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Observations on Innovation In Pension Fund Management In the Impending Future

Portions of the edited keynote speech given by Robert Merton at the 2005 NCREIF-PREA Fall Conference

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Robert C. Merton

This morning I will offer some observations on the role of financial science and financial innovation in influencing the evolving practice of providing retirement benefits and dynamic pension portfolio management.

New financial product and market designs, improved computer and telecommunication technologies, and advances in the theory of finance during the past quarter century have led to dramatic and rapid changes in the structure of global financial markets and institutions. The scientific breakthroughs in financial engineering in this period both shaped and were shaped by the extraordinary flow of financial innovation that coincided with those changes. The cumulative impact has significantly affected all of us—as users, producers, and overseers of the financial system—most importantly in long-horizon asset management providing for retirement benefits.

The view of the future of financial practices in retirement investing and services, as elsewhere in the economic sphere, is clouded with significant uncertainties. With this in mind, I will nevertheless try to describe prospective future trends in pension products and service design and the innovations to support their implementation. My remarks will address three topics: (1) What are the challenges to pension plan design today in delivering the retirement part of the household life cycle? (2) What are the directions for plan design improvements to meet these challenges in the impending future, with emphasis on the risks that are not being taken into account in current practice? (3) How can derivative securities and other investment management innovations improve the effectiveness of the production of pension benefits?

Challenges to Pension Plan Design: DB and DC

Some trends are already well under way. As a result of major technological innovation and widespread deregulation, the household sector of users in the more

fully developed financial systems has experienced a major secular trend of *disaggregation*—some call it *disintermediation*—of financial services, including pension services. Households today are called on to make a wide range of important and detailed financial decisions they did not have to in the past. Among the most significant examples in both developed and emerging countries is the strong trend away from defined-benefit (DB) corporate pension plans, which require no management decisions by the employee, toward defined-contribution (DC) plans, which certainly do. This trend away from DB and toward individual employee-managed retirement accounts is happening now because of accounting changes, equity market behavior post the 1990s, low inflation, and the impending baby boomer retirement demographics, all of which are making transparent that the cost of these DB plans is much larger than had been understood in the past.

The shift to DC is not, however, the long-run answer. In the United States alone, there are more than 9,000 mutual funds and a vast array of other retail investment products to choose from. Along with insurance products and liquidity services, the household faces a daunting task to assemble these various components into a coherent, effective lifetime financial plan. Some see this trend of disaggregation continuing and widening. Perhaps so, especially in the more immediate future with the widespread growth of relatively inexpensive Internet access to so-called financial advice engines. However, the creation of all these alternatives combined with the deregulation needed to make them possible has consequences. Deep and wide-ranging disaggregation has left households with the responsibility for making important and technologically complex micro financial decisions involving risk. The essence of the current challenge is thus: Defined benefit is expensive to the sponsor, but its beneficiaries

very much like the simplicity and security of the payout pattern it offers as base coverage. Defined contribution is a lot less expensive and well defined in terms of risk exposure for the sponsor but is too complex and too risky for the end user.

Directions for Plan Design Improvements: Risks That Are Not Now Considered

I see the next generation of pension plan design as something we might call a “structured-DC” plan, which is designed to produce the payout pattern and simplicity of a DB plan but to do so using a DC-type institutional structure. After all, cost to the sponsor is the principal problem with DB, not its payout pattern. To transform a series of inputs of contributed funds based on a percentage of wages earned into a promised benefit linked to a replacement ratio of final pay requires significant dynamic portfolio optimization and execution. This new product is much more complex for its producer than a standard DC plan but much less complex to use by its consumer than a standard DC plan.

What advances in asset allocation and optimal dynamic trading strategies are needed to produce this improved plan? The past several decades have seen explosive growth in asset management. Over that time period, the financial service industry has made significant progress in developing and improving portfolio allocation and performance measurement. However, the central objective function employed today comes from the same basic mean variance portfolio model with its efficient frontier criteria that was developed by Markowitz, Tobin, and Sharpe in the 1950s and 1960s and for which they were later, most deservedly, awarded the Nobel Prize. This criterion, based on a static one-period model of maximization of expected end-of-period wealth, is simply not rich enough to capture the myriad of risk dimensions in real-world lifetime financial plans. After nearly half a century, it is time for the next generation of advice models to find their way into mainstream practice.

Human Capital

Standard portfolio analysis and financial advice is almost always devoted exclusively to financial assets. Yet the single largest asset most people have for most of their life is their human capital. There are two elements of human capital that need to be taken into account—one is the value of that human capital because that is an asset, just like your other assets, and the other is its risk characteristics. Consider a hypothetical: A professor and a stockbroker have more or less the same wealth and the same emotional tolerance for risk. How would you optimally allocate their financial wealth between risky equities and,

say, cash or bonds? The stockbroker's human capital is extremely sensitive to the stock market, not only because his or her clients are richer and happier if the stock market goes up but also, as we know, when the stock market goes down, trading volume dries up. It is not only the size of trade but the frequency of trading that determines the stock broker's compensation. Clearly the value of the stockbroker's human capital is quite sensitive to the stock market. In making an optimal allocation, you should thus take account of that sensitivity and explicitly recognize that there is an implicit, but nonetheless significant, exposure to stock performance for the broker's human capital. So seemingly paradoxically, you would optimally allocate more of the professor's financial wealth to the stock market than the stockbroker's. In sum, human capital is one important dimension of value and risk not taken explicitly into account in current practice.

Investment Opportunity Set

I'm going to do a pop quiz. Which would you rather have: \$5 million or \$10 million? Feeling pretty confident in your answer? Now let me give you the rest of the story. Which would you rather have: \$5 million in an environment where the only investment you have is a 10 percent sure inflation-adjusted, “real” interest rate or \$10 million in an environment for the indefinite future where the only investment earns 1 percent real for sure? So \$5 million at 10 percent or \$10 million at 1 percent? You could convert each of these into a perpetual flow: 10 percent applied to \$5 million would provide \$500,000 a year inflation-adjusted in perpetuity; 1 percent applied to \$10 million would provide \$100,000 in perpetuity. If I had reframed the choice in my first question to say, “Which would you rather have: \$500,000 a year real forever or \$100,000?” you would have been equally secure in your answer. The point made from this second hypothetical is that, even for measuring economic welfare, wealth is not a sufficient statistic, and therefore, more than end-of-period wealth must be considered when doing optimal portfolio allocations.

What matters to people, particularly in the context of the retirement part of the life cycle, is not how much wealth they have but the standard of living they can enjoy. The standard of living is much better represented as a lifetime flow or a perpetuity than as a stock of wealth. What we see is another dimension of risk in addition to wealth—changes in what you can earn with that wealth, described by changes in the investment opportunity set of risk and return, including the interest rate. From the perspective of what really matters to people—their standard of living—what is the “risk-free” asset? It is not a Treasury bill. It is an inflation-protected life annuity whose mark-



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Home ownership is a key element in retirement planning for two reasons:

The house is a store of asset value for the individual, and it is also a hedge against unexpected changes in the cost of housing.

to-market value can fluctuate substantially as real interest rates change. I remind you that long-maturity Treasury inflation-protected securities were yielding a 4 percent real rate five years ago. Today that real rate is 2 percent. If you consider the impact of that change on the amount of annuity cash flow one can buy from a given amount of wealth, it is quite substantial.

Neither of the first-order risks in these two examples are embedded in the portfolio allocation models that are used currently and that has implications in terms of good advice, in terms of risk and in terms of investment choices.

Residential Housing

We know that a big chunk of consumption is residential housing. We also know that changes in local residential housing prices and changes in the general Consumer Price Index (CPI) are not in lock step with each other. Therefore, home ownership is a key element in retirement planning for two reasons: The house is a store of asset value for the individual, and it is also a hedge against unexpected changes in the cost of housing. It is not a precise hedge against general inflation, although it does offer some of that, but it is prepaid consumption for a very important part of the consumption profile.

I bring this up to get you to think about your standard mean variance optimizer. If you own a house, as I do, in Cambridge, MA, and you take the amount of your net worth that is tied up in that house, and you put that in the optimizer, what does it tell you? You are way overweighted in a very concentrated, specialized investment. You're not diversified; it is not even national real estate; it is Cambridge real estate. It looks like a very concentrated investment from the standard of a diversified portfolio with respect to generic wealth; it is actually a very safe, good hedge of long-term consumption.

Another example is the Harvard University endowment. Among its many assets is much residential-type real estate in Cambridge, and even with its large endowment, it is probably overweighted relative to a standard risk-return analysis. However, if you analyze Harvard's liabilities and its goals, one of its biggest costs is faculty salaries, and Boston has to compete with Princeton, NJ; Chicago; and so forth for the best people. The biggest component of those professors' consumption is almost always housing. And the biggest differential across those places comes from housing and the standard of living. I can tell you firsthand that hiring people to teach in Boston when the cost of housing is double what it is in some of those other places is difficult unless you are willing to pay up considerably. From Harvard's point of view, owning residential real estate is actually a hedge against that

because, if it turns out that Cambridge is twice as expensive as everywhere else, at least it will have the value in its portfolio to pay those higher differentials to attract people. If Cambridge real estate goes down in value, the portfolio is less valuable; although the endowment is smaller, the needs for the endowment are also smaller. This is a kind of asset liability management. I hate to think of my consumption as a liability, but structurally it is identical to that.

In terms of the real optimal portfolio, housing is a key element. It is also a complex security because it has residual asset value. In other words, if I own my place, even with great optimism I know I am not going to need its provision of shelter services indefinitely (as much as I might like it). But my house with some maintenance has indefinite duration for providing shelter, so there is a component of my house's value that I really don't need in my retirement. It is the part of the value of my house representing the shelter services it provides after I no longer consume because I am no longer on this Earth. If we can "strip out" that value that is not needed for consumption and use it to enhance retirement income when I am alive, it is going to represent an important increase in efficiency. This will take a major improvement in the products offered in the reverse-mortgage market, which exists but I believe, as you know probably better than I, is not exactly a well functioning market.

Manufacture of Investment Products

I'd like to provide some observations on trends in the production process for retirement benefits, a recent example of which one could call "barbell investing." At one end, we have providers of very efficient indexing or exposure applications. In the more retail implementation, exchange-traded funds, index funds, or derivatives can be used to achieve very efficient exposures to different asset classes. At the other end, we have providers of "alpha generation," which is superior performance beyond what can be achieved by simply mixing asset classes efficiently. Typical pure providers in that category are hedge funds and other alternatives to traditional financial asset classes, such as certain aspects of real estate investing. Those providers from the two extreme ends of the investing spectrum are growing rapidly in terms of assets under management at the expense of—or at least putting pressure on—the traditional long-only asset managers in the vast middle offering various blends of both. We see it in the mutual fund industry, and we see it in the institutional markets. This barbell trend of separating the two activities and then bringing them together is really a reconciliation of practice with theory. If you go back and look at the way theoretically you would set up money management, that

is how you would do it. You'd have passive exposures to asset classes for efficient diversification and separately an alpha mechanism for adding superior performance and then mix the two to create your optimal portfolio. That's a reality that's happening.

Part of why that is happening is the recognition that asset-management shops are not capable of providing the best performance by owning all elements of production with vertical integration like the old Ford Motor Company, which was so vertically integrated it even owned the forest that supplied the wood to use in the steel mills it owned to produce the steel for its cars. Instead, the investment world is evolving to have "assemblers." "Final assemblers" produce these integrated products for households either directly or indirectly and outsource those things they don't have a comparative advantage in doing themselves. What are some of the implications of that trend? One is that assemblers need to have an integrated and consistent risk measurement system for alternatives and traditional asset classes. The alternatives—hedge funds, private equity, or real estate—offer some challenges to the traditional risk measurement methods. One characteristic of alternatives, particularly private equity and real estate, is that they are not trading all the time. Their underlying assets don't trade very much, so reported net asset values are stale. If you take just those reported net asset value (NAV) numbers and apply them in the risk-return frontier analysis, you're going to get an enormous bias, which can have a big impact on risk measurement. As we all know, standard performance measurement looks at some asset class or some portfolio and asks, "Does it have superior performance, or how does it incrementally diversify my portfolio?" If you have an asset that is marked infrequently but that reports NAV on a periodic basis and you use that NAV the same way you would for a frequently trading portfolio of equities, it will look like a much better diversifier than it is in reality.

It's important to know and understand the likely sustainable sources of returns for alternatives. I believe that there are three potential sustainable sources for hedge funds. The first is rather prosaic. Hedge funds take systematic market risks. Their managers may think they are hedging the portfolio against directional bets in the equity market, but they miss more subtle forms of exposure, such as in convertible bond arbitrage if the manager is long on convertible bonds and short on equities to hedge the direct effect of stock price changes. If, however, the manager is not hedged against changes in equity market volatility, he is actually making a bet on the direction of the equity market. It turns out that changes in equity market volatility and the returns on equities are negatively related, so even though the manager hedged the direct

effect, the portfolio can end up with significant exposures to the stock market through indirect effects. As we know, if you have a systematic market exposure, being compensated in terms of an excess return is not surprising, and it is a sustainable, albeit prosaic, source of return.

The second source of return is based on some work in progress that a colleague of mine, George Chacko, has done on "liquidity event" risk. This risk is different from liquidity differences measured by the bid-ask spread on a given day. A liquidity event is one of those episodic periods in which the markets behave like deer in the headlights of a car and freeze typically linked to "flight to quality." Taking the Credit Suisse Tremont Hedge Fund Index and looking at the returns from 1994 to 2004, Chacko studied the returns of different hedge fund styles, all of which produced significantly positive outperformance by some considerable margin. Then he added to the return regression analysis a single variable from the equity market that is a surrogate for liquidity event risk. He reran the ten years of returns, and every single style alpha became statistically insignificant. A very important component of the outperformance in every single hedge-fund style in this period can be attributed to the factor related to liquidity event risk.

Chacko reports that the median time for individual equity shares between trades is about two minutes. The median time for an individual corporate bond to trade is six months! That is because most corporate bonds almost don't trade at all. So you can see by being long on the bond of a specific corporation and short on its equity, the convertible bond strategy is inherently short on liquidity. In other work in progress, Myron Scholes has found liquidity event risk appears to be related to the "small firm effect," one of the systematic excess equity return factors in the celebrated Fama and French model in which a portfolio long on small-cap stocks and short on the large-cap ones, just like the long-short equity hedge fund style, produces excess returns. There is some evidence that the small-cap minus the large-cap stock portfolio is a reflection of the same liquidity event risk.

The third sustainable return source for hedge funds is dealing with institutional rigidities. What I mean by institutional rigidities is that, in the markets, particularly with all the innovations and regulatory changes going on, you find that certain systematic players in the market are impeded from doing what they want to do from an economic perspective as a consequence of regulations, taxes, and other rigidities. Hedge funds, because they are so lightly regulated, are a natural vehicle to effectively intermediate among those intermediaries. More than half the participants in the credit market are not mark-to-market players, whereas in the equity market, almost everybody



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these days is mark to market. By not being mark to market, which is an instance of an accounting rigidity, those players behave and respond differently than ones that are mark to market.

A second example of rigidities is an institution that can hold only investment-grade bonds. That means if GM or Ford or any other is downgraded below investment grade, even if the institution loves the company, it is not permitted to buy or hold the company's bonds for a long term. That is a rigidity. And I could go on with other instances and examples of rigidities. Hedge funds can intermediate these and do. It is a legitimate return to earn for intermediation services, albeit done through the markets. Some may question whether institutional rigidity is no more than a fancy, multisyllable expression for just saying hedge funds buy at a better price than their counterparts. But a test of the existence of an institutional rigidity is that the hedge fund could tell the counterpart, "We are doing this trade with you, and this is how we are going to make money," and the counterpart still does the trade with it. Why? Because the hedge fund through the market provides a service, loosening some constraint that the counterpart could not otherwise address. That is how, at least in principle, one can distinguish making money from rigidities and from simply being faster and smarter.

Interplay of Corporate Assets And Pension Management

We have all heard that asset-liability management (ALM) is one of the latest trends in pension plan financial management. One does not just manage assets, but does so relative to liabilities. Generally, ALM is an improvement over the past practice of considering assets only, as if all plans had the same liability profiles. However, ALM as practiced is only an intermediate step, and the approach needs to be expanded.

In the case, for example, of the classic corporate DB plan, the usual way is to examine the risk profile of the pension assets against the risk profile of the pension liabilities. That is a step up to consider pension assets and pension liabilities, but an important next step along those lines is to extend ALM to assets and liabilities of the whole corporation. The pension fund for a corporation that is not planning to go bankrupt is an encumbered asset of the shareholders. No matter how it is institutionally walled off with separate trustees, if the pension fund does well, incrementally the shareholders are the beneficiaries because the pension liabilities for the most part are fixed-rate debt and in the United States, fixed in nominal terms. I'm not going to

get into the complex issues surrounding pensions, financially distressed firms, and the pension insurer, the Pension Benefit Guaranty Corporation. Instead, I focus here on the vast majority of firms, which intend to stay in business.

For such firms, the character of the pension assets is very much like owning a building with a full-recourse mortgage against it: The building is an encumbered asset. The firm can't do what it wants with the asset until it lifts the lien on the building. As with the building, so the pension fund is an encumbered asset, but its incremental gains and losses are the shareholders', not the pensioners'. Once that characterization is accepted, then it follows that the optimal risk characteristics of the fund need to be framed and related to the risks of the other corporate assets, the entire left side of the balance sheet. The same thing applies with pension liabilities and everything else on the liability side of the balance sheet. This is a topic for a whole talk by itself, but it is enough to say here that the impact of the pension plan risks on strategic corporate investment and financing policies can be quite significant and thus corporation-wide ALM can lead to significantly different investment policies for the pension fund than if the plan were a "stand-alone" entity.

Derivative Securities

I turn now to new applications of derivative securities and other market-proven financial innovations to enhance the ability to deliver more return per unit of risk. The first lesson is to get the most from what you have. Earlier I said the individual with the reverse mortgage should use the value of the house to enhance the standard of living. That can also be done at the institutional level. With derivatives and other innovations, we can decompose all the risks of investments, strip out and get rid of the ones we don't want or don't need, and keep the ones we do. One instance that comes to mind is that most pension funds don't need liquidity. It often comes with the asset held, but the fund does not need it. It is now possible to strip that unneeded liquidity out and then sell it because you're paying for it. It is like having a radio in your car: If you never play it, why not take it out and sell it?

Consider a pension fund that already has all the direct-investment real estate it would like to hold, and suppose a property-casualty insurance company would love to have market exposure to private equity real estate but has a liquidity problem. A P&C company must have liquidity because if there is an event where it has to write a big check, it can't tell the insured, "The check will be in the mail in six years when this investment materializes." It has to write the check right away. So the P&C needs

liquidity, but it would otherwise like to have the market exposure in its portfolio to the private real estate class as the pension fund does.

What can be done to improve both institutions' portfolios? If the pension fund is holding fixed-income assets as part of its portfolio, then as a substitute, it could buy more private equity real estate and enter into a total-return asset swap in which it agrees to pay over the life of the swap the total returns on its private equity real estate portfolio and receives in return from the P&C fixed payments like a bond. Except for transaction cost, the swap costs nothing; there is no investment, just a transfer of risk. What do the two institutions achieve? The P&C gets the total return on the private equity real estate portfolio, which is what it wanted. However, what assets does it actually hold? Instead of holding the private equity assets, the P&C holds, let's say, U.S. Treasury bonds that are highly liquid and from which it can raise 98 cents on a dollar in an hour if it needs to. So it has substantial liquidity.

What about the pension fund? It holds the private equity real estate, but it has swapped away its market risk in return for fixed payments like a bond. What is the interest rate on that fixed payment? Typically, it will be larger than the rate on the liquid Treasury bonds. That difference, aside from the credit risk of the counterparts—and we can deal with that difference—is compensation for liquidity. So one earns 5 percent on liquid Treasuries, and the pension fund receives 6 percent on the swap; that extra 100 basis points can be attributed to compensation for giving up liquidity. The pension fund has no liquidity. It is holding this illiquid real estate portfolio, and it has this five- to six-year swap, so it has no liquidity, but it doesn't need it. The P&C, in contrast, has lots of liquidity. If you don't need liquidity, you can add to performance that way in your pension fund by selling it. That's adding to the demand side for real estate. So you can see if this kind of arrangement grows and develops, OTC or exchange-traded, then it expands the class of investors who can take private real estate equity risk. In effect, you have eliminated one of the impediments, the lack of liquidity for investment. You can judge whether that is good or bad for you. Maybe you don't want more investors in real estate with you. The point is, in general, one would think that expanding the investor base for asset classes is a good thing, at least for society. So that is on the demand side.

Derivatives for Real Estate Owners/Operators

What about REOCs (real estate operating companies)? There are many large developers and holders of real estate, families or private corporations, that have very

large concentrated risk and no direct access to the equity market to share that risk. And if they don't have access to the equity market, even at cost, then they have a binding risk budget.

There is only so much risk they can take because they have only so much equity to support a given credit rating for the asset risk they are doing. Every firm has this, but public firms have access to capital markets at cost that can issue equities. Private entities don't have that alternative. So they have a binding risk budget.

Here's another way to think about it: Consider a balance sheet of a REOC, with assets on the left side. Whatever the assets are, measure their total volatility. Whatever credit rating you want to set for the financing of those assets, fix that. Those two things—the riskiness of the assets and the credit rating for the financing—determine how much equity the firm has to have. It has no choice. There are no more degrees of freedom. So you understand that whatever the volatility sources on the left side of the balance sheet, the firm must have the appropriate equity cushion, which has a cost.

Suppose the REOC could strip out the components of the risk it is taking in its real estate businesses that are not necessary to add value. These are generic risks in the sense that they are not risks for which the REOC is getting extra returns. It is not a risk reflecting a comparative advantage of its ability to know local real estate or its experience in developing or whatever its expertise may be. It is just generic risk: either interest rate risk or risk to real estate markets in its area and so forth. Suppose the REOC could get rid of real estate risk it has no control over and no comparative advantage with and continues to perform the same way it was before? What would that do? It would take some of the volatility out of the left side of the balance sheet. That means for the same amount of equity and for the same credit rating, the REOC creates the capacity to do more projects that are adding value, to the firm's comparative advantage. How can it do that? Suppose the firm enters into a total-return swap in which it pays the return on some broad index of real estate, but some amount of the real estate risk is generic, passive risk. If the REOC had an efficient way to strip that out, you see how that would improve the firm's capacity to do what it is good at. That is a real potential value adder.

I bring that up because there is also potentially significant supply for swap contracts on the investor side that would like to have generic real estate exposure but don't want to get involved in the actual purchase of the real estate. I believe there is a two-sided market. Two-sided markets meaning, fundamentally, on each side of



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the market, there are natural players who want to be on that side. Two-sidedness is a precursor for the potential to have a well-developed market. If everyone wants to be on one side of the market, it gets very tough to develop it.

A Derivative for Tenant Credit Risk

My last point is to think across market opportunities. We have talked about derivatives in the real estate market; we have discussed issues and problems with respect

to liquidity. But there are other markets that may be of some interest. I know people in real estate are using the interest rate markets to hedge what they perceive as exposures they have there. That's routine and is an example of working in a non-real estate derivative to deal with some of the risks associated with real estate.

Another area that is exploding is the credit derivative market. Basically, there are deeply traded indices in credit space, 400, 600, maybe even 700 company names for which you can buy or sell credit protection. You can trade it in all kinds of forms. You can buy an instrument that says if company A defaults, you'll get paid a prespecified amount of money. You can buy protection or sell protection against default bankruptcy in the credit markets.

Where might you use that? I get the impression that some of the risk associated with real estate has to do with long-dated leases and to counterparts with multibillion-dollar market caps that seemingly almost overnight are worthless. Point being, to the extent that you have long-dated lease risk, credit risk, ask yourself, "I'm a real estate person; do I have a comparative advantage in doing credit analysis?" With all respect, I would say probably not. And maybe that is a risk that doesn't add value to the business, particularly again for REOCs.

You can go across markets, use the credit derivative market to buy protection, protect your leases or any other contracts you have with corporate counterparts. I'm throwing that on the table as another tool to decompose and manage the risk so you can ask the question, "Do I want to take that exposure; is it adding value to our portfolio, or is it just taking up risk capacity with no other benefit?" and do something about it. Similarly, there are things you can do with the equity market derivatives to hedge off.

I hope you sense my enthusiasm for this subject, even if you didn't get all the lyrics. The first time I hear a song, the second time I hear a song, maybe even the fifth time I hear the song, I don't know what the singer is saying. But I still say, "Hey, that has a nice tune." Eventually, if I hear it enough times and I still like it, I get to know the lyrics. If you haven't gotten the lyrics, my fault; I sure hope, though, you got the tune. Thank you very much. ■