

**United States of America
Financial Crisis Inquiry Commission**

**INTERVIEW OF
ROGER STEIN**

Wednesday, May 26, 2010

***** Confidential *****

INTERVIEW: V. CUNICELLI AND R. BUBB WITH ROGER STEIN
MAY 26, 1020

VICTOR CUNICELLI: This is Victor Cunicelli of the Financial Crisis Inquiry Commission. Today's date is 26 May, 2010. The time is approximately 2:30 p.m. eastern standard. I'm accompanied by Ryan Bubb, of the FCIC, and some attorneys. We're at the law offices of Sullivan & Cromwell for an interview of Mr. Roger Stein. This interview will be recorded with the consent of Mr. Stein. Mr. Stein, could I get your assent for the record?

ROGER STEIN: Of course.

CUNICELLI: Will everyone please state your full name and affiliation for the record, and please spell your last name for the transcriptionist. I'll start. Cunicelli is C U N I C E L L I. Mr. Bubb?

RYAN BUBB: Ryan Bubb, with FCIC. B U B B.

STEVEN EHRENBERG: Steven Ehrenberg, E H R E N B E R G, of Sullivan & Cromwell. And with me today is Matthew Sullivan. Go ahead.

STEIN: Roger Stein from Moody's Investor Services, S T E I N.

CUNICELLI: Mr. Stein, in the way of background, the FCIC was established by statute public law 111-21 and signed into law by the president. It is bipartisan, consists of ten commissioners. It's charged with examining the causes of the financial crisis and collapse or near-collapse of major domestic financial institutions. The commission is charged with composing a report of findings to the President and Congress by 15 December 2010. The Commission may compel attendance and testimony of witnesses and production of records. I could provide you a copy of the statute by which the commission was formed, if you so desire.

STEIN: Okay.

CUNICELLI: Please be advised that the FCIC is an agency of the United States, and FCIC staff are federal employees under the aegis of 18 United States Code Section 1001 concerning false statements. With that I'd ask you just to keep in mind anything that comes before the commission, we request confidentiality on topics presented and whatnot, of course outside your confidential speaking with counsel. Oh, I was just going to give you a caution about please make all your responses audible and verbal. No head nods or whatnot. And I was going to give you the Rosetta Stone here. If we put up a finger, it basically means can you stop talking for one second, we want to clarify or whatnot so that we don't have crosstalk on the transcript. With that, I'll turn it over to Mr. Bubb.

BUBB: _____ I confess, I'm the--

CUNICELLI: I apologize.

EHRENBERG: May I just make a quick remark for the record?

CUNICELLI: Of course. Caveat.

EHRENBERG: We just wanted to note that although this is being taped, it is a voluntary interview and not a deposition or sworn testimony, and it's not being conducted pursuant to the federal rules of civil procedure and because of commission procedures, we're not entitled to make formal objections and any future parties that may come into possession of the recording or transcript made from that recording should understand those limitations.

BUBB: Mr. Stein, I should confess that I'm the first to violate this, put the finger up and not interrupt so do as Vic says, not as I do. And while this has the appearance of a sort of formal deposition, it's really not a deposition. So let me just give you a little context for why we're here and what my goals are. So as Mr. Cunicelli, I work on the Financial Crisis Inquiry Commission. It's a congressional body charged with investigating the causes of the financial crisis. Congress passed a statute which created us, specifying 22 factors that Congress thought the commission should investigate. And then we had ten Commissioners appointed by both the Democratic and Republican leadership of Congress, who give us direction about what indeed we should be investigating. One of those topics that they've asked us to investigate is the rating on mortgage-related securities. Obviously, mortgage-related securities--many performed much worse than they were expected to perform over the last several years, and so understanding how those poorly performing securities got rated Triple A or otherwise investment grade is something we're trying to figure out.

I am, in fact, nominally a lawyer, but I'm not really a lawyer. I am indeed a member of the Bar, but I'm really a social scientist. I'm trained as an economist, and it's my job to educate our commissioners, who come from all manner of backgrounds, so they can understand how exactly Moody's rated mortgage-related securities, in particular residential mortgage-backed securities, which I'll refer to as RMBS, encourage you to as well, if that's a convenient acronym.

And so I'm here today for you to educate me so that I can educate them because obviously you know a ton about the way these securities were ultimately rated, the models that went into generating loss distributions for the mortgage pools and how that ultimately translated into the ratings on the liabilities of the structure.

STEIN: Okay. Maybe I should clarify what my role is?

BUBB: Great.

STEIN: I actually built models, but I never sat in the rating committee on subprime mortgages.

BUBB: Great.

STEIN: So it may be the case that you'd need to talk with other people who were in the committees, if you want the full picture.

BUBB: Of course.

STEIN: Okay.

BUBB: Why don't we start with, can you give us your educational background?

STEIN: Sure. I did my undergraduate work at the State University of New York in Bennington. And I got a master's and ph.D. at NYU.

BUBB: In?

STEIN: What was then called Information Systems, what's now called Statistics Information Systems and Operations Research.

BUBB: And can you give us your employment history at Moody's, when you started, what your title was, what your role was and it evolved over time?

STEIN: I started Moody's in 1989, as an associate analyst. I had a job in the structured finance department rating CDOs they were called them, providing support for analysts. I then moved to the newly-formed speculative grade ratings group, to rate speculative grade debt. I was charged with developing some statistical rating models.

BUBB: What year was that?

STEIN: I believe in 1990, I think. Then I did some additional work on the modeling side, miscellaneous things in the financial institutions group. And then I think I moved to the public finance data support group. Sorry, first I moved to the technology group. Then I moved--

BUBB: What year did you move to the technology group?

STEIN: I don't remember exactly. I think it might have been '94, '95. I should say I've been at Moody's for 20 years so I may not exactly remember the dates.

BUBB: Of course.

STEIN: Then I moved from there into the support group for public finance, a data support group, my first managerial job, of a nine-person group. And, from there, I joined a newly formed venture that Moody's was starting, called Moody's Risk Management Services. The idea was to produce quantitative non-ratings-based measures of credit risk. Moody's acquired a company called KMV and--

BUBB: KMV?

STEIN: KMV. And I think it was 2002. The KMV company and the MRMS Group, MRMS Group, merged, and I joined the head of the research department there, with another fellow. And, in 2005, I rejoined Moody's, and I had responsibility for managing the funds group.

BUBB: So just to clarify, when you co-headed research for the merged MRMS and KMV, this

was a Moody's subsidiary?

STEIN: A Moody's Corporation subsidiary.

BUBB: And it was separate from Moody's Investor Services.

STEIN: It was.

BUBB: And so this is why you went back to Moody's Investor Services.

STEIN: Exactly.

BUBB: I see. I'm sorry. Continue: Moody's Investor Services, what was your role and profile?

STEIN: I was charged with two things. One was developing a new loan for subprime mortgages. And the other was to manage the funds group. Managed funds group it was called.

BUBB: Okay. And that's where you are today? That's your role today?

STEIN: From there, we spun off the modeling part of the business, and a new group was formed, called the new products group, in about 2007. And that group was charged with developing tools for the rating agency, outside of the rating agency. And that group was then merged back into the rating agency around 2008, but I'm not sure. And that's now my group which is called quantitative research and analytics.

BUBB: To make sure I understand. So in '05, you returned to Moody's Investor Services, and one of your roles was to develop a new model for rating subprime mortgages, but the modeling group was then moved into the new products group?

STEIN: Yes.

BUBB: Along with you. You moved to the new products group.

STEIN: Yes.

BUBB: Still part of Moody's Investor Services.

STEIN: I believe the new products group--I have to confess I don't remember the organization structure. Maybe part of Moody's Corporation or part of Moody's Investor Services, I'm not sure.

BUBB: Okay.

STEIN: And that's something we can get back to you on.

BUBB: Sure. Sure. And then now that new products group has been folded back into?

STEIN: It was broken into two groups, one that was a software business, and the other turned

into a group called quantitative research and analytics, and that's the group that I head. The funds business was also spun off of that group into the financial institutions group, I believe. But I'd stopped managing the funds group in 2007.

BUBB: And the quantitative research analytics group?

STEIN: And analytics.

BUBB: What is the larger unit within what that sits?

STEIN: That's in Moody's Investors Service.

BUBB: Is there some intermediate unit that it sits in?

STEIN: No.

BUBB: Okay. So it's not specific to structured planning?

STEIN: No.

BUBB: What is your precise title?

STEIN: Group managing director.

BUBB: And you're responsible for the entire group, quantitative research and analytics group?

STEIN: Yes.

BUBB: And how long have you been group MD?

STEIN: I think maybe a year, year and a half.

BUBB: And what was your title before you were group MD?

STEIN: Team MD.

BUBB: And what team were you MD for?

STEIN: Again, it was two teams. One was a small research group that developed the subprime model. And the other was the managed funds group.

BUBB: I see. Forgive my confusion. And how long were you a team MD? Or since when were you a team MD, do you recall?

STEIN: A team MD title was a title that didn't exist when I became an MD, I think. Maybe it did, but it was, I think, 2001 or 2002 I was promoted. 2001 I think it was.

BUBB: Was when you became MD?

STEIN: It could have been 2002.

BUBB: I see.

STEIN: During part of the period, I also think around maybe '92, '93, a period, I was in Japan a lot doing some business for us there, developing tools for the Japanese office to use. I forgot to mention that.

BUBB: Oh, sure. So I want to understand this subprime M3 model.

STEIN: Okay.

BUBB: And you seem like the person to educate me on how it was developed.

STEIN: I can tell you broadly about it. I didn't fit the model, but I can tell you about how the model pieces come together.

BUBB: Fantastic. So this is 2005. You're headed back to Moody's Investor Services.

STEIN: Yes. Moody's Investors Service.

BUBB: Moody's Investor?

STEIN: Investors Service.

BUBB: Investors Service. Plural on Investor, singular on Service.

STEIN: An apostrophe on--.

BUBB: I see, possessive.

STEIN: Actually I think you're right. There's no apostrophe. Apostrophe on Moody's. "S" on investors. And nothing on service.

BUBB: I'm glad we got that cleared up. So who did you report to when you began that job?

STEIN: I reported initially to Noel Kirnon and then to Gus Harris.

BUBB: When did you start reporting to Gus Harris?

STEIN: I don't remember exactly. I think it was at the time when Noel was promoted, which I believe was a few months after I rejoined Moody's Investors Service.

BUBB: And how was this product described to you? What was the goal?

STEIN: So there were really a few different goals, I think. Probably five goals of this project,

maybe four. The first was to take the existing prime version of M3 that had been developed a few years earlier. When I say M3, I mean the Moody's mortgage metrics model. We call it M3. Take that model and using the same modeling framework, build some prime functionality in a statistically rigorous fashion. That was the first objective. The second was to calibrate it so that it produced outputs that were consistent with the expert views of the RMBS experts in the company, primarily in the RMBS ratings team.

The third thing that was important was that the software be able to run quickly so that analysts could do what-if analysis experiment and so forth so you can imagine if a tool requires 12 hours to run for a pool, the analyst can't do that much testing.

BUBB: Right.

STEIN: And then I guess the last criterion was to provide more transparency into the layered risk within mortgage pools.

BUBB: Now there is a tool that existed for rating subprime RMBS at this time, that was used to generate a distribution of pool loss for subprime pools. What was that [pre-existed?]? Did it have a name? Was there a name for this tool?

STEIN: The tool that came before?

BUBB: Before subprime M3.

STEIN: I don't know. I never saw that tool. I never looked at it.

BUBB: Okay.

STEIN: Again, our mandate was to build something from the prime version of M3.

BUBB: That's right. And to supplant the tool that was then being used to rate subprime models.

STEIN: I think the goal was eventually for that to be the case.

BUBB: Yeah.

STEIN: I don't recall that the plan or the execution was a "throwing a switch" kind of a thing. I think it was more gradual than that.

BUBB: Okay. And you talk about calibrating a model so it was consistent with experts on subprime pools in the RMBS group. The natural way to do that, I would think, would be to calibrate it to the prior tool. But that wasn't the approach?

STEIN: No.

BUBB: Why? Do you have a sense?

BUBB: I just want to make sure I understand this. So you've got a bunch of data which we're going to get to eventually just to talk about what the data was, that provided a set of parameters. For example, you mentioned a couple here. 36 CFR 1256.52 Commercial Info

The historical data would tell you that, based on that period from which data came, on average had this sort of sensitivity, but experts in the RMBS group, experts on subprime, thought that those sensitivities were wrong, that they were insufficiently--the historical data reflected insufficient sensitivity.

STEIN: More generally they felt that the losses the model was producing were not consistent with the risks in the pools. They were too low.

BUBB: I see. So this was not based on expert views on this intermediate parameter, but rather views on the--

STEIN: In many cases, it was.

BUBB: Okay.

STEIN: But ultimately, if the analysts' theory about a particular parameter was X and, by setting the parameter by X the losses were not high enough, then we would make other adjustments as necessary. For subprime mortgages during that period, our analysis suggested that 36CFR1256.52:Commerc

BUBB: I see. But the tweak here was, 36CFR1256.52:Commercial Info

STEIN: Yes. 36CFR1256.52:Commercial Info.

BUBB: Sorry. Is it the levels or the slope?

STEIN: 36CFR1256.52:Commercial Info

BUBB: Oh, it was decreased.

STEIN: Yes, decreased.

BUBB: I'm sorry. And what about the slope?

STEIN: 36 CFR 1256.52 Commercial Info

BUBB: I see. Forgive me if you've said this and I just forgot: 36CFR1256.52:Commercial Info

STEIN: The calibration of the model was an interactive process with members of my team, the RMBS team and other groups. So we would meet weekly to discuss different approaches to doing calibration, and I don't recall whether this specific tweak came from a modeler or whether it came from an RMBS analyst. But there was a fair mix of both, I would say.

BUBB: And help me think about this calibration. So one view of what was going on here was that your experts are wrong. The data say what the data say about ultimate pool losses, based on historical experience and that these experts views, in fact, are subject to various biases. We make mistakes. Experts make mistakes. And that you were overriding what the data were saying, based on sort of idiosyncratic views. "Why have a model at all?" would go this view. What do you think?

STEIN: Well, I think several things. One is, I don't think ex-post is necessarily feasible to determine whether a specific view on a probability is right or wrong. I think probability is by construction--unless they're zero--have some probability of happening, and the single draw is impossible to say whether that probability was correctly assessed or not. And that said, I think that history bears out the--let me say this differently. Had we done as you suggest, had we done as you are recommending, for example, we would have had levels that are much lower than what ultimately were assessed by the analysts. Historical data was not capable of producing losses in the tail, particularly that analysts felt were appropriate. More importantly, it couldn't even produce losses at mean, that were sufficiently risky. I sometimes wondered if we had had more historical data whether that would have made a difference, but our recent experiments suggest that, even using this last period of data, one still could not produce losses that are sufficiently large in the tail, based solely on historical data.

BUBB: So do I infer from that, that essentially the losses we experienced over the last several years are unprecedented historically?

STEIN: Certainly the home price decline at a national level is unprecedented since the change of various banking regulations and so forth, yes. At a national level, it's true, I think.

BUBB: And when was the M3 for subprime that you were developing that model made available to analysts rating new deals and actually employed in the ratings process?

STEIN: There was a beta period within the company, which started sometime in the second quarter, I think, of 2007. And around, I think, the beginning of the fourth quarter, the model began to be used, I believe, in a graduated fashion, side-by-side with other analyses and so on as analysts got more experience with it. I think that by probably the first quarter the model was being used more regularly. That said, I think you should probably check with the folks who were actually rating the deals as I wasn't involved with that.

BUBB: Sure.

STEIN: By the--I think the end of the second quarter beginning with the third quarter, there were additional adjustments that were being made to the model to make it, again, more conservative.

BUBB: This is, oh, 2008.

STEIN: 2007.

BUBB: I'm sorry I misunderstood. So the beta period began in what year?

STEIN: I'm sorry. I might have misspoken. April of 2006. Sorry about that.

BUBB: Oh, okay. So April 2006, were [baiting?] the M3 for subprime. By the fourth quarter of 2006, it's being used on some deals, but not all subprime deals.

STEIN: I think I might characterize it differently.

BUBB: Okay.

STEIN: I think it might be sort of being used side-by-side.

BUBB: That's right.

STEIN: And I don't know whether that was for all deals or some deals.

BUBB: And this is side-by-side with what?

STEIN: Whatever the other committee inputs are.

BUBB: And then by Q1 2007, the M3 subprime model is actually being used no longer side-by-side, on its own. Training wheels are off.

STEIN: Is being used as an input into the rating process.

BUBB: Yeah, yeah, yeah, yeah.

STEIN: And I think it might be useful to pause and think about how the models are used within Moody's, at some point. I don't know if you'd like to do that now or later.

BUBB: Let's wait on that. I want to understand the guts of this model first. I appreciate and would like to talk about the fact that the model output is not the exclusive determinant of the ultimate ratings. Well, let's just sequence this, to get into the guts of the model.

STEIN: Sure.

BUBB: And it's all to come out with that model output, and then _____ will say, "Okay. What did we do with that model output?" So you said in 2007 Q2, Q3, you were making adjustments.

STEIN: Yes.

BUBB: Can you explain?

STEIN: Yeah. The analysts using the model had been ultimately assigning ratings with much higher enhancement levels than were output from the model, and there was discussion internally as to whether some of the reasons for their views were transient or were more permanent features of the market. As those features became more well established, we moved some of those external adjustments into the model.

BUBB: _____ so the analysts had been increasing their credit enhancements.

STEIN: Yes.

BUBB: Relative to what was coming out of the subprime M3 model?

STEIN: Yes.

BUBB: And then the reasons for those adjustments were themselves incorporated into--

STEIN: Some of them were.

BUBB: Some of them were. And what were some of the reasons for the adjustments?

STEIN: Some of the reasons, as I recall, 36CFR1256.52:Commercial Info

[REDACTED]

They remained outside. Things of that sort, I think. I don't remember the whole list though.

BUBB: And then anything else in the story of the model rollout? So we're not at the 2007 Q3. We've made more adjustments. What happens then? Any other major or interesting changes to the models used?

STEIN: I don't remember when the different changes went into effect. I don't remember the timing of all this,--

BUBB: Oh, sure.

STEIN: --but my recollection is that the model levels continued to be lower than the committee levels, and, as a result, there was much discussion about whether the model was outliving its usefulness and so forth and how to make it more useful.

BUBB: And do you remember the reasons why analysts were still adjusting?

STEIN: I don't. I don't remember that.

BUBB: Is it still under active development, the M3 subprime model?

STEIN: A new version of the model is under development now. A new version of the model came out, I think, in 2008, and then another new version is just underway now.

BUBB: And what are the sorts of improvements that are being made?

STEIN: Well, we had a longer dataset, a richer dataset. We had learned a few interesting features about underwriting that weren't observable at the time the first model was made. That was built into the model. We also learned a bit from the work we'd done on the prime model. And so we thought about how to incorporate some of those things into the subprime model.

BUBB: What were those?

STEIN: Well, for example, 36CFR1256.52:Commercial Info

BUBB: And those are being implemented?

STEIN: Those were implemented in a series of new releases of the model.

BUBB: And these were improvements that had been previously made to the M3 for prime?

STEIN: The M3 for prime model was also rebuilt last year, and so some of those enhancements were done to that model.

BUBB: Were you involved in that effort as well?

STEIN: I was.

BUBB: Yeah. Okay. This is very helpful. So let's go back to the development of the M3 for subprime model. 36CFR1256.52:Commercial Info
 What was the _____?

STEIN: So the architecture of the model, I don't know if you've had any chance to hear about the model before so, if I repeat something you've heard, please correct me. The structure of the model is such as that there were really three sets of models within it. 36CFR1256.52:Commercial Info

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED] That's how the economic factors enter into the model.

BUBB: And did you simulate out a set of economic factors?

STEIN: We used the simulator that was developed for the prime version of M3. The thinking in doing that was that the same state of the world should obtain for both prime and subprime mortgages with respect to macroeconomic factors. That is, unemployment, for example, in Texas shouldn't be different because I happened to be looking at a prime mortgage versus a subprime mortgage.

BUBB: Was the economic factor simulation, was there a term for this so I sound more intelligent? What would you describe that as?

STEIN: Simulation engine.

BUBB: The simulation engine for the economic factors. Was this updated for all of M3, as the subprime was developed, or did you literally just sort of take off the shelf the existing simulating engine without any modifications?

STEIN: Something between the two. 36CFR1256.52:Commercial Info

[REDACTED]
[REDACTED]

BUBB: Hmm. 36CFR1256.52:Commercial Info

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

STEIN: Yeah, that's correct. That's correct.

BUBB: Could you explain more? Could you unpack that?

STEIN: There were two types of adjustments we made. The first type we talked about earlier, which was,

36CFR1256.52:Commercial Info

[Redacted]

[Redacted]

BUBB: This shock of [this oracle?] simulation, this was done for all 1,250 draws?

STEIN: That's correct. Yes.

BUBB: And was it only done to the Triple A--

STEIN: It was done for every path or every loss in the distribution.

BUBB: Okay. Why call this a shock? Why not just call this the model? Why not code this into the model directly?

STEIN: It was coded into the model directly.

BUBB: Sorry. Let me make it more precise, you describe this as a shock.

STEIN: Yes.

BUBB: When I think shock, I think, well, you got the normal state of things, and now we're going to disturb it in some fashion. Why is that the metaphor? Why isn't it simply, "We have a behavioral model. And, oh, by the way, it gets the five percent number. It doesn't get the three percent number." Why is it, "Oh, we have a three percent model, but then we shock it"?

STEIN: Well, I can maybe clarify.

BUBB: Yes.

STEIN: Maybe you will have a better term for this than I.

BUBB: No, no, no. Sure, sure, sure.

STEIN: This is the first time I've used that term.

BUBB: Okay.

STEIN: There may be a better term that we can come up with together. But the idea was, 36CFR

BUBB: Then the 30 percent number is from historical data--

STEIN: Historical. Yes.

BUBB: --you fit the model to initially, and now we're doing an adjustment to?

STEIN: Exactly.

BUBB: Okay. And that was just part of the model incorporated those adjustments.

STEIN: Exactly. Some of these were substantial.

BUBB: I see. And then the second adjustment is directed to the expected loss that comes out?

STEIN: That's correct.

BUBB: And is the whole distribution represented?

STEIN: It extends the tail of the distribution.

BUBB: Of the tail of distribution. So it's actually for each of those. So the distribution is made up of these 1,250 draws. So that's why it's the distribution not like one thing.

STEIN: That's correct.

BUBB: Each of those draws, the loss number for that draw is being shifted. Is that right? Am I starting to understand?

STEIN: I fear I'm not doing an adequate job in explaining this.

BUBB: No, it's my limitation, I'm sure.

STEIN: I think that the way to think about it is, 36CFR1256.52:Commercial Info

BUBB: 36CFR1256.52:Commercial Info.

STEIN: 36CFR1256.52:Commercial Info
[Redacted]
[Redacted]

BUBB: Yeah.

STEIN: 36CFR1256.52:Commercial Info
[Redacted] And again, maybe
“shocked” is the wrong term, but it's certainly not the loss one would have gotten by looking at
historical data. It's a much higher loss than that. 36CFR1256.52:Commercial Info
[Redacted]
[Redacted]
[Redacted]
[Redacted]

BUBB: Forgive me. I'm still a little bit confused. 36CFR1256.52:Commercial Info
[Redacted]
[Redacted]
[Redacted]

STEIN: So we take the worst case.

BUBB: The single worst case?

STEIN: Single worst case under the simulation for that particular pool.

BUBB: Meaning of those 1,250 draws, this is the worst of the 1,250 draws.

STEIN: Yes, exactly.

BUBB: And that one we're going to?

STEIN: Shock again.

BUBB: I see. And that's used how?

STEIN: That then becomes the basis for the Triple A enhancement level.

BUBB: 36CFR1256.52:Commercial Info
[Redacted] Losses adjust, come to [before?] Triple A. I mean this isn't the model now, but I
understand that the committee has to do things about it.

STEIN: Yeah, the model isn't the same as the rating.

BUBB: Of course. Yep, yep, yep.

STEIN: 36CFR1256.52:Commercial Info
[Redacted]

BUBB: 36CFR1256.52:Commercial Info
[Redacted]

STEIN: I believe a way to say it would be that the analysts would look at that output, make adjustments to that output and then do what you've described.

BUBB: And the adjustment would be based on the legal issues--

STEIN: 36CFR1256.52:Commercial Info
[Redacted]

BUBB: So how did you figure out how big to make that shock on the last, the worst draw?

STEIN: Again, this was a fairly long process. And we made adjustments and such that the levels were consistent with what analysts and other experts within the RMBS team and, more broadly, within Moody's, were comfortable sufficiently represented the risks in the tail of the population of transactions. It's important, I think, to note that the historical data provided no guidance in this regard, so you might think of it as a Bayesian-type exercise, if that works in a way of thinking about it.

BUBB: So we're really using the analysts' current beliefs about the tail events, to drive the ultimate assumptions used in the model.

STEIN: That's correct. It wasn't just the analysts, and then again, I'm not sure how familiar you are with the Moody's processes, but these were not just opinions of analysts, they were long committees that would discuss these issues and so forth before resolving them. So it, I believe, was the case that these represented the best views of the organization, with respect to those tail losses, primarily again because the historical data provided no guidance in this regard.

BUBB: Hmm. So that's interesting. So the model's, in some sense, the tail; the analyst is the dog; the committee is the long--use a metaphor.

STEIN: I don't know that I'd use that metaphor. I think that when you have a model that must contemplate events for which there is no data, it's not clear how else one might calibrate that model, besides using an expert judgment.

BUBB: What was the point of having the model at that point? I mean another way to go here would be, "Look, we've got analysts who have debated these things for a long time. They're good Bayesians. They've updated based on the latest, greatest events in the housing market. They can just rate deals with their own Gestalt assessment of the state of things."

STEIN: Again, there were several benefits for the model. One of those benefits was transparency. The goal of the model was to provide market participants--investors, issuers, others in the market--with a better understanding of the factors that drive Moody's ratings. In addition, while the committee view that was used for this calibration may reflect a general view, on an individual transaction, that committee's view is not available typically. 36CFR1256.52:Commercial Info

An analyst will take it to their committee an individual transaction which may be very different than the general market. So the purpose of the model was twofold: to provide transparency and to provide consistency in ranking among the different transactions, I believe.

BUBB: A related question. Under that view, one could have a transparent model, a model that performs the role you describe, both the ranking and transparency role, without using any historical data. So you could literally have a set of assumed coefficients that would output a risk for a loan that had been tuned so that the ultimate losses in the pools matched expert judgment, but that didn't begin with what one might characterize as a contrivance of using historical data and achieve the same two functions of transparency and ordinal ranking of pools that you describe. What am I missing, or am I missing anything? Is that right?

STEIN: I don't think that this is in any way a contrivance. I believe that, to do as you propose, would be extraordinarily difficult because of the interaction 36CFR1256.52:Commercial Info
 So I think that the historical data provides tremendous guidance on the shapes and relationships of different behaviors, but may not provide sufficient guidance on the levels of those behaviors. So the shape 36CFR1256.52:Commercial Info, for example, is a complicated function of the structure of the loan, which is probably difficult to just come up with. "Gestalt, ' I think is the word you used. On the other hand, moving that up or down will affect 36CFR1256.52:Commercial Info, and so while the historical data may provide good guidance on the relationships and the shapes of things, it is probably, given the historical record, going to provide optimistic levels in the model.

BUBB: On that note, could you describe a bit the data that was used?

STEIN: Certainly. At some point I'd like to take a break to use the lavatory, but I can answer this first and then take a break. Or we could pick up with this when I get back, whichever you prefer.

BUBB: Let's take a break now.

STEIN: Thank you.

EHRENBURG: It's 3:25. We'll go off record.

CUNICELLI: I have 3:40 p.m. We're back on record. Mr. Ehrenberg, no substantive discussions while we were gone?

EHRENBURG: That's correct.

CUNICELLI: All right. Thank you.

BUBB: The data. Tell us about the data used to develop the subprime M3 model.

STEIN: We had the goal of establishing a consortium of data providers to contribute loan-level data, both historical, securitized and unsecuritized loan-level data, to our efforts. This is similar to something we had done at MRMS company in which we got various banks interested in contributing data for the development of the private-firm default models. We did the same thing with mortgage providers, and we collected data from--I think at the time the model was being developed, it was nine different providers of data, but I could be wrong and can provide the exact number if that's important. And we then set about integrating that data. As you might imagine, different originators may use different codings for, for example, documentation type. Some might use three categories while others might use nine. So we've developed mappings between the different categories.

We also did a fair amount of work developing rules to check for business logic 36CFR1256.52:Commercial I

things like that. In cases where there were discrepancies, we would often engage the data provider in a dialogue so that we could understand better if we're misinterpreting the data, and we developed a set of rules for each data provider, to transform their data in a way that was conformable so that we could pool the data from different providers and also that we could identify records that were clearly errors.

BUBB: These data providers, they were mortgage originators?

STEIN: Mortgage originators, I believe. Yes.

BUBB: And how far back did this dataset go?

STEIN: I seem to recall that it went back about ten years. One of the benefits of using data of this sort, as opposed to data from securitizations, was that we could track loans for longer periods of time and avoid various types of statistical censorship issues that would arise in using only securitized data.

BUBB: And were these all subprime originators?

STEIN: I don't remember. I believe all of the originators that contributed data had subprime operations, I believe, or they would not have been able to produce subprime loans for our [AUDIO

GLITCH]. Whether they were what you might call pure play or not, I don't recall. I don't recall who the contributors were at this point, but again, that's information that's available. We can get that for you.

BUBB: And all the data used were for subprime loans. You didn't include prime loans _____.

STEIN: That's correct.

BUBB: How would you identify what counted as a subprime loan?

STEIN: I believe we had asked the originators for their subprime data, and what they contributed was as a first pass considered subprime data. We then applied some additional filters of various sorts, I believe, and honestly I don't recall the exact set of criteria we used for scrubbing and filtering the data. Again, if that's important, it's something we can provide you at a later day.

BUBB: I assume one of the filters was a FICO filter? Do you know that?

STEIN: We found that using a FICO filter by itself was not necessarily a good way to discriminate because there were subprime loans that had sometimes high FICOs. These might be, for example,--I'm making this up; I don't remember an exact example--but there may be a borrower who has a relatively high FICO, but for some other reason has something in their credit file that makes him unattractive as a prime borrower. So these types of things would happen. At one point, I knew, although I don't now know, the distribution of FICO scores, but they were certainly above, for example, 620 or 630, in some cases. They may also went to quite low, as you'd imagine.

BUBB: How did this dataset compare to the data then being used in a pre-prime borrower?

STEIN: That data I did not have access to. The licensing agreement for that data required us to return it to the data provider after some period of time, which had expired.

BUBB: This is so you fitted the model for M3. You had the coefficients or whatever the analog was in the model,--

STEIN: In the coefficients.

BUBB: --but not the data anymore.

STEIN: After we had finished conforming the data and filtering it for data errors, I believe we had over two million subprime loans, and I believe the data went back through I don't remember. I think it was '90-something. I think it was nine or ten years of data. Most of the data, as you'd imagine, because it's subprime, was in the period after, say 2000, because the market began to increase at that point. We did look at whether this data seemed consistent with the data that was being reported by other institutions, either in their modeling research or in their investment research, and we were able to find that, in general, the data agreed quite closely with what was being shown by other modelers, at least with respect to the marginal distributions.

So these were the types of things that we looked at.

[Redacted text block]

[Redacted] That was done using our database of mortgage data.

BUBB: Good. But for the what?

STEIN: Subprime mortgage rate.

BUBB: Rate?

STEIN: Rate.

BUBB: As in an interest rate.

STEIN: Yes.

BUBB: You put it there as a premium with those?

STEIN: Subprime mortgages in general--if you go to the bank and you're a subprime borrower, almost certainly you'll pay a much higher rate than if you are a conforming-loan borrower. And that rate is a bit sticky, and it moves slowly. You might think of this as like the Fannie of the Freddie Mac mortgage rate set for subprime borrowers.

[Redacted text block]

[Redacted text block]

[Redacted] And then there was a validation process that we went

through after that.

BUBB: ^{36CFR1256.52:Commercial Info}
[redacted] Is that right?

STEIN: Yes.

BUBB: How did that work? What was the approach taken?

STEIN: In this set of models, and I don't remember the exact structural form of the models or coefficients and so on, but, as I described earlier, ^{36CFR1256.52:Commercial Info}
[redacted]

[redacted] I'd have to go back and check my notes. But we prefer to have the macroeconomic variables enter in, in an economical sense as opposed to a statistical sense. ^{36CFR1256.52:Commercial Info}
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[redacted] And this, I think, goes to your earlier question about why it would not be, my view that it would extraordinarily difficult to do this by hand, as it were, because these relationships are not obvious. When one looks at losses, one needs to dig deeply into the data, to see the interactions.

BUBB: So the data do---it's not just Gestalt analyst views that we learned from the data [IN-AUDIBLE/CROSSTALK]

STEIN: Maybe I can say this more clearly. The analysts' views were used to set levels, primarily.

BUBB: Oh, I got that.

STEIN: The data was used to understand the relationship of different factors to the different processes that we were modeling.

BUBB: For the purpose of estimating the relationship between ^{36CFR1256.52:Commercial Info}
[redacted]

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STEIN: 36CFR1256.52:Commercial Info

BUBB: 36CFR1256.52:Commercial Info

STEIN: That's correct. yes.

BUBB: Where did the data come from?

STEIN: That came from economy.com. This actually was being developed during the period at which Moody's was acquiring economy.com so at the time we were using the data, they were not yet a Moody's company. 36CFR1256.52:Commercial Info

BUBB: Do I understand that the smallest geographic unit in the model was the state?

STEIN: Initially. This is probably something that answers an earlier question of yours, which is about changes to the model. 36CFR1256.52:Commercial Info

BUBB: 36CFR1256.52:Commercial Info

STEIN: Yes.

BUBB: When were 36CFR1256.52:Commercial Info incorporated, roughly?

STEIN: I don't recall. I think it was the end of 2008. 36CFR1256.52:Commercial Info

BUBB: And [AUDIO GLITCH]. 36CFR1256.52:Commercial Info

STEIN: Yes.

BUBB: Did you have those periods in taking your look back in the data pool?

STEIN: I believe that we did, at the state level, for some states. 36CFR1256.52:Commercial Info

so we did not feel that data would be forth-

coming in the realized economy, and, as a result of the extended downward, the negative borrower equity impact.

BUBB: How far down did you have to go? Do you have any negative equity histories?

STEIN: There were some, but again, the thought was that things could probably be much worse than they were in the data so we would extend beyond the historical data.

BUBB: How far down did you have data for?

STEIN: I don't recall.

BUBB: And how did you go about extrapolating? Is extrapolation a fair term for this, or how would you describe this extension?

STEIN: I think that would be fair. It was probably extrapolation. It was nonlinear so sometimes--I know you're a trained economist, but sometimes when people hear the word extrapolation, they think of a straight line, and that was not what was done. This was a nonlinear type of a relationship, but I don't remember the details of what it was. Again, I was not involved in actually estimating the model. My primary function was to build and lead the team that did it.

BUBB: One of the upsides of the recent housing-market downturn is, you now have data with which to estimate this relationship.

STEIN: Yes and no. I think while it's true that there is now much more severe home-price decline data than we've ever had and it's certainly true that certain relationships that were not obvious historically are now more clear. The relationship between underwriting quality, for example, and performance, which has now become clear but historically was not, is available. That said, when I look at the most recent simulators that we've built, using everything that we've learned from the crisis and all of the data that we have,

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And this goes to my earlier comment that I've wondered what would have happened if we'd had more data. My sense is that additional data would have made the models more precise, but would not led to the predictions that we needed to see, to be comfortable with the risk levels of these securities.

BUBB: Did the subprime M3 model ultimately give different answers, in terms of expected pool loss, than the tool that preceded it?

STEIN: I don't have any knowledge of that previous tool so I don't the answer to that. A rating analyst might be able to tell you that, but I don't know.

BUBB: So I presume during the beta-testing period, you were running these models side-by-side.

STEIN: We were getting feedback from the analysts directly. Our benchmark was the analysts

committee output, not some model or some data of some sort. One of the design objectives of the model, however, you may recall, was to create a model that would represent faithfully Moody's view of the risk, in the tail particularly, of these mortgage pools, and not rely solely on historical data. We achieved that goal in that model. You'd have a fairly high correlation with the sample pools that we were given and also produced average levels of losses and Triple A's that were consistent with what analysts and other experts in the firm believed to be the true risks of the pool, rather than the historical risks of the pool.

BUBB: Were analysts' expectations of these tilt risks ultimately borne out, or did the mortgage crisis result in more severe product defaults than analysts had contemplated for rating Triple A tranches?

STEIN: I don't understand what you mean by tilt risk.

BUBB: So you described the process of calibrating the M3, the M3 subprime model, in which historical data is being used 36CFR1256.52:Commercial Info

[REDACTED]

STEIN: That was an input to the process. Yes.

CUNICELLI: That was an input of the process. Analysts had views of that about how bad things could be or how bad--I want to say this precisely--if you think of Triple A as sort of a particular quantile of this distribution, they had a view about how bad that was. Was the realization worse than that view, in the actual subprime crisis? Was it not as bad?

STEIN: The definition of Triple A, as I understand it, is actually an expected loss so it's not a specific quantile of a distribution because the shape of the tail will affect the level of loss beyond any attachment point. Some of the other rating agencies use a "probability of default" definition, which would be consistent with what you've said. So I don't believe the analysts were looking at a quantile when they talk about these types of things. In general, I think that when analysts and other people make probability forecasts, it's not possible to determine, as we've discussed, the rightness of those forecasts with a single realization, anymore than rolling the die once can tell you whether the die is a fair die or not. And so I don't know how I could answer that question, without rerunning history many times.

BUBB: And put another way, have any deals that were rated with the M3 subprime model suffered the losses of the Triple A tranches?

STEIN: I don't know. I'm not involved in monitoring so I don't know that.

BUBB: How many subprime RMBS rated by Moody's, in any fashion, suffered losses of their Triple A tranches?

STEIN: Again, I'm not involved with the monitoring so I don't know which tranches have suffered losses.

BUBB: Do you know if any have?

STEIN: I don't know that.

BUBB: How were originators factored into the M3 subprime model?

STEIN: In the version of the model that we are discussing, originators were not factored into the model. I assume you mean the risk of specific originators.

BUBB: Correct.

STEIN: Those adjustments were made by the committee outside of the model. 36CFR1256.52:Comme

BUBB: How were those originators' factors determined?

STEIN: That is done by, again, the committee, not by the modelers.

BUBB: How many different originators did you have data on? Just the data providers, or did the data providers provide data for loans they didn't originate?

STEIN: 36CFR1256.52:Commercial Info

It was actually a separate analysis that was done by a special team.

BUBB: For the _____ the subprime M3 model, did you just have data from originators who chose to provide data to you, or did some of those data providers have loans or originated from multiple originators?

STEIN: I believe the originators were providing the information from their own loan books, but I'm not positive. We can check that.

BUBB: When I go through this presentation, parts of it, this is the document titled Introducing Moody's Mortgage Metrics, which appears to be a PowerPoint presentation. The base number is Moody's FCIC 0011496. I think maybe you were on this presentation, Mr. Stein, at least in some part of it. Is this familiar to you? Does this ring any bells, this presentation?

STEIN: This looks like a presentation that we may have made at a briefing.

BUBB: Who are the sorts of groups you've briefed on the model? Just give me a sense.

STEIN: I don't recall how those briefings were organized. They were primarily organized by the RMBS team so they were presumably users of the RMBS research.

BUBB: Internal to Moody's or clients of Moody's?

STEIN: They would have been--I don't know whether they were clients, but they would be interested in Moody's opinion on RMBS, I would guess.

BUBB: But external to Moody's, these are?

STEIN: I believe this was, again, I don't know which presentation this is.

BUBB: Sure. Sure.

STEIN: There were a number of internal and external ones so this looks like an external presentation.

BUBB: So starting on--it's page 12. It's the faintest of pages in the page numbers, in the lower right-hand corner, of the font, title Pool Level Output. Can you describe what is it that we're seeing here? What is the table?

STEIN: So this table shows the output of the Moody's mortgage metrics model, based on the tranching rules that were developed for tranching RMBS transactions. These are, as I mentioned earlier, collateral-only numbers. They don't include any waterfall or legal adjustment or something. This is purely a model number and not really a rating.

BUBB: And they're showing the credit enhancement. With a caveat you just gave about this being collateral numbers that correspond to Moody's expected loss benchmarks for various ratings?

STEIN: Yes. Although I should say that the methodology for tranching did not produce the ratings. This was credit-enhancement levels associated with these ratings for purposes of use in the subsequent analysis.

BUBB: That's generally literally what I said, which is, there's an idealized effective loss over some horizon associated with each rating, and these are enhancements at which the expected loss for the tranches above that or for the bonds that add that credit enhancement would suffer expected losses equal to those idealized expected losses.

STEIN: Again, I think the way to think about these numbers is not as ratings but as the input losses that would be used in the rating process in determining as a starting point, the ultimate rating on the tranche or the Double A tranche or the Single A tranche, or something like that.

BUBB: So for the Triple A, it says 28.09. That's the loss realization that would then be run into the waterfall.

STEIN: With various other adjustments of various sorts. Yes.

BUBB: So it would be 28.09 percent of the collateral lost in value, adjusted with a set of qualitative and other factors. How different would the ultimate credit enhancement be that would come

out of the ratings process?

STEIN: I don't know. I do know that when we would speak with analysts, the differences could be sometimes large, could be 30 or 40 percent, sometimes higher. So in this particular case, I think this was a sample pool. I don't know if there was ever a committee done for this particular sample pool, but it varied by the transaction, depending on what the analysts saw, if they were concerned about the construction of the portfolio.

BUBB: When you say 30 or 40 percent, do you mean percentage points?

STEIN: Relative. Relative percent.

BUBB: Relative percent. So if you would, would you turn to page 26. Again, it's very faint. It has a table of loan characteristics. 36CFR1256.52:Commercial Info

STEIN: Yes.

BUBB: What do the x's in this table represent?

STEIN: That I believe was our indication that that factor was in that model 36CFR1256.52:Commercial Info

BUBB: And when you say used, that means, just to unpack it, 36CFR1256.52:Commercial Info

STEIN: That's correct.

BUBB: I'm puzzled by 36CFR1256.52:Commercial Info
 Why wasn't it used in the default model?

STEIN: 36CFR1256.52:Commercial Info

BUBB: 36CFR1256.52:Commercial Info

STEIN: Again, I don't have the details of the model in front of me, but it was done in this proportional-hazards framework. So in this case, 36CFR1256.52:Commercial Info

BUBB: 36CFR1256.52:Commercial Info

STEIN: I have to go back and check. I just don't remember, but I believe it would be cumulative. But again, I can check that.

BUBB: That would be great. We'll follow up with you. Before,

STEIN: I don't remember. I'd have to check, but I can do that.

CUNICELLI: Okay.

STEIN: But we also shocked the losses that came out as well.

BUBB: What is your sense for how accurate the model was in estimating the relationship between negative home-price appreciation and default based on the actual performance of loans during the crisis?

STEIN: I'm not sure I understand what you're asking.

BUBB: So we had large increases in mortgage defaults in '06, '07 before prices had fallen much. They'd only come down maybe two percent in calendar year 2006, something like this. Don't quote me on that because it's just rough, and yet there'd been a large increase in defaults. And it may be that your model predicted that, with a two percent decline in price, there would be a large increase in defaults. But I think, for many people, there was surprise at how with stagnant or very slightly declining housing prices we had large increases in mortgage defaults. Was your model predicting large increases consistent with reality in the relationship between housing prices and defaults or under-predicting that relationship relative to later data?

STEIN: I don't remember the exact period you're talking about, but the model's estimates of losses turned to be lower than the losses that were realized and, in fact, lower than--let me say this differently. The analysts' adjustments on top of the model turned out to be closer to the losses that were realized than model was.

BUBB: So I understand those to be statements about levels of losses. What are your thoughts on the slope of loss versus housing prices? That is, in reality, mortgages in the United States, beginning in 2006, experienced varying degrees of housing-price declines. In some states, we had large housing-price declines. Other states, we had no housing-price declines, as a matter of fact. And one could look at the relationship in the realized data, say, in 2007, of controlling for all the

factors, the relationship between housing-price declines and default. That slope understood heuristically. I realize that these are portional-hazard models, and so it may be more complicated than simply a slope. Is that slope that realized the data in '07 what you had predicted using your M3 subprime model? Or did you have the slope wrong? Just heuristically speaking, like help me understand.

STEIN:

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Certainly prepayments dropped precipitously as home prices dropped, which increased losses on pools. Whether they increased at a rate that was consistent with the ultimate realized losses is something that we haven't examined formally. But certainly during the period of, say, 2007, analysts were making larger adjustments to the model than they had before.

BUBB:

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STEIN: We've done that for the new version of the model, in terms of a variety of tests. For this version of the model, we did not go backwards and do that. The model fell out of use as its predictions became less and less consistent with the additional risks the analysts were seeing.

BUBB: So in the new model, where you've estimated the slope, do you have any sense for whether this is a larger slope than the old model, smaller slope than the old model?

STEIN: The newest model, it's again a different form of model. The factors are different and so forth so I don't know that I can directly compare them. I would imagine that--actually I don't know. We haven't looked at it in that way.

BUBB: Was this issue that I'm raising a topic of debate within the teams that develop these models?

STEIN: Yes, although not this particular topic that you're describing.

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BUBB: And was specifically the relationship between housing prices and losses a subject of debate, that slope?

STEIN:

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but I don't recall exactly the form of those discussions or adjustments. [BLANK TO 1:51:26]

BUBB: Just want to show you a document that I expect you've never seen before, but I think you may have some expertise that would help me understand it. This is a Rating Committee Memorandum, case number Moody's FCIC 8593, that was used to rate a deal called CMLTI 2006-NC2. Have you ever seen a Rating Committee Memorandum before of any type?

STEIN: I've seen Rating Committee Memoranda for funds committees before.

BUBB: Have you ever seen one for an RMBS?

STEIN: I don't think I have.

BUBB: On the first page, under Committee Votes and Comments, it says, "Follow-up from Committee. Inform not meet about M3 results versus Committee result." And below is a copy of an email from Wioletta Frankowicz, F R A N K O W I C Z, to Navneet Agarwal, A G A R W A L, and the text of the message is, "Navneet, Committee asked, I inform you that the results from M3 subprime model for deal on share drive under link above were higher than what committee agreed on the deal. In particular, we are curious to know to what extent the SATE(?)/loan--balance distribution drove levels of portion D. Average balance was the only weakness of this deal's portion D versus previous deals, and M3 was much higher. Thanks so much."

When it says that the results were higher, I'm just not familiar enough with how Moody's talks about model results. Based on your understanding--I know this document is new to you, but what does it mean when someone reports that the committee's results were higher. What was higher exactly?

STEIN: I don't know. It could be that the rating implied was higher or that the credit enhancement was higher. I don't know. I can't really speculate on what this is about. I'm not familiar with any of this material.

BUBB: So what do committees ultimately report? Do they report credit-enhancement levels?

STEIN: I'm sorry, respectfully suggest that you would be better informed by speaking with somebody who was familiar with this matter.

BUBB: Did you ever hear results? Did you ever hear from committees that M3 was predicting higher losses than the tools that were used previously?

STEIN: I do not recall hearing that. When we have an opportunity, could we take a break?

BUBB: Yeah, now is actually a great time. Let's take a break now.

SULLIVAN: It's 4:35. We go off record.

SULLIVAN: All right. It's 4:50 p.m. We're back on the record.

BUBB: So I'm going to start with another document. This is a document titled Subprime M3 Rollouts, base number Moody's FCIC 12140. Take a moment to review this. Have you seen this document before, Mr. Stein?

STEIN: I don't recall seeing this document. May I take some time to read it?

BUBB: Yeah. Yeah. [BLANK TO 1:57:45] And then this is to draw your attention to what I

want to talk about, the section on transition, on the second page, I'd like to talk about. [BLANK TO 1:59:01] So on the second page, the section on transition, it says, "If M3 is within one notch" (parentheses) "(defined as one percent at Triple A and 0.25 percent at EL), please move to M3 right away. If there's more than on notch higher, you can consider transitions over two yields." And then it goes on to describe more about the transition. First, and forgive my ignorance, questions, incredibly _____ because it is. What did EL refer to?

STEIN: I believe EL in this context would refer to the expected loss, so that would be the mean loss on the pool, and not the most likely loss, but the mean loss.

BUBB: And when it says "one notch is defined as one percent Triple A and 0.25 percent at expected loss, what does that mean?"

STEIN: I don't know. I've not seen this memo before, so I can't--I might, if I thought I understood it, offer to interpret it for you. But I don't understand it, this whole section.

BUBB: Okay. Another document for you. Just take a second to review. This is an email dated--an email chain, the top of which is dated 19th of January 2006. The base number is PSI Moody's 000001.

STEIN: _____

BUBB: Oh. Forgive me.

EHRENBERG: [It was just noted?], but it looks like there might be some additional pages that aren't here. Sort of ends half-sentence on the second page. I think you're on the first page. There you go. Down at the bottom. Looks like it ends mid-sentence.

BUBB: No, it sure does.

STEIN: And, actually, it looks like my second page is different than yours.

EHRENBERG: Then his second page is different. Is this--

BUBB: Forgive me. Let me sort this out. So I have your second page, and what do you have?

EHRENBERG: A different email altogether.

BUBB: Forgive me. Yeah, that's [two of three?].

EHRENBERG: Got it. Okay.

BUBB: Sorry. My fault. So that's right. So we need, just to clarify for the record, now that we all have the same document, it does indeed appear that the first email in the chain, which is the final email in the document, is cut off mid-sentence. So this first email in the chain on the reverse side, which is from you, Mr. Stein, to Jay Siegel, Mark DiRienz(?) and Warren Kornfeld, cc: Michael Kanef(?) and Jody Rasch, was sent on January 11, 2006. Do you remember sending this

email?

STEIN: I do not remember this express email, but I'm sure I sent it.

BUBB: Yup. All right. The email describes a list of development priorities for 2006. Listed in the order that you state, quote: "I think we should attack them." Included is an item about half-way down: "Conditional resource likely to come through, revise of simulation methodology for M3 by December '06." What was the revision of the simulation methodology you were planning?

STEIN: The methodology that was used in Moody's mortgage metrics prime model was done in a way that made it very difficult to make adjustments for calibration to the simulation. Because it was very involved. And so we had the idea that we would bring somebody on to create a more streamlined model.

BUBB: And did you in fact implement that project?

STEIN: We did. I believe it was April, though it may have been the summer. We hired a student of one of my former staff. And she began work on that as her first project. And when I say she was a student, she was no longer a student. She had finished her ph.D. and was on the market.

BUBB: And what was it about--you said this was for the purposes of making it easier to calibrate--

STEIN: Yes.

BUBB: --the simulation? Why did you need to calibrate the M3 product?

STEIN: Again, the levels that analysts often thought were appropriate were difficult for us to generate in the subprime model. And, as a result, we had a few different approaches we thought about for shocking those. One approach was to further shock the actual simulators through random numbers and things like that. The other was to do some of the adjustments to the behavior that we've talked about. It turned out to be easier to adjust the behavior than it was to adjust the simulator. And it was a point of interest to determine which of those actually produced more useful results. So this project was designed to redo the simulator and then evaluate the results on the historical model and then move forward at that point.

BUBB: And when you describe the calibration exercise you ultimately went through, it sounded like you ended up not shocking the simulator, but rather shocked the behavior. _____ right?

STEIN: Yes.

BUBB: I see. So why was that? Why did you not go the route of shocking the simulator?

STEIN: Shocking the simulator would have required a number of technical adjustments to the simulator, which were relatively more complicated to implement than the ones we did. It also could engender changes to the prime model. So as a business, we prioritized this as something

we would do after we got analysts and market participants access to the subprime model for their use and then we would circle back to see if this other solution was a more robust one.

BUBB: And you did, ultimately, circle back?

STEIN: We did.

BUBB: And what did you conclude?

STEIN: We ultimately--although it took a far longer time than we initially expected to do this work; building the simulator was complicated--we ultimately used a version of the newer simulator because it was easier to adjust. However, we also maintained a number of the behavioral adjustments, as well. So we used a combination of both approaches, and once we had done that adjustment--though when done that re-estimation of the simulator.

Another reason was to improve the speed of the simulator to permit us to examine whether performing more simulations would materially change the results. The simulator that was existing in prime M3 was very slow. It also did not easily permit stress testing using economic data, or--I shouldn't say that--it did not permit one to run historical data on an existing pool. So it could not be used for surveillance in any way. So in addition to the inability of the loan-level models to process seasoned pools, the simulator also did not permit some of that, which at the time made sense since the simulator was part of M3, which was used for new transaction analysis, rather than surveillance.

BUBB: The revised simulator, did it still produce 1,250 scenarios for use in characterizing a loss distribution for a pool?

STEIN: It did produce initially 1,250, and as we made additional enhancements to it, we were able to simulate larger numbers of paths. These changes were the types of things that would have been very difficult to do, because of the construction of the old simulator.

BUBB: And can you describe how the new simulator worked?

STEIN: In what sense?

BUBB: So ultimately the new simulator produced a set of economic scenarios. 36CFR1256.52:Co

How did it come up with those counts for each of those variables?

STEIN: I understand. This actually reminded me of another difference. 36CFR1256.52:Commercial Info

So the new simulator--I can describe the algorithm if that's what you're asking?

BUBB: It is.

STEIN: Okay. So we initially generate--I am going to have to give you approximate answers because I don't remember which version--we've made a number of changes. I can give you the general gist of this. 36CFR1256.52:Commercial Info

[Redacted]

BUBB: Will you just clarify something? 36CFR1256.52:Commercial Info

[Redacted]

STEIN: So both an estimate--yes, yes, that's correct.

BUBB: Did you start using, literally, 36CFR1256.52:Commercial Info

[Redacted]

STEIN: Prior two quarters.

BUBB: Prior two quarters?

STEIN: Yes.

BUBB: And that was, I presume, updated quarterly?

STEIN: Every quarter. This was the same as the other simulator. 36CFR1256.52:Commercial Info

[Redacted]

BUBB: And I presume there are a set of assumptions behind the data-generating process 36CFR

[Redacted] ?

STEIN: Yes. 36CFR1256.52:Commercial Info

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so the assumptions that I think you're talking about are embedded in the parameters of those estimates.

BUBB: And those estimates were based on

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STEIN: Yes.

BUBB: --data? In the historical housing price data used to estimate the model, is there any period in which for a calendar year there's negative national home price appreciation?

STEIN: The data went back either to 1960 or 1953, I don't remember which. And I do not believe there was any national home price decline. Again, this is one of the reasons why we need to do this extra calibration.

BUBB: Because the model on some of them without the calibrated shocks you tried earlier wouldn't generate any negative home price appreciation?

STEIN: That's not correct.

BUBB: Okay.

STEIN: It would generate many negative scenarios. It would not generate a sufficiently large number of negative scenarios to produce levels of the sort that the Moody's experts believed were appropriate for pool losses. That inconsistency in the historical data versus what the analysts believed could happen, but might not have happened in the past, was the reason for the calibration.

BUBB: So over the course of 2006 through 2009, we in fact experienced something like--

STEIN: Yes.

BUBB: --minus--I'm not going to get this right--38 percent--on that order--of home-price declines. Do I understand correctly that the model on its own would not generate a three-year negative, minus 38 percent national home-price decline?

STEIN: I don't recall the exact quantiles of each home-price decline. I do believe there were negative home-price declines.

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[Redacted text block]

BUBB: In your calibration process for the M3 subprime model and for the simulator model, in

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STEIN: You're talking about the new version?

BUBB: The new version.

STEIN:

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BUBB: And the analysts who had these views about the tail risk of a national decline in home prices, can you give me a sense for how they viewed the likelihood of a national decline of 38 percent over three years? What would be your interaction with them to try to calibrate this model? So you described them as Bayesians earlier and your exercise as trying to capture their view in the model. And through that, you would have learned what their views are. Can you characterize that view and relate them to what we actually experienced over the last years?

STEIN: I don't know specifically what their views on a 38 percent, three-year home-price decline were. At the end of 2006, the discussions that we were having, both with our economists and with each other, involved a one-year decline of perhaps five percent. Not as an assumption, but just as what the street was saying was a likely decline. We had many conversations with a number of economists. That decline would not have produced losses even outside of the historical levels of the model, I do not believe. So the levels--if I can use your Bayesian analogy, the levels that the analysts were using in expectation were far in excess of that five percent decline for one year.

BUBB: Were they close to the 38 percent over three years?

STEIN: I wouldn't know.

BUBB: Okay.

STEIN: I'd like to make clear, though, that five percent was not a Moody's assumption.

BUBB: Yep. Yep.

STEIN: That was a summary of research that we had seen. Again, if I draw your attention to the actual calibration, the calibration itself would have had to contemplate home price declines of a

much, much higher magnitude than that five percent.

BUBB: How high?

STEIN: I don't know how high, but the five percent number would not have produced anything near the levels that we saw.

BUBB: Would there be a record by which you could determine how high were considered in a calibration exercise?

STEIN: No, but--I doubt--there are no records of that sort.

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. However, you might--well, no, I guess you couldn't do that, either.

BUBB: In the M3 prime model, one thing that puzzled me is that it's set up to predict home prices over these 40 years--"predict" is too strong--

STEIN: Excuse me, sir.

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BUBB: Forgive me.

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STEIN: Are we talking about the new simulation?

BUBB: No, we're talking about the M3 prime old simulation.

STEIN: Okay. I was not involved in the development of that tool.

BUBB: Yep. I understand. The thing that puzzled me about it was, as the home prices increased over the first half of the 2000s, from 2001 to 2005, there was no way in which it incorporated a sense that we had an asset bubble. And, in fact, this housing-price decline was not based on fundamental changes in the housing market, but rather was driven by expectation of future price declines, and therefore was potentially unstable. Was this revision exercise at all in response to concern that the old M3 prime model was projecting off of an unrealistically high level of housing prices? Or was that--that has just nothing to do with this exercise?

STEIN: I think that the exercise was geared towards making the simulation more transparent and easier to work with.

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And so the primary--again, having not--the team that I oversaw was not involved in the development, and it's a natural thing for modelers to want to rebuild something.

BUBB: So I actually want to go back to this email, and I know you didn't finish your discussion

of the new simulation engine, but just to make better use of time, I think, okay, other questions I want to spend our time on. So forgive me for cutting you off; it's just to get you out--

STEIN: Not at all.

BUBB: --faster.

STEIN: I appreciate the efficiency.

BUBB: So the next line on your priority list is: "conditional resource--very likely to come through--develop a prime data consortium and consider recalibrating prime models, to start by 9/06." Can you describe what is this project?

STEIN: So it's often the case that you recalibrate, or re-estimate, models periodically. When I was at K&V, for example, we would think of a three-year cycle. Every three years or so, you'd want to re-estimate a model. And you do that to determine whether the structure of the market _____ risk assumption changed at all in a material way. And you can imagine various statistical tests that you can do with the coefficients and power of prediction of the model and so on. This prime model was developed I think about three years--or two-and-a-half years--before this email was written. So it was my expectation that we'd want to do something similar at some point with that model. We haven't talked about validation of the models, which is an important part of the process. I'm not sure that you would like to talk about that.

BUBB: Can you give us the three-minute overview, the three-minute version, of how validation works, as opposed--

STEIN: Yes.

BUBB: --to the twenty-minutes or the one-minute?

STEIN: 36CFR1256.52:Commercial Info

BUBB: When you say the model was locked, what do you mean?

STEIN: 36CFR1256.52:Commercial Info

BUBB: You couldn't--coefficient. Say it's a polynomial. We're going to fix the coefficients.

STEIN: 36CFR1256.52:Commercial Info

BUBB: Yep.

BUBB: So you describe this desire to consider recalibrating a prime model, which was two to three years old at this point, and described that as--you discussed how you guys have a rule of thumb of wanting to update models every three years or so.

STEIN: Sometimes five years. Sometimes two years. It would--

BUBB: Sure. Was this motivated at all by a sense that the prime M3 model was not performing well at predicting the performance of pools during the period?

STEIN: I don't think I had strong views on the behavior of the prime model at this point. Again, it was a model that was developed by another group. Our primary rule was to implement adjustments for analysts to account for new risk factors, and so forth. And to update the economic data. So I did not have a view on the performance of the model.

BUBB: Was this plan to update and recalibrate the prime model something that was at your initiation? Or did somebody else say to you, "Mr. Stein, please update this model."

STEIN: I don't recall. I suspect that in setting up my group, we started to put in place the same types of protocols that we would put in place if we were doing this in our other shops. And one of those was to think about a life cycle of a model. This may have been the outgrowth of that, I think. Again, I think that at this time the model was probably about two-and-a-half years old. So it would seem that by the time we were wrapping up this subprime model, it would be time to start thinking about the prime model.

BUBB: The next message in the chain is from Warren Kornfeld, who says, "This is a message to a group of people," including yourself. Mr. Kornfeld says, "Jay, Mark and I had a chance to get together yesterday to discuss--the three of us believe the priority should be as follows"--and lists a set of priorities that begins with subprime M3, and, quite a bit further down the list, discusses the two projects that you and I had discussed, namely updating and recalibrating the prime M3 model and revising the simulation methodology for both prime and subprime M3.

You then replied, quote, "By way of disclosure, not recalibrating the prime model and not fixing the simulation would create a growing number of inconsistencies, parentheses, (problems) in the existing models, as was the case through most of 2004. These typically manifest themselves in complaints from analysts and external users. Addressing these in an ad hoc manner will likely become a significant part of the team's work and will take significant time away from other initiatives. Is your intent that this ad hoc work should also be deprioritized?" Could you explain what you meant?

STEIN: Yes. I think I can. I don't recall writing this, but my recollection was that when I first joined the team, the people that were maintaining the model had told me that it was becoming increasingly difficult to accommodate--I shouldn't say difficult; I should say time-consuming--to include new adjustments for different risks into the model and to make adjustments to the model because of the way the model was structured. And in order to get the consistency with what the analysts expected to see required more and more ad hoc work. Adjustments of the sort we've been talking about that we made to the prime model, but there were more of those to the sub-

prime model. But there were more of those, at that time, to prime, because that was the model that was being used for prime mortgages.

BUBB: What's the difference between an ad hoc adjustment and a non-ad hoc adjustment?

STEIN: I probably use that language loosely. I thought of an ad hoc adjustment as being sort of an adjustment, for example, 36CFR1256.52:Commercial Info So one might think of this as being an atheoretical adjustment, outside of the framework of the model itself, but within the model--a software adjustment.

BUBB: And you talked about a growing number of inconsistencies in the existing models, as was the case through most of 2004. What was the occurring in 2004 that you're referring to?

STEIN: What was the--I'm sorry, I didn't understand your comment, sir.

BUBB: Yeah. In your first sentence, you say, "Not recalibrating the prime model and not fixing simulation will create a growing number of inconsistencies, parentheses, (problems) in the existing models, as was the case throughout most of 2004." What were the inconsistencies or problems experienced throughout most of 2004?

STEIN: Again, I think this is probably--without having recollection of this particular email, having written it--I think this was probably about these theoretically inconsistent adjustments to the model that we described before--what I described here as ad hoc or atheoretical adjustments. And I believe that there was also, in some cases, inconsistency in the analysts' expectations about risk and what the model would do. Which would require these additional hits for different factors. They were referred to as "hits." 36CFR1256.52:Commercial Info

BUBB: Another email.

STEIN: Should I give this back to you, sir?

BUBB: Sure. So this is an email chain dated at the top October 6, 2007. The Bates number's Moody's DOGR 0006729. Maybe just take a moment to review and let me know when you're ready to chat about it. So I should add appendage to the document. At the back is a different Bates number--Moody's COGR 0005888, which is a--looks like a calendar event for an event dated October 8, 2007. Subject line: Thinking about our U.S., our MBS methodology. This email chain refers to a meeting. Do you recall this meeting?

STEIN: Now, the meeting that's described on the first--or the last page--of the document?

BUBB: Yes.

STEIN: I recall a meeting that took place that sounds like what is described here. I don't recall the date of that meeting, though.

BUBB: And you were at that meeting? The meeting you recall?

STEIN: Yes.

BUBB: What was the meeting about?

STEIN: I believe Andrew Kimball at the time was the chief credit officer. And he had asked to convene a meeting to get thinking around rating methodologies on mortgages. And whether there was additional or new information that we could use as a company in looking at ratings.

BUBB: How did he convene it? Because he was concerned that Moody's methodology had flaws?

STEIN: I don't know why he convened the meeting.

BUBB: Why did he say he was convening the meeting?

STEIN: Well, as I described it, I believe he was trying to get input on how to further refine ratings in light of--and this looks like it was October of 2007, in light of what had been a market correction.

BUBB: And what was the discussion at the meeting? Just describe as much detail as you can--

STEIN: I have only very vague recollection of the meeting. I recall [Marcus Andy?] offering to have his team become more involved in providing forecasts. I recall Brian Clarkson being very interested in the views of several analysts who were there. And I recall some general fact-sharing about how things are done in different areas. The meeting, I believe, adjourned, but I don't recall the time.

BUBB: What were the analysts' views that Brian Clarkson was very interested in?

STEIN: I don't recall the specific views. I just recall him turning to the analysts and saying he wanted them involved in this ongoing process and asking them if they'd be interested in that and them saying, "Yes, absolutely."

BUBB: What was the outcome of the meeting?

STEIN: I don't recall a specific outcome, although around this time, we did undertake--actually, I'm not sure if this timing works. I don't recall when this happened. Subsequent to this meeting, at some point in the future, we did begin doing new work in a number of areas. Data collection and some new modeling, as well.

BUBB: And what was the purpose of that new work?

STEIN: The new?

BUBB: The new work you described that occurred.

STEIN: This was the simulator revision--the--sorry, the revalidation of the subprime loan-level models and so forth. So one of the ideas that came out was that there was now new data available--at least 18 months more data available and that we could use that to test out-of-sample the performance, the power, of these models. And we did that exercise. If you're interested, the results showed the models were still quite powerful at ranking and, as a result, I think a lot of the focus may have shifted to the level of calibration of that. Although that would be speculation on my part.

BUBB: Was there concern expressed at the meetings that the level to the model did not capture the experience over the preceding quarters?

STEIN: I think at this point, analysts were often adding substantial adjustments above--sort of raising levels beyond what the model was predicting to bring their committee recommendations to a level that they were comfortable with--and the committees were comfortable with. So it would not have been, I guess, unreasonable for there to have been questions about how to incorporate some of those adjustments into the model. Again, when there were adjustments made in committee, there were two criteria we would use to determine whether to bring them into the model or not. The first was whether we could do it in a non- ad hoc manner. We could do it within the framework of the model. And then the other was to determine whether these were in fact persistent features or they were transient. If they were transient, we would not have wanted to build them into the model.

BUBB: In the first page of this document, at the bottom, there's a paragraph that begins, "Tuesday, we should convene a smaller group to discuss what to recommend to you to do about it. That would be analogous to the JDA working group." What is a JDA working group?

STEIN: I don't know what the JDA working group was.

BUBB: What does JDA refer to?

STEIN: At Moody's, when analyzing--sorry; I should say I don't know in this instance what the reference is, but a common use of JDA at Moody's is to refer to a "joint default analysis," which is the notion that if--it's actually the idea that there are two sources of credit support. And then in order for an investor to realize a loss on an instrument, both of those sources have to be removed. So the probability of default and the correlation--default correlation--needs to be contemplated jointly. So it's a "joint default analysis."

BUBB: One more for you.

STEIN: Shall I give this back to you, sir?

EHRENBERG: Sure. This is the one we just looked at.

STEIN: This is--there was another.

BUBB: This is a slightly different one.

STEIN: Oh, Okay.

BUBB: The date at the top is--it's an email chain; the date at the top is November 9, 2007, and the Bates number is [PSI?] Moody's 000033. Just take a moment to review. And I want to focus your attention on the highlighted text from an email of [yours?]. Feel free to read as much as you need to get comfortable.

STEIN: Thank you.

BUBB: I want to start with the email at the top of the second page, the reverse side, which is from you to a large group of people, dated November 9, 2007, that describes a set of questions about the project. And could you describe what is the project you're talking about? What's the goal of this project?

STEIN: I believe I was actually out of the office while these emails were circulating, so I was not able to participate in some of the meetings. And I think one of the purposes of this email was to determine exactly that--what is the purpose of the project?

BUBB: And what was the purpose?

STEIN: I recall only vaguely this particular project, but I believe there was a desire to look at sensitivity of losses for--it looks like [Alt-A?] mortgages to certain attributes that were listed. And so one could imagine doing it a number of ways for a multi-variance setting or a univariant setting. But, again, I don't have a firm recollection of this project or the conversations around it, so I'm interpreting that for you now.

BUBB: And it says in the email below, the second paragraph: "We'll be determining the biggest contributors of default important. In this case we need to determine this relationship by Monday morning, which effectively gives us less than a full working day." And your response to that email, your second question is: "Two, if the objective in doing this to develop a rating approach, why is the timing so short?" Why was the timing so short?

STEIN: Again, I don't recall this specific instance, although I do recall there being a publication--market commentary--that was being prepared. And that may have been--there may have been some timing associated with the market commentary. That's speculation on my part.

BUBB: And then your email on the first page--

STEIN: This page?

BUBB: Correct. Dated November 9, 2007. You say, in part, the highlighted section: "My staff is sensitive to both priorities and the risks associates with demands to do something quick and dirty that then becomes part of a rating process. The reason Ashish(?) pushed back was that the pro-

posed use of the data would quite likely lead to false conclusions that might be used for rating decisions." What did you mean?

STEIN: My staff is admonished by me, whenever somebody asks for a request without context, to get the context to ensure that people don't unknowingly make assumptions about the data that might not be true, for example. Or assumptions about statistical approach. I believe Ashish was probably pushing back on the notion of developing a full-blown, multi-variable regression type analysis on this data in a short period of time. I know from the sentence above that it would appear that--I'm guessing this happened by phone--Warren and I spoke, and we came to a conclusion about some alternative that would work, given the time constraint. So it looks like that initial idea may have been abandoned in favor of something that would have been more robust, given the amount of time there was to do the analysis. Again, I don't recall specifically that conversation, but I'm inferring that from this email from Jay.

BUBB: In the paragraph with the highlighted portion, at the end it says, "In the past, our [MVS?] has published research which we did not review, but that seemed counter to our own." What were you referring to?

STEIN: I seem to recall there was one publication that we saw where there was a result, some graph perhaps, that looked different than what we thought the data should look like. And I don't recall whether it was resolved to be that the data was in fact a different data set, whether it was a different interpretation, or whether one or the other of the two groups had made a mistake in their initial calculations. But the type of research that I'm referring to here would have been a market commentary type of thing. My own recollection--again, which is fuzzy--is that this was a small, technical point on a graph or something like that, not a big result.

BUBB: Was the project described in these emails indeed complete by the Monday deadline?

STEIN: I don't recall. I don't recall. But I should say this: almost certainly the one that--the initial project was not done. Certainly not done--was not done by Monday. It sounds like there was an alternative solution that either could have been done in the time allocated or, alternatively, perhaps the allocated time was extended. So perhaps Warren agreed that we needed more time and so we'd do it on Thursday, instead of Monday or something like that. I apologize for not having better recollection of this email.

BUBB: As team MD, and later, I guess, group MD, if I remember this correctly, did you feel like you had sufficient resources to develop models for predicting mortgage performance?

STEIN: I know that you're an econometrician as well, and I've managed research groups for many years. I have never been in a situation where I didn't feel I could use more resources, even when I had open head count. So there was always another hypothesis you'd like to test. There was always another idea you'd want to try out. So in general I've never in my entire career been satisfied with my resourcing levels, even when I, again, had very large teams and many open head count. Having said that, I don't recall ever being told I could not hire more resource for a project. I think that there was sometimes discussion, as would be the case in any business, about the timing of a hire. Should it be done this month versus in three months, or something like that.

And I also believe that during peak periods, unless we had adopted a model of very lax resourcing, during peak periods, there would be stress. And so there were periods where people would work late--very late. And we tried to keep those to a very infrequent number. And, in fact, that was one of the barometers we would use for deciding if we needed to hire more staff.

BUBB: Who made decisions on resources, staffing levels, and the like? For your grouping?

STEIN: Which resources that were recommendations to hire resources or--

BUBB: I'm sorry. Who made decisions on, let's say, staffing levels as one type of resource--human resources?

STEIN: I believe at this point I was reporting to Gus Harris. Yes, I believe I was reporting to Gus Harris, so Gus would have been the person to whom I spoke, to request resource. However, it had happened in the past, for example, that another group would have resource and they'd want--say, they would have an open head count, and they would want a project done, they would offer that open head count in exchange for our doing that project. So there were sometimes other types of resourcing that was done, but the primary means was through conversations with my manager.

BUBB: And you said that you never had an instance where you told your manager, Gus, or whomever, that you needed more resources, and the resources were not forthcoming?

STEIN: I don't recall an instance where I was told, "You cannot hire somebody." Again, there were times that I was told, "You cannot hire them today, but we'll budget them for some other period," maybe three months from now or something like that. But I don't ever recall somebody saying to me, "You can't have any more resource." In fact, the question was often posed differently. "How much resource do you need for the next year?" was often how I was presented with the question.

BUBB: You described before how you had developed a view--I think, if I understood correctly, in part over the course of your time at K&V about the life cycle of a model and how often it should be updated. Do you feel that Moody's updated its mortgage models frequently enough?

STEIN: I think that the context of the use of the model becomes important. And, again, three years was what we'd use for one class of models. There was another model that we developed, which I understand was just updated. So that would make it five or six years. It depends on the model and how it's used in this setting because the model is just one of many inputs. You would not necessarily use the same criteria for this that you would for other tools. So it's not really--there's not an equivalency between the work at hand being the work that's done or at least it's not so they can directly compare.

BUBB: So I've only got one more question, which is a big-picture question. So here we are at the commission trying to understand the causes of the financial crisis. One of the issues we're investigating, obviously, is the process by which many of these mortgage-related securities, like

RMBS, achieved triple A ratings, and then subsequently performed very poorly. What do you think we should know in trying to understand how that happened?

STEIN: I think that the good work that you're doing here will be helpful in putting that picture together. My own sense is that the rather dramatic decline in home prices was unanticipated by almost all market participants, and certainly that was a factor in the performance. I do believe that the notion that a probability can be wrong with a single draw is an important one to keep in mind. And while I keep that in mind as well, I don't believe that with a single draw, one can ever know whether the probability is correct or not. I can't think of other things that I would mention, but if I do, I will certainly let you know through my attorney.

BUBB: Thank you.

BUBB: Well, thank you very much for your time.

STEIN: Thank you, gentlemen, also. It was true to your word.

BUBB: Yeah.

STEIN: It's before six o'clock.

BUBB: Six o'clock. We'll go off record.

[END OF AUDIO]

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