Stochastic Optimization: Notation clarification

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Define the **objective function of the whole Stochastic Optimization problem** g as:

$$g(x,\xi) = Min\, c^t x + \mathbb{E}_\xi \left[Q(x,\xi)\right]$$

<u>Note</u>:
$\mathbb{E}_\xi \left[g(x,\xi)\right] \equiv g(x)$ which is the objective function of the Deterministic Equivalent

- **RP** $= \underset{x\in\mathbb{K}_1}{min}\, \mathbb{E}_\xi \left[g(x,\xi)\right] = g\left(x^*(\xi)\right)$
- **WS** $= \mathbb{E}_\xi \left[\underset{x\in\mathbb{K}_1}{min}\, g(x,\mathring{\xi})\right] = \mathbb{E}_\xi \left[g\left(x^*(\mathring{\xi}),\mathring{\xi}\right)\right]$ where $\mathring{\xi} \equiv \xi$ *known*, in current period (so $\mathring{\xi}$ is a known parameter for this period, <u>and</u> a random variable ξ in any other). In short, $\mathring{\xi}$ and ξ are not the same thing and it must be pointed out by using a different notation.
- **EEV** $= \mathbb{E}_\xi \left[g\left(x^*(\bar{\xi}),\xi\right)\right] = g\left(x^*(\bar{\xi})\right)$ where $\bar{\xi} \triangleq \mathbb{E}_\xi[\xi]$
- **EV** $= \underset{x\in\mathbb{K}_1}{min}\, g(x,\bar{\xi}) = g\left(x^*(\bar{\xi}),\bar{\xi}\right)$

Note that whenever we include a 2nd argument in g we mean a <u>different</u> g than the one that has only 1 argument, which is the objective function of the Deterministic Equivalent, as stated at the beginning of this document.

The purpose of this document is to clarify the sometimes confusing notation employed in the stochastic optimization literature.