Sharpe ratios of all factor exposures. So the picture that emerges from this table is very clear. Active bonds and ETFs are in the largest taxable bond category, that's intermediate-term bond funds, have been structurally short duration, long investment-grade spreads, and long high-yield exposure against the index. Either directly or perhaps indirectly through factor [tells], that are not directly included in the analysis. So regressing excess returns of these funds against factors shows that exploiting credit and liquidity risk premia has been a particularly important ingredient in the not so secret sauce of active portfolio management. Both the T statistics and R square show that the tilts have been central to portfolios beyond a reasonable doubt. Steve: So Jim, some of the structural tilts that Ravi mentioned are off-benchmark positions to core bond investors. And high-yield spreads, in particular, investors might say "well, you're just taking more risk and therefore being rewarded for that risk." How do you address someone who makes that criticism? Jim: First you need to understand that rating agencies' views don't necessarily monotonically map to the real risk in the environment. This is where credit analysts can be very valuable, and in fact for us historically, about a third of our credit views have differed from the agencies. That said, the ability to anticipate upgrades or downgrades across the high-yield spectrum can be very valuable. If you're looking at bonds that we think have a high probability of entering the investment-grade space from high-yield, so-called rising stars, it's very advantageous to get there before it actually, actually happens. Secondly, if you foresee something that is now investment-grade dropping in rating in the future, that can be very valuable to get out before the non-economic constrained investors who cannot hold high-yield, do so. Steve So Helen, the bigger concept that we're really discussing here is this notion of active share, or the extent to which a manager deviates from the benchmark, perhaps vis-a-vis some of these structural tilts that the panel has alluded to here today. Did you look at that in the paper, and what did you find? Helen: We did look at that and we found the level of activeness may pay in bond management. This means the more portfolio positions deviate from the index, the more potential the [fund] will outperform. Because we don't have direct access to the fund managers' positions, we use correlations between fund returns and index returns as a proxy for the degree to which the fund is hugging the index. The higher the correlation, the lower the active share. And what we found was for the last five years the correlation between fund access return and the correlation between the fund return and the index return is -0.57. So this indicate it may pay to deviate, or put it in a different way, when an active manager deviate, it might indicate that there are potentially profitable investment opportunities in that portfolio. Steve: Jamil, the seventh point in your paper, talks about this notion of whether factors are alpha or beta. Beta of course is a term given to a systematic factor that should be compensated for in equilibrium, whereas alpha is the residual return associated with investing or trading skill. What we hear more and more is that certain structural tilts should actually be thought of as beta. Do you agree with this notion? Jamil: Well, I think the whole question is more

about theology than finance. It does appear that some tilts, actually most of the tilts today are treated as beta or what people call sometimes smart beta. And yet we think that perhaps they're not really betas because we don't have a strong theoretical prior about those factors. In the paper we ask for example why is it that duration, would be thought of as a systematic factor, as a risk factor? Rather than sunspots, for example. Well, it's not an obvious question, and the answer in my mind is simply that duration has worked, okay? And generally, factors are whatever has worked over the last 30 years. And clearly, being overweight duration has added value to bond portfolios during the latest 30-year period, which was a period of declining rates. So in other words, the whole risk factor [evocable], may have to do with what's essentially a single data point, which is a single monetary policy experiment that has taken place over the last 30 years. More generally I think systematic factors appear to have in common the fact that they have generally worked in the US in the last 30 years. However, we only know this with the benefit of hindsight. So why should we penalize active managers who made active decisions in the past to tilt towards factors which turned out to be correct? Furthermore, we think that timing is very important as well. Active managers still have to choose when to be long duration and when to be short duration, and that leads one to think that these tilts may in fact be more alpha than was previously thought or supposed. Steve: Right. In the second half of the paper, you talk quite a bit about, you run through some thought experiments about what might happen if say the market were to go fully passive. And this is sort of the more philosophical part of the paper, I would say. Jamil, can you talk a little bit more about this notion of what we think might be some of the issues if passive investors were to dominate at equilibrium? Jamil: Well, yes, we tried to think about that scenario. We tried to think about a world where only passive managers exist. And as you know, the mandate of passive manager is to replicate the market, to replicate an index, typically. And if every asset manager were to be passive, then all assets would get absorbed without due consideration of the characteristics of those assets. In other words, their cash flows, the governance structure of the firm issuing those securities, broad risk-return parameters. Now, you know that prices convey information about expected future cash flow, about the discount rate we're using. Because there are, out there, rational investors who are conducting detailed research, and trying to figure out the fair value based on that research. And yet in a world where you only have passive investors or, for that purpose, non-economic investors, prices would cease to be informative, and that's because assets get bought without being analyzed. Think about it: The passive market has no notion and no interest in analyzing the forward return of assets. Its only mandate is just to replicate an index. And so from that point of view, the market would be subject to what we call a degenerate Say's Law. Say's Law after Jean-Baptiste Say, who's a 19th century French economist. And that law says that supply creates its own demand. In other words, suppliers of securities can rest assured that all those securities will be absorbed. Jim: Now, the good news there is that this is very unlikely for very elegant theoretical reasons. This goes back to a seminal paper by Grossman and Stiglitz in, in 1980, where they posed, you know, a very similar question, and really what they thought about the cost of [acquiring] information, and what it meant for performance. And so the idea is if there's any cost to pro, to acquiring information, then you have a value created by that. And so the value created by the information gathering then gets filled into the market and you need to compensate those who gather the information. Steve: Excellent. So, Jamil, so apart from low fees, what benefits can passive managers actually deliver? Jamil: Well, believe it or not, passive management has its virtues. And active management can have its shortcomings. So for example, if you are among those investors who are interested in macro investments, asset allocation, and you only seek index replication at the asset class level, then passive investment can provide you with a cost-effective way to access this kind of trade expression. Also, active managers can overreach in terms of research, they can overinvest in research, they can invest in information acquisition in certain markets and market segments. If you have a healthy number of passive choices, that helps keep active managers on their toes, and that's not a bad thing. And lastly, because

most indexes are not directly investable, then the competition between active and passive managers will allow investors to screen out or weed out those active managers that charge higher fees without really bringing additional value. Jim: In fact, there's evidence to suggest that the presence of passive investors actually makes active investors stronger. It acts as a disciplining mechanism, and over time, as performance is revealed, those weaker investors will attract less assets, lose assets and fall away from the pool. So passive becomes very valuable as a mechanism to discipline the quality of active managers. Steve: So Ravi, I've heard it said that, that there's no such thing as passive, just different shades of active. Would you agree with that notion? Ravi: That's very well put, Steve. In fact, strictly speaking, passive management means owning the entire market. And I think the way it's implemented, passive investing outsources the active components to an index provider. The market itself is an ever-evolving set of securities, that a manager has to decide if to buy or when to buy, if they're going to replicate a segment of the market. Jim: There are practical trading-related reasons as well. Fixed income indices rebalance at the end of every month. So if I am a passive investor, I have to make the decision “am I gonna rebalance my portfolio and trade only at the end of the month on the close, or am I gonna make the active choice to rebalance earlier in the month?” Helen: Just want to add one point: The very choice of say a passive ETF is actually an active choice. Investors in passive ETFs are sometimes unwittingly taking a market view, and because investors often buy and sell these passive ETFs, they're actively timing the market. Furthermore, the asset allocation decision is the most active decision an investor can have, Because it contributes to the majority of the portfolio return far more than active decisions at the asset class level can do. Steve: So tying it all together, Jamil, what are the key conclusions of your paper? Jamil: Well, I guess two main things, two main messages: As far as we can tell, active management works in fixed income, and it works because bonds are different from stocks. And this for two reasons: Reason number one is that bonds mature, and reason number two is that almost half of the market’s participants are non-economic. And both those reasons open up opportunities of excess returns for active managers.