Firing Costs, Employment and Misallocation
Evidence from Randomly-Assigned Judges

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Why should we care about firing costs?

- Firing costs make it more costly for firms to reallocate labor in response to exogenous shocks.

- Misallocation of resources over time and across firms, potentially inefficient.

- Both job creation and job destruction are reduced, ambiguous effect on average employment level.
Using a quasi–experiment:

1. quantify the magnitude to which firing costs reduce labor reallocation over time;

2. test the effect of firing costs on average employment level.
Very large literature,

1. cross–countries comparisons:
   - Lazear 1990
   - Bassanini and Garnero 2013

2. within–country comparisons:
   - David, Kerr, and Kugler 2007;
   - Kugler and Pica 2008;

but no true source of exogenous variation of firing costs:

- unobservable factors differing between countries;
- firms sorting into the low firing costs regime within countries.
- **Ideal experiment:** randomly and credibly allocate firing costs to firms.

- **My experiment:**
  - Setting in which longer trials imply higher firing costs (Italy).
  - Consider one large Italian labor court.
  - Within this court, firms are randomly allocated to judges.
  - There are fast and slow judges.

- Random allocation of firms to judges $\Rightarrow$
  $\Rightarrow$ Exogenous variation of *experienced trials length* $\Rightarrow$
  $\Rightarrow$ Exogenous variation of *future expected firing costs* $\Rightarrow$
  $\Rightarrow$ Employment changes
  $\Rightarrow$ Employment levels
Employment inaction

A 10% increase in expected firing costs reduces the hazard of employment changes by 3.6%.
## Results

### Employment inaction

A 10% increase in expected firing costs reduces the hazard of employment changes by 3.6%.

### Employment levels

A 10% increase in expected firing costs increases by 3% average employment levels.
Results

Employment inaction
A 10% increase in expected firing costs reduces the hazard of employment changes by 3.6%.

Employment levels
A 10% increase in expected firing costs increases by 3% average employment levels.

- Potentially inefficient high level of employment due to lower labor reallocation
A long trial ending today implies:

1. A large (sunk) cost to be paid today by the firm.
2. Expectations of future firing costs revised upwards.

- Trial cost does not matter *directly* for future optimal decisions because it is sunk.
- It matters *indirectly* by changing future expectations on firing costs.

**Liquidity constraints do not matter**

The effects estimated do not depend on how much the firm is liquidity constrained.
Firms learn trials length (firing costs)

- Firms might have incomplete information on trials length in the area where they operate.
- Firms have priors on the trial length.
- Firms’ experienced trials lengths are signals of the true trial length.
- These signals are used to update priors.
- Firms assigned to slow judges and experiencing long trials updated their priors differently than firms assigned to fast judges and experiencing short trials.

Younger firms have more to learn

The effects estimated is larger in size for younger firms, given less experience, imprecise priors, they are more likely to revise their expectations.
Longer trials imply higher firing costs

Firing costs = Transfer + Tax

1. Legal costs, Tax

2. Organizational costs, longer period of uncertainty (Bloom 2009), Tax

3. Foregone wages $\times$ prob. worker wins the case, large firms only, Transfer

4. Penalty delayed payment of forgone social security contributions $\times$ prob. worker wins the case, large firms only, Tax
A partial equilibrium model of firing costs

Bentolila and Bertola 1990

\[
\max_{\{n_t\}_{t=1}^{\infty}} \sum_{t=1}^{\infty} \delta^t E\{[z_t f(n_t) - wn_t - F \max\{0, n_{t-1} - n_t\}]\} \quad s.t. \quad n_t \geq 0
\]

- employment \( n_t \) as the only input
- shock \( z_t \) identically distributed over time with cumulative density function \( G \)
- exogenous wage \( w \)
- firing cost \( F \)
- firing costs raise firms’ (downward) adjustment costs.
Simulation employment levels
$n_t$ (labor)

$z_t$ (shock)

$z_t$  $\bar{z}_t$  $\bar{z}_t'$

$\uparrow F$  $\uparrow F$

Simulation employment levels
Simulation employment levels
$n_t$ (labor)

Simulation employment levels
Firing costs:

- reduce employment changes,

- have an ambiguous effect on employment levels,

- lead to misallocation of resources over time: underemployment in good times and overemployment in bad times.
Court data from one large Italian labor court:

- 320,191 trials filed between 2001 and 2012 (trials end between 2001 and 2014);
- 82 judges;
- 82,518 trials involving 25,906 firms

Firms data:

- universe of firms (220,341) operating in the geographical area for which the labor court has jurisdiction;
- monthly employment from 1990 to 2013, (National Social Security (INPS) agency data).

Linkage:

- 7617 firms matched between the two data sets
- No significant difference in the observable characteristics of the trials of firms linked and not linked
Figure: Time line: empirical strategy

\[ \Delta n_{i1} = 0 \quad \Delta n_{i2} = 0 \quad \Delta n_{i3} \neq 0 \]

-2 -1 0 1 2 3

\( n_{i0} \quad n_{i1} \quad n_{i2} \quad n_{i3} \)

Trial starts

Trial ends

days

months

\( n_{it} \) monthly employment in month \( t \) at firm \( i \).

\( \Delta n_{it} \) employment change in month \( t \) with respect to month \( t-1 \).
Table: Firms for which no monthly employment change is observed (censored)

<table>
<thead>
<tr>
<th>Year end of trial</th>
<th>Number of firms</th>
<th>Number of firms censored</th>
<th>Percentage of firms censored (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>29</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2002</td>
<td>394</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2003</td>
<td>512</td>
<td>2</td>
<td>0.39</td>
</tr>
<tr>
<td>2004</td>
<td>589</td>
<td>3</td>
<td>0.51</td>
</tr>
<tr>
<td>2005</td>
<td>689</td>
<td>5</td>
<td>0.73</td>
</tr>
<tr>
<td>2006</td>
<td>649</td>
<td>6</td>
<td>0.92</td>
</tr>
<tr>
<td>2007</td>
<td>607</td>
<td>5</td>
<td>0.82</td>
</tr>
<tr>
<td>2008</td>
<td>551</td>
<td>7</td>
<td>1.27</td>
</tr>
<tr>
<td>2009</td>
<td>508</td>
<td>10</td>
<td>1.97</td>
</tr>
<tr>
<td>2010</td>
<td>600</td>
<td>16</td>
<td>2.67</td>
</tr>
<tr>
<td>2011</td>
<td>712</td>
<td>43</td>
<td>6.04</td>
</tr>
<tr>
<td>2012</td>
<td>981</td>
<td>86</td>
<td>8.77</td>
</tr>
<tr>
<td>2013</td>
<td>796</td>
<td>325</td>
<td>40.83</td>
</tr>
<tr>
<td>Overall</td>
<td>7617</td>
<td>508</td>
<td>6.67</td>
</tr>
</tbody>
</table>
The instrument, which is defined for each firm $i$ assigned to judge $j(i)$ is simply a mean:

$$Z_{j(i)} = \left( \frac{1}{n_{j(i)}} \right) \left( \sum_{k=1}^{n_{j(i)}} \ell_k \right) .$$

- $\ell_k$ is the length of the $k$–case seen by judge $j$.
- $n_{j(i)}$ is the total number of cases seen by judge $j$, excluding cases used as treatments.

- Total number of trials: 320191
- Trials used as treatments: 7617
- Trials used to construct $Z_{j(i)}$: 312574
Figure: Instrument: average length of trials assigned to each judge.

Instrument (Z) 95% CI
Cox model – Control function

- First stage:
  \[ \ell_i = \delta_0 + \delta_1 Z_{j(i)} + \delta_2 D_i + v_i \]

- Second stage:
  \[ h_{it} = h_0(t) \exp(\beta_1 \ell_i + \beta_2 D_i + g(v_i)) \]

- \( \ell_i \): length of the trial of firm \( i \)
- \( Z_{j(i)} \): average length of judge \( j(i) \) assigned to firm \( i \)
- \( h_{it} \): hazard that firm \( i \) changes employment \( t \) months after the end of its trial
- \( h_0(t) \): baseline hazard
- \( D_i \): calendar monthly and yearly dummies for start of trial
- \( g(v_i) \): polynomial in the estimated residual
**Table:** The effect of trial length on the hazard of employment change

| Dependent variable                        | Trial’s length | \( h(t|X) \) |
|-------------------------------------------|----------------|---------------|
| Estimation method                         | OLS            | ML            |
| Stage                                     | First          | Second        |
|                                           | (1)            | (2)           |
| Trial length                              | -0.0370***     |               |
|                                           | (0.0059)       | [0.0059]      |
| Judge’s avg. length                       | 0.4110***      |               |
|                                           | (0.0257)       |               |
| Cragg–Donald Wald F statistic             |                | 256           |
| Observations                              | 7617           | 7617          |

Note: Standard errors in parentheses are clustered at the judge level in column (1). * significant at 10%, ** significant at 5%, *** significant at 1%.
Economic significance

- $\beta_1$ is the effect of one unit increase in trial length on the natural logarithm of the hazard ratio.

**Result**

- At the median length of trials of 11 months, 10% increase in trials length **reduces the hazard** of employment changes by 3.6%.  
  
  This represents* an **increases in the duration** of the number of months until employment change of 3.7%.

- At the median duration of 4 months until employment change, a 7 months longer trial increases the time until employment change by 1 month.

*: Assumptions, $\beta_1$ is also the effect of one unit increase of the length of trials on the natural logarithm of the time until employment change.
Figure: No heterogeneous effects by financial constraints. 

Note: Each quantile corresponds to a separate estimation and the dashed lines show 95% confidence intervals. Quantiles of firms’ available liquidity before going to court.
Figure: No heterogeneous effects by firm size

Note: Each quantile corresponds to a separate estimation and the dashed lines show 95% confidence intervals. Quantiles of firms' size (number of employees) before going to court.
**Figure: Heterogeneity by firm age**

Note: Each quantile corresponds to a separate estimation and the dashed lines show 95% confidence intervals. Firm age: years from incorporation of the firm to trial.
Employment Levels

\[ \ell_i = \delta_0 + \delta_1 Z_{j(i)} + \delta_2 D_i + \nu_i \]  
first–stage

\[ \log(\bar{n}_i) = \gamma + \alpha \hat{\ell}_i + \phi D_i + \varepsilon_i \]  
second–stage

- \( \bar{n}_i \) is the average employment level at firm \( i \) in all \( M \) months after the end of the trial.

- Trials end between 2001-2013: concern of composition bias.

- \( M = 48 \) hold sample fixed with firms which trials ended between January 2001 and January 2010. (Results robust to different choices of \( M \)).
Table: Firing costs increase average employment levels

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Trial length</th>
<th>ln(Employment)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimation method</td>
<td>OLS</td>
<td>IV</td>
</tr>
<tr>
<td>Stage</td>
<td>First</td>
<td>Second</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Trial length</td>
<td>0.0319**</td>
<td>(0.0134)</td>
</tr>
<tr>
<td>Judge avg. length</td>
<td>0.4054***</td>
<td>(0.0427)</td>
</tr>
<tr>
<td>Cragg–Donald Wald F statistic</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>3094</td>
<td>3094</td>
</tr>
<tr>
<td>Number of firms</td>
<td>3094</td>
<td>3094</td>
</tr>
</tbody>
</table>

Note: Standard errors in parentheses are clustered at the judge level in column (1) and at the firm level in column (2). * significant at 10%, ** significant at 5%, *** significant at 1%.
Robustness checks

1. Inclusion of firms controls does not change the estimates.

2. Linear model IV instead of Cox model Control Function for time until employment change, same results.

3. Using variance of employment instead of duration model gives the same result.

4. The effect is the same for firms experiencing firing and non–firing trials.

5. The effect is bigger for firms born after 2001. Cleaner identification because it guarantees the use of the first trial ever experienced by firms.

6. Results do not change if the duration analysis begins from the start of the trial.
Conclusions

- Random allocation of firms to judges creates an exogenous variation of the length of trials experienced by firms which creates an exogenous variation of expected firing costs.

- Firing costs reduce employment adjustments over time.

- Both Job Creation and Job Destruction are reduced, theory cannot unambiguously say the net effect of firing costs on employment levels. Reduced form estimates suggest that higher firing costs increase employment levels.

- Higher employment level potentially inefficient.
APPENDIX SLIDES
Dynamic problem

The firm chooses employment after the current shock realization $z_t$ is observed

$$V(n_{t-1}, z_t) = \max_{n_t \geq 0} z_t f(n_t) - wn_t - F \max\{0, n_{t-1} - n_t\} + \delta E_t \{V(n_t, z_{t+1})\}$$
Increase labor

MB of increasing labor at $t$

\[
z_t f'(n_{t-1}) + \delta E_{t-1} \left( \frac{\partial V(n_{t-1}, z_{t+1})}{\partial n_{t-1}} \right) > \text{MC of increasing labor at } t \]

then it is optimal to increase labor in period $t$ relatively to period $t-1$,

\[
n_t > n_{t-1}
\]

\[
z_t > \frac{w - \delta E_{t-1} \left( \frac{\partial V(n_{t-1}, z_{t+1})}{\partial n_{t-1}} \right)}{f'(n_{t-1})} \equiv \bar{z}_t
\]

Optimal labor satisfies the following first order condition:

\[
z_t f'(n_t) = w - \delta E_t \left( \frac{\partial V(n_t, z_{t+1})}{\partial n_t} \right)
\]
Decrease labor

MB of decreasing labor at \( t \)

\[
\text{MC of decreasing labor at } t \geq z_t f'(n_{t-1}) + \delta E_{t-1} \left( \frac{\partial V(n_{t-1}, z_{t+1})}{\partial n_{t-1}} \right) + F
\]

Then it is optimal to decrease labor in period \( t \) relatively to period \( t - 1 \),

\[
n_t < n_{t-1}
\]

\[
z_t < \frac{w - F - \delta E_{t-1} \left( \frac{\partial V(n_{t-1}, z_{t+1})}{\partial n_{t-1}} \right)}{f'(n_{t-1})} \equiv Z_t
\]

Optimal labor satisfies the following first order condition:

\[
z_t f'(n_t) = w - F - \delta E_t \left( \frac{\partial V(n_t, z_{t+1})}{\partial n_t} \right)
\]
\[ w - F < z_t f'(n_{t-1}) + \delta E_{t-1} \left( \frac{\partial V(n_{t-1}, z_{t+1})}{\partial n_{t-1}} \right) < w \]

then it is optimal for the firm not to change employment in this period relatively to the previous period.

\[ n_t = n_{t-1} \]

\[ z_t < z_t < \bar{z}_t \]
<table>
<thead>
<tr>
<th>Percentiles</th>
<th>Judges average length (months). All trials.</th>
<th>Trial length (months). Only firms trials.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>9</td>
<td>0.33</td>
</tr>
<tr>
<td>5th</td>
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<td>2</td>
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<td>10th</td>
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<td>4</td>
</tr>
<tr>
<td>25th</td>
<td>13</td>
<td>7</td>
</tr>
<tr>
<td><strong>50th</strong></td>
<td><strong>18</strong></td>
<td><strong>11</strong></td>
</tr>
<tr>
<td>75th</td>
<td>21</td>
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<td>90th</td>
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<td>95th</td>
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<tr>
<td>Mean</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Number of judges</td>
<td>82</td>
<td>82</td>
</tr>
<tr>
<td>Number of trials</td>
<td>320191</td>
<td>7617</td>
</tr>
<tr>
<td>Percentiles</td>
<td>Firms average employment (number of employees)</td>
<td>Firms duration employment inaction (months)</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------------------------------------</td>
<td>-------------------------------------------</td>
</tr>
<tr>
<td>1st</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5th</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10th</td>
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<td>2</td>
</tr>
<tr>
<td>25th</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td><strong>50th</strong></td>
<td><strong>6</strong></td>
<td><strong>4</strong></td>
</tr>
<tr>
<td>75th</td>
<td>14</td>
<td>8</td>
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<td>90th</td>
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<td>95th</td>
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<td>99th</td>
<td>830</td>
<td>52</td>
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<tr>
<td>Mean</td>
<td>74</td>
<td>7</td>
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<tr>
<td>Standard deviation</td>
<td>1041</td>
<td>10</td>
</tr>
<tr>
<td>Number of firms</td>
<td>7617</td>
<td>7617</td>
</tr>
</tbody>
</table>
Table: Comparison of trials of firms linked and not linked between databases

<table>
<thead>
<tr>
<th>Variables</th>
<th>Averages</th>
<th>p-value for</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Firms</td>
<td>Firms</td>
</tr>
<tr>
<td></td>
<td>not linked</td>
<td>linked</td>
</tr>
<tr>
<td><strong>Object of controversy:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall % of trials with given object</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compensantion</td>
<td>0.2842</td>
<td>0.2965</td>
</tr>
<tr>
<td>29%</td>
<td>(0.4510)</td>
<td>(0.4567)</td>
</tr>
<tr>
<td>Attendance allowance</td>
<td>0.0004</td>
<td>0.0004</td>
</tr>
<tr>
<td>0.04%</td>
<td>(0.0189)</td>
<td>(0.0192)</td>
</tr>
<tr>
<td>Other hypothesis</td>
<td>0.1976</td>
<td>0.2078</td>
</tr>
<tr>
<td>20%</td>
<td>(0.3982)</td>
<td>(0.4057)</td>
</tr>
<tr>
<td>Other controversies</td>
<td>0.0338</td>
<td>0.0329</td>
</tr>
<tr>
<td>3%</td>
<td>(0.1807)</td>
<td>(0.1783)</td>
</tr>
<tr>
<td>Disability living allowance</td>
<td>0.0002</td>
<td>0.0001</td>
</tr>
<tr>
<td>0.02%</td>
<td>(0.0157)</td>
<td>(0.0115)</td>
</tr>
<tr>
<td>Pension</td>
<td>0.0002</td>
<td>0.0002</td>
</tr>
<tr>
<td>0.02%</td>
<td>(0.0134)</td>
<td>(0.0126)</td>
</tr>
<tr>
<td>Temporary work contract</td>
<td>0.0506</td>
<td>0.0464</td>
</tr>
<tr>
<td>5%</td>
<td>(0.2192)</td>
<td>(0.2103)</td>
</tr>
<tr>
<td>Termination of employment</td>
<td>0.1809</td>
<td>0.2039</td>
</tr>
<tr>
<td>19%</td>
<td>(0.3849)</td>
<td>(0.4029)</td>
</tr>
<tr>
<td>Type of employment relationship</td>
<td>0.0575</td>
<td>0.0454</td>
</tr>
<tr>
<td>5%</td>
<td>(0.2328)</td>
<td>(0.2082)</td>
</tr>
<tr>
<td>Other types of cases</td>
<td>0.1947</td>
<td>0.1665</td>
</tr>
<tr>
<td>18%</td>
<td>(0.3960)</td>
<td>(0.3726)</td>
</tr>
<tr>
<td>Number of parties involved in trials</td>
<td>2.41</td>
<td>2.41</td>
</tr>
<tr>
<td>Overall average: 2.41</td>
<td>(2.50)</td>
<td>(2.36)</td>
</tr>
<tr>
<td>Number of trials</td>
<td>44,552</td>
<td>37,966</td>
</tr>
<tr>
<td>Number of firms</td>
<td>17,859</td>
<td>7617</td>
</tr>
</tbody>
</table>
Figure: First stage.

Instrument: average length of trials of each judge (Months)

R-squared = 0.40
The Cox proportional hazard model can be written as

\[
\ln(\Lambda(T_i)) = -\beta_1 \ell_{i0} + \eta_i
\]

where \(\Lambda(T_i) = \int_0^{T_i} u \, du\) of the underlying employment inaction duration \(T_i\) of firm \(i\).

If \(\eta_i\) has an extreme value distribution independent of the regressors and the baseline hazard \(h_0(t) = 1\).

\[
\ln(T_i) = -\beta_1 \ell_{i0} + \eta_i
\]

The estimated coefficients of the Cox Proportional model can be interpreted as the effect of a one unit increase of the average length of trials on the logarithm of the duration of the spell of employment inaction.
Figure: Heterogeneity by financial constraints, available liquidity over assets

Note: Each quantile corresponds to a separate estimation and the dashed lines show 95% confidence intervals.
Figure: Heterogeneity by financial constraints, available liquidity over employees

Note: Each quantile corresponds to a separate estimation and the dashed lines show 95% confidence intervals.
Figure: Effect of firing costs on employment levels with fixed samples
Exclusion restriction: outcome and length of the trial

Frequency of ruling favor firm of each judge

Instrument: average length of trials of each judge (Months)

Fitted Values

R-squared = 0.00
Exclusion restriction: outcome and length of the trial

Table: Outcome and length of the trial are independent

<table>
<thead>
<tr>
<th>Sample Stage</th>
<th>Only firms match emp. data</th>
<th>All firms</th>
<th>( \ell_i )</th>
<th>( y_i )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Second</td>
<td>Second</td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>( \ell_i )</td>
<td>-0.0085</td>
<td>-0.0050</td>
<td>(0.0062)</td>
<td>(0.0060)</td>
</tr>
<tr>
<td>Observations</td>
<td>3,865</td>
<td>41,742</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ \ell_i = \delta_0 + \delta_1 Z_{j(i)} + \nu_i \]
\[ y_i = \alpha_0 + \alpha_1 \ell_i + u_i \]

\( y_i = \begin{cases} 
1 & \text{if judge } j \text{ in trial } i \text{ ruled in favor of the firm} \\
0 & \text{otherwise}
\end{cases} \]

Note: Linear probability model. Subset of trials that ended with a decision by the judge. Standard errors in parentheses are clustered at the judge level.
Exclusion restriction, settlements

Frequency of settlement of each judge

Instrument: average length of trials of each judge (Months)

Fitted Values

R-squared = 0.00
**Exclusion restriction, settlements**

**Table:** Fast judges are not more likely to induce a settlement

<table>
<thead>
<tr>
<th>Sample</th>
<th>Only trials of firms match emp. data</th>
<th>Universe of trials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
</tbody>
</table>

Judge average length $Z_j(i)$

<table>
<thead>
<tr>
<th>Judge average length $Z_j(i)$</th>
<th>0.00093</th>
<th>-0.00080</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0.00195)</td>
<td>(0.00049)</td>
<td></td>
</tr>
</tbody>
</table>

Observations

| Observations | 8007 | 320191 |

$$y_i = \alpha_0 + \alpha_1 Z_j(i) + u_i$$

$$y_i = \begin{cases} 
1 & \text{if trial } i \text{ ended with a settlement} \\
0 & \text{otherwise} 
\end{cases}$$

Note: Linear probability model. Standard errors in parentheses are clustered at the judge level.