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.

Parameter

Historical Data

Simulation Model

Competition Model

Lead Time Model

Default Model

Expected Unmet Need

Contingent Scenarios

- RH Interchange
- Procurement Data 2012/13
- 250 Data Entries
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“

- **Target Program Volume (TPV)**
- **Procurement Volume**
- **Budget**
- **Price**

**Risk-induced Shortage**

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

- **Entrant**
- **Incumbent**
- **Buyer**

**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 – 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 Probabilities:
- Incumbent 3%/year
- Entrant 3%/year

Registration:
- Entrant Product Registration: all countries
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.
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: 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.
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
- Burkina Faso
- Bangladesh
- Cameroon
- DR Congo
- Ethiopia
- Ghana
- Guatemala
- Haiti
- Indonesia
- Kenya
- Madagascar
- Malawi
- Mali
- Mozambique
- Myanmar
- Nepal
- Nigeria
- Pakistan
- Philippines
- Senegal
- Tanzania
- Uganda
- Yemen
- Zambia
- Zimbabwe

Risk-Induced Shortage
USAID

Risk-Induced Shortage
UNFPA
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 Budgets

Results:

• Decreasing budgets of one organization 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

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 procure all units from the entrant.
  - if costs are above $0.05 per unit, UNFPA should procure all units from the entrant.
• What are the expected benefits of the new supplier if UNFPA re-allocates X% and USAID Y% from incumbent to new supplier?

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Thank you very much!

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