



Longevity and mortality risk

Uncertainties about future mortality and life expectancy are proving a problem for pension funds and insurance companies. They are increasingly looking to hedge longevity risk, but the market is lacking instruments for it to hedge against. Last month, in conjunction with Tullett Prebon, Risk hosted a roundtable to discuss the ways of assessing longevity risk and the development of such a market

Risk: How important is longevity risk within life insurance and pensions? How aware are pension funds about the risks within their policies?

Thomas Streiff (TS): Pension funds and insurance companies are well aware of the risks. What to do about the risk is the bigger challenge. Managing longevity is extremely important and it is a significant risk. If you just look at the annuity market place in the US – which is where most of the annuity business is today – it is an extremely large business and has been growing rapidly. In the first half of this year, it experienced 10% growth over last year. The living benefits in annuities are much more complicated than a typical pension annuity, which is a straight life annuity or joint life annuity.

Christopher Murphy (CM): The actuarial profession has been tasked with predicting mortality through the years, but history tells us that it's extremely difficult to get these assumptions right and has highlighted the difficulty in dealing with this issue.

Risk: Are pension funds aware of some of the deficiencies of the data on mortality?

Matthieu Robert (MR): We don't have full transparency, but pension funds have been slow to update their estimates of life expectancy. In the UK, some companies have recently been forced to be more conservative and increase the life expectancy of their policy holders under IAS19 and the *Pension Protection Act*, however, there are still some using aggressive assumptions. As for their awareness, we can



Thomas Streiff

The Panel

Barbara Blasel Global risk solutions, BNP Paribas

Benoit Chriqui Director, Head of inflation trading, Barclays Capital

Evan Guppy Manager, Inflation structuring, HSBC

Nadir Latif Business development, Member of Executive Committee, Tullett Prebon

Christopher Murphy Managing director, Morgan Stanley

Yan Phoa Director, Derivatives trading, Lehman Brothers

Michaël Picot Director, Alternative derivatives trading, Calyon

Matthieu Robert Managing director, Head of inflation, Dresdner Kleinwort

Thomas Streiff Managing director, UBS

Nicolas Tabardel Vice-president, Inflation trading, Citi

see from the end of the 1990s and the beginning of this decade that it is only when long-dated interest rates dropped to historical low levels that they realised they had problems with their guaranteed annuity obligations and the potential losses they were facing. They bought a lot of long-dated receiver swaptions to cover their risk. It is interesting to see how quickly they went from no hedge to executing huge hedging programmes against falling interest rates.

Nicolas Tabardel (NT): If we go back to before 2000, the typical pension fund was heavily invested in equities, and equities were going up so longevity was not too much of a concern to anyone. After 2000, equities went down and rates fell, which increased liabilities and people started to realise that there is a lot of risk here. Since then, we have seen more and more liability-driven investment (LDI) and, in a typical LDI approach, the manager of the pension will try to quantify and hedge inflation risk, interest rate risk and longevity risk. The first two are now quite easy to deal with, but for longevity risk there are a lack of instruments, although there is more and more will to deal with this.

Evan Guppy (EG): The reason we are seeing pension buyouts is that people are really concerned about interest rate risk, inflation risk and longevity risk. There is a premium they can pay in order to make those



Christopher Murphy

problems go away. The problem is that the cost of that risk transfer is too great for many pension funds, which is why we need capital markets solutions to bring in more participants to take on that risk.

Risk: Do you feel that the clients you are speaking with are moving more towards the buyout solution or are people crying out for more financial derivatives to manage longevity?

Yan Phoa (YP): The emergence of the bulk buyout business was driven by a big change in the regulatory and accounting regimes for pension funds. The UK has probably gone furthest in valuing and marking to market these liabilities through the corporate balance sheet. Rating agencies have started to focus on them too. For the pension fund trustees, there is much more personal liability to ensure they are acting in the best interests of the pensioners. So, overall, people are much more aware of risk. Pension trustees are looking much more at whether they are adequately funded from a personal liability perspective. What this has done is make corporates realise that they don't want to have this unknown liability hanging over them. This, in turn, has driven the emergence of this buyout market where people are willing to take on that risk at a premium to where, historically, those liabilities had been valued. Insurance companies have to price it for the uncertainty of the future. From the pension funds' perspective, as long as the corporate sponsor is financially sound, any mistakes in the estimation of this risk can be rectified by going back and changing the contribution they are receiving. A pension fund will mark it only to where it is reasonable, whereas an insurance company has to mark it for future uncertainty and that naturally is done at a cost as they will have to be more defensive in their estimates.

Risk: There has been a call from the media for pension funds to be more transparent in their mortality assumptions. Is this possible?

Barbara Blasel (BB): It is possible, although the modelling and the determining of the data is an issue. All the evidence points to a systemic underestimate of future longevity improvement at all times in the past. We somehow have to get there to determine longevity and improvement in mortality in order to build up a market, but it will take some time to find standardised mechanisms to do so.

CM: If there is a deep and liquid market in longevity risk, this problem would go away. We would no longer need to make the assumptions. If you go back 10 years, pension funds needed to make inflation assumptions, now they don't. The market decides it for them.

Risk: What role have reinsurers played so far? Is that the best route to take?

TS: We are going to see an increasing role for reinsurers. We now see reinsurers emerging as a potential solution for all of these risks and taking them in a package. Most investment banks look at the risk of inflation and capital markets as part of the things that they do, but they don't necessarily want to deal with longevity risk or behaviour risk that we are talking about in annuity, so they want that to go somewhere else, whereas reinsurers could take on all of

the risk and then distribute what they don't want.

Benoit Chriqui (BC): The advantage of reinsurers is that they can be flexible in terms of structures or formats, they can be quite accommodative. But they are not going to be the driver of the market. First, they are interested in risk diversification, and longevity risk is just one type of risk, even when you consider very different pension schemes, so they will be limited in terms of size of transaction they are willing to do. Second, they are relative-value players, so they are only going to be interested in the trade if they can collect a premium to where they see fair value. The pensions on the other hand might only be interested in hedging if it is close to where they are currently valuing their liabilities, so might be reluctant to trade at the premium demanded by reinsurers.

BB: Reinsurers have some kind of diversification by not only absorbing longevity risk but also mortality risk. It's not a perfect hedge but there is some degree of diversification that probably allows them to absorb more risk on the longevity side. But there is one constraint on the reinsurance side, which is capacity. In recent years, there has been a decrease in the number of reinsurance players.

Michaël Picot (MP): Giving all the risk to a handful of companies is not the targeted solution. Reinsurers might have the capacity to generate more returns than the pension funds, but they would need to extract the longevity component and distribute it to the market. This is precisely a role longevity derivatives can play.



Nadir Latif

Risk: There have been attempts to launch longevity securities; BNP Paribas was involved in one of the bonds in late 2004. How do you describe the attempts to get this off the ground so far?

BB: The feedback was very positive. That was the first attempt to hedge against longevity trends. It was probably a bit too early for the market, therefore ultimately the bond hasn't been issued. The reasons for that are manifold. One was the introduction of the pension reform at the same time, so pension funds were more focused on that. Also, a supranational was the issuer, so yield was lower than some participants were expecting. On the other hand, to provide a stable, long-dated asset, it was important to have a high rating from the issuer.

Risk: What is the potential for longevity-linked securities?

NT: One issue with the bond format is that the buyer then takes on the credit risk of the issuer. If you're trying to hedge longevity risk with a () bond, you introduce a new problem with the credit risk, and that is at least as important as the longevity risk you were concerned with in the first place. Maybe a derivative format is better, because the credit risk can be managed with a collateral agreement.

CM: That was the problem with the BNP Paribas structure in that it wasn't leveraged in any way. So, if you wanted to hedge out your longevity risk, you would have to put 100% of your assets in this bond. That is just not a feasible solution. At Morgan Stanley, we took a mandate from an insurer and worked on a similar type of project for 12 months where we designed a bond that would pay a

high coupon that would be reduced if longevity turned out to be greater than current assumptions. The problem was that at least half of the investors were not interested and 80% of the remaining half was not allowed to invest in this product.

YP: Having a funded instrument is not going to be how the market moves forward. The other problem with the bond is that, for it to have some sort of liquidity, it needs to be large and a one-size-fits-all solution. It is going to be hard to get enough people to feel comfortable that the basis risk is acceptable.

NT: There is also the issue of supply. We know where the demand will come from: pension funds. But who is going to supply the risk that we need? There is a partial hedge in mortality risk, but there is still a need in the tail of the distribution that we cannot source.



Matthieu Robert

Risk: What are your views on the basis risk issue and the one-size-fits-all argument?

TS: I'm optimistic about a future for an index approach but my optimism is tempered by the issues raised. If I separate the market into annuity and pension funds, the basis risk is probably more manageable on the pension side. It's still an issue but a bit more manageable. On the annuity market, because those are voluntary buyers and you have natural anti-selection with voluntary buyers, the basis risk can be much bigger.

CM: Doesn't that suggest that you just need another index?

TS: It may, in fact. If you can match an index that takes into account your anti-selection then you're in business. That is difficult to do because what you're trying is to get the buyer to be the seller and that is where your challenge is.

YP: On the annuity side, it's a much more concentrated market and the competitive advantage of annuity providers is the information they have. That data is proprietary and for them to say they are going to contribute in-house data that is their competitive advantage into an industry effort is going to be tough.

TS: You can get them to contribute the data such that they are giving you meaningful information by virtue of what they are buying and selling as opposed to what they collect in their own database. That is hard to achieve but that is how you will end up with an index that is matching what is actually happening in a place where you have voluntary buyers.

EG: It is going to be quite difficult for a funded instrument to work because the trustees and pension firms that are most aggressive in trying to address their problems are the guys that are pursuing interest rate and inflation strategies. For them to change their approach to longevity and to reintegrate their asset and liability management seems unlikely. But, if you're trying to go down the derivatives route, then sure, there is no reason why it couldn't work.

MR: Concerning the index, if you want an interdealer derivatives market on longevity risk to develop, you have to agree on one or two indexes. It is most likely that we will have global indexes (i.e.,

on national population) trading. Pension funds will have the choice to hedge their exposure with the global index and keep the basis risk or to try to pass the risk relative to the subindex to which they are exposed to a bank. With the first approach, I think it is possible to work with the pension fund on historical analysis and comparison between the global population and the particular population of the subindex in order to come up with some appropriate hedge ratio between the pension fund risk on the subindex and the hedge on the global index.

Risk: There have been a number of attempts by banks that have started developing indexes. Is there an obvious candidate as to the type of index we could use? What are the obstacles?

BB: The idea should be to work on some kind of standardised index because it's the only way to allow for the development of a derivatives market and to have transparent indexes that are tradable. On the other hand, even setting up these indexes is already an issue because forecasting longevity expectations for the next 30 years is quite hard. We have to start with population mortality data because this database has sufficient historical information. To set up forecasts for the next 25–30 years, one would need an observation period of 30 years or even more. It would be great to have also subindexes that cover certain groups of the population, such as specific professional groups, and also cover regional differences within one country. But, in the end, it comes down to availability of robust data. Although longevity is seen as a global risk, risk sellers would definitely want to have their particular geographic exposure reflected, so one could possibly think of a handful of indexes for the main markets from which companies can choose and design their individual derivatives to reflect their specific exposure. This would, in turn, become their individual exposure.

MP: Even population mortality rate is a debatable issue because it is a difficult figure to produce, for example, due to infrequent population censuses. Still, I expect to see two types of indexes. The first one would be life expectancy index, just quoting life expectancy at birth. The second approach is the life metrics approach based on explicit qx ratio, which is much more ambitious and therefore allows things like quoting the different life expectancies at a given age. It also gives more room to hedge longevity with mortality and a simple way to address the basis risk with a 'technical age' approach (sliding on the curve to project one's specific population on the general population).

BC: On the derivative side, I agree it is impossible to have the market develop with multiple indexes. There is not enough two-sided interest to create many small markets, so you need to have everyone focus on one specific index to help improve liquidity. The problem on the pension side is that they will not view a central index as a particularly good metric for their own longevity exposure. There needs to be education to the pensions in terms of showing and explaining the correlation between different indexes and how using



Nicolas Tabardel



Evan Guppy

a central index would not be a bad hedge. But even then, it will still be difficult, because although a central index would be a good hedge, if it is used to value the liabilities, it could still give a very different value because of basis difference, and pensions might have a hard time not valuing their liabilities at the same level as their hedge. The other point is that there are lots of banks thinking about indexes and how to construct them, but the first difficulty is data collection. You also need to have a robust metric and have a transparent way of collection that is unbiased. On that note, it would help if the government got involved and stepped in to recommend a metric to be used in valuing longevity liabilities, and then have an office that would be in charge of collecting the data.

YP: We need a transparent and impartial data collection method. The government fits that role very well. You got to have the commitment to produce the data on an ongoing basis. We're talking about transactions that are going to span the next 20–40 years. The market needs to feel comfortable that the data is going to be provided in a consistent manner. It needs to be timely, you need a long historical series so you can understand the behaviour of the index in the past. There will be basis risk between how their particular population behaves versus the general population, but what you're trying to hedge is the change in the trend in the future.

EG: I don't think the government needs to get involved. There are examples in the property market and indeed in credit derivatives where it is quite possible to have an independent market-wide body to collect the data. The key point is really more about independence. If you want to use derivatives to draw more players into the market, that means you want data that is supplied by someone who is visibly independent, visibly reliable. If you're saying you want life insurers and pension funds to be trading with money managers and hedge funds based on data that is collected by the insurers and the pension funds, then it's probably not going to be very appealing for the money managers. The government is already collecting that for the widest possible population set you can have in the UK. The other point is how do you use that to construct a tradable index? I think people would be more comfortable if, as a group, we come up with some methodology and some index that would either be an independent market-based index that could evolve out of something that was one firm's idea but is ultimately owned by the whole market.

NT: I see a parallel to the inflation market. There is a basic trade-off between liquidity and basis risk in trading one single index versus multiple indexes. In the inflation market in Europe, the market is concentrated on European inflation – that's where the liquidity is. It's transparent and liquid. On the other hand, you have firms' liabilities that are not indexed to European inflation but that use European inflation to hedge. They can use French inflation, or Italian or Spanish but it's less liquid and is more expensive. It is less transparent. We are always going to have this kind of trade-off. Whether we trade a single longevity index or several, the question is: who is going to

warehouse the basis risk? Is it better to warehouse the basis risk in banks or in the pension funds or clients? If the bank is required to provide customised index for clients, then it will have to hedge with a liquid index and warehouse the basis risk. If it has a cost, is it more efficient to have a cost in the bank or to have the cost at the client?

MR: There is no choice at the beginning but to go for a standardised index. What is important is the transparency and the independence in the building process of the index. I am quite sceptical of any index that is built by a bank, even if it is relatively transparent. I would typically prefer something built by a government institute. For example, the Office of National Statistics (ONS) in the UK has already started collecting data on mortality rates for the country. The ONS data is published on an annual basis. The idea will be to use this set of data and have a panel of banks agreeing on how to construct the index based on this set of data.

TS: Standardisation is a good idea. A certified pension actuary society and a society of actuaries on the insurance side could play a role in gathering the data. They do a better job of gathering and analysing the relevant data. In stable population countries, generally mortality data is better than in countries where you have a lot of turnover in the population through emigration or immigration. General population data in the US is skewed because of the high level of immigration. That is an example where we would never rely on that data. We would rely on Society of Actuaries data or pension actuary data if it's on the pension side. That's where we have historically looked for standardised data. That is exactly what you are doing in buyout situations: you are placing the longevity risk with an entity that understands the data from a very different perspective than what you get in a generalised government index. I'm in favour of a standardised index, but it's not as big an answer as might otherwise be viewed because of specific challenges of the data.

Nadir Latif: There has been a lot of discussion about indexes based on government statistics. Would the market prefer an index provider that is owned by several of the large banks and/or the interdealer brokers? In terms of developing the market place, getting a group of banks to agree to take joint ownership of a company that is independent in constructing the methodology of the index might be the quicker way to develop the market rather than going down the route of a link with a government-based entity. Of course the independent company could still base the index on government-based data.

BC: If I were a pension fund, I would disagree with a group of banks gathering the data to value my liabilities. If different banks in the group had different interests, then this method would be fine, but here banks are likely to always take the other side of the pensions. The most important thing in this case is to get the pension funds comfortable with the level of impartiality and that means not owning the collection process or the creation of the index process.

EG: One of the advantages of having an independent firm collect



Yan Phoa

the data is that, as soon as the firm is up and running and publishing the index, you then have the banks that have committed themselves to supporting the index.

YP: One concern is continuity of such an index. It has to be a long-term commitment. You have to have the commitment to see the market succeed, at the same time, you have to make the commitment to fund the index.

NT: As a client, I would be very wary of an index that is sponsored directly by banks, whether by a single bank or a group of banks. What happens if my bank doesn't sponsor the index? Do I get the data later, do other people have better information? That's the dangerous issue. There is also an issue of the continuity of such an index. It's hard to guarantee that as a private entity that is owned by a group of banks. The only entity that can guarantee that over a lengthy time horizon is the government.

CM: It needs to be based on government data, but there is no way that the government is going to start publishing an index, so it will have to be an independent index provider but maybe based on ONS data. The involvement of actuaries in publishing that index would be detrimental to the success of that index and there is widespread scepticism about the value-added of actuaries in that process.

BC: The end-user should ultimately decide. There should be more fact-gathering as to what type of central index would make sense to somebody who has exposure to a subindex. Because the basis risk is so important, there is a high likelihood that, if banks get together and set up an index without properly consulting the end-user, that this index will not be well received.



Barbara Blasel

Risk: Is there any interest from clients about having a solution built for them? Is there consensus over the methodology for a standardised index?

BB: Clients are relatively open in terms of the types of solutions they are looking for. In terms of indexes, market players need to get comfortable with the modelling, and then transparency and continuation are key in this context. As long as one can agree on a single methodology and really continuously focus on this methodology, then this is the driver for market participants getting comfortable with the modelling and the analysis.

CM: Having a level of subjectivity in the creation of the index is probably something that the pension and life insurance companies would want to see because that is what they are comfortable with and used to. But if you are talking about attracting new pools of capital, like hedge funds, to this market, we will have extreme scepticism about any potential tweaking to the underlying data that is at all subjective.

YP: I think that is a fair point. There's trying to get the best information out of the data and trying to keep the data as close to the raw form as possible. I would argue for trading that each institution can do what it wants with the data in-house. What you



Benoit Chiriqui

actually trade and settle the trades against, you may find that you always want to revert to the raw data.

TS: And that's how mortality tables are used now in the insurance industry. They take a standard mortality table and adjust it for their circumstances. So they will take what is, in essence, raw data and put their own subjectivity on it based on how they want to price that business. So I can see exactly the same thing happening here.

CM: To some extent, banks are indifferent as to how the index is constructed. It matters more to the end-users who are going to end up wearing the risk. And so, maybe the pension and insurance industry should be discussing this topic as well and saying what they want the index to look like.

Risk: How big do you actually see this market becoming? Are we seeing any swaps and forwards transacted at this point in time, or is it a little too early?

BC: There is some activity. But there are a couple of issues on which we have touched that make it a little difficult to see how this market is going to develop into something very large such as the inflation market. There is significant end-user interest, and defined benefits schemes are heavily exposed to longevity. But you have a very one-sided business. One problem I see with this market developing is that the end-users are currently using their own assumptions. If they used the buyout assumptions, it would be more expensive for them. If a market started to develop, where would that market start to establish itself? At the buyout assumption? Even more expensive than the buyout level? And then, once you have an actual active market, these pension funds to some extent will have to market-to-market. Even if they claim their basis is different, it will become more difficult to justify the assumptions they are using. To some extent, the end-users who most need this market to hedge their liabilities might also be reluctant to see it develop in a transparent way.

EG: There is a definite first-mover advantage for the pension schemes that do something if a market gets up and running. Part of the reason for going down a capital markets and derivatives route is trying to get more players involved. The question is whether there are sufficient investors interested in taking on some of that risk to offset the £1 trillion in pension liabilities. That is the great unknown at the moment and, until the market gets up and running, it is difficult to see whether money managers, hedge funds or anybody else are actually going to be willing and how much money they are going to be willing to put up and at what price. One thing I would hope is that, if you are going to have more people involved in that space that can take on the mortality risk, then hopefully the market will start to offer inside where buyouts are at the moment.

CM: This market may take a lot longer to develop than perhaps we're all hoping for because you can argue now that pension funds potentially shouldn't be marking to an FRS-17 mark, they should be marking to buyout. Buyout prices include the longevity risk associated – that is the only thing that's left to hedge out. I don't see

any appetite at all for doing that. Clearly, legislation has gone a long way to getting pension funds to address the risk embedded in their liabilities and mark them to market, but the industry has been kicked so much that there is no great appetite to create more stress in the system. I'm sceptical as to how this market will develop. I'm not so optimistic that it will come inside the buyout price. For this market to take off, you need new pools of capital to come in and, if money is made available to take on some of this risk, you would be much more inclined to do it within a buyout vehicle because you not only get to take longevity risk at perhaps a good price but you also get control of assets that you can work over time.

Risk: Have you seen any trades of this kind in the market?

NT: Not directly in longevity derivatives, but the buyout market has been very active. There has been a recent twist in the buyout market, where Citi did a transaction with Thomson Regional Newspaper (TRN). TRN effectively transferred the financial responsibility for its pension fund to Citi. What is interesting is that it allowed us to operate under pension fund regulations, not insurance regulations, which may be more attractive in certain circumstances. That is where a longevity market is needed. It's not as simple as hedging interest rate risk. It's a trend that has started and will continue to develop. We will see more and more transfers because it's a very efficient way to do this. It is natural for banks to use an LDI approach after transfers. This is going to create a lot of demand for longevity derivatives.

Risk: Are more institutions moving towards this structure? Were there any regulatory hurdles that had to be crossed?

NT: We are seeing more and more enquiries about this specific transfer. A lot of people are interested in doing similar deals. In terms of regulatory hurdles, there were a few things to check in order to ensure that we could actually do this, as well as making sure that members and trustees were kept in the loop.

Risk: Do we need to come up with more capital-efficient structures before the market can gain traction?

TS: One of the ways I look at it is dividing up the markets and then dividing up the risks within those markets. If you look at the US pensions, there is the US defined-benefit pension market, which is worth \$2.3 trillion. Meanwhile, US variable annuities – most of which have benefits that are hedgeable in this way – are worth \$1.3 trillion. It is a huge market place. The part of the market that has the most capital markets solutions attached to it so far is the US variable annuity market. There are banks that are stepping in and taking longevity risk in those transactions, there are reinsurers that are stepping in, there are those that are just taking the volatility aspects of it. The insurance companies keep the longevity risk if they want to, and there are plenty that don't want to. But they don't want the volatility and the mark-to-market aspect of the liability, so they'll ask an investment bank to come in and take out that volatility. I may be the most optimistic person at the table in seeing this market develop and maybe that is because I see it developing so rapidly and so much money being spent by insurers in the US to hedge these risks today in a lot of different ways. They range from futures to cashflow-structured over-the-counter hedges and everything in between.

YP: The trend is for risk to be transferred now that people are much more aware of risk and the impact of volatility. That is going to be a secular long-term trend – risk is going to be aggregated and managed and it will be from different sources and disaggregated into its different components or different risk aspects, some of which can be hedged today and some of which will need to find a market. It is a question of what price and how much capital you can attract to take on that risk. That is something that everyone is



Michaël Picot

bullish about. What form that takes with regard to mortality and longevity risk is hard to say at this point but it will happen, that risk will get disaggregated from all the other risks that traditionally come bundled together.

Risk: Is this going to be vanilla in terms of derivatives?

MP: I do not think that longevity derivatives will be merely designed to address the pure longevity risk. They will also be tailored to meet the demands of the new regulatory or accounting rules and their underlying shift towards mark-to-market approaches. These typically require giving a value to the mortality/longevity contingencies embedded in products otherwise sensitive to market shifts.

EG: As with inflation it is an unbalanced market as end-users ultimately get what they want. Banks end up with basis risk between different inflation indexes or seasonality risk that they cannot hedge but hope that they have priced correctly and will balance out. It is hard to see mortality as being similar to that. The market will need to find people who are willing to take on and price basis risk in return for a risk premium and it is there that the transfer of risk from end-users will take place.

BC: Swaps are the building blocks. The derivatisation of the risk really happens when you have different interests and an active market. The problem with the longevity market is that it is very much a buy-and-hold market, so I don't see volumes being very large in terms of interbank dealing and, if they're not very large, then it is very difficult to go to the next level of derivatisation. It is going to be difficult to have an interbank market on volatility, for example, for a long time. That being said, because transactions are likely to be bespoke, end-user structures could very well immediately be very complex. Maybe one could have some optionality or something exotic embedded in the first trade with a reinsurer on one side, a pension on the other side and a bank providing the structuring and keeping the unhedgeable correlation or volatility risk. But, in terms of the development of the interbank market, it should be slow.

NT: The first step is to agree on a forward curve and we are not even there yet. If there is going to be any complexity in the market, there is more going to be because of different subindexes that people want to trade rather than trading more complex structures that include volatility features. The subindexes will be the drivers of the complexity.



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Cyril Gonzalez
Head of index-linked derivatives
T. +44 (0)20 7200 7000
E. CGonzalez@tullettprebon.com
www.tullettprebon.com