

# Presentation of Uncertainty

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March 13, 2015

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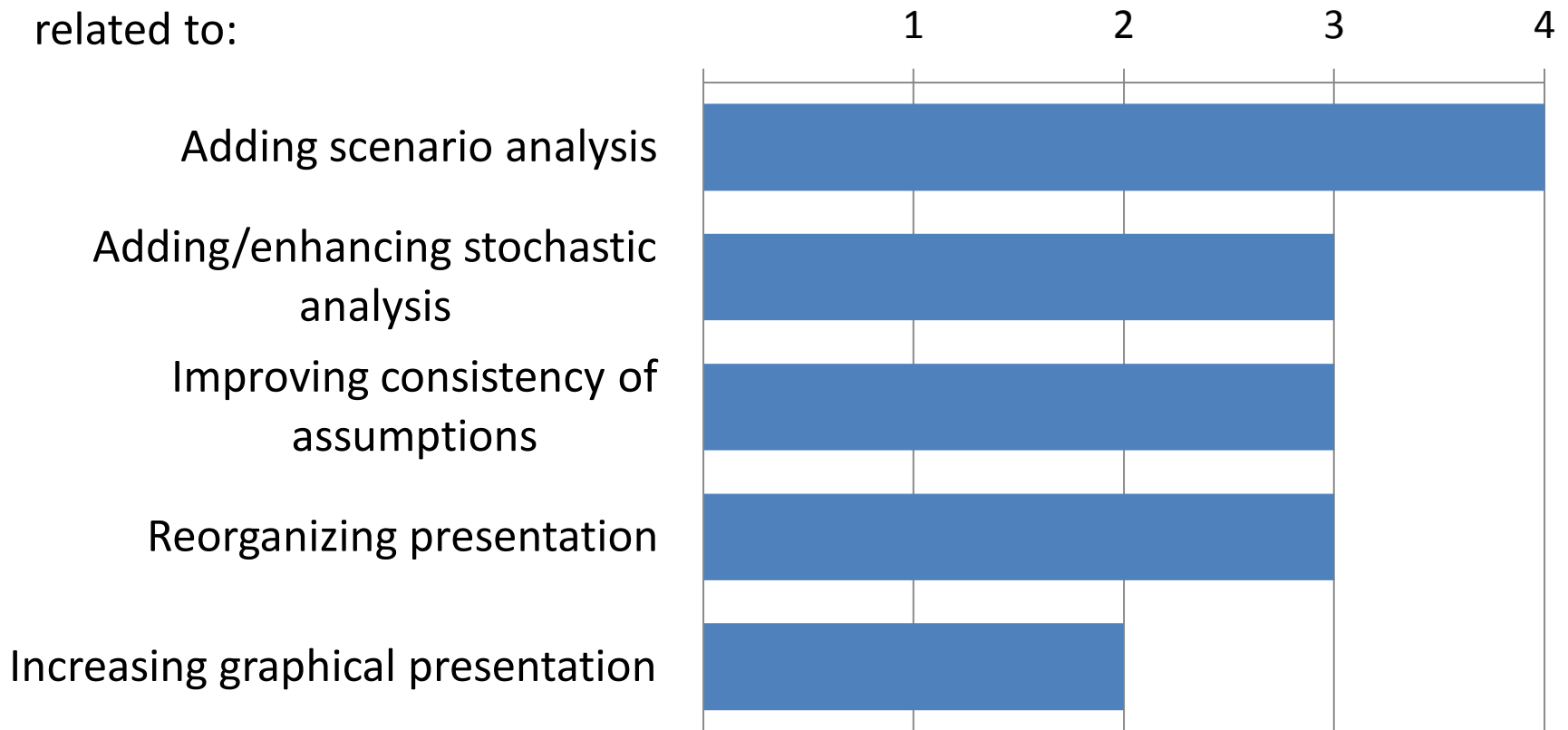
Past Panel Recommendations

Reasons for Presenting Uncertainty

Ideas for Improving Presentation

# Past Panel Recommendations

Of the last 4 Technical Panels, the number making recommendations related to:



# 2011 Panel Recommendations

- Expand the list of key assumptions
  - OCACT Response: Trustee changes are in line
- Create a (new) chapter covering uncertainty
  - OCACT Response: Trustees support current placement
- Probabilistic consistency of assumptions
  - OCACT Response: Agree to work toward this goal
- Compare Alts I – III with integrated scenarios and stochastic simulations
  - OCACT Response: Trustees did not change
- Emphasize sensitivity analysis as starting point
  - OCACT Response: Trustees did not change

# Reasons for Presenting Uncertainty

- Understanding the reliability of projections
- Understanding how changes in the environment – demographic, economic, and policy – affect program finances
- Demonstrating the cost-benefit of insurance
- Facilitating decisions where uncertainty exists
- Framing conversations about uncertainty

Proposition:

Inspire confidence in Trustees' report

# Idea 1: Develop Models of Key Assumptions

## Develop models to support alternative long-run average assumptions

- Current method uses best estimate for Alt II and generally symmetric range for Alts I & III
- Modeling the long-run average assumptions would:
  - Add rigor to basis for assumptions
  - Enable consistency of presentation
  - Support more realistic ranges, including asymmetric ranges
- Summarize the distribution of each assumption in aggregate

## Other improvements depend on this step.

- “Phase I” recommendations apply prior to this capability
- “Phase II” recommendations apply after this capability is established

# Current Presentation of Uncertainty

- Alternatives I & III
  - Primary means of communicating uncertainty throughout report
  - Deterministic projections based on all lower-/higher-cost long-range average assumptions
- Sensitivity Analysis
  - Primarily in Appendix D
  - Varies individual assumptions from Alts I & III one at a time
  - Informs about contribution of individual assumptions to Alternatives I & III
  - May not inform about the relative effects of individual assumptions on Trust finances
- Stochastic Analysis
  - Primarily in Appendix E
  - Time-series analysis centered on Intermediate assumptions
  - No relation to Alternatives I & III

My general direction: Reduce the size of presentation and integrate methods to be mutually supporting

## Idea 2: Add a Summary of Sensitivity Data

- Current: 10pp of tables and descriptions

Table VI.D1.—Sensitivity of OASDI Measures to Varying Fertility Assumptions  
[As a percentage of taxable payroll]

Valuation period	Ultimate total fertility rate <sup>a b</sup>		
	1.7	2.0	2.3
<b>Summarized income rate:</b>			
25-year: 2014-38 .....	14.74	14.75	14.75
50-year: 2014-63 .....	14.09	14.08	14.07
75-year: 2014-88 .....	13.93	13.89	13.85
<b>Summarized cost rate:</b>			
25-year: 2014-38 .....	16.22	16.25	16.28
50-year: 2014-63 .....	16.61	16.50	16.40
75-year: 2014-88 .....	17.20	16.77	16.36
<b>Actuarial balance:</b>			
25-year: 2014-38 .....	-1.48	-1.50	-1.53
50-year: 2014-63 .....	-2.52	-2.42	-2.33
75-year: 2014-88 .....	-3.27	-2.88	-2.51
Annual balance for 2088 .....	-7.18	-4.90	-3.06
Year of combined trust fund reserve depletion .....	2033	2033	2032

- A summary would:
  - Provide rapid recognition of key variables
  - Improve understanding of how key variables affect program finances



# Summarization of Sensitivities – Phase I

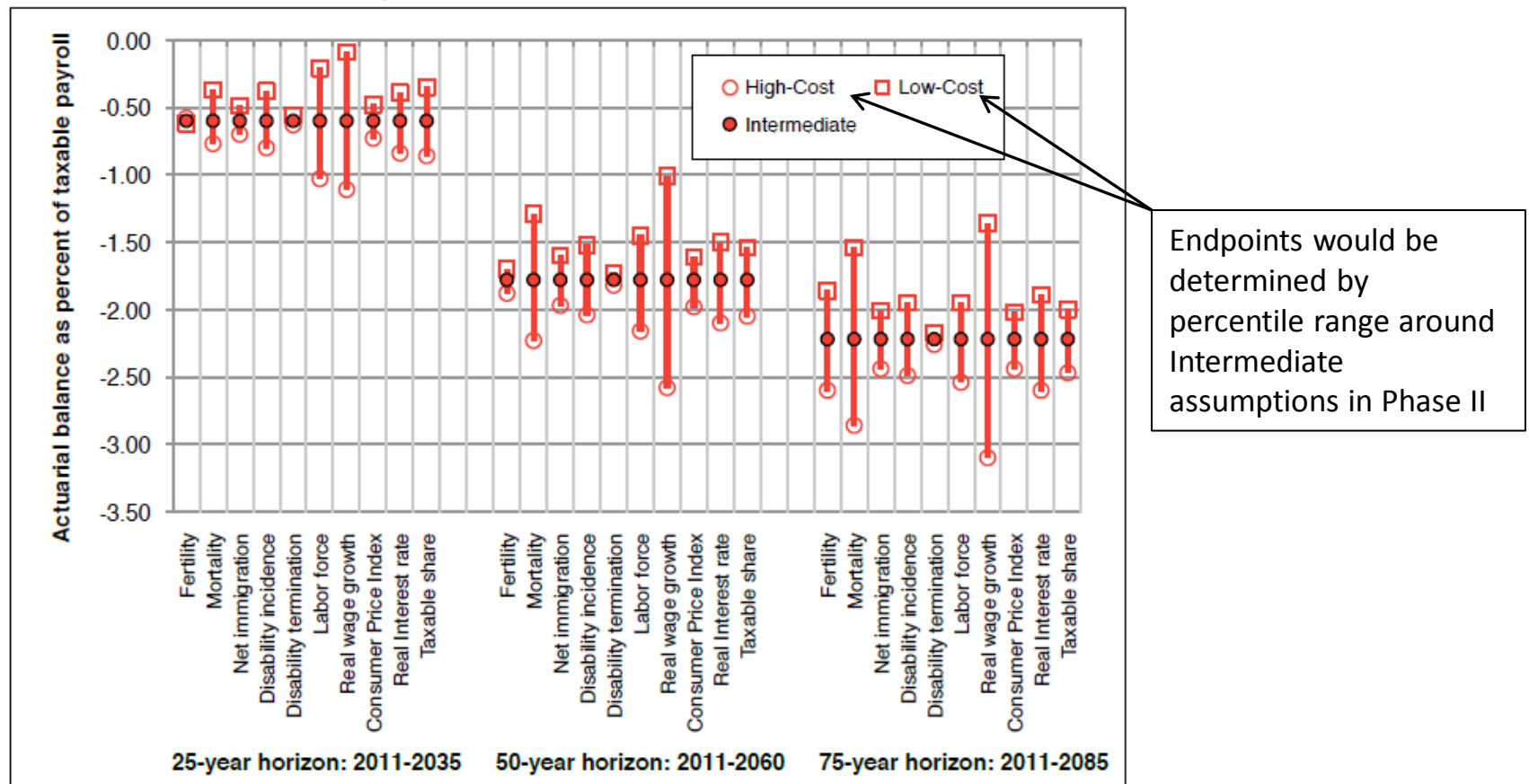
- Remove alternative assumptions from Table II.C1
- Add a summary table to the section on “Uncertainty of the Projections”
- Retain use of alternative scenario assumptions for sensitivities in Phase I

	Intermed.	Alt Scenario I			Alt Scenario II		
Long-range Assumption	Expected Average	Expected Average	Change in Expected Average	Effect on Actuarial Balance	Expected Average	Change in Expected Average	Effect on Actuarial Balance
<b>Demographic:</b>							
Fertility	2.0	2.3	.3	.37	1.7	-.3	-.39
Mortality Improvement	.79	.41	-.38	.46	1.20	.41	-.48
Net Immigration	1,125	1,430	305	.21	830	-295	-.24
<b>Economic:</b>							
Real-Wage Differential	1.13	1.76	.63	1.00	.52	-.61	-1.02
CPI	2.70	3.40	.7	.15	2.00	-.7	-.16
Real Interest Rate	2.90	3.40	.5	.22	2.40	-.5	-.22
<b>Programmatic:</b>							
Disability Incidence	5.4	4.3	-1.1	.27	6.5	1.1	-.27
Disability Termination	10.4	12.6	2.2	.04	8.3	-2.1	-.01

# Summarization of Sensitivities – Phase II

Graphic representation adding comparability of assumptions:

Figure 4. Sensitivity of Summarized Actuarial Balance to Range of Assumptions: 25-, 50-, and 75-Year Horizons (as a Percent of Taxable Payroll)<sup>4</sup>



Source: 2011 Technical Panel on Assumptions and Methods Report to the Social Security Advisory Board, p.19

## Idea 3: Use Scenarios for Alternatives I & III

- Current: “These alternatives... are intended to illustrate the effect of clearly defined scenarios that are... very favorable or unfavorable for the program’s financial status.”
- Integrated Scenarios (‘03 Panel): “...using sets of assumptions that would have a positive or negative overall impact on the program but would also be consistent in the sense that the various assumptions could plausibly be expected to occur in combination.”
- Additional suggestion: Provide a narrative “hook” that reinforces the plausibility of the scenario.
- Maintain distinction between sensitivity analysis and scenario analysis
- Plausible scenarios would:
  - Encourage attention to uncertainty
  - Enhance understanding of uncertainty
  - Enhance the credibility of the analysis
  - Test underlying models for assumption ranges
  - Frame discussion of uncertainty about variables

# Guidelines for Integrated Scenarios

- Select assumptions that are plausibly consistent with each other
- Only two alternative scenarios – keep simple!
- All key assumptions should vary from Intermediate assumptions – none held constant
  - For each key assumption, the two alternative assumptions should vary from the Intermediate assumption in opposite directions.
  - There is no requirement that all assumptions for a single scenario move cost in the same direction. It may be more realistic if they do not.
  - Assumptions related to the scenario should stand out from unrelated assumptions.
- Range selection
  - The alternative scenarios should not appear to be best/worst cases
  - Present alternative scenarios that are distinct from stochastic boundaries until long-run average assumptions can be modeled (in Phase II)
  - In Phase II, select alternative scenarios that bracket a percentile range around a summary measure of the Intermediate projection, such as the 75-year actuarial balance. E.g., select one scenario with a 75-year actuarial balance at the 10<sup>th</sup> percentile and one scenario with a 75-year actuarial balance at the 90<sup>th</sup> percentile.
- The scenarios should appeal to potential audiences (policy and broader public); they should not incite controversy

# Integrated Scenario Example

## Higher (Lower) than Expected Economic Growth

- Highlighted assumptions
  - High (low) inflation
  - High (low) real wage growth
  - High (low) real interest rates
  - High (low) labor participation
- A few potential modifications to this example:
  - Expand focus - e.g., Higher Economic Growth, Lower Longevity Improvement
  - Show that long-run effects that may not be permanent – e.g., 20-year Low-Growth scenario

## Idea 4: Improve Effectiveness of Stochastic Presentation

Past Technical Panels have consistently pushed for improving stochastic analysis. This makes sense as there is still room for critical development (e.g., assumption modeling).

Presentation of stochastic results has pitfalls, though.

Effective use of stochastic analysis would:

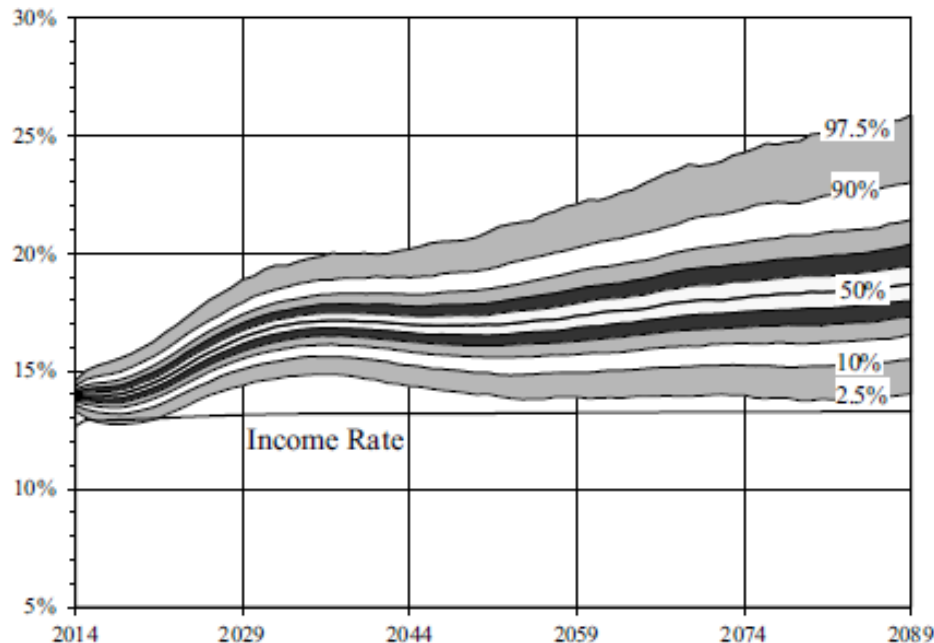
- Improve understanding of the uncertainty around modeled variables
- Reinforce confidence in projections and methodology
- Provide metrics for assessing relative likelihoods
- Be secondary to good scenario analysis
- Assert Trustees' expertise and consideration in the modeling of uncertain outcomes

# Pitfalls in Stochastic Presentation

- Common
  - May imply certainty about the distribution of outcomes
  - Inadequate attention to tail risks
  - Over-reliance on normal distributions
  - May not reflect correlations between key risks
  - Percentile boundaries misinterpreted as scenarios
- Specific to Trustees Report
  - Long-range projection increases the likelihood of differing states during the projection period
  - Modeling variation in the duration of effects

# Current Stochastic Presentation

Figure VI.E1.—Long-Range OASDI Cost Rates From Stochastic Modeling



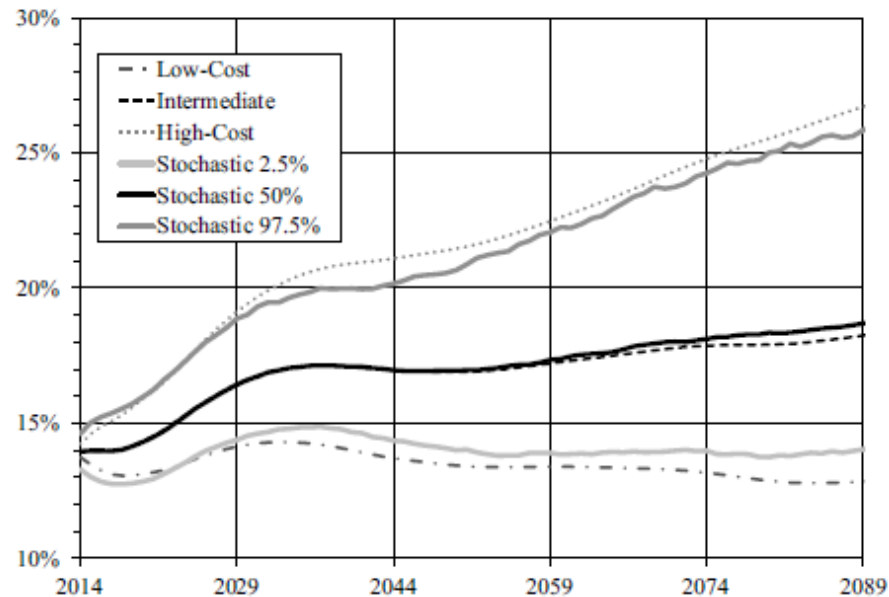
“Figure VI.E1 displays the probability distribution of the year-by-year OASDI cost rates...”

(p.182, 2014 Trustees Report)



# Current Stochastic Presentation

Figure VLE3.—OASDI Cost Rates: Comparison of Stochastic to Low-Cost, Intermediate, and High-Cost Alternatives  
[as a percentage of taxable payroll]



- 2011 Technical Panel recommended comparison of stochastic and deterministic results. Presentation is missing a key recommendation for “probabilistic consistency.”
- Reader is unlikely to understand the inconsistencies between percentile range and Alts I & III. E.g., compare Figures II.D7 & II.D8 (pp.19-20).

# Alternative Stochastic Presentation – Phase I

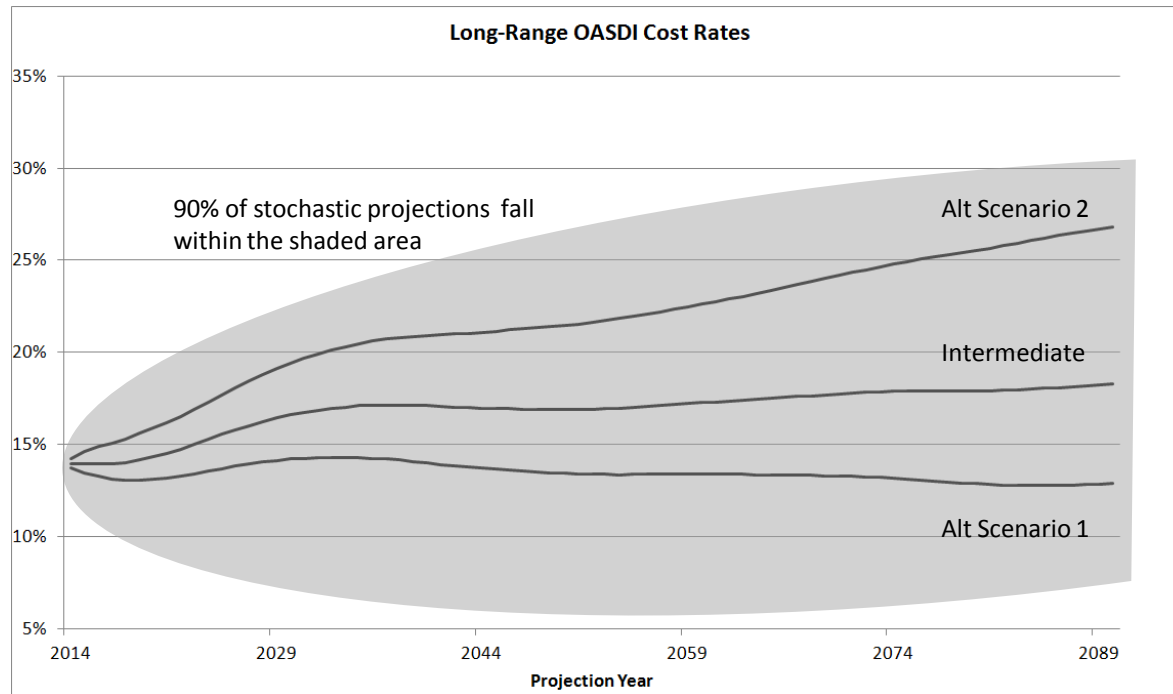
- Enhance understanding of stochastic analysis by clearly associating results with the Intermediate assumptions
- Overview chapter:
  - Remove graph (Figure II.D8)
  - Specify that the stochastic range relates to Alt II (not Alts I or III) in the narrative
- Long-Range Estimates chapter:
  - Include percentile range for key intermediate outputs (e.g.: cost rates, worker/beneficiary ratio, actuarial balance)
  - Keep disclosure of percentile range distinct from Alternatives I & III
- Appendix E
  - Basic description of stochastic model and assumptions
  - Clarify how the stochastic parameters relate to the Intermediate assumptions
  - Clarify that the stochastic parameters are not related to alternative scenario assumptions

# Alternative Stochastic Presentation – Phase II

- Integrate stochastic and deterministic approaches
- Overlay stochastic range on deterministic depictions
  - Vertical bars at intervals, or
  - Shaded range without lines
  - Specify the percentiles used for the stochastic range to clarify that it does not include minimums or maximums
- Demonstrate consistency in approaches
  - Integrated scenarios should fall within the stochastic range
  - Use summary measures, such as the 75-year actuarial balance, to show the likelihood of the integrated scenarios

# Alternative Stochastic Presentation – Phase II

- Example of integrated stochastic presentation:



- In the narrative description:
  - “90% of our stochastic scenarios fall within the shaded range.”
  - “80% of our stochastic scenarios had a 75-year actuarial balance that was higher than the Scenario 1 actuarial balance and lower than the Scenario 2 actuarial balance.”

# Idea 5: Improve Disclosure

- Specificity of uncertainty
  - Clarity about what is known and unknown
  - The term “probability” can be misleading
- Matching presentation to audiences
  - Report Body: Public, policymakers
  - Appendices: Experts
  - Databases and documents available on the internet: Researchers
- This matters
  - Attract attention to uncertainty where necessary
  - Encourage development of modeling and estimation

# Specificity

“...Actual future costs are unlikely to be as extreme as those portrayed by the low-cost or high-cost projections. The method for constructing the low-cost and high-cost projections does not lend itself to estimating the probability that actual experience will lie within or outside the range they define.”

(2014 Trustees Report, p.18.)

As a result, readers may:

- Interpret low- and high-cost projections as extreme scenarios
- Question how the likelihood of the projections can be determined if the probability of experience cannot be determined

# Matching Audiences

Table IV.B2.—Covered Workers and Beneficiaries, Calendar Years 1945-2090 (Cont.)

Calendar year	Covered workers <sup>a</sup> (in thousands)	Beneficiaries <sup>b</sup> (in thousands)			Covered workers per OASDI beneficiary	OASDI beneficiaries per 100 covered workers
		OASI	DI	OASDI		
<b>Low-cost:</b>						
2014	165,996	47,861	10,977	58,838	2.8	35
2015	168,951	49,360	10,937	60,296	2.8	36
2020	181,302	57,729	10,667	68,396	2.7	38
2025	186,743	65,012	10,679	75,690	2.5	41
2030	190,730	71,805	10,385	82,190	2.3	43
2035	195,416	76,153	10,339	86,492	2.3	44
2040	202,184	77,996	10,483	88,480	2.3	44
2045	210,045	78,779	10,976	89,754	2.3	43
2050	218,205	80,087	11,367	91,454	2.4	42
2055	226,529	82,319	11,776	94,095	2.4	42
2060	235,171	85,302	12,074	97,376	2.4	41
2065	244,535	88,323	12,553	100,877	2.4	41
2070	254,931	91,572	13,082	104,655	2.4	41
2075	266,242	94,386	13,624	108,011	2.5	41
2080	278,237	96,455	14,485	110,940	2.5	40
2085	290,461	99,793	15,383	115,176	2.5	40
2090	302,748	104,648	16,098	120,746	2.5	40
<b>High-cost:</b>						
2014	164,648	47,871	11,085	58,956	2.8	36
2015	165,331	49,395	11,284	60,679	2.7	37
2020	172,359	58,101	12,332	70,433	2.4	41
2025	178,063	66,046	13,425	79,470	2.2	45
2030	181,104	73,860	14,027	87,886	2.1	49
2035	184,214	79,439	14,724	94,162	2.0	51
2040	188,064	82,557	15,386	97,943	1.9	52
2045	191,522	84,360	16,330	100,690	1.9	53
2050	193,992	86,420	16,964	103,384	1.9	53
2055	195,378	89,056	17,513	106,570	1.8	55
2060	196,044	92,349	17,744	110,093	1.8	56
2065	196,561	95,652	18,090	113,742	1.7	58
2070	197,016	99,410	18,312	117,722	1.7	60
2075	197,253	102,978	18,302	121,280	1.6	61
2080	197,068	105,598	18,506	124,103	1.6	63
2085	196,467	108,419	18,577	126,997	1.5	65
2090	195,580	111,272	18,368	129,640	1.5	66

- Full Table is 2 pages
- This information is also provided in a graph (Figure IV.B2)
- Would this data be just as effective if excluded from the report and (still) available from the website? Would a much smaller table suffice?

# Bringing the Ideas Together

- 1) Develop Models for Key Assumptions – a gateway to further progress
- 2) Add a Summary of Sensitivity Data
- 3) Use Scenarios for Alternatives I & III
- 4) Improve Effectiveness of Stochastic Presentation
- 5) Improve Disclosure



# Appendix: Miscellaneous Thoughts

- Importance of considering measures of uncertainty in policy discussions
- Consider stress testing
- Consider uncertainty around the Labor Force Participation Rate