

**An Analysis of  
Social Impact Bond Financing:  
Attribution and Deadweight**

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by

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# Abstract

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The recent introduction of social impact bonds, a subset of payment-by-results contracting continues to attract an increasing amount of attention today. As the government continues to innovate and pilot exciting new procedures and contracts to address public social issues, the launch of social impact bonds has captured a mass of public attention, bridging the gap between social and private finance. Since the introduction of the first social impact bond pilot initiated in Peterborough, UK, preliminary interim results from the program suggest positive outcomes attributed to the implementation of the social impact bond, which leads to the main motivating questions of this thesis. In the midst of these suggestive positive outcomes, we tend to overlook other factors that may also be playing a role in contributing to these outcomes (e.g. macroeconomic variables and characteristics of sample taken). By assessing and controlling for these factors, we can effectively determine (or at least get a better understanding of): Do social impact bonds actually work? Are social impact bonds (or the service implementation contracted from them) responsible for the positive social results or outcomes that are observed within the time horizon of the contract? Moreover, can it be confidently said that the observed improved social outcomes was accurately attributed to the implementation of the social impact bond initiative? Or were there other factors occurring simultaneously in the background at play that contributed to these positive results? And as a result, if the positive results cannot be fully attributed to the project, would the public sector have been better off placing its funding into other provisions of services? Thus, the main purpose of this paper is to develop a research methodology that closely examines and assesses the impact of SIBs within societies and takes a deeper look at the relationship of attribution and deadweight effects within SIB implementations and observed social outcomes. Furthermore, the paper aims to assess whether positive results that occur in the midst of an implementation of a SIB project are actually a result of causality from the implementation of the SIB project or are simply a by-product of correlation that occurred simultaneously with the implementation of the project.

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And finally, I would like to thank **my parents** for providing me the opportunity to attend an incredible academic institution where I spent the best years of my life. Thank you for always staying by my side and always encouraging me to achieve my best!

# Structure of Thesis

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This report is divided into four sections addressing a specific audience in each. The first section is addressed towards an audience with no prior knowledge of payment-by-results contracting, and introduces the fundamentals of social impact bond financing, the nature of the contract, and its applications. Furthermore, it seeks to provide a concise overview outlining and explaining its usage by the public sector, benefits and applications of this type of contracting, and the various parties involved within this specific contract.

The second section is addressed towards an audience of whom is already familiar with the concept of payment-by-results contracting and social impact bond financing, and begins to introduce the audience to the main issues of social impact bond financing and consequently the fundamental questions this thesis aims to answer: impact evaluation. This section will introduce an example of a hypothetical scenario involving a contract between multiple parties aimed at achieving a particular outcome and then design and propose a research methodology to evaluate the efficacy of impact due solely from a social impact bond. The research methodology is structured using statistical methods to evaluate the level of impact provided by the social impact bond, dependent on the scenario and measures involved.

The third section (addressed to the same audience as within the second section) attempts to take the proposed research methodology in section 2 and apply it to an actual case study of the first social impact bond program launched. The purpose of the third section is to generate statistical results and observations that can then be used to gauge whether if positive results achieved within the time horizon of the project's implementation, was a cause of the project itself, or a by-product of correlation with the project. Due to the limited data available on these SIB pilots, a full conclusion regarding the impact of these SIBs may not be possible.

Lastly, the fourth section, addressed towards an audience who has read through all three previous sections, aims to conclude the report with some concluding and broader thoughts that build on impact evaluation and additional matters to consider when considering social impact bond financing. More specifically, it aims to adopt a more financial perspective analyzing the cost-effectiveness of SIB programs and certain externalities SIBs may generate.

# Purpose of Thesis

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## *How This Thesis Adds to Existing Literature and Research:*

Literature and research (almost entirely qualitative) regarding social impact bonds has existed for quite some time since the launch of the first social impact bond pilot in September 2010. The idea behind the basic mechanics of this specific type of contract, “payment-by-results” / “performance-based” / “outcomes-based contracting”, has existed even longer. Qualitative literature and research explaining the fundamentals of SIB financing, the contracting model, and the role of the various parties is nothing new. Furthermore, there exists very little writing on specifically the efficacy of the service implementation the social impact bond finances and this can most likely be attributed to two reasons:

- 1) There exists very little (publicly available) data on the results of the projects financed by social impact bonds.
  - a. Social impact bond financing is only effective if the service implementation it finances is actually effective
- 2) Publicly available interim results of the first social impact bond pilot may be giving the impression that results are more positive (and social impact bond financing is more effective) than they really are
  - a. Hence, results may be taken for granted at face value

In effect, this thesis attempts to fill in that gap by attempting to examine the attribution and deadweight effects of SIB financing by developing an approach to observe the counterfactual as a means of comparing with the observed. Furthermore, this thesis seeks to break down the interim figures provided by the first social impact bond initiative and add some more color to other factors that may be driving the observed interim figures.

### **Why This Topic Matters:**

By assessing attribution (impact evaluation) and deadweight effects, one can answer two questions:

- 1) Do the service implementations financed by a social impact bond actually work, and by examining that, we can conclude, does SIB financing actually work?
- 2) Are the outcome payments to investors or returns reflective of how successful the program actually was?

### **Note to Reader(s):**

If you already have a strong knowledge of how social impact bond financing operates, please skip to Section 2 of this thesis. If you would like to receive a more detailed understanding of how social impact bond financing operates than Section 1 provides, please refer to the following:

- Center for Social Impact Bonds <[http://data.gov.uk/sib\\_knowledge\\_box/](http://data.gov.uk/sib_knowledge_box/)>
- Social Impact Bond Technical Guide for Service Providers  
<<http://www.marsdd.com/mars-library/social-impact-bond-technical-guide-for-service-providers/>>
- Frequently Asked Questions: Social Impact Bonds  
<<http://www.americanprogress.org/wpcontent/uploads/2012/12/FAQSocialImpactBonds-1.pdf>>
- From Potential to Action: Bringing Social Impact Bonds to the US  
<[http://mckinseysociety.com/downloads/reports/Social-Innovation/McKinsey\\_Social\\_Impact\\_Bonds\\_Report.pdf](http://mckinseysociety.com/downloads/reports/Social-Innovation/McKinsey_Social_Impact_Bonds_Report.pdf)>
- The Peterborough Pilot Social Impact Bond  
<<http://emmatomkinson.files.wordpress.com/2013/06/case-study-the-peterborough-pilot-social-impact-bond-oct-2013.pdf>>
- A Technical Guide to Commissioning Social Impact Bonds  
<[http://www.socialfinance.org.uk/sites/default/files/technical\\_guide\\_to\\_commissioning\\_social\\_impact\\_bonds.pdf](http://www.socialfinance.org.uk/sites/default/files/technical_guide_to_commissioning_social_impact_bonds.pdf)>

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# Section 1

## Fundamentals of Social Impact Bond Financing

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### What is a Social Impact Bond?

#### *The Nature of the Contract: A Social Impact Bond is Not a Bond*

To those of who are new to the idea of a social impact bond or commonly abbreviated as a SIB, it must first be addressed that a social impact bond is technically by definition not a bond. Whereas bonds provide a fixed income source of cash inflows and an absolute and guaranteed rate of return, social impact bonds contrast such that the rates of return vary from 0% to a capped return dependent on the outcomes achieved. In fact, social impact bonds are considerably riskier than traditional corporate bonds because if desired outcomes set by the separate party, the commissioner (which in most cases is the government), are not achieved, the private investor(s) risk(s) losing 100% of their invested capital, thereby receiving a rate of return of 0%. Furthermore, there currently exists no secondary market for SIBs and investors must remain invested within the contract(s) for a predetermined amount of time dependent on the terms of the contract(s).

Within finance, all securities are typically thought of as contracts between one or more parties. A social impact bond is no different. Like debt and equity, a social impact bond is a contract between multiple parties within the public sector, VCSE (voluntary, community, and social enterprise) sector, and private sector. Depending on the type of SIB issued, the parties involved can include a commissioner, a service provider, private investor(s), an intermediary, and a special purpose vehicle.

## ***The Purpose of a Social Impact Bond***

A social impact bond (as its name suggests) is aimed towards creating social impacts that achieve both improved social outcomes and cost savings for the public sector. Said differently, a SIB is a “unique approach to improving social outcomes within the community by incentivizing non-government investors to fund support programs.”<sup>1</sup> Furthermore, these public sector cost savings can now be used to provide financing for other (social) programs and/or potentially generate savings for the taxpayer as well.

Abstracting from the multitude of parties involved within this type of contract, it is easier to conceptualize the basic idea of it as a relationship between the public sector and the VCSE sector. Before introducing more parties and the private sector into the context, let’s consider only two parties: the government or commissioner (the public sector) and an external organization, the service provider (the VCSE sector). The contractual relationship between the two sectors are created when the external organization agrees to design and perform a social intervention with the goal of achieving a specific desired outcome(s) set out by the commissioner, and in exchange, receive a payout contingent on the success of the intervention. This contractual relationship is referred to as payment by results contracting.

## **SIB Financing: An Evolution of Payment by Results Contracting**

### ***Payment-by-Results Contracting / Performance-Based Contracting***

A social impact bond is a form of payment by results contracting (or performance-based contracting). Furthermore, a social impact bond is both a specific type of PbR contracting, and more importantly, a means of financing a PbR contract. Under PbR contracting, the government rewards the service provider with payments if the service provider can achieve certain results or

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<sup>1</sup> Source: Development of the PSM Methodology, Peterborough Social Impact Bond: An Independent Assessment, Ministry of Justice, May 2012

outcomes within a specified timeframe with the amount of these payments being entirely contingent on the quality of results produced by the service provider. In brief, PbR contracting is a relatively new business model of paying for providers of public services such that payments are linked to outputs as opposed to the generic historical approach of paying for inputs. For example, under the historical approach of paying for inputs, the public sector would pay for staff, buildings, property, plants, and equipment as a means to engage in activities, procedures, or implementations to deliver a certain output or outcome in the form of increased health or education levels or reduced poverty or crime rates within a certain region. In contrast, under PbR contracting, the public sector is skipping the purchase of inputs and paying directly for outputs and outcomes. By paying only for outputs, the nature of the PbR contract has now achieved the following:

- The external organization now has much greater flexibility in selecting its own inputs and procedures it believes would achieve the desired outcomes best.
- The quality of services or provisions delivered by the service provider is maximized because the nature of the contract incentivizes optimal performance as better performance is rewarded higher payments, and in doing so, allows the public sector to fully capture the expertise of the VCSE sector.

Before going further, it needs to be understood that PbR contracting can only exist between the service provider and commissioner (or public sector) once the following prerequisites are satisfied:

- The 3<sup>rd</sup> party service provider(s) can address the (social) issue better than the commissioner (public sector) is able to whether that be through a more cost-effective and/or impactful manner

- Outcomes / results of the service provision can be quantitatively measured and evaluated and this can be captured through an absolute or percentage increase or decrease in outcome / results

Understanding those aspects of PbR contracting brings us to the most important purpose of the nature of this form of contracting: The outcomes-based contract informs future policy making by generating a much wider evidence base for service implementations that work both efficiently in terms of cost and effectively in terms of impact.

### *How Social Impact Bond Financing Fits into All of This*

Social impact bonds were designed to address a major constraint of traditional PbR contracting: Service providers (social enterprises and charities) within the VCSE sector may not always have the necessary upfront working capital to perform the intervention, and may not be able to undertake the risk of potentially losing all of their capital invested within the contract. This not only limits opportunities for good service providers to work with the public sector, but also doesn't allow the public sector to capture the full expertise of what the VCSE sector has to offer, effectively causing each sector to be worse off. To address this, the private sector or private investor(s) are introduced as an additional party to the contract.

By introducing private investor(s) to the contract and having them finance the upfront working capital requirements of the project, social impact bonds create a bridge between social finance and personal finance and this can be captured through the perspectives of the three sectors:

- 1) **Public Sector:** Contract creates cost savings for the public sector and brings in new funding

- 2) **VCSE Sector:** Contract allows 3<sup>rd</sup> party service providers additional opportunities to engage with the public sector by having private investors fund their working capital requirements
- 3) **Private Sector:** Contract allows socially minded investors to earn a financial return on a cause they support

### ***Applications of Social Impact Bond Financing***

Applications of SIB financing can be directed towards services in society that are “characterized by a weak theory of service, such that the evidence on the conversion of inputs and activities to outcomes” may leave room for improvement.<sup>2</sup> Current examples of applications of SIB financing include service provisions directed towards issues involving homelessness, youth education, public health, crime/re-offending, and drug and alcohol addiction. Furthermore, while the name “social impact bond” suggests that this type of contract only addresses social issues, this is not the case as SIB financing can be applied to any area within society “characterized by a weak theory of service”.

The outcomes-based nature of the contract evaluates success through either a reduction or increase of some rate or level, depending on the specific social issue. With reference to the examples above, a successful service implementation by means of a SIB would cause a reduction in homelessness, crime, and drug and alcohol addiction rates or levels and vice-versa for the latter social issues. More importantly, these reductions or increases in rates can only be properly evaluated when compared to a baseline or counterfactual scenario (the status quo scenario that would have occurred in the absence of the SIB).

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<sup>2</sup> Source: Knowledge Box, Centre for Social Impact Bonds, <[http://data.gov.uk/sib\\_knowledge\\_box/knowledge-box](http://data.gov.uk/sib_knowledge_box/knowledge-box)>

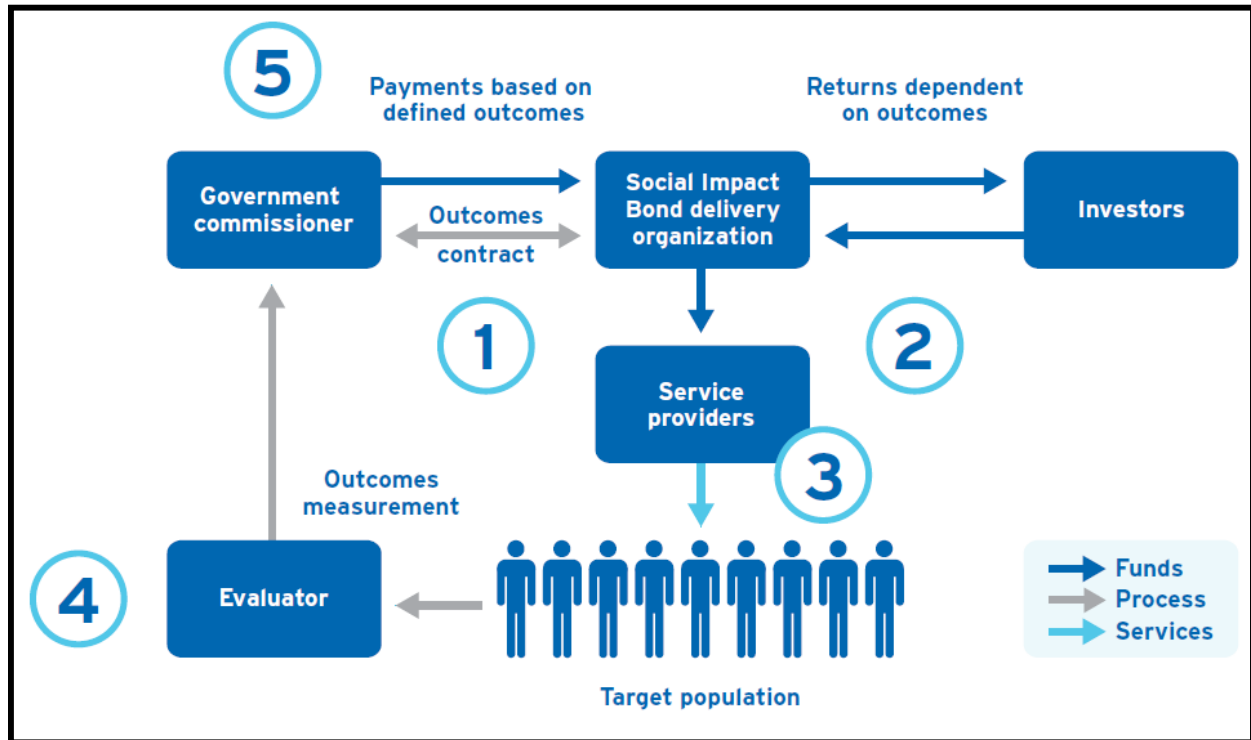
### ***Benefits of Social Impact Bond Financing***

Bringing the public, VCSE, and private sectors together unlocks the following capabilities:

- 1) Preliminary upfront financing for and encouragement of new innovative service provisions to tackle complex social issues
- 2) Allows the public sector to save money in the short and long-term time horizons and allows it to channel its funding into other service provisions or public issues
- 3) Expands or provides an opportunity for the VCSE sector to develop a reputation and grow as a result of awareness from working with the public sector
- 4) Introduces new partnerships between government and non-government organizations due to elimination of working capital constraint
- 5) A stronger focus on policy objectives backed up by a robust evidence base if the service implementation proves successful
- 6) Aligns risk tolerances such that risk is shifted away from the public sector and towards the private sector where private investors can earn a financial return
- 7) Drives the existence of high potential ideas that would otherwise not be implemented due to the lack of flexibility with prior traditional service implementation contracts
- 8) Value per dollar of public sector spending is increased and perpetual future savings for the public sector if service implementation is effective as adoption and implementation of promising programs can now be accelerated

# Understanding the SIB Model and the Various Parties Involved

## *The Basic Social Impact Bond Model*



Source: *Social Impact Bond Technical Guide for Service Providers*, Center for Impact Investing, November 2013

As represented in the figure above, the basic social impact bond model can be illustrated as a number of contracts represented by the inflows and outflows of funds, processes, and services amongst the various parties involved:

**Step 1:** The *commissioner / government* needs to address a social issue currently affecting the target population. Consequently, the *commissioner* creates a SIB contract with a social impact bond delivery organization or *intermediary*, which then establishes contracts with *service providers* and *private investors*. Although there is an *intermediary* here, this is not always the case as the *commissioner* can establish a contract directly with the *service provider(s)* and *private investor(s)* without an intermediary.

➤ **Role of the Intermediary**: Also known as the delivery agency, the intermediary “engage[s] and negotiate[s] with different stakeholders” and typically has the “technical skills [in negotiating contracts], financial knowledge, expert knowledge in the relevant policy areas, and the skills to negotiate with a range of stakeholders” including the government, investors, and local organizations and agencies potentially affected by implementing a SIB”.<sup>3</sup>

**Step 2:** *Private investor(s)* provide the working capital or financing towards the *intermediary* or directly towards the *service provider(s)*, which the *service provider(s)* use in designing a service implementation for the target population being affected by the social issue.

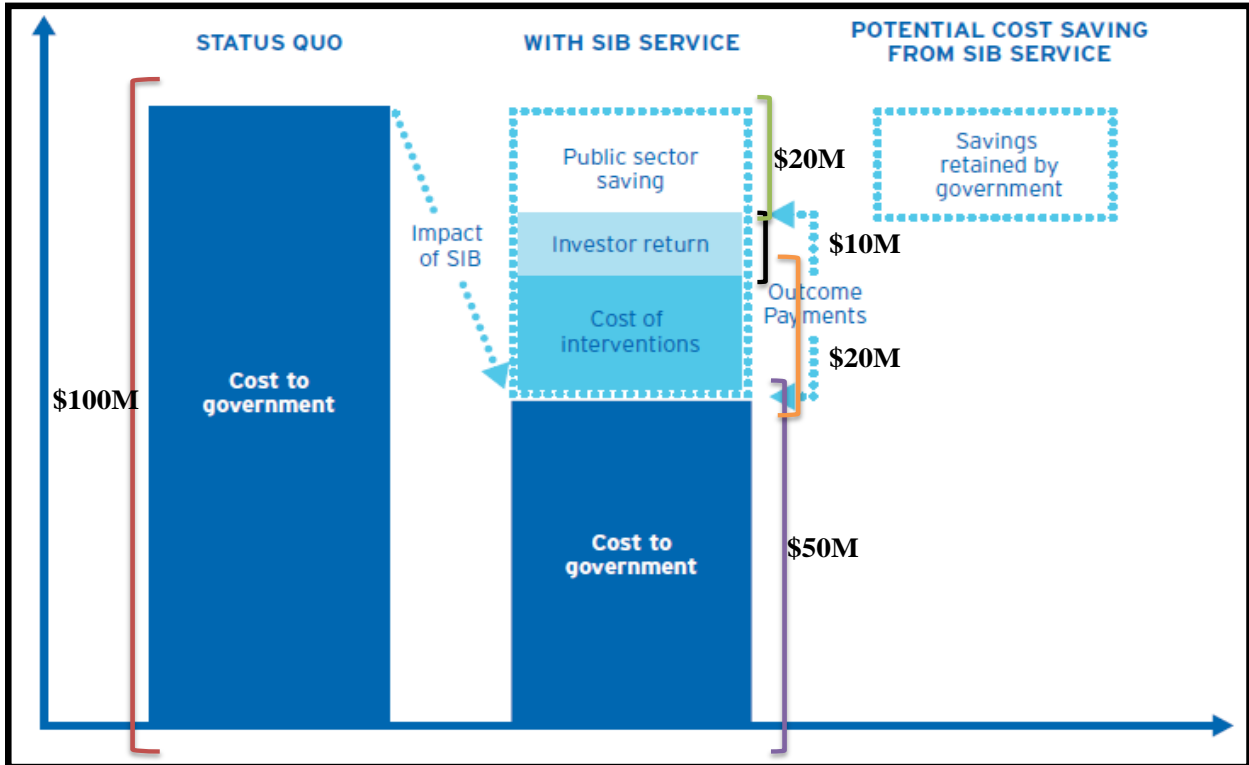
**Step 3:** The *service provider(s)* perform(s) the service implementation on cohort(s) of the *target population* or *service users* over a specified time horizon established within the SIB contract.

**Step 4:** Results / outcomes of the service implementation are compared against a baseline outcome (or outcomes of an appropriate control group). If successful, savings realized by the *commissioner* are distributed back to the *private investor(s)* in the form of payment (with the size contingent on the degree of success of the service implementation), allowing the *private investor(s)* to earn a return on their investment ranging from 0% (outcomes achieved from service implementation were not satisfactory) to a capped ROI percentage set forth in the contract by the commissioner.

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<sup>3</sup> Source: Knowledge Box, Center for Social Impact Bonds, <[http://data.gov.uk/sib\\_knowledge\\_box/knowledge-box](http://data.gov.uk/sib_knowledge_box/knowledge-box)>

## Costs, Savings, and Returns of SIB Financing



Note: Diagram taken from *Social Impact Bond Technical Guide for Service Providers*, Center for Impact Investing, November 2013  
 Note: Diagram was also modified by the author of this thesis.

The figure above illustrates a hypothetical scenario portraying the costs, savings, and returns of SIB financing. In the status quo scenario, the government / commissioner would traditionally spend \$100M per year in total on service programs. With the presence of the social impact bond, in the event that the service provision financed by the social impact bond is successful, the government incurs a cost of \$20M from implementing the proposed intervention, which would include the costs of the program itself, developing the contract, hiring the service provider, program evaluation, advisors / intermediaries, and performance management changes, and also a \$10M cost of providing a return to the private investors. Post successful implementation, the government / commissioner saves \$20M which it can now channel into other service provisions or have these savings realized by taxpayers.

One fundamental assumption in this scenario was that the service implementation be successful. Had the service provision been unsuccessful, the government does not incur the costs of \$30M and all costs (\$20M) are borne by the private investors.

## **Section 2**

# **Impact Evaluation of SIB Financing**

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### **Do Social Impact Bonds Actually Work?**

#### *Revisiting the Purpose of Impact Evaluation*

This section of this thesis is focused on exploring and answering the question: Do social impact bonds actually work? In short, in addition to what the observed results of a service implementation tell us, the bigger question that still remains to be answered is: Can positive successful social outcomes / results be accurately attributed to the SIB implementation itself, or was it simply correlated with it? Or taking a different approach, the inverse of the question: Can negative unsuccessful social outcomes / results be due to an unsuccessful SIB implementation, or was the SIB implementation actually partially effective, but not enough to overcome other explanatory variables / factors occurring in the background? This section proceeds into developing a research approach / methodology for impact evaluation of the service provision financed by the social impact bond.

#### *Setting Up a Hypothetical Scenario to Illustrate the Implementation of SIB Financing*

Before developing the research methodology of how to explore the motivating questions asked above, constructing a hypothetical scenario illustrating the effects of SIB financing would prove useful.

Variables Involved in Hypothetical Scenario	
Social Issue	<i>Social Issue X</i>
Social Output	<i>Social Output S</i>
Region (with Treatment Group)	<i>Region A</i>
Region (with Control Group)	<i>Region B</i>
Treatment Group	<i>Cohort T / Group T</i>
Control Group / Comparison Group	<i>Cohort C / Group C</i>
Time Horizon	<i>h</i>
Time Period (Beginning of SIB Implementation)	<i>t = 0</i>
Time Period (End of SIB Implementation)	<i>t = 1</i>

For the purposes of this hypothetical scenario, we will consider an issue, named *Social Issue X*. Now let's suppose the commissioner (which can either be the government / public sector or an entity of the private sector<sup>4</sup>) wanted to address *Social Issue X* occurring in *Region A*. Through a social impact bond contract, the commissioner would hire a service provider(s) to perform a service implementation financed by the private investor(s).<sup>5</sup> This service implementation would target a specific cohort of test subjects and this treatment group would be termed *Cohort T / Group T*. Furthermore, the hypothetical scenario will go under the assumption that after a time horizon of *h* (as agreed in the SIB contract), the results or outcomes of the service implementation that can be seen in time period *t = 1* (end of SIB implementation) are proven to be successful with respect to the terms of the SIB contract imposed by the commissioner. That is, rates/levels or changes in rates/levels in social issue X have increased/decreased to a level of social output S such that it has activated payments from the SIB contract<sup>6</sup>.

<sup>4</sup> Note: The commissioner does not have to be from the public sector. The only restriction is that the commissioner and service provider have to be different parties.

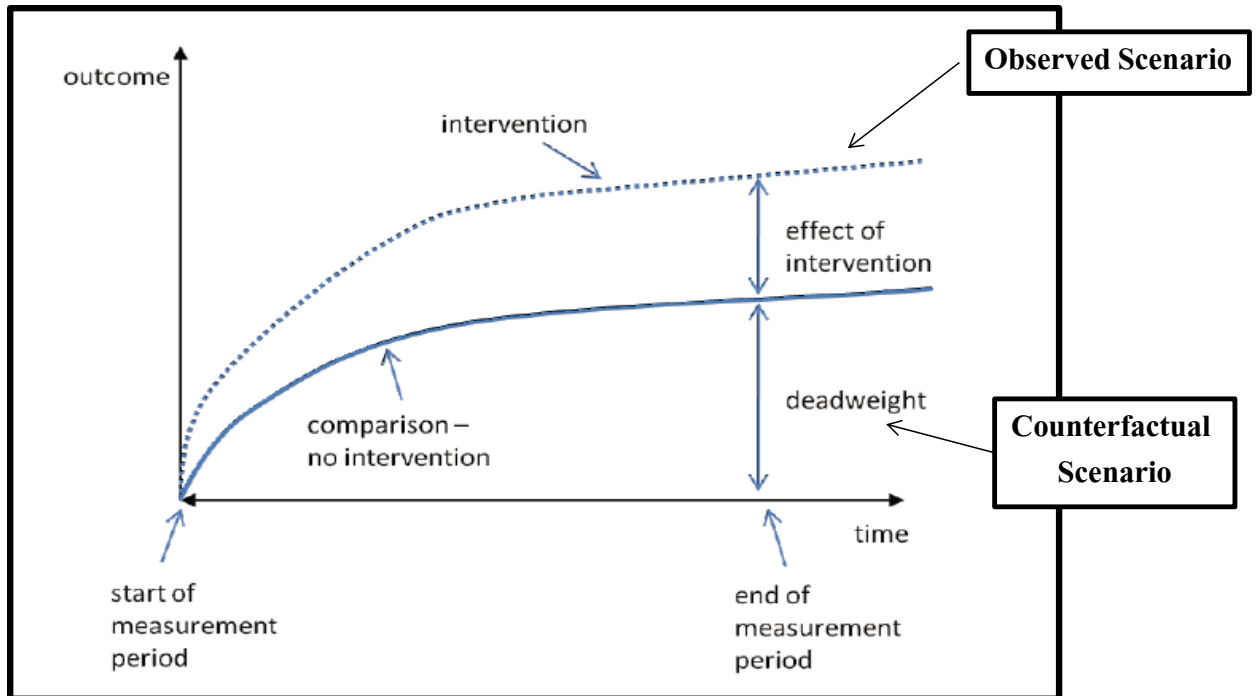
<sup>5</sup> Note: The service provider and private investor(s) may be the same party. If the service provider chooses, it can finance the service implementation itself.

<sup>6</sup> Note: Payments activated successfully due to an outcome that was compared to some type of baseline, whether that be an earlier point in time or a control/comparison group.

### ***The Counterfactual, Deadweight, and Attribution***

If we hold the assumption that the outcomes of the SIB service implementation were successful (such that the reduction / increase in the particular outcome was [socially] positive), then in evaluating the efficacy of the SIB, the counterfactual scenario must also always be taken into consideration. That is, in properly evaluating the impact of the SIB, it is necessary to compare the outcomes that occurred as a result of the intervention to an estimate of what the outcomes would have been had the implementation not occurred at all (within the status quo scenario), with the former scenario ideally illustrating a (socially) positive difference. In a perfect world to obtain a perfect estimate, this would entail comparing *Cohort T* with itself between the two scenarios. In an attempt to replicate scenarios that would occur in reality, we will instead use the control/comparison group, *Cohort C / Group C*.

In comparing the two outcomes between the former scenario and the counterfactual, we can calculate an implied estimated deadweight amount, the difference in outcomes that would have resulted regardless of the presence of a service implementation. More specifically, through utilizing deadweight, we are trying to capture the capital expenditure used on the implementation to produce the desired results that would have happened anyway. As an illustration, please see the diagram below.



Note: Original graphic was taken from Knowledge Box from the Center for Social Impact Bonds. Graphic was modified by the author of thesis to illustrate additional ideas.

Furthermore, by calculating deadweight, we now have the basis to calculate the impact (effect of intervention)<sup>7</sup> or attribution of the social impact bond implementation, such that the attribution is equal to the difference between the actual outcome figure and the deadweight figure.

## Evaluation Approaches Depends on the Nature of the Contract

### *Setting up the Framework Based on the Nature of the Contract and Outcome Payments*

Before we dive into the approaches used to calculate the level of impact and more importantly if causality is observed, we need to first set up the framework of how to conduct our statistical and/or econometrical tests. The setup of this framework is largely dependent on the nature of the contract or more specifically, the results the outcome payments are derived off.

Building off this, outcome payments may be based on the following:

<sup>7</sup> Note: The effect of intervention would be the effect that can be safely attributed to the presence of the service provision financed by the social impact bond.

- The difference between *Output S* with respect to *Cohort T* in  $t = 1$  and  $t = 0$ 
  - $S_{T,1} - S_{T,0}$
- The difference between *Output S* with respect to *Cohort T* in  $t = 1$  and *Cohort C* in  $t = 1$ 
  - $S_{T,1} - S_{C,1}$
- A difference within a difference such that the difference is measured on
  - $[(\text{Output } S \text{ for Cohort } T \text{ in } t = 1) - (\text{Output } S \text{ for Cohort } T \text{ in } t = 0)] - [(\text{Output } S \text{ for Cohort } C \text{ in } t = 1) - (\text{Output } S \text{ for Cohort } C \text{ in } t = 0)]$
  - $[S_{T,1} - S_{T,0}] - [S_{C,1} - S_{C,0}]$

Note that the difference does between the two time periods does not necessarily have to be between  $t = 1$  and  $t = 0$ . Based on what is specified in the contract, it may be  $t = -1$  (one year before the beginning of implementation),  $t = -2$ , and etc.

### ***Binary Measures Vs. Frequency Measures***

Further complicating the nature of the contract is whether the outcome payments are being evaluated on a binary or frequency measure.

A binary measure “splits participants into two categories” such that “one category represents the desired state (e.g. not reconvicted, clean drug test, housed or employed) and one the undesired state (reconvicted, drug user, homelessness or unemployed)”<sup>8</sup>. As a result, we will have the variable  $p_T$  representing the proportion of *Cohort T* falling into the desired category and the variable  $(1 - p_T) = q_T$  representing the proportion of the *Cohort T* falling into the undesired category. Similarly, we’ll let the variables  $p_C$  and  $q_C$  represent the respective proportions of the *Cohort C*.

Frequency measures “capture the extent of improvement” and “involve counts or scales”<sup>9</sup>. In keeping with our original variables from the hypothetical scenario, to represent

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<sup>8</sup> Source: Knowledge Box, Center for Social Impact Bonds, <[http://data.gov.uk/sib\\_knowledge\\_box/knowledge-box](http://data.gov.uk/sib_knowledge_box/knowledge-box)>

<sup>9</sup> Source: Knowledge Box, Center for Social Impact Bonds, <[http://data.gov.uk/sib\\_knowledge\\_box/knowledge-box](http://data.gov.uk/sib_knowledge_box/knowledge-box)>

frequency measures, we will use the variables  $S_T$  and  $S_C$  to represent frequency outputs of *Cohort T* and *Cohort C*.

### ***Measuring Outcomes on Percentage Points Vs. Percentage Change***

As mentioned earlier, payments from the commissioner are based on outcomes, which are based on differences between the status quo and the scenario with the presence of the SIB. When trying to measure the difference between the two scenarios within a binary measuring system, the difference in percentage points between two rates (e.g.  $p_T - p_C$ ) are used. Contrarily, within a frequency measuring system, a percentage change  $[(\text{Output in } t = I \text{ less output in } t = 0) / (\text{Output in } t = 0)]$  (e.g.  $S_{T,I} - S_{C,I} / S_{T,I}$ ) is used instead.

### ***Addressing Attribution Issues***

Prior to or when evaluating the efficacy of a service implementation financed by a SIB, two issues that could bias the observed results are the “Creaming” or “Cherry Picking” problem and the absence of a service gap. More specifically, when performing impact evaluation, we first need to know whether there was a control in place prior to the start of the implementation for targeting individuals who were easier to treat, and equally important, if there were other service provisions occurring simultaneously. In effect, these two issues either need to be addressed prior to the start of the service provision or need to be controlled for during impact evaluation.

### ***Attribution and Deadweight Effects***

We need the counterfactual output to calculate the magnitude of deadweight. We can then utilize the magnitude of deadweight to calculate the magnitude of attribution, such that the true impact (or lack of) from the SIB implementation is equal to the difference between the observed output level and the magnitude of deadweight. In addition to capturing the impact of the SIB, this

difference also allows us to statistically infer (or disprove) causality between the observed social output and the service provision with [100% (1- $\alpha$ )] confidence.

## Two Approaches to Infer Causality and Attribution

In the next few sections, we are going to assume that you have the data set associated with the social impact bond pilot(s) for both the social output, the dependent variable  $y$  and the factors that may explain the output, the explanatory variables  $x_1, x_2, x_3, \dots, x_n$ , and wanted to test for causality and attribution.

### *Outcome Payment Structure for Hypothetical Scenario*

The outcome payments will be based on the difference in percentage changes for social output  $S$  between *Cohort T* and *Cohort C* in  $t = 1$ . That is, we will assume that payments will be activated if at the end of the SIB time horizon  $h$  in time  $t = 1$ ,  $[(y_{T,1} - y_{C,1}) / y_{T,1}] \geq D_{C,T,1}$ , where  $D_{C,T,1}$  represents a threshold percentage change that must be crossed. This implicitly assumes that outcome payments are activated on the basis that the treatment group experiences an increase of some social output. On the other hand, if outcome payments are activated on the basis that the treatment group experiences a reduction of some social output, the equation would be redefined into  $[(y_{T,1} - y_{C,1}) / y_{T,1}] \geq -D_{C,T,1}$ .

In this hypothetical scenario, I have already assumed that outcome payments are made on the basis of a comparison between the treatment group and the comparison group in the same time period. This does not always have to be the case as outcome payments can be based on any of the payment scenarios stated earlier. Furthermore, by assuming this, a counterfactual scenario needs to be created for both the treatment group and the comparison group, whereas the counterfactual scenario would only needed to be created for the treatment group if outcome

payments were based on the difference within the treatment group over two or more time periods.

### ***Approach #1: Events Study***

#### ***Formulating the Probabilistic Multiple Regression Equation***

To infer the counterfactual, we need to build a probabilistic multiple regression equation accounting for explanatory factors (e.g. macroeconomic variables or characteristics of sample) that may have affected the social output. Because of how the outcome payments are structured, two regression equations need to be built, one for the treatment group and one for the comparison group.

#### ***➤ Identify the Explanatory Variables that May Explain the Output***

E.g. When looking at the change in recidivism rates, possible explanatory variables may include regional levels of poverty, population, criminal activity, unemployment / employment, education, age group, marital status, and nationalities/ethnicities.

#### ***➤ Stepwise Regression and Correlation Matrix***

If we look at the potential list of variables in Step 1, the list can get quite large, and the number of corresponding  $\beta$  coefficients can get even larger if we further introduce curvilinear terms and interaction terms. As a result, we will utilize a stepwise regression to both reduce the number and identify only those explanatory variables that are significant at  $(1-\alpha)$ . Thus, we can reduce our list to those variables with a statistically significant T-Value and P-Value. We can also generate a correlation matrix to illustrate both the strength and direction of each individual relationship between  $y$  and  $x_i$ .

➤ ***Scatterplot Illustrating Relationship Between y and  $x_i$***

Now that we have our statistically significant  $x_i$  variables, we need to take into account that the relationship of one or more of these variables may not be linearly related to y. Through a scatterplot, we can capture any nonlinear relationships between y and  $x_i$  and introduce variations of the explanatory variables accordingly. (E.g.  $x_i^2$ ,  $\ln(x_i)$ ).

➤ ***Repeating Stepwise Regression and Correlation Matrix on Variations of Variables***

After running the stepwise and correlation, we can now utilize a stronger model that accounts for nonlinear relationships statistically significant at  $\alpha$ . At this stage, generating the correlation matrix is crucial because it allows us to observe if any of our independent variables exhibit multicollinearity with each other or as a group, which may distort our interpretation of its respective  $\beta$ , and we can adjust accordingly by removing explanatory variables that exhibit a correlation  $r \geq .8$  and eliminate the explanatory variable with the higher p-value.

➤ ***The Probabilistic Multiple Regression Equation***

At this point, we should have all of our statistically significant independent variables (and variations of independent variables), and interaction terms between various independent variables. Assuming we only have two quantitative variables, our multiple regression equation will look like the following:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_3 x_4 + \varepsilon$$

*where  $x_1$  and  $x_2$  represent the quantitative variables,  $x_3 =$  variation of  $x_1$ ,  $x_4 =$  variation of  $x_2$ , and  $x_3 x_4$  represents an interaction term such that the variations can range from ln, sq, sqrt ( $x_i$ ), etc.*

### ***Statistically Inferring Causality, Deadweight, and Attribution***

**Step 1:** Now that we have our multiple regression equation for the counterfactual, we can predict with  $[100\%*(1-\alpha)]$  confidence for a predicted value of  $\hat{y}$  within the interval of  $[a, b]$ . This  $\hat{y}$  represents the magnitude of the deadweight effect of the social impact bond.

**Step 2:** We now calculate our abnormal return in  $t=I$  by taking the difference between the actual observed  $y$  and our predicted  $\hat{y}$  in  $t=I$  from our multiple regression equation of the counterfactual. This difference  $(y-\hat{y})$  is the magnitude of the attribution, and can be captured in the range of  $[y - b, y - a]$ .

**Step 3:** Dividing this difference by our standard error,  $\epsilon$ , will provide with us a t-statistic, and if statistically significant (based on sample size, degrees of freedom, and p-value), we can statistically conclude with  $[100\%*(1-\alpha)]$  confidence that the service implementation and hence the social impact bond did cause the difference in observed output or outcome.

### ***Adding Some Granularity to the Explanatory Variables***

An equally interesting thing to observe for is if the presence of the social impact bond may have caused an effect on the explanatory factors (e.g. macroeconomic variables) which in turn had the explanatory factors cause a greater effect on the social output than they would have otherwise in the absence of the social impact bond. If we characterize the presence of the social impact bond as a dummy variable, then we can capture this effect through the coefficients of the interaction terms between the dummy variable and the quantitative variable(s). If we take the same regression equation posed earlier, our new regression equation will result to:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_3 x_4 + \beta_7 x_3 x_5 + \beta_8 x_4 x_5 + \epsilon$$

*where  $x_1$  and  $x_2$  represent the quantitative variables,  $x_3 =$  variation of  $x_1$ ,  $x_4 =$  variation of  $x_2$ ,  $x_5$  represents the SIB dummy variable and  $x_i x_j$  represents an interaction term such that the variations can range from ln, sq, sqrt ( $x_i$ ), etc.*

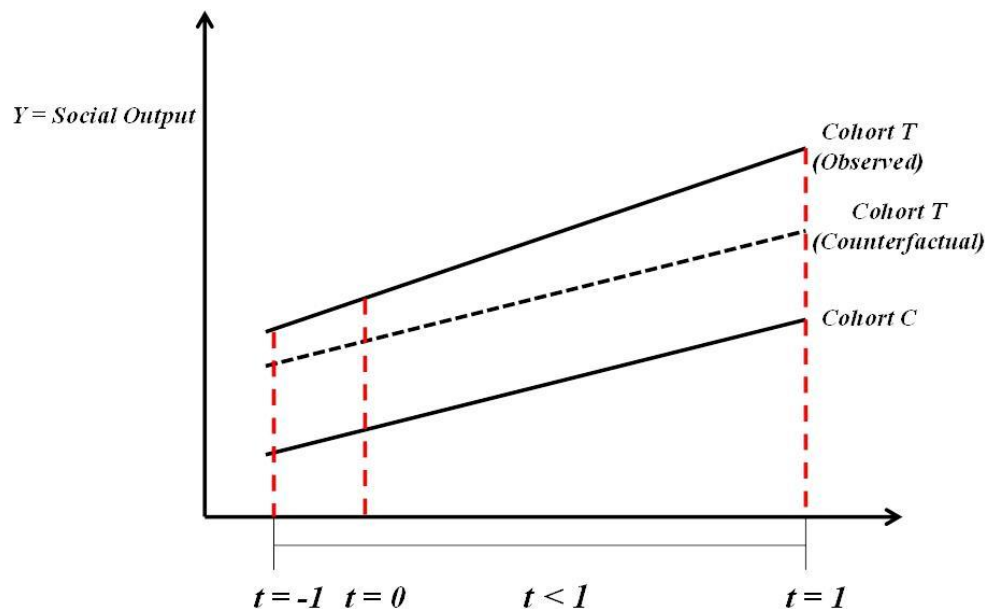
In the presence of a social impact bond, we can now see if there was an interaction between the presence of the social impact bond and explanatory variable if that specific  $\beta$  associated with the interaction term was statistically significant and  $\neq 0$ .

## ***Approach #2: Differences in Differences***

### ***Shortfalls to Approach #1***

As a second approach, utilizing a differences in differences method allows us to account for unobserved, immeasurable, and omitted explanatory variables that may affect the social output which the first approach may fall short of capturing. Furthermore, there is also an  $\alpha\%$  chance that Approach #1 produces a type 1 error, and employing a differences in differences method could also serve as a sanity check to the conclusions implied by Approach #1.

### ***Setting Up the Framework for a Differences-in-Differences Study***



Referring back to our hypothetical scenario, in order to effectively utilize this approach, ***Cohort T*** and ***Cohort C*** need to exhibit a parallel trend pattern for  $t < 0$  (see diagram above). Ideally, ***Cohort T*** and ***Cohort C*** would also contain virtually identical samples, but that may be

difficult to control for in practice. Instead, what we can control for is the effect of an economic shock or reform through the parallel trend assumption for the social output levels in  $t < 0$ . With reference to the diagram above, an ideal candidate would exhibit a (near) constant difference of  $Y_T - Y_C = D_{T,C}$  for some time horizon  $t < 0$ . As we approach  $t = 0$ , we observe a slight divergence from the parallel trend, with the difference getting larger, and the full effect of the social impact bond in  $t = 1$ . Now suppose the difference between social outputs for *Cohorts T* and *C* have hovered around  $D_{T,C}$  for  $t < 0$ . With reference to the diagram above, we can capture the full magnitude of the social impact bond's effect in  $t = 1$  by taking the observed social output for *Cohort T* in  $t = 1$  less  $D_{T,C}$ .

### ***Capturing the Effect with a Regression***

To capture the magnitude of the SIB, we can also create a regression equation:

$$y_{it} = \beta_0 + \beta_1 x_i + \beta_2 T_t + \beta_3 X_i T_t + \varepsilon_{it},$$

where  $X_i$  is a dummy variable taking the value 1 if it is the treatment group and 0 if it is the comparison group,  $T_t$  is a dummy variable taking the value 1 in the time period at which the SIB ended and 0 in the time period at which the SIB began, and  $X_i T_t$  as the interaction effect of the SIB on the treatment group

Utilizing this regression on all our data points ranging from  $t < 1$  to  $t = 1$ , we can capture  $\beta_3$  and statistically infer the magnitude of the SIB with 100%  $(1-\alpha)$  confidence. Furthermore, we can also statistically infer causality by performing a test on the statistical significance of  $\beta_3$  at the  $\alpha$  level.

## Section 3

# Analysis of the HMP Peterborough SIB Case Study

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### *Application of this Thesis on a Case Study*

In Section 1, this thesis provided an overview of how social impact bond financing works and the various parties involved in the contract(s). In Section 2, this thesis proposed two approaches to evaluate the impact of the service provision financed by the social impact bond. In this section, this thesis aims to first take the abstract concepts discussed in Section 1 and illustrate them in practice. This thesis then attempts to take the two approaches discussed in Section 2 and apply them to a case with the available data.

The HMP Peterborough social impact bond pilot was the first SIB initiative to be launched. The Ministry of Justice (MoJ) (commissioner) releases interim results every few months, and since those releases, there has existed quite an amount of commentary and writing on the observed positive (interim) results. Full cohort results were published on April 2014 and this thesis attempts to break down those figures and add some more color to other factors that may be driving these observed figures.

The reason the HMP Peterborough SIB pilot was chosen as the case study for this thesis is because it is the only SIB initiative with publicly available data to be analyzed. Even with the release of these interim results from the MoJ, publicly available data surrounding this initiative is very limited and this thesis will be limited in some respects to draw a full conclusion.

# Overview of the HMP Peterborough Social Impact Bond

## Background on the HMP Peterborough SIB Pilot

Local Area	Region	Start Date of Pilot	Length of Pilot	Re-Conviction Measure
Peterborough	East of England	Sep-10	6 Years	Frequency Measure
HMP Doncaster	Yorkshire and The Humber	Oct-11	4 Years	Binary Measure

### Details of the Peterborough Social Impact Bond Initiative

#### Outcomes: Re-Conviction Events

- Who the Social Impact Bond Initiative Targets:*
  - Gender: **Male** Prisoners
  - Age: **18<sup>+</sup>**
  - Short-Sentenced: **<12 Months** in Prison
- Evaluations Will Be Based on the Results of 3 Cohorts*
  - **Cohort 1: Sep 9, 2010 – Jun 30, 2012**
  - Cohort 2: Jul 2, 2012 – Dec 31, 2013
  - Cohort 3: N/A
- Importance of Offender Group Reconviction Scores (OGRS):*
  - Measures the offenders’ probability of reoffending again based on **age, gender, and criminal history**
  - Ranges in [0 -1] with a lower score representing a lower probability of re-offending, and vice-versa
- Outcomes Based Evaluation: Frequency Measure vs. Binary Measure:*
  - Peterborough SIB utilizes frequency measure: **# of Re-Conviction Events per 100 Offenders**
  - Doncaster SIB utilizes binary measure: **Re-Conviction Rates - % of Offenders that are Re-Convicted**
- Re-Conviction Events vs. Reoffending Events*
  - Both: 12 months for an offense to occur after release and further 6 months to be re-convicted/ proven
  - Re-Conviction Events: Excludes Cautions; Reoffending Events: Includes Cautions
  - No cherry-picking and service gap problems

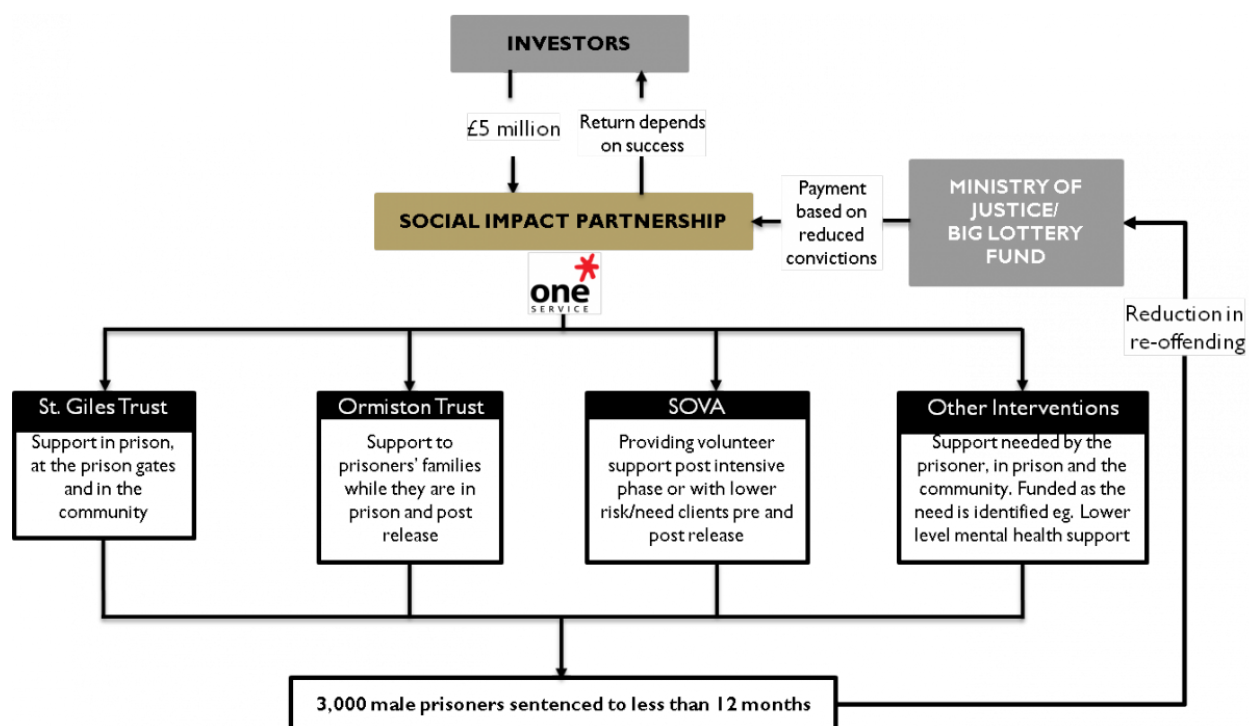
*Note: Data was assembled from multiple sources. Image was produced by the author of thesis.*

The Peterborough social impact bond, the first social impact bond pilot, was launched in September 9, 2010. The purpose of the SIB was to “reduce the reconviction rates of short-sentence male prisoners leaving HMP Peterborough”<sup>10</sup>, one of the local prisons within the East of England. More specifically, the service implementation financed by the SIB provides interventions for adults (18<sup>+</sup> of age) that have received custodial sentences of less than 12 months that were discharged from the HMP Peterborough prison. Demographically, these “short-sentence prisoners currently receive little or no statutory support from Probation Services”,

<sup>10</sup> Source: Development of the PSM Methodology, Peterborough Social Impact Bond: An Independent Assessment, MoJ, May 2012

indicative of a service gap with “their reoffending rates particularly high, with over 60% reoffending within one year of release”, indicating a potential regional cherry-picking problem.<sup>11</sup>

**Parties Involved in the Contract (Abbreviated)**



Source: Presentation from David Hutchinson, CEO of Social Finance, 2012

**Commissioner:** The *Ministry of Justice*, a government department within the UK, is the *commissioner* for this SIB but does not play an active role in managing the service implementation aside from hiring the *intermediary*, *Social Finance*, and financing the payments to the private investors.

- This is a special case where the commissioner plays more of a passive role and allows the intermediary to play the active role.

**Service Providers:** *One Service* manages the service intervention, with the *St. Giles Trust*, the *Ormiston Trust*, and *SOVA* providing the actual service interventions to the prison offenders. (See diagram above for a more in-depth description of various service providers.)

<sup>11</sup> Source: Peterborough Social Impact Bond, Social Finance, 2011

**Intermediary:** *Social Finance* is acting as the *intermediary* for this SIB and is in charge of raising the required social investment from the *private investors*. Social Finance is raising £5M from *private investors* in the time span of 6 years evenly<sup>12</sup>.

**Special Purpose Vehicle:** *Social Impact Partnership* is the SPV setup by *Social Finance* that would receive the payments from the MoJ and the Big Lottery Fund in the scenario where positive social outcomes were achieved, i.e. reoffending for male, short-sentenced prisoners were reduced relative to the comparison group

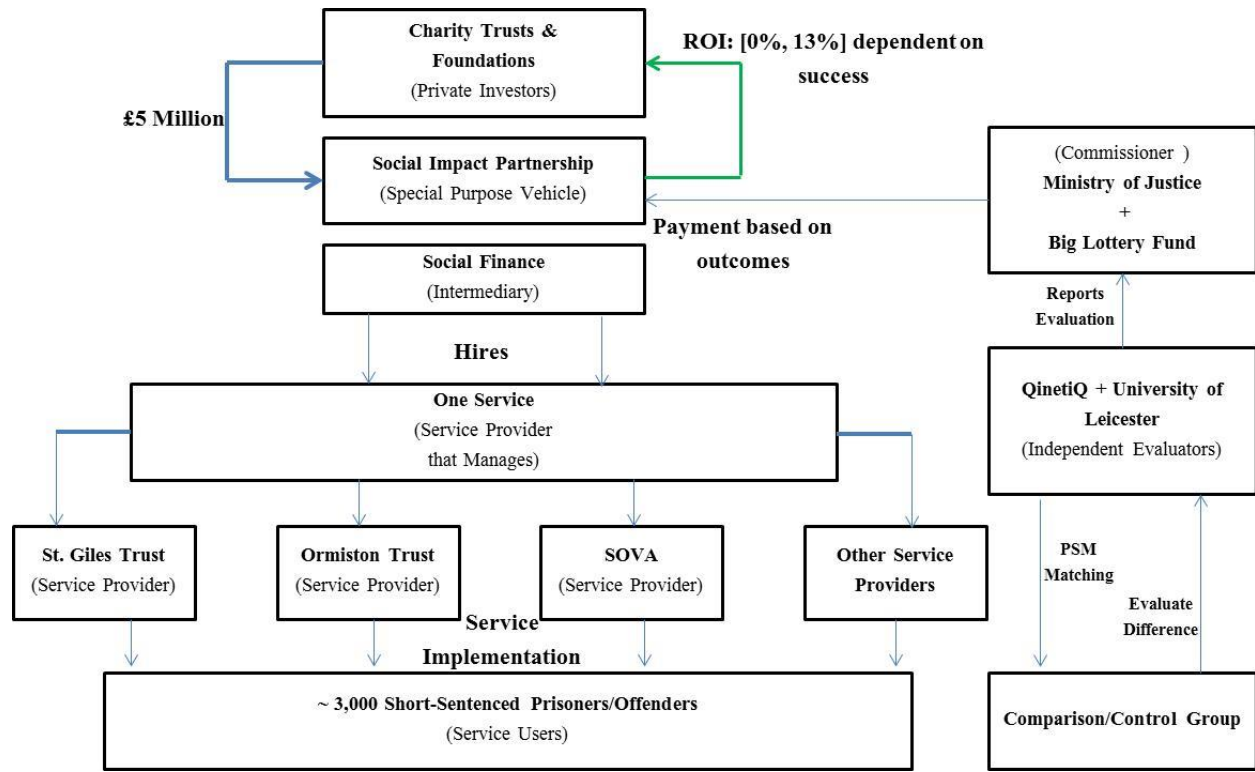
- **Role of a SPV:** Acts as “a legal entity that is created solely for a particular financial transaction” and “is a common approach when contracting with a group of entities in public private partnerships. Furthermore, “investor’s funding is channeled into the SPV which enters into a contract with the commissioner. The SPV then acts as the delivery body for the intervention”.<sup>13</sup>

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<sup>12</sup> Source: Peterborough Social Impact Bond, Social Finance, 2011

<sup>13</sup> Source: Knowledge Box, Centre for Social Impact Bonds, <[http://data.gov.uk/sib\\_knowledge\\_box/knowledge-box](http://data.gov.uk/sib_knowledge_box/knowledge-box)>

**Parties Involved in the Contract (Full)**



Note: Data was assembled from multiple sources. Image was produced by the author of thesis.

**Independent Assessor(s):** *QinetiQ* and the *University of Leicester* are the independent assessors evaluating the efficacy of the social impact bond and the amount of payments due to the investors once the SIB pilot is over. These two assessors were selected by the Ministry of Justice based on competitive tender.

**Private Investors:** This group includes the *Barrow Cadbury Charitable Trust*, *Esmée Fairbairn Foundation*, *Friends Provident Foundation*, *Henry Smith Charity*, *Johansson Trust*, *Paul Hamlyn Foundation*, and the *Tudor Trust*.<sup>14</sup> According to *Social Finance*, these investors have a strong focus on the social cause and understand the interventions taking place.

<sup>14</sup> Source: The Peterborough Pilot Social Impact Bond, Alex Nicholls & Emma Tomkinson, October 2013

### ***Measurement of Social Outcomes***

The measure used between the two groups by the evaluators is the “frequency of re-conviction events” defined as “the number of times an offender is re-convicted in the 12 months following release from prison”<sup>15</sup>, as opposed to a re-conviction rate which is a binary measure which measures the proportion of offenders that do re-offend. The frequency measure “counts the number of times an offender is re-convicted at court, regardless of the number of re-offences committed”<sup>16</sup>. The frequency measure used is re-convictions as opposed to re-offences because “the number of court appearances is more closely linked to costs to the criminal justice system than the number of offences committed”<sup>17</sup>.

The Peterborough SIB utilizes three cohorts (Cohort 1, 2, and 3) of approximately 1,000 offenders in each. The length of time that each cohort exists for is dependent on the time required for 1,000 short-sentenced (serving less than 12 months) offenders to be released, but not longer than 24 months per cohort; whichever occurs first. Cohort 1 of the Peterborough SIB is based on a 22-month cohort lasting from September 2010 to June 2012.

### ***Measuring the Counterfactual / Creating the Control Group***

To measure the efficacy of the SIB initiative, the evaluators analyze the frequency of re-conviction outcomes for a matched control group from all local prisons within England and Wales (excluding HMP Peterborough and Doncaster). This matched control group’s frequency levels of re-conviction events will then be used as a comparison against that of the re-conviction events originating from the HMP Peterborough treatment group. This control / comparison group will be developed via propensity score matching (PSM) and will create a comparison group of

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<sup>15</sup> Source: Development of the PSM Methodology, Peterborough Social Impact Bond: An Independent Assessment, Ministry of Justice, May 2012

<sup>16</sup> Source: Development of the PSM Methodology, Peterborough Social Impact Bond: An Independent Assessment, Ministry of Justice, May 2012

<sup>17</sup> Source: Development of the PSM Methodology, Peterborough Social Impact Bond: An Independent Assessment, Ministry of Justice, May 2012

prisoners that were released within the same time horizon as that of prisoners released from the treatment group. Via PSM, characteristics of prisoners are now controlled for when evaluating impact as characteristics of members within the comparison group should be very similar to that of the treatment group. Each member within Cohort 1 will be matched to at most and ideally 10 similar offenders from other local prisons.<sup>18</sup>

### ***Propensity Score Matching***

The evaluators utilize a logistic regression method matching prisoners based on the following characteristics:

- Age at Release
- Nationality / Ethnicity
- Age at First Offense
- # of Previous Offenses
- # of Previous Convictions
- Length of Sentence
- Specific Index Offenses

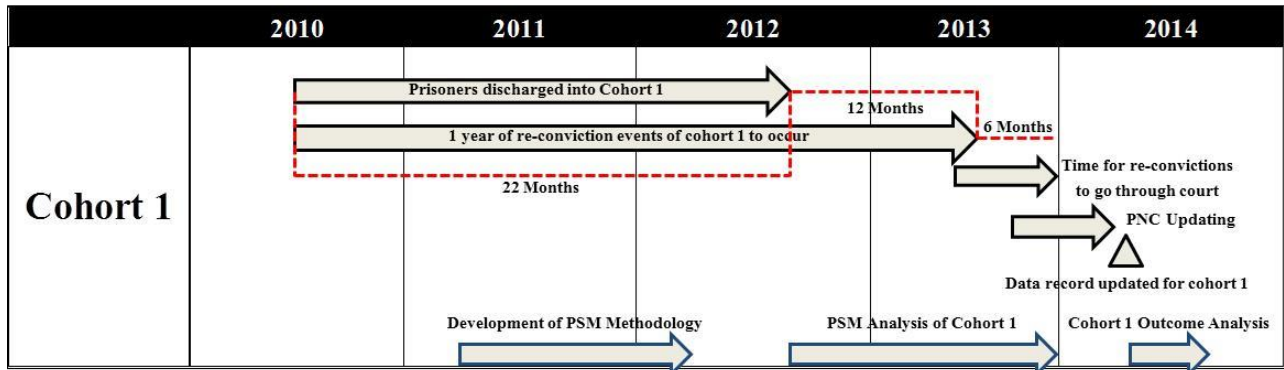
Utilizing these explanatory variables in the logistic regression, offenders between the treatment group and comparison group are then matched up to a statistical significance level of  $\alpha = 20\%$ . Furthermore, if every cohort within the treatment group contains about 1,000 offenders, the comparison group should contain approximately 10,000 offenders.

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<sup>18</sup> Note: Due to noisy data within the Police National Computer (PNC), a perfect match may not always be possible and a ratio of 1:10 may not always be possible due to missing data for some prisoners.

*Time Horizon for Cohorts*

**Time Horizon for Cohort 1**



*Note: Data was Development of the PSM Methodology released by MoJ. Image was produced by the author of this thesis.*

The Peterborough SIB will be evaluated such that “the final results for the Peterborough pilot will be based on a 12 month re-conviction measure which counts offences 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)”.<sup>19</sup> Consequently, offenders are evaluated over an 18 month time period (re-offences included in the latter 6 months as well), and this 18 month time period will either end when 24 months has passed or as seen in Peterborough’s Cohort 1’s case, when approximately 1,000 offenders were released in what occurred to be a 22 month period (as opposed to 24). Cohort 1 (which began on September 9, 2010) was completed in June 30, 2012 and Cohort 2 began on July 1, 2012.

Occurring simultaneously in the background is the propensity score matching to compose the comparison cohort. Payments for Cohort 1 (contingent on its success) are expected to be made in summer of 2014, as it takes an additional few months to update and process the data from the Police National Computer (PNC) and evaluate the success between the two cohorts.

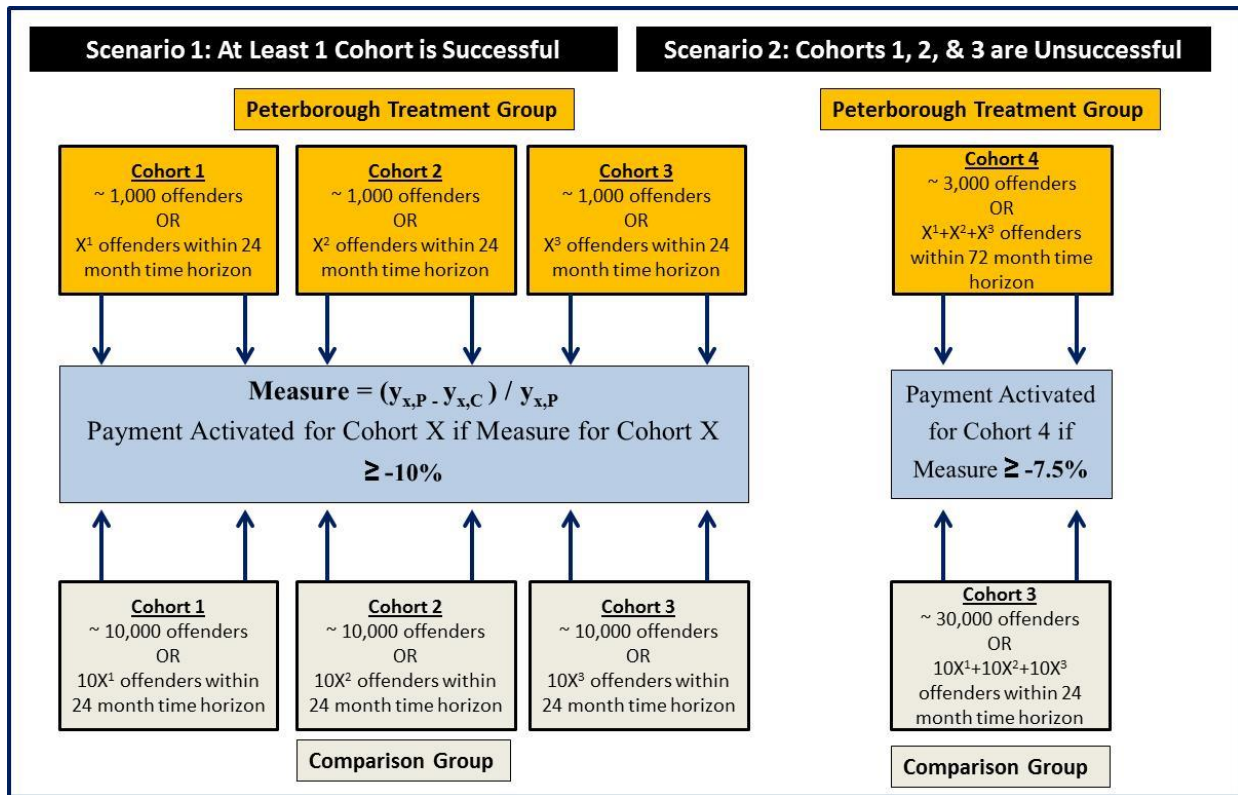
<sup>19</sup> Interim Re-Conviction Figures for Peterborough and Doncaster, Payment by Results Pilots, MoJ, April 2014

### ***Payment Scheme***

The private investors will be paid a return on their investment conditional on the “observed improvement of reconviction events of the released prisoners” from HMP Peterborough.<sup>20</sup> Payments (which include a repayment of capital and a return if required social outcomes are achieved) to the private investors will be made by the Ministry of Justice and the Big Lottery Fund. Investors get a return on capital ranging from 0% (because they stand to lose all their invested capital) to a capped 13% (set by the commissioner) if at least a 10% reduction in re-conviction events occurs between that of the treatment group and that of the control group. That is, in order to activate payments from the SIB for any of the three cohorts,  $[(Y_{T,i} - Y_{C,i}) / Y_{T,i}] \geq -10\%$ , where  $i$  represents the respective cohort. Should this 10% reduction not be achieved for any of the three cohorts, all three cohorts will be pooled together forming Cohort 4 of approximately 3,000 prisoners and success will therefore be based on a 7.5% reduction in re-conviction events relative to that of the control/comparison group. That is, should the three prior cohorts prove unsuccessful in crossing the threshold, then in order to activate payments from the SIB,  $[(Y_{T,1} + Y_{T,2} + Y_{T,3}) - (Y_{C,1} + Y_{C,2} + Y_{C,3})] / (Y_{T,1} + Y_{T,2} + Y_{T,3}) \geq -7.5\%$ .

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<sup>20</sup> Source: Development of the PSM Methodology, Peterborough Social Impact Bond: An Independent Assessment, Ministry of Justice, May 2012



Note: Diagram was produced by author of thesis.

The Ministry of Justice (together with the Big Lottery Fund) will pay a special purpose vehicle (Social Impact Partnership) set up by Social Finance (that in turn transfers the funds over to the private investors) “a fixed unit payment for each reduced conviction event in a SIB cohort less than a matched baseline cohort, providing the reduction in conviction events in the SIB cohort is at least 10%”<sup>21</sup> or in the latter scenario, a 7.5% reduction.

Investors receive a corresponding increasing return capped at 13% IRR (as a result of combined payments from both the MoJ and the Big Lottery Fund) over an eight year period<sup>22</sup>. The total payment provided from the MoJ is capped at £8M.<sup>23</sup> Because private investors stand to lose all of their investment in the program, the annual IRR for private investors is represented by [-100%, 13%]. Furthermore, if the SIB reduces the frequency of re-conviction events by at least

<sup>21</sup> Source: Development of the PSM Methodology, Peterborough Social Impact Bond: An Independent Assessment, Ministry of Justice, May 2012

<sup>22</sup> Source: Peterborough Social Impact Bond, Social Finance, 2011

<sup>23</sup> Source: The Peterborough Pilot Social Impact Bond, Alex Nicholls and Emma Tomkison, October 2013

10% in the first scenario or by at least 7.5% in the second scenario, then “a minimum payment equivalent to a return of 2.5% per annum would be released by the MoJ and Big Lottery Fund”<sup>24</sup>, and on an increasing trend as the threshold is crossed further and further, capped at £8M, equivalent to an approximate 13% IRR.

## **Impact Evaluation of the HMP Peterborough SIB**

In the proceeding segments, I will try to evaluate the attribution of the service implementation financed by the Peterborough SIB via the two approaches I described in Section 2 of this thesis.

### ***Re-Conviction Events vs. Reoffending Events***

Outcome payments for the Peterborough SIB are based on a relative reduction in re-conviction events between the HMP Peterborough prison treatment group and the national prisons comparison group. While re-conviction events are better linked financially to the costs incurred by the public sector, this thesis examines the impact of the SIB through the measure of the frequency of reoffending events. The reasoning for this is two-fold: In examining the social impact of a service implementation, reducing the frequency of reoffending events not only creates more value for society (as re-conviction events underestimate and are a function of reoffending events), but also establishes a stronger evidence base of service implementations for future policy making.

### ***Addressing the Cherry Picking Problem and the Service Gap Issue***

The Peterborough SIB outcome payments are designed such that outcomes are measured on the entire cohort of those offenders sentenced within HMP Peterborough. This eliminates the cherry-picking problem on the prisoner-level but there may still exist some bias as to why the

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<sup>24</sup> Source: The Peterborough Pilot Social Impact Bond, Alex Nicholls and Emma Tomkison, October 2013

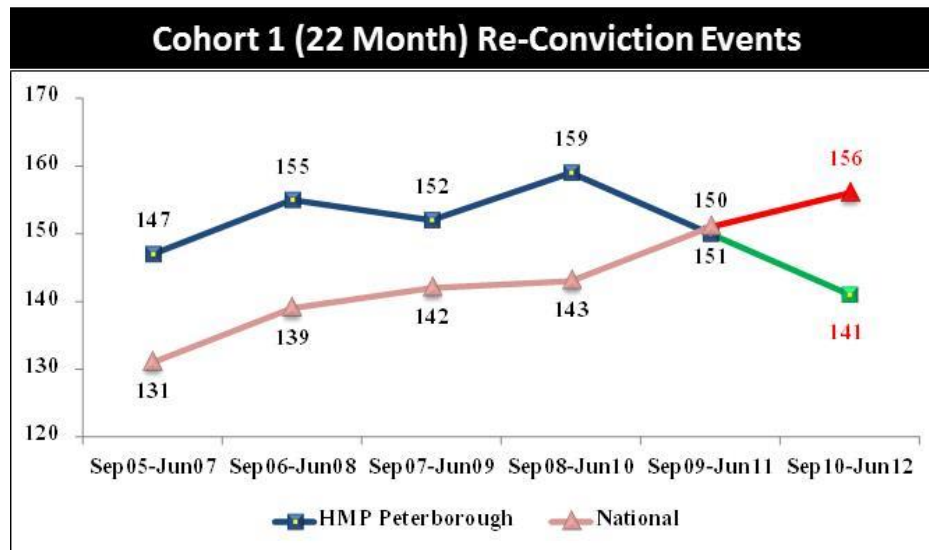
prison, HMP Peterborough was chosen in the first place, (e.g. for its high re-conviction rates). Regardless by measuring outcomes on the entire cohort of offenders inclusive of those who did not receive the treatment, service providers no longer have an incentive to only target those that are easiest to work with within HMP Peterborough because “results are measured on all prisoners released, not just those who engage with the program”.<sup>25</sup>

Equally important, HMP Peterborough was in a service gap during the time horizon of the SIB, which allows the attribution effect to be captured more clearly, provided that offender characteristics and macroeconomic variables are controlled for.

## Observations Prior to Implementation of Research Approaches

Before I proceeded with the two approaches outlined in section 2, I decided to take a closer look at the figures published by the Ministry of Justice and see if I could infer some implications on the numbers that weren't being illustrated clearly at face value.

### *What the Observed Effects Tell Us at Face Value*

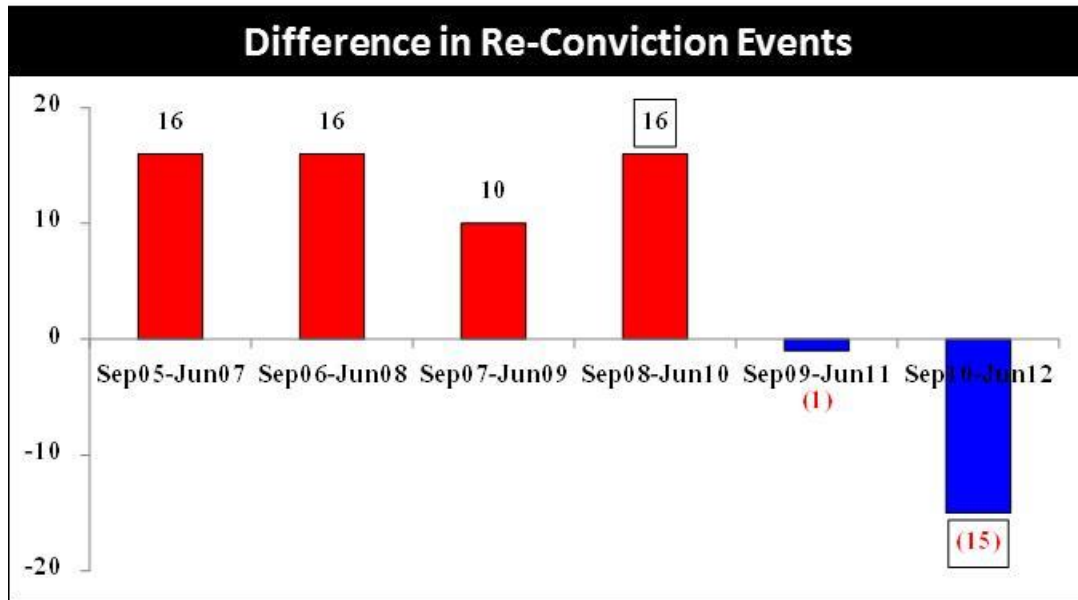


*These are the full 22 month cohort 1 results of the frequency of re-conviction events for both HMP Peterborough and national averages.*

Data taken from April 2014 Interim Re-Conviction Figures for Peterborough and Doncaster Payment by Results Pilots. Graph was created by the author of thesis.

<sup>25</sup> Source: Peterborough Social Impact Bond, Social Finance, 2011

**Observed Effect:** During the time of the SIB implementation horizon (Sep10 – Jun12), it can be seen that the treatment group’s frequencies are clearly on a downward trend and the comparison group’s frequencies are on an upward trend implying effective service provision.

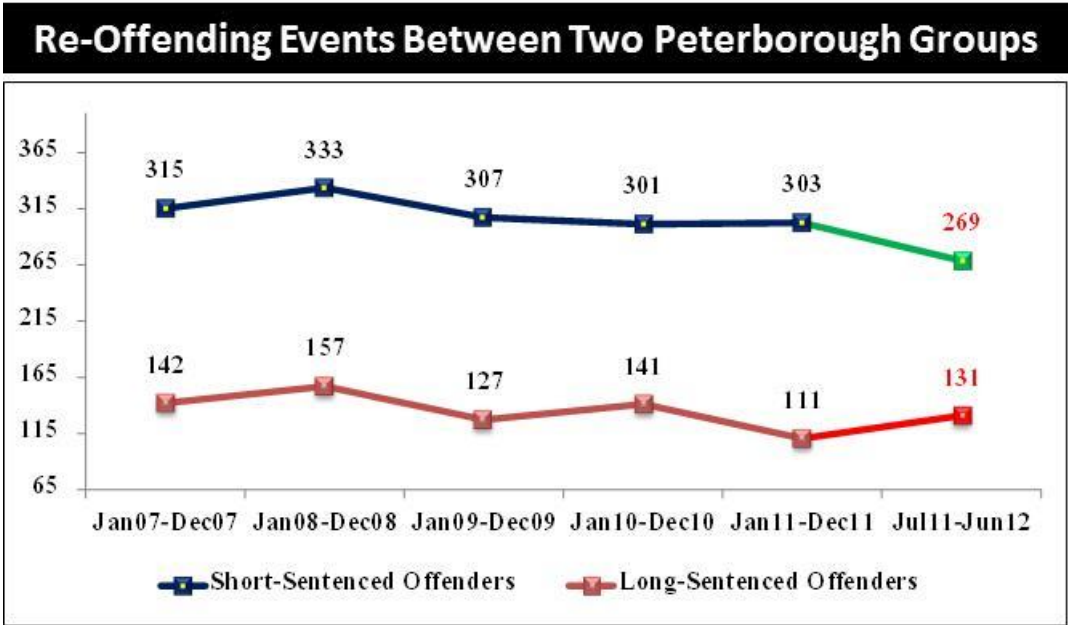


Data taken from April 2014 Interim Re-Conviction Figures for Peterborough and Doncaster Payment by Results Pilots. Graph was created by author of thesis.

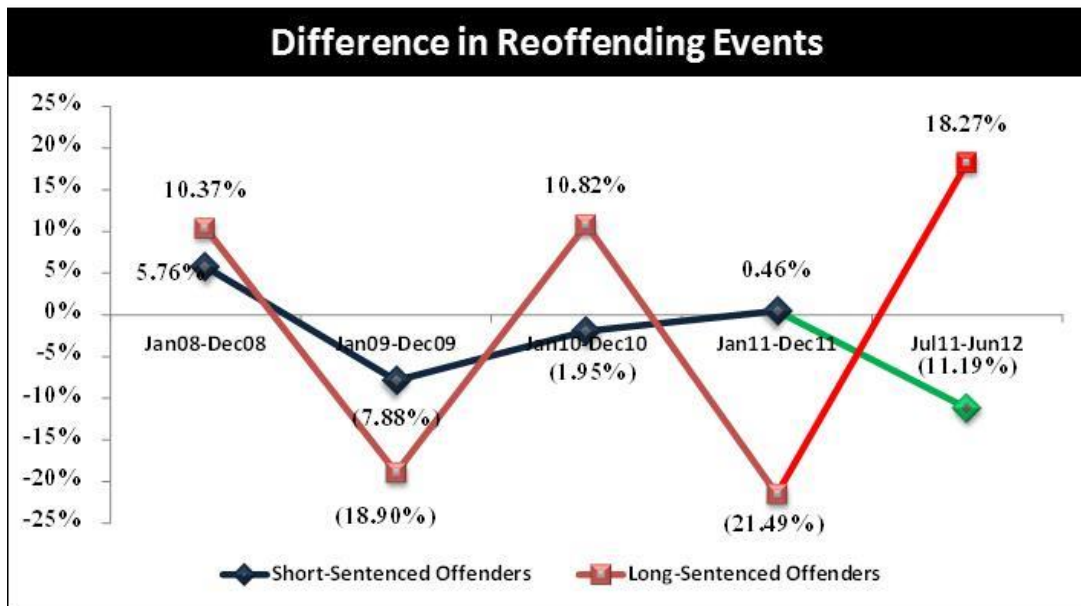
**Observed Effect:** The difference between the two groups (Treatment – Control) has historically been around 16 units. During the time horizon of the implementation, the difference became negative implying positive outcomes.

### ***Short-Sentenced Offenders vs. Long-Sentenced Offenders***

I also looked at the reoffending events of short-sentenced offenders versus that of long-sentenced offenders. Given that the SIB targeted short-sentenced offenders, we can effectively treat long-sentenced offenders as a control / comparison cohort because both types of offenders would be subject to the same macroeconomic conditions.



**Observed Effect:** Reoffending events between both groups follow a parallel trend prior to SIB implementation horizon (Sep10) and begin to diverge during the starting presence of the SIB.



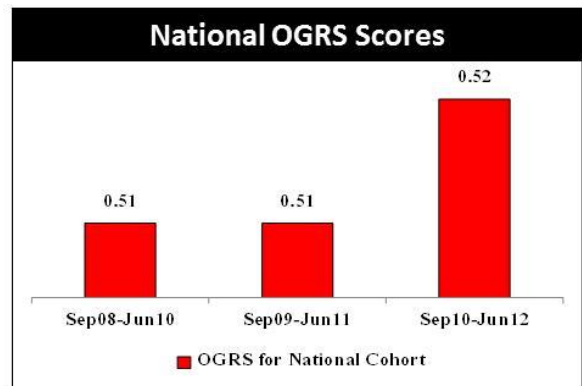
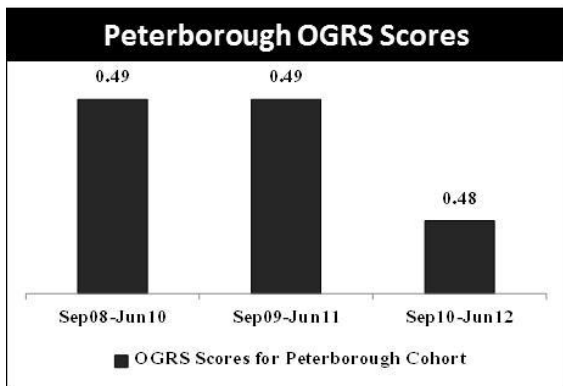
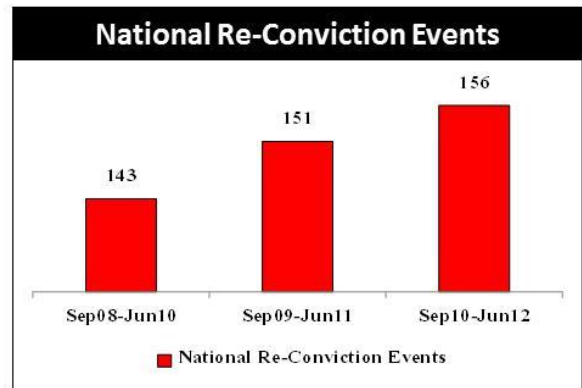
Furthermore, I computed the percentile changes from period to period to further illustrate the effect of the presence of the SIB.

**Observed Effect:** From the years prior to Sep10, reoffending rates attributed to short-sentenced offenders and long-sentenced offenders moved in a parallel trend decreasing from the time

horizons during Jan08-Dec08 to Jan09-Jan10 and then increasing again from the time horizons Jan09-Dec09 to Jan10-Dec10. However, from the time horizons Jan10-Dec10 to Jan11-Dec11 and from Jan11-Dec11 to Jul11-Jun12, the two series appear to diverge and based on this observation, it can safely be said that at least part of the drop in re-conviction events (a function of reoffending events) was caused by the presence of the social impact bond.

***Adding a Different Perspective: OGRS Scores***

When the MoJ published interim results for the Peterborough SIB pilot, one type of figure it also included was OGRS scores (see beginning of Section 3) for the offenders in each cohort. Furthermore, I looked at the trend in both re-conviction rates and OGRS scores and noticed a few things:



**Key Takeaways:**

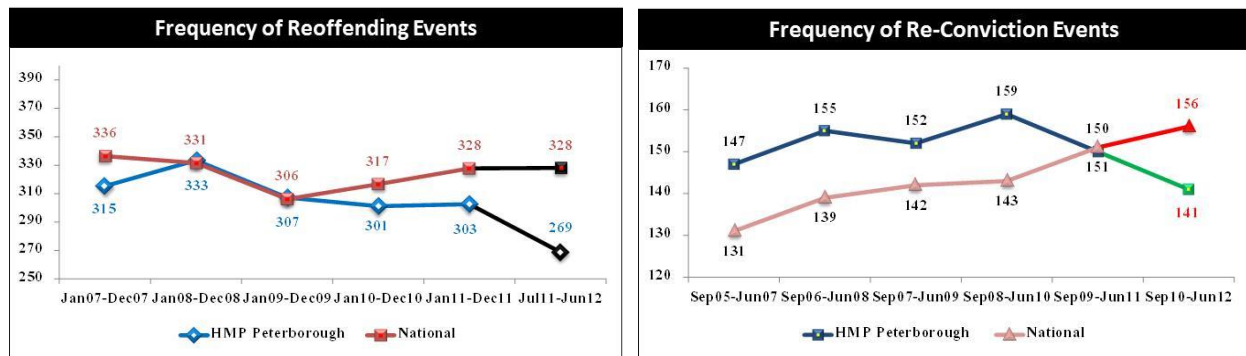
- True, re-conviction rates are decreasing for treatment group and increasing for national averages
- But, likelihood of reoffending are also decreasing for treatment group and increasing for national averages

Peterborough				National			
Discharge Period	OGRS Scores	Re-Conviction Rate	Frequency of Re-Conviction Events per 100 Offenders	Discharge Period	OGRS Scores	Re-Conviction Rate	Frequency of Re-Conviction Events per 100 Offenders
Sep05-Jun07	0.50	56.6%	147	Sep05-Jun07	0.52	55.9%	131
Sep06-Jun08	0.50	57.2%	155	Sep06-Jun08	0.52	56.4%	139
Sep07-Jun09	0.50	55.8%	152	Sep07-Jun09	0.52	55.9%	142
Sep08-Jun10	0.49	54.0%	159	Sep08-Jun10	0.51	54.5%	143
Sep09-Jun11	0.49	52.7%	150	Sep09-Jun11	0.51	55.0%	151
Sep10-Jun12	0.48	51.7%	141	Sep10-Jun12	0.52	55.1%	156

- OGRS scores (provided by the MoJ) may also not be a robust metric to measure probability of prisoner reoffending as Peterborough has lower OGRS but higher re-conviction rates than national averages, when the OGRS scores for Peterborough should be higher due to higher re-conviction rates.

**Re-Conviction Events vs. Reoffending Events (cont.)**

Building off on the substitution of reoffending events for re-conviction events, the question still remains: Are reoffending events even a good proxy for re-conviction events?

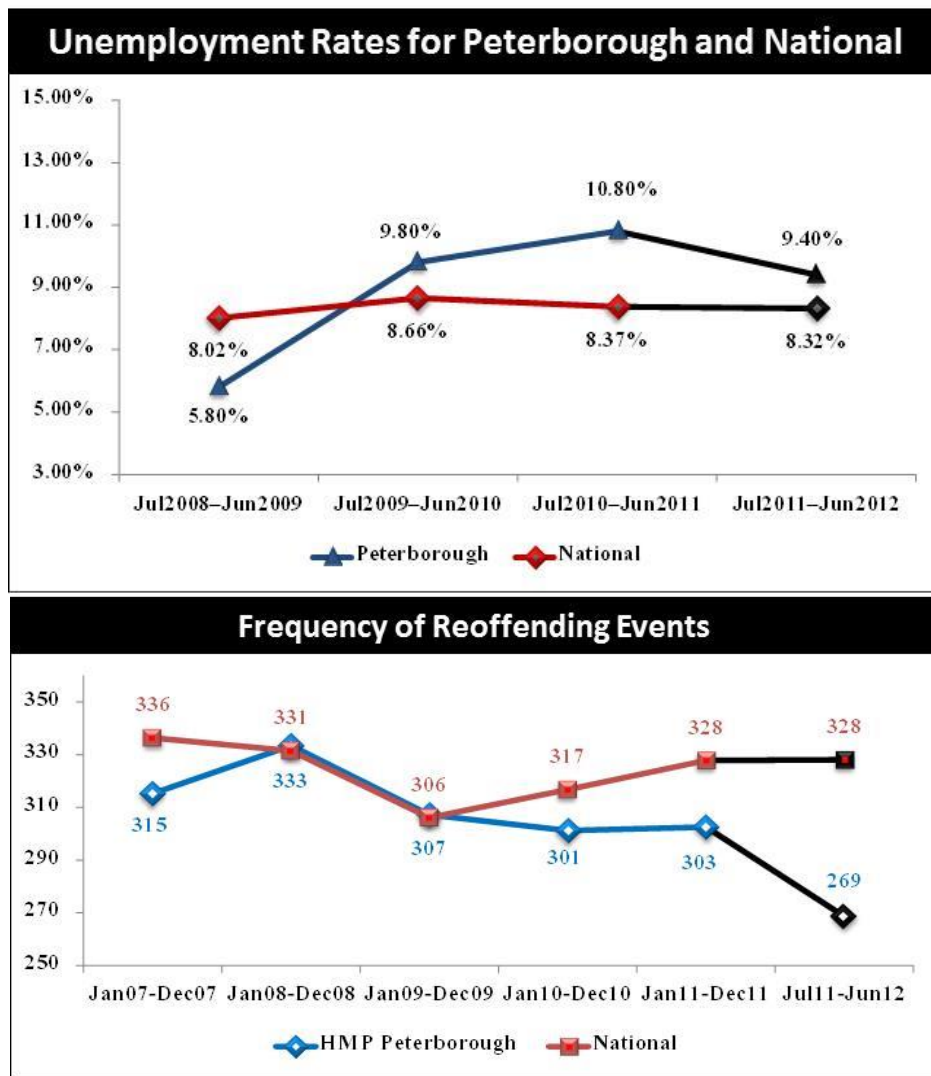


As indicated in the graphs above, reoffending events seem to be a relatively good (although not perfect) proxy for re-conviction events as both graphs illustrate similar trends prior and during the implementation of the SIB. Moreover, there are some disparities between the two due to the

different time horizons on the basis they are being compared on (a result of limited publicly available data).

***A Detour: Unemployment Rates vs. Frequency of Re-Offending Events***

The last thing I want to cover before going into the research methodology is unemployment rates vs. frequency of reoffending events (and you will understand why I set it up this way in the next few segments as I show my results). I plotted unemployment rates for both the local region Peterborough and national rates for the years July 2008 – June 2012 (as 2008 was the furthest back I could go with the available macroeconomic data on Peterborough).



**Observed Effect:** When looking at the two graphs side by side, there appears to be some correlation between unemployment rates and reoffending events during the time horizon of the SIB. Moreover, HMP Peterborough's frequency measures were decreasing as unemployment rates were falling from 10.8% to 9.40%. At the same time, the national average frequency measure stayed constant at 328 units, while its unemployment rates were staying steady as well in the range, [8.32%, 8.37%].

## **Applying the Research Methodology to the HMP Peterborough SIB**

### ***Setting Up the Framework for Approach #1***

I first made the assumption that the three main explanatory factors that would affect the output, reoffending events (which I substituted for re-conviction events for the aforementioned reasons), were the characteristics of the prisoners themselves, macroeconomic conditions, and omitted / immeasurable variables. I then made the second assumption that the evaluators' propensity score matching technique would control for the characteristics of the prisoners; as a result when determining the impact of the SIB, the only things that would need to be controlled for are macroeconomic conditions and omitted variables for both the treatment and comparison cohorts.

I mentioned earlier that because outcome payments were based on the treatment cohort's performance relative to that of the comparison cohort, two counterfactual scenarios would need to be created to control for macroeconomic conditions in each region. For the purposes of this thesis and for someone who even had the macroeconomic data and reoffending data for every local region within the UK, it is recommended that they stick only to examining the counterfactual for the treatment group, HMP Peterborough, for the following reasons:

- Controlling for macroeconomic factors for a certain region, (e.g. Peterborough) makes the assumption that these macroeconomic factors matter because prisoners will be returning back to their local region, in this case, Peterborough
- Because prisoners may not be returning to Peterborough, we can introduce a dummy variable,  $X_n$  that takes a binary value of 0 if the offender is not from Peterborough and 1 if he is
- This inevitably gets much more complicated for the comparison group because we would then have to introduce a mass amount of dummy variables to account for the many different regions prisoners may be returning back to

Furthermore, we now have:

- $y$  = Frequency of Reoffending Events; Utilize all  $y_n$  such that  $y_n$  is in time period  $t < I$
- $x_1, x_2, \dots, x_n$  = Macroeconomic Variables; Utilize all  $x_n$  such that  $x_n$  is in time period  $t < I$
- A dummy variable,  $x_n$ , to represent if the offender is from/returning to Peterborough

Utilizing statistical software, we can now calculate the predicted  $\hat{y}$  in  $t = I$  and calculate the magnitude accordingly through  $(y - \hat{y})$  in  $t = I$ . Causality can then be inferred as well.

Due to the limited publicly available data on both the results of this social impact bond pilot and macroeconomic data at the local regional level, I had to change my research approach to focus on a few different areas as opposed to concluding with causality from the SIB pilot (or lack of it). Furthermore, with the limited publicly available macroeconomic data at the local regional level for Peterborough (i.e. its macroeconomic data only dates back to the earliest starting point of July 2008), I was not able to generate a valid sample size to run a regression on determining the counterfactual for Peterborough. Instead, the purpose of this segment was to

provide the setup for someone who has access to all this data (i.e. access to the full Peterborough SIB figures and full macroeconomic time series data on Peterborough; ideally the evaluators).

### ***Thesis' Application of Approach #1***

Due to the limitations of obtaining data to successfully apply Approach #1 to Peterborough, I decided to run a regression at the national level (England and Wales) instead. By doing this, I was hoping to generate a regression equation (after normalizing for the effects of the Peterborough and Doncaster SIB pilots for their respective time horizons of implementation) that would provide some predictive power for determining the reoffending level in Peterborough in  $t = 1$ . Furthermore, the available data at the time of experiment were:

- ✓ Reoffending (not re-conviction) events from years 2000 – 2012, excluding 2001
- ✓ Macroeconomic data for all of England and Wales (and for some variables, all of UK)
- ✓ No macroeconomic data available for local regions (e.g. Peterborough and Doncaster prior to 2009)
- ✓ Reoffending events data for Peterborough and local prisons only date earliest up to 2007

When creating the regression equation for England and Wales, I did the following:

- ✓ Normalized for different time horizons of explanatory macroeconomic variables
- ✓ Normalized for the SIB effects from Peterborough and Doncaster

### ***Results of Regressions***

- Due to a sample size of 12 data points, (2000-2012, excluding 2001), I was only able to run bivariate regressions between each explanatory variable and the dependent variable.
- ✓ Running bivariate relationships also allowed me to account for multicollinearity since all of the explanatory variables were macroeconomic

- The regression model turned out to have no predicative power for HMP Peterborough's output levels as expected because the reoffending events for HMP Peterborough were significantly higher than National averages
- ✓ Statistically, this makes sense as I was trying to utilize a y variable that was not in the model's range of y values for National levels

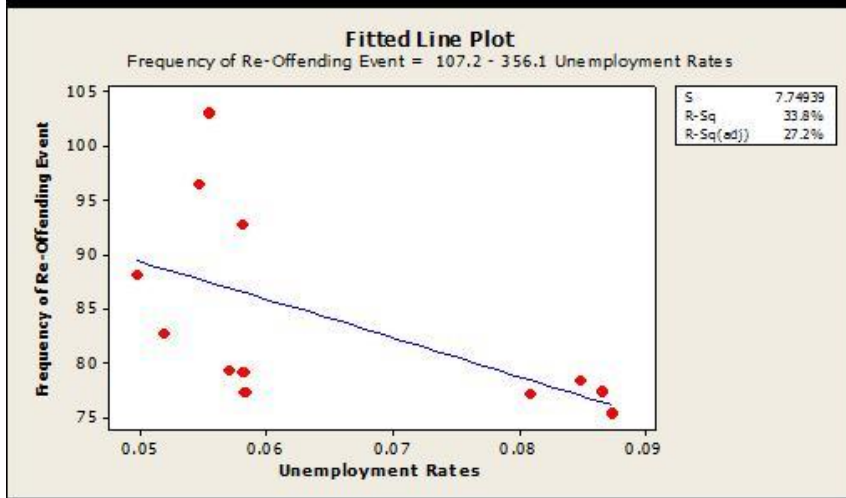
Although the regression model served no predicative power for Peterborough's reoffending levels, the regressions output did produce some interesting takeaways on the effect of certain macroeconomic factors on reoffending events at the national level.

Regressions Output of 8 Bivariate Regressions								
Explanatory Variable	Characteristics of Explanatory Variable							
	Coefficient of		Std Error of	T-Statistic	P-Value	R-Sq	Std Error	# of Unusual Observations
	Constant	Explanatory Variable						
Unemployment	107.220	-356.100	157.5000	-2.26	0.047	27.20%	7.74939	1
Crime	42.540	0.00000928	0.00000277	3.35	0.007	48.20%	6.53709	0
Claimants	101.260	-0.00002458	0.00001395	-1.76	0.109	16.10%	8.32058	1
Homelessness	64.363	0.00021776	0.0000422	5.16	0.000	70.00%	4.97717	2
Divorces by Wife	25.570	0.0006514	0.0001324	4.92	0.001	67.80%	5.14991	1
GDP Growth (UK)	79.767	109.5300	85.58000	1.28	0.229	5.50%	8.82946	2
Disposable Income per Head (UK)	267.410	-0.011772	0.003014	-3.91	0.003	56.40%	5.99403	2
GDP per Head (UK)	224.090	-0.005892	0.001695	-3.48	0.006	50.20%	6.40974	0

**Key Takeaways on Effect of Macroeconomic Variables on Reoffending Events (National):**

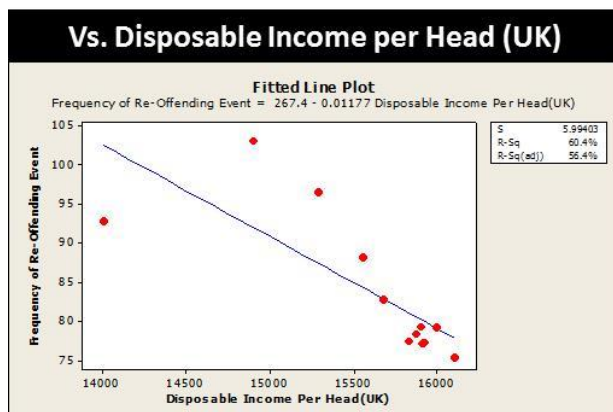
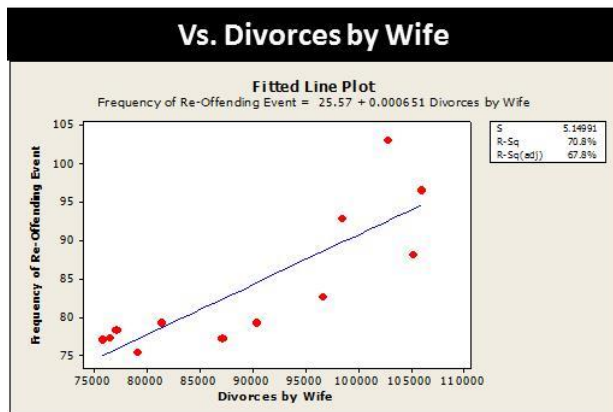
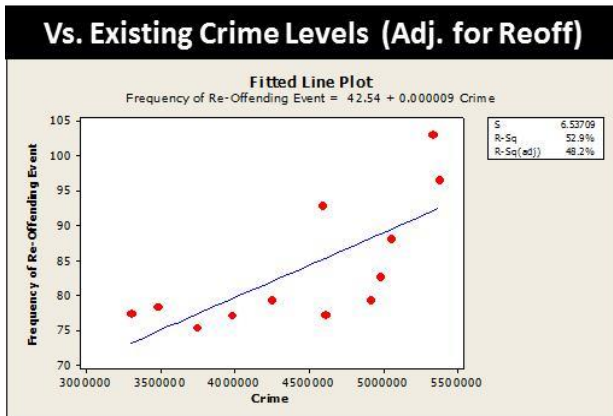
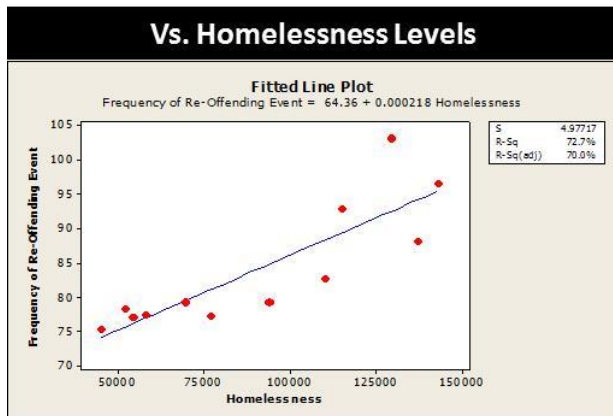
- There were no strong predictors of reoffending events based on the available noisy data
- Some macroeconomic factors exhibited a strong R-Sq and p-value
  - ✓ However, the coefficients on these factors were also too small to make any practical inferences
- Based on the sample size,
  - ✓ Unemployment rates were related to reoffending events in an unexpected manner with a t-statistic of -2.26 implying that as unemployment rates were going up, reoffending events were going down.

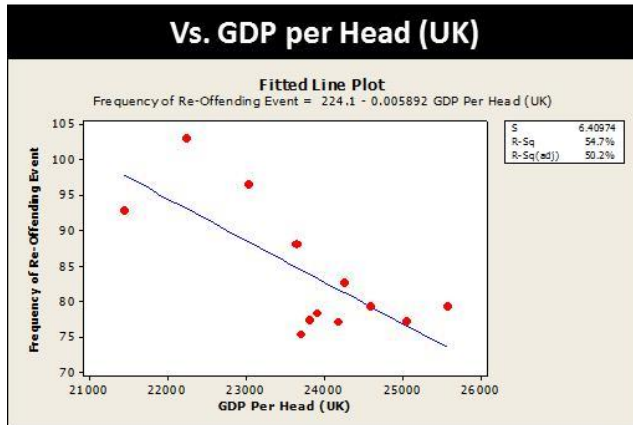
## Vs. Unemployment Rates



By looking at the fitted line plot, it makes sense the t-statistic was negative as the statistical package was forcing a line through the data points. In fact, we cannot conclude unemployment rates are negatively related to reoffending rates as the data points (as indicated in the fitted line plot) are too noisy for statistical inference.

- ✓ Homelessness levels, existing crime levels (adjusted for reoffending levels), divorces by wife, disposable income per head (UK), and GDP per Head were all linearly related to reoffending events as expected





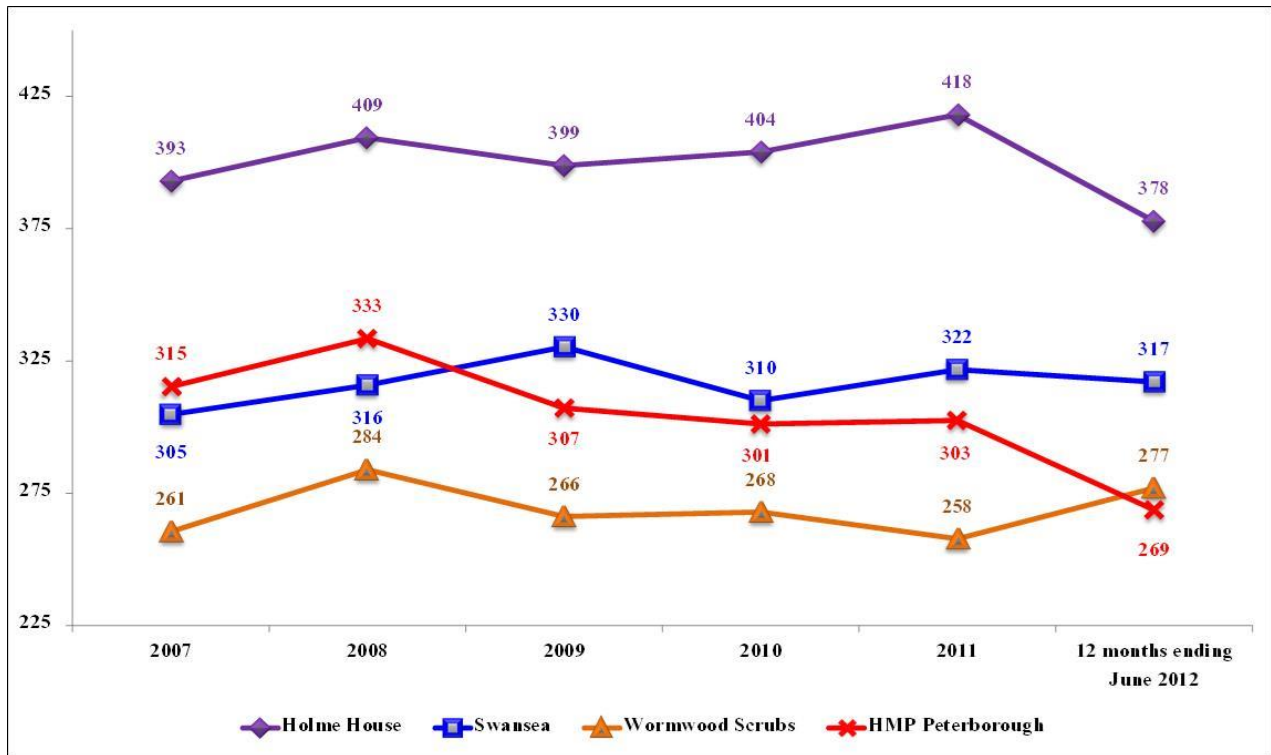
### *Setting Up the Framework for Approach #2*

Although this thesis does not fully complete approach #2 due to the limited availability of data on reoffending rates and macroeconomic variables at the local regional level, it still attempts to setup the framework for Approach #2 by selecting the candidates to be used within the differences-in-differences approach.

Based on the publicly available data (dating earliest back to year ended 2007) I had on local prisons in the UK, I calculated the differences of output levels between that of every local prison (with the exception of Doncaster) and Peterborough. Following the parallel trend assumption, I then took the standard deviation for differences in the years 2007-2011 (excluding 2012 due to the SIB presence for HMP Peterborough) and chose candidates (or prisons) based on the three smallest standard deviations.

	2007	2008	2009	2010	2011	June 2012 (LTM)	Std Dev of 2007-2011
<b>Male Local</b>							
<b>Prisons</b>	<b>Difference in Frequency of Reoffending Events</b>						
<b>Holme</b>							
House	78	94	84	89	103	63	9.67
Swansea	-10	1	15	-5	6	2	9.99
<b>Wormwood</b>							
Scrubs	-55	-31	-49	-47	-57	-38	10.17
Pentonville	7	-13	-18	-25	-12	-24	11.69
Bristol	101	94	85	71	101	57	12.77
Bullington	-2	-1	-24	-15	-32	-17	13.54
Manchester	-27	0	-27	-30	-40	-30	14.65
Hull	59	47	41	72	77	69	15.50
Exeter	59	52	60	80	93	52	16.95
Cardiff	40	28	10	12	-13	-11	19.95
Doncaster	-1	-5	-39	-43	-41	-44	20.88
Norwich	41	1	16	55	24	30	20.95
Altcourse	4	-3	-37	-27	15	13	21.60
Leeds	66	49	9	29	16	21	23.60
Liverpool	-9	-26	-58	-53	-4	-16	24.84
Leicester	-1	-9	-21	5	45	138	24.99

	2007	2008	2009	2010	2011	June 2012 (LTM)	Std Dev of 2007-2011
<b>Male Local Prisons</b>	<b>Difference in Frequency of Reoffending Events</b>						
Lincoln	12	32	6	-29	-23	6	25.23
Birmingham	7	-8	-46	-44	-48	-37	25.48
Preston	91	99	42	87	107	107	25.57
Brixton	4	12	-54	-8	-27	-18	26.47
Winchester	11	25	46	59	80	54	27.22
Parc	26	-24	-32	-12	-46	-25	27.51
Chelmsford	-6	-19	-47	11	25	-10	27.60
Belmarsh	-23	32	-42	-24	-18	-29	27.93
Dorchester	117	119	95	57	68	79	28.14
Nottingham	52	0	34	-1	-18	0	28.68
Lewes	80	51	0	8	14	14	33.84
Forest Bank	17	-1	-21	-46	42	40	34.11
Wandsworth	46	68	22	3	-19	-7	34.40
High Down	77	26	-5	-5	-14	11	37.47
Gloucester	82	79	-1	40	90	87	38.12
Woodhill	-11	-6	-23	-84	-89	-67	40.61
Bedford	-51	-21	-55	50	31	19	47.79
Durham	72	72	58	132	258	218	83.39



**Observed Effect:** The top three candidates came out to be Holme House, Swansea, and Wormwood Scrubs. Wormwood Scrubs appears to be the ideal candidate as it follows the parallel trend for years prior to 2012, but also diverges sharply during the time horizon of the SIB.

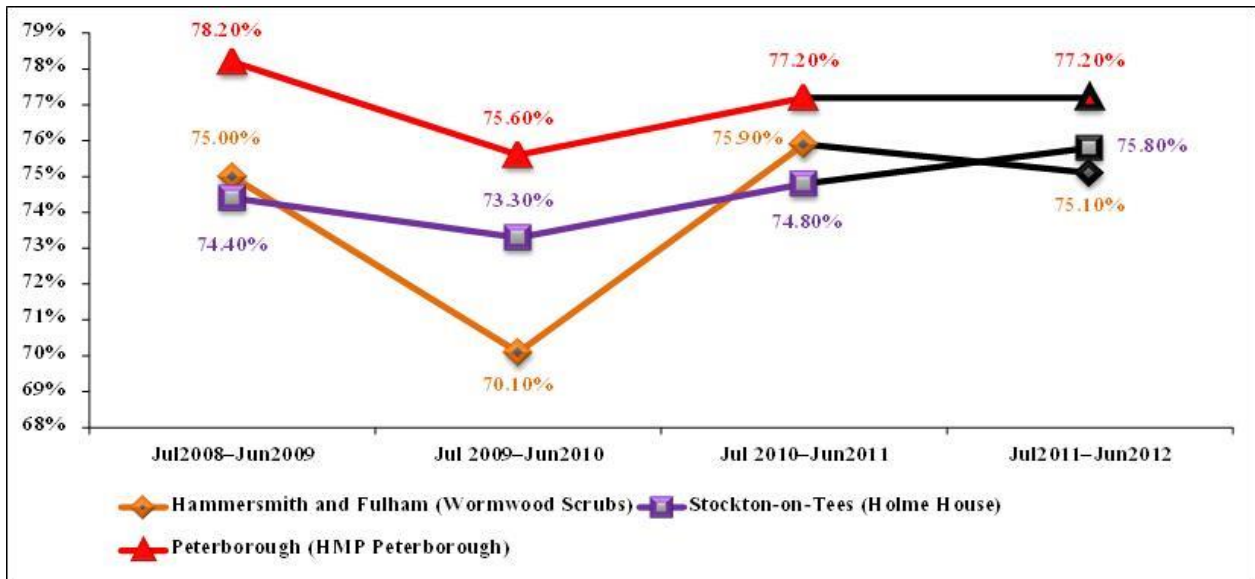
For someone who has access to the macroeconomic data at the local regional level, he can now control for macroeconomic factors between the two regions through a regression with omitted variables being captured within the differences, and capture the magnitude of the effect of the SIB through the coefficient of the interaction term involving the treatment group, state of the world in time  $t = 1$ , and the dummy variable capturing the presence of the SIB.

***Findings from the Candidates of the Differences-in-Differences Approach***

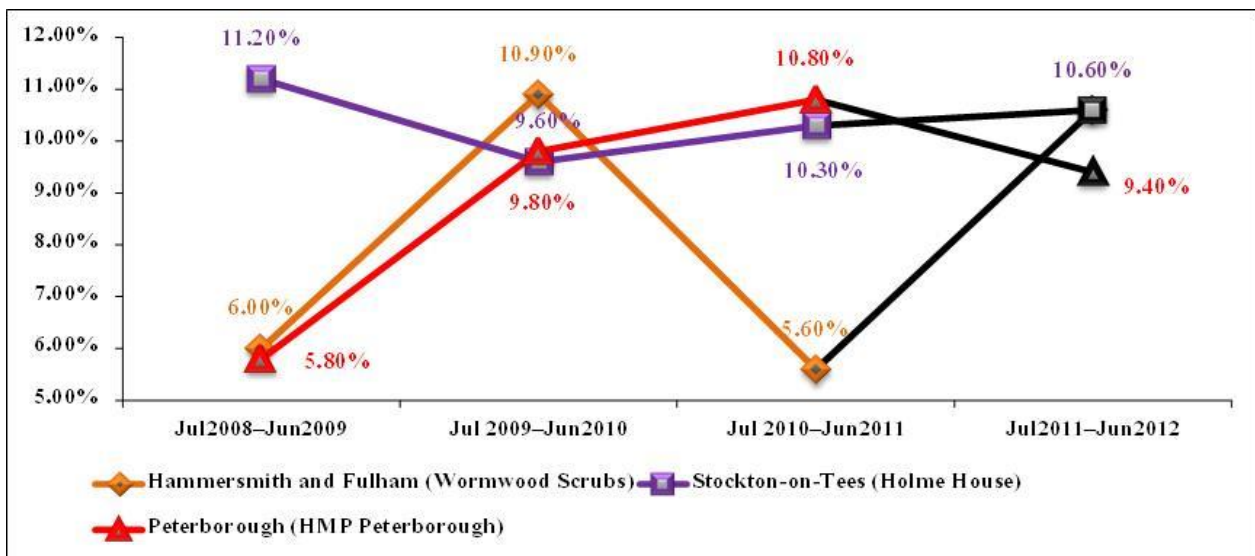
At the same time, I was curious as to why Holme House, a prison that followed the parallel trend prerequisite, did not diverge from the parallel trend with Peterborough during the

time horizon of the SIB. I decided to look at both unemployment rates and employment rates for the years I had data for (July 2008 – Jun 2012 on an annual basis) for the local regions Holme House and Wormwood Scrubs were located in.

### Employment Rates



### Unemployment Rates



### **Observed Effects:**

- From Dec 2011 to June 2012, Holme House experienced sharp drop in reoffending events.  
At the same time, Stockton-on-Tees's employment rates went up by 1%. However, the local region's unemployment rates also increased by .30%.
- From Dec 2011 to June 2012, Wormwood Scrubs experienced a sharp increase in reoffending events as its unemployment rates jumped 5%.
- From July 2010 to June 2012, Peterborough's unemployment rates decreased by 1.40% while its employment rates stayed the same.
- **Main Takeaway:** What we can infer from the data above is that there may have been a correlation between unemployment rates and employment rates but we cannot be sure due to noisy data (such that the time horizons don't match up perfectly between the macroeconomic factors and reoffending events) and a small sample size. However, the figures do shed additional light on two prisons, Peterborough and Wormwood Scrubs, whose reoffending events reacted as expected with regards to changes in unemployment rates, making the case stronger than Peterborough and Wormwood Scrubs should be the two cohorts used within the differences-in-differences approach.

## Section 4

### Concluding Remarks

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**The main takeaways from the findings in Section 3 are as follows:**

- Unemployment rates as a macroeconomic factor may have had some attribution effect, but based on the (publicly available) data on reoffending (and re-conviction) events, there was insufficient evidence based on the available data to draw any practical conclusions on the effect of macroeconomic variables towards reoffending events at the *national level*
  - This may be due to noisy data (mismatching of time horizons of available data) and an insufficient sample size and must be tested again by someone who has the data with the sufficient sample size and appropriately matched time horizons of reoffending events and macroeconomic variables at both the *local regional level* (e.g. Peterborough and other local regions)
  - As illustrated in Section 3 through Approach #2, although it cannot be said for sure, there appears to be some correlation between that of the unemployment and employment rates and reoffending events at the *local regional level*
- Combining the observations of the long-sentenced offenders vs. short-sentenced offenders, with that of the OGRS scores and the aforementioned points, it can confidently be stated that there at least appears to be some attribution effect from the presence of the social impact bond for HMP Peterborough and some deadweight effect as well from the characteristics of the prisoners and unemployment rates

**The main purposes of this thesis were to:**

- Based on the limited publicly available data, observe the effect of macroeconomic variables on the frequency of national reoffending levels at the *national level*

- Set up the framework and issues to consider for both Approach #1 and Approach #2 for those who have access to the data to successfully test for attribution and deadweight
  - I.e. Evaluators assigned to the HMP Peterborough SIB Pilot

### ***Data Set for Those Who Have Access to Macroeconomic Data at the Local Regional Level***

After reaching out to the Ministry of Justice, I have obtained the data set for quarterly re-conviction figures from the years September 2005 to June 2012. This data set will be posted within the Appendix section of this thesis and would benefit those who have access to the necessary macroeconomic data and are interested in testing for attribution for the HMP Peterborough SIB.

### ***Bringing it All Together and Next Steps***

After reading through Sections 1 -3, the reader should now have a solid understanding of the fundamentals of SIB financing, the importance of attribution and deadweight effects, how to estimate the magnitude of the SIB through the counterfactual and infer causality, and then apply that framework to a live example. More importantly, solving for attribution and deadweight effects allows us to establish the proper accurate evidence base for more cost-effective and socially impactful future service implementations and future social policies. Once attribution and deadweight effects are accounted for, two questions still remain:

Assuming that causality was inferred for the presence of the SIB and results activated outcome payments,

- Was the social issue actually taken care of by the SIB or was it simply displaced to another region?
- After capturing the magnitude of the attribution and deadweight from the SIB, are investors earning a fair return on their investment based on the percentage threshold that

results must cross and the capped IRR? And with every percentage point decrease in re-conviction events relative to the national comparison group, how much are investors paying actually paying for (taking into account deadweight) based on their initial £5M annual investment? And with the effect of macroeconomic variables that may work in favor or against investors, were returns accurately reflective of how successful the SIB program actually was?

And by answering those two remaining questions (and sub-questions), we can now effectively answer the main motivating question of why assessing attribution and deadweight effects matter. That is, we can now answer: Do the service implementations generated by SIB financing actually work and more importantly, does SIB financing actually work?

# Appendix

Data Table 1 –

## Peterborough and National 12 month re-conviction figures, September 05 - June 2012, by quarter

(2) – Includes offenders discharged from the 9<sup>th</sup> of Sept until the 31<sup>st</sup> of Dec

Discharge Period	Quarter	Peterborough					National				
		No. of offenders	No. of re-offenders	Re-conviction rate	No. of re-conviction events	Frequency of re-conviction events per 100 offenders	No. of offenders	No. of re-offenders	Re-conviction rate	No. of re-conviction events	Frequency of re-conviction events per 100 offenders
Sep05-Jun07	Sep05 - Dec05 <sup>(2)</sup>	172	100	58.1%	249	145	7,698	4,689	60.9%	12,024	156
	Jan06 - Mar06	102	60	58.8%	127	125	5,016	2,866	57.1%	6,633	132
	Apr06 - Jun06	122	67	54.9%	199	163	4,800	2,702	56.3%	6,207	129
	Jul06 - Sep06	111	68	61.3%	183	165	4,538	2,408	53.1%	5,301	117
	Oct06 - Dec06	103	54	52.4%	135	131	3,907	2,096	53.6%	4,777	122
	Jan07 - Mar07	113	58	51.3%	142	126	3,403	1,819	53.5%	4,154	122
	Apr07 - Jun07	112	66	58.9%	196	175	3,550	1,822	51.3%	4,066	115
<b>Total</b>		<b>835</b>	<b>473</b>	<b>56.6%</b>	<b>1,231</b>	<b>147</b>	<b>32,912</b>	<b>18,402</b>	<b>55.9%</b>	<b>43,162</b>	<b>131</b>
Sep06-Jun08	Sep06 - Dec06 <sup>(2)</sup>	156	95	60.9%	263	169	7,041	4,359	61.9%	11,947	170
	Jan07 - Mar07	126	68	54.0%	183	145	4,564	2,715	59.5%	6,902	151
	Apr07 - Jun07	115	68	59.1%	198	172	4,432	2,519	56.8%	5,955	134
	Jul07 - Sep07	162	89	54.9%	248	153	4,393	2,383	54.2%	5,724	130
	Oct07 - Dec07	175	105	60.0%	276	158	5,027	2,730	54.3%	6,365	127
	Jan08 - Mar08	133	66	49.6%	171	129	3,916	2,040	52.1%	4,817	123
	Apr08 - Jun08	158	95	60.1%	245	155	4,236	2,219	52.4%	5,086	120
<b>Total</b>		<b>1,025</b>	<b>586</b>	<b>57.2%</b>	<b>1,584</b>	<b>155</b>	<b>33,609</b>	<b>18,965</b>	<b>56.4%</b>	<b>46,796</b>	<b>139</b>
Sep07-Jun09	Sep07 - Dec07 <sup>(2)</sup>	233	146	62.7%	392	168	8,278	5,167	62.4%	14,616	177
	Jan08 - Mar08	146	77	52.7%	218	149	5,012	2,942	58.7%	7,815	156
	Apr08 - Jun08	170	105	61.8%	286	168	5,218	2,999	57.5%	7,440	143
	Jul08 - Sep08	170	80	47.1%	180	106	5,158	2,819	54.7%	6,748	131
	Oct08 - Dec08	179	97	54.2%	297	166	5,052	2,675	52.9%	6,336	125
	Jan09 - Mar09	132	71	53.8%	204	155	3,603	1,793	49.8%	4,123	114
	Apr09 - Jun09	139	76	54.7%	198	142	4,212	2,038	48.4%	4,742	113
<b>Total</b>		<b>1,169</b>	<b>652</b>	<b>55.8%</b>	<b>1,775</b>	<b>152</b>	<b>36,533</b>	<b>20,433</b>	<b>55.9%</b>	<b>51,820</b>	<b>142</b>
Sep08-Jun10	Sep08 - Dec08 <sup>(2)</sup>	257	148	57.6%	481	187	8,973	5,569	62.1%	16,058	179
	Jan09 - Mar09	150	86	57.3%	283	189	4,669	2,647	56.7%	6,879	147
	Apr09 - Jun09	150	85	56.7%	233	155	5,154	2,727	52.9%	6,933	135
	Jul09 - Sep09	159	81	50.9%	235	148	4,891	2,565	52.4%	6,368	130
	Oct09 - Dec09	137	71	51.8%	203	148	4,960	2,523	50.9%	6,316	127
	Jan10 - Mar10	128	66	51.6%	158	123	4,092	2,060	50.3%	5,081	124
	Apr10 - Jun10	107	51	47.7%	133	124	3,769	1,824	48.4%	4,498	119
<b>Total</b>		<b>1,088</b>	<b>588</b>	<b>54.0%</b>	<b>1,726</b>	<b>159</b>	<b>36,508</b>	<b>19,915</b>	<b>54.5%</b>	<b>52,133</b>	<b>143</b>
Sep09-Jun11	Sep09 - Dec09 <sup>(2)</sup>	215	125	58.1%	415	193	8,398	5,029	59.9%	15,355	183
	Jan10 - Mar10	148	80	54.1%	219	148	5,122	2,871	56.1%	7,952	155
	Apr10 - Jun10	116	54	46.6%	151	130	4,682	2,503	53.5%	6,628	142
	Jul10 - Sep10	126	62	49.2%	159	126	4,218	2,286	54.2%	6,056	144
	Oct10 - Dec10	126	67	53.2%	157	125	4,359	2,379	54.6%	6,130	141
	Jan11 - Mar11	115	59	51.3%	174	151	3,730	1,946	52.2%	5,128	137
	Apr11 - Jun11	94	48	51.1%	138	147	3,840	1,878	48.9%	4,651	121
<b>Total</b>		<b>940</b>	<b>495</b>	<b>52.7%</b>	<b>1,413</b>	<b>150</b>	<b>34,349</b>	<b>18,892</b>	<b>55.0%</b>	<b>51,900</b>	<b>151</b>
Sep10-Jun12	Sep10 - Dec10 <sup>(2)</sup>	200	114	57.0%	359	180	7,421	4,638	62.5%	14,792	199
	Jan11 - Mar11	136	74	54.4%	223	164	4,745	2,748	57.9%	8,325	175
	Apr11 - Jun11	107	57	53.3%	161	150	4,650	2,516	54.1%	6,868	148
	Jul11 - Sep11	124	54	43.5%	127	102	4,459	2,384	53.5%	6,538	147
	Oct11 - Dec11	127	66	52.0%	159	125	4,492	2,284	50.8%	5,930	132
	Jan12 - Mar12	150	83	55.3%	220	147	4,017	2,018	50.2%	5,199	129
	Apr12 - Jun12	162	72	44.4%	169	104	3,815	1,922	50.4%	4,929	129
<b>Total</b>		<b>1,006</b>	<b>520</b>	<b>51.7%</b>	<b>1,418</b>	<b>141</b>	<b>33,599</b>	<b>18,510</b>	<b>55.1%</b>	<b>52,581</b>	<b>156</b>

Data Table 2 – Constituents of National Comparison Group of Data Table 1

Altcourse	Blakenhurst	Cardiff	Exeter	Holme House	Lewes	Norwich	Preston	Winchester
Bedford	Bristol	Chelmsford	Forest Bank	Hull	Lincoln	Nottingham	Shrewsbury	Woodhill
Belmarsh	Brixton	Dorchester	Gloucester	Leeds	Liverpool	Parc	Swansea	Wormwood Scrubs
Birmingham	Bullingdon	Durham	High Down	Leicester	Manchester	Pentoville	Wandsworth	

### Data Table 3 – Full 22 Month Cohort 1 Figures for Peterborough and National Cohorts

Full 22 Month Cohort (Data Released on Apr 24, 2014)								
12 Month Re-Conviction Period								
Peterborough								
Discharge Period	No. of Offenders	OGRS Scores	Change in		Total No. of Re-Conviction Events	Frequency of Re-Conviction Events per 100 Offenders	% Changes in Re-conviction Events per 100 Offenders	
			OGRS Scores	Re-Conviction Rate				
Sep05-Jun07	835	0.50		56.6%	473	1227	147	
Sep06-Jun08	1,025	0.50	0.00%	57.2%	586	1589	155	5.44%
Sep07-Jun09	1,169	0.50	0.00%	55.8%	652	1777	152	(1.94%)
Sep08-Jun10	1,088	0.49	(2.00%)	54.0%	588	1730	159	4.61%
Sep09-Jun11	940	0.49	0.00%	52.7%	495	1410	150	(5.66%)
<b>Sep10-Jun12</b>	<b>1,006</b>	<b>0.48</b>	<b>(2.04%)</b>	<b>51.7%</b>	<b>520</b>	<b>1418</b>	<b>141</b>	<b>(6.00%)</b>
<b>Observed Effect From Intervention</b>								<b>(11.32%)</b>

Full 22 Month Cohort (Data Released on Apr 24, 2014)								
12 Month Re-Conviction Period								
National								
Discharge Period	No. of Offender	OGRS Scores	Change in		Total No. of Re-Conviction Events	Frequency of Re-Conviction Events per 100 Offenders	% Changes in Re-conviction Events per 100 Offenders	
			OGRS Scores	Re-Conviction Rate				
Sep05-Jun07	32,912	0.52		55.9%	18,398	43115	131	
Sep06-Jun08	33,609	0.52	0.00%	56.4%	18,955	46717	139	6.11%
Sep07-Jun09	36,533	0.52	0.00%	55.9%	20,422	51877	142	2.16%
Sep08-Jun10	36,508	0.51	(1.92%)	54.5%	19,897	52206	143	0.70%
Sep09-Jun11	34,349	0.51	0.00%	55.0%	18,892	51867	151	5.59%
<b>Sep10-Jun12</b>	<b>33,599</b>	<b>0.52</b>	<b>1.96%</b>	<b>55.1%</b>	<b>18,513</b>	<b>52414</b>	<b>156</b>	<b>3.31%</b>
<b>Observed Effect From Intervention</b>								<b>9.09%</b>

### Data Table 4 –

### Re-Offending Figures for Peterborough Short-Sentenced and Long-Sentenced Offenders

Table 22a: Proven re-offending of adult offenders given sentences of less than 12 months, by individual prison, based on first release from each prison<sup>1</sup>, 2007 to June 2012<sup>2 3</sup> (Male)

Peterborough								
Discharge Period	No. of Offenders	Re-Offending Rate	No. of Reoffenders	Total No. of Re-Offending Events	Average number of re-offences per re-offender	Average number of re-offences per offender	Frequency of Re-Offending Events per 100 Offenders	% Changes in Re-Offending Events per 100 Offenders
Jan08-Dec08	1,020	62.55%	638	3,401	5.33	3.33	333	5.76%
Jan09-Dec09	936	58.65%	549	2,875	5.24	3.07	307	(7.88%)
Jan10-Dec10	767	57.89%	444	2,310	5.20	3.01	301	(1.95%)
Jan11-Dec11	469	58.21%	273	1,419	5.20	3.03	303	0.46%
<b>Jul11-Jun12</b>	<b>511</b>	<b>56.16%</b>	<b>287</b>	<b>1,373</b>	<b>4.78</b>	<b>2.69</b>	<b>269</b>	<b>(11.19%)</b>

Table 22b: Proven re-offending of adult offenders given sentences of 12 months or more, by individual prison, based on first release from each prison<sup>1</sup>, 2007 to June 2012<sup>2 3</sup> (Male)

Peterborough								
Discharge Period	No. of Offenders	Re-Offending Rate	No. of Reoffenders	Total No. of Re-Offending Events	Average number of re-offences per re-offender	Average number of re-offences per offender	Frequency of Re-Offending Events per 100 Offenders	% Changes in Re-Offending Events per 100 Offenders
Jan08-Dec08	286	41.96%	120	449	3.74	1.57	157	10.37%
Jan09-Dec09	344	36.92%	127	438	3.45	1.27	127	(18.90%)
Jan10-Dec10	365	42.47%	155	515	3.32	1.41	141	10.82%
Jan11-Dec11	232	39.66%	92	257	2.79	1.11	111	(21.49%)
<b>Jul11-Jun12</b>	<b>216</b>	<b>40.74%</b>	<b>88</b>	<b>283</b>	<b>3.22</b>	<b>1.31</b>	<b>131</b>	<b>18.27%</b>

## Data Table 5 – National Re-Offending Statistics

1. Data are not available for 2001 due to a problem with archived data on Court Orders

	12 Months Ending December,					12 Months Ending June,					2010-2012	
	2000	2002	2003	2004	2005	2006	2007	2008	2009	2010		2011
<b>Adult offenders</b>												
Proportion of offenders who re-offend (%)	26.17%	27.63%	26.88%	25.47%	24.92%	24.66%	24.55%	25.14%	25.27%	24.94%	25.49%	25.09%
Average number of re-offences per re-offender	3.39	3.59	3.44	3.27	3.10	3.00	2.93	2.94	2.85	2.82	2.88	2.92
Average number of re-offences per offender (frequency rate)	0.89	0.99	0.93	0.83	0.77	0.74	0.72	0.74	0.72	0.70	0.74	0.73
Number of re-offences	423,989	491,373	481,879	427,365	411,154	410,836	417,519	440,892	418,858	394,685	403,726	381,461
Number of re-offenders	125,023	136,943	139,936	130,547	132,594	137,172	142,552	149,730	147,100	140,065	139,941	130,732
Number of offenders in cohort	477,698	495,664	520,660	512,600	532,045	556,196	580,553	595,504	582,069	561,561	548,911	521,002
Average number of previous offences per offender	10.78	11.28	11.41	11.77	11.48	11.29	11.20	11.45	11.89	12.04	12.43	13.09
<b>Frequency of Re-Offending Events per 100 Offenders</b>	<b>89</b>	<b>99</b>	<b>93</b>	<b>83</b>	<b>77</b>	<b>74</b>	<b>72</b>	<b>74</b>	<b>72</b>	<b>70</b>	<b>74</b>	<b>73</b>
<b>Percentage Increases (Decreases)</b>		<b>11.69%</b>	<b>(6.64%)</b>	<b>(9.92%)</b>	<b>(7.31%)</b>	<b>(4.42%)</b>	<b>(2.64%)</b>	<b>2.95%</b>	<b>(2.80%)</b>	<b>(2.33%)</b>	<b>4.65%</b>	<b>(0.45%)</b>
												<b>4.17%</b>
<b>Male Adults</b>												
Proportion of offenders who re-offend (%)	27.46%	28.96%	28.18%	26.84%	26.53%	26.30%	26.22%	26.84%	26.98%	26.66%	27.24%	26.77%
Average number of re-offences per re-offender	3.38	3.56	3.43	3.29	3.12	3.02	2.95	2.95	2.86	2.83	2.89	2.92
Average number of re-offences per offender (frequency rate)	0.93	1.03	0.97	0.88	0.83	0.79	0.77	0.79	0.77	0.75	0.79	0.78
Number of re-offences	368,491	423,178	415,525	370,485	359,189	359,806	365,472	384,949	366,479	345,417	352,658	333,550
Number of re-offenders	108,938	118,775	121,197	112,712	115,086	119,300	123,926	130,273	128,063	122,071	121,945	114,167
Number of offenders in cohort	396,727	410,147	430,126	419,878	433,844	453,558	472,619	485,438	474,740	457,956	447,718	426,540
<b>Frequency of Re-Offending Events per 100 Offenders</b>	<b>93</b>	<b>103</b>	<b>97</b>	<b>88</b>	<b>83</b>	<b>79</b>	<b>77</b>	<b>79</b>	<b>77</b>	<b>75</b>	<b>79</b>	<b>78</b>
<b>Percentage Increases (Decreases)</b>		<b>11.08%</b>	<b>(6.37%)</b>	<b>(8.66%)</b>	<b>(6.17%)</b>	<b>(4.18%)</b>	<b>(2.52%)</b>	<b>2.55%</b>	<b>(2.65%)</b>	<b>(2.29%)</b>	<b>4.43%</b>	<b>(0.72%)</b>
												<b>3.68%</b>

## Data Table 5 – Regression Inputs

Year	Frequency of Re-	Employment	Unemployment				Divorces by	GDP	Disposable	GDP Per		
	Offending Events	Rates	Rates	Crime	Claimants	Homelessness	Wife	Growth	Income Per	Head	Inactivity	(UK)
2000	92.88	0.942017164	0.057982836	4591073	670800	114992	98438	0.035	14004	21431	0.233	
2002	103.18	0.944571168	0.055428832	5333639	601700	129173	102796	0.056	14901	22239	0.234	
2003	96.61	0.945450745	0.054549255	5380428	576400	142555	106013	0.069	15292	23023	0.233	
2004	88.24	0.950293562	0.049706438	5056592	523900	136895	105177	0.048	15556	23632	0.233	
2005	82.79	0.948222287	0.051777713	4984170	587100	110055	96644	0.056	15675	24244	0.233	
2006	79.33	0.943037975	0.056962025	4917885	619100	93870	90375	0.054	15898	24591	0.228	
2007	77.33	0.941833888	0.058166112	4608427.5	553600	76685	87151	0.059	15917	25031	0.233	
2008	79.30	0.941856404	0.058143596	4243946	544700	69275	81466	0.037	15992	25570	0.229	
2009	77.20	0.919191418	0.080808582	3981783	1024700	54270	75834	-0.047	15911	24167	0.232	
2010	75.43	0.912689733	0.087310267	3748464.5	911400	45040	79178	0.054	16104	23683	0.232	
2011	78.43	0.915274541	0.084725459	3479779	885400	52140	77083	0.033	15876	23894	0.234	
2012	77.44	0.913407138	0.086592862	3302132.5	922900	57835	76490	0.011	15827	23800	0.224	

## Data Table 6 – National Employment & Unemployment Figures

England & Wales - Males					
	Economically Active	Economically Active - In Employment		Economically Active - Unemployed	
2000	14,099,000	13,281,500	94.20%	817,500	5.80%
2001	14,155,250	13,389,000	94.59%	766,250	5.41%
2002	14,248,000	13,458,250	94.46%	789,750	5.54%
2003	14,354,000	13,571,000	94.55%	783,000	5.45%
2004	14,434,750	13,717,250	95.03%	717,500	4.97%
2005	14,562,250	13,808,250	94.82%	754,000	5.18%
2006	14,733,500	13,894,250	94.30%	839,250	5.70%
2007	14,875,500	14,010,250	94.18%	865,250	5.82%
2008	15,031,750	14,157,750	94.19%	874,000	5.81%
2009	15,125,250	13,903,000	91.92%	1,222,250	8.08%
2010	15,087,000	13,769,750	91.27%	1,317,250	8.73%
2011	15,234,500	13,943,750	91.53%	1,290,750	8.47%
2012	15,333,250	14,005,500	91.34%	1,327,750	8.66%
2013	15,458,000	14,194,500	91.83%	1,263,500	8.17%

## Data Table 7 – Employment & Unemployment Figures for Local Regions Used in

### Differences-in-Differences Approach

Time Period	Hammersmith and Fulham (Wormwood Scrubs)		Stockton-on-Tees (Holme House)		Peterborough (HMP Peterborough)	
	Employment	Unemployment	Employment	Unemployment	Employment	Unemployment
Jul2008–Jun2009	75.00%	6.00%	74.40%	11.20%	78.20%	5.80%
Jul 2009–Jun2010	70.10%	10.90%	73.30%	9.60%	75.60%	9.80%
Jul 2010–Jun2011	75.90%	5.60%	74.80%	10.30%	77.20%	10.80%
Jul2011–Jun2012	75.10%	10.60%	75.80%	10.60%	77.20%	9.40%

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