INSTITUTE FOR DEFENSE ANALYSES

Measuring the Impact of Military Personnel Investment on Training Readiness

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Executive Summary

Full-time support (FTS), or Title 32 Active Guard Reserve and Active Duty Operational Support personnel, perform day-to-day operations necessary for producing Army National Guard (ARNG) individual and unit readiness. In this Institute for Defense Analyses research, we estimate the impact of additional FTS on collective training readiness of Modified Table of Equipment (MTOE) ARNG companies. Our analysis includes descriptive analysis, reduced-form causal models, and a structural model. The structural model facilitates counterfactual forecasts: how would changes to FTS resources impact collective training readiness, particularly when the impact is nonlinear and the effects of FTS accrue over time?

Our results are inconclusive as we await additional data; nevertheless, four preliminary results deserve mention. First, collective training readiness broadly follows its intended cycle. Second, increasing company FTS increases how thoroughly companies plan their collective training. Third, FTS appear to be dynamically reallocated to underperforming units; failure to account for FTS reallocation will understate the true impact of FTS on readiness. Fourth, additional FTS increases how well the company performs in future collective training exercises. We are awaiting additional periods of data to estimate the structural model.

To understand these dynamics, it is important to understand how the Army National Guard manages readiness. In short, readiness is a stock, readiness must be periodically sacrificed to perform necessary changes, and FTS contribute to rebuilding this stock. In greater detail, Army Force Generation (ARFORGEN) and its subsequent instantiations stipulate that ARNG unit readiness follows a cycle. In the first year of the cycle (the "reset" year), units rotate personnel and undergo other necessary disruptions. These actions compromise readiness in the short-term but set the foundation for long-term readiness. In the ensuing years of the cycle, ARNG units perform collective training to rebuild readiness; by the final year, units achieve high readiness and are deployable. Our descriptive results broadly confirm that ARNG MTOE units follow this intended cycle.

FTS contribute to building collective training readiness by, among other things, planning collective training events. Many FTS utilize the Defense Training Management System (DTMS) to organize their planning. Our study exploits data from DTMS about if and when FTS submit plans to DTMS. We find that units with fewer FTS also submit fewer training plans, indicating that units with fewer FTS may not plan their collective training exercises as effectively.

In turn, collective training exercises serve as both practice and assessment. Training and Evaluation Outlines (T&EOs) describe the specific missions that different MTOE units must be able to execute. In turn, Missions Essential Task Lists (METLs) enumerate what units must do to be considered proficient at T&EO missions. In effect, scores from these METLs assess the training readiness of units (and ultimately feed into headline C-Level unit readiness scores). We exploit these METLs data in our analysis. Consistent with readiness as a stock that requires time to build, we find that units with additional FTS achieve higher METs scores the following year. We also find that units with additional FTS have lower contemporaneous METs scores. These facts jointly indicate that FTS are reallocated to underperforming units, as well as that these additional FTS improve future readiness.

Our structural model takes seriously the production and dynamics of readiness over the ARFORGEN cycle. Although we are waiting for additional data to estimate the model, the model will provide answers to policy-relevant question: by how much would additional FTS accelerate readiness timelines; to what extent would additional FTS increase the peak of end-cycle readiness?

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6/18/2021

Context

Related readiness research at IDA

SARA model:

AC/RC cost-risk frontier (bird's eye view)

Random draws to force demand

AC/RC rebalancing:

AC/RC cost-risk frontier (granular unit-by-unit view)

Tailored to specific OPlans

Prior FTS studies:

Impact of FTS on personnel readiness

Impact of Military Technicians on ground equipment readiness

Impact of Military Technicians on aviation equipment readiness

The current study…

What is Readiness?
How does Army National Guard (ARNG) build readiness?

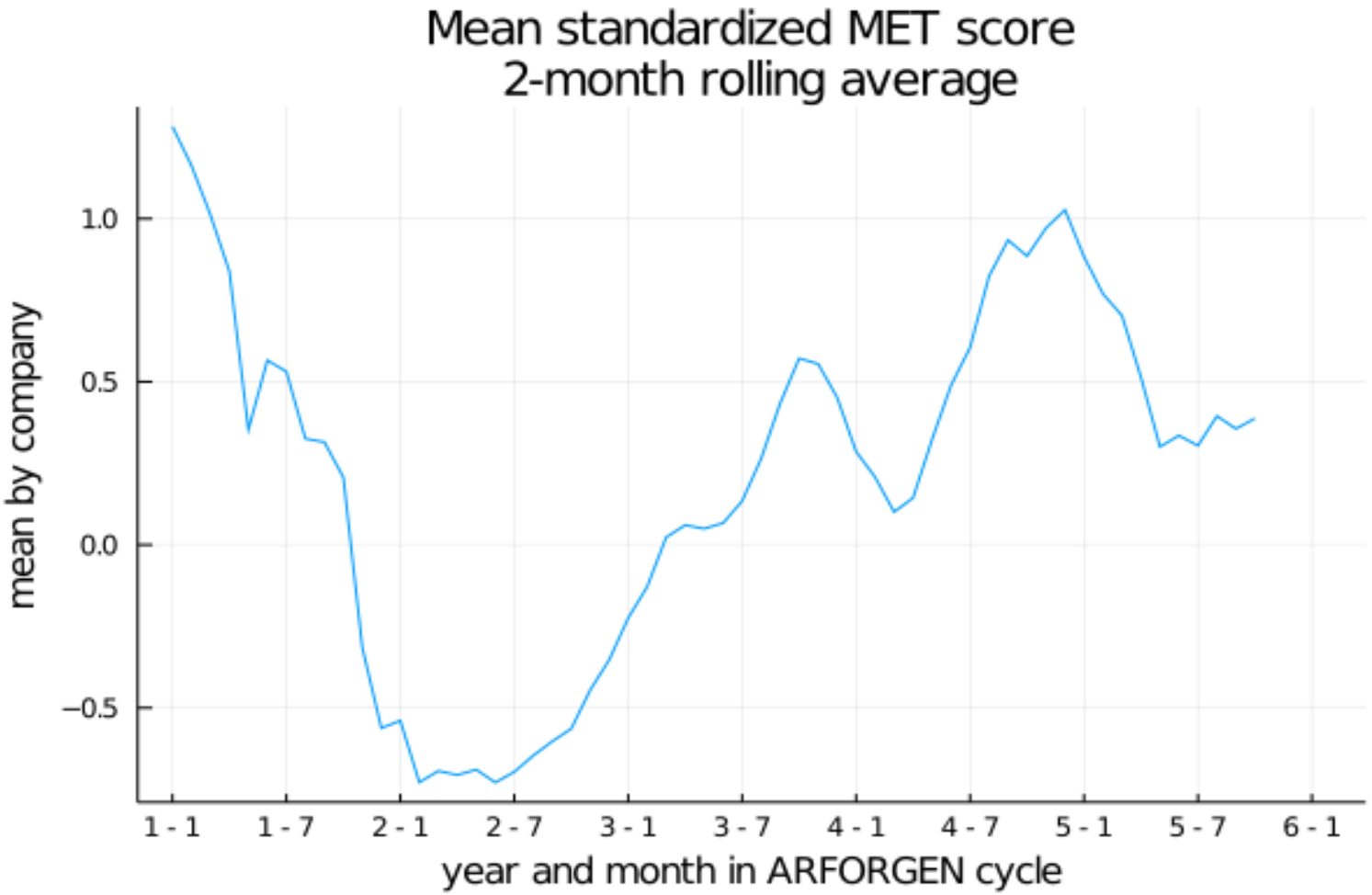
C levels, PRST

Mission Essential Tasks (METs), Training and Evaluation Outline (T&EO), National Training Center (NTC) and related

Army Force Generation (ARFORGEN) cycle

- Build readiness stock over ~5 year cycle, reset
- Training, planning contribute to flows

Mission Essential Task (MET) scores plummet during reset, gain ~2 std by year 5



Company-level Non-Commissioned Officers (NCO): Admin duties undergird training

MTOE Company-level FTS

Who

NCOs: Training, Supply, Readiness, Admin (usually only 2-3)

Active Duty Operational Support (ADOS): ARFORGEN dependent

What

Operate 7 admin systems (*Defense Training Management System*)
Plan training (submit plans to DTMS), file paperwork (e.g., for pay)

Experience matters!

Depends on unit type, size

How allocated

States allocate authorizations using attributes we can observe

BCT's may reallocate company FTS in response to deficits

Question: What impact do FTS have on collective training readiness outcomes at the company level?

Preliminary evidence (weakly) suggest additional FTS:

- Increase current utilization of training management systems
- Increase future MET scores

Structural model will allow counterfactual estimation

- How would the MET curve look if all units had 1 more FTS?
- How would the MET curve look if all units had median FTS?

Awaiting additional periods of data

Data

Data (selected)

Training

DTMS – training plans

DTMS – METs & T&EOs

Personnel: G1 database – FTS counts, experience

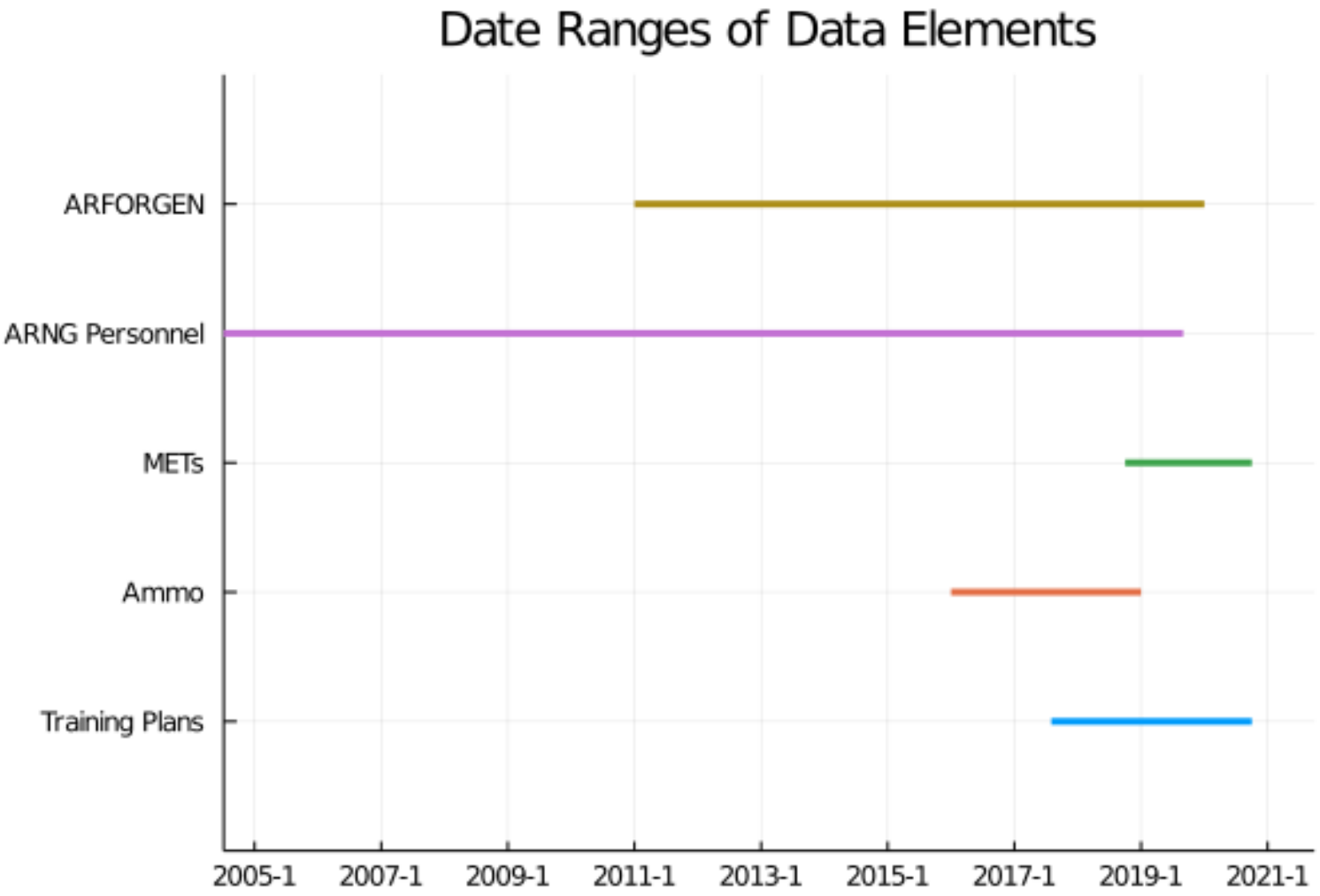
Unit hierarchy: unit table from 2020

Matched 736 COs under 169 BNs under 26 of 29 BCTs

Other:

ARFORGEN, FTS authorizations, rotations, funding, ammo utilization, individual training data,

As-of-yet limited overlap in data limits analysis



Unit Training Schedules

Two related outcomes; motivation for structure

Readiness is a stock. FTS contributions are a flow

Unit Training Plan (UTS) submissions are best measure of flow

Non-submission in a month:

- Did not submit during the month
- Has submitted in prior months

Some evidence that FTS deficits impede planning

FTS shortfalls presage planning shortfalls

	UTS Submitted		
	(1)	(2)	(3)
FTS count	0.026***	0.023***	0.017*
	(0.006)	(0.006)	(0.009)
Personnel count	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.001)
ARFORGEN stage	Yes	Yes	Yes
Unit type	Yes		
US Census Bureau division	Yes	Yes	
month	Yes	Yes	Yes
Company ID			Yes
Estimator	OLS	OLS	OLS
N	7,311	7,311	7,407
R^2	0.044	0.042	0.166

Mission Essential Tasks

Naïve regression suggests FTS augment struggling units; FTS appears to boost readiness on a lag

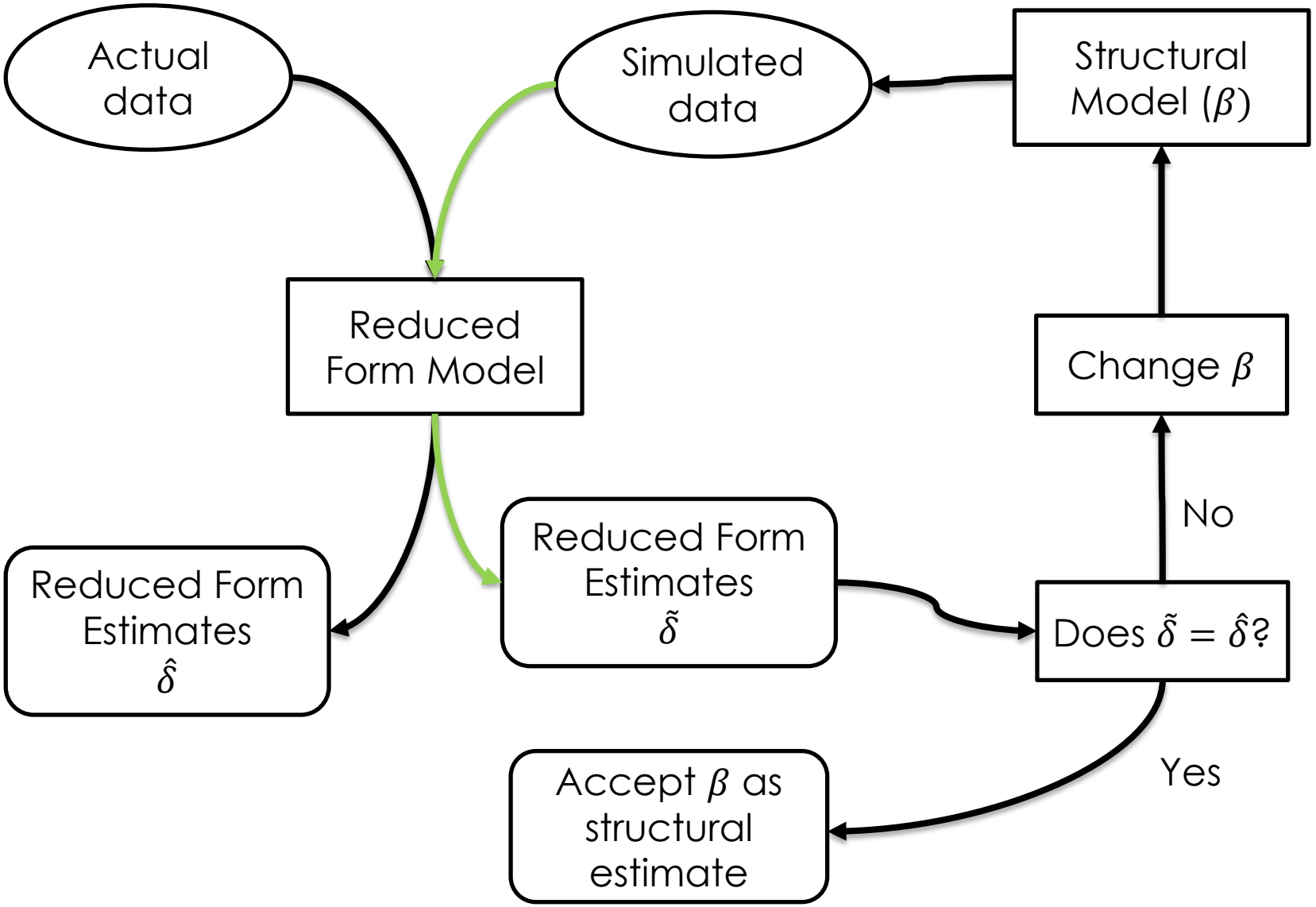
	Average Std Score				
	(1)	(2)	(3)	(4)	(5)
FTS count	-0.057**				
	(0.021)				
Personnel count	0.001	0.006*	0.006*	0.006*	0.001*
	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
FTS count, 3 lags		0.014			
		(0.026)			
FTS count, 6 lags			-0.017		
			(0.026)		
FTS count, 12 lags				0.037	0.045*
				(0.029)	(0.022)
ARFORGEN stage	Yes	Yes	Yes	Yes	Yes
Month	Yes	Yes	Yes	Yes	Yes
Unit type	Yes				
US Census Bureau division	Yes				
Company ID		Yes	Yes	Yes	
Estimator	OLS	OLS	OLS	OLS	OLS
N	1,565	1,393	1,377	1,351	1,523
R^2	0.357	0.772	0.774	0.773	0.327

Worse MET scores predict subsequent increases in FTS

	FTS count			
	(1)	(2)	(3)	(4)
FTS count, 12 lags	-0.216***	-0.218***	-0.221***	0.047
	(0.052)	(0.053)	(0.053)	(0.044)
Average Std Score, 6 lags	-0.212**	-0.218**	-0.224**	0.048
	(0.078)	(0.078)	(0.079)	(0.046)
Personnel count	-0.021**	-0.020**	-0.021**	0.006***
	(0.007)	(0.007)	(0.008)	(0.001)
FTS count, 6 lags			-0.047	0.326***
			(0.042)	(0.040)
FTS count, 24 lags			0.064	0.141***
			(0.058)	(0.036)
ARFORGEN stage	Yes	Yes	Yes	Yes
Company ID	Yes	Yes	Yes	
Month		Yes	Yes	Yes
Unit type				Yes
US Census Bureau Division				Yes
Estimator	OLS	OLS	OLS	OLS
N	554	554	543	711
R^2	0.860	0.861	0.861	0.366

Structural Model
&
Indirect Inference

Indirect Inference



Indirect inference

Indirect inference separates estimation into two stages:

1. Estimate (mis-)specified models from actual data
2. Fit a structural model
    - Specify a structural model: simulates, predicts under counterfactuals
    - Estimate (mis-)specified models from simulated data
    - Choose structural parameters so estimated models match

Initial estimates provide descriptive results

Structural model allows for counterfactual predictions:

- Increase FTS in understaffed units?
- Increase experience of FTS?

Indirect inference is robust, flexible, tractable

Structural model: what produces training readiness

Std. MET scores measure **R**eadiness with error:

$$STDMET_{t,k}=R_{t,k}+e_{t,k}$$

Latent training **R**eadiness is persistent and accumulates **T**raining flows:

$$R_{t+1,k}=\alpha \quad +\gamma\, R_{t,k}+g\mathrm{RESET}_t+\mathrm{T}_{t,k}+\vartheta_{t+1,k}$$

UTS submissions measure **T**raining flows:

$$UTS_{t,k}=\text{Probit}(\mathrm{T}_{t,k},\mathrm{month}_t)$$

Training flows depend on **I**nputs and Re**Q**uirements:

$$T_{t,k}=(I_{t,k}^{\sigma}-Q_{t,k}^{\sigma})^{1/\sigma}$$

Training **I**nputs in period t are determined by the sum of company FTS plus other things:

$$\mathrm{S}_{t,k}=\beta*FTS_{t,k}+\varphi_{t,k}$$

Training re**Q**uirements is unit-cycle fixed effect and shock:

$$\mathrm{Q}_{t,k}=\theta_{k,cycle(t)}+\varepsilon_{t,k}$$

FTS counts depend upon exogenous entry, exogenous exit, endogenous reallocation
Intra-BCT FTS reallocation depends on L-3 **R**eadiness, prior company FTS counts

Reduced form models

Run prior regressions

Run regression of FTS entry/exit on L3 of self MET and sister MET

Regressions parameters may not identify causal parameters;
This is okay

Estimation needs to be fast (e.g., linear regression)

Counterfactual Predictions

The structural models allows "if-then" statements:

"With 20% greater experience, T&EO completion would rise 10 p.p."

"Adding 1 FTS to units with 2 FTS would increase OC/T scores by 15%"

To generate counterfactual predictions:

Change data to the desired counterfactual

Simulate outcomes using the fitted structural model

Aggregate results into something interpretable

Final Steps

Estimate structural model
Other outcomes?

After receiving additional data:

Reestimate descriptive statistics

Estimate structural model

Structural model spells out if-then consequences:

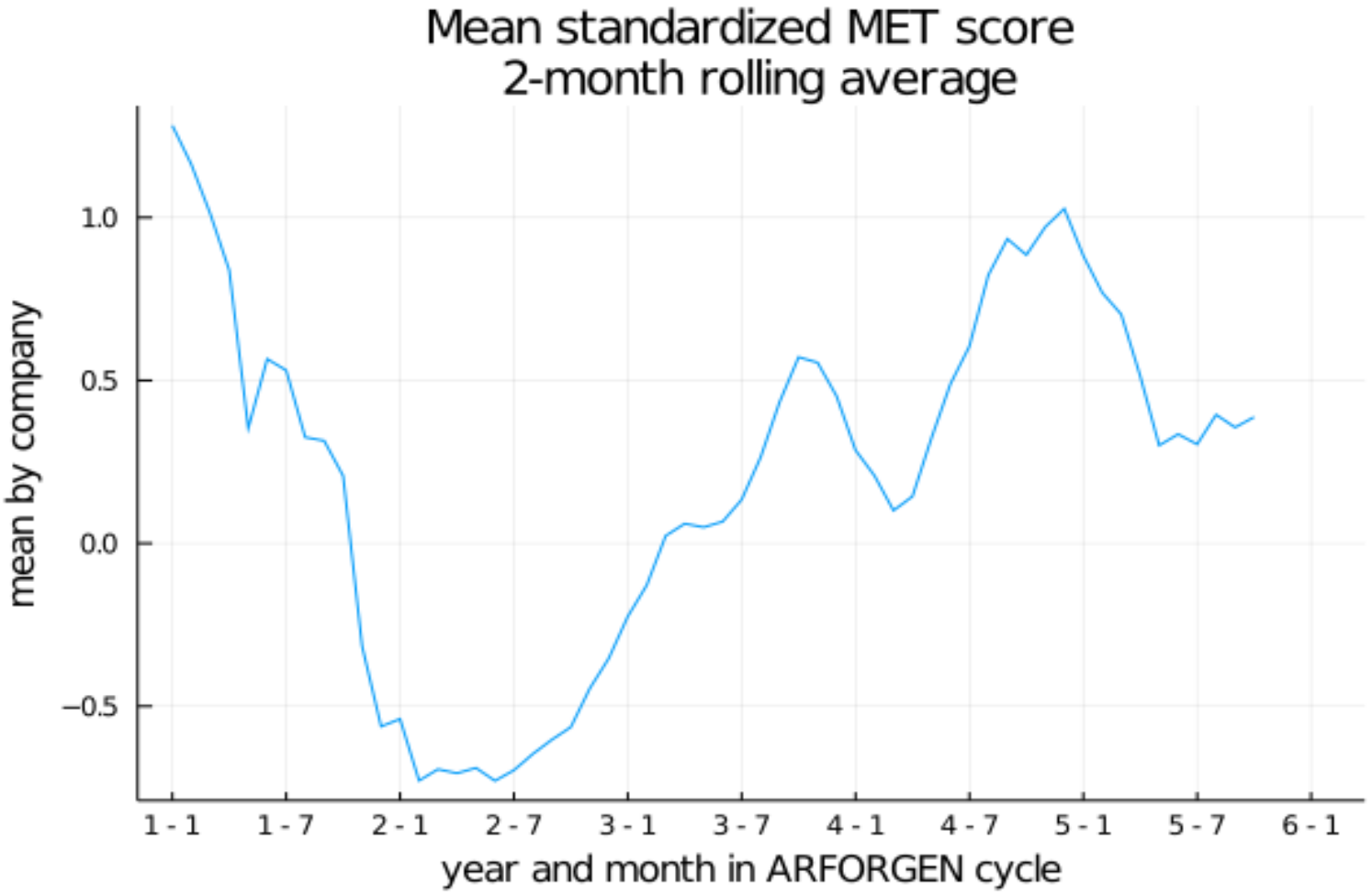
Primary goal is to take cumulative effects and nonlinearity seriously

Will permit statements like:

> "Adding 1 FTS to all units over duration of cycle will increase stage 5 readiness by .4 standard deviations"
>
> "Reducing FTS to 2 for all units over duration of cycle would reduce year 5 readiness to what is currently attained at the end of year 3"

Other outcomes may merit investigation: attrition of FTS?

MET score ARFORGEN curve, revisited



Conclusion

Conclusion

Results suggest that additional FTS:

Increase planning

Increase MET scores

Are assigned to struggling units, introducing endogeneity

More precise and authoritative estimates require:

Longer data horizon (in progress)

Structural model spells out if-then consequences:

These analyses will permit estimation of our structural model

Appendices

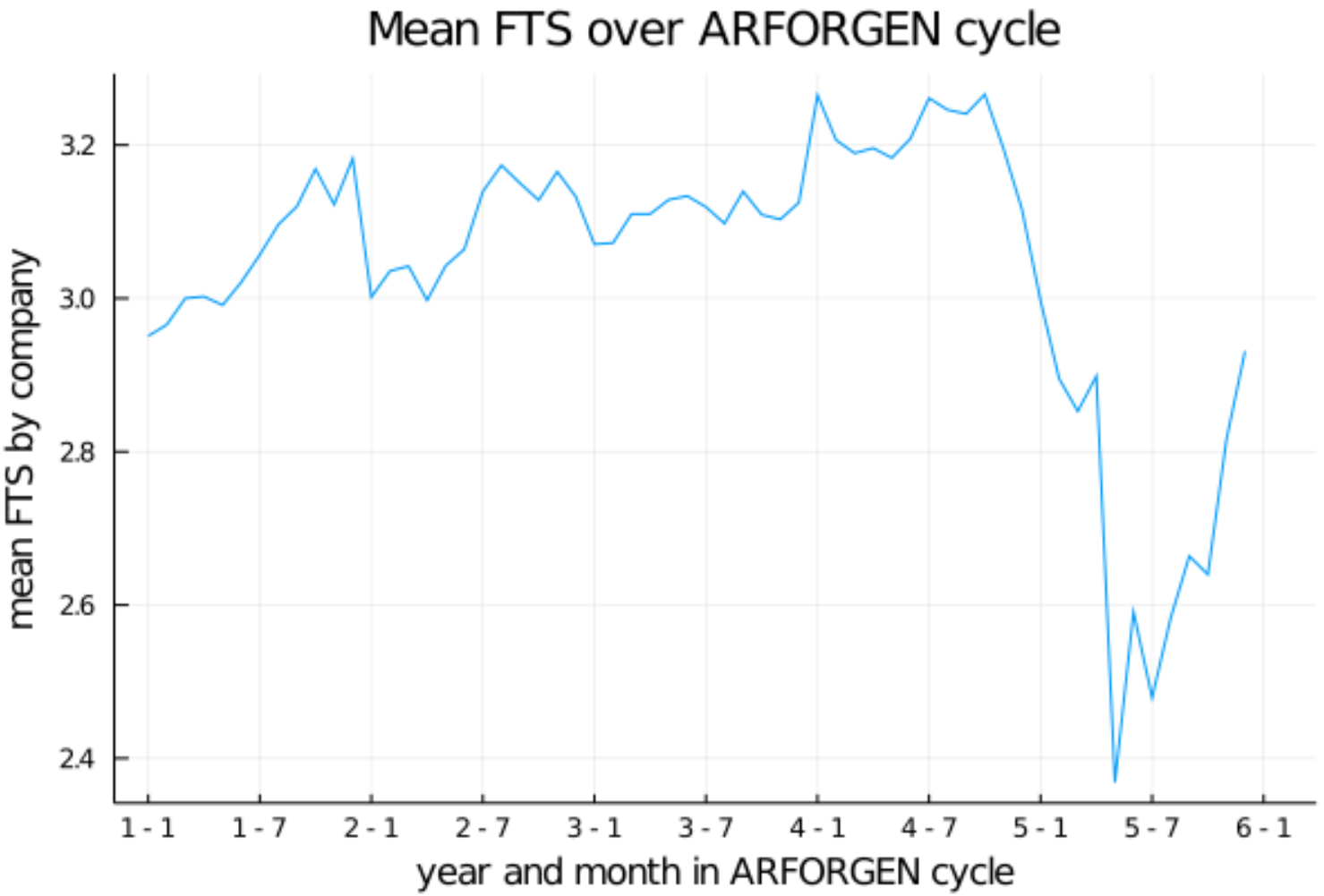
Appendix:
Ammo Utilization

Coarseness of ammo data stymie analysis

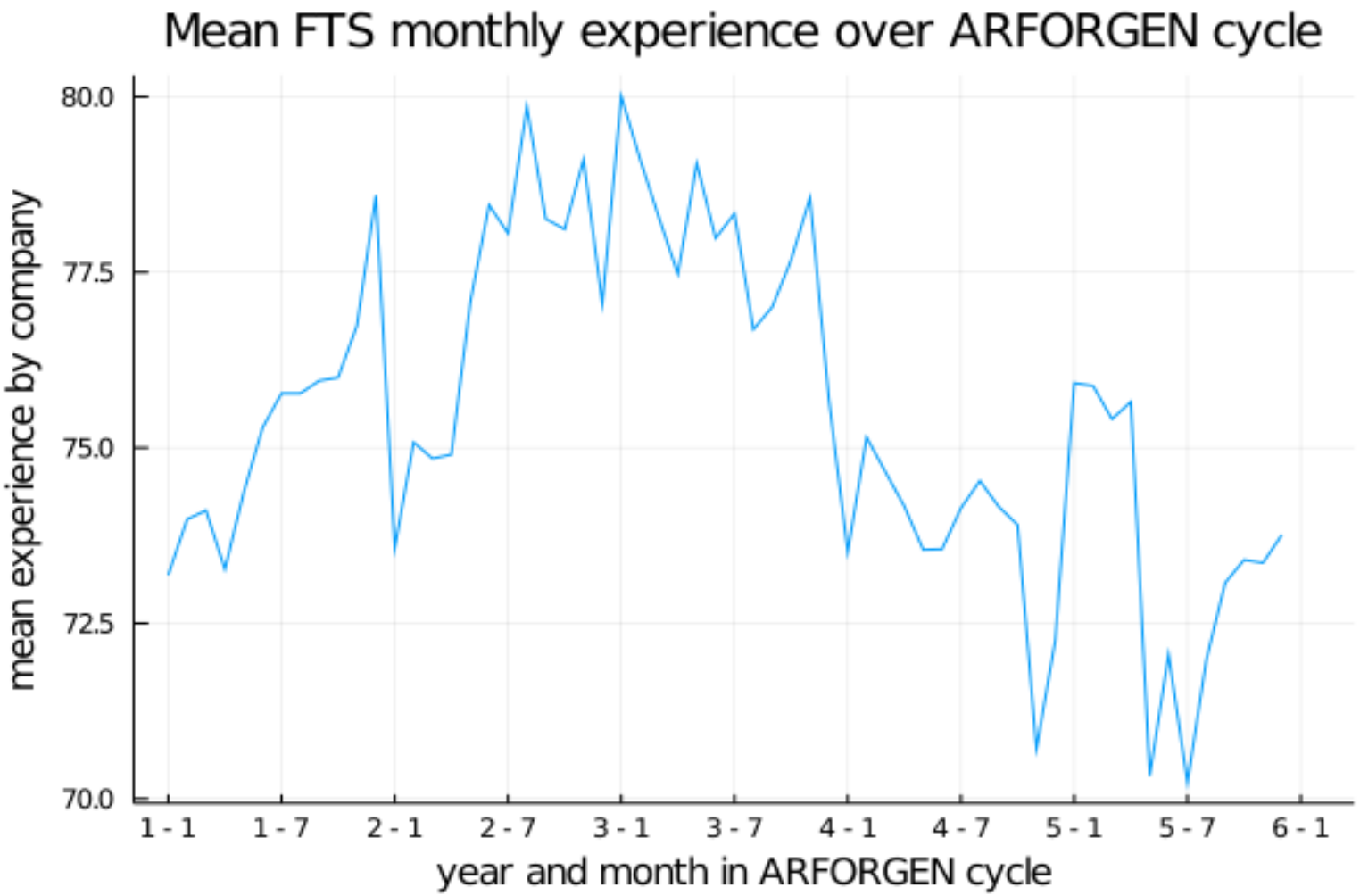
	log Expenditures		log Authorizations	
	(1)	(2)	(3)	(4)
FTS count	-0.006	0.248	-0.021	0.148
	(0.029)	(0.142)	(0.034)	(0.171)
Personnel count	0.001	0.003	0.001	0.003
	(0.001)	(0.002)	(0.001)	(0.002)
Concave FTS experience		-0.043		-0.030
		(0.033)		(0.039)
ARFORGEN stage	Yes	Yes	Yes	Yes
Unit type	Yes	Yes	Yes	Yes
Census Division	Yes	Yes	Yes	Yes
Weapon Family	Yes	Yes	Yes	Yes
Estimator	OLS	OLS	OLS	OLS
N	4,333	17,443	4,333	17,443
R^2	0.555	0.568	0.530	0.544

Appendix:
Other Descriptive Statistics

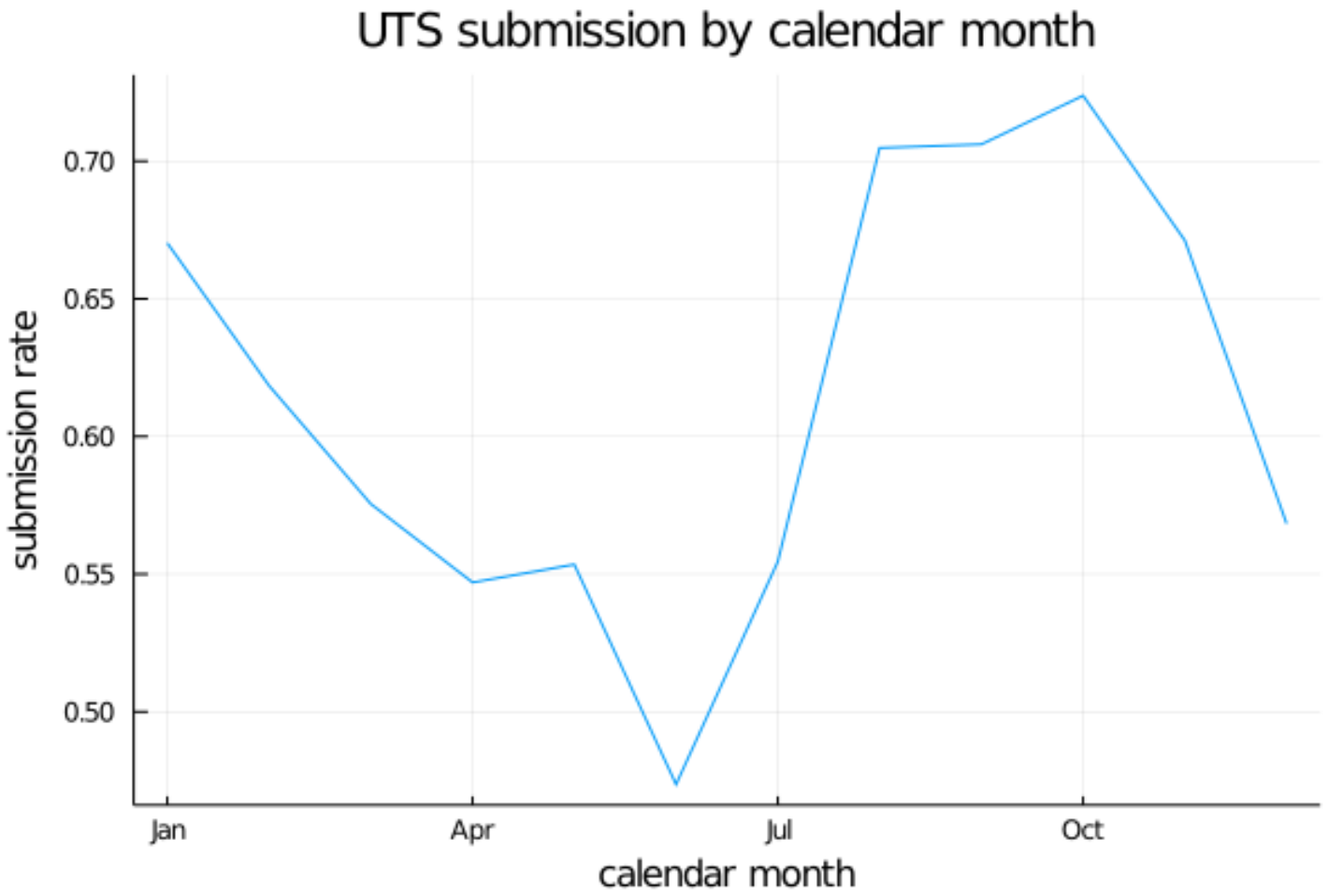
Reasonable Company mean FTS; gradual gains up to R1



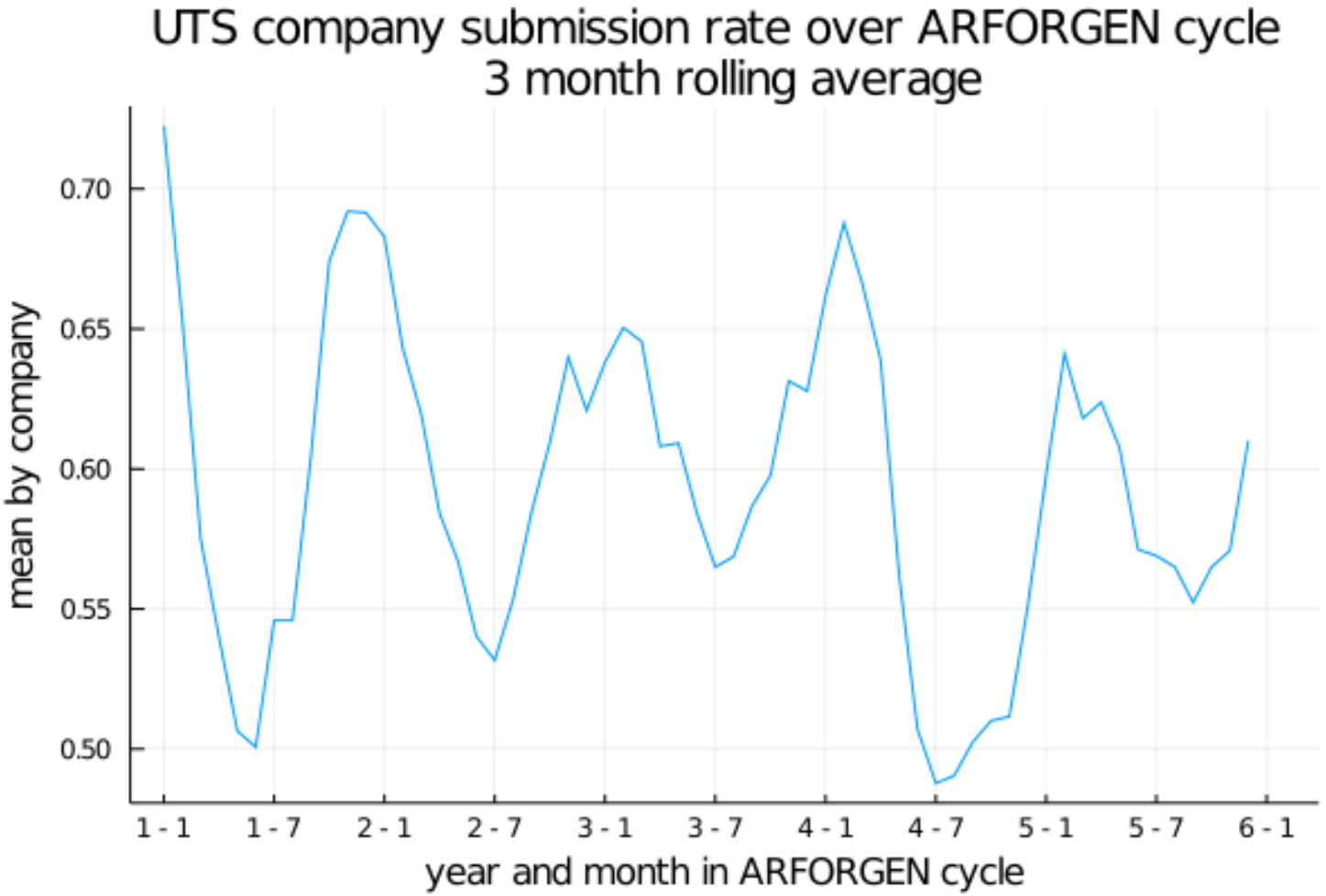
FTS experience peaks mid-cycle, but not by much



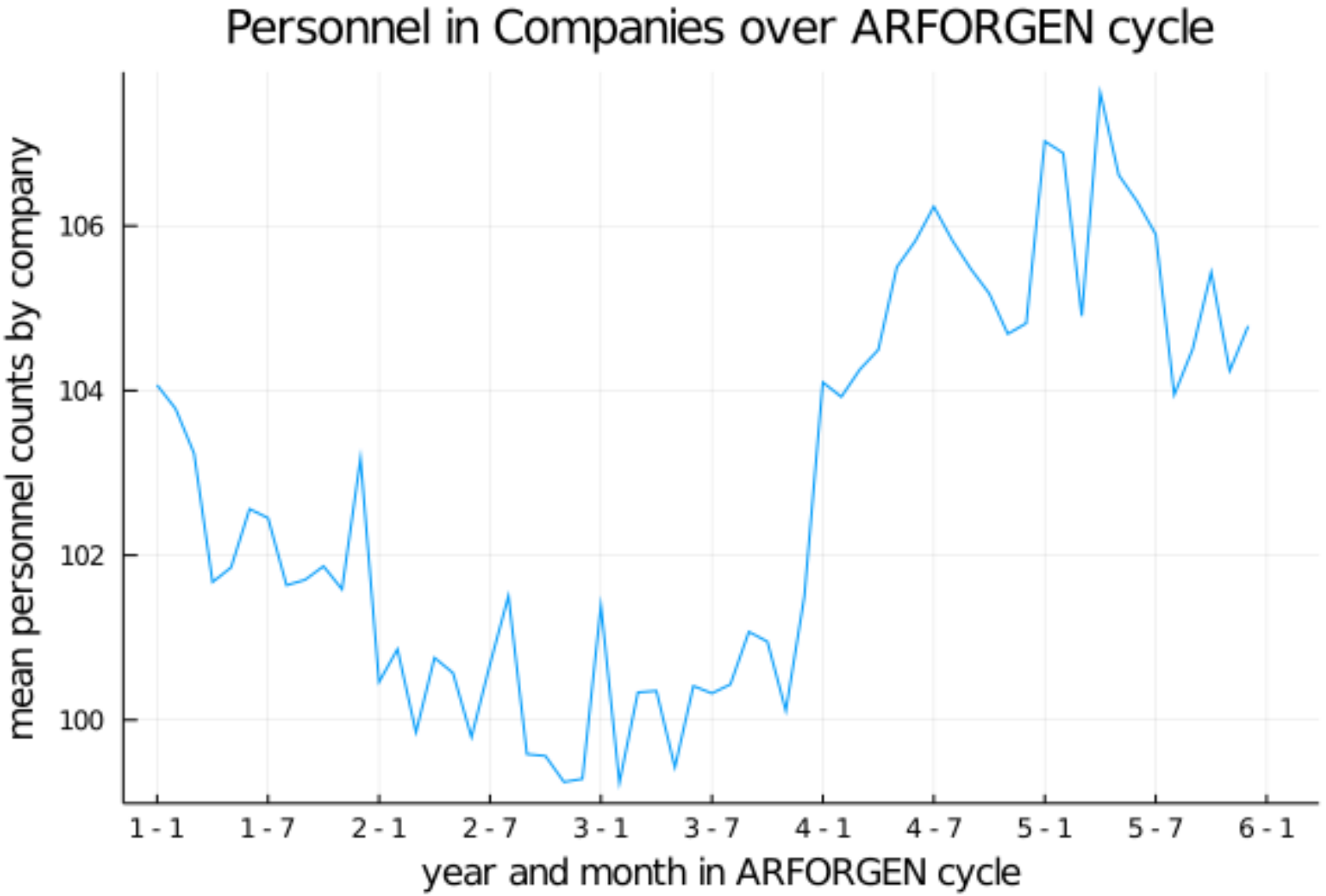
Training plans surge in advance of new fiscal year



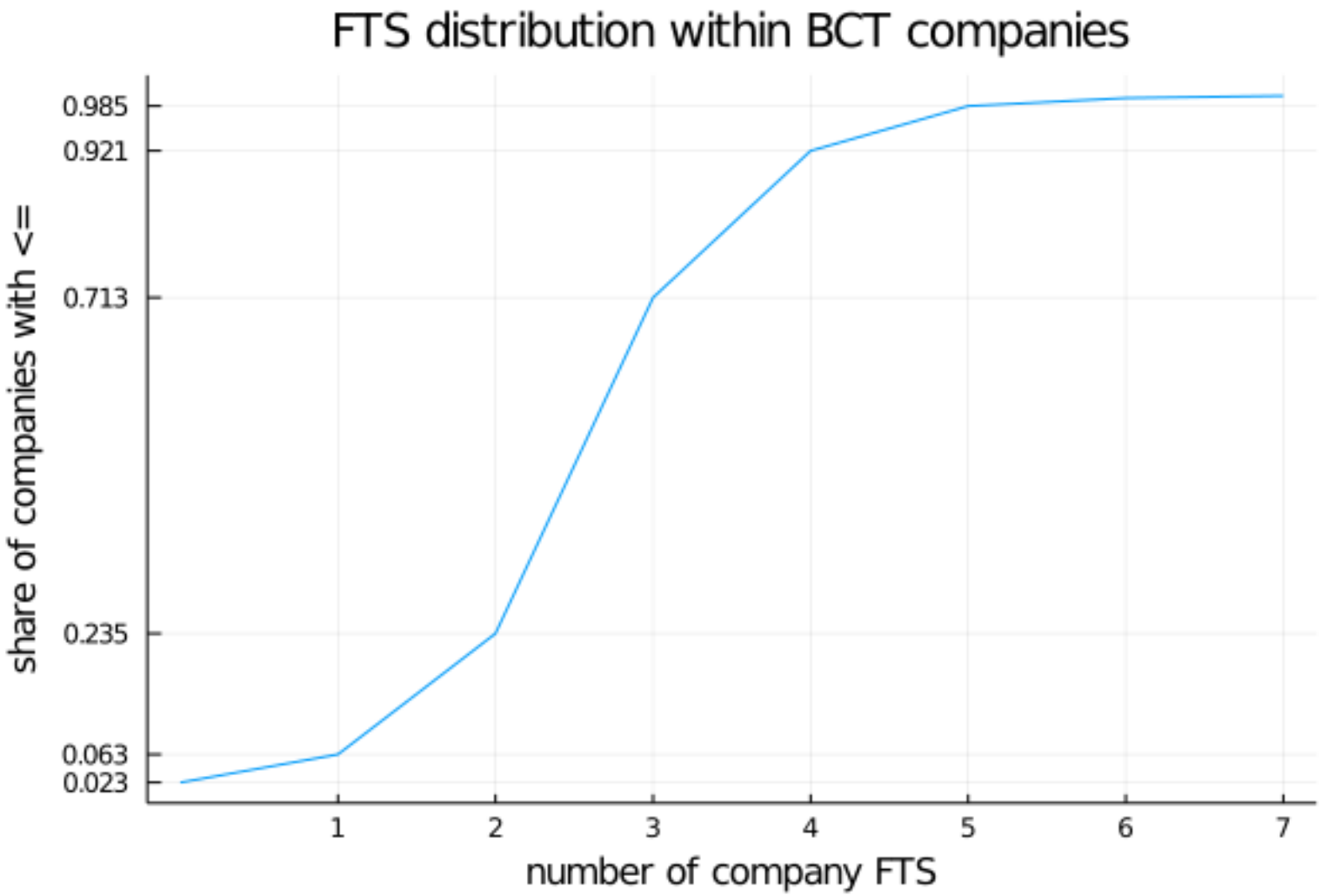
But plan submissions rates do not trend over ARFORGEN



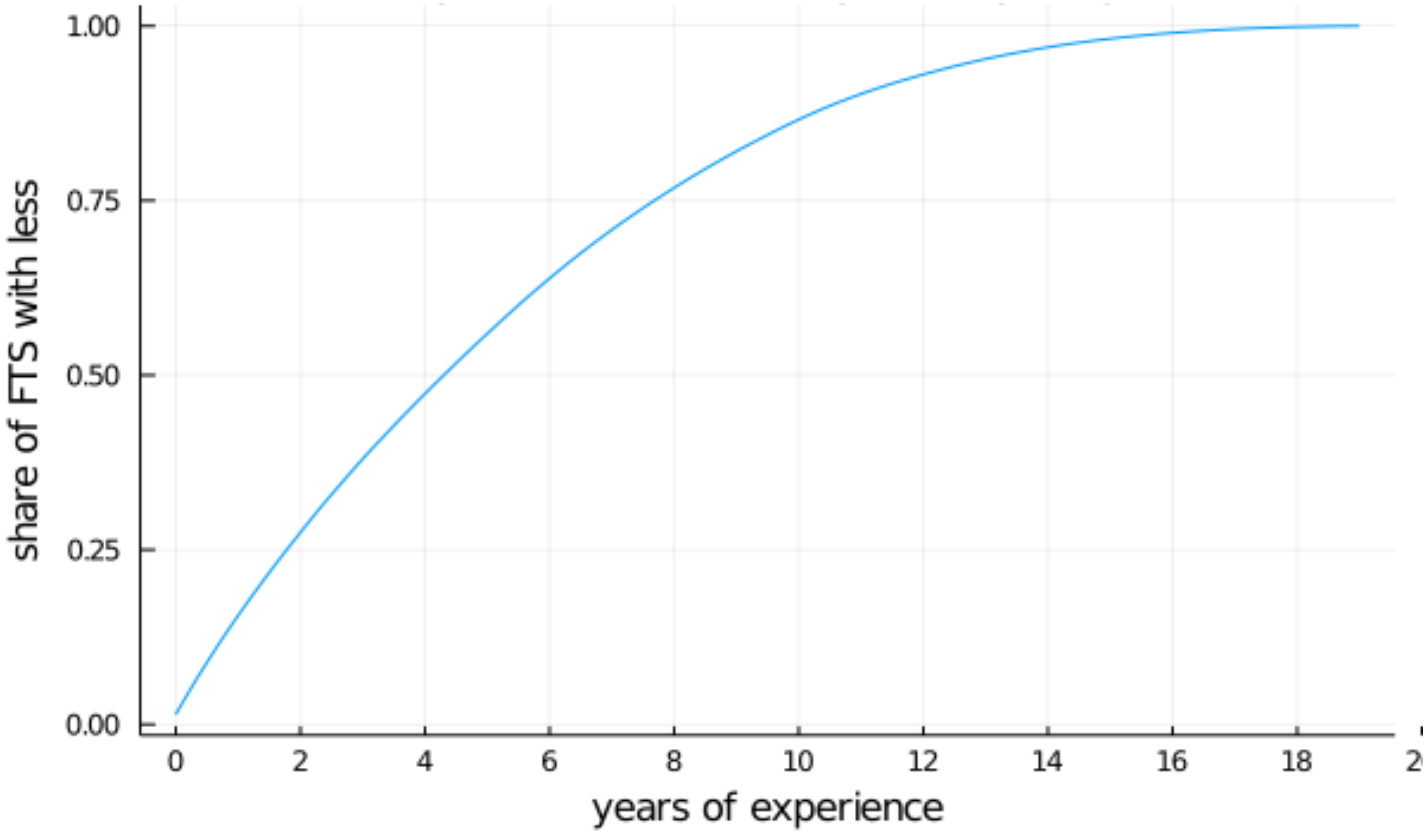
Reasonable company personnel counts and trends



FTS distribution matches expectations



Many company FTS are highly experienced



MET score standardization permits analysis

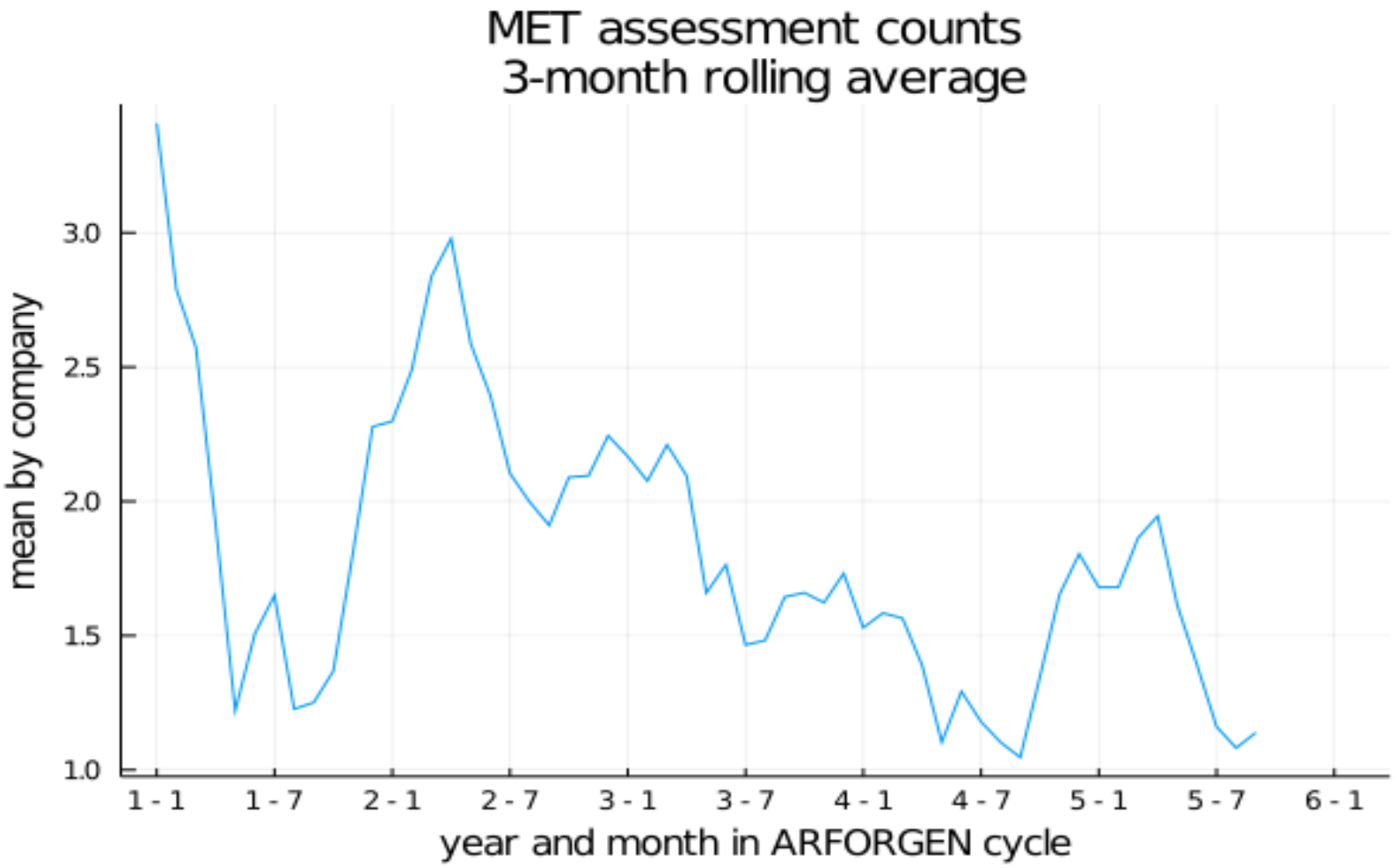
Restrict analysis to company-level tasks

Convert T, T-, P, P-, U to a 5 point scale

Standardize scores within tasks

- Scores are relative within a task
- Prevents shifts in task composition from driving results

Company MET assessments peak in 2nd, 5th year



Appendix:
Additional UTS

No evidence that FTS shortfalls impact submission errors

	num_UTS_submitted	
	(1)	(2)
num_fts	0.060	0.042
	(0.033)	(0.033)
co_ID_total_personnel_count	0.000	0.000
	(0.001)	(0.001)
co_ID_concave_cum_mo_exp	-0.003	-0.002
	(0.008)	(0.008)
ARFORGEN_stage_2	-0.080	-0.088
	(0.068)	(0.068)
ARFORGEN_stage_3	-0.042	-0.086
	(0.068)	(0.067)
ARFORGEN_stage_4	-0.040	-0.089
	(0.066)	(0.065)
ARFORGEN_stage_5	0.174*	0.062
	(0.077)	(0.074)
unit_type	Yes	
US_census_bureau_division_1	Yes	Yes
Estimator	OLS	OLS
N	7,311	7,311
R^2	0.010	0.006

No experience effect? May be measurement problem

	UTS Submitted		
	(1)	(2)	(3)
FTS count	0.039***	0.034**	-0.003
	(0.011)	(0.011)	(0.018)
Personnel count	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.001)
Concave cumulative months experience	-0.004	-0.003	0.006
	(0.003)	(0.003)	(0.005)
ARFORGEN stage	Yes	Yes	Yes
Unit type	Yes		
US Census Bureau division	Yes	Yes	
Month	Yes	Yes	Yes
Company ID			Yes
Estimator	OLS	OLS	OLS
N	7,311	7,311	7,407
R^2	0.044	0.042	0.166

Appendix:
X-Combat Training Center (XCTC) Products

Data

Training

DTMS – training plans, METs & T&EOs, qualifications (I,C,PW), other

Longer date ranges awaiting DUA approval

Ammo utilization

At battalion-year level

XCTC OC/T reports

Extremely valuable but limited to two Brigade Combat Teams (BCTs)

Personnel: G1 data pull – FTS counts, experience

Need latest year, possibly NCO identifiers

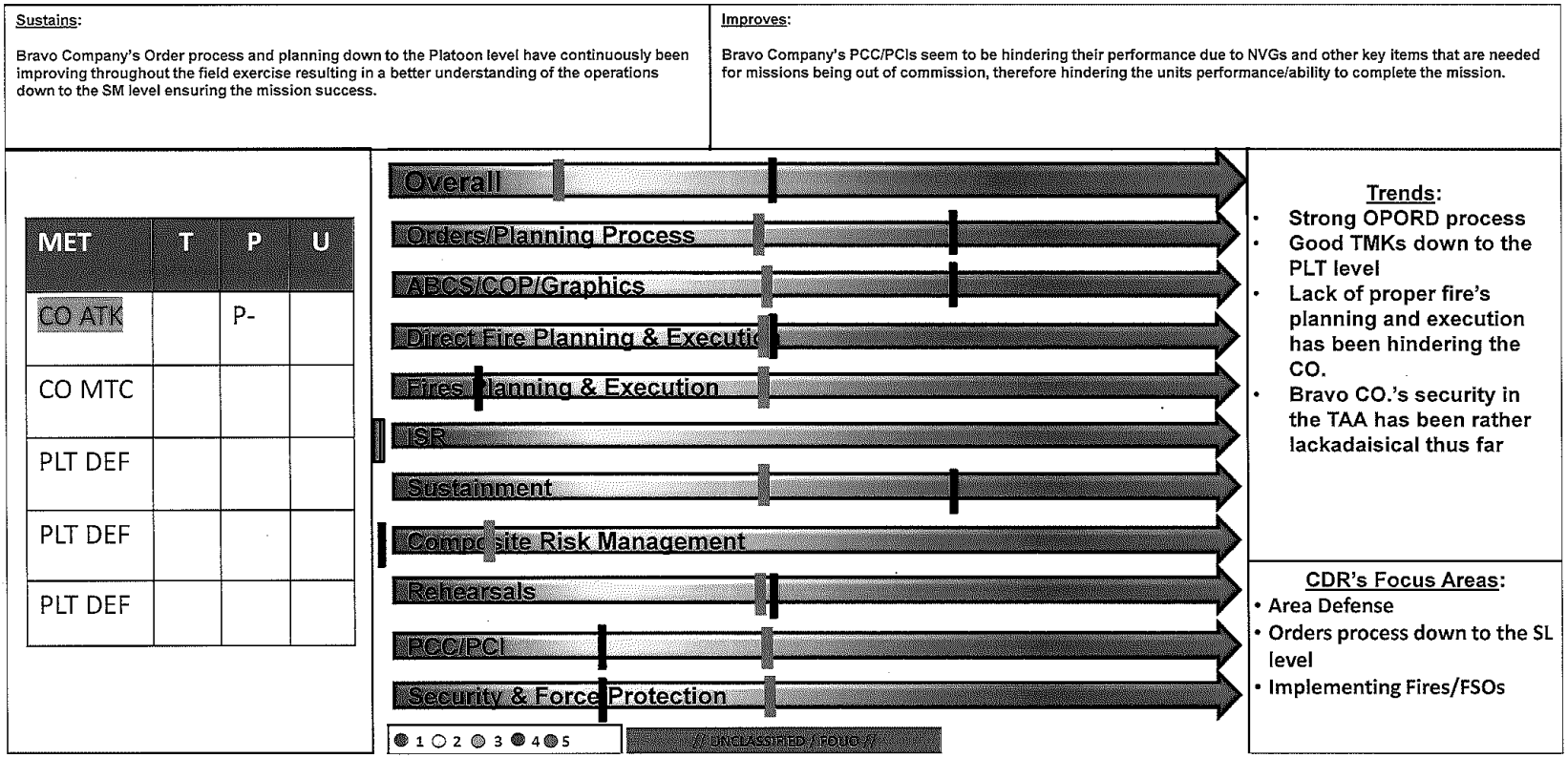
Unit hierarchy: unit table from 2020

Matched 736 companies under 169 battalions under 26 of 29 BCTs

Other:

ARFORGEN, FTS authorizations, rotations, funding

Observer-Coach/Trainer (OC/T) products feed Combat Training Center reports, but are distinct



Sustains:

Bravo Company's Order process and planning down to the Platoon level have continuously been improving throughout the field exercise resulting in a better understanding of the operations down to the SM level ensuring the mission success.

Improves:

Bravo Company's PCC/PCIs seem to be hindering their performance due to NVGs and other key items that are needed for missions being out of commission, therefore hindering the units performance/ability to complete the mission.

MET	T	P	U
CO ATK		P-	
CO MTC			
PLT DEF			
PLT DEF			
PLT DEF			

Trends:

- Strong OPORD process
- Good TMKs down to the PLT level
- Lack of proper fire's planning and execution has been hindering the CO.
- Bravo CO.'s security in the TAA has been rather lackadaisical thus far

CDR's Focus Areas:

- Area Defense
- Orders process down to the SL level
- Implementing Fires/FSOs

We have converted received reports into tabular format

Only 2 BCTs represented, but suggest useful variation

Data - XCTC OC/T Products

Platoon-level evaluations, feed 1st Army OC/T report:

Yellow Card – includes pairs of 1-5 scores: CO priors, OC/T assessment

Sustain & Improves, Trends – OC/Ts highlight problem areas, successes

T&EO – OC/T objective scoring of METLs

OC/Ts are comfortable sharing these OC/T report precursors (!):

Not systematically archived

Not codified in tabular format

Archiving, codifying data would bolster further research

Training Readiness

Certification

Individual/platform/crew weapons qualifications

Mission Essential Task, Training and Evaluation Outlines

- T&EO - used to assess performance at steps in a MET
- Feed into DRRS PRST T scores

Performance

XCTC OC/T reports (impartial reports of units in simulated missions)

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14. ABSTRACT

Full-time support (FTS), or Title 32 Active Guard Reserve and Active Duty Operational Support personnel, perform days-to-day operations necessary for producing Army National Guard individual and unit readiness. We analyze the impact of additional FTS on collective training. We find that additional FTS accelerate the planning process and, on a lag, boost assessed readiness on mission essential tasks. In addition, we find that higher-level units reallocate FTS from more ready companies to less ready companies. To provide policy-relevant counterfactuals, we estimate a structural model. In our model, the number and experience of company-level FTS increase training flows, which are partly measured through utilization a training specific database. In turn, training flows build up a latent readiness stock, which impacts different training-related outcomes, including assessed readiness on mission-essential tasks. Personnel are reallocated between companies in a BCT depending on lagged readiness. The structural model supports counterfactual predictions, which can be leveraged to more efficiently allocate personnel resources, and, ultimately, determine a viable and cost-effect component mix.

15. SUBJECT TERMS

Readiness, Training, Collective Training, XCTC, DTMS, Mission Essential Tasks, Full-Time Support, Title 32, ADOS

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