

# HOW STRATA AFFECT THE PROPORTIONAL HAZARD TEST'S PERFORMANCE

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## 1 INTRODUCTION

### Research Question

For the Cox duration model's Schoenfeld-based proportional hazards (PH) test, does the test's approximated calculation perform differently than the test's actual calculation (AC) when the approximation's simplifying assumption (SA) is not met?

### Findings, Thus Far

- General difficulties finding scenarios in which SA is clearly met)
- Yes, the two calculation variants perform differently...
- ...but, descriptively, in ways that appear to reflect previous research's findings  $\Rightarrow$  raises new questions about SA's role

### Previous Research

Focuses on situations where the two calculations should perform similarly, ex ante (Metzger 2023, 2024)

- The two calculations perform very differently in unexpected situations.
- AC's false positive rate skyrockets as correlation between PH violator and non-violator increases.

## 2 THE CALCULATION VARIANTS

**Key Difference:** simplifying assumption (SA) about information matrix  $\mathcal{J}^E$  used when calculating test statistic

$$\mathcal{J}^E = \begin{pmatrix} \mathcal{J}_1 & \mathcal{J}_2 \\ \mathcal{J}'_2 & \mathcal{J}_3 \end{pmatrix} \quad \mathcal{J}_1 = \sum \hat{V}(t_k)$$

$$\mathcal{J}_2 = \sum \hat{V}(t_k)g(t_k)$$

$$\mathcal{J}_3 = \sum \hat{V}(t_k)g^2(t_k)$$

$k$ : kth event time ( $0 < t_1 < \dots < t_k < t_K$ )

$\hat{V}(t_k)$ :  $J \times J$  VCE at time  $t_k$  from original Cox model

### ① Approximation

Used: Stata, R (survival < 3.0-10), Python (lifelines)

Assumes:  $\hat{V}(t_k)$  constant across all  $t_k$ , implying (1)  $\mathcal{J}_2 = 0$ ;  
(2)  $\bar{V} = \sum \hat{V}(t_k) / d$  as reasonable substitution for  $\hat{V}(t_k)$

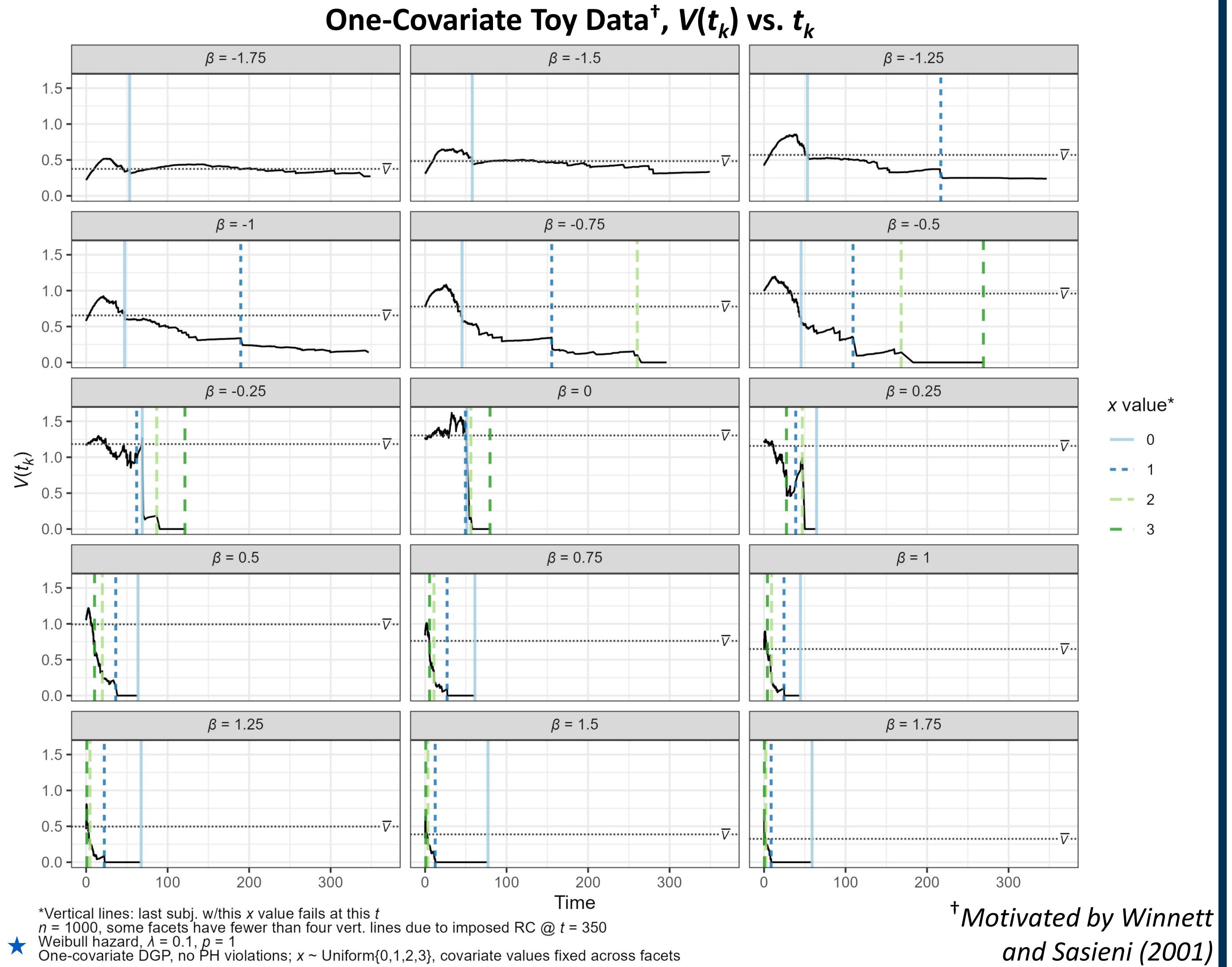
### ② Actual (AC)

Used: R (survival  $\geq$  3.0-10)

Assumes: no simplifications

## 3 SA VIOLATIONS: PREVALENCE?

Answer: Unsettlingly abundant. Still unclear whether all SA violations are alike.



## 5 MC SIMULATIONS: FINDINGS (TO DATE)

>> Current Take-Home Point: SA violations don't affect the approximation's size, but do seem to reduce its power. However, the AC's power also decreases <<

