Projecting Generation Decisions Induced by a Stochastic Program on a Family of Supply Curve Functions

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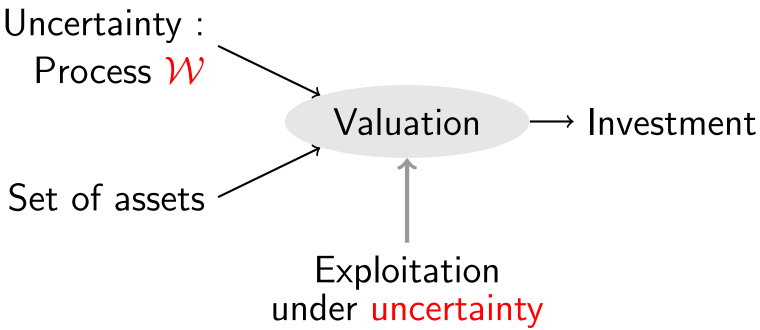
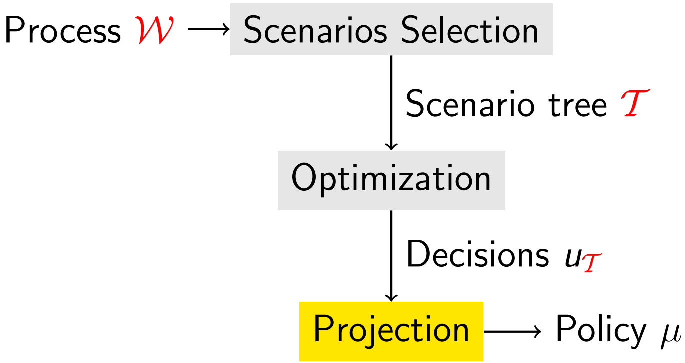
Projecting generation decisions on supply curve functions

Valuation of production assets should benefit from finer exploitation models



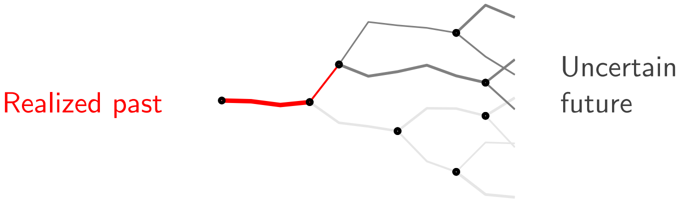
Decisions contingent on our uncertainty representation should be generalized



Optimization tractability calls for an approximate representation of the uncertainty

Set of realizations of the process $\mathcal{W}$
and their probability.

Evolving vision of the future,
believed to add robustness to decisions.



The optimization step yields feasible and implementable decisions. . . for a set of scenarios

Decisions : arbitrage between a producer's generation technologies over a time horizon

Objective function : ~~expected~~ cumulated profit
mean over the scenarios

Information at time t : system state, realized past, compatible future scenarios

Dynamics, operating constraints (feasibility) **for each scenario**

Same decisions if same information (measurability/implementability)

A way to generalize decisions : Finding a policy from information-decision pairs

Learning set $\mathcal{LS}$

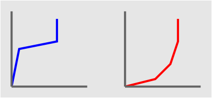
Information states and time steps
paired with
tree-contingent optimal decisions $u_{\mathcal{T}}$

Parameterized space of policies $\mathcal{H}$

Selection of a policy on the basis of the learning set

Supply curve functions (SCF's) are promising candidate policies

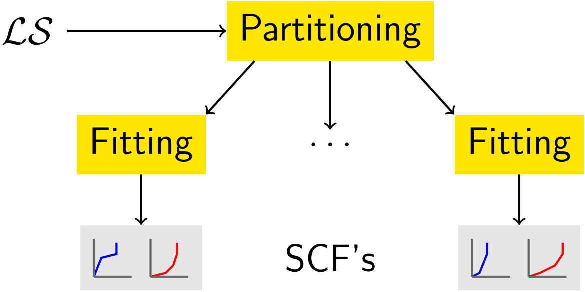
A supply curve function is robust
with respect to uncertainty about the demand



Individual SCF's for distinct
production technologies

Need for different sets of SCF's to adapt strategy
e.g. to stock levels

The supply curve functions must reflect the knowledge captured in the learning set



The policy : information-based context detector pointing to the adequate set of SCF's

Multiple runs on different trees enlarge the learning set

Many scenarios were discarded
from the tree for tractability

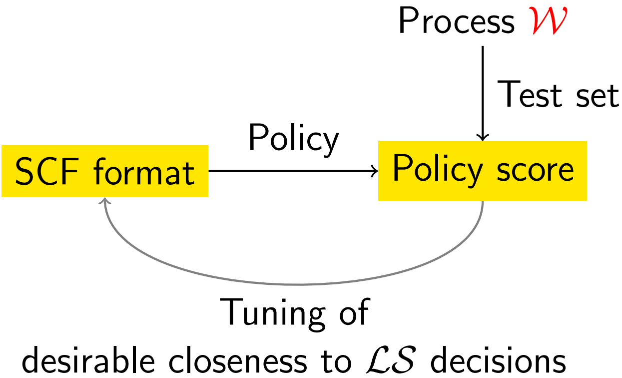
From them
we build a sequence of perturbed trees $\{\mathcal{T}_1, \ldots, \mathcal{T}_M\}$

Optimization on each tree provides
new objects
to the learning set $\mathcal{LS}$

The projection on SCF's mitigates overfitting risk, taking advantage of the problem specificities

- Post-optimization regularization
- Market logic behind
- Multiple scenario trees exploitation

The desirable flexibility of the SCF format is a numerical test dependent issue



Yet assessing the projection step is complicated by the approximations in the other steps

Scenario tree building algorithm

- ✓ Exhaustiveness vs tractability

Optimization in the stochastic programming framework

- ✓ Convexity requirements

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Projection on Supply Curve Functions

- ✓ A priori guess for the policy form
- ✓ Clustering, multiple trees and fitting

Projection step : viable alternative to a policy format imposed at the optimization step