Defense Services Equations

# Presetnation of Estimatinating Euation

As described in section 4.3, this paper includes five different equations: likelihood some options are exercised; likelihood all options are exercised; likelihood of a ceiling breach; size of ceiling breach given a breach occurring; and likelihood of termination. The variable indicators used in the equations are listed in Appendix B. Each predictor in the equations has a subscript i, which refers to the individual contract or task order. The level 2, 3, and 4 variables, covered in Table B 3, are listed at the start of each equation with an α coefficient that varies has a different intercept for each value of with the underlying variable (that is, subscripts j, k, l, m, n, o, and p) and whose calculation is described in the corresponding formula at the end of equation. Subscript j refers to the NAICS subsector, subscript k refers to the NAICS detailed industry, subscript l refers to the service area, subscript m refers to the contracting agency, subscript n refers to the contracting office, subscript o refers to the place of performance, and subscript p refers to the calendar year (for those equations that include it).

The remaining variables have β coefficients, with each non-base level of the categorical variables receiving a separate coefficient.

## Warning: replacing previous import 'Hmisc::summarize' by 'dplyr::summarize'  
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## when loading 'csis360'

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## when loading 'csis360'

# Options

Note that because we use the complete dataset for exercised options, there’s no 1 million entry variant.

##   
## =======================================================================  
## Some Opt All Opt   
## -----------------------------------------------------------------------  
## (Intercept) 0.05 1.15 \*\*\*  
## (0.22) (0.15)   
## cln\_US6sal 0.01 0.08   
## (0.06) (0.06)   
## cln\_PSCrate -0.06 -0.07 \*   
## (0.03) (0.03)   
## cp\_OffPerf7 -0.16 \*\*\* 0.00   
## (0.05) (0.05)   
## cp\_OffPSC7 -0.18 \*\* 0.18 \*\*   
## (0.06) (0.06)   
## cn\_PairHist7 0.26 \*\*\* 0.14 \*\*\*  
## (0.02) (0.03)   
## cln\_PairCA -0.07 -0.22 \*\*\*  
## (0.04) (0.05)   
## cln\_Base 0.23 \*\*\* -0.14 \*\*\*  
## (0.04) (0.03)   
## clr\_Ceil2Base 0.30 \*\*\* -0.80 \*\*\*  
## (0.01) (0.02)   
## cln\_Days 0.29 \*\*\* -0.45 \*\*\*  
## (0.03) (0.04)   
## Comp1 offer 0.01 0.00   
## (0.03) (0.03)   
## Comp2-4 offers -0.03 -0.04   
## (0.03) (0.03)   
## Comp5+ offers -0.07 \* -0.08 \*   
## (0.03) (0.03)   
## VehS-IDC -0.69 \*\*\* -0.20 \*\*\*  
## (0.04) (0.05)   
## VehM-IDC -0.23 \*\*\* -0.13 \*\*   
## (0.04) (0.04)   
## VehFSS/GWAC -0.17 \*\*\* -0.06   
## (0.04) (0.04)   
## VehBPA/BOA -0.29 \*\*\* 0.25 \*   
## (0.08) (0.10)   
## PricingOther FP -0.70 \*\*\* -0.50 \*   
## (0.17) (0.22)   
## PricingIncentive -0.34 0.58   
## (0.30) (0.31)   
## PricingCombination or Other 0.36 \*\*\* -0.14 \*   
## (0.09) (0.07)   
## PricingOther CB 0.25 \*\*\* 0.21 \*\*\*  
## (0.06) (0.06)   
## PricingT&M/LH/FPLOE 0.06 -0.03   
## (0.07) (0.07)   
## PricingUCA -0.09 -0.09   
## (0.12) (0.15)   
## CrisisARRA -0.42 \* -0.24   
## (0.16) (0.22)   
## CrisisDis -0.32 -1.46 \*\*\*  
## (0.31) (0.42)   
## CrisisOCO -0.34 \*\* -0.26 \*   
## (0.12) (0.12)   
## cln\_Def6HHI -0.13 \*\* -0.09   
## (0.05) (0.05)   
## clr\_Def6toUS -0.01 0.04   
## (0.04) (0.05)   
## cln\_Def3HHI -0.02 -0.05   
## (0.05) (0.06)   
## clr\_Def3toUS 0.03 -0.02   
## (0.08) (0.08)   
## cp\_PairObl7 -0.02 -0.07   
## (0.05) (0.06)   
## cln\_OffObl7 0.20 \*\*\* -0.09 \*\*   
## (0.05) (0.03)   
## cln\_OffFocus -0.32 \*\*\* -0.13 \*   
## (0.06) (0.06)   
## cp\_OffPerf7:cp\_PairObl7 0.69 \*\*\* 0.15   
## (0.08) (0.09)   
## cp\_PairObl7:cln\_OffObl7 0.13   
## (0.12)   
## cn\_PairHist7:PricingOther FP -0.09   
## (0.37)   
## cn\_PairHist7:PricingIncentive 1.55 \*\*   
## (0.51)   
## cn\_PairHist7:PricingCombination or Other -0.45 \*   
## (0.18)   
## cn\_PairHist7:PricingOther CB 0.20 \*   
## (0.10)   
## cn\_PairHist7:PricingT&M/LH/FPLOE 0.08   
## (0.12)   
## cn\_PairHist7:PricingUCA 0.16   
## (0.22)   
## cp\_OffPerf7:cln\_PairCA -0.61 \*\*\*   
## (0.06)   
## cln\_Base:clr\_Ceil2Base 0.26 \*\*\*   
## (0.02)   
## cp\_OffPSC7:cln\_OffObl7 1.03 \*\*\*   
## (0.16)   
## cp\_OffPSC7:cln\_OffFocus -0.10   
## (0.11)   
## cln\_PSCrate:PricingOther FP -0.23   
## (0.61)   
## cln\_PSCrate:PricingIncentive -0.60   
## (0.70)   
## cln\_PSCrate:PricingCombination or Other 0.40 \*   
## (0.20)   
## cln\_PSCrate:PricingOther CB 0.43 \*\*   
## (0.14)   
## cln\_PSCrate:PricingT&M/LH/FPLOE 0.17   
## (0.20)   
## cln\_PSCrate:PricingUCA 1.42 \*\*\*  
## (0.37)   
## cln\_OffObl7:cln\_OffFocus -0.00   
## (0.07)   
## -----------------------------------------------------------------------  
## AIC 75772.83 59424.62   
## BIC 76242.82 59858.10   
## Log Likelihood -37835.41 -29663.31   
## Num. obs. 74274 51357   
## Num. groups: ServArea:(NAICS6:NAICS3) 1508 1327   
## Num. groups: Office:Agency 758 676   
## Num. groups: NAICS6:NAICS3 624 573   
## Num. groups: Place 121 103   
## Num. groups: NAICS3 78 73   
## Num. groups: Agency 25 25   
## Num. groups: StartFY 9 9   
## Var: ServArea:(NAICS6:NAICS3) (Intercept) 0.14 0.03   
## Var: Office:Agency (Intercept) 0.54 0.22   
## Var: NAICS6:NAICS3 (Intercept) 0.04 0.09   
## Var: Place (Intercept) 0.27 0.07   
## Var: NAICS3 (Intercept) 0.03 0.02   
## Var: Agency (Intercept) 0.00 0.06   
## Var: StartFY (Intercept) 0.29 0.03   
## =======================================================================  
## \*\*\* p < 0.001, \*\* p < 0.01, \* p < 0.05

## Some Options Likelihood

## All Options Likelihood

# Ceiling Breach

##   
## ============================================================================  
## Breach Likelihood BreachSize   
## ----------------------------------------------------------------------------  
## (Intercept) -4.55 \*\*\* 8.82 \*\*\*  
## (0.18) (0.13)   
## cln\_US6sal -0.00 -0.02   
## (0.06) (0.06)   
## cln\_PSCrate 0.06 \*\*\* 0.09 \*\*\*  
## (0.01) (0.02)   
## cp\_OffPerf7 0.07 \*\* -0.06   
## (0.03) (0.04)   
## cp\_OffPSC7 0.19 \*\*\* 0.13 \*\*\*  
## (0.02) (0.03)   
## cn\_PairHist7 -0.08 \*\*\* 0.03   
## (0.01) (0.02)   
## cln\_PairCA 0.44 \*\*\* -0.01   
## (0.02) (0.03)   
## cln\_Base 1.35 \*\*\* 2.65 \*\*\*  
## (0.01) (0.02)   
## clr\_Ceil2Base 0.25 \*\*\* 0.25 \*\*\*  
## (0.01) (0.02)   
## cln\_Days 0.28 \*\*\* 0.05 \*   
## (0.01) (0.02)   
## Comp1 offer -0.03 -0.05   
## (0.02) (0.03)   
## Comp2-4 offers 0.11 \*\*\* -0.11 \*\*\*  
## (0.01) (0.02)   
## Comp5+ offers 0.18 \*\*\* -0.07 \*\*   
## (0.01) (0.02)   
## VehS-IDC -0.48 \*\*\* -0.01   
## (0.02) (0.02)   
## VehM-IDC -0.18 \*\*\* -0.02   
## (0.02) (0.03)   
## VehFSS/GWAC -0.01 0.12 \*   
## (0.03) (0.05)   
## VehBPA/BOA -0.29 \*\*\* -0.13 \*   
## (0.03) (0.06)   
## PricingOther FP -0.40 \*\*\* -0.36 \*   
## (0.09) (0.14)   
## PricingIncentive 2.39 \*\*\* 0.81 \*\*\*  
## (0.07) (0.12)   
## PricingCombination or Other 0.26 \*\*\* 0.43 \*\*\*  
## (0.05) (0.07)   
## PricingOther CB -0.09 \*\* 0.81 \*\*\*  
## (0.03) (0.05)   
## PricingT&M/LH/FPLOE 0.11 \* 0.66 \*\*\*  
## (0.04) (0.07)   
## PricingUCA 0.07 0.37 \*\*\*  
## (0.04) (0.07)   
## CrisisARRA 0.12 \*\* -0.06   
## (0.04) (0.06)   
## CrisisDis 0.07 0.39 \*\*   
## (0.09) (0.13)   
## CrisisOCO -0.10 \* 0.08   
## (0.05) (0.08)   
## cln\_Def6HHI -0.02 0.06 \*   
## (0.02) (0.03)   
## clr\_Def6toUS 0.07 \* 0.01   
## (0.03) (0.03)   
## clr\_Def3toUS -0.46 \*\*\* 0.29 \*\*\*  
## (0.07) (0.08)   
## cp\_PairObl7 -0.24 \*\*\* 0.01   
## (0.03) (0.04)   
## cln\_OffObl7 0.04 \* 0.06 \*   
## (0.02) (0.02)   
## cln\_OffFocus -0.36 \*\*\*   
## (0.04)   
## cp\_OffPerf7:cln\_PairCA 0.38 \*\*\* -0.20 \*\*\*  
## (0.03) (0.04)   
## cp\_OffPerf7:cln\_Days -0.12 \*\*\*   
## (0.02)   
## ----------------------------------------------------------------------------  
## AIC 347679.35 242103.91   
## BIC 348163.79 242464.78   
## Log Likelihood -173798.68 -121011.95   
## Num. obs. 1000000 61184   
## Num. groups: ServArea:(NAICS6:NAICS3) 3242 1292   
## Num. groups: Office:Agency 1092 656   
## Num. groups: NAICS6:NAICS3 878 557   
## Num. groups: Place 186 123   
## Num. groups: NAICS3 82 75   
## Num. groups: Agency 26 24   
## Num. groups: StartFY 9 9   
## Var: ServArea:(NAICS6:NAICS3) (Intercept) 0.21 0.14   
## Var: Office:Agency (Intercept) 1.54 0.15   
## Var: NAICS6:NAICS3 (Intercept) 0.15 0.04   
## Var: Place (Intercept) 0.19 0.11   
## Var: NAICS3 (Intercept) 0.20 0.07   
## Var: Agency (Intercept) 0.16 0.06   
## Var: StartFY (Intercept) 0.02 0.01   
## Var: Residual 2.98   
## ============================================================================  
## \*\*\* p < 0.001, \*\* p < 0.01, \* p < 0.05

## Breach Likelihood

## Breach Size

#Terminations

##   
## =================================================================  
## Termination Likelihood  
## -----------------------------------------------------------------  
## (Intercept) -4.45 \*\*\*   
## (0.15)   
## cln\_US6sal -0.05   
## (0.06)   
## cln\_PSCrate -0.02   
## (0.02)   
## cp\_OffPerf7 0.03   
## (0.04)   
## cp\_OffPSC7 0.31 \*\*\*   
## (0.04)   
## cn\_PairHist7 -0.28 \*\*\*   
## (0.02)   
## cln\_PairCA -0.04   
## (0.03)   
## cln\_Base 0.29 \*\*\*   
## (0.02)   
## cln\_Days 0.90 \*\*\*   
## (0.02)   
## clr\_Ceil2Base 0.50 \*\*\*   
## (0.01)   
## Comp1 offer 0.30 \*\*\*   
## (0.03)   
## Comp2-4 offers 0.37 \*\*\*   
## (0.03)   
## Comp5+ offers 0.71 \*\*\*   
## (0.03)   
## VehS-IDC -0.67 \*\*\*   
## (0.03)   
## VehM-IDC -0.41 \*\*\*   
## (0.03)   
## VehFSS/GWAC -0.18 \*\*\*   
## (0.04)   
## VehBPA/BOA -0.97 \*\*\*   
## (0.06)   
## PricingOther FP -0.95 \*\*\*   
## (0.10)   
## PricingIncentive -1.02 \*\*   
## (0.39)   
## PricingCombination or Other -0.16   
## (0.10)   
## PricingOther CB -0.37 \*\*\*   
## (0.08)   
## PricingT&M/LH/FPLOE -0.45 \*\*\*   
## (0.09)   
## PricingUCA -0.72 \*\*\*   
## (0.14)   
## CrisisARRA -0.32 \*   
## (0.13)   
## CrisisDis 0.48 \*   
## (0.19)   
## CrisisOCO -0.07   
## (0.08)   
## cln\_Def6HHI 0.04   
## (0.04)   
## clr\_Def6toUS 0.02   
## (0.04)   
## cln\_Def3HHI 0.03   
## (0.04)   
## clr\_Def3toUS 0.24 \*\*   
## (0.09)   
## cp\_PairObl7 -0.13 \*\*\*   
## (0.04)   
## cln\_OffObl7 0.03   
## (0.03)   
## cln\_OffFocus -0.24 \*\*\*   
## (0.05)   
## cn\_PairHist7:PricingOther FP 0.09   
## (0.18)   
## cn\_PairHist7:PricingIncentive -0.09   
## (0.65)   
## cn\_PairHist7:PricingCombination or Other 0.32   
## (0.23)   
## cn\_PairHist7:PricingOther CB 0.30 \*   
## (0.13)   
## cn\_PairHist7:PricingT&M/LH/FPLOE -0.60 \*\*\*   
## (0.18)   
## cn\_PairHist7:PricingUCA -0.51   
## (0.26)   
## -----------------------------------------------------------------  
## AIC 142606.35   
## BIC 143149.86   
## Log Likelihood -71257.17   
## Num. obs. 1000000   
## Num. groups: ServArea:(NAICS6:NAICS3) 3242   
## Num. groups: Office:Agency 1092   
## Num. groups: NAICS6:NAICS3 878   
## Num. groups: Place 186   
## Num. groups: NAICS3 82   
## Num. groups: Agency 26   
## Num. groups: StartFY 9   
## Var: ServArea:(NAICS6:NAICS3) (Intercept) 0.18   
## Var: Office:Agency (Intercept) 0.66   
## Var: NAICS6:NAICS3 (Intercept) 0.11   
## Var: Place (Intercept) 0.39   
## Var: NAICS3 (Intercept) 0.04   
## Var: Agency (Intercept) 0.06   
## Var: StartFY (Intercept) 0.01   
## =================================================================  
## \*\*\* p < 0.001, \*\* p < 0.01, \* p < 0.05