

# HMP Peterborough Social Impact Bond - cohort 2 and final cohort impact evaluation

Jake Anders and Richard Dorsett

Sunday, 11 June 2017



## **Executive Summary**

In 2010, the world's first Social Impact Bond (SIB) was launched at Peterborough Prison. It was used to fund an intervention – 'The One Service' – aimed at reducing the reoffending among prisoners discharged after serving a sentence of less than 12 months. Under the terms of the SIB, investors are paid according to how successful the One Service is in reducing reconvictions. If a minimum threshold of a 7.5% reduction in reconviction events is reached across the pilot, payment is triggered. Additionally, there is an option to trigger an early payment if a 10% reduction is noted in the number of reconviction events in individual cohorts.

A propensity score matching (PSM) approach was used to estimate impact. For cohort 1, the impact was estimated, by a previous team of independent assessors, to be a reduction in reconviction events of 8.4% (Jolliffe and Hedderman, 2014). Anders and Dorsett (2017) reviewed the PSM approach, prompted in part by the desire to understand the reasons behind the differences in reconviction rates between prisoners discharged from HMP Peterborough and prisoners discharged from other prisons. Following their review, Anders and Dorsett (2017) recommended that the cohort 1 approach be maintained for cohort 2. They also recommended an adjustment to the sample selection in Cohort 2. It is important to note that this recommendation was based on the analysis of cohort 1 data and was not informed by cohort 2 reoffending data. Matching was performed for cohort 2 using a dataset that excluded reoffending data.

We estimate that the One Service reduced the number of reconviction events among those discharged from HMP Peterborough by 9.7% for cohort 2. The reduction across both cohorts is estimated to be 9.0%, which reached the minimum threshold of 7.5% across all cohorts. This reduction is sufficient to trigger an outcome payment.

## **Authors**

Jake Anders is Senior Research Associate in the Department of Learning and Leadership at UCL Institute of Education, University College London. He was formerly Research Fellow at the National Institute of Economic and Social Research (NIESR).

Richard Dorsett is Professor of Economic Evaluation at the University of Westminster, Visiting Professor at UCL Institute of Education and NIESR Fellow. He was formerly Principal Research Fellow and Director of Policy Evaluation at NIESR.

## 1 Introduction

In 2010, the world's first Social Impact Bond (SIB) was launched at Peterborough Prison. The Ministry of Justice (MoJ) and the Big Lottery Fund agreed to pay for the successful outcomes of the project if it reduced reoffending by 7.5% overall. There was also an opportunity to receive early payments if individual cohorts reduced reoffending by 10%. A SIB is a form of 'payment by results' (PbR) where funding is raised from private, non-government investors and used to pay for interventions to improve social outcomes. If these interventions are effective, this could result in savings to Government and wider benefits to society. As part of a SIB the Government agrees to pay a proportion of these savings back to the investors as a return on their investment. If the outcomes do not improve, investors lose their investment.

The Peterborough pilot uses a SIB to fund interventions to reduce reoffending among male offenders released from HMP Peterborough having served short prison sentences (less than 12 months). It is coordinated by Social Finance, a not-for-profit financial intermediary, who obtained investment funding from private individuals, trusts and foundations to finance the pilot. This investment is used to fund an intervention called the 'One Service'. This is a voluntary scheme offering through the gate support to reduce reoffending, meaning that contact is made with prisoners before release and continued in the community. It is delivered by a mix of paid caseworkers and volunteers. It takes a pragmatic and client-led approach, in which the mix of activities for each offender is determined by caseworkers according to individual need.

The Peterborough SIB pilot was originally intended to operate until 2017, funding the delivery of the One Service to three cohorts of around 1,000 prisoners released from the prison. Support from the One Service was available to cohort members for a period of up to 12 months post-release, and engagement was on a voluntary basis. While the pilot operated on a PbR basis under the SIB model for the first two cohorts of released prisoners, a third cohort received One Service support under a 'fee-for-service' arrangement, rather than under the original SIB-funded PbR model. This change to the model was due to the roll-out of 'Transforming Rehabilitation' reforms to probation, which introduced mandatory statutory supervision for short-sentenced offenders – the target group for the Peterborough pilot – and also included a PbR funding mechanism to incentivise providers to reduce reoffending. This meant that while the pilot was concluded early in order to avoid any duplication in services to the same

population, the alternative fee-for-service funding arrangement for the third cohort enabled the pilot to continue operating until the new Community Rehabilitation Company (CRC) providers implemented their approach to rehabilitation.

Under the terms of the SIB, the MoJ, supported by the Big Lottery Fund, will repay investors their capital and a return on their investment according to how successful the One Service is in reducing reconvictions. Specifically, payment requires a 7.5% reduction in the number of reconviction events in the 12 months following discharge across the whole pilot. This measurement is called the 'final cohort' – the weighted mean of cohort 1 and cohort 2. If reconviction events are reduced by 10% in either of the first two cohorts of prisoners, a payment will also be made.<sup>1</sup>

The impact of the intervention was estimated using a propensity score matching (PSM) approach. Cave et al. (2012) describe the development of the PSM approach used for cohort 1.<sup>2</sup> The impact for that cohort was estimated (by a previous team of independent assessors) to be a reduction in reoffending of 8.4% (Jolliffe and Hedderman, 2014).<sup>3</sup>

Following publication of the cohort 1 results, MoJ commissioned a review of the methodological approach. This was prompted in part by the desire to understand the reasons behind the differences in reconviction rates between prisoners discharged from HMP Peterborough and prisoners discharged from other prisons.<sup>4</sup> That review did not propose any major changes to the cohort 1 PSM methodology.

It did recommend a change to the sample definition. With cohort 1, prisoners leaving HMP Peterborough at any point during the cohort period were regarded as being in the treatment group. Those leaving a different prison during the cohort 1 period and not later leaving HMP Peterborough within the same cohort period made up the pool of potential comparators. That definition entails a systematic difference between the treatment group and the (resulting) comparison group. Individuals who would have potentially been in the comparison group were instead included in the treatment group if they had a subsequent short sentence, this time at HMP Peterborough. Since the treatment group is much smaller than the comparison group, its mean number of reconvictions is more likely to be influenced by their inclusion. In view of this, a different sample definition was used for cohort 2. The cohort 2 treatment group includes all those whose first discharge in the cohort 2 period was from HMP

---

<sup>1</sup>A reconviction is defined as an offence committed in the 12 months following release from prison, and resulting in conviction at court either in those 12 months or in a further 6 month period (allowing time for cases to progress through the courts). If an offender is reconvicted of multiple offences on one sentencing occasion, this counts as one reconviction event.

<sup>2</sup>[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/217392/peterborough-social-impact-bond-assessment.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/217392/peterborough-social-impact-bond-assessment.pdf)

<sup>3</sup>[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/341684/peterborough-social-impact-bond-report.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/341684/peterborough-social-impact-bond-report.pdf)

<sup>4</sup>The MoJ announced its intention to review the cohort 1 methodology in [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/341682/pbr-pilots-cohort-1-results.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/341682/pbr-pilots-cohort-1-results.pdf) (Annex B).

Peterborough. The cohort 2 comparison group includes all those whose first discharge in the cohort 2 period was from a non-Peterborough prison.

In order to learn more from the evaluation, an additional analysis was carried out that assessed the extent to which the estimated impacts varied according to the definition of the sample. The results of this sensitivity analyses are presented in a separate report.

In all, three reports followed the cohort 1 evaluation:

- **Methodology Review** – assesses the cohort 1 approach and recommends an approach for cohort 2 and the final cohort (Anders and Dorsett, 2017)
- **Cohort 2 Report** – presents impact estimates for cohort 2 and the final cohort
- **Learning Exercise** – explores the sensitivity of the results to the recommendation in the Methodology Review to alter the sample definition (Dorsett, 2017).

The remainder of this report begins with a description of the data in Chapter 2. Chapter 3 assesses the extent to which matching produced a well-balanced comparison group suitable for producing impact estimates. These estimates are presented in Chapter 4, along with estimates for the final cohort. Chapter 5 concludes.

## **2 Data**

### **2.1 Offending data**

The data supplied by MoJ for the analysis in this document were taken from the Police National Computer (PNC). They covered men released from prison who had been serving sentences of less than 12 months. The number of reconviction events in the 12 months following release for each individual was recorded and formed the outcome variable. The data recorded some background characteristics, details on the nature of the prisoner's offence and his offending history. The history variables included Copas scores, which provide a measure of the rate at which individuals have built up convictions throughout their criminal career (Copas and Marshall, 1998). There was also information on whether an individual was a chronic offender, defined as being among those individuals who accounted for half of the total number of previous offences in a cohort.

Data for cohort 2 covered individuals released from sentences of less than 12 months in the period 2 July 2012 to 1 July 2014. In addition to HMP Peterborough, the data included men released from the following prisons: Altcourse, Bedford, Belmarsh, Birmingham, Bristol, Bullingdon, Cardiff, Chelmsford, Dorchester, Durham, Elmley, Exeter, Forest Bank, Gloucester, Hewell, High Down, Holme House, Hull, Leeds, Leicester, Lewes, Lincoln, Liverpool, Manchester, Norwich, Nottingham, Parc, Pentonville, Preston, Swansea, Thameside, Wandsworth, Winchester, Woodhill, and Wormwood Scrubs.<sup>1</sup>

### **2.2 Notable features of the data**

There were 997 eligible prisoners released from HMP Peterborough (and who it was possible to match to the PNC) during the cohort 2 period. This reduced to 911 under the revised sampling definition adopted for cohort 2. In addition, 45 were excluded from the estimation sample due to missing information regarding the nature of their index offence or because their index offence was a breach of licence conditions, a breach of a detention and training order or a breach of a conditional discharge. These exclusion rules are similar to those applied in Jolliffe and Hedderman (2014). The resulting sample therefore was made up of 866 HMP Peterborough prisoners. The same exclusion rules were

---

<sup>1</sup>HMP Doncaster was excluded as it was also conducting a payment-by-results trial during the same period.

applied to other prisons, reducing the size of the national cohort sample by 117 prisoners. The number of prisoners from other prisons was further reduced due to missing information on ethnicity and nationality (21 and 14 prisoners, respectively).

Table 2.1 shows the age distribution in HMP Peterborough and in other prisons. As noted in Anders and Dorsett (2017), there were very few prisoners under the age of 21. The protocol in Anders and Dorsett (2017) recommended that under-21s be excluded from the analysis in cohort 2 unless they were more in evidence than they were in cohort 1. Since this was the case, they were retained.

Table 2.1: Age distribution in Peterborough and other prisons

Age	Other Prisons	Peterborough	Overall
18	0.009	0.002	0.009
19	0.017	0.003	0.017
20	0.016	0.006	0.016
21	0.042	0.048	0.042
22	0.046	0.048	0.046
23	0.047	0.044	0.047
24	0.046	0.050	0.046
25-34	0.400	0.435	0.401
35-44	0.238	0.224	0.238
45-54	0.109	0.100	0.108
55-64	0.024	0.033	0.024
65+	0.006	0.005	0.006
N	34041	866	34907

**Notes:** Column proportions.

Table 2.2 shows the distribution of sentence lengths. This appears quite similar for Peterborough compared to other prisons. The same is true for the distribution of releases by month over the course of the cohort period (Table 2.3).

Table 2.2: Sentence length distribution in Peterborough and other prisons

Month	Other Prisons	Peterborough	Overall
1	0.069	0.095	0.069
2	0.151	0.136	0.150
3	0.186	0.164	0.185
4	0.170	0.179	0.170
5	0.116	0.105	0.116
6	0.127	0.125	0.127
7	0.030	0.029	0.030
8	0.065	0.062	0.065
9	0.035	0.052	0.036
10	0.034	0.036	0.034
11	0.010	0.008	0.010
12	0.008	0.009	0.008
N	34041	866	34907

Notes: Column proportions.

Table 2.3: Release month distribution in Peterborough and other prisons

Month	Other Prisons	Peterborough	Overall
Jul 2012	0.059	0.064	0.059
Aug 2012	0.062	0.057	0.062
Sep 2012	0.051	0.052	0.051
Oct 2012	0.056	0.052	0.056
Nov 2012	0.055	0.042	0.054
Dec 2012	0.049	0.058	0.049
Jan 2013	0.045	0.043	0.045
Feb 2013	0.039	0.035	0.039
Mar 2013	0.045	0.075	0.046
Apr 2013	0.044	0.042	0.044
May 2013	0.044	0.039	0.044
Jun 2013	0.035	0.042	0.035
Jul 2013	0.039	0.036	0.039
Aug 2013	0.040	0.031	0.040
Sep 2013	0.034	0.043	0.035
Oct 2013	0.038	0.036	0.038
Nov 2013	0.036	0.029	0.036
Dec 2013	0.037	0.040	0.037
Jan 2014	0.034	0.036	0.034
Feb 2014	0.029	0.029	0.029
Mar 2014	0.034	0.036	0.034
Apr 2014	0.034	0.038	0.034
May 2014	0.031	0.021	0.031
Jun 2014	0.029	0.028	0.029
Jul 2014	0.001	0.000	0.001
N	34,041	866	34,907

Notes: Column proportions.

### 3 Matching

This chapter begins by describing the matching method used to estimate the effect of the pilot. It then shows the balance of the sample before and after matching.

PSM estimators (or matching estimators more generally) can be implemented in many ways. The approach used by Jolliffe and Hedderman (2014) was to match up to 10 prisoners from comparator prisons to each Peterborough prisoner. This was done without replacement, meaning that once a prisoner had been matched to a Peterborough prisoner he was no longer available to match to other Peterborough prisoners. Matches were selected on the basis of the propensity score. This propensity score was estimated for all prisoners (from Peterborough and other prisons alike). It represents the probability, on the basis of each prisoner's characteristics, of being a prisoner at Peterborough rather than elsewhere. Matching on the propensity score can result in the identification of a matched sample that looks similar to, in this case, the group of Peterborough prisoners with regard to those characteristics included in the estimation of the propensity score. It has the practical advantage of allowing the match to be on the basis of a single index.<sup>1</sup> To ensure that matches were sufficiently close a 'caliper' was applied, requiring that the difference in propensity scores between a Peterborough prisoner and those matched from other prisons was no more than 0.05.

The choice of PSM approach is potentially important. For instance, requiring that each non-Peterborough prisoner be used as a match no more than once means that the order in which Peterborough prisoners are matched is relevant (there are fewer potential non-Peterborough prisoners available for those Peterborough prisoners who are matched later). The Methodology Review (Anders and Dorsett, 2017) considered the PSM approach in detail.

We note that the data used for matching excluded outcome information. This is in line with the protocol set out in Anders and Dorsett (2017) and was intended to prevent the match being adjusted in light of knowledge of the resulting impact estimate.

Table 3.1 compares the characteristics of those released from HMP Peterborough with those released from other prisons before matching had taken place. Unsurprisingly, this reveals statistically significant differences in a number of potentially important characteristics for predicting reoffending. These

---

<sup>1</sup>The alternative of matching on a range of characteristics places heavy demands on the data.

differences demonstrate the importance of adopting a matching approach, rather than simply comparing raw reconviction rates between HMP Peterborough and other prisons. Across all variables there was an average absolute standardised difference between Peterborough and other prisons of 0.07.

The propensity score regression model was specified to be the same as that reported in Jolliffe and Hedderman (2014) but with the addition of whether the index offence was breach of a suspended supervision order.<sup>2</sup> The model included age at release, ethnicity, previous offences, previous conviction occasions, previous custodial sentences, age at first offence, Copas score, previous T1/T2 convictions, whether index offence was severe, whether individual was identified as a chronic offender, and a number of specific categories of index offence. The full specification and coefficients are reported as Table A.1 in Appendix A.

The predicted probability of being incarcerated at HMP Peterborough rather than a different prison (i.e. the propensity score) was calculated for each individual. As outlined above, each HMP Peterborough prisoner was matched with those 10 individuals released from other prisons who had the most similar propensity scores. The caliper of 0.05 ensured that all matches were between individuals with sufficiently similar propensity scores but also meant that some individuals had fewer than 10 matches.

Once the matching had been completed, the balance between HMP Peterborough and other prisons within the newly constructed matched dataset was assessed. Table 3.2 shows little evidence of differences in reported characteristics between those released from HMP Peterborough and matched individuals released from other prisons. The average absolute standardised difference across all characteristics was reduced to 0.02, indicating a closer similarity than pre-matching. There were no significant differences at the 95% level in any of the characteristics considered (the proportion with offence type soliciting/prostitution was significant at the 90% level); the balancing was at least as good as that achieved in cohort 1.

---

<sup>2</sup>This was removed by Jolliffe and Hedderman (2014) due to non-significance but its exclusion resulted in poor balance on this characteristic in Cohort 2.

Table 3.1: Cohort 2 average characteristics pre-matching

Characteristic	Other Prisons	Peterborough	Std. Diff.	p
Age at Release	32.9	32.9	-0.00	0.99
Age of First Offence	18.6	20.1	0.17	0.00***
Previous Offences	38.9	33.4	-0.13	0.00***
Previous Conviction Occasions	18.7	15.6	-0.18	0.00***
Previous Custodial Sentences	5.4	4.3	-0.14	0.00***
Sentence Length	127.8	129.2	0.02	0.59
Time Served	52.2	54.1	0.05	0.10*
Previous T1 T2 Convictions	1.6	1.3	-0.12	0.00***
White - British	73.3	64.7	-0.19	0.00***
White - Foreign	10.9	22.6	0.32	0.00***
Black - British	6.8	3.9	-0.13	0.00***
Black - Foreign	2.1	1.6	-0.03	0.34
Asian/Middle Eastern - British	4.5	5.1	0.03	0.43
Asian/Middle Eastern - Foreign	2.4	2.1	-0.02	0.56
Copas Score	-54.8	-69.5	-0.18	0.00***
Severe Offence	1.0	1.3	0.03	0.44
Chronic Offender	17.2	13.4	-0.10	0.00***
Offence: Absconding	1.5	1.4	-0.01	0.77
Offence: Breach CO	7.2	5.3	-0.08	0.03**
Offence: Breach SSO	9.4	13.2	0.12	0.00***
Offence: Criminal/Malicious Damage	1.9	1.4	-0.04	0.28
Offence: Domestic Burglary	2.0	2.8	0.05	0.10*
Offence: Drink Driving	2.6	3.6	0.06	0.07*
Offence: Drug Import/Export/Production	1.0	1.6	0.05	0.10*
Offence: Drug Possession/Small-Scale Supply	2.2	2.5	0.02	0.47
Offence: Fraud/Forgery	3.0	3.9	0.05	0.10*
Offence: Handling	1.4	1.0	-0.04	0.32
Offence: Other	3.7	2.9	-0.05	0.20
Offence: Other Burglary	4.0	2.5	-0.08	0.03**
Offence: Other Motoring Offences	5.1	6.6	0.06	0.05**
Offence: Public Order	4.2	3.9	-0.01	0.67
Offence: Robbery	0.2	0.1	-0.03	0.50
Offence: Serious Violence	0.4	0.6	0.02	0.48
Offence: Sexual	1.5	0.8	-0.07	0.09*
Offence: Child Sexual	0.7	1.0	0.04	0.22
Offence: Soliciting/Prostitution	0.0	0.0	-0.02	0.61
Offence: Taking and Driving Away	1.3	1.2	-0.01	0.76
Offence: Theft	21.1	19.7	-0.03	0.35
Offence: Theft from a Vehicle	1.2	1.2	-0.01	0.81
Offence: Violence	24.4	22.7	-0.04	0.27
N	34,041	866	0.07	

**Notes:** Std. diff = Difference between the characteristic in Peterborough and in other prisons in units of the standard deviation of the variable in the sample i.e. translated into a standardised difference which is comparable across variables. p = p-value from a test of the null hypothesis of no mean difference between Peterborough and other prisons with regard to the variable in question (i.e. the level of statistical significance of the observed difference). Stars also indicate statistical significance as follows: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Table 3.2: Cohort 2 average characteristics post-matching

Characteristic	Other Prisons	Peterborough	Std. Diff.	p
Age at Release	33.0	32.9	-0.01	0.78
Age of First Offence	20.1	20.1	-0.00	0.96
Previous Offences	32.9	33.4	0.01	0.74
Previous Conviction Occasions	15.2	15.6	0.02	0.56
Previous Custodial Sentences	4.2	4.3	0.02	0.55
Sentence Length	129.3	129.2	-0.00	0.98
Time Served	52.2	54.1	0.05	0.25
Previous T1 T2 Convictions	1.3	1.3	0.00	0.89
White - British	65.6	64.7	-0.02	0.60
White - Foreign	21.4	22.6	0.03	0.40
Black - British	4.9	3.9	-0.05	0.17
Black - Foreign	1.7	1.6	-0.00	0.90
Asian/Middle Eastern - British	4.2	5.1	0.04	0.23
Asian/Middle Eastern - Foreign	2.4	2.1	-0.02	0.57
Copas Score	-70.5	-69.5	0.01	0.74
Severe Offence	1.4	1.3	-0.01	0.72
Chronic Offender	13.1	13.4	0.01	0.81
Offence: Absconding	1.5	1.4	-0.01	0.87
Offence: Breach CO	4.9	5.3	0.02	0.57
Offence: Breach SSO	13.7	13.2	-0.02	0.67
Offence: Criminal/Malicious Damage	1.4	1.4	-0.00	0.98
Offence: Domestic Burglary	2.9	2.8	-0.01	0.83
Offence: Drink Driving	4.0	3.6	-0.02	0.53
Offence: Drug Import/Export/Production	1.6	1.6	-0.00	0.98
Offence: Drug Possession/Small-Scale Supply	3.0	2.5	-0.03	0.43
Offence: Fraud/Forgery	3.2	3.9	0.04	0.28
Offence: Handling	1.4	1.0	-0.03	0.31
Offence: Other	3.2	2.9	-0.02	0.63
Offence: Other Burglary	2.4	2.5	0.01	0.76
Offence: Other Motoring Offences	6.7	6.6	-0.01	0.86
Offence: Public Order	4.2	3.9	-0.01	0.69
Offence: Robbery	0.2	0.1	-0.02	0.52
Offence: Serious Violence	0.7	0.6	-0.01	0.70
Offence: Sexual	0.8	0.8	0.00	1.00
Offence: Child Sexual	0.7	1.0	0.03	0.40
Offence: Soliciting/Prostitution	0.0	0.0	-0.03	0.08*
Offence: Taking and Driving Away	1.4	1.2	-0.02	0.61
Offence: Theft	19.8	19.7	-0.00	0.95
Offence: Theft from a Vehicle	1.1	1.2	0.01	0.78
Offence: Violence	21.3	22.7	0.03	0.34
N	8,609	866	0.02	

**Notes:** Reporting means (or percentages for binary variables) by whether prisoner was released from Peterborough or another eligible prison. Std. diff = Difference between the characteristic in Peterborough and in other prisons in units of the standard deviation of the variable in the sample i.e. translated into a standardised difference which is comparable across variables. p = p-value from a test of the null hypothesis of no mean difference between Peterborough and other prisons with regard to the variable in question (i.e. the level of statistical significance of the observed difference). Stars also indicate statistical significance as follows: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## 4 Results for cohort 2 and the final cohort

As noted in Chapter 3, matching was performed using a dataset that excluded reconviction information. Having done this, the matched sample was supplied to MoJ who then provided the reconviction data for those individuals. This allowed the impact of the One Service to be estimated. This Chapter presents the cohort 2 impact estimate and then combines this with the cohort 1 estimate to produce an estimate for the final cohort.

### 4.1 Cohort 2 impact evaluation

The estimated impact for cohort 2 is shown in Table 4.1. The mean impact was a reduction of 0.141 reconviction events among cohort 2 prisoners. Also shown is the standard error of the impact estimate. This indicates that the reduction was not statistically significant at the conventional 95% level (the implied confidence interval goes from a reduction of 29.4 to an increase of 1), although it was significant at the 90% level.

It is the percentage reduction on an individual cohort that is used to assess whether the SIB payment is due. The impact reported in Table 4.1 translates into a 9.74% reduction (calculated as  $100 \times 0.141$  divided by 1.451) for cohort 2. This is below the 10% threshold and so is insufficient to qualify for an early payment. The 95% confidence interval for the percentage impact runs from a reduction of 20% to an increase of 1%. Consistent with the results presented in Table 4.1, this indicates that

Table 4.1: Estimated impact of Peterborough Prison pilot programme on reconviction events

	Mean number of reconviction events
Other Prisons	1.451*** (0.024)
Peterborough	1.309*** (0.074)
Peterborough Diff.	-0.141* (0.078)
Observations	9,475

**Notes:** Regression estimates, using weights provided through propensity score matching (10:1 nearest neighbour matching without replacement). Standard errors in parentheses. Stars also indicate statistical significance as follows: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

the percentage impact did not attain statistical significance at the 95% significance level. However, neither does it exclude the possibility that the true impact was greater than the 10% threshold.

## 4.2 Final cohort impact estimate

Anders and Dorsett (2017) sets out the protocol for calculating the impact for the final cohort; cohorts 1 and 2 combined. This can be expressed as a weighted sum of the cohort-specific impact estimates as follows:

$$\Delta_{12} = \Delta_1 w_1 + \Delta_2 w_2 \quad (4.1)$$

where  $\Delta_{12}$  is the final cohort impact estimate,  $\Delta_i$  is the impact in cohort  $i$  and  $w_i$  is a weight representing the proportion of the total counterfactual reconviction events across both cohorts accounted for by cohort  $i$ .

From Jolliffe and Hedderman (2014), the mean counterfactual number of reconvictions for cohort 1 was 1.55, implying a counterfactual total of  $1.55 \times 936 = 1,451$  reconvictions.<sup>1</sup> For cohort 2, the mean counterfactual number of reconvictions was 1.451, implying a total of  $1.451 \times 866 = 1,257$ .<sup>2</sup>

This implies an estimated reduction for the final cohort as follows:

$$\begin{aligned} \Delta_{12} &= 8.39\% * \frac{1,451}{1,451 + 1,257} + 9.74\% * \frac{1,257}{1,451 + 1,257} \\ &= 8.39\% * 0.54 + 9.74\% * 0.46 \\ &= 9.02\%. \end{aligned} \quad (4.2)$$

This exceeds the minimum threshold of 7.5% for the final cohort and is therefore sufficient to trigger payment under the SIB contract.

---

<sup>1</sup>p.11 of (Jolliffe and Hedderman, 2014) identifies that there were 936 HMP Peterborough prisoners in the cohort 1 estimation sample.

<sup>2</sup>There were 866 HMP Peterborough prisoners in the cohort 2 estimation sample.

## **5 Conclusion**

The results reported in this paper suggest that the matching approach taken by Jolliffe and Hedderman (2014) worked well when applied to Cohort 2 data. The resulting impact estimated for cohort 2 was below the threshold for SIB payment. The results for cohorts 1 and 2 combined was of sufficient size to trigger payment under the terms of the SIB contract.

## Bibliography

- Anders, J. and Dorsett, R. (2017). A review of the matching process for the impact analysis of the HMP Peterborough Social Impact Bond. MoJ Research Report.
- Cave, S., Williams, T., Jolliffe, D., and Hedderman, C. (2012). Peterborough Social Impact Bond: an independent assessment. Development of the PSM methodology. Ministry of Justice Research Series 8/12, Ministry of Justice.
- Copas, J. and Marshall, P. (1998). The offender group reconviction scale: a statistical reconviction score for use by probation officers. *Journal of the Royal Statistical Society: Series C (Applied Statistics)*, 47:159–171.
- Dorsett, R. (2017). HMP Peterborough Social Impact Bond - learning exercise. MoJ Research Report.
- Jolliffe, D. and Hedderman, C. (2014). Peterborough Social Impact Bond: Final Report on Cohort 1 Analysis. Report prepared for the Ministry of Justice, University of Leicester.

## A Appendix: Full matching regression model

Table A.1: Logistic regression model to estimate propensity score (modelling being incarcerated in HMP Peterborough rather than another prison)

	Matching	
Age at release	0.00462	(0.19)
Age at release squared /1000	-0.0177	(-0.06)
White - British	0.178	(1.52)
White - Foreign	0.908	(6.56)***
Asian/Middle Eastern - Foreign	0.0438	(0.17)
Previous offences	0.0210	(3.75)**
Previous offences squared /1000	-0.0479	(-2.47)**
Previous conviction occasions	-0.0446	(-4.05)***
Previous conviction occasions squared /1000	0.185	(3.50)***
Previous custodial sentences	-0.0133	(-0.86)
Previous custodial sentences squared /1000	0.108	(0.49)
Age at first offence	0.0357	(1.51)
Age at first offence-squared /1000	-0.614	(-1.60)
Copas score	0.0300	(0.31)
Previous T1 T2 convictions	-0.0249	(-0.85)
Previous T1 T2 convictions squared /1000	1.688	(1.13)
Severe offence	0.542	(1.65)*
Chronic offender	-0.207	(-1.09)
Offence: domestic burglary	0.353	(1.65)*
Offence: other burglary	-0.316	(-1.42)
Offence: drink driving	0.190	(0.99)
Offence: Drug import/export/production	0.570	(2.05)**
Offence: Drug possession/small-scale supply	0.331	(1.49)
Offence: motoring	0.237	(1.64)
Offence: public order	0.0760	(0.42)
Offence: Sexual	-0.728	(-1.80)*
Offence: taking and driving away	0.0341	(0.10)
Offence: breach of community order	-0.144	(-0.91)
Offence: breach of suspended supervision order	0.478	(4.40)***
Observations	34907	
Log likelihood	-3971.756	
Chi-squared	169.262	

**Notes:** Reporting coefficients from logistic regression model of whether individuals are incarcerated in HMP Peterborough, rather than any other prison. Sample: Male prisoners released from a sentence of less than 12 months during the Cohort 2 period. *t* statistics in parentheses. Stars indicate statistical significance as follows: \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$