

# **Bounds Analysis of Competing Risks: A Nonparametric Evaluation of the Effect of Unemployment Benefits on Migration in Germany**

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## **Economic Motivation**

- **Many studies suggest that unemployment compensation prolongs the duration of unemployment:**
  - Katz and Meyer, 1990; Card and Levine, 2000; Lalive and Zweimüller, 2004; van Ours and Vodopivec, 2006 ...
- **Effects on interregional mobility of unemployed jobseekers ambiguous:**
  - **Theory A** (Hassler et. al, 2005):  
Unemployment compensation reduces incentives to accept a job in more distant regions and thus reduces the interregional mobility of unemployed persons
  - **Theory B** (Tatsiramos, 2003):  
Unemployment compensation provides the resources for investing in interregional mobility and thus fosters migration
- **Household context or decision process not modelled.**

- **Empirical Studies reflect this ambiguity:**
  - Negative impact → Goss and Paul (1990), Antolin and Bover (1997), Kettunen (2002), Arntz (2005), Arntz and Wilke (2006)
  - Positive impact → Tatsiramos (2003)
  - Selection issues not resolved satisfactorily
  - Effect of household composition unclear
- **Our identification strategy: a natural experiment**
  - In 1997, a reform reduced the maximum receipt of unemployment benefits for individuals >42 years
  - Use difference in differences (DiD)
  - Heterogeneous treatment effects (education, household context)

- Non-parametric approach to estimate effect on competing risks:
  - Large sample size of German administrative data:
    - IAB employment subsample 1975-2001 (IABS) : 2% sample
    - IAB employee and benefit recipient history: 50% sample of males

- **Data limitations of merged administrative individual data:**
  - Individual employment histories are not fully observed.
    - Observed: employment, receipt of unemployment compensation
    - Unobserved: unemployment without unemployment compensation, being out of labour force, self-employment, civil servants
  - Partially identified unemployment duration.
  - Data identifies lower and bound for the true unemployment duration only.

- **Methodological challenge:**

Develop a non-parametric approach to estimate the reform effect on competing (possibly dependent) risks taking into account the data limitations.

→ Single-risk model: Bounds for a DiD reform effect on the non-parametric survival probabilities (Lee/Wilke, 2008?, JBES)

→ Assumes independent censoring.

→ Results are inconsistent in case of dependent competing risk.

- **We suggest:**
  - Bounds for the cumulative incidence curve (CIC)
    - CIC is a descriptive tool for the risk-specific observed durations of competing and possibly dependent risks.
  
  - No solution to the fundamental identification problem of competing risks (Cox, 1962; Tsiatis, 1975).
    - We are not able to identify causal effects without additional assumptions.
  
  - Our results are valid in case of dependent risks, although they do not have a causal interpretation in this case.

## A model of partially identified unemployment durations:

$T_{lk}$  random variable of the latent transition time from  $l = 0, 1, \dots, K$  original to  $k = 0, 1, \dots, K$  destination states with  $k \neq l$ .

$\tau_{ilk}$   $i = 1, \dots, n$  iid realisations of  $T_{lk}$  are on a discrete scale

$\tau_{0k}$  ( $\tau_k$ ) transition from unemployment ( $k=0$ ) to another state ( $k=1, \dots, K$ )

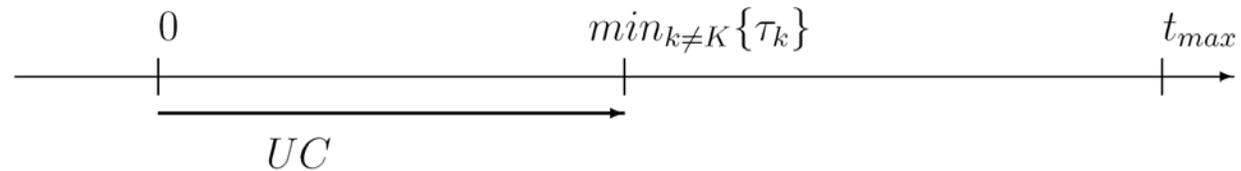
$k=1, \dots, K-1$  observable labour market states (local, non-local employment)

$K$  unobservable labour market states: e.g. being out of labour force and self-employment  $\rightarrow$  indistinguishable from unemployment without unemployment compensation (UC)

$\tau_r = \min_{k \neq K} \{\tau_k\}$  smallest transition (may not be observed)

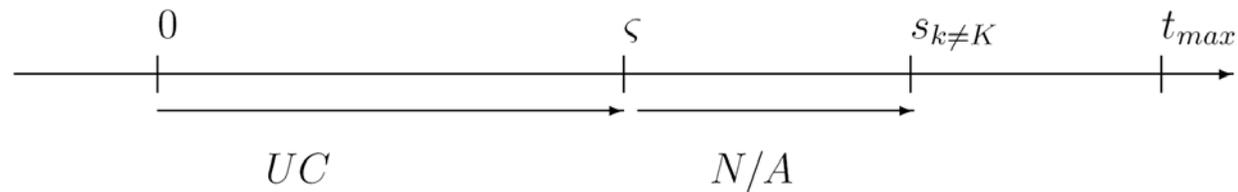
$\zeta$  beginning of unobserved period (end of UC)

## A fully identified unemployment duration ( $\delta=0$ ):



- Implementation of  $\delta=0$ : Unemployment with permanent unemployment compensation (allowing for minor gaps of <4 weeks).

## A partially identified unemployment duration ( $\delta=1$ ):



N/A: unobserved labour market state

- $\tau_k$  is not fully identified, but there are two extreme, observationally indistinguishable cases that can be used to bound  $\tau_k$ :

### Lower bound of the true unemployment duration:

There is an exit to  $K$  during N/A at  $\zeta$ .

**Upper bound:** No exit to  $K$  during N/A



## **Bounding the DiD change of the CIC :**

Using the monotonic relation,  $I_k^{LB}(t) \leq I_k^{UB}(t)$ , we can establish bounds for the DiD changes (same as in Lee/Wilke, 2008, for the survival curve).

# Application

**Data:** IAB merged individual administrative data

- IAB employment sample 1975-2001 (2% sample)
- IAB Employee and Benefit Recipient History (50% sample of males) 1975-2005

- Contains individuals in employment that are subject to social insurance contributions
- Non-local transitions to employment: new workplace located neither in the local nor an adjacent labour market region
- Reform in 1997: **Natural experiment:**  
A reduction of the maximum entitlement length for unemployment benefits for individuals >41 years by up to 10 months (from up to 22 to 12 months).

## **Choice of control and treatment group**

### ➤ **Treatment group:**

Individuals aged 42-44 entitled to >12 months of counterfactual entitlements

### ➤ **Control group:**

Individuals aged 36-41 entitled to >12 months of counterfactual entitlements

### • **Restrict sample to**

- Previously full-time working men from West Germany
- Pre-reform period: 1995/1996
- Post reform period: 1999/2000

Table 4: Estimated actual UB entitlement length for unemployment spells with counterfactual UB of >12 months in the pre- and post-reform era by treatment and control group, IAB-R01

UB duration	Control group		Treatment group	
	pre-1997	post-1997	pre-1997	post-1997
6-8 months	2.1%	1.3%	0.00%	1.5%
9-11 months	6.9%	4.5%	0.00%	5.6%
12 months	91.0%	94.2%	0.00%	93.0%
13-14 months	0.0%	0.0%	8.1%	0.0%
15-16 months	0.0%	0.0%	7.2%	0.0%
17-18 months	0.0%	0.0%	56.4%	0.0%
19-20 months	0.0%	0.0%	3.1%	0.0%
21-22 months	0.0%	0.0%	25.2%	0.0%
Average months	11.8	11.9	18.5	11.8
Total spells	4,294	3,577	1,557	1,436

## Heterogeneous treatment effect:

depends on former wage income and household context

- No treatment for low wage group
- Strongest treatment for high wage group

		Income replacement rate			
	UB/UA claims	Empl.	1-12 months	>12 months	Change
I	UB + welfare/ UA + welfare	100%	>67%	>67%	0%
II	UB/ UA (+ welfare)	100%	67%	58-67%	0 to -9%
III	UB/ No claim	100%	67%	0%	-67%

→ Welfare receipt is not in the data.

→ Look at effects for different education levels because qualified workers are more likely to belong to II and III

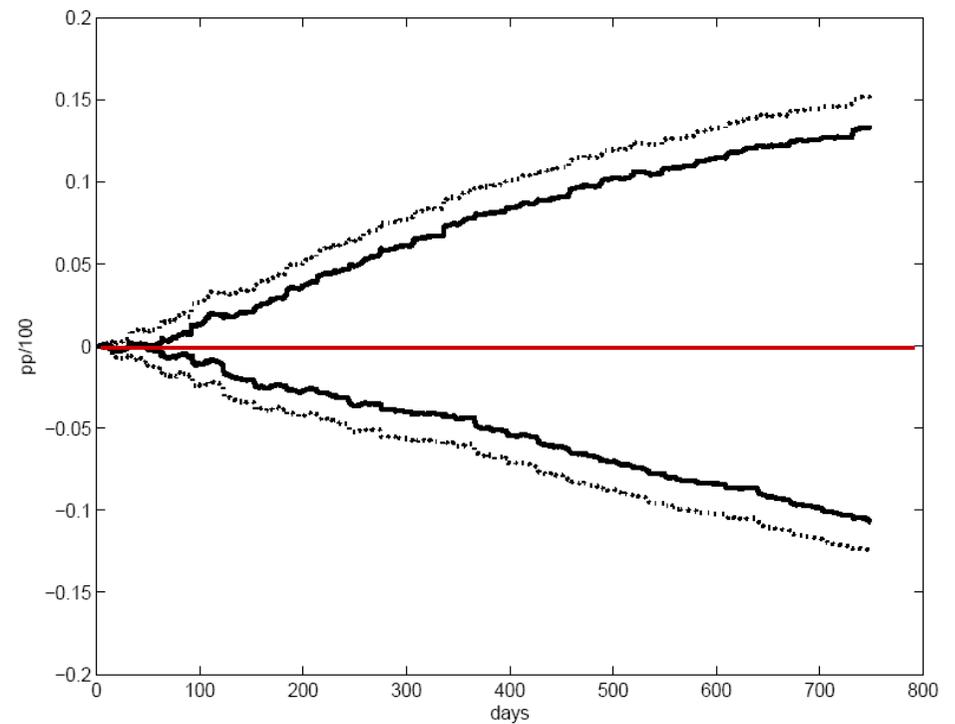
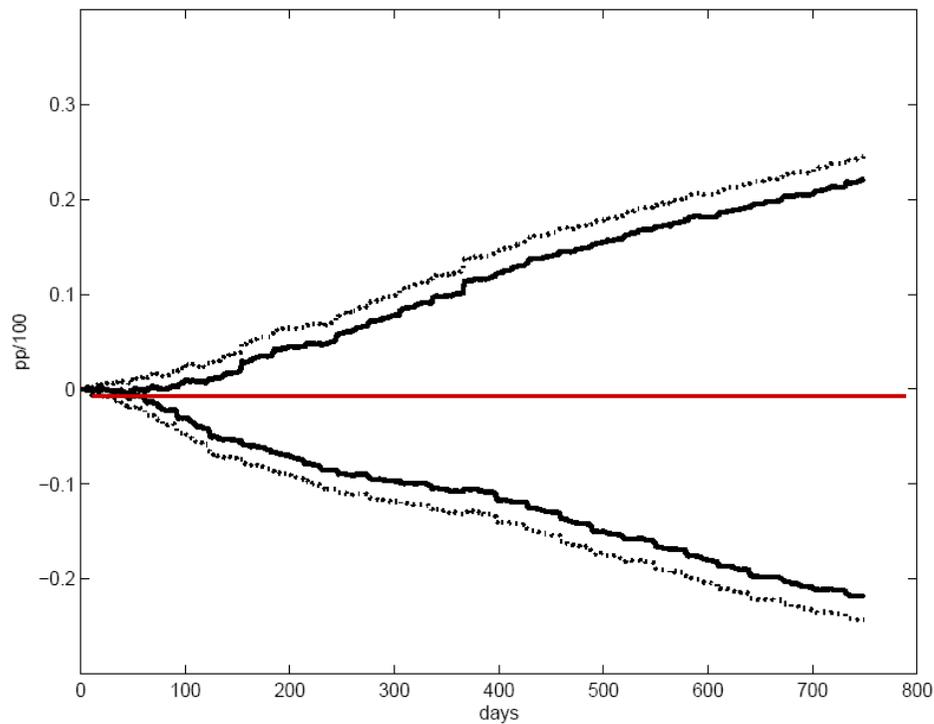
# Worst case bounds for the reform effect on the CICs

- 50% sample of males
- 90% bootstrap CI (Horowitz/Manski, 2004)

Local job finding

Migration

high skilled, single males



**Bounds due to missing interval information are too wide and preclude any interpretation of the results.**

### **Approaches to tighten bounds**

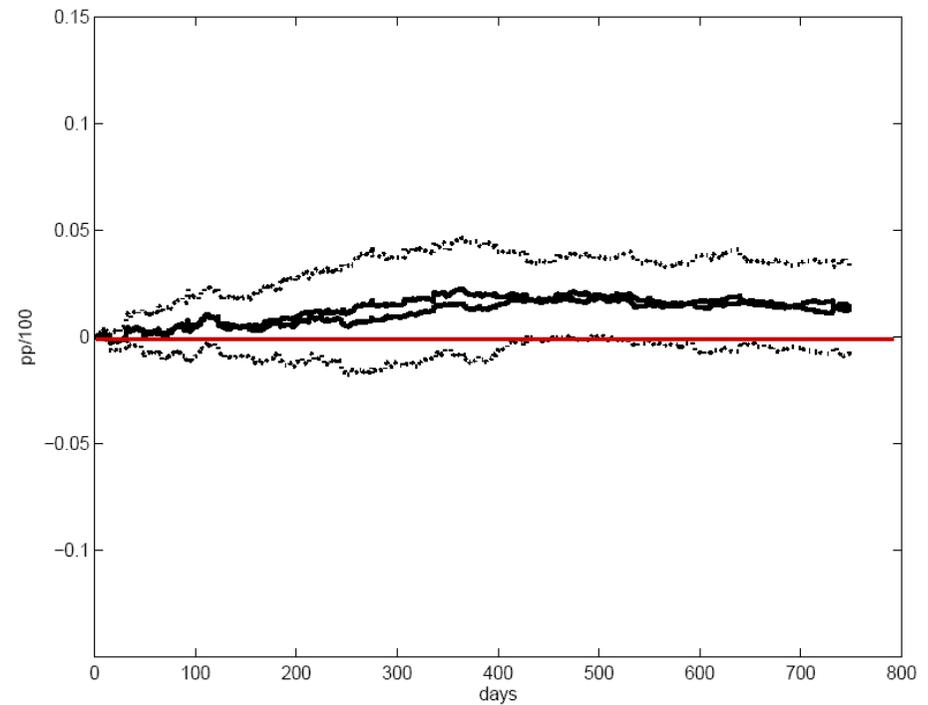
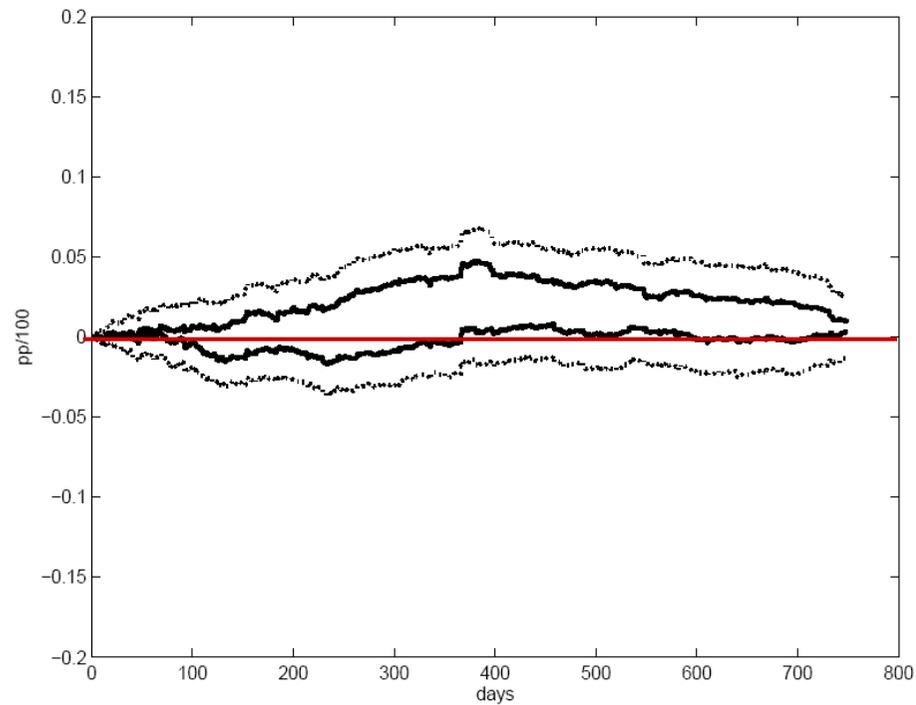
1. Economic reasoning: Assume that probability of experiencing  $K$  is a function of the length of the unobserved period.
2. Reduce the share of partially identified observations ( $\delta=1$ ) by excluding a sample of uninformative spells.
3. Estimation of  $P(r \neq K | \delta = 1, x)$  based on survey information.
4. Assume that the unknown probability does not depend on calendar time and control/treatment group.

# Bounds under an additional independence assumption

Local exits

Migration

high skilled, single males

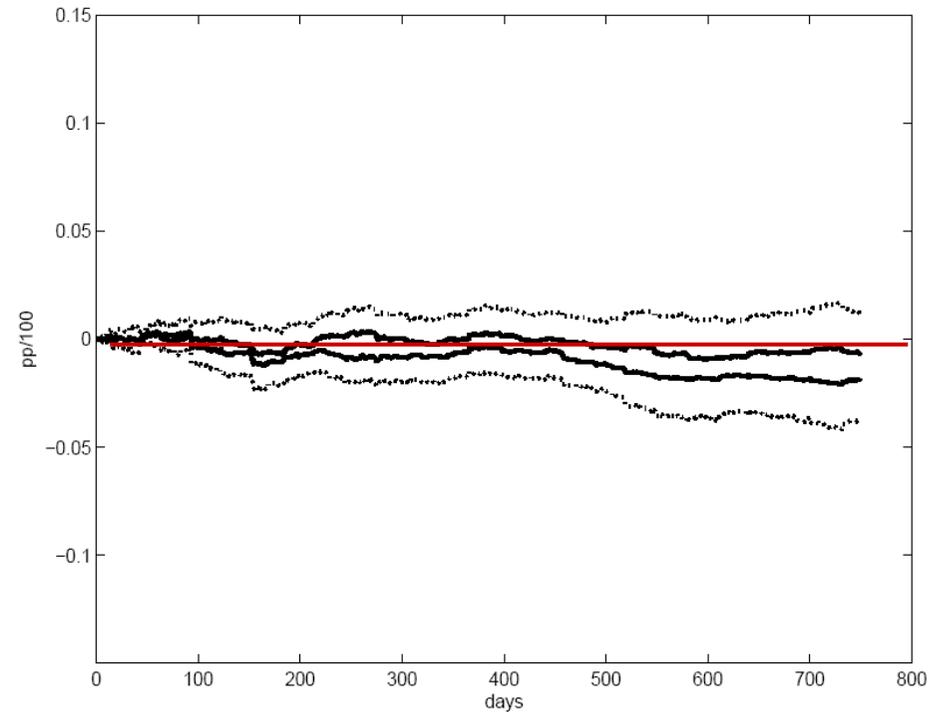
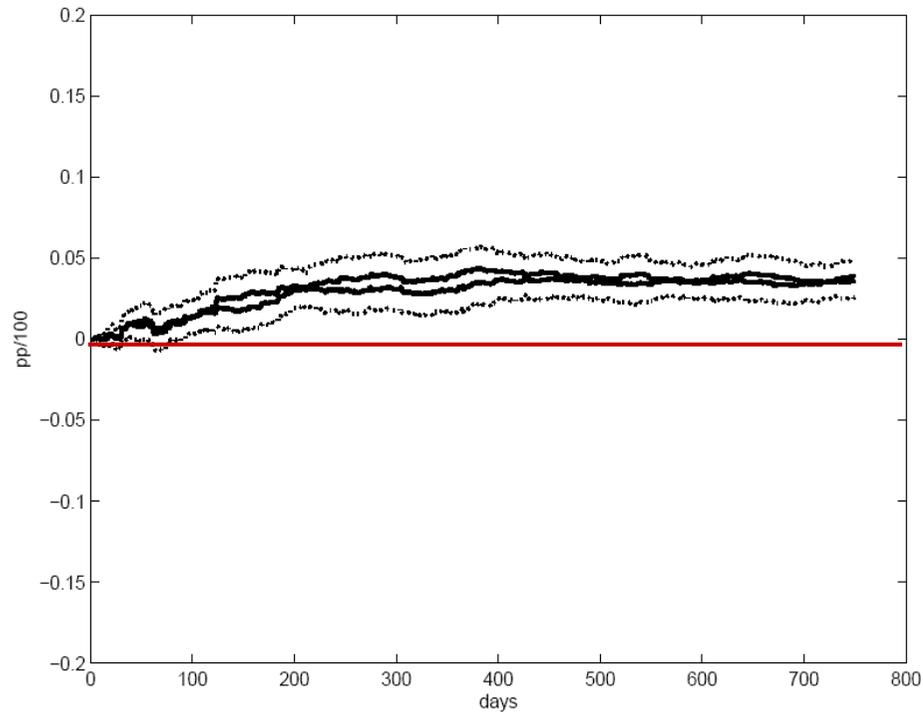


# Bounds under an additional independence assumption

Local exits

Migration

high skilled, married males

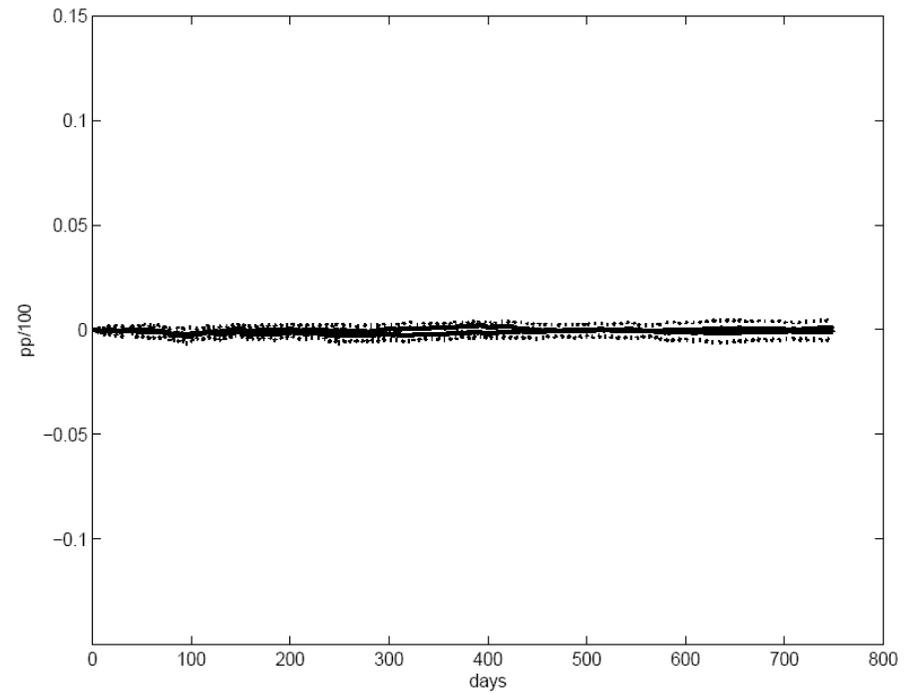
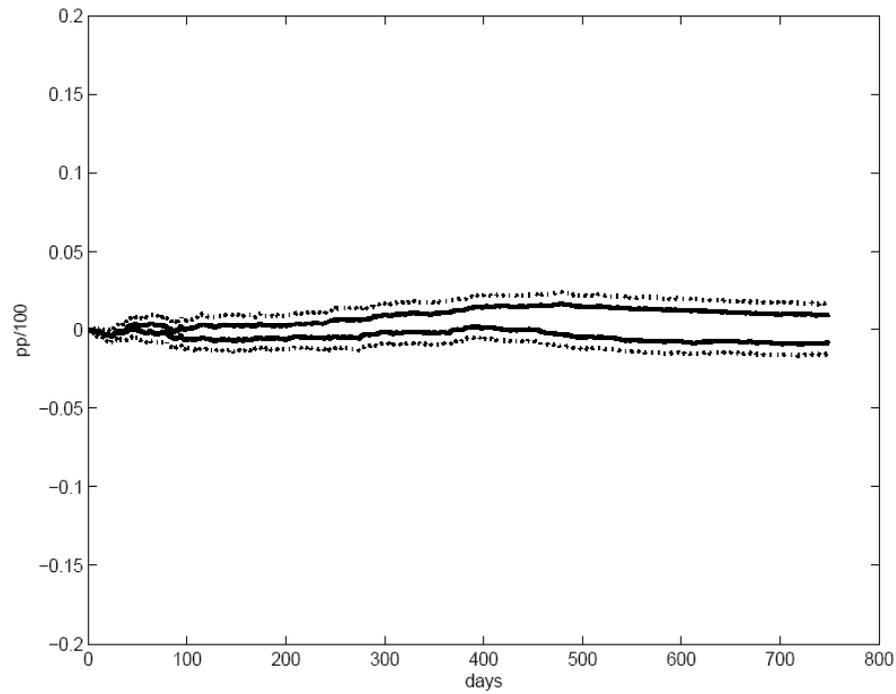


# Bounds under an additional independence assumption

Local exits

Migration

less skilled, males



## Conclusion and Outlook

- We present an approach to bound a DiD effect in a depending competing risks framework with partially identified interval data.
  - Similar data problems are relevant in many data sets.
- Application to effect of UB receipt on employment transitions:  
For skilled unemployed we find evidence that a shorter UB receipt increases transitions to local and non-local employment
  - Only small group was affected by the reform
  - The majority of unemployed in Germany are low wage or early retired (aged >55).
  - The household context (single/married) can result in reversed treatment effect pattern. Economic Theory may want to model this.

Thank you for your attention!

Table 5: Descriptive summary of full sample, IAB-R01

	Control group		Treatment group	
	pre-1997	post-1997	pre-1997	post-1997
<i>LB spells</i>				
median duration (days)	79	73	88	73
exit to local job	54.5% (54.9%)	53.8% (57.0%)	53.4% (53.9%)	52.9% (56.2%)
exit to non-local job	7.7% (7.8%)	8.4% (8.9%)	6.7% (6.8%)	8.2% (8.7%)
exit to other destination	37.1% (37.3%)	32.1% (34.1%)	39.0% (39.3%)	32.9% (35.0%)
total exits	99.3% (100.0%)	94.3% (100.0%)	99.1% (100.0%)	94.0% (100.0%)
<i>UB spells</i>				
median duration (days)	161	124	185	130.5
exit to local job	75.1% (77.4%)	65.9% (74.6%)	72.1% (75.1%)	64.8% (74.1%)
exit to non-local job	12.8% (13.1%)	11.0% (12.5%)	12.5% (13.0%)	11.2% (12.8%)
exit to other destination	9.2% (9.5%)	11.4% (12.9%)	11.4% (11.9%)	11.5% (13.1%)
total exits	97.1% (100.0%)	88.3% (100.0%)	96.0% (100.0%)	87.5% (100.0%)
Total spells	4,294	3,577	1,557	1,436