Workload, Time Use and Efficiency

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Motivation

- Task juggling (parallel processing of projects) is a problematic common occurrence:
  - Coviello, Ichino and Persico (2014) find that judges who juggle multiple cases, are slower to complete cases
  - Tan and Netessine (2014) find that service quality decreases in busy restaurants
- Fluctuations in workload often require task juggling (e.g. judges, scientists, accountants, doctors)
- Implicitly assumes that agents respond in same way to workload, or information of future workload
  - But response to workload may differ across production environments

Contribution

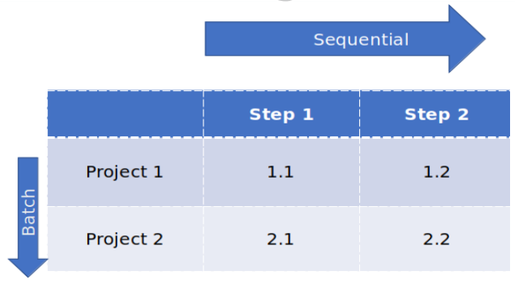
1. We study how workload affects performance and work processes:
   - How does workload affect performance: output quantity, quality and timeliness?
   - How do workers adjust their labor input and organize their tasks in response to workload?
2. We present a theoretical model that shows that task juggling is sometimes optimal and empirical evidence to support this hypothesis:
   - When projects are homogeneous, there may be scale efficiencies from task juggling (working in batches)
   - When projects are heterogeneous, there are no scale efficiencies and sequential processing is optimal (no task juggling)

Model: Batch vs Sequential Processing

- Dynamic multi-tasking model with three tradeoffs: quality-quantity, labor-leisure and timeliness-process efficiency.
- In processing workload, the worker decides the number of tasks to complete, the ordering of the tasks and the time spent on each task.

Processing order and time cost per task:

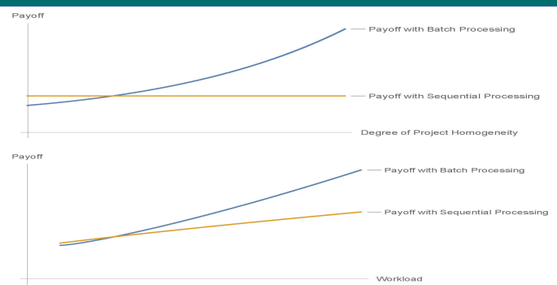
- Batch processing: tasks are completed within steps, across projects
  - Time cost for batch decreases with length of batch (number of projects) and level of project homogeneity
- Sequential processing: tasks are completed across steps, within projects
  - Time cost for project decreases with number of (steps) and project specificity



Equilibrium

Optimal processing:

- Batch processing is optimal:
  - In homogeneous projects (degree of homogeneity large)
  - When workload is sufficiently large
  - High workload increases not just quantity, but also performance (quality, timeliness)
- Sequential processing is optimal:
  - In heterogeneous projects (project homogeneity small)
  - When workload is low
  - High workload only increases quantity and may decrease performance (timeliness)



Key Comparative Statics

Performance Metrics		Setting	
Outcomes	wrt	Homogeneous	Heterogeneous
Quantity (# tasks completed)	Current workload	+	+
	Future workload	-/+	+
Quality	Current workload	+	0
	Future workload	0	0
Tardiness (% of tasks completed past due)	Current workload	-	+
	Future workload	+/-	-

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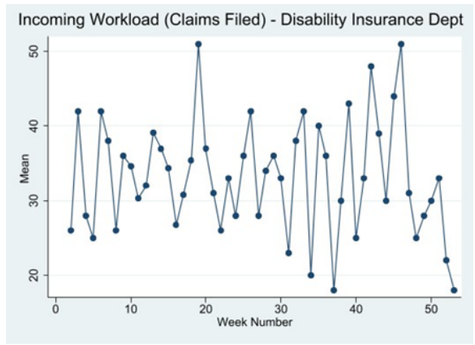
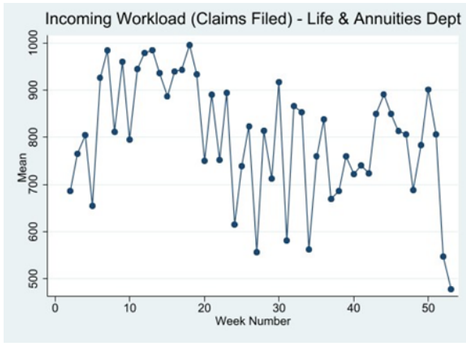
Empirics – Institutional Details

- Life & Annuities (LA; 37 examiners)
  - Linear production process
  - Homogeneous case files
- Disability & Long-term Care (DI; 57 examiners)
  - Hub-and-spokes process
  - Heterogeneous case files



- Plausibly exogenous variation in workload:
  - Large case load fluctuations throughout year
  - Capacity cannot be adjusted to short-term fluctuations due to training requirements
- Signal of future workload: new notices turn into claims ca. 5-6 weeks later



Efficiency: Batch vs Sequential

Dependent Variable	CoV: # Unique tasks / Max # within tasks		CoV-Alt: # Unique tasks / # Tasks completed	
Setting	Homogeneous	Heterogeneous	Homogeneous	Heterogeneous
Current Workload (normalized)	0.009	-0.102*	-0.000	-0.033***
	(0.028)	(0.053)	(0.035)	(0.008)
Future Workload (normalized)	0.107***	0.078	0.057	-0.008
	(0.030)	(0.052)	(0.043)	(0.009)

Controlling for: age, tenure, pay level, month and individual fixed effects. Robust Ses

Results align with comparative statics and suggest that batch processing occurs in the homogenous environment, and sequential processing in the heterogeneous environment

Performance: Quantity, Quality, Tardiness

Dependent Variable	Total number of tasks completed		Quality Score		Tardiness	
Setting	Homogeneous	Heterogeneous	Homogeneous	Heterogeneous	Homogeneous	Heterogeneous
Current Workload	0.059***	0.020**	0.021*	-0.028	-2.627***	0.411
	(0.015)	(0.010)	(0.010)	(0.075)	(0.827)	(0.733)
Future Workload	-0.040	0.026*	0.034*	-0.021	-1.684	-0.959
	(0.025)	(0.014)	(0.017)	(0.051)	(1.103)	(0.798)

Controlling for: age, tenure, pay level, month and individual fixed effects. Robust Ses

Output quantity increases in response to current workload in both the homogenous and heterogeneous environment, by 6 and 2%, respectively. Timeliness and quality however only increase in response to workload in the homogeneous environment. This aligns with efficiencies of scale in the homogeneous environment when agents engage in batch processing.

Discussion

- People in different production environments may respond differently to changes in workload
  - In a homogenous environment, an increase in workload could lead to an increase in performance because batch processing (task juggling) can improve efficiency
  - In a heterogeneous environment, an increase in workload does not improve performance (other than increase quantity) because there are no efficiency gains
- Implications for organization of work: there are potential advantages to homogenizing work processes and task juggling

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