vat_compete_2024_x_y.dfw

#1: CaseMode ≔ Sensitive

#2: InputMode ≔ Word

(transp cost, differentiation parameter): Note μ is used below for section 2. but then I switched the entire paper to λ (location)

#3: μ ∈ Real (0, ∞)

#4: λ ∈ Real (0, ∞)

rate of sales tax

#5: τ ∈ Real (0, ∞)

total consumer population

#6: n ∈ Real (0, ∞)

Unit costs

#7: ca ∈ Real [0, ∞)

#8: cb ∈ Real [0, ∞)

prices

#9: pa ∈ Real (0, ∞)

#10: pb ∈ Real (0, ∞)

#11: qa ∈ Real (0, ∞)

#12: qb ∈ Real (0, ∞)

A's market share

#13: $\hat{x} \in \mathbb{R}\ (0, 1)$

basic valuations

#14: $v_a \in \mathbb{R}\ (0, \infty)$

#15: $v_b \in \mathbb{R}\ (0, \infty)$

#16: $\Delta v \in \mathbb{R}\ [0, \infty)$

fraction of slow-computing consumers

#17: $\sigma \in \mathbb{R}\ [0, 1]$

*** Section 2: Price embedded into the price (benchmark model)

eq (1)

#18: $q_a = p_a \cdot (1 + \tau)$

#19: $q_b = p_b \cdot (1 + \tau)$

#20: SOLVE($q_a = p_a \cdot (1 + \tau)$, p_a)

#21: $$p_a = \frac{q_a}{\tau + 1}$$

#22: SOLVE($q_b = p_b \cdot (1 + \tau)$, p_b)

#23: $$p_b = \frac{q_b}{\tau + 1}$$

eq (2) Utility functions

#24: $v_a - p_a \cdot (1 + \tau) - \mu \cdot x$

#25: $v_a - q_a - \mu \cdot x$

#26: $vb - pb\cdot(1 + \tau) - \mu\cdot(1 - x)$

#27: $vb - qb - \mu\cdot(1 - x)$

#28: $va - pa\cdot(1 + \tau) - \mu\cdot x = vb - pb\cdot(1 + \tau) - \mu\cdot(1 - x)$

#29: $\text{SOLVE}(va - pa\cdot(1 + \tau) - \mu\cdot x = vb - pb\cdot(1 + \tau) - \mu\cdot(1 - x), x)$

eq (3)

#30: $$xhat = -\frac{pa\cdot(\tau + 1) - pb\cdot(\tau + 1) - va + vb - \mu}{2\cdot\mu}$$

#31: $$xhat = -\frac{pa\cdot(\tau + 1) - pb\cdot(\tau + 1) - \Delta v - \mu}{2\cdot\mu}$$

#32: $$xhat = -\frac{qa - qb - \Delta v - \mu}{2\cdot\mu}$$

eq (4) Profit max w.r.t. qa and qb (tax inclusive)

#33: $profita = (pa - ca)\cdot n\cdot xhat$

#34: $profitb = (pb - cb)\cdot n\cdot(1 - xhat)$

#35: $$profita = \left(\frac{qa}{\tau + 1} - ca\right)\cdot n\cdot\left(-\frac{qa - qb - \Delta v - \mu}{2\cdot\mu}\right)$$

#36: $$profitb = \left(\frac{qb}{\tau + 1} - cb\right)\cdot n\cdot\left(1 - -\frac{qa - qb - \Delta v - \mu}{2\cdot\mu}\right)$$

Appendix A. eq (A.1)

#37: $$\frac{d}{d\ qa}\left(profita = \left(\frac{qa}{\tau + 1} - ca\right)\cdot n\cdot\left(-\frac{qa - qb - \Delta v - \mu}{2\cdot\mu}\right)\right)$$

#38: $$0 = \frac{n\cdot(ca\cdot(\tau + 1) - 2\cdot qa + qb + \Delta v + \mu)}{2\cdot\mu\cdot(\tau + 1)}$$

#39: $$\frac{d}{d\ qa}\frac{d}{d\ qa}\left(profita = \left(\frac{qa}{\tau + 1} - ca\right)\cdot n\cdot\left(-\frac{qa - qb - \Delta v - \mu}{2\cdot\mu}\right)\right)$$

#40: $$0 > -\frac{n}{\mu\cdot(\tau + 1)}$$

#41: $$\frac{d}{d\ qb}\left(profitb = \left(\frac{qb}{\tau + 1} - cb\right)\cdot n\cdot\left(1 - -\frac{qa - qb - \Delta v - \mu}{2\cdot\mu}\right)\right)$$

#42: $$0 = \frac{n\cdot(cb\cdot(\tau + 1) + qa - 2\cdot qb - \Delta v + \mu)}{2\cdot\mu\cdot(\tau + 1)}$$

#43: $$\frac{d}{d\ qb}\frac{d}{d\ qb}\left(profitb = \left(\frac{qb}{\tau + 1} - cb\right)\cdot n\cdot\left(1 - -\frac{qa - qb - \Delta v - \mu}{2\cdot\mu}\right)\right)$$

#44: $$0 > -\frac{n}{\mu\cdot(\tau + 1)}$$

eq (5)

#45: $$SOLVE\left(\left[0 = \frac{n\cdot(ca\cdot(\tau + 1) - 2\cdot qa + qb + \Delta v + \mu)}{2\cdot\mu\cdot(\tau + 1)},\ 0 = \frac{n\cdot(cb\cdot(\tau + 1) + qa - 2\cdot qb - \Delta v + \mu)}{2\cdot\mu\cdot(\tau + 1)}\right], [qa,$$

qb]

#46: $$\left[qaI = \frac{2\cdot ca\cdot(\tau + 1) + cb\cdot(\tau + 1) + \Delta v + 3\cdot\mu}{3} \wedge qbI = \frac{ca\cdot(\tau + 1) + 2\cdot cb\cdot(\tau + 1) - \Delta v + 3\cdot\mu}{3}\right]$$

#47: $$\left[pa\cdot(1 + \tau) = \frac{2\cdot ca\cdot(\tau + 1) + cb\cdot(\tau + 1) + \Delta v + 3\cdot\mu}{3} \wedge pb\cdot(1 + \tau) = \frac{ca\cdot(\tau + 1) + 2\cdot cb\cdot(\tau + 1) - \Delta v + 3\cdot\mu}{3}\right]$$

#48: $$\text{SOLVE}\left(\left[pa\cdot(1 + \tau) = \frac{2\cdot ca\cdot(\tau + 1) + cb\cdot(\tau + 1) + \Delta v + 3\cdot\mu}{3} \wedge pb\cdot(1 + \tau) = \frac{ca\cdot(\tau + 1) + 2\cdot cb\cdot(\tau + 1) - \Delta v + 3\cdot\mu}{3}\right], [pa, pb]\right)$$

#49: $$\left[paI = \frac{2\cdot ca\cdot(\tau + 1) + cb\cdot(\tau + 1) + \Delta v + 3\cdot\mu}{3\cdot(\tau + 1)} \wedge pbI = \frac{ca\cdot(\tau + 1) + 2\cdot cb\cdot(\tau + 1) - \Delta v + 3\cdot\mu}{3\cdot(\tau + 1)}\right]$$

Define $\Delta c = ca - cb$

eq (6)

#50: $$xhatI = -\frac{\Delta c\cdot(\tau + 1) - \Delta v - 3\cdot\mu}{6\cdot\mu}$$

#51: $$\text{profitaI} = \frac{n\cdot(\Delta c\cdot(\tau + 1) - \Delta v - 3\cdot\mu)^2}{18\cdot\mu\cdot(\tau + 1)}$$

#52: $$\text{profitbI} = \frac{n\cdot(\Delta c\cdot(\tau + 1) - \Delta v + 3\cdot\mu)^2}{18\cdot\mu\cdot(\tau + 1)}$$

Result 1a

#53: $$\frac{d}{d\tau}\left(\text{qaI} = \frac{2\cdot ca\cdot(\tau + 1) + cb\cdot(\tau + 1) + \Delta v + 3\cdot\mu}{3}\right)$$

#54: $$0 < \frac{2\cdot ca + cb}{3}$$

#55: $$\frac{d}{d\tau}\left(\text{qbI} = \frac{ca\cdot(\tau + 1) + 2\cdot cb\cdot(\tau + 1) - \Delta v + 3\cdot\mu}{3}\right)$$

#56: $$0 < \frac{ca + 2\cdot cb}{3}$$

#57: $$\frac{d}{d\tau}\left(\text{paI} = \frac{2\cdot ca\cdot(\tau + 1) + cb\cdot(\tau + 1) + \Delta v + 3\cdot\mu}{3\cdot(\tau + 1)}\right)$$

#58: $$0 > -\frac{\Delta v + 3\cdot\mu}{3\cdot(\tau + 1)^2}$$

$$\#59:\quad \frac{d}{d\tau}\left(pbI = \frac{ca\cdot(\tau+1) + 2\cdot cb\cdot(\tau+1) - \Delta v + 3\cdot\mu}{3\cdot(\tau+1)}\right)$$

$$\#60:\quad 0 > \frac{\Delta v - 3\cdot\mu}{3\cdot(\tau+1)^2}$$

by Assumption 2.

restriction xhat > 0 if

$$\#61:\quad -\frac{\Delta c\cdot(\tau+1) - \Delta v - 3\cdot\mu}{6\cdot\mu} > 0$$

$$\#62:\quad \text{SOLVE}\left(-\frac{\Delta c\cdot(\tau+1) - \Delta v - 3\cdot\mu}{6\cdot\mu} > 0,\ \mu\right)$$

$$\#63:\quad \left(\mu < \frac{\Delta c\cdot(\tau+1) - \Delta v}{3} \wedge \mu < 0\right) \vee \left(\mu > \frac{\Delta c\cdot(\tau+1) - \Delta v}{3} \wedge \mu > 0\right)$$

$$\#64:\quad \mu > \frac{\Delta c\cdot(\tau+1) - \Delta v}{3}$$

restriction xhat < 1 if

$$\#65:\quad -\frac{\Delta c\cdot(\tau+1) - \Delta v - 3\cdot\mu}{6\cdot\mu} < 1$$

$$\#66:\quad \text{SOLVE}\left(-\frac{\Delta c\cdot(\tau+1) - \Delta v - 3\cdot\mu}{6\cdot\mu} < 1,\ \mu\right)$$

#67: $$\left(\mu < \frac{\Delta v - \Delta c\cdot(\tau + 1)}{3} \wedge \mu < 0\right) \vee \left(\mu > \frac{\Delta v - \Delta c\cdot(\tau + 1)}{3} \wedge \mu > 0\right)$$

#68: $$\mu > \frac{\Delta v - \Delta c\cdot(\tau + 1)}{3}$$

xhatI > 0 if

#69: $\Delta c\cdot(\tau + 1) - \Delta v - 3\cdot\mu < 0$

#70: SOLVE($\Delta c\cdot(\tau + 1) - \Delta v - 3\cdot\mu < 0$, μ)

#71: $$\mu > \frac{\Delta c\cdot(\tau + 1) - \Delta v}{3}$$

*** Section 3: Price competition with sales tax separated from price

eq (7) utility functions

buys A (fast-computing)

#72: $va - pa\cdot(1 + \tau) - \lambda\cdot x$

buys A (slow computing)

#73: $va - pa - \lambda\cdot x$

buy B (fast)

#74: $vb - pb\cdot(1 + \tau) - \lambda\cdot(1 - x)$

buy B (slow)

#75: $vb - pb - \lambda\cdot(1 - x)$

eqs (8): indiff consumers

xhat_s

#76: $va - pa - \lambda\cdot xhats = vb - pb - \lambda\cdot(1 - xhats)$

#77: SOLVE(va − pa − λ·xhats = vb − pb − λ·(1 − xhats), xhats)

#78: $$xhats = -\frac{pa - pb - va + vb - \lambda}{2\cdot\lambda}$$

#79: $$xhats = \frac{1}{2} - \frac{pa - pb - \Delta v}{2\cdot\lambda}$$

xhatf

#80: $va - pa\cdot(1 + \tau) - \lambda\cdot x = vb - pb\cdot(1 + \tau) - \lambda\cdot(1 - x)$

#81: SOLVE(va − pa·(1 + τ) − λ·x = vb − pb·(1 + τ) − λ·(1 − x), x)

#82: $$xhatf = -\frac{pa\cdot(\tau + 1) - pb\cdot(\tau + 1) - va + vb - \lambda}{2\cdot\lambda}$$

#83: $$xhatf = \frac{1}{2} - \frac{(pa - pb)\cdot(\tau + 1) - \Delta v}{2\cdot\lambda}$$

eq (9) profit max

#84: $profita = (pa - ca)\cdot n\cdot((1 - \sigma)\cdot xhatf + \sigma\cdot xhats)$

#85: $profitb = (pb - cb)\cdot n\cdot((1 - \sigma)\cdot(1 - xhatf) + \sigma\cdot(1 - xhats))$

eq (10) and Appendix B: eql prices

#86: $$profita = (pa - ca)\cdot n\cdot\left((1 - \sigma)\cdot\left(\frac{1}{2} - \frac{(pa - pb)\cdot(\tau + 1) - \Delta v}{2\cdot\lambda}\right) + \sigma\cdot\left(\frac{1}{2} - \frac{pa - pb - \Delta v}{2\cdot\lambda}\right)\right)$$

#87: $$\text{profitb} = (pb - cb)\cdot n\cdot\left((1-\sigma)\cdot\left(1-\left(\frac{1}{2}-\frac{(pa-pb)\cdot(\tau+1)-\Delta v}{2\cdot\lambda}\right)\right)+\sigma\cdot\left(1-\left(\frac{1}{2}-\frac{pa-pb-\Delta v}{2\cdot\lambda}\right)\right)\right)$$

#88: $$\frac{d}{d\,pa}\left(\text{profita} = (pa - ca)\cdot n\cdot\left((1-\sigma)\cdot\left(\frac{1}{2}-\frac{(pa-pb)\cdot(\tau+1)-\Delta v}{2\cdot\lambda}\right)+\sigma\cdot\left(\frac{1}{2}-\frac{pa-pb-\Delta v}{2\cdot\lambda}\right)\right)\right)$$

#89: $$0 = -\frac{n\cdot(ca\cdot(\sigma\cdot\tau-\tau-1)-2\cdot pa\cdot(\sigma\cdot\tau-\tau-1)+pb\cdot(\sigma\cdot\tau-\tau-1)-\Delta v-\lambda)}{2\cdot\lambda}$$

#90: $$\frac{d}{d\,pa}\frac{d}{d\,pa}\left(\text{profita} = (pa - ca)\cdot n\cdot\left((1-\sigma)\cdot\left(\frac{1}{2}-\frac{(pa-pb)\cdot(\tau+1)-\Delta v}{2\cdot\lambda}\right)+\sigma\cdot\left(\frac{1}{2}-\frac{pa-pb-\Delta v}{2\cdot\lambda}\right)\right)\right)$$

#91: $$0 > \frac{n\cdot(\sigma\cdot\tau-\tau-1)}{\lambda}$$

#92: $$0 > \frac{n\cdot(\tau\cdot(\sigma-1)-1)}{\lambda}$$

#93: $$\frac{d}{d\,pb}\left(\text{profitb} = (pb - cb)\cdot n\cdot\left((1-\sigma)\cdot\left(1-\left(\frac{1}{2}-\frac{(pa-pb)\cdot(\tau+1)-\Delta v}{2\cdot\lambda}\right)\right)+\sigma\cdot\left(1-\left(\frac{1}{2}-\right.\right.\right.\right.$$

$$\frac{pa - pb - \Delta v}{2 \cdot \lambda}\right)\right)\right)\right)$$

#94: $$0 = -\frac{n \cdot (cb \cdot (\sigma \cdot \tau - \tau - 1) + pa \cdot (\sigma \cdot \tau - \tau - 1) - 2 \cdot pb \cdot (\sigma \cdot \tau - \tau - 1) + \Delta v - \lambda)}{2 \cdot \lambda}$$

#95: $$\frac{d}{d\,pb}\frac{d}{d\,pb}\left(profitb = (pb - cb) \cdot n \cdot \left((1 - \sigma) \cdot \left(1 - \left(\frac{1}{2} - \frac{(pa - pb) \cdot (\tau + 1) - \Delta v}{2 \cdot \lambda}\right)\right) + \sigma \cdot \left(1 - \left(\frac{1}{2} - \frac{pa - pb - \Delta v}{2 \cdot \lambda}\right)\right)\right)\right)$$

#96: $$0 > \frac{n \cdot (\sigma \cdot \tau - \tau - 1)}{\lambda}$$

#97: $$0 > \frac{n \cdot (\tau \cdot (\sigma - 1) - 1)}{\lambda}$$

#98: $$\text{SOLVE}\left(\left[0 = -\frac{n \cdot (ca \cdot (\sigma \cdot \tau - \tau - 1) - 2 \cdot pa \cdot (\sigma \cdot \tau - \tau - 1) + pb \cdot (\sigma \cdot \tau - \tau - 1) - \Delta v - \lambda)}{2 \cdot \lambda}, 0 = -\frac{n \cdot (cb \cdot (\sigma \cdot \tau - \tau - 1) + pa \cdot (\sigma \cdot \tau - \tau - 1) - 2 \cdot pb \cdot (\sigma \cdot \tau - \tau - 1) + \Delta v - \lambda)}{2 \cdot \lambda}\right], [pa, pb]\right)$$

eq (10)

#99: $$\left[pae = \frac{2 \cdot ca \cdot (\sigma \cdot \tau - \tau - 1) + cb \cdot (\sigma \cdot \tau - \tau - 1) - \Delta v - 3 \cdot \lambda}{3 \cdot (\sigma \cdot \tau - \tau - 1)} \wedge pbe =\right.$$

$$\frac{ca\cdot(\sigma\cdot\tau-\tau-1)+2\cdot cb\cdot(\sigma\cdot\tau-\tau-1)+\Delta v-3\cdot\lambda}{3\cdot(\sigma\cdot\tau-\tau-1)}\Bigg]$$

eq (11): eql profits

$$\#100:\quad profitae = -\frac{n\cdot(ca\cdot(\sigma\cdot\tau-\tau-1)-cb\cdot(\sigma\cdot\tau-\tau-1)+\Delta v+3\cdot\lambda)^2}{18\cdot\lambda\cdot(\sigma\cdot\tau-\tau-1)}$$

$$\#101:\quad profitbe = -\frac{n\cdot(ca\cdot(\sigma\cdot\tau-\tau-1)-cb\cdot(\sigma\cdot\tau-\tau-1)+\Delta v-3\cdot\lambda)^2}{18\cdot\lambda\cdot(\sigma\cdot\tau-\tau-1)}$$

Result 2: setting σ=0

$$\#102:\ \left[pae\_zero = \frac{2\cdot ca\cdot(\tau+1)+cb\cdot(\tau+1)+\Delta v+3\cdot\lambda}{3\cdot(\tau+1)} \wedge pbe\_zero = \frac{ca\cdot(\tau+1)+2\cdot cb\cdot(\tau+1)-\Delta v+3\cdot\lambda}{3\cdot(\tau+1)}\right]$$

compare it to pa_I and pb_I

$$\#103:\quad \left[paI = \frac{2\cdot ca\cdot(\tau+1)+cb\cdot(\tau+1)+\Delta v+3\cdot\lambda}{3\cdot(\tau+1)} \wedge pbI = \frac{ca\cdot(\tau+1)+2\cdot cb\cdot(\tau+1)-\Delta v+3\cdot\lambda}{3\cdot(\tau+1)}\right]$$

$$\#104:\ pae\_zero - paI = \frac{2\cdot ca\cdot(\tau+1)+cb\cdot(\tau+1)+\Delta v+3\cdot\lambda}{3\cdot(\tau+1)} - \frac{2\cdot ca\cdot(\tau+1)+cb\cdot(\tau+1)+\Delta v+3\cdot\lambda}{3\cdot(\tau+1)}$$

$$\#105:\quad pae\_zero - paI = 0$$

#106: $$\text{pbe\_zero} - \text{pbI} = \frac{\text{ca}\cdot(\tau + 1) + 2\cdot\text{cb}\cdot(\tau + 1) - \Delta v + 3\cdot\lambda}{3\cdot(\tau + 1)} - \frac{\text{ca}\cdot(\tau + 1) + 2\cdot\text{cb}\cdot(\tau + 1) - \Delta v + 3\cdot\lambda}{3\cdot(\tau + 1)}$$

#107: $$\text{pbe\_zero} - \text{pbI} = 0$$

Result 3 & Appendix B

#108: $$\frac{d}{d\sigma}\left(\text{pae} = \frac{2\cdot\text{ca}\cdot(\sigma\cdot\tau - \tau - 1) + \text{cb}\cdot(\sigma\cdot\tau - \tau - 1) - \Delta v - 3\cdot\lambda}{3\cdot(\sigma\cdot\tau - \tau - 1)}\right)$$

eq (B.2)

#109: $$0 < \frac{\tau\cdot(\Delta v + 3\cdot\lambda)}{3\cdot(\sigma\cdot\tau - \tau - 1)^2}$$

#110: $$\frac{d}{d\sigma}\left(\text{pbe} = \frac{\text{ca}\cdot(\sigma\cdot\tau - \tau - 1) + 2\cdot\text{cb}\cdot(\sigma\cdot\tau - \tau - 1) + \Delta v - 3\cdot\lambda}{3\cdot(\sigma\cdot\tau - \tau - 1)}\right)$$

#111: $$0 < \frac{\tau\cdot(3\cdot\lambda - \Delta v)}{3\cdot(\sigma\cdot\tau - \tau - 1)^2}$$

eq (B.3)

#112: $$\frac{d}{d\sigma}\left(\text{profitae} = -\frac{n\cdot(\text{ca}\cdot(\sigma\cdot\tau - \tau - 1) - \text{cb}\cdot(\sigma\cdot\tau - \tau - 1) + \Delta v + 3\cdot\lambda)^2}{18\cdot\lambda\cdot(\sigma\cdot\tau - \tau - 1)}\right)$$

#113:

$$\frac{n\cdot\tau\cdot(ca\cdot(\sigma\cdot\tau-\tau-1)-cb\cdot(\sigma\cdot\tau-\tau-1)-\Delta v-3\cdot\lambda)\cdot(ca\cdot(\sigma\cdot\tau-\tau-1)-cb\cdot(\sigma\cdot\tau-\tau-1)+\Delta v+3\cdot\lambda)}{18\cdot\lambda\cdot(\sigma\cdot\tau-\tau-1)^2}$$

#114: $$\frac{d}{d\sigma}\left(\text{profitbe} = -\frac{n\cdot(ca\cdot(\sigma\cdot\tau-\tau-1)-cb\cdot(\sigma\cdot\tau-\tau-1)+\Delta v-3\cdot\lambda)^2}{18\cdot\lambda\cdot(\sigma\cdot\tau-\tau-1)}\right)$$

#115: $$0 < -\frac{n\cdot\tau\cdot(ca\cdot(\sigma\cdot\tau-\tau-1)-cb\cdot(\sigma\cdot\tau-\tau-1)-\Delta v+3\cdot\lambda)\cdot(ca\cdot(\sigma\cdot\tau-\tau-1)-cb\cdot(\sigma\cdot\tau-\tau-1)+\Delta v-3\cdot\lambda)}{18\cdot\lambda\cdot(\sigma\cdot\tau-\tau-1)^2}$$

compare to the way it is typed it in the paper, eqs (B.3)

#116: $$d\_profitae\_paper = \frac{n\cdot\tau\cdot((3\cdot\lambda+\Delta v)^2-(\Delta c\cdot(1+\tau-\sigma\cdot\tau))^2)}{18\cdot\lambda\cdot(1+\tau-\sigma\cdot\tau)^2}$$

compare derivatives for A: [yes!]

$$\#117: \frac{n\cdot\tau\cdot\left(\left(3\cdot\lambda + \Delta v\right)^2 - \left(\Delta c\cdot\left(1 + \tau - \sigma\cdot\tau\right)\right)^2\right)}{18\cdot\lambda\cdot\left(1 + \tau - \sigma\cdot\tau\right)^2} - \frac{n\cdot\tau\cdot\left(ca\cdot\left(\sigma\cdot\tau - \tau - 1\right) - cb\cdot\left(\sigma\cdot\tau - \tau - 1\right) - \Delta v - 3\cdot\lambda\right)\cdot\left(ca\cdot\left(\sigma\cdot\tau - \tau - 1\right) - cb\cdot\left(\sigma\cdot\tau - \tau - 1\right) + \Delta v + 3\cdot\lambda\right)}{18\cdot\lambda\cdot\left(\sigma\cdot\tau - \tau - 1\right)^2}$$

$$\#118: \frac{n\cdot\tau\cdot\left(\left(3\cdot\lambda + \Delta v\right)^2 - \left(\left(ca - cb\right)\cdot\left(1 + \tau - \sigma\cdot\tau\right)\right)^2\right)}{18\cdot\lambda\cdot\left(1 + \tau - \sigma\cdot\tau\right)^2} - \frac{n\cdot\tau\cdot\left(ca\cdot\left(\sigma\cdot\tau - \tau - 1\right) - cb\cdot\left(\sigma\cdot\tau - \tau - 1\right) - \Delta v - 3\cdot\lambda\right)\cdot\left(ca\cdot\left(\sigma\cdot\tau - \tau - 1\right) - cb\cdot\left(\sigma\cdot\tau - \tau - 1\right) + \Delta v + 3\cdot\lambda\right)}{18\cdot\lambda\cdot\left(\sigma\cdot\tau - \tau - 1\right)^2}$$

$$\#119: 0$$

compare to the way it is typed it in the paper, eqs (B.3)

$$\#120:\ d\_profitbe\_paper = \frac{n\cdot\tau\cdot\left(\left(3\cdot\lambda - \Delta v\right)^2 - \left(\Delta c\cdot\left(1 + \tau - \sigma\cdot\tau\right)\right)^2\right)}{18\cdot\lambda\cdot\left(1 + \tau - \sigma\cdot\tau\right)^2}$$

$$\#121:\ \frac{n\cdot\tau\cdot\left(\left(3\cdot\lambda - \Delta v\right)^2 - \left(\Delta c\cdot\left(1 + \tau - \sigma\cdot\tau\right)\right)^2\right)}{18\cdot\lambda\cdot\left(1 + \tau - \sigma\cdot\tau\right)^2} - -$$

$$\frac{n\cdot\tau\cdot\left(ca\cdot\left(\sigma\cdot\tau - \tau - 1\right) - cb\cdot\left(\sigma\cdot\tau - \tau - 1\right) - \Delta v + 3\cdot\lambda\right)\cdot\left(ca\cdot\left(\sigma\cdot\tau - \tau - 1\right) - cb\cdot\left(\sigma\cdot\tau - \tau - 1\right) + \Delta v - 3\cdot\lambda\right)}{18\cdot\lambda\cdot\left(\sigma\cdot\tau - \tau - 1\right)^2}$$

$$\#122:\ \frac{n\cdot\tau\cdot\left(\left(3\cdot\lambda - \Delta v\right)^2 - \left(\left(ca - cb\right)\cdot\left(1 + \tau - \sigma\cdot\tau\right)\right)^2\right)}{18\cdot\lambda\cdot\left(1 + \tau - \sigma\cdot\tau\right)^2} - -$$

$$\frac{n\cdot\tau\cdot\left(ca\cdot\left(\sigma\cdot\tau - \tau - 1\right) - cb\cdot\left(\sigma\cdot\tau - \tau - 1\right) - \Delta v + 3\cdot\lambda\right)\cdot\left(ca\cdot\left(\sigma\cdot\tau - \tau - 1\right) - cb\cdot\left(\sigma\cdot\tau - \tau - 1\right) + \Delta v\right)}{18\cdot\lambda\cdot\left(\sigma\cdot\tau - \tau - 1\right)^2}$$

– 3·λ)
———————

#123: 0