Unemployment Duration and Re-employment Wages: A Control Function Approach

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What is the Control Function approach?

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3. Obtain, in a reduced form, the generalized residuals (v_2) – 1st stage

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$$\mathbf{y_2} = \pi X + \beta z + \mathbf{v_2} \tag{2}$$

4. Add the generalized residuals to the 2nd stage

$$y_1 = \gamma_1 \mathbf{y_2} + \delta X + \rho \mathbf{v_2} + e_1 \tag{3}$$

Remember: $y_2 - v_2 = \hat{y}_2$

Control Function: Advantages

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In the context of the our application, we can also obtain:

- Hausman Test
- Inverse Mills Ratio

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Unemployment Duration and Re-employment Wages

- There is not a single theory which justifies the earnings losses of displaced workers (Carrington and Fallick, 2015).
  - job-specific human capital (Becker, 1962)
  - matching (Jovanovic, 1979)
  - wage-productivity gap (Lazear, 1981)
  - signalling (Gibbons and Katz, 1989)
  - unionism (Hildreth and Oswald, 1997)
  - intra-household reallocation (Lundberg, 1985)
  - health (Kessler, House and Turner, 1987)

- Estimation issue: simultaneity present in the relationship between joblessness duration and re-employment wage

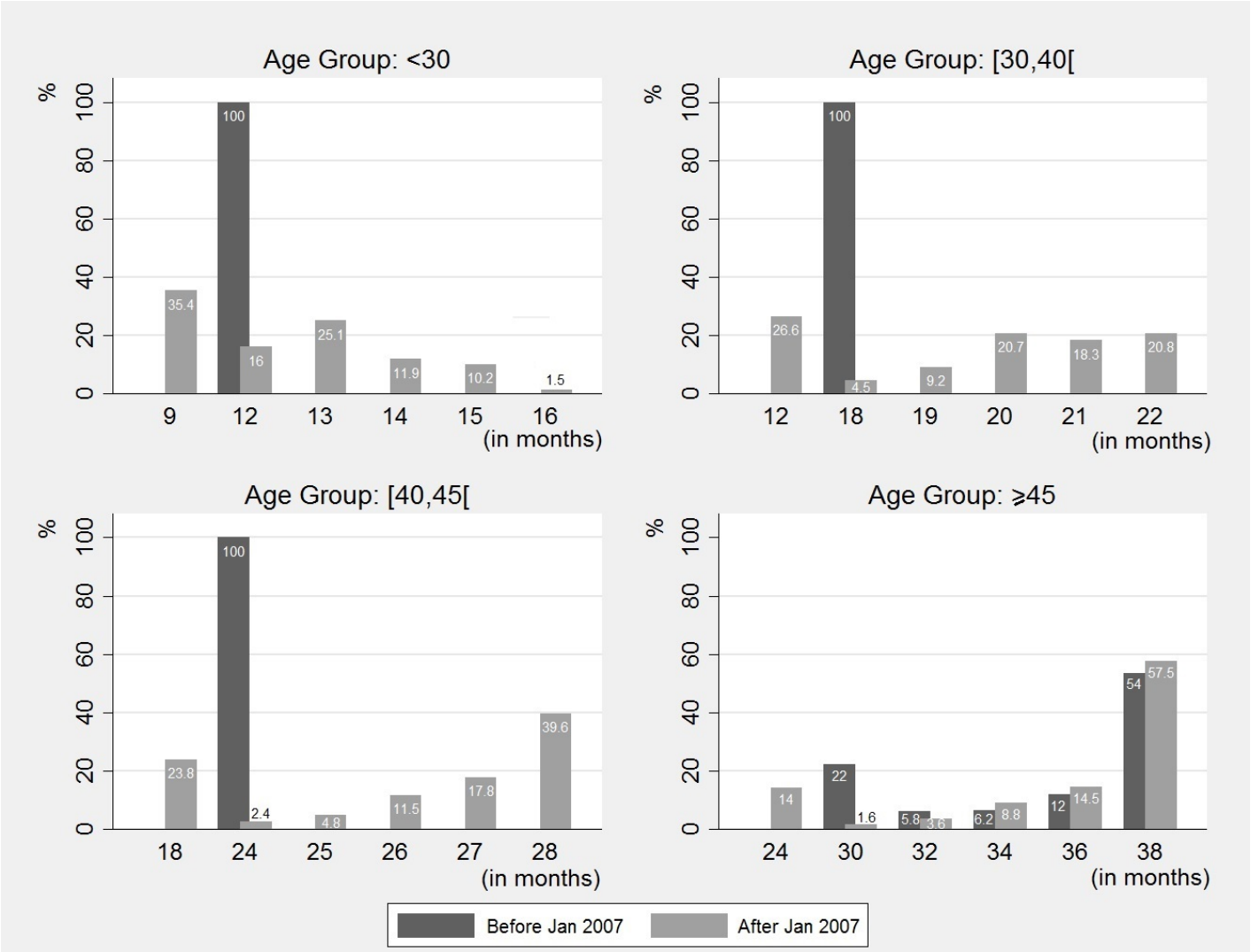
$$\log(PostW_i) = \alpha_0 + \alpha_1 \log(UD_i) + X'\beta + u_i$$

Unemployment Benefits Rules in Portugal

Unemployment insurance (UI)

- involuntarily unemployed
- working for a minimum period
- potential duration = f (age, job history)
- daily benefit based on remunerations of past 2 years

Figure: Percentage of individuals by age group and potential duration of unemployment benefit, before and after the 2007 reform



First Stage - Identification Strategies

Identify the exogenous variation in the joblessness duration:

- Potential Duration of Unemployment Benefits
  - Vast literature indicates strong correlation between potential duration of UB and joblessness duration. The rules are not directly related to the wage but include two of the determinants (age, experience).

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- Age Discontinuity in the Potential Duration of Unemployment Benefits
  - Individuals with 29 or 30 years old have, on average, similar labour supply characteristics but are entitled to different potential durations. There is room for enough difference on experience.
- Change in the Potential Duration of Unemployment Benefits
  - As the benefits require involuntary unemployment there is no room for strategic behaviour. The policy change did not affect all the individuals in the same way. Correlation with age is -0.03 and correlation with experience is 0.18.

First Stage - Results

Table Accelerated Failure Time
Unemployment Duration Equation

Variable	(1)
Difference in Potential Rules	.089
	(.0002)
Age (groups)	
[30,40[	.284
	(.004)
[40,45[	.592
	(.004)
$\geq$45	1.449
	(.004)
Log likelihood	-18 481
N	18 543

Notes: standard errors in parenthesis below the estimates. The equations also include gender dummy, tenure quadratic polynomial, reasons of unemployment dummies, unemployment rate and six region dummies.

Second Stage - Results

Variable	OLS	CF
Ln(Duration)	-.076	-.049
	(.005)	[.012]
1st stage residuals		-.068
		[.028]
Ln(Previous Wage)	.566	.568
	(.011)	[.016]
Age (groups)		
[30,40[	.016	.012
	(.012)	[.012]
[40,45[	-.008	-.020
	(.018)	[.019]
$\geq$45	.007	-.021
	(.017)	[.021]
Constant	3.084	3.109
	(.091)	[.111]
Adj R^2	.264	.265
N	8 423	

Notes: bootstrapped standard errors in squared parenthesis below the estimates. The equations also include the controls of the first stage.

Problem: **Simultaneity**

unemployment duration $\uparrow$ $\longleftrightarrow$ reservation wage $\downarrow$ $\longleftrightarrow$ re-employment wage $\downarrow$

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Individuals who got a job $\neq$ individuals who did not get a job

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Solution: Include the generalized residuals from the first stage ✓
Statistic: Hausman test

Problem: **Selection**

$$\text{Individuals who got a job} \neq \text{individuals who did not get a job}$$

Solution: Include the hazard rate from the first stage
Statistic: Inverse Mills ratio

Second Stage - with selection control

Variable	OLS	CF	CF+S
Ln(Duration)	-.076	-.049	-.052
	(.005)	[.012]	[.012]
1st stage residuals		-.068	-.072
		[.028]	[.029]
1st stage hazard			-.310
			[.292]
Ln(Previous Wage)	.566	.568	.569
	(.011)	[.016]	[.016]
Age (groups)			
[30,40[	.016	.012	.008
	(.012)	[.012]	[.013]
[40,45[	-.008	-.020	-.028
	(.018)	[.019]	[.022]
$\geq$45	.007	-.021	-.037
	(.017)	[.021]	[.028]
Constant	3.084	3.109	3.157
	(.091)	[.111]	[.117]
Adj R^2	.264	.265	.265
N		8 423	

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Selection direction

The **hazard rate** is the ratio between the density and the cumulative density functions. That is, it can be interpreted as an **Inverse Mills Ratio**. From the estimated coefficient we can then calculate the correlation between the two residuals.

$$\hat{\sigma}^2 = \frac{1}{N}\sum_i \left[\hat{v}_i^2 + \hat{\alpha}\hat{\lambda}_i\right] \tag{4}$$

$\hat{v}_i^2$ - squared individual residuals from second stage
$\hat{\alpha}$ - estimated coefficient of the hazard rate in the second stage
$\hat{\lambda}_i$ - estimated individual hazard rate from the first stage

$$\hat{\rho} = \frac{\hat{\alpha}}{\hat{\sigma}} \tag{5}$$

Provides the correlation between the two residuals, which in this case is 0.21 but not statistically significant.

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- Namely for the estimation of survival analysis models which can include more individuals than those used for the second stage
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Note: Stata command to be constructed soon

Thank you!

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