A Online Appendix of "Leave the Door Open? Prison Conditions and Recidivism," by Giovanni Mastrobuoni and Daniele Terlizzese

Selection into Bollate

The Regional branch of the Prison Administration for Lombardy (the "*Provveditorato Regionale di Milano*", RPA), together with the prison administration of Bollate, assesses each transfer application according to the following criteria. The inmates selected should: have a residual sentence in the range of 2 to 10 years (the upper limit has later been removed); be in good health, and not be under methadone treatment; have a definitive sentence;[56] have shown propensity and active interest for rehabilitation programs (this is reflected in a positive assessment by a specialized team, that drafts a psychological profile of each applying inmate); have had generally good behaviour in the previous prison(s); and, finally, reside or have interests and relationships in the Lombardy region.[57] Once the assessment is completed and the various criteria deemed satisfied, the transfer of the inmate to Bollate is finalized.

Clearly, these criteria involve a good deal of positive selection: inmates are explicitly screened to identify those who would be more receptive of the rehabilitation efforts, and it is therefore highly likely that their intrinsic propensity to recidivate be lower than that of the average inmate. [58] Therefore, a naive comparison between their recidivism and that of the average inmate would almost surely overstate the causal effect on recidivism of serving the sentence in an open prison.

Focussing on the intensive margin of the treatment – the length of the residual sentence upon arrival to Bollate – might help to sidestep the selection problem. The time it takes for the screen-

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[56]The Italian judicial system allows for up to two courts of appeal. Depending on whether or not a given sentence is resisted, and up to which degree of appeal, the time which elapses before the sentence becomes definitive can vary by several years. Although in principle a convict should not go to prison before the sentence is definitive, there can be a number of reasons why he/she is incarcerated before the final appeal is decided.

[57]This aspect is not peculiar to Bollate. In general, convicts are sent to prisons geographically close to their area of residency and interest.

[58]By average inmate we actually mean "average among those inmates with similarly long sentences". A long sentence, by itself, would likely induce negative selection.

ing procedure to be completed and therefore, given the total time served, the length of the residual sentence upon arrival to Bollate, can vary for a host of factors (incomplete requests, bureaucratic delays in handling applications, number and speed of appeal trials...). The variability imparted by these factors might in principle be exploited to tease out the causal effect of the treatment on recidivism. However, the length of the delay itself might reflect some selection. For example, "better" inmates (more educated, with better labour skills, better behaviour, etc.) might be identified more quickly, so they would end up in Bollate earlier; or, conversely, "better" inmates might be retained for longer by the prison of origin, so they would end up in Bollate later.

Unfortunately, we are not able to weigh the importance of the different delays, and we cannot control for all the variables that belong to the information set relevant for the selection process of inmates (we only know whether they applied or were proposed, where they were spending their previous prison time and their previous criminal history).

Randomization and Balance Tests

Appendix Table A2 presents a test of the random assignment of our main measure of the treatment (potential years served in the open prison). The aim is to test the ability of observables to predict the intention to treat. We control for the total time served, the delay in receiving the sentence, and the variable "age," as these are mechanically linked to the time spent in Bollate.[59]

Columns 1 and 2 show that for the sample of displaced inmates the observed covariates are jointly unable to predict the intention to treat (the F test for the joint significance of all the covariates has a tail probability of 26 percent). Even taken one by one, only the coefficient on the homicide dummy is significantly different from zero, and only at the 10 percent level.

In Columns 3 and 4 we repeat the exercise without controlling for the time from incarceration to first sentence and for age. Two more dummies become significant, again only at the 10 percent level, but the tail probability of the F test is in fact even higher (34 percent), suggesting that the variability imparted by the delays in meting out the conviction or by the constraints due to the com-

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[59]The previous discussion would suggest conditioning also on the variable "drug addiction;" conservatively, Appendix Table A2 includes this variables among the covariates whose significance gets tested, but the results would be unchanged had we conditioned also on "drug addiction."

position of available cells in Bollate is not generating selection. While in our baseline regression we remain cautious and exploit only the variability among inmates with equal conviction delay, age and drug addiction, we will show that our results are essentially unchanged when not imposing such restrictions.[60]

The test for the random assignment of the treatment fails, instead, when we consider the sample of selected inmates (this is true also if we exclude from the selected those whose entry reason is unknown[61]). Several covariates are statistically significant, and the F test of their joint insignificance has a tail probability of only 0.1 percent. This was expected, since the delays in the selection process – which is the variability we exploit when we consider the selected sample – are potentially correlated with the inmates' individual characteristics, and we are unable to control for all the information available to the people doing the selection.

An alternative way to test for random assignment of the treatment is presented in Appendix Table A3. We first construct a measure of recidivism risk by regressing recidivism on all the pre-treatment characteristics listed in the upper part of Appendix Table A2, together with age fixed effects and (possibly) prison of origin and year by month of transfer to Bollate fixed effects. We thus exclude from this regression total time served, time from incarceration to first sentence and potential time spent in Bollate.[62] Next, we regress this measure of predicted recidivism on potential time spent in Bollate, total time served and time from incarceration to first sentence. A negative and significant coefficient on potential time spent in Bollate would mean that low risk inmates – as predicted on the basis of pre-treatment characteristics – tend to spend more time in Bollate, and would thus falsify the random assignment of the treatment. Appendix Table A3 shows that potential time spent in Bollate is uncorrelated with predicted recidivism (the point estimate is not significantly different from 0 and, if anything, is slightly positive).

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[60]We will always control for the total time served. This is key, since residual and total time served are strongly positively correlated. Without conditioning on the total time served, inmates with longer residual sentences are associated with more serious crimes.

[61]For brevity we do not show these results, which are available upon request.

[62]The R-squared in this first regression is around 20 percent.

Results for the Selected Inmates

Appendix Table A8 shows how time spent in Bollate reduces recidivism for the selected group of inmates, replicating for this group the estimate of equation (2) in the main text (we use here the same definitions of variables). The first two columns include also inmates for whom the cause of entry is unknown while the following two columns restrict the analysis only to inmates who are known to have been screened.

When analyzing selected inmates we exploit the variability in the timing of transfer to Bollate arising from differences in the speed with which the request to be transferred to Bollate was submitted (either by the inmate himself, or by the prison of origin) and in the length of time it took to screen the applications of inmates and grant their request. If our vector of controls were to include all the variables observed by the people involved in the selection process, then we could conclude that condition (CIA) in the main text holds.

If, however, the people doing the screening had access to a larger information set, we would not be able to rule out the possibility that the transfer to Bollate occurs earlier for inmates with lower ε_i (for example, it might be that less problematic inmates are more quickly identified), thus inducing a negative correlation between ε_i and S_i^O, which would spuriously magnify the (negative) effect of the treatment and would challenge the causal interpretation of the results. For this reason we use the estimates on the sample of selected inmates only to help interpreting the results for the displaced inmates and understanding the mechanism underlying those results.

Spatial Lag Error Model for the Standard Errors

In the main text errors were clustered by week of exit and cell block. In this Section, to assess the robustness of that modelling choice, we model the errors as following a spatial structure (i.e. we use a spatial lag model). In particular, we allows the errors of inmates who spent at least one day together in the same cell block to be correlated with each other:

$$R_i = \beta_0 + \beta_1 D_i + \beta_2 S_i + \gamma' X_i + \lambda W \varepsilon_i + \varepsilon_i, \tag{A1}$$

where W is an adjacency matrix whose element (i, j) is positive when inmates i and j have spent at least one day in the cell block , and equal to zero otherwise. The adjacency matrix can be specified in a dichotomous or in a standardized way. The value of the (i, j) entry will be 1 in the former case, so that the composite error term is allowed to depend on the *sum* of all the peers' errors. With the standardized version the adjacency matrix the value of the (i, j) entry is normalized, so that the rows sum up to one. In this case the composite error term is allowed to depend on the peers' *average* errors. While the spatial lag model seems supported by the data (the loading λ is statistically significant), the standard errors are almost identical to the clustered standard errors used in the man text.
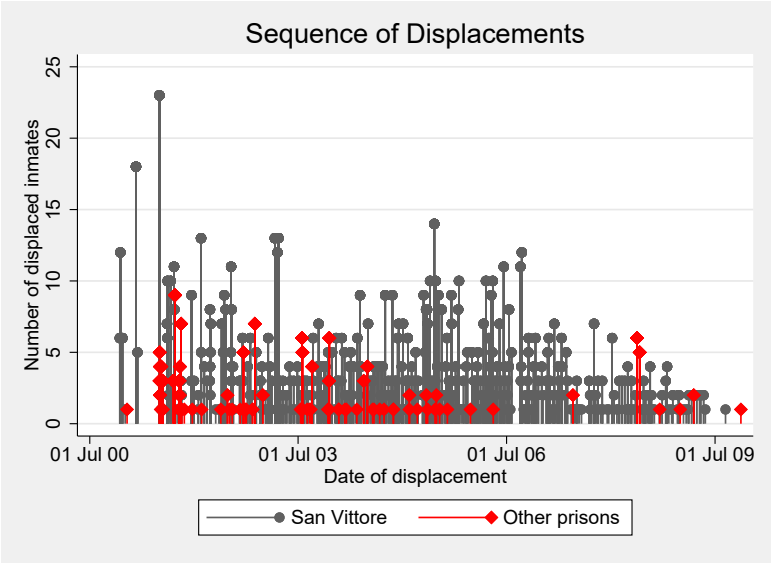
Figures

Figure A1: Sequence of Displacements

Notes: The figure plots the daily number of inmates displaced to Bollate from the San Vittore prison and from all the other prisons.
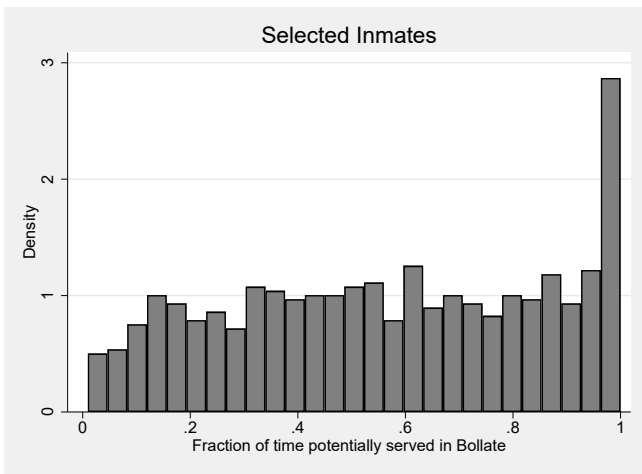
Figure A2: Distribution of the Fraction of Time Potentially Served in Bollate

Notes: The figure plots the distribution of the fraction of the total time that remains to be served when the inmate is transferred to Bollate. The left panel refers to selected inmates, the right one to the displaced.

Tables

Table A1: Running costs for Bollate and the average prison

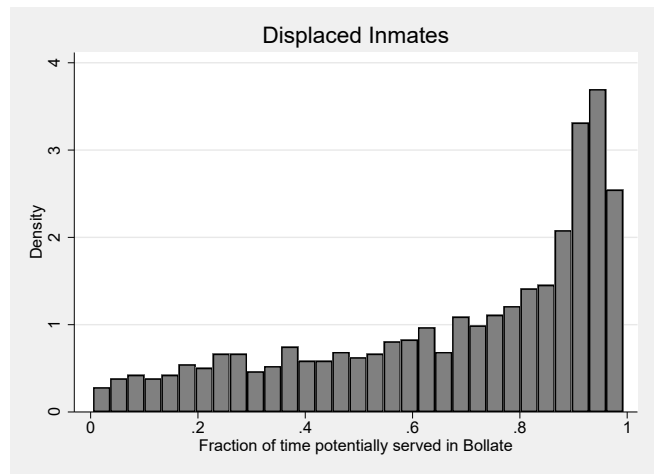| Budget item	Year 2012 Bollate Total cost	Year 2012 Bollate Cost per inmate	Year 2012 Whole country Cost per inmate	Year 2013 Bollate Total cost	Year 2013 Bollate Cost per inmate	Year 2013 Whole country Cost per inmate
Goods and services	3,798,587	9.17	10.57	2,814,203.63	6.75	8.89
Labor costs	20,316,848	49.04	92.02	20,732,849	49.70	90.88
Inmate living, assistance, rehabilitation, and transport costs	2,927,871	7.07	8.56	2,856,439	6.85	9.37
Investments	44,159	0.11	3.75	51,063	0.12	7.37
Total:	27,087,465	65.39	115.21	26,454,555	63.41	116.87

Notes: All costs are in euro, at current prices of the year. The costs per inmate are per day in prison. To increase the comparability between the costs for Bollate and for the average prison we excluded from the latter a (rough) estimate of the central administration costs.

Table A2: Randomization Test

	(1)	(2)	(3)	(4)	(5)	(6)
		Displaced Inmates			Selected Inmates	
	Potential years treated		**Potential years treated**		**Potential years treated**	
	coef	se	coef	se	coef	se
Art. 4 BIS	0.164	0.110	0.053	0.113	-0.062	0.117
Total number of incarcerations	-0.005	0.005	-0.001	0.006	-0.030	0.016
In a relationship	-0.031	0.038	-0.019	0.040	-0.203	0.107
Separated or divorced	0.045	0.062	0.060	0.065	-0.173	0.167
College degree	0.004	0.066	-0.001	0.071	0.347	0.184
Secondary schooling	0.013	0.038	0.034	0.040	0.333	0.133
Primary schooling	-0.006	0.052	0.005	0.057	0.117	0.180
Homicide	-0.714	0.399	-0.660	0.358	-0.297	0.253
Fraud	0.059	0.066	0.118	0.064	0.214	0.159
Threat of violence	0.119	0.134	0.109	0.133	0.026	0.146
Drug-related crime	0.292	0.185	0.233	0.185	-0.004	0.234
Assault	0.047	0.056	0.087	0.056	0.289	0.145
Theft	0.068	0.054	0.085	0.051	0.220	0.089
Robbery	0.076	0.060	0.067	0.061	0.077	0.100
Crimes against the State	0.048	0.043	0.048	0.044	-0.086	0.085
Crimes against the Public Health	-0.127	0.189	-0.048	0.188	0.235	0.234
Other crime	0.054	0.067	0.081	0.064	0.016	0.165
Drug addiction	0.039	0.046	0.045	0.048	0.027	0.122
Time from incarceration to first sentence	*-0.816*	*0.203*				
Total years served	*0.429*	*0.045*	*0.360*	*0.031*	*0.235*	*0.023*
Age fixed effects	√				√	
Observations	1,538		1,553		760	
R-squared	0.586		0.555		0.434	
F-statistic for joint test	1.192		1.112		2.432	
p-value	0.264		0.338		0.001	

Notes: Columns 1, 3 and 5 show the coefficients of a regression where "Potential years treated" in Bollate is regressed on the variables listed in the first column, with or without age fixed effects. Columns 1 to 4 refers to the sample of displaced inmates, columns 5 and 6 to the sample of selected inmates. The latter includes 281 inmates whose reason of entry is unknown. The F-test at the bottom for the joint significance of these regressors excludes the variables which are expected, a priori, to affect the timing of transfer to Bollate (see Section 1.3; these are the variables below the continuous line, in italics; including or not drug addiction among them does not alter the results). Clustered standard errors (by cell block and week of release, for a total of 392 clusters) in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A3: Balancing Test based on Predicted Recidivism (displaced inmates)

	(1)	(2)	(3)	(4)
		Recidivism index		
	Index 1	Index 2	Index 1	Index 2
Potential years treated	0.005	0.000	0.005	0.005
	(0.008)	(0.008)	(0.008)	(0.008)
Total years served	-0.007	-0.004	0.001	0.000
	(0.004)	(0.004)	(0.004)	(0.004)
Time from incarceration to first sentence	-0.027	-0.032	-0.052	-0.054
	(0.016)	(0.017)	(0.015)	(0.016)
Age fixed effects	√	√	√	√
Prison Fixed effects			√	√
Year/Month fixed effects			√	√
Observations	1,538	1,531	1,527	1,527
R-squared	0.406	0.381	0.489	0.515

Notes: We construct a measure of predicted recidivism (recidivism risk) by regressing actual recidivism on all observable characteristics listed in the upper part of Table A2 plus age fixed effects (denoted Index 1, in Columns 1 and 3) and prison of origin fixed effects (denoted Index 2 in Columns 2 and 4). "Potential years treated" in Bollate, "Total years served" and "Time from incarceration to first sentence" are, therefore, excluded from this first step. The table presents the second step regression, in which predicted recidivism is regressed on "Potential years treated," "Total time served" and "Time from incarceration to first sentence". Clustered standard errors (by cell block and week of release, for a total of 392 clusters) in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table A4: Regressions with Additional Identification Conditions

	(1)	(2)	(3)	(4)
		Recidivates within 3 years		
Potential years treated	-0.064	-0.065	-0.076	-0.077
	(0.024)	(0.028)	(0.036)	(0.037)
Total years served	0.024			
	(0.018)			
Time from incarceration to first sentence	0.051	0.066	0.071	
	(0.064)	(0.083)	(0.099)	
Rank in the Delay of Displacement	-0.000			
	(0.002)			
Total sentence FE (trimesters)		√		
Total sentence FE (months)			√	√
Time from incarceration to first sentence FE (months)				√
Observations	1,494	1,485	1,462	1,454
R-squared	0.264	0.276	0.294	0.311

Notes: Only the reduced form regressions are shown. All regressions control for the additional covariates and fixed effects included in Column 4 of Table 4. Clustered standard errors (by prison section and week of release) in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A5: Recidivism and Treatment Intensity with "Spatially" Lagged Errors (Displaced inmates) (dependent variable: inmate recidivates within 3 years (0/1))

	(1)	(2)	(3)	(4)
Adjacency matrix:	Dichotomic		Standartized	
Potential years treated	-0.073	-0.065	-0.073	-0.069
	(0.019)	(0.019)	(0.019)	(0.019)
Total years served	0.013	0.024	0.014	0.023
	(0.011)	(0.014)	(0.011)	(0.014)
lambda	0.437	0.486	0.411	0.486
	(0.017)	(0.003)	(0.029)	(0.003)
Other Xs		$\checkmark$		$\checkmark$
Observations	1,537	1,537	1,537	1,537
log-likelihood	-1072	-903.5	-1071	-894

Notes: The adjacency matrix allows inmates who have potentially interacted in prison for at least one day to have correlated errors.The "Other Xs" are all the additional covariates and fixed effects included in Column 4 of Table 4. "Spatially" lagged standard errors in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table A6: Complete Regression Table 4 of the Reduced Form (dependent variable: inmate recidivates within 3 years (0/1))

	(2)	(3)	(4)	(5)
	Displaced inmate recidivates within 3 years (0/1)			
Potential years treated	-0.073	-0.063	-0.064	-0.063
	(0.019)	(0.020)	(0.021)	(0.023)
Total years served	0.014	0.015	0.025	0.023
	(0.012)	(0.014)	(0.017)	(0.017)
Drug addiction		0.117	0.156	0.148
		(0.030)	(0.039)	(0.042)
Time from incarceration to first sentence		0.011	0.047	0.051
		(0.053)	(0.055)	(0.064)
Art. 4 bis			-0.038	-0.024
			(0.053)	(0.054)
Total number of incarcerations			0.053	0.053
			(0.005)	(0.005)
In a relationship			0.016	0.013
			(0.029)	(0.030)
Separated or divorced			0.034	0.039
			(0.045)	(0.046)
College degree			-0.012	-0.012
			(0.062)	(0.062)
Secondary schooling			-0.019	-0.016
			(0.034)	(0.035)
Primary schooling			-0.021	-0.022
			(0.040)	(0.041)
Homicide			-0.086	-0.100
			(0.094)	(0.100)
Fraud			-0.019	-0.018
			(0.056)	(0.059)
Threat of violence			0.088	0.083
			(0.059)	(0.063)
Drug-related crime			0.217	0.217
			(0.101)	(0.104)
Assault			0.018	0.012
			(0.043)	(0.044)
Theft			0.085	0.095
			(0.028)	(0.030)
Robbery			0.027	0.036
			(0.039)	(0.040)
Crimes against the State			0.005	0.004
			(0.031)	(0.031)
Crimes against the Public Health			-0.209	-0.201
			(0.097)	(0.100)
Other crime			0.031	0.037
			(0.044)	(0.044)
Age at exit FE		√	√	√
Prison FE			√	√
Year/Month FE			√	√
Prison × Year/Month FE				√
Observations	1,553	1,538	1,527	1,494
R-squared	0.011	0.093	0.255	0.264

Notes: Clustered standard errors (by cell block and week of release, for a total of 392 clusters) in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Table A7: Complete Regression Table 4 of the First Stage (dependent variable: Actual Years in Bollate)

	(1)	(2)	(3)	(4)	(5)
	Panel C: First stage (d.v. Actual years treated)				
Potential years served in Bollate	0.684	0.616	0.618	0.606	0.612
	(0.040)	(0.048)	(0.045)	(0.043)	(0.047)
Total years served		0.049	0.041	0.028	0.021
		(0.013)	(0.014)	(0.017)	(0.022)
Drug addiction			-0.027	0.081	0.072
			(0.024)	(0.030)	(0.030)
Time from incarceration to first sentence			0.041	0.075	0.100
			(0.069)	(0.078)	(0.088)
Art. 4 bis				-0.024	-0.041
				(0.074)	(0.078)
Total number of incarcerations				0.007	0.005
				(0.004)	(0.004)
In a relationship				-0.038	-0.035
				(0.025)	(0.025)
Separated or divorced				-0.028	-0.023
				(0.049)	(0.052)
College degree				-0.015	-0.007
				(0.046)	(0.047)
Secondary schooling				-0.010	-0.004
				(0.029)	(0.030)
Primary schooling				-0.037	-0.040
				(0.038)	(0.040)
Homicide				0.087	0.104
				(0.132)	(0.134)
Fraud				0.010	-0.008
				(0.057)	(0.056)
Threat of violence				0.049	0.026
				(0.089)	(0.094)
Drug-related crime				0.048	0.009
				(0.086)	(0.089)
Assault				0.068	0.080
				(0.040)	(0.041)
Theft				0.062	0.072
				(0.029)	(0.030)
Robbery				0.093	0.087
				(0.042)	(0.044)
Crimes against the State				-0.002	0.002
				(0.029)	(0.030)
Crimes against the Public Health				-0.034	0.011
				(0.086)	(0.091)
Other crime				0.040	0.050
				(0.040)	(0.040)
Constant	0.101	0.089	0.101	0.032	0.030
	(0.025)	(0.024)	(0.025)	(0.040)	(0.041)
Age at exit FE			√	√	√
Prison FE				√	√
Year/Month FE				√	√
Prison × Year/Month FE					√
Observations	1,553	1,553	1,538	1,527	1,494
R-squared	0.695	0.701	0.704	0.741	0.745

Notes: Clustered standard errors (by cell block and week of release, for a total of 392 clusters) in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A8: Effect of the Bollate Treatment for Selected Inmates (dependent variable: inmate recidivates within 3 years (0/1))

Sample:	(1)	(2)	(3)	(4)
	Selected and unknowns		Selected inmates	
	Panel A: Reduced Form Model			
Potential years treated	-0.043	-0.052	-0.074	-0.050
	(0.015)	(0.019)	(0.019)	(0.028)
Total years served	0.007	0.024	0.012	0.027
	(0.007)	(0.009)	(0.007)	(0.014)
Applied to be treated	-0.143	-0.097	-0.071	-0.098
	(0.039)	(0.058)	(0.050)	(0.074)
Transferred by the Justice Dep.	-0.138	-0.192	-0.068	-0.111
	(0.051)	(0.060)	(0.056)	(0.078)
R-squared	0.027	0.378	0.034	0.492
	Panel B: 2SLS Model			
Actual years treated	-0.095	-0.129	-0.101	-0.072
	(0.032)	(0.051)	(0.026)	(0.039)
Total years served	0.009	0.025	0.013	0.027
	(0.007)	(0.009)	(0.007)	(0.014)
Applied to be treated	-0.104	-0.043	-0.071	-0.105
	(0.040)	(0.058)	(0.049)	(0.074)
Transferred by the Justice Dep.	-0.117	-0.158	-0.082	-0.123
	(0.051)	(0.062)	(0.057)	(0.082)
Other Xs		√		√
Prison FE		√		√
Year/Month FE		√		√
Age at exit FE		√		√
Observations	760	726	479	445
R-squared	0.025	0.110	0.021	0.180
F-stat	78.17	44.19	249.7	135.2

Notes: The average recidivism is 28 percent for selected inmates, 33.1 when also inmates with unknown entry reason are included. A flag on the variables in the bottom part of the Table (below the double continuous line) signals inclusion in both, reduced form and 2SLS regressions. The "Other Xs" are all the covariates included in the central panel of Table 3. Clustered standard errors (by cell block and week of release, for a total of 339 clusters) in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A9: Logit Hazard Model (dependent variable: inmate recidivates within 3 years (0/1))

	(1)	(2)
	Recidivates	
Potential years treated	-0.240	-0.240
	(0.074)	(0.074)
Total years served	0.017	0.017
	(0.049)	(0.049)
Time from incarceration to first sentence	0.001	0.001
	(0.001)	(0.001)
Quartic in time	√	
Time fixed effects		√
Observations	42,237	41,304
Number of individuals	1538	1538
pseudo-R2	0.0464	0.0516

Notes: We construct monthly panel data and use a logit hazard model (inmates are followed up to when they recidivate or 3 years past release, whatever comes first. All regressions control for the additional covariates and fixed effects included in Column 4 of Table 4. Clustered standard errors (by cell block and week of release, for a total of 392 clusters) in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A10: Effect of the Treatment for Displaced Inmates by Type of Future Crime

Recidivism based on ... crimes:	(1) all	(2) violent	(3) non-violent
Panel A: Reduced Form Model			
Potential years treated	-0.063	-0.011	-0.052
	(0.023)	(0.015)	(0.022)
Total years served	0.023	0.007	0.016
	(0.017)	(0.011)	(0.017)
Observations	1,494	1,494	1,494
R-squared	0.264	0.225	0.194
Panel B: 2SLS Model			
Actual years treated	-0.102	-0.017	-0.085
	(0.040)	(0.025)	(0.038)
Total years served	0.025	0.008	0.017
	(0.019)	(0.012)	(0.018)
Age at exit FE	√	√	√
Other Xs	√	√	√
Prison FE	√	√	√
Year/Month FE	√	√	√
Prison × Year/Month FE	√	√	√
Observations	1,494	1,494	1,494
R-squared	0.107	0.067	0.065
F-stat on the excluded instrument	172.7	172.7	172.7

Notes: The average recidivism rate is 39.5 percent. For violent crimes it is 14.2 percent. A flag on the variables in the bottom part of the Table (below the double continuous line) signals inclusion in both, reduced form and 2SLS regressions. The "Other Xs" are all the covariates included in the central panel of Table 3. Clustered standard errors (by cell block and week of release, for a total of 392 clusters) in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$