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Volume Allocation Model for DMPA Procurement

A Study of Competition & Risk

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Motivation

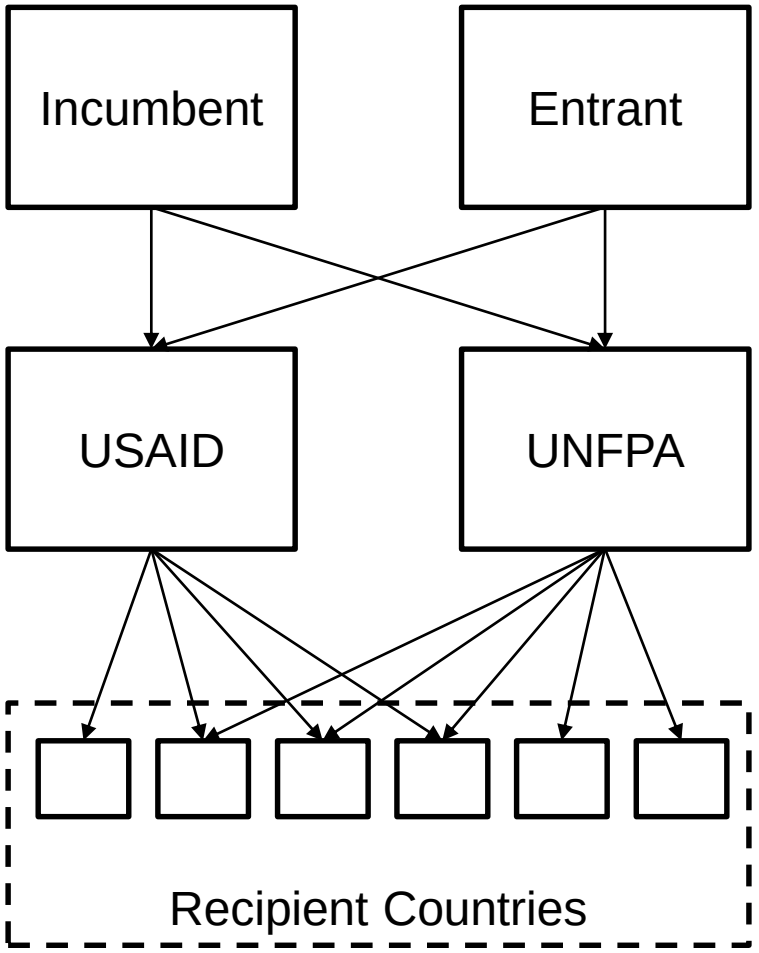
Problem Set-Up & Research Question

- USAID & UNFPA fund and procure DMPA for eligible countries
- Today: only one supplier (Pfizer) can provide a WHO-PQ product
- Future: New generic supplier(s) will enter the market

- How should USAID & UNFPA split the procurement volume between incumbent and entrant?

Major Drivers

- Purchasing costs
- Uncertain lead times of both suppliers
- Default risks of both suppliers



We conduct an extensive simulation study to guide decision makers on how to best split procurement volumes

Some questions we intend to answer….

- What are the expected benefits of the new supplier if UNFPA re-allocates X% and USAID Y% from incumbent to new supplier?
- What drives this benefit most (cost, capacity of entrant, etc.)?
- What is the downside (expected shortages) if UNFPA and USAID re-allocate volume from incumbent to entrant?
- How “bad” can the entrant perform (in terms of long lead times) until UNFPA and USAID experience substantial disruptions?
- How are benefits and disadvantages impacted by in-country registration?
- How do changes in UNFPA’s and USAID’s procurement budgets for DMPA drive the results?
- What is the value of coordination between UNFPA and USAID?

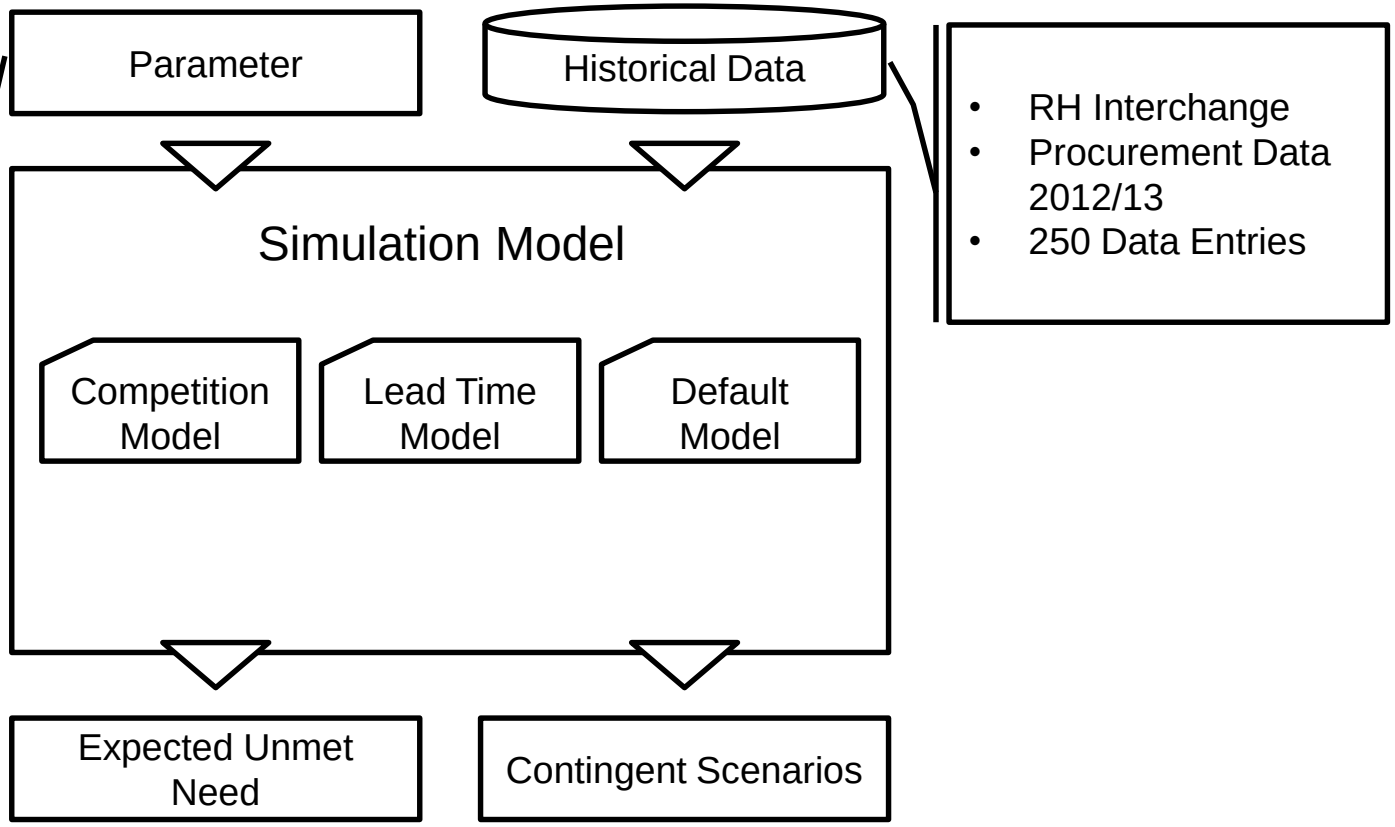
Simulation model

General:
- Budget
- Target program vol.
- Production capa.

Competition:
- Current prices
- Supplier prod. cost
- Min. entrant discount/max. incumbent premium

Lead Time:
- Contracted lead times
- Lead time distribution
- Country registration (entrant)

Default:
- Entrant default probability
- Compensation capa.



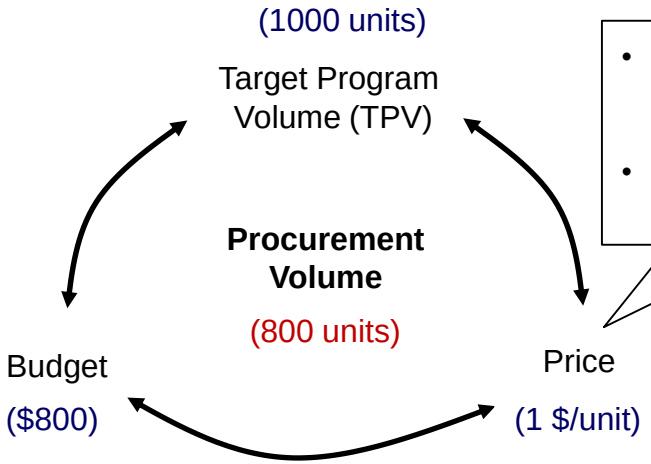
Outcome measure: expected unmet need

(See appendix for formal definition)

We capture the (positive and negative) effects of different volume splits by one outcome measure:

Price-induced Shortage

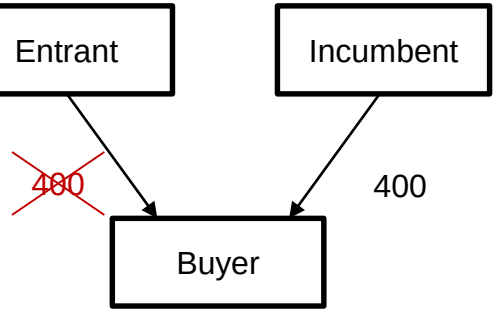
„TPV minus doses purchased with a given budget“



- New entrant induces competitive pressure and lowers prices
- Competition depends on split

Risk-induced Shortage

„shortages due to delivery failures from long lead times & supplier defaults“



- Risk-induced shortage depends on volume split

Objective & Optimization Rationale

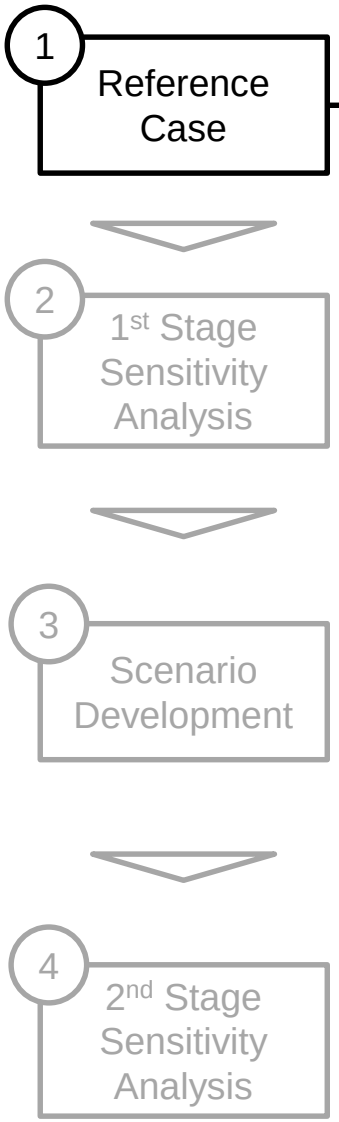
Price-induced Shortage

\+ Risk-induced Shortage

= Expected Unmet Need (EUN)

- Determine the volume split that minimizes EUN!
- Consider constraints such as production capacity of entrant and incumbent and the purchasing budgets of buying organizations.

Reference case



Reference Case – Parameters

Target Program Volume and Budget:

- USAID 58 Mil/year; Budget $ 38.4 Mil/year
- UNFPA 48 Mil/year; Budget $ 32 Mil/year
- Last year price $0.8/unit

Production Capacity and Compensation Capacity:

- Incumbent: 95,000,000; 5,000,000 units/year
- Entrant: 15,000,000; 0 units/year

Lead Time (LT):

- Contracted LT USAID: 51 days
- Contracted LT UNFPA: 69 days
- LT Buffer USAID: 1 SD (+34 days)
- LT Buffer UNFPA: 1 SD (+46 days)

Default Probabilites:

- Incumbent 3%/year
- Entrant 3%/year

Registration

- Entrant Product Registration: all countries

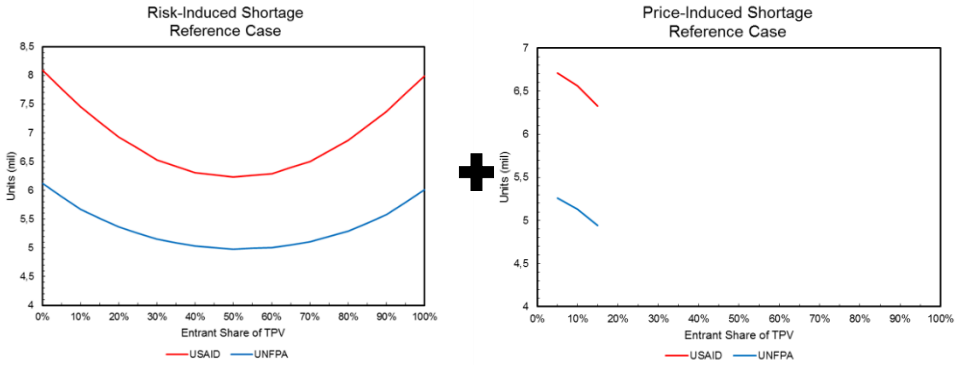
Optimal sourcing decision in the reference case

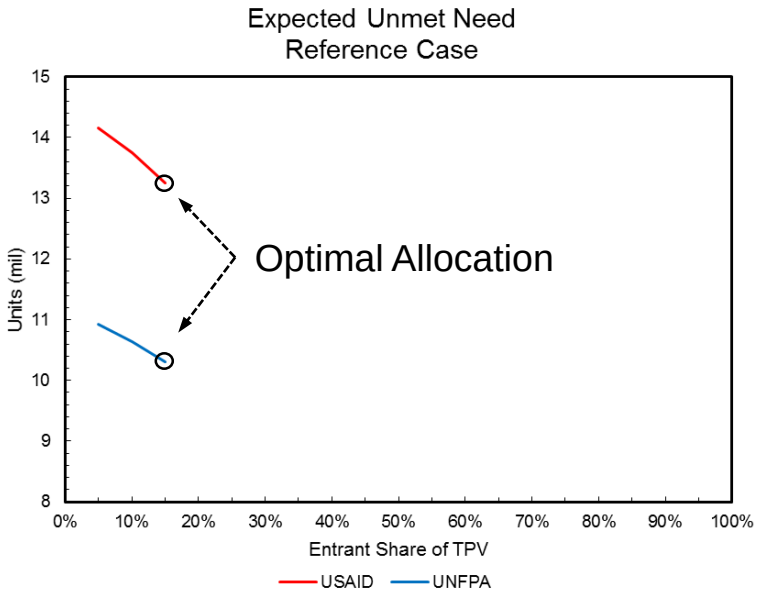
Question: Which entrant share minimizes expected unmet need?

Preliminary analysis: optimal decision

Reference case:

- The sum of risk- and price-induced shortages yield expected unmet need.
- As both are decreasing in entrant share, expected unmet need is also decreasing.
- Optimal volume split for both USAID and UNFPA is: 15% entrant; 85% incumbent.





Average lead times influence risk …

Average Lead Time

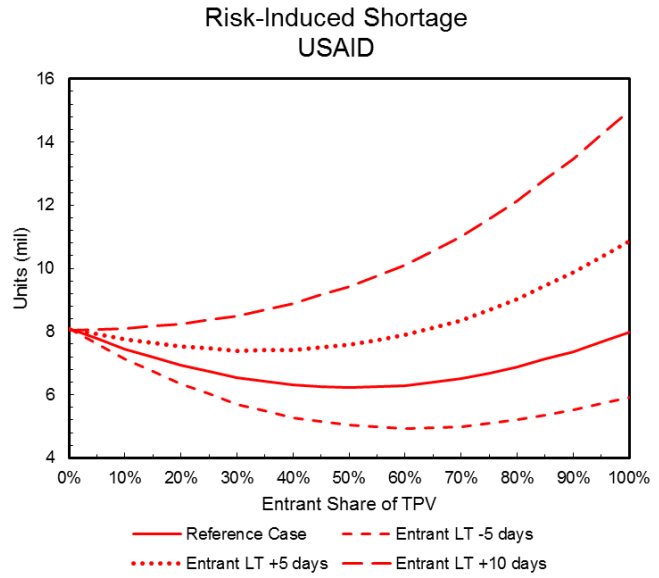
The difference between incumbent's and entrant's average lead time drives optimal splits.

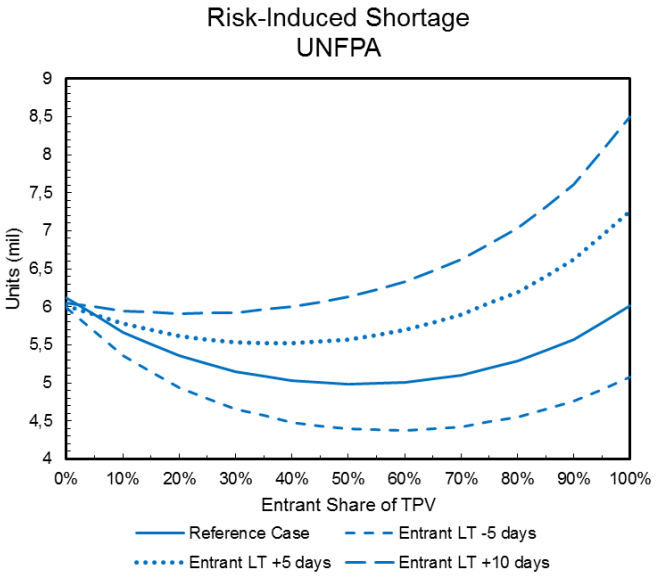
Result:

- The entrant supplier reduces risk:

  Assuming the same average lead times (LTs) and lead time distributions both buyers can utilize a diversification effect which is highest at equal splits.

- A higher average entrant lead time
  - increases risk-induced shortage,
  - reduces benefits of diversification and shifts maximum diversification to lower entrant shares,
- Note that average LT proxies the negotiated lead time. Lower average entrant LT reduces risk exposure.





Scenario I: Splitting decisions under risk (1)

Scenario I: High Risk

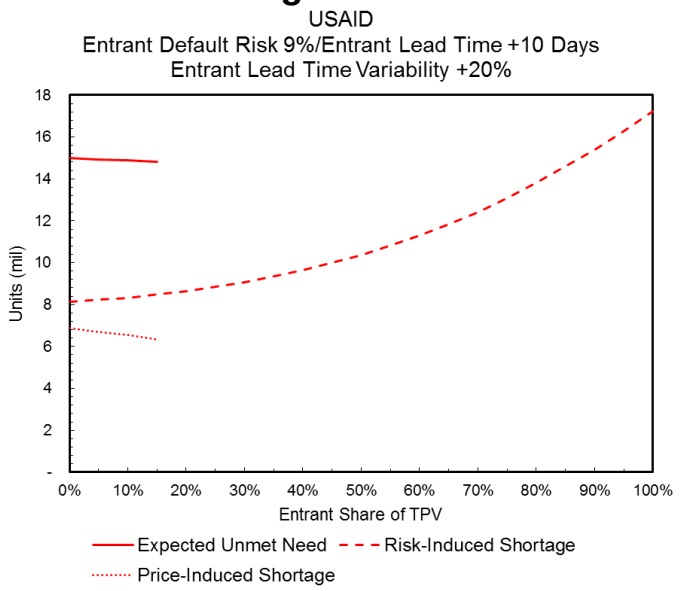
Reference case

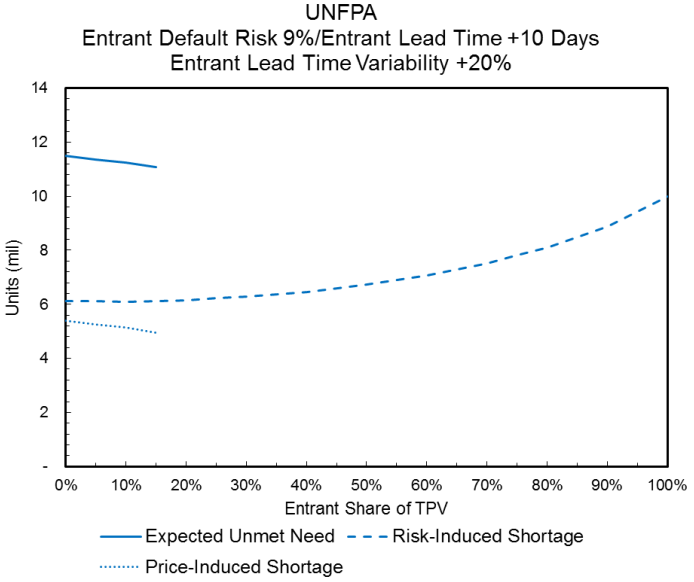
- shows that a buyer can participate in diversification effects from contracting two suppliers.
- Diversification and competition can both work in favor of a new entrant.

Results:

- But: benefits of diversification
  - depend on the split,
  - are limited by budget and capacity constraints,
  - depend on differences in average lead times, lead time variability, and default probability.
- Increasing differences reduce diversification effects (and diversification may disappear for very high differences).
- Another risk related driver is country registration.

High Risk Case





Scenario IV: Country registration

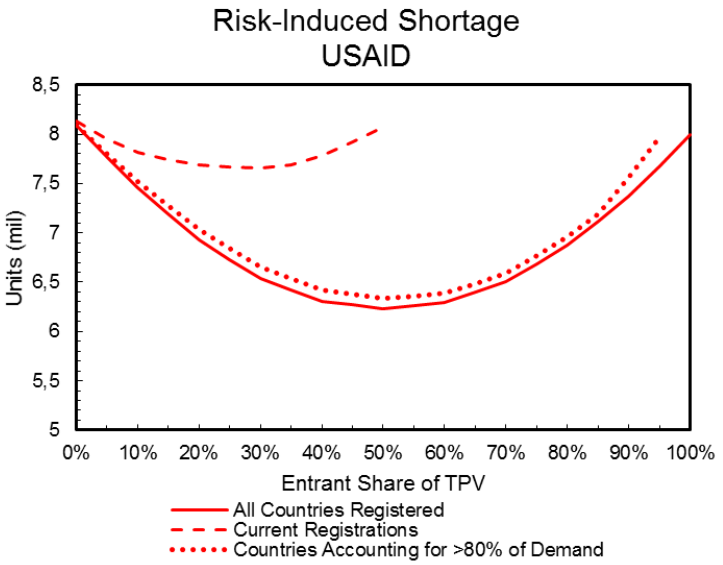
Scenario IV: Country Registration

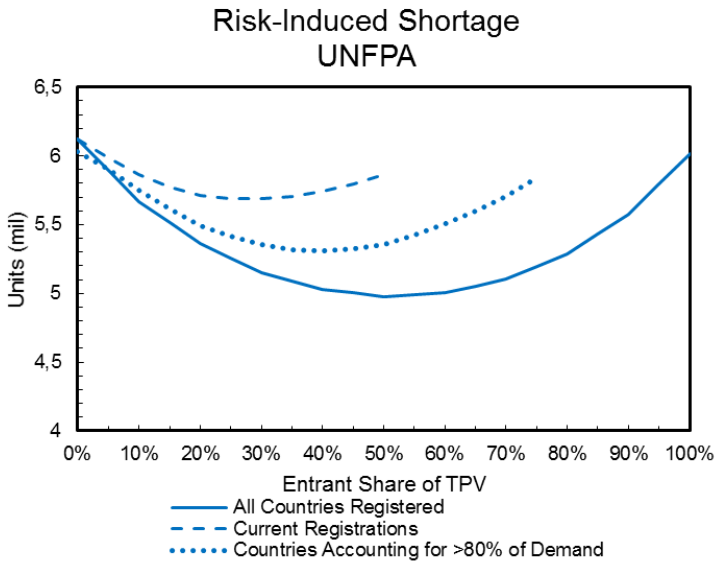
Results:

- The number of countries in which the entrant is registered limits the effects of risk diversification.
- If the entrant registers its product in more countries, diversification effects increase.
- Risk-induced shortage decreases and converges to the "all countries registered" scenario for more countries registered.
- More registered countries could also increase competition if the entrant has higher capacity because otherwise the maximum volume the entrant can supply is limited. (Not shown on slide)

Current registrations & countries with demand >80%:

Afghanistan	Indonesia	Pakistan
Burkina Faso	Kenya	Philippines
Bangladesh	Madagascar	Senegal
Cameroon	Malawi	Tanzania
DR Congo	Mali	Uganda
Ethiopia	Mozambique	Yemen
Ghana	Myanmar	Zambia
Guatemala	Nepal	Zimbabwe
Haiti	Nigeria	





Scenario V: Buffer stock

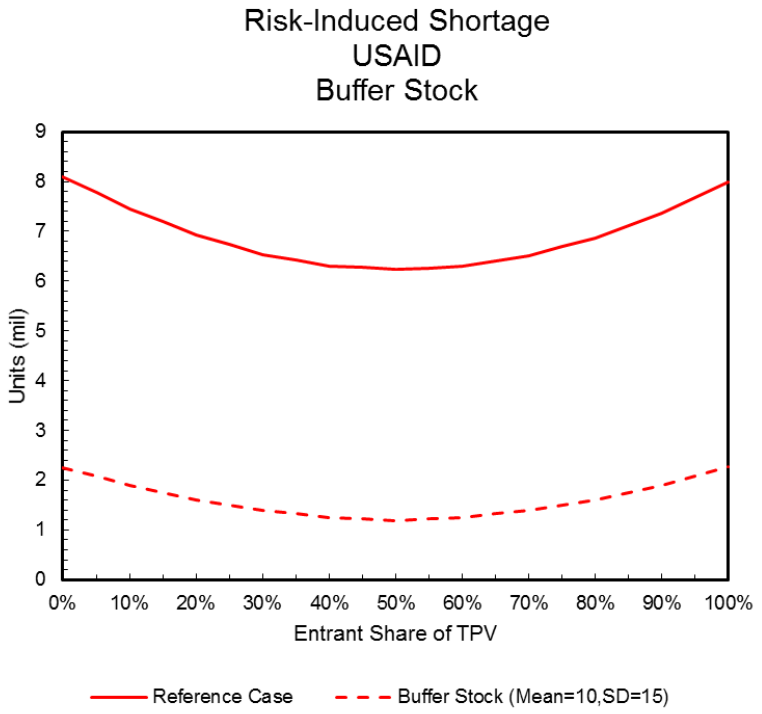
Scenario V: Buffer Stock

Results:

- Operating a buffer stock can lower risk-induced shortage.
- Example: USAID employing a buffer stock with lower mean lead time (10 days) results in approx. 5.5 mil. units less risk effect.

Back-of-the-envelope calculation:

- Suppose USAID chooses to split 20%/80% (entrant/incumbent) resulting in a weighted average price of $0.73 per unit. Hence the 5.5 mil. units less shortage amount to approx. $4 mil.
- USAID prefers to operate the buffer stock (instead of buying additional units) and reduces risk if operational costs were below $4 mil.*



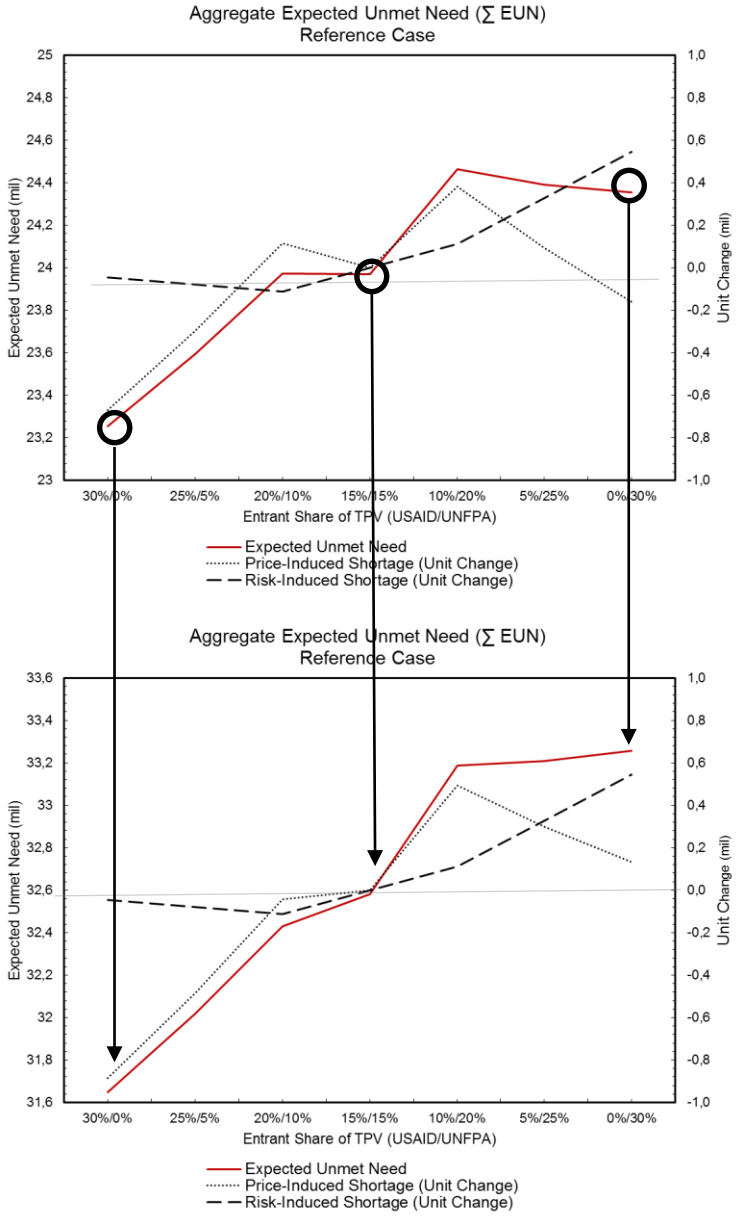
* This calculation disregards the fact that if USAID buys additional units these units are at risk of becoming shortage.

Scenario VII: Decreasing procurement budget

Scenario VII: Decreasing Procurement Budgets

Results:

- Decreasing budgets of one organizations result in increasing price-induced shortage.
- The optimal decision depends on the difference between budgets. Decreasing the budget of one organization shifts the optimal coordinated decision towards the other organization.
- If the other organization decides to increase budgets in response, coordination becomes even more important.

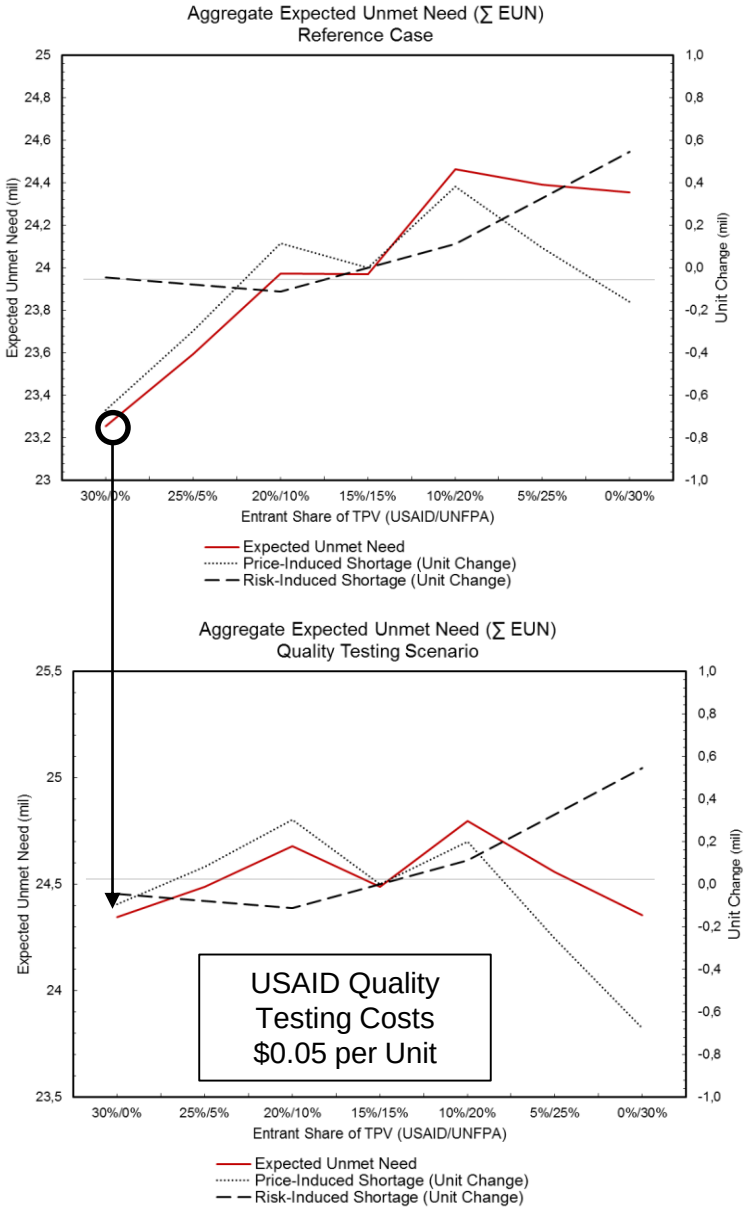


Scenario VIII: Quality testing

Scenario VIII: Quality Testing

Results:

- Costly quality testing can change the optimal coordinated decision.
- Example: Suppose USAID has to perform quality tests on the entrants product at a fixed per unit cost.
- At testing costs of $0.05 per unit, the optimal allocation changes:
  - if costs are below $0.05 per unit, it remains optimal for USAID to be procure all units from the entrant.
  - if costs are above $0.05 per unit, UNFPA should procure all units from the entrant.



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