

Prison work and recidivism

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WORK IN PROGRESS

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Prison labor: principles

UN's *Standard minimum rules for the treatment of prisoners* (1955):
all able convicts should be required to work

- for pay;
- in useful, nonafflictive occupations;
- preferably in full-time jobs created by the prison administration;

Rationales:

- avoid **idleness** and inactivity;
- earn **money** for self and dependents;
- develop **work habits** and **skills** for a normal post-release life.

Prison labor: reality

Rationing of work opportunities for convicts, due to

- scarce funds for prison work programs;
- overcrowding.

As a consequence, many inmates spend **long hours in a cell**.

In Italy (compulsory work programs)

- participation: 30% at end of 2017;
- average hourly wage: €3.45;
- reincarceration rate: 60%;
- average daily hours in a cell: 20

Question

Does substituting idle time in a cell with active time at work reduce reincarceration?

- Institutional setting: the Italian prison labor system
- Admin data from the Department of Prison Administration (DPA)
- Two-fold empirical method:
 - quasi-experimental analysis (credible identification)
 - structural analysis (identification of mechanisms)

Institutional background

The Italian Prison Code, three key provisions:

- 1 work is compulsory *for convicts*; two types of jobs
 - **prison jobs** (90%), mostly unskilled, offered by the DPA, **all eligible**:
 - **external jobs** (10%) offered by private employers, **highly selected**.
- 2 prison work is not punitive and convicts must be paid a **fair wage**
 - in prison jobs: at least 2/3 of negotiated national wage.
- 3 providing work opportunities *to convicts* is compulsory for the DPA

In reality prison work is heavily rationed. ▶ rationing

The rationing mechanism for prison jobs is **work sharing**.

Assignment to prison work

Rotation mechanism characterized by two components.

① Discretionary component:

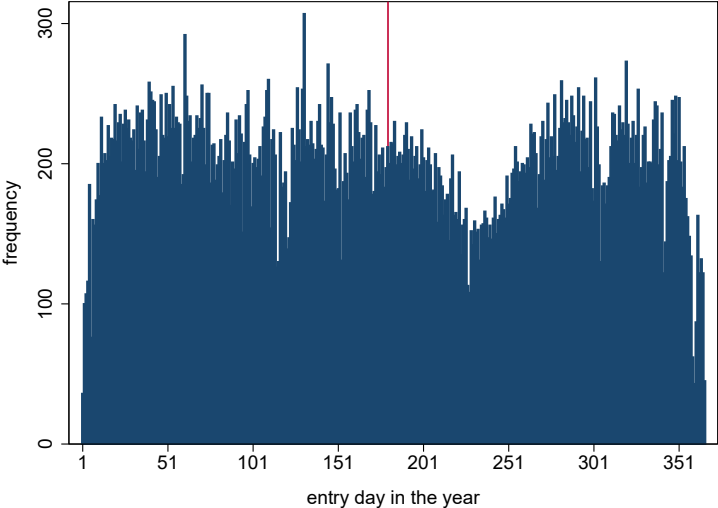
- convicts may be deemed “unreliable” or are unfit to work;
- **key implication**: time at work reflects unobserved characteristics.

② Deterministic component (imposed by the law):

- assignment order must reflect the duration of the unemployment spell;
- **key implication**: *ceteris paribus*, inmate admitted earlier
 - will have higher work priority at any stage of the rotation process;
 - and so will work for longer, on average. [▶ example](#)

The deterministic component provides an **instrument**: one's entry date

Distribution of entry dates



Model

- ① prison warden chooses inmates' work assignments;
- ② technologies transform work time into “rehabilitative stocks”;
 - liquidity buffer
 - increased human capital
 - reduced criminal capital
- ③ inmate is released and chooses whether to commit crime.

Technologies

Term earnings: $a_{\omega+1} = w \sum_{t=\alpha}^{\omega} h_t$;

- translate into $\lambda a_{\omega+1}$ **effective liquidity** upon release;
 λ is a sufficient statistic (Chetty, 2009).

Human capital: $\kappa_{t+1} = (1 - \delta)\kappa_t + \theta h_t \kappa_t$;

- unskilled prison work improves **soft skills** and **mental health**
(Heckman and Kautz, 2012; Nurse *et al.*, 2003)

Criminal capital: $k_{t+1} = (1 - d_{p_t})k_t + \rho \ell_t k_t$;

- prison work reduces criminogenic social interactions inside the cell
(Bayer *et al.*, 2009)

Inmate's problem

- infinite horizon, risk-neutral individual, two states $s = \{f, p\}$
- binary choice, engage in crime again ($x = 1$) or not ($x = 0$).

$$V_{\omega+1}^f(a_{\omega+1}) = \max_{x, a_{\omega+2}} \{ \mathbb{E}[c_{\omega+1}(x)] + v_{\omega+1}(x) + \beta \mathbb{E}[V_{\omega+2}^s(a_{\omega+2})] \},$$

subject to

$$c_{\omega+1}(x) = \begin{cases} \lambda a_{\omega+1} - a_{\omega+2} + E\gamma k_{\omega+1} & \text{if } x = 0 \\ \lambda a_{\omega+1} - a_{\omega+2} + E\gamma k_{\omega+1} + nqk_{\omega+1} & \text{if } x = 1 \text{ not apprehended.} \\ c_p & \text{if } x = 1 \text{ apprehended} \end{cases}$$

$$V_{\omega+2}^s(a_{\omega+2}) = \begin{cases} V_{\omega+2}^f(a_{\omega+2}) & \text{if } x = 0 \\ V_{\omega+2}^f(a_{\omega+2}) & \text{if } x = 1 \text{ not apprehended} \\ V_{\omega+2}^p & \text{if } x = 1 \text{ apprehended} \end{cases}$$

Inmate's optimum

- probability of reincarceration in the period following release:

$$\begin{aligned} R(\mathbf{h}) = & \pi F(z_2 c_p + a_0 - z_1 a_1 + (z_1 - 1) \lambda w \sum_{t=\alpha}^{\omega} h_t \\ & + (z_1 - 1) \eta \gamma \kappa_{\alpha} \prod_{t=\alpha}^{\omega} (1 - \delta + \theta h_t) + z_1 n q k_{\alpha} \prod_{t=\alpha}^{\omega} (1 - d_{p_t} + \rho(1 - h_t)) \\ & - \beta \mathbb{E}[V_{\omega+2}^{f,0}(a_0; \lambda, \theta)] + z_1 \beta \mathbb{E}[V_{\omega+2}^{f,1}(a_1; \lambda, \rho, \theta)]) \end{aligned}$$

- prison work at t affects reincarceration via
 - **liquidity** effect (λ)
 - **training** effect (θ)
 - **rehabilitation** effect (ρ)
- Model implies that λ , θ , and ρ are separately identified.

Warden's problem

The prison warden

- receives **wage fund** W_t , not transferable across periods;
- chooses work allocation based on rotation and **discretion**:

$$h_{it} = \frac{\mathbb{I}[s_{it} \geq s_t]}{\sum_{i=1}^{N_t} \mathbb{I}[s_{it} \geq s_t]} \frac{W_t}{w} + \varepsilon_{it}, \quad \text{with} \quad \sum_{i=1}^{N_t} \varepsilon_{it} = 0.$$

$$s_{it} = \begin{cases} \max\{0, \xi_t - \xi_{i\alpha}\} & \text{if never assigned to work,} \\ \max\{0, \xi_t - \xi_{ie}\} & \text{if ever assigned to work.} \end{cases}$$

$$\varepsilon_{it} = \phi \left[h_{it}^* - \frac{\mathbb{I}[s_{it} \geq s_t]}{\sum_{i=1}^{N_t} \mathbb{I}[s_{it} \geq s_t]} \frac{W_t}{w} \right]$$

Data

- internal database maintained by the DPA;
- 94,857 **adult convicts** released from 209 facilities:

Year	Released	Year	Released
2009	21,347	2011	24,878
2010	24,213	2012	24,819

- sample selection:
 - ① **male** convicts only, 94.5%;
 - ② convicts w/**complete work records** ($\alpha > 2004$), 95.3%.
 - ③ convicted for property crimes, 88.2%

Sample statistics, 1/5

Variable	Mean	St. dev.	Min	Max
Italian	0.581	0.493	0	1
Moroccan	0.100	0.300	0	1
Tunisian	0.064	0.245	0	1
Romanian	0.060	0.245	0	1
Albanian	0.033	0.179	0	1
Age at release	36.3	10.5	18.0	88.0
<i>age 18-24</i>	0.133	0.339	0	1
<i>age 25-31</i>	0.267	0.442	0	1
<i>age 32-38</i>	0.245	0.430	0	1
<i>age 39-45</i>	0.178	0.382	0	1
<i>age 46+</i>	0.177	0.482	0	1

Sample statistics, 2/5

Variable	Mean	St. dev.	Min	Max
Number of children	0.62	1.18	0	17
Nonmissing marital status	0.877	0.329	0	1
<i>married</i>	0.274	0.446	0	1
<i>never married</i>	0.552	0.497	0	1
<i>divorced or separated</i>	0.068	0.252	0	1
Nonmissing edu attainment	0.546	0.498	0	1
<i>years of education</i>	7.04	2.99	0	16
<i>no education</i>	0.092	0.289	0	1
<i>elementary school</i>	0.212	0.409	0	1
<i>middle school</i>	0.605	0.489	0	1
<i>high school</i>	0.079	0.269	0	1
<i>college</i>	0.012	0.111	0	1

Sample statistics, 3/5

Variable	Mean	St. dev.	Min	Max
Year entered prison	2008.8	1.49	2005	2012
Year released	2010.6	1.10	2009	2012
Released North	0.394	0.489	0	1
Released South	0.420	0.494	0	1
Prison term (years)	1.81	1.17	0.5	6.0
Reincarcerated within 1 year	0.184	0.387	0	1
<i>days out</i>	162.5	102.8	0	365
Reincarcerated within 2 years	0.271	0.445	0	1
<i>days out</i>	279.8	198.7	0	730
Reincarcerated within 3 years	0.321	0.467	0	1
<i>days out</i>	374.8	291.2	0	1095

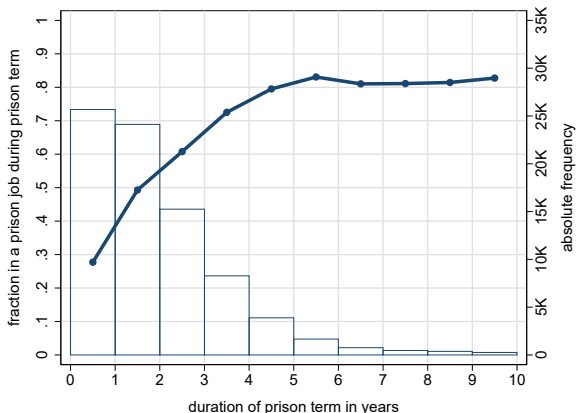
Sample statistics, 4/5

Variable	Mean	St. dev.	Min	Max
Number of offenses	1.82	1.16	1	12
Drug dealing	0.460	0.498	0	1
Larceny/Burglary/MV theft	0.267	0.442	0	1
Robbery	0.206	0.404	0	1
Assault	0.176	0.381	0	1
Receiving stolen goods	0.126	0.331	0	1
Against judicial system	0.083	0.276	0	1
Fraud/Forgery/Counterfeit.	0.078	0.269	0	1
Menacing	0.077	0.266	0	1
Extortion	0.064	0.245	0	1
Criminal association	0.047	0.211	0	1
Vandalism	0.031	0.173	0	1
Rape	0.022	0.147	0	1
Murder (any kind)	0.012	0.111	0	1
Other offenses	0.137	0.244	0	1

Sample statistics, 5/5

Variable	Mean	St. dev.	Min	Max
Worked during prison term	0.488	0.500	0	1
<i>hours worked per year</i>	206.4	243.0	0.3	1962.5
<i>total hours worked</i>	499.5	756.8	1	8894
<i>hourly wage</i>	3.44	0.50	2.18	43.55
<i>net hourly wage</i>	2.91	0.64	1.47	39.30
<i>annual earnings</i>	707.62	845.47	1.01	7508.79
<i>net annual earnings</i>	621.96	774.73	0.61	7005.69
<i>total earnings</i>	1718.82	2642.62	2.93	32561.57
<i>net total earnings</i>	1515.83	2402.72	1.76	30203.59

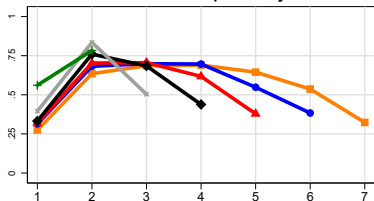
Prison terms and fraction in prison jobs



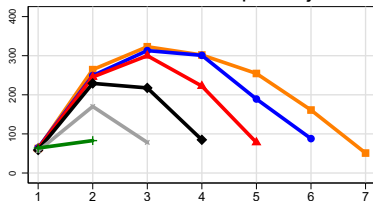
- about 20% of convicts are “ineligible” for prison jobs, unobservable.
- dropped in the main analysis (intensive margin), robust to inclusion.

Work and earnings profiles by term

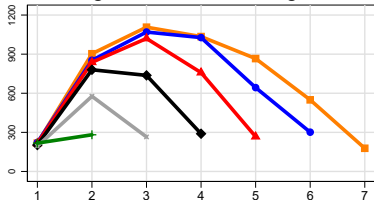
fraction in a prison job



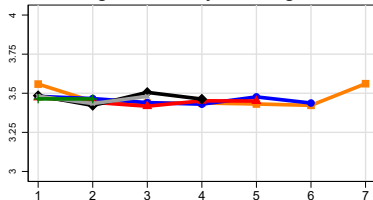
annual hours in a prison job



gross annual earnings



gross hourly earnings



horizontal axis: calendar year in prison (1 = entry calendar year)

6-year 5-year 4-year 3-year 2-year 1-year

Empirical analysis I: “reduced form”

A specification “consistent” with the model structure:

$$R_{itp} = \beta_0 + \beta_1 h_i + \beta_2 \mathbf{X}_i + \zeta_{tp} + u_{itp}$$

- h_i are standardized average annual hours
- \mathbf{X}_i are dummies for age and conviction offenses, nationality, probability of apprehension
- ζ_{tp} are year and prison dummies, for the entire term

s.e. are clustered at the release prison level

Results: eligible inmates

Reincarcerated within:	1 year	3 years	1 year	3 years
Work hours (h_i)	-0.003 ⁺ (0.002)	-0.004 (0.002)	-0.104** (0.036)	-0.149** (0.043)
Italian	0.065** (0.006)	0.144** (0.007)	0.054** (0.008)	0.128** (0.010)
Apprehension (π_i)	-0.056** (0.016)	-0.100** (0.018)	-0.050** (0.016)	-0.092** (0.018)
1st stage:				
Entry day			-0.060** (0.007)	
F-stat			67.8	
Method	OLS	OLS	2SLS	2SLS
Obs.	35,976	35,976	35,976	35,976

Results: all inmates

Reincarcerated within:	1 year	3 years	1 year	3 years
Work hours (h_i)	0.003 (0.002)	0.005* (0.002)	-0.124** (0.028)	-0.157** (0.034)
Italian	0.047** (0.004)	0.116** (0.006)	0.019** (0.008)	0.081** (0.011)
Apprehension (π_i)	-0.038** (0.013)	-0.079** (0.014)	-0.030* (0.013)	-0.069** (0.014)
1st stage:				
Entry day			-0.053** (0.005)	
F-stat			137.1	
Method	OLS	OLS	2SLS	2SLS
Obs.	73,742	73,742	73,742	73,742

Back-of-the envelope calculation

Implied rate of return on public funds allocated to prison jobs in Italy:

- variable (short-run) annual cost per inmate: €8000
- average prison term in sample: 2.2 years
- 14.9 pp reduction implies expected reduction of 3.9 months, €2622
- via 1 std dev (240 hours) per year, 528 hours in 2.2 years
- at a cost of $528 \times €3.5 \approx €1848$

$$2622/1848 - 1 \approx 42\%$$

Empirical analysis II: structural

The structural analysis allows to pin down the **mechanisms**.

Simple procedure, so to make the structural estimates

- transparent (source of identification);
- comparable with the “reduced-form” ones.

Strategy:

- Assume F is uniform in $[-U, U]$, consistent with LPM
- Calibrate $\{\kappa_{\alpha i}, k_{\alpha i}, \gamma_i, q_i, \pi_i, \beta, \delta\}$
- Estimate $\{\lambda, \theta, \rho, \eta_i, c_p, d_{p_t}, U\}$ via GMM
 - exact same instruments as in the “reduced form” are employed

Calibration

Parameter	Value	Source
β	0.97	
δ	0.1	Fan, Seshadri, Taber (2015)
π_i	0.04 - 0.92	Italian CJStats
n_i	$1/\pi_i$	
$\kappa_{i\alpha}$	0-17 (years of education)	Data
γ	wage-schooling locus	SHIW
$k_{i\alpha}$	1-6 (proj. term / offenses)	Data
q_i	s.t. 10% income stolen	Fu and Wolpin (2018)
time endow.	16 hours/day	Non-sleeping time

Results

Parameter		Point estimate (s.e.)
Liquidy effect	λ	2.45** (0.56)
Rehabilitation effect	ρ	0.11 (0.32)
Training effect	θ	0.74** (0.26)
Prison consumption	c_p	3.94* (1.76)
Employment rate, Italians	η_I	0.05** (0.01)
Employment rate, foreign-born	η_F	0.07** (0.02)
Support of unobservables	U	24.90** (6.64)
Obs.		35,976

Mechanisms

Overall effect after 1 year (for 1 SD increase in average annual hours)

“Reduced-form” estimates	Structural estimates
-0.104	-0.109

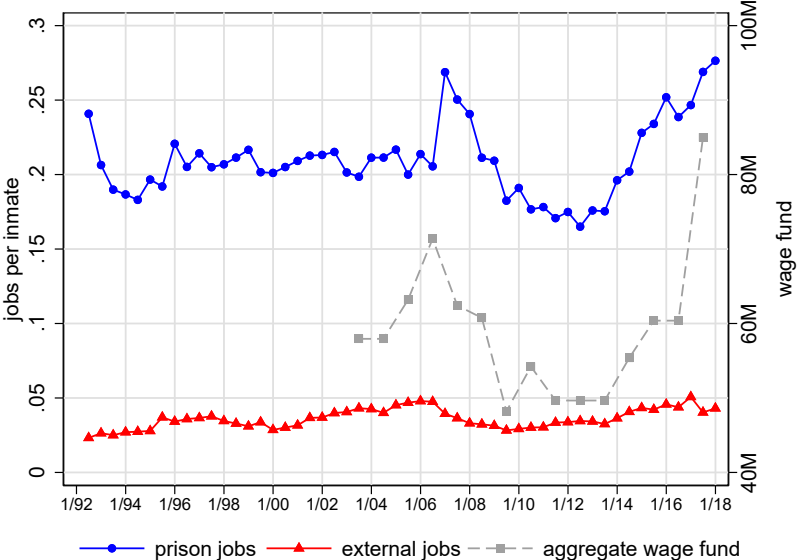
Structural decomposition:

Mechanism	Contribution	Share
Liquidity	-0.037	33.9%
Rehabilitation (criminal capital)	-0.001	1.0%
Training (human capital)	-0.071	65.1%
Total	-0.109	100%

Conclusions

- Paid employment in unskilled prison jobs contributes substantially to the rehabilitation of convicts.
- One standard deviation increase in annual hours spent at work (240 hours per year) reduces the reincarceration rate by
 - ≈ 10 percentage points one year of release, off a base of 18.4%;
 - ≈ 15 percentage points three year of release off a base of 32.1%.
- The implied rate of return on government funds is over 40%
- The liquidity effect accounts for 1/3, the training effect for 2/3; so the monetary compensation in prison work programs is important, and even more so the habit of working and associated mental health.
- The criminal capital channel is irrelevant.

Prison jobs and the wage fund



The rotation mechanism, example

- One prison, offering one job
- Turnover period of one quarter
- So 4 inmates are assigned to work every year
- Assignment to work takes place at the beginning of the year
- The score is the duration of the current unemployment spell
- Two cohorts (entry year): 2008 and 2009

The rotation mechanism, example

Summary at date 12/31/2008

Inmate:	<i>F</i>	<i>E</i>	<i>D</i>	<i>C</i>	<i>B</i>	<i>A</i>
Entry year	2009	2009	2008	2008	2008	2008
Entry date	9/24/09	9/23/09	9/26/08	9/25/08	9/24/08	9/23/08
Release date	9/24/12	9/23/12	9/26/11	9/25/11	9/24/11	9/23/11
Last employed	-	-	-	-	-	-
Priority score	0	0	97	98	99	100
Assigned 2009	No	No	Yes	Yes	Yes	Yes
Days worked	0	0	0	0	0	0

The rotation mechanism, example

Summary at date 12/31/2009

Inmate:	<i>F</i>	<i>E</i>	<i>D</i>	<i>C</i>	<i>B</i>	<i>A</i>
Entry year	2009	2009	2008	2008	2008	2008
Entry date	6/24/09	6/23/09	9/24/08	9/25/08	9/24/08	9/23/08
Release date	6/24/12	6/23/12	9/24/11	9/25/11	9/24/11	9/23/11
Last employed	-	-	12/31/09	9/30/09	6/30/09	3/31/09
Priority score	190	191	0	92	184	275
Assigned 2010	Yes	Yes	No	No	Yes	Yes
Days worked	0	0	91	91	90	89

The rotation mechanism, example

Summary at date 12/31/2010

Inmate:	<i>F</i>	<i>E</i>	<i>D</i>	<i>C</i>	<i>B</i>	<i>A</i>
Entry year	2009	2009	2008	2008	2008	2008
Entry date	6/24/09	6/23/09	9/24/08	9/25/08	9/24/08	9/23/08
Release date	6/24/12	6/23/12	9/24/11	9/25/11	9/24/11	9/23/11
Last employed	9/30/10	6/30/10	12/31/09	9/30/09	12/31/10	3/31/10
Priority score	92	184	365	457	0	275
Assigned 2011	No	Yes	Yes	Yes	No	Yes
Days worked	91	90	91	91	182	178

The rotation mechanism, example

Summary at date 12/31/2011

Inmate:	<i>F</i>	<i>E</i>	<i>D</i>	<i>C</i>	<i>B</i>	<i>A</i>
Entry year	2009	2009	2008	2008	2008	2008
Entry date	6/24/09	6/23/09	9/24/08	9/25/08	9/24/08	9/23/08
Release date	6/24/12	6/23/12	9/24/11	9/25/11	9/24/11	9/23/11
Last employed	9/30/10	9/30/11	6/30/11	3/31/11	12/31/10	
Priority score	457	92	-	-	-	-
Assigned 2012	Yes	Yes	-	-	-	-
Days worked	91	181	181	180	182	262

The rotation mechanism, example

Summary at date 12/31/2012

Inmate:	\mathcal{F}	\mathcal{E}	\mathcal{D}	\mathcal{C}	\mathcal{B}	\mathcal{A}
Entry year	2009	2009	2008	2008	2008	2008
Entry date	6/24/09	6/23/09	9/24/08	9/25/08	9/24/08	9/23/08
Release date	6/24/12	6/23/12	9/24/11	9/25/11	9/24/11	9/23/11
Last employed	3/31/12	6/23/12	6/30/11	3/31/11	12/31/10	9/23/11
Priority score	-	-	-	-	-	-
Assigned 2013	-	-	-	-	-	-
Days worked	180	264	181	180	182	262

Within each cohort, inmates who enter earlier work more, on average