Appendix

In this Appendix, we provide flow-chart depictions of the actions of the network agents. We divide the actions into three types: buyer's action, suppliers' action and raw supplier's actions. Note "suppliers" here refer to all non-raw material suppliers and "raw suppliers" here refer to all raw material suppliers.
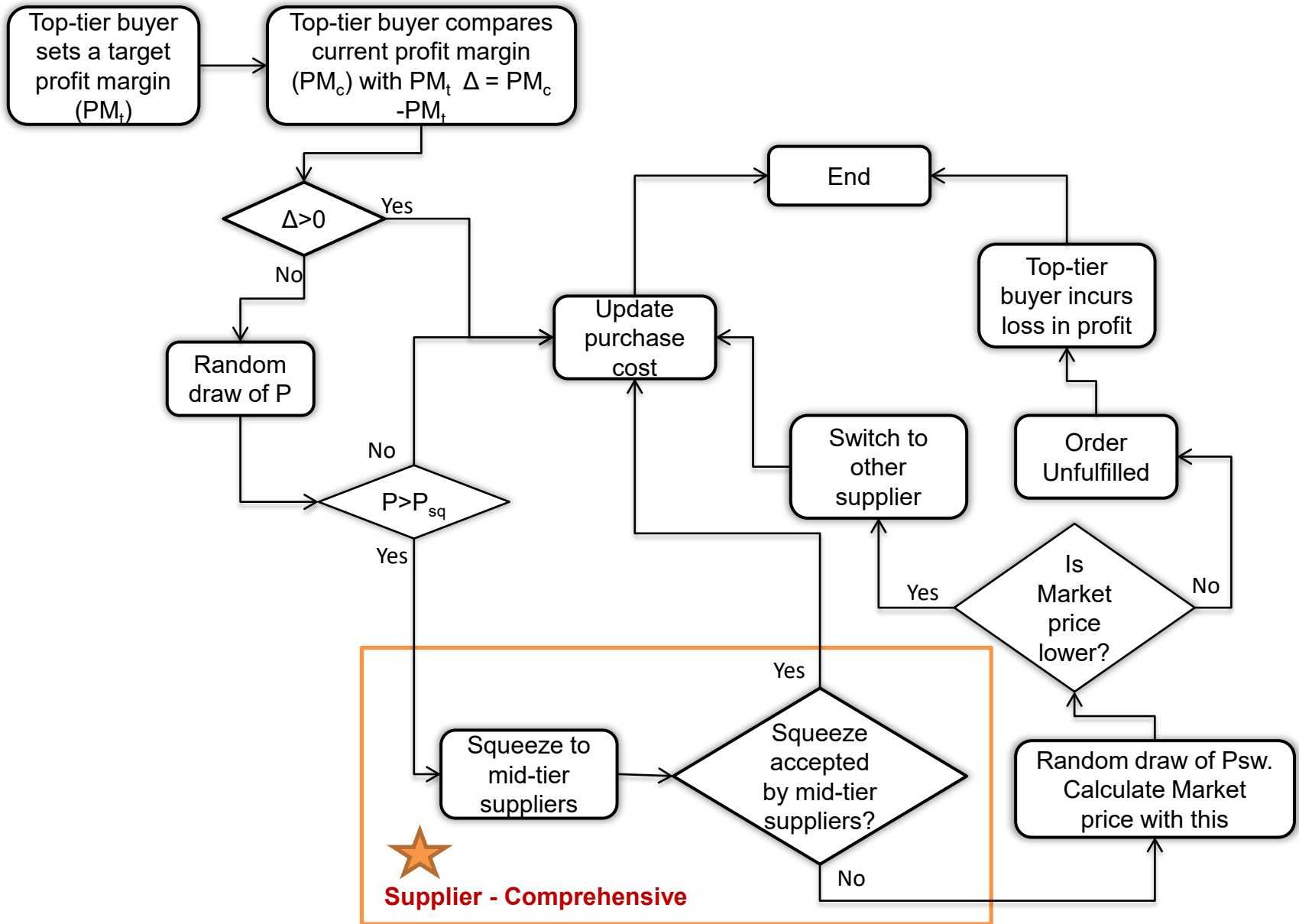
In order to improve readability, we remove the details associated with "Supplier-Comprehensive" step from the "Buyer's Logic" flow chart and provide them toward the end in a separate process flow. Similarly, we remove the details associated with "Raw Supplier Comprehensive" and provide them at the end in a separate process flow.

Below we provide a directory of the flowcharts provided in this Appendix. Note that the word "Only" at the end of the model name is to denote a somewhat independent path. However, these independent path models are not 100% orthogonal. For example, in every independent path model, there is an element of acceptance or rejection and as such they are not truly independent from the acceptance or rejection path model.

- Buyer's Logic
- Learning Logic
- Supplier-Cost Reduction Only
- Supplier-Switching Only
- Supplier-Rejection Only
- Supplier-Acceptance Only
- Raw Supplier-Cost Reduction Only
- Raw Supplier-Switching Only*
- Raw Supplier-Rejection Only
- Raw Supplier-Acceptance Only
- Supplier-Comprehensive
- Raw Supplier-Comprehensive
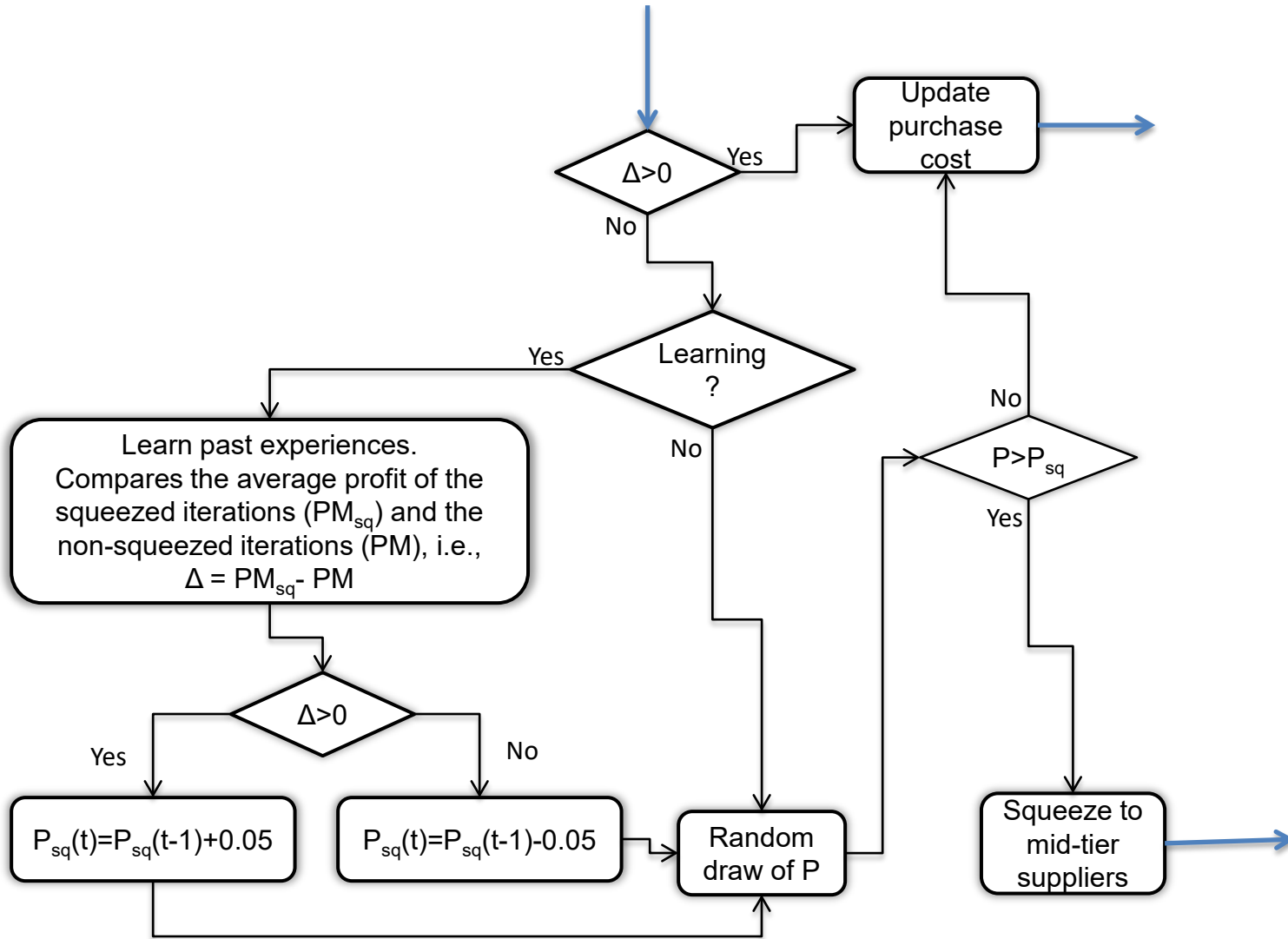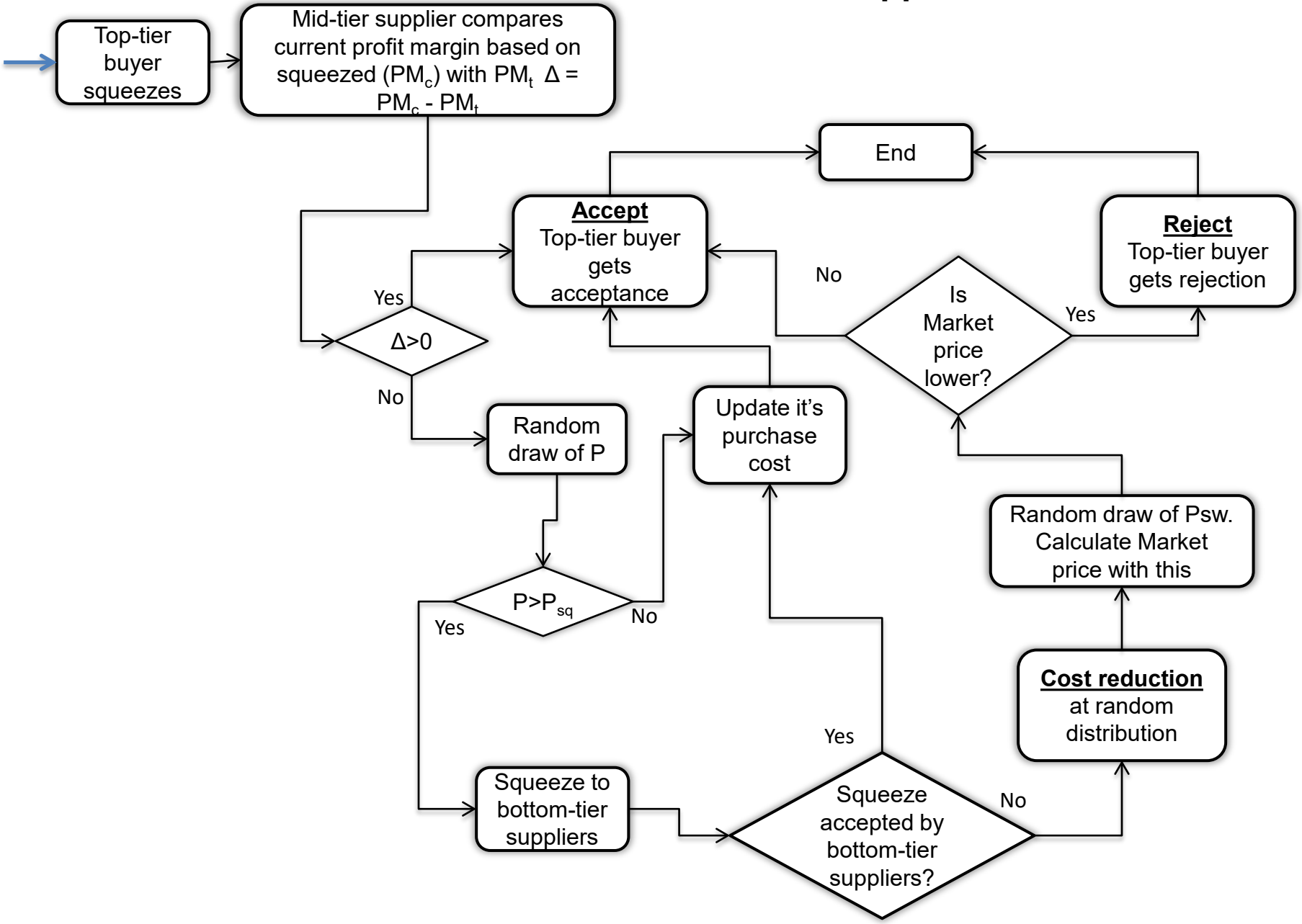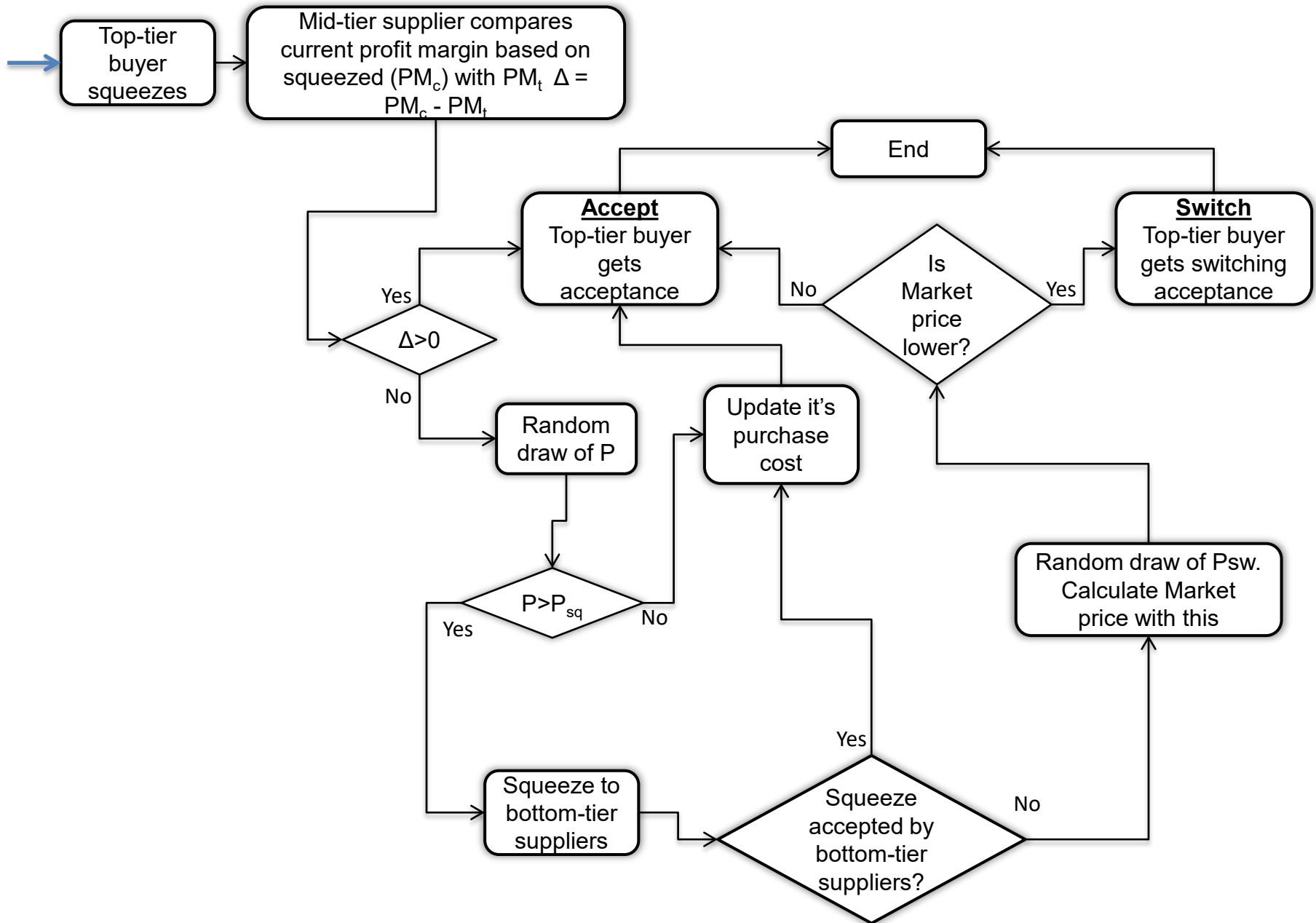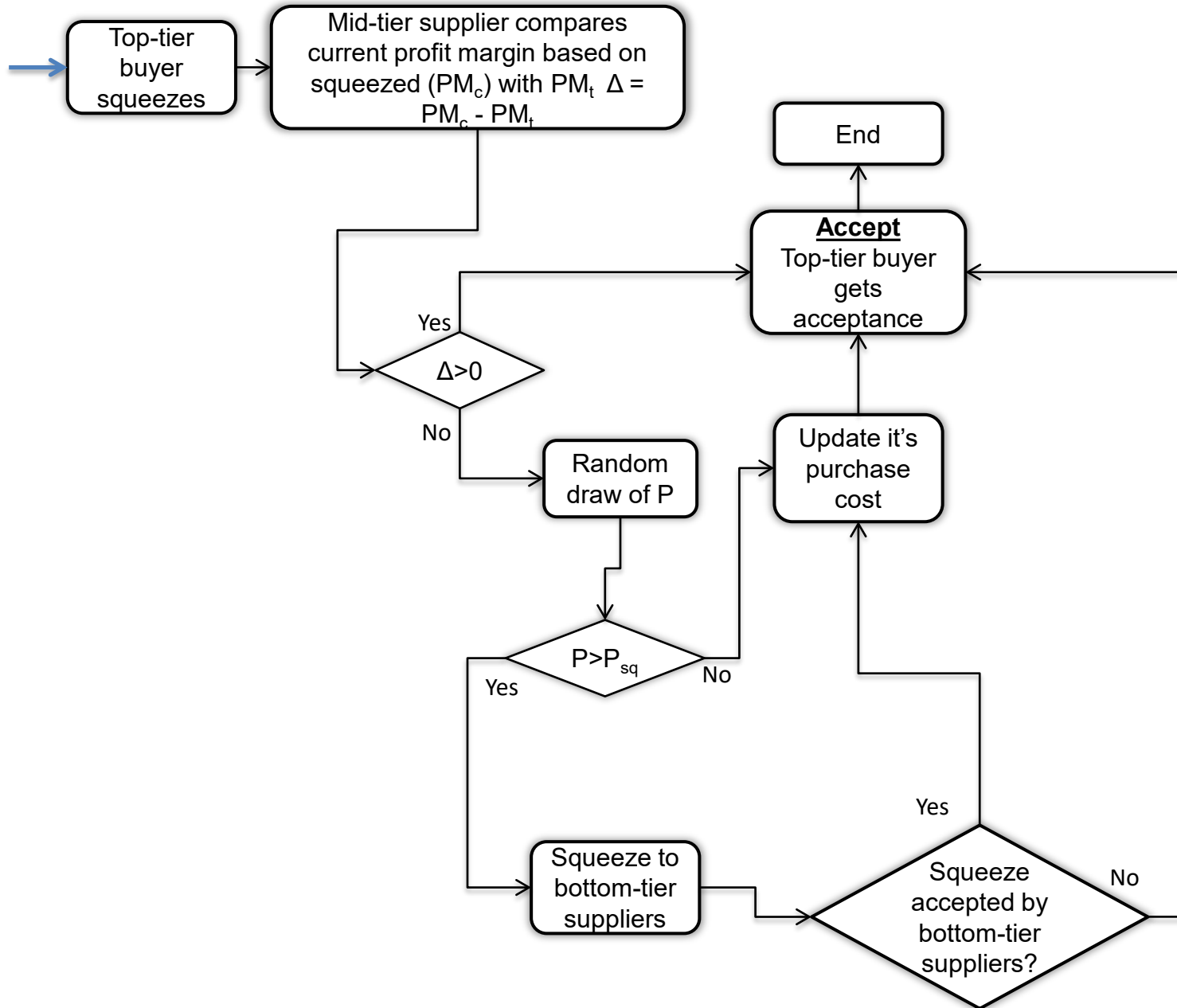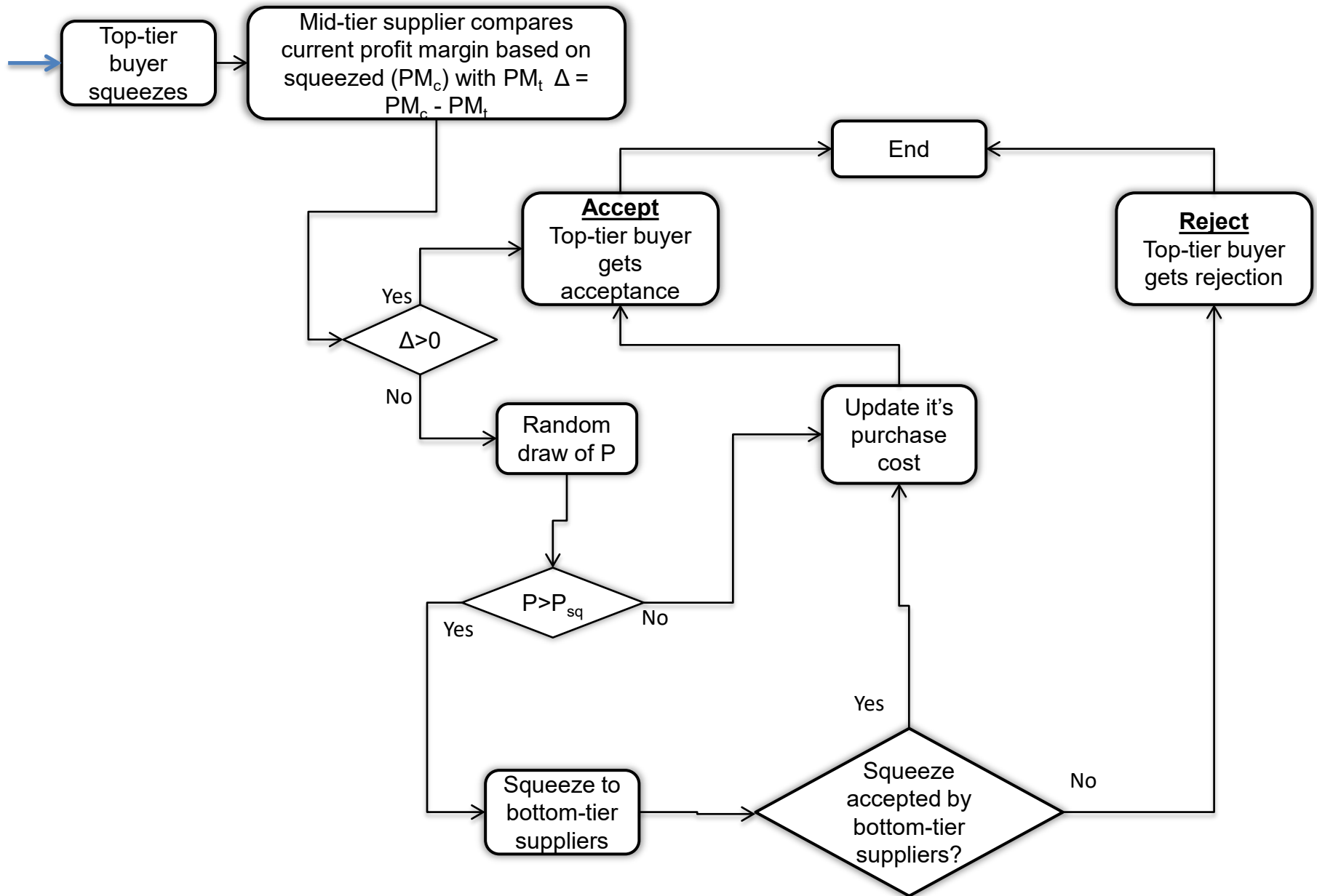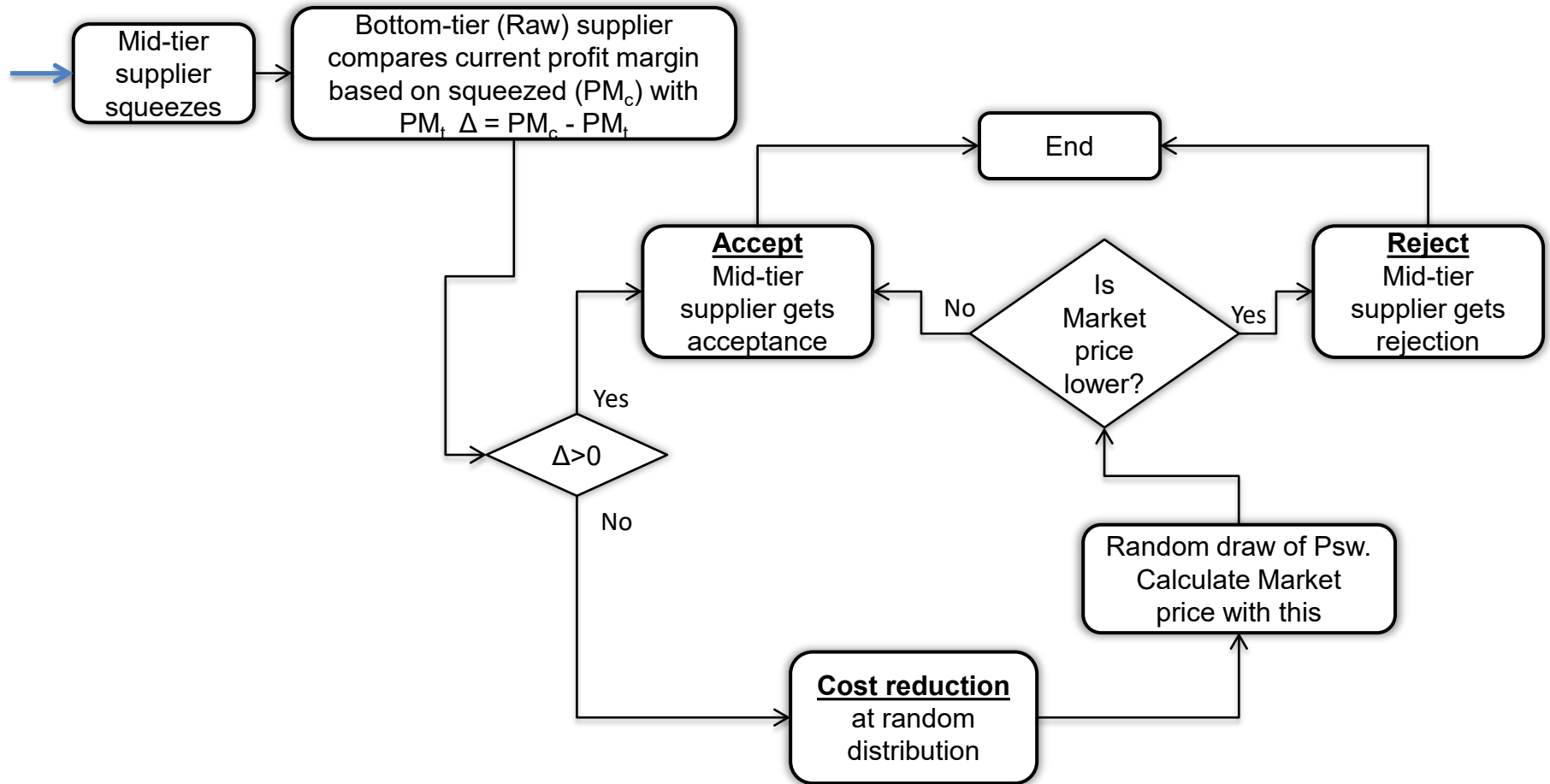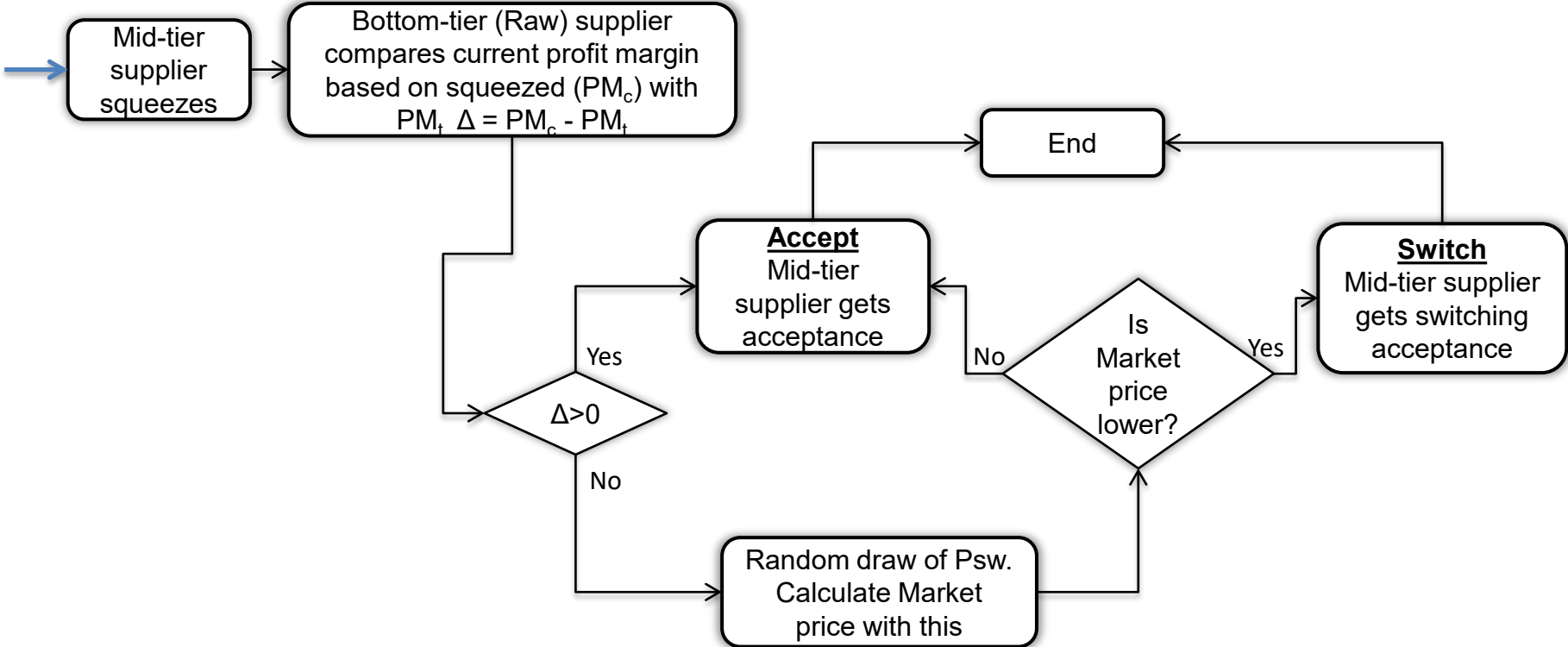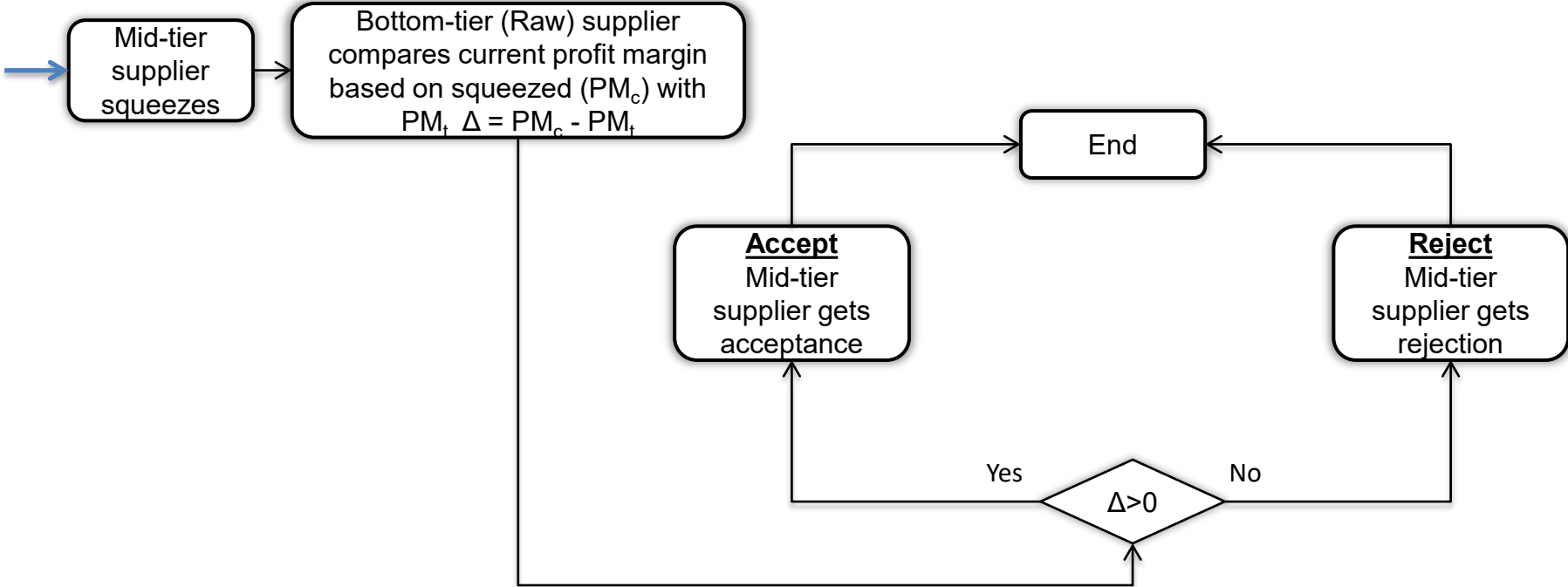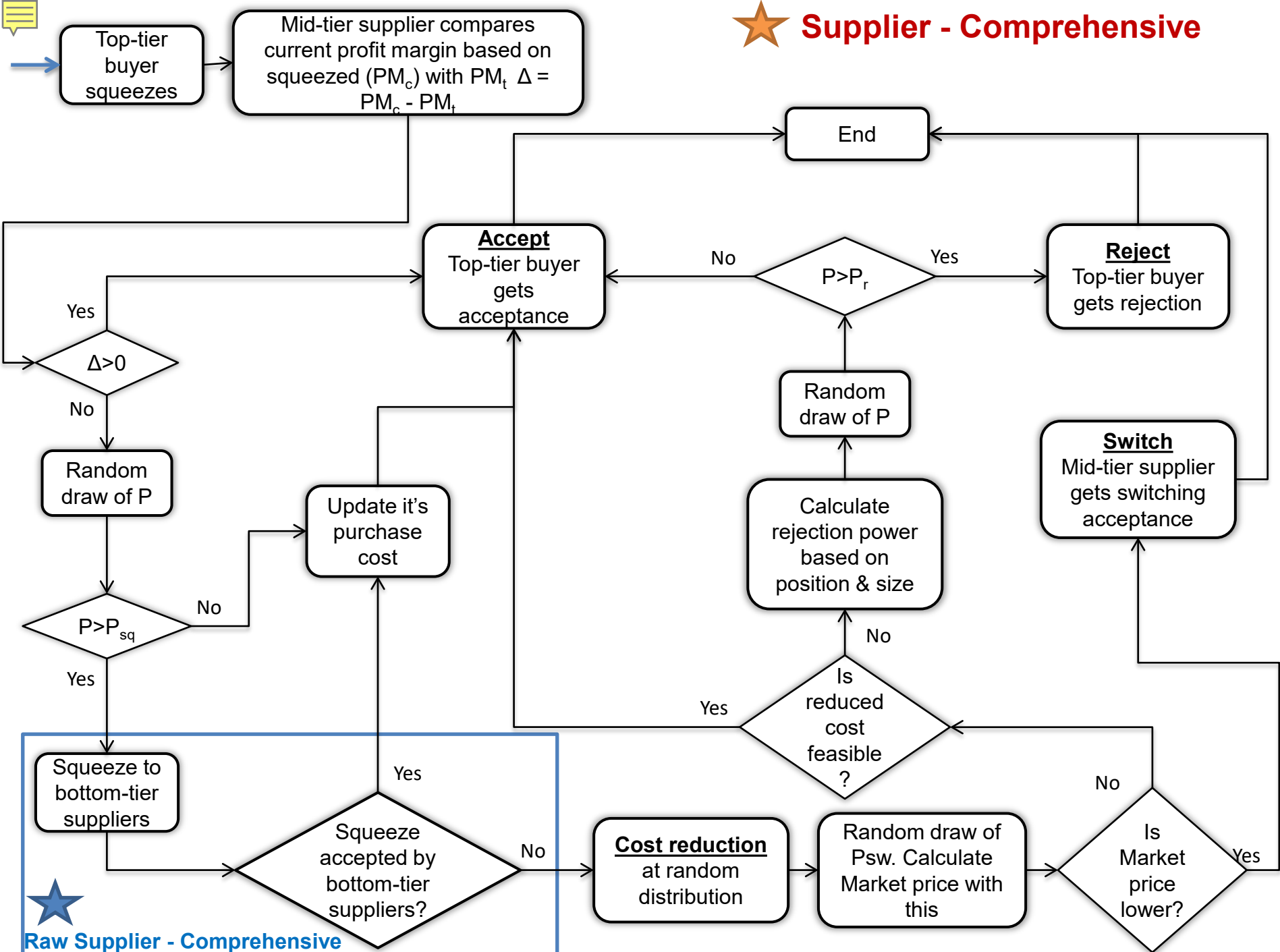
*Note that although raw material suppliers do not have the option to switch suppliers themselves, they are subject to interactions with downstream buyer when switching happens, which indirectly impacts downstream buyers. Thus, we include this interaction into the flowchart.

Buyer's Logic

```
Top-tier buyer          Top-tier buyer compares
sets a target           current profit margin
profit margin    →      (PM_c) with PM_t  Δ = PM_c
(PM_t)                  -PM_t
```

$$\Delta > 0 \quad \text{Yes}$$

No → **Random draw of P**

P > P_sq — No / Yes

Squeeze to mid-tier suppliers → **Squeeze accepted by mid-tier suppliers?** (Yes / No)

⭐ **Supplier - Comprehensive**

Update purchase cost

Switch to other supplier

Is Market price lower? (Yes / No)

Random draw of Psw. Calculate Market price with this

Order Unfulfilled

Top-tier buyer incurs loss in profit

End

Δ>0

Yes

Update purchase cost

No

Learning ?

Yes

No

Learn past experiences. Compares the average profit of the squeezed iterations (PM_{sq}) and the non-squeezed iterations (PM), i.e., $Δ = PM_{sq} - PM$

$P > P_{sq}$

No

Yes

Δ>0

Yes

No

$P_{sq}(t) = P_{sq}(t-1) + 0.05$

$P_{sq}(t) = P_{sq}(t-1) - 0.05$

Random draw of P

Squeeze to mid-tier suppliers

Top-tier buyer squeezes

Mid-tier supplier compares current profit margin based on squeezed (PM_c) with PM_t $\Delta = PM_c - PM_t$

End

Accept
Top-tier buyer gets acceptance

Reject
Top-tier buyer gets rejection

$\Delta > 0$

Yes

No

Is Market price lower?

No

Yes

Random draw of P

Update it's purchase cost

Random draw of Psw. Calculate Market price with this

$P > P_{sq}$

Yes

No

Squeeze to bottom-tier suppliers

Squeeze accepted by bottom-tier suppliers?

Yes

No

Cost reduction
at random distribution

```mermaid
flowchart
```

Top-tier buyer squeezes → Mid-tier supplier compares current profit margin based on squeezed (PM_c) with PM_t $\Delta = PM_c - PM_t$

$\Delta > 0$
- Yes → **Accept** Top-tier buyer gets acceptance
- No → Random draw of P

Random draw of P → $P > P_{sq}$
- Yes → Squeeze to bottom-tier suppliers
- No → Update it's purchase cost

Squeeze to bottom-tier suppliers → Squeeze accepted by bottom-tier suppliers?
- Yes → Update it's purchase cost
- No → Random draw of Psw. Calculate Market price with this

Random draw of Psw. Calculate Market price with this → Is Market price lower?
- No → **Accept** Top-tier buyer gets acceptance
- Yes → **Switch** Top-tier buyer gets switching acceptance

Update it's purchase cost → **Accept** Top-tier buyer gets acceptance

Accept → End
Switch → End

Top-tier buyer squeezes

Mid-tier supplier compares current profit margin based on squeezed (PM_c) with PM_t $\Delta = PM_c - PM_t$

End

Accept
Top-tier buyer gets acceptance

Reject
Top-tier buyer gets rejection

Yes

$\Delta > 0$

No

Random draw of P

Update it's purchase cost

$P > P_{sq}$

Yes

No

Squeeze to bottom-tier suppliers

Yes

Squeeze accepted by bottom-tier suppliers?

No

Mid-tier supplier squeezes

Bottom-tier (Raw) supplier compares current profit margin based on squeezed (PM_c) with PM_t $\Delta = PM_c - PM_t$

End

Accept
Mid-tier supplier gets acceptance

Is Market price lower?

Reject
Mid-tier supplier gets rejection

No

Yes

$\Delta > 0$

Yes

No

Random draw of Psw. Calculate Market price with this

Cost reduction
at random distribution

Mid-tier supplier squeezes

Bottom-tier (Raw) supplier compares current profit margin based on squeezed (PM_c) with PM_t $\Delta = PM_c - PM_t$

End

<u>Accept</u>
Mid-tier supplier gets acceptance

<u>Switch</u>
Mid-tier supplier gets switching acceptance

$\Delta > 0$

Yes

No

Is Market price lower?

No

Yes

Random draw of Psw. Calculate Market price with this

Mid-tier supplier squeezes

Bottom-tier (Raw) supplier compares current profit margin based on squeezed (PM_c) with PM_t $\Delta = PM_c - PM_t$

$\Delta > 0$

Yes

No

End

Accept
Mid-tier supplier gets acceptance

Mid-tier supplier squeezes

Bottom-tier (Raw) supplier compares current profit margin based on squeezed (PM_c) with PM_t $\Delta = PM_c - PM_t$

End

Accept
Mid-tier supplier gets acceptance

Reject
Mid-tier supplier gets rejection

Yes

No

$\Delta > 0$

```
[Top-tier buyer squeezes] → [Mid-tier supplier compares current profit margin based on squeezed (PM_c) with PM_t  Δ = PM_c - PM_t]
```

Top-tier buyer squeezes

Mid-tier supplier compares current profit margin based on squeezed (PM_c) with PM_t $\Delta = PM_c - PM_t$

End

Accept
Top-tier buyer gets acceptance

$P > P_r$ — No → Accept ; Yes → Reject

Reject
Top-tier buyer gets rejection

$\Delta > 0$ — Yes → Accept ; No → Random draw of P

Random draw of P

Random draw of P

$P > P_{sq}$ — No → Update it's purchase cost ; Yes → Squeeze to bottom-tier suppliers

Update it's purchase cost

Calculate rejection power based on position & size

Switch
Mid-tier supplier gets switching acceptance

Squeeze to bottom-tier suppliers

Is reduced cost feasible? — Yes → Update it's purchase cost ; No → Calculate rejection power based on position & size

Squeeze accepted by bottom-tier suppliers? — Yes → Update it's purchase cost ; No → Cost reduction

Cost reduction
at random distribution

Random draw of Psw. Calculate Market price with this

Is Market price lower? — No → Is reduced cost feasible? ; Yes → Switch

Raw Supplier - Comprehensive

Mid-tier supplier squeezes

Bottom-tier (Raw) supplier compares current profit margin based on squeezed (PM_c) with PM_t $\Delta = PM_c - PM_t$

End

Accept
Mid-tier supplier gets acceptance

$\Delta > 0$

$P > P_r$

Reject
Mid-tier supplier gets rejection

Random draw of P

Calculate rejection power based on position & size

Switch
Mid-tier supplier gets switching acceptance

Is reduced cost feasible?

Cost reduction
at random distribution

Random draw of Psw. Calculate Market price with this

Is Market price lower?