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PROPOSAL FOR A SOCIAL IMPACT BOND FOR REDUCTION OF RECIDIVISM IN THE CZECH REPUBLIC

Diploma Thesis

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I declare on my word of honour that I have written the diploma thesis on my own with the use of stated literature.

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Abstract

The diploma thesis aims to propose a Social Impact Bond (SIB) for reduction of recidivism in the Czech Republic. The theoretical part presents the key criteria for success and how to avoid mistakes that may occur with SIB. The empirical part is focused on the SIB setup itself. First of all, it is a definition of key determinants influencing repeat crime. The results show that young men without a university degree are most likely to commit another crime. This probability is further exacerbated by the number of previous crimes committed. The social program within the SIB should thus focus on individuals with these characteristics, especially in the first year after their release from prison. The estimated societal costs of recidivism reached almost CZK 25.5 billion in 2018, which, however, are still underestimated due to the large number of incalculable latent cases. Reducing recidivism by only 7.5% would thus bring social savings of almost CZK 2 billion, which can also serve as an amount for which the SIB can be issued. SIB's profitability is difficult to determine due to the great diversity of social program settings.

Key Words: Social Impact bond, Recidivism, Costs of recidivism, Survival analysis

JEL classification: B55, C24, H53, K14

Abstrakt

Diplomová práce si klade za cíl navrhnout 'Social Impact Bond' (SIB) jako efektivní nástroj pro snížení recidivy v České republice. Teoretická část představuje klíčové kritéria úspěchu a jak se vyvarovat chybám, které v souvislosti se SIB mohou vzniknout. Empirická část je zaměřená na samotné nastavení SIB. V prvé řadě se jedná o definici klíčových determinantů ovlivňující opakovanou trestnou činnost. Výsledky dokazují, že u méně vzdělaných mladých mužů je největší pravděpodobnost opakované trestné činnosti. Tato pravděpodobnost je dále umocněná počtem předešlých spáchaných trestních činů. Sociální program v rámci SIB by tak měl být zaměřen právě na jedince s těmito vlastnostmi, a to zejména v prvním roce po jejich propuštění z vězení. Odhadované společenské náklady recidivy dosáhly v roce 2018 skoro 25,5 miliard Kč, které jsou ovšem stále podhodnocené díky velkému množství nevyčíslitelných latentních případů. Snížení recidivy o pouhých 7,5% by tak přineslo společenské úspory ve výši téměř 2 miliard Kč, které mohou zároveň sloužit jako částka za kterou může být SIB emitován. Profitabilitu lze jen obtížně určit vzhledem k velké různorodosti nastavení sociálního programu.

Klíčová slova: Social Impact bond, Recidivismus, Náklady recidivy, Survival analysis

JEL klasifikace: B55, C24, H53, K14

Contents

Introduction

As the theory of Social Impact Bonds (SIBs) claims, SIBs are a more efficient and, most importantly, less costly way of introducing social policies. The aim of the thesis is to propose a Social Impact Bond (SIB) for the reduction of recidivism in the Czech Republic.

First of all, it is an introduction to the SIB as such. Its methodology, advantages, disadvantages, and its potential use, which the thesis seeks to demonstrate, could be theoretically more effective than the current system of social policy implementation. This is done by a rigorous overview of the theoretical background of SIB, their valuation, and fulfillment conditions followed by reviewing functioning SIBs around the world and finding the essential criteria for SIB to be successful.

Secondly, it is also the definition of the problem of recidivism in the Czech Republic. Over 60% of the prison population is made up of repeat offenders. At the same time, up to 50% of registered crimes can be attributed to recidivists.

The empirical part also deals with the identification of key determinants of recidivist, influencing his or her further criminal activity which is done by Survival analysis. As a result, social intervention within the SIB can be better targeted and more effective. At the same time, the thesis seeks to quantify the total social costs of recidivism. These costs also serve to set the price at which the SIB could be issued, as they can be used to derive cost savings in the event of a reduction in recidivism.

Finally, the study provides several recurrence reduction scenarios and a proposal for the price at which the SIB could be issued. In this part, the study also tries to prove that investing in SIB is an attractive and profitable opportunity for investors. In the end, a simple SIB evaluation system is proposed.

1 What is Social Impact Bond

Social Impact Bonds (SIBs), sometimes also refered to as Social Benefit Bonds (SBBs) (Mitropoulos and Dick, 2015), are a new type of tool for delivering public services through an innovation in social program financing (M. E. Warner, 2013). Using them to invest in public policies started with their development in UK (McHugh et al., 2013). SIBs are getting attention also in the US (Tripodi, 2010), Australia (Tomkinson, 2012), and occasional cases can be found around the whole world (Azemati et al., 2013).

Even though SIBs have a designation 'bonds' there are not bonds exactly (Fraser, Tan, Kruithof, et al., 2018) as one would have imagined from the financial point of view as the return is contingent (Fraser, Tan, Lagarde, et al., 2018). All bonds can be perceived as debt instruments. Liang et al. (2014) describes debt as "...the obligation of a borrower (the debtor) to repay borrowed amounts to a lender (the creditor) according to a pre-determined schedule." (p. 271). State or corporation issue bonds to get the money immediately once they are bought by the public and, in return, pay the interest of specified amount at specified times. Usually, the money raised this way goes into consolidated revenues and from there are used for financing social policies and other state's expenditures (Mitropoulos and Dick, 2015). SIBs are quite different. The common feature is that SIBs operate for a fixed period of time and that there is a final payout. Funders of the social interventions are not sure about the rate of return since that depends on the agreed outcomes and the way they achieve them (Mitropoulos and Dick, 2015). Even though this rate of return can be small, on the other hand, if the intervention is well set, that rate of return can be enormous and, therefore, attract private investors to invest in social service that has a positive impact (M. E. Warner, 2013).

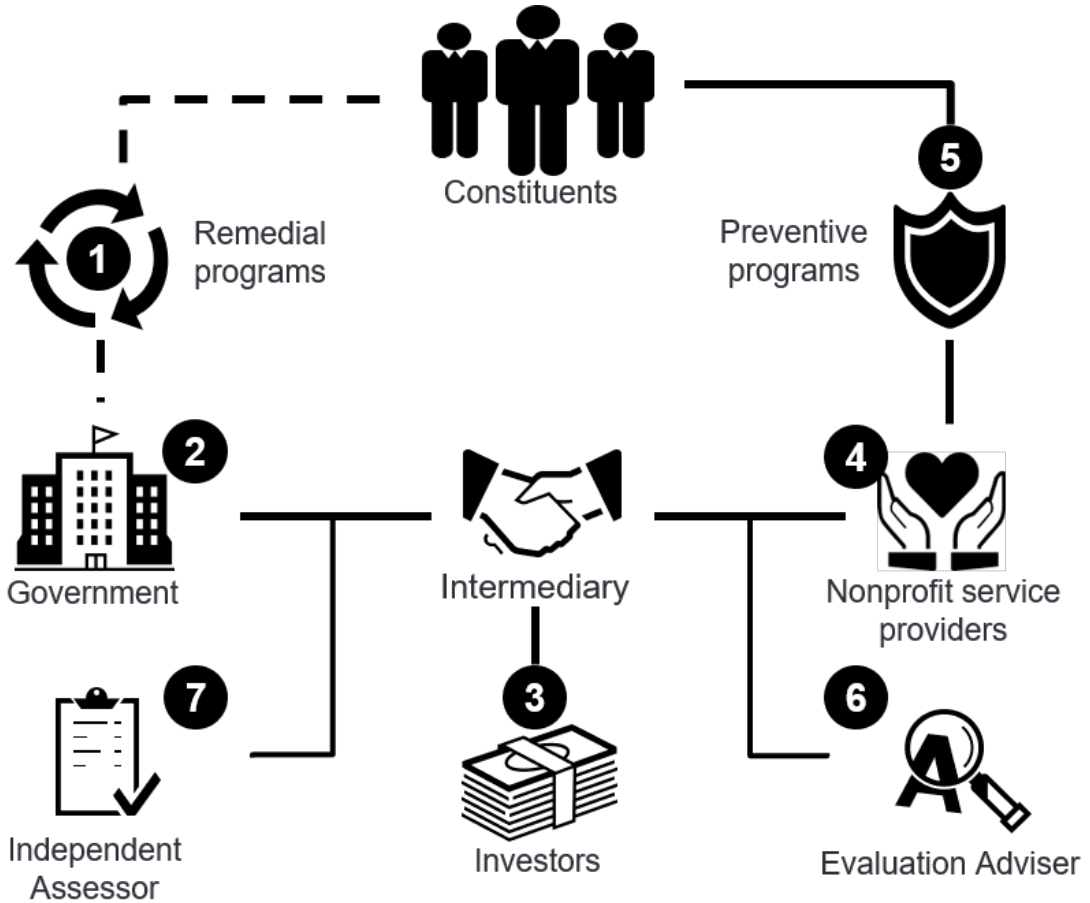
SIBs are a certain form of Payment by Results (PbR) (McHugh et al., 2013). SIBs are extending this framework since the social investments are coming from capital markets and are paid for from the state budget if and only if the arranged criteria are met at the end of given period. A private investor can, therefore, earn interesting investment returns when counting with risk (European Parliament, 2014). On the other hand, the government would not introduce a SIB without knowing that savings from a successful SIB would exceed the offered payment. All that suggests that SIB should be far more efficient. The

investor would be driven by innovation focusing on meeting the desired outcomes with as few resources as possible and, therefore, on getting the biggest reward. Since the reward is paid on if the agreed outcomes are met, SIBs as a form of delivering social services would have gotten the risk out of the hands from the Government (Fox and Albertson, 2011).

1.1 How does it work?

As stated before SIB is based on a Payment by Result (PbR) contract. SIBs are built on relations among philanthropy, government, and the investment community (Ragin and Palandjian, 2013). In the SIB scenario, it is the investor from the private sector who bears the whole risk of the program even though that investor does not have to actually manage the program, so it is very similar to some kind of bet. However, the intermediary is known to the investor so there is never zero influence of the investor on the social program. If the program turns out to be successful, meaning that all the agreed criteria in the contract had been met, the investor will get paid by the state and makes a profit. On the other hand, if the program turns out to be unsuccessful, the state will make no expenditure and the whole loss is carried by the investor (Mitropoulos and Dick, 2015). Figure 1 describes the SIB scheme in a detail way.

Figure 1: Social Impact Bond scheme



Source: McKinsey&Company (2012), modified

1. **Constituents** are the center of a SIB scheme as those are the people who are directly affected by a social program within the SIB. In the case of this thesis, they would be recidivists. As discussed in a more detailed way in Chapter 1.2, SIBs are best used in areas where local governments provide so called **Remedial programs**. Remedial programs are programs that focus on issues after they have already happened. For instance, incarceration for criminals or emergency room access for homeless people (McKinsey&Company, 2012). Such programs are expensive and risky for the government and not very effective for Constituents as they are often focused on the consequences and not the cause (McKinsey&Company, 2012).

2. Local **government** enters a contract with an **intermediary**[1] to develop SIB. The contract must precisely define the criteria for success and its measurement[2]. For instance, government specifies that they want to reduce recidivism among the released prisoners by 10% and are willing to pay CZK 50 million for it. The intermediary's task is then to choose the evidence-based approach to achieve these goals, to choose non-profit organizations that can implement this solution, to raise capital from investors, to supervise the project, and possibly adjust it as needed. If the project meets the targeted outcomes, the government will pay investors their capital plus return through intermediaries. The intermediary and service providers should also receive previously agreed amount for the successful completion of the SIB. (McKinsey&Company, 2012).

3. **Investors** are most likely to be philanthropists who are motivated mainly by the vision of helping the whole society rather than financial motives. Investors' money is distributed through intermediary to nonprofit organization which is in charge of social programs (McKinsey&Company, 2012).

4. **Nonprofit service providers** are chosen by the intermediary based on the ability to implement the evidence-based preventive solutions selected by the intermediary. Then, the nonprofit service providers are in charge of implementing social (preventive) programs (McKinsey&Company, 2012).

[1] **Intermediary** is usually represented by a consulting company with expertise in finance, social impacts, contract dealing, fundraising, and the specific issue that the SIB is aimed for (The National Lottery Community Fund, 2017).

[2] Further discussed in Chapter 1.3.4

5. **Preventive programs** are programs that focus on preventing issues so the negative social outcome does not occur. For instance, alternatives to incarceration or constant support for homeless people at some level (McKinsey&Company, 2012). These programs are delivered by the nonprofit service providers to the Constituents (McKinsey&Company, 2012).

6. An **Evaluation Adviser** is hired by the intermediary and analyzes the ongoing results of the entire social program and provides expert opinions. In the event of unfavorable developments, it proposes to the intermediary a recommendation on what to change for the program to succeed (McKinsey&Company, 2012).

7. An **Independent Assessor** must be present from the beginning, when setting up the contract. Independent assessors are responsible for developing the methodology that will be used for social program evaluation (Cave et al., 2012). The independent assessor thus decides on the success of the program after its completion (McKinsey&Company, 2012).

When setting up the contract, the government knows how much they value a reduction of recidivism by 10%. This estimate can be done either by the government itself or by the external consulting company. More accurately, the government would know how much taxpayers' money they would have saved if the recidivism would have decreased by 10%. The contract would be set on a smaller amount than the amount of potential cost savings so the government would make a profit (European Parliament, 2014). The estimation of cost savings from reduced recidivism is one of the subjects of this thesis and can be found in Chapter 5.3.

Raising money comes after the contract is set. Even though this part may seem like the hardest part of this scheme especially in these days, the opposite is true. There's plenty of socially motivated investors who would like to invest in something that would help the society, cause good, and furthermore, is also profitable (Mulgan et al., 2010).

As shown in Figure 1, raised money is financing particular services that aim at the goal that the government had set in the contract. If those services are successful they improve the outcomes. And with those measured outcomes, for instance, a reduction of recidivism,

the government saves money. The intermediary will pick the most effective and cheapest social programs to achieve the desired results so it can have the most profit from the government payout. In the end of the social program, with those savings, the government can pay the outcomes and the returns to the investors if the SIB delivers the desired reduction of recidivism (European Parliament, 2014). The most difficult part in this scheme is the measurement of the outcome that must be provided by preferably more independent assessors (Liang et al., 2014). This issue and more theoretical disadvantages are further discussed in the Chapter 1.3 that focuses on theoretical problems with SIBs.

1.2 Theoretical advantages of SIBs

SIBs possess a great potential for an increase in investments and, most importantly, the quality of investments to ameliorate social wellbeing (Mulgan et al., 2010). Following section highlights the differences between SIB and current state of delivering social policies.

1.2.1 Innovation

SIBs possess a great opportunity to inspect innovative solutions for, at first glance, unsolvable social problems (Nazari Chamaki, Jenkins, and Hashemi, 2018). Supporters of PbR claims that letting up providers to deliver services in multiple different ways will support greater innovation (Fox and Albertson, 2011). SIB enables the testing of new ideas in a way that is less difficult for everybody. Government defines problem and reward for removal. Private sectors finds solutions that is unknown to government as it is private sector is driven by the vision of profit. Also, involving investors who are knowledgeable and experienced in a particular area would bring new rigor and discipline to the supply of social services (European Parliament, 2014).

1.2.2 Rigour

SIBs are promoting evidence-based action when focusing on the evidence in the middle of the process. SIB needs to be evaluated by design. Unlike most of the social policies that are attempted to be evaluated by impact assessment before they are enacted without any concerns about the evaluation of their actual effects. If the SIB is successful, this leads to design with focus on being measurable. With this approach, SIBs are enhancing methods that are working while encouraging evaluation of impact in general which is a deeply underestimated problem in delivering social policies (Mulgan et al., 2010).

1.2.3 Flexibility & Partnership

While the program is implemented, data can be gathered and observed. Furthermore, they can be measured and the social program could be adjusted if the program is not working as assumed. The 'normal' way of implementing social policies used is such that once it is in place, there is nothing to do with it. At the same time, no one knows much about its success, because the government is not very interested in it. This possibility of adjustment leads to another big advantage that SIBs represent and that is Partnership. While carefully observing the data and social program, various new ways could be found on how to link other expertise and cooperate to come up with the best possible outcomes (Mulgan et al., 2010). Also, as stated before, there are many individuals with the intention of investing in social change. The idea of SIB can bring this type of people together and, since there is not so much politics involved, actually cause a good impact on society.

1.2.4 Risk Transfer

Probably the greatest advantage in the eyes of politicians would be the risk transfer. When big government investment is made with very low or none impact what so ever, government faces a critique. This would completely disappear as the payment for a SIB would be made only if the SIB meets the agreed targets and if it does not, it is not the fault of the government. Moreover, it is suggested that these raised funds from private investors would flow into areas that would normally do not receive necessary funding from the government since those areas are often labeled too risky. However, those are the areas most appealing to hedge fund investors (Mitropoulos and Dick, 2015). This way, investors can feed their altruistic needs while having the chance of making a profit (Nazari Chamaki, Jenkins, and Hashemi, 2018).

To support this, Mulgan et al. (2010) states that so called 'Charitable funding' would play a major part. Charitable funding is based on emotions and mostly floats to areas where political considerations play an important role. This would be observed to a greater extent. Areas related to prisoners, youth offenders, drug addicts, etc. pose greater political attention and more discussion since it is the taxpayers' money that would be spent on these 'problematic' groups of people and, if come to nothing when social policy is set

incorrectly, cause a great scandal. Therefore, a greater focus on measurable outcomes and reinvestment may increase charitable foundations' ability to attract donations from the public as donations would be reused on multiple projects (Mulgan et al., 2010).

1.2.5 Consistency

Last but not least, SIBs can also provide a certainty of funding for a longer period. SIBs have systematic structure thanks to that the government can achieve cost-effective solutions and the third sector organizations can obtain consistent goals and foreseeable funding (Mulgan et al., 2010).

Generally, many countries, including the Czech Republic, are facing the problem of aging population and the pressure on public resources is enormous. As mentioned in the previous chapter, SIBs can save governments', more precisely, taxpayers' money by allocating resources where they are needed the most. This is done by new evidence-based action that helps to correct poorly set incentives and by new ways of funding (Mulgan et al., 2010). Especially those incorrectly set incentives are an issue that needs more attention and which can be partially corrected by SIBs. There are many people with the resources and ability to cause an impact in public policy but they have no incentives to act. SIBs can provide this slight nudge (Thaler and Sunstein, 2009). By letting new market entrants invest not only into something for a good cause but also into something that could provide a return based on analytical rigor could be an incentive big enough to persuade these new entrants from the private and voluntary sector to invest in SIBs and, therefore, secure new funding for public policies (Fox and Albertson, 2011).

1.3 Theoretical problems and challenges of SIBs

Even tough SIBs carry many benefits and advantages, there are some challenges that need to be mentioned and tackled.

1.3.1 Complexity

The most common argument against SIBs comes directly from the Ministries of Finance that claim that SIBs are an unnecessarily complicated way of financing better social programs (Mulgan et al., 2010). Furthermore, the governments' cost of capital is far cheaper than the markets' ones[3]. So, if they are better and more effective approaches of delivering social policies, the government should provide the funding directly and not via SIBs (Mulgan et al., 2010).

1.3.2 Asymmetric information

Moreover, previously mentioned benefit of risk transfer has its downside as well. SIBs are a form of a Public Private Partnership (PPPs) and PPPs in general often have troubles with risk transfer (M. Warner, 2012). SIBs are releasing the government of its responsibility to solve social problems (Helbitz et al., 2016). The government is not choosing the provider that delivers certain social services and, therefore, losing the democratic accountability (McHugh et al., 2013). Loss of this direct relationship between the provider and the government will cause an increase of asymmetric information in favor of the provider. Then, if the provider would choose to reach the desired outcome by using bad, unethical, or immoral practices, the government would have very limited power to influence these wrong approaches (McHugh et al., 2013). The importance of setting the right and fair contract is enormous and should include an agreement on how to achieve the desired results.

[3]Governments may borrow at a lower interest rate than private firms. Also, public costs of capital is lower as the risk is spread among more risk bearers, i.e., the taxpayers (Irwin C., 2007)

1.3.3 Lack of Evidence

What can seem great but is rather challenging is the fact that SIBs are rather new and there are very few ways to follow. This lack of knowledge causes difficulties when attracting investors since there are no hard data or previous cases to built on. Therefore, attracting investors can be tied with serious marketing costs (European Parliament, 2014). Besides, as described in Chapter 1.1, SIBs involve other parties which can make negotiations more complex and slightly more difficult to manage. However, challenges can be prevented if carefully considered when SIBs are in the development phase. The biggest problems with SIBs are most likely to be found in the risk management, designing phase of SIBs and in its implementation (Mulgan et al., 2010).

Social interventions of a medium, or bigger, scale represent a certain risk since providing strong evidence of such intervention to be functional in a particular environment, i.e., place and context, is very rare. Therefore, examiners of social programs are rather skeptical when a social program promises an impact greater than 30% compared to other alternatives as number of previous smaller projects showed that an social intervention with impact greater than 30% is hard to reproduce (Mulgan et al., 2010). Experience suggests aiming at impacts around 10%, up to 20% at most. (Mulgan et al., 2010).

1.3.4 Measurement & Robust Evidence

Most likely the biggest critique or an issue that the literature claims against the SIBs is the complex problem of outcome measurement. For example, when talking about the recidivism rate, released prisoners may be affected by a social program within the SIB but the result might also rely on other unrelated changes in housing, the employment market in the local area, or different benefits (European Parliament, 2014). There are also others, more general problems with measurement and design. For instance, a bias commonly known as 'Cherry picking' which selects only the participants that are the most suited for particular intervention and, therefore, most likely to meet the targeted outcomes. Or it could be 'Cream skimming' bias that includes in the final cohort only the ones that exhibits the highest impact (Gotsis, 2017). However, both of these biases can be prevented if the contract is set up correctly. That is, if it clearly defines the sample on which the

social program is to be applied and on which the measurement will be performed. On the other hand, the Cherry picking bias does not have to be necessarily a bad thing. If social intervention within the SIB is properly targeted at a certain type of people, the required reduction in recidivism can be achieved more effectively and in a cheaper way. Chapter 5.2.4 uses survival analysis to reveal a few key determinants influencing repeat crime and where the SIB should be targeted.

To truly determine whether the SIB is successful or not, i.e., whether the contract met the agreed criteria and the payment should be made, SIB outcome must be measured fairly and correctly without any biases. Mulgan et al. (2010) states that "Robust measurement requires that there is a clear link to the desired outcome, shared assumptions on costs, conservative and defensible forecasts and an allowance for second order effects." (p. 17), which seems straightforward but can be rather problematic. Establishing a system to gather robust evidence for a determination whether a SIB is truly successful or not can be difficult and resource-intensive (Sinclair et al., 2014). Most of the times the social interventions are interacting with other social interventions that are already in place and it is hard to estimate the impact of just one exact social program. This must be considered and accounted for when setting up SIB, also, the control group should be similarly affected by already existing social programs. When estimating the impact of SIB, one has to be sure that the resulting effects are due to SIB and not to chance. Therefore, the cohort size must be set accordingly to the size of a SIB (Mulgan et al., 2010). The evaluation method for the resulting SIB leading to the reduction of recidivism in the Czech Republic is more discussed and proposed in Chapter 5.3.2.

1.3.5 Unintended Consequences

Another challenge for SIBs lies in the unintended consequences. The purpose of SIBs is not to displace already existing interventions, and related spending, by incentivizing existing funders to cut spending. Even though this may seem as an easy obstacle to cross, it can be challenging in cases where interventions overlap. For instance, some charities may feel that social investment organization is a competitive threat, in the sense that increasing social investments could cause a reduction of grants for charities (European Par-

liament, 2014). To solve this, SIB provider can include other already existing providers in the same area of interest rather than exclude them. By doing so, the SIB partner provides a strong incentive to make the SIB work and can make an agreement with the other providers in the same area of interest (Mulgan et al., 2010).

1.3.6 Design & Implementation

Designing and proposing a SIB is a very time and resource-intensive task. Three main steps of implementation might be identified (Mulgan et al., 2010):

- From interest to feasibility assessment;
- From deepening analysis, testing different perspectives, finding potential sources of financing to creating a business case;
- From contract creation to contract conclusion.

To complete all of these steps, strong analytical and conceptual skills as well as pilot studies are required. It is also necessary to have strong managerial skills in contract dealing. Even if the design and implementation are challenging, compared to the current way of social policies, SIBs are a great tool to tackle hard to solve problems, making it worthwhile to explore and implement.

1.4 Essential Criteria of Success

In order for the use of SIB to make sense at all and to avoid all challenges, Mulgan et al. (2010) sums up the criteria that SIB should meet in order to work and perform properly:

- **Preventative intervention**[4] - the intervention is preventative and there is no sufficient funding available at the moment
- **Improves social wellbeing** - The intervention improves wellbeing and prevents from poor outcomes, especially in areas of social need
- **Evidence and Measurable impact** - The social intervention is under strict supervision, data are gathered throughout the whole process which provides clear evidence of the impact and increases confidence in funders in SIBs
- **Aligns incentives** - The government achieves savings or lower cost because of the actions done by others
- **Savings bigger than costs** - The savings must be much greater than are the costs of intervention and transaction costs. That guarantees investors enough return to undertake the risks related to the scheme of SIBs and can provide financial assets for social investments
- **Preference for SIBs** - The Government must be open to the use of SIBs

Without these conditions, the SIB cannot function. The last condition is especially important - the preference for SIBs. If governments are not open to this idea, then the SIB, and especially contract negotiations, cannot succeed.

[4]The intervention is preventative because such interventions prevent the rediscovery of a negative social issue, thus saving social costs in the long run (McKinsey&Company, 2012).

2 Social Impact Bonds in use

Generally, SIBs are a good fit in the areas where funding intensive services with complex individual needs are necessary. Where the financial and political costs are high when not addressing the particular issue (Helbitz et al., 2016). Therefore, SIBs find themselves the most useful to fight controversial topics such as criminality, homelessness, or drug addiction (Arena et al., 2016). On the other hand, SIBs are also used to support children and family care, education (Liang et al., 2014) or health and social care (Fraser, Tan, Kruithof, et al., 2018). However, the thesis focuses mainly on SIBs used to fight recidivism.

2.1 Different types of SIB

However easy and straightforward the SIB theory may sound, the reality might differ. Just a very few SIBs that are or were in use follow the abovementioned theory of SIBs strictly. Existing SIBs can be divided into three categories based on their compliance with the abovementioned theory as stated in Arena et al. (2016). The biggest difference between the three types of SIB models is in their structure and risk management as they differ most in independence from the government and the amount of risk borne by the investor. With the help of this division, it is possible to classify individual existing SIBs into the relevant categories and further evaluate which category, i.e., how strict adherence to the theory, is the most effective for the SIB.

2.1.1 Fully compliant SIB

The fully compliant SIB is completely consistent with the theory. In this setup, the leading role belongs to the intermediary[5]. Therefore, the intermediary decides about the implementation of the social intervention, arranges the funding, manages the repayments, controls the progress of the introduced social program, and can even change it if it finds beneficial since the government has very limited control over the service provider. All the responsibilities are handed over to the intermediary. This way allows the intermediary the

[5]The intermediary is the one in whose competence is the selection of the nonprofit service providers, raising money from investors, etc. as described in Figure 1.

maximum flexibility and to do anything within the boundaries of the contract to achieve the desired result (Arena et al., 2016). Also, this scenario does not provide any guarantee to the investor for a refund of at least some amount of money if the targeted outcomes are not met (Ramsden, Noya, and Galitopoulou, 2016). An example of such a SIB would be the very first one - HMP Peterborough (Anders and Dorsett, 2017).

2.1.2 Partially compliant SIB

SIBs that fall into this category are the ones that are limited on their regional level meaning that their impact on the whole society is somehow restricted. Also, the government plays an important role in designing and implementing the SIB (Arena et al., 2016).

Another distinguishing factor is that partially compliant SIBs are lacking the innovation since SIBs of this type are mostly just an extension of already existing social programs (Arena et al., 2016).

Moreover, the investor is not carrying the full risk. Usually, another party is involved that guarantees at least some coverage of the investor's investment (Ramsden, Noya, and Galitopoulou, 2016). An example of such a SIB would be the Riker Island SIB (Phillips and Olson, 2013).

2.1.3 Marginally compliant SIB

The last category is characterized by a simple expansion of an existing program usually done by one service provider. Even though these types of SIBs are based on the PbR logic the included parties are focusing on the intervention rather than targeting certain outcomes. Also, marginally compliant SIBs are limited on a regional level and are characterized by a major government involvement (Arena et al., 2016). Moreover, the contract is unique by involving a save net for investors that, therefore, do not carry that big of a risk (Ramsden, Noya, and Galitopoulou, 2016). This type of SIBs is very common for SIBs in the United States (Arena et al., 2016).

2.2 Peterborough Prison

As mentioned in the first chapter, the idea of SIB was first invented and applied in the United Kingdom in 2010. The SIB was launched in the UK, in Peterborough Prison. This SIB was used to fund a program called 'The One Service' which was aimed to decrease recidivism among the male offenders released after a sentence of less than 12 months (Anders and Dorsett, 2017). Investors were to be paid based on the results achieved, in this case by reducing recidivism.

In this case, the Ministry of Finance merged with the Big Lottery Fund, which agreed to participate in the payment of rewards in the event of the success of the SIB. The SIB will be considered successful if the reduction of re-conviction events overall decreases by 7.5%. An early payment could be obtained if individual cohorts showed a 10% reduction in re-offending (Anders and Dorsett, 2017).

The social service - 'One Service' - was an optional scheme to support the reduction of recidivism. The first contact with the offenders was made whilst they were still in prison and continued once the prisoner was released. Every prisoner was treated individually based on his specific needs by paid caseworkers and volunteers. By a pro-client approach and mixture of activities, offenders received unique treatment for their needs (Anders and Dorsett, 2017). This demonstrates the advantage of SIB. Result driven private sector will pick the best solution to a problem, even if more complicated while observing in detail its progress.

Originally, the SIB was not to be terminated before 2017. Peterborough SIB funded the One Service for three cohorts of approximately 1,000 offenders. One Service was a voluntary program for prisoners for a period of up to twelve months after the release. The first two cohorts operated on a PbR basis. The third cohort received support based on 'fee-for-service' agreement and not completely on the PbR scheme. This change was due to reforms called 'Transforming Rehabilitation' which were reforms introduced during the operation of the ongoing One Service program. These newly introduced reforms introduced mandatory statutory supervision of short convicted offenders, which is the target group for the Peterborough SIB. Transforming Rehabilitation reforms also included a PbR funding scheme to incentives for providers to limit recidivism. To avoid duplica-

tion in services among the same population, the SIB was concluded earlier (Anders and Dorsett, 2017).

As stated at the beginning of this chapter, the SIB was to be considered successful if the re-offending decrease by 7.5%. More specifically, if the number of re-convictions decreases by 7.5% in the twelve months after the release of the whole program. This measurement was called 'final cohort' and it was the weighted average of cohort 1 and cohort 2. Also, if the recidivism decreased by 10% in either of those two cohorts, the SIB will be considered successful as well (Anders and Dorsett, 2017).

To estimate the impact, a Propensity Score Matching (PSM) method was used (Jolliffe and Hedderman, 2014). PSM method is a method that matches together with a subject from a treatment group to a subject from a control group based on their similarity in observed characteristics. If the relevant differences between two subjects are captured in the observable (pre-treatment) covariates, i.e., outcomes are independent of treatment prior to pre-treatment covariates, then the PSM method can yield to an unbiased estimate of the treatment effect (Dehejia and Wahba, 2002). This method is also proposed as the best possible for the evaluation of SIB to reduce recidivism in the Czech Republic and is described in more detail in Chapter 5.3.2.

All of the estimations were done by independent assessors to ensure impartiality. The estimated reduction in re-convictions for cohort 1 was 8.4% (Ministry of Justice, 2014). The results and used methodology were rigorously examined by several independent investigators, but there were no major changes (Anders and Dorsett, 2017). With this first cohort, the treatment group was formed by the offenders leaving the Peterborough prison whilst the potential control group was consisting of offenders leaving another prison and those who were still staying at Peterborough prison during the cohort 1 period (Anders and Dorsett, 2017). A slightly different approach was used in cohort 2. The treatment group consisted of offenders that were released from the Peterborough prison for the first time in their lives during the cohort 2 period whilst the control group was formed by all the offenders that were released from different prisons for the first time of their lives. For cohort 2 the reduction in recidivism was estimated on 9.74%, therefore, a result not eligible for earlier payment. This result was not significant at the 95% level but was significant at the 90% level (Anders and Dorsett, 2017). Nevertheless, the reduction of 10% was not

achieved and so the final cohort estimation needed to be estimated to determine whether the SIB was successful or not.

Final cohort was estimated quite straightforwardly as a weighted sum of the cohort-specific impact estimates as described in Anders and Dorsett (2017):

$$\Delta_{12} = \Delta_1\omega_1 + \Delta_2\omega_2 \tag{1}$$

In this simple equation, Δ_{12} stands for the final cohort estimate whilst δ_i represents the impact in cohort i and ω_i stands for the weighted proportion of the total counterfactual reconviction events across both cohorts accounted for by cohort i. An estimate for the final cohort was 9.02% reduction in reconviction (Anders and Dorsett, 2017).

This number is bigger than 7.5% which means that the SIB was, in fact, successful and the payment was made.

2.3 Riker Island

Another SIB focused on the reduction of recidivism which gained a lot of attention was the Riker Island SIB, issued in August 2012, because it was the first SIB in the United States (Phillips and Olson, 2013). Being the first SIB in the United States is not the only reason for its popularity, the other reason is that the investor of this SIB was well known Goldman Sachs Bank's Urban Investment Group (UID) that funded this SIB by a loan [6] of $9.6 million to the MDRC (Manpower Demonstration Research Corporation) that was supposed to be repaid from the actual cost savings as a result of the expected reduction of re-offending, as usual in the cases of SIB (Phillips and Olson, 2013).

This SIB was focused on incarcerated people on Riker Island at the age of 16 to 18. In here, the social program was therapeutic services for the youngsters - Moral Reconation Therapy - focused on developing social decision-making skills (Berlin, 2016).

The SIB supposed to be repaid partially by the actual projected cost savings of New York City from the reduction in recidivism to the MDRC and then MDRC was supposed to repay the loan to the Goldman Sachs. The actual payment was based on the percentage reduction in the re-admission rate and related net savings with such reduction. For instance, in the reduction in the re-admission rate was between 11% and 12%, the projected net savings were $1,700,000, and city payment to the MDRC was supposed to be $10,080,000. If the reduction was between 16% and 20% the projected net savings were $11,700,000 and the payment to MDRC should have been $10,944,000. Even though this does not seem to be too profitable for MDRC, a grant in the amount of $7.2 million was given to MDRC by Bloomberg Philanthropies which meant that the major share of the loan provided by Goldman Sachs would have been repaid anyway and, therefore, greatly reducing the risk of Goldman Sachs (Phillips and Olson, 2013).

To sum up, if the recidivism drops by 10%, the Goldman Sachs would get repay the full investment and the bigger the drop of recidivism the bigger the interest and Goldman Sachs can make a profit up to $2.1 million. On the other hand, if the recidivism drops by less than 10% the Goldman Sachs would lose $2.4 million since Bloomberg Philanthropies

[6] Loan was given to MDRC that is an experienced intermediary for bringing together public and private funders to test new ideas in the policy making

pays $7.2 million of the loan no matter the result.

If the program would be successful, the New York City would pay Goldman Sachs the loan with interest and MDRC would be free to reinvest the Bloomberg's grant of $7.2 million further in other SIBs (M. Warner, 2012). In the end, the SIB did not meet its targets and was designated as a failure.

2.3.1 Why did it fail to meet the targets?

The Vera Institute for Justice was elected as an independent assessor of the results during the contract dealing. This institute came to the conclusion that the program did not cause the required reduction of recidivism after a one-year to follow up meaning the program did not meet its targets and was interrupted in August 2015 (Berlin, 2016). Even though they did not provide an explanation of the failure in their report, some explanations can be found in the MDRC data. Moral Reconation Therapy was assigned to almost all people from the targeted evaluation, however, the amount of Moral Reconation Therapy among the targeted group varied a lot. While forty percent of participants from the earlier studies who received numerous sessions exhibited positive outcomes, only nine percent of participants completed the whole 12 stages of the program. The original plan was for 30% of participants to complete the program Berlin (2016). This partial failure of the plan was mainly due to security-related interruptions causing scheduled sessions delay and cancellations. Also, the length of the stay for an adolescent is hard to predict. Another factor was the incredibly high-stress level that was these young people experiencing while awaiting their trial causing their inclusion and participation rather difficult (Berlin, 2016).

Even though this SIB was technically a failure, it does not have to necessarily undermine the concept of SIB nor the benefits of SIB. During the interventions, a lot of data were gathered that will support further research. And even though the Goldman Sachs lost some money, in the eyes of public Goldman Sachs is the firm that is not feared to invest in social policies and in the public good. SIBs are representing a very unique opportunity to invest in something real, to make a real difference with the potential of earning interest and also, with great side benefits like better public perception. Without a doubt, SIB is a risky investment but as it turns out in this case, a loss of money does not have to mean a

loss generally (Phillips and Olson, 2013).

2.4 New York State SIB

Since SIBs are a very new and unique way to tackle not only recidivism many SIBs are currently in use or in the evaluation phase. One of those is New York State SIB that was introduced in 2013 for an amount of $13.5 million. New York State SIB not only aims to reduce recidivism but also focusing on the increase in employment among newly released offenders (Gotsis, 2017).

The service delivery period was set to four years. The main motivation behind the project was a fact that 44% of offenders under the supervision are without employment and are back in jail within two years after the release. Bank of America Merrill Lynch's (BAML) clientele fund this SIB by $12.18 million as BAML is also an intermediary in this case. The rest of the funding, $1.32 million was provided by the Rockefeller Foundation which served as a guarantee (10% of the invested money) to the investors if the whole project would not meet the necessary targets to get the full refund. However, if at least the minimum agreed reduction in relapse is not achieved, all the money will be wasted and the investor will get nothing at all (NFF, 2018).

The intervention is meant to support 2,000 high-risk recently released offenders in the state of New York to move back into the social life by re-entry to the transitional employment services focused on increasing non-funded employment, hence, reducing re-offending (NFF, 2018).

The evaluation will be measured by Randomized Control Trial by an independent assessor and will take five and a half years (Gotsis, 2017). RCT method was chosen as an evaluation method as the targeted offenders are chosen randomly without any further specified characteristics[7]. The evaluation is tied to previously agreed success criteria and will be focused on a number of prison bed-days, engagement in a transitional job, and an increase in employment (NFF, 2018). For investors to get their payment the intervention must reduce recidivism by at least 8% and/or increase employment by at least 5%. If results exceed this threshold, the returns up to 12.5% could be earned (Gotsis, 2017) meaning the maximum payment of $21.6 million if the recidivism reduces by at least 40%.

[7]RCT method is more suitable when the experiment is randomized. On the contrary, PSM method is better when the experiment is non-randomized or where pre-treatment characteristics are included (Collins and Le Manach, 2012)

3 Methodology used for SIB proposal

Several things are needed to set up and design the SIB. First of all, it is the identification and estimation of savings from the remedy of some recidivists, respectively the saved social costs from the reduction of recidivism. At the same time, such an estimate provides the amount for which a SIB can be issued, i.e., the the base of the payment. The approach follows Heeks et al. (2018) and is described directly in Chapter 5.1.

Furthermore, it is necessary to know the period after release in which the individual is most likely to commit a crime again. The social program can thus be more intense in this critical period of time. It is also necessary to identify the characteristics of the offender that most affect his or her repeated crime and thus target the social program to the individual most likely to commit other crimes. For the SIB to be successful it needs to be output oriented which means to know what offenders are most likely to commit a crime again amd therefore, where the social program should be targeted. To define that, a survival analysis, described in Chapter 3.1, is used. This estimation may also be used to find out the period where the released offenders are most likely not to return back to prison.

Finally, to determine whether the investment into the SIB is profitable or not and under what conditions, a methodology of Internal Rate of Return (IRR) is used.

3.1 Survival analysis

Survival analysis is a great tool to determine the time until an event occurs which is an outcome variable. Survival time is very flexible and time can represent days, months, or even years. An event can be represented by disease, death, recovery, etc. The time between the beginning of a study and an event is usually called ‘survival time’ and the event is referred to as ‘failure’ (Kleinbaum and Klein, 2012).

Survival analysis is focusing on the time until reimprisonment occurs which helps to estimate the time during which persons released from prison are most likely to commit a crime again. The analysis consists of the Survivor function and Hazard function.

3.1.1 Survivor function

For both, survivor and hazard function, a denotation of random variable T must be introduced. T represents a person's survival time that can theoretically be any non-negative value. The actual survival time for a person is denoted by t and is assumed to be a realization of the random variable T as described in Dickman and Hakulinen (2003).

For both functions, a dummy variable d, which indicates failure must be introduced as well. $d = 1$ if and only if a failure, or in other words, if an event occurs. Meaning that an individual was imprisoned again during the experiment. On the other hand, $d = 0$ if censored occurred [8]. Meaning that an individual was released from prison during our study period but did not fail during the experiment (Kleinbaum and Klein, 2012). In this case, was not imprisoned again.

Generally, it is assumed that this random variable t follows probability distribution function $f(t)$ and has a cumulative distribution function $F(t) = Pr(T \leq t) = \int_0^t f(x)dx$. Therefore, a survivor function $S(t)$ that determines an individual probability of surviving until at least time t is written as follows (Dickman and Hakulinen, 2003)

$$S(t) = Pr(T > t) = 1 - F(t) \tag{2}$$

3.1.2 Hazard function

Hazard function is denoted by $\lambda(t)$ and interprets a death rate at time t, conditional on survival up to time t as described in Dickman and Hakulinen (2003). The main difference between hazard and survivor function is in its interpretation. Whilst survivor function is interpreted as a probability of surviving until at least time t, meaning at surviving and not failing, the hazard function is focused on the exact opposite. The hazard function is focused on failing, therefore, on event occurring (Kleinbaum and Klein, 2012). Formally, the hazard function can be written as in Kleinbaum and Klein (2012)

$$\lambda(t) = \lim_{\Delta t \to 0} \frac{P(t \leq T < t + \Delta t \mid T \geq t}{\Delta t} \tag{3}$$

where hazard function $\lambda(t)$ equals the limit, as Δt approaches zero, of a probability state-

[8] Censoring is described in a more detailed way in a chapter 5.2.1 which is discussing the dataset.

ment divided by Δt. The probability statement is a conditional probability that an individual's survival time T will be in the time interval between t and $t + \Delta t$, given that the survival time is at least as big as t as described in Kleinbaum and Klein (2012). Because of this conditional probability in the numerator, hazard function is often referred to as a conditional failure rate. The designation rate is more accurate since the value does not have to necessarily lie between 0 and 1, as it is the case survivor function, but it takes values from zero to infinity.

A relationship between survivor function and hazard function is quite straightforward as described in Dickman and Hakulinen (2003). The cumulative hazard function is given by

$$\Lambda(t) = \int_0^t \lambda(u)du \tag{4}$$

Now, distribution function, survivor function and hazard function are mathematically related such that if we know one, we can define the other two. For instance, hazard function is given by

$$\lambda(t) = \frac{f(t)}{S(t)} = \frac{f(t)}{1 - F(t)}$$

the right side of the equation can be adjusted using the substitution method where the substitutes are $y = 1 - F(t)$; $dy = -f(t)dt$; $dt = -\frac{dy}{f(t)}$

$$\frac{d}{dt}\int \frac{f(t)}{1 - F(t)}dt = \int \frac{f(t)}{-y}\frac{dy}{f(t)}dy = -\frac{d}{dt}lny$$

after substituting back, the equation can be re-written as

$$\lambda(t) = -\frac{d}{dt}ln(S(t)) \tag{5}$$

Therefore, after integrating and expanding it is possible to express the survivor function using the hazard function

$$S(t) = exp\left[-\int_0^t \lambda(u)du\right]$$

which can be easily transformed into formula expressing survivor function using just cumulative hazard function

$$S(t) = exp(-\Lambda(t)) \tag{6}$$

Naturally, a cumulative hazard function can also be expressed using survivor function as

$$\Lambda(t) = -lnS(t) \tag{7}$$

3.1.3 Parametric regression model - Weibull distribution

As far as parametric regressions go, the Weibull distribution is the most common in econometrics (Cameron and Trivedi, 2005). As the designation parametric suggests, the difference from the hazard function stated above is that now a parameter is involved. As stated in Zhang (2016) "While semi-parametric model focuses on the influence of covariates on hazard, fully parametric model can also calculate the distribution form of survival time" (p. 1).

The Weibull has hazard $\lambda(t) = \gamma\alpha t^{\alpha-1}$, which is increasing if $\alpha > 1$ and decreasing if $\alpha < 1$ which is exactly this case as declining hazard function means that the risk of failure is greater in the beginning and decreasing with time (Rogers and Hanley, 1982). Because of this, α is sometimes called as a shape parameter. On the other hand, γ is referred to as a scale parameter as it is a variance-like parameter on a log-time scale (Zhang, 2016). Similarly, the survival function transforms into $S(t) = exp(-\gamma t^{\alpha})$ (Cameron and Trivedi, 2005).

Weibull regression model uses a regression-like model to predict the time T to relapse (Rogers and Hanley, 1982). A function of covariates is written as:

$$lnT = \beta_0 + X_i'\beta + \epsilon \tag{8}$$

where β_0 is the constant and β represents the coefficient for corresponding covariates and ϵ is a log-Weibull error term.

Weibull regression is estimated by Maximum Likelihood which chooses estimation parameters such that the likelihood of observing the actual sample is maximized (Cameron and Trivedi, 2005).

Taking logs a standard log-likelihood function can be written as:

$$lnL = \sum_{i=1}^{N} logf(t_i) \tag{9}$$

where, $f(t_i) = \lambda(t_i) * S(t_i)$ which can be re-written as:

$$f(t_i) = \lambda(t_i)exp\Big(-\int_0^{t_i} \lambda(u)du\Big) \tag{10}$$

However, as previously mentioned, dataset is right-censored which needs to be included in the estimation. Therefore, a dummy variable δ_i needs to be included which is a right-censoring indicator with

$$\delta_i = \begin{cases} 1 & \text{if no censoring} \\ 0 & \text{if right-censoring.} \end{cases}$$

Now, putting it into log-likehood function (9) whilst knowing (10) a new log-likehood function is:

$$lnL = \sum_{i=1}^{N} (1-\delta_i) log(\lambda(t_i) exp\big(-\int_0^{t_i} \lambda(u)du\big) + \delta_i log\Big(exp\big(-\int_0^{t_i} \lambda(u)du\big)\Big) \quad (11)$$

3.2 Return on Investment

The last step of the thesis is to evaluate whether the investment into SIB is profitable and attractive for investors. From the estimated total costs of recidivism, it can be estimated cost savings while reducing recidivism by any percentage. Following the theory, those cost savings may represent the amount at which the SIB will be issued.

Evaluating the profitability of the potential investment into SIB is not exactly clear because there are countless ways and approaches on how to achieve the goal of reducing recidivism at various costs. Therefore, to evaluate the investment a method of Internal Rate of Return is used to set annual maximum costs at which the investment would be still profitable.

3.2.1 Internal Rate of Return

The internal rate of return is the discount rate at which the net present value of the investment is equal to zero. In other words, it is the discount rate at which the investment still pays off. The equation for estimating the Internal Rate of Return (IRR) has the form (Fairley and Jacoby, 1975):

$$PV = S_0 + \frac{S_1}{(1+r)^1} + \frac{S_2}{(1+r)^2} + ... + \frac{S_n}{(1+r)^n} = 0 \tag{12}$$

The equation expresses the IRR r at which the present value PV of a stream of anticipated costs and returns S_i is equal to zero. Naturally, S_i may be positive or negative, depending on the type of investment.

4 Definition of the problem

Recidivism in the Czech Republic is a long lasting issue. The following chapters prove the presence of these unfavorable statistics in comparison with other countries. High rate of recidivism indicates inner issues of the criminal justice system and brings enormous cost for society in committed crime and opportunity costs of prisoners.

4.1 Comparison of incarceration rate within EU

The number of convicted persons in the Czech Republic was almost 20,000 in 2018 according to the Statistical Yearbook of the Prison Service of the Czech Republic by Mäsiarová (2018) that provides the most recent data [9]. The Eurostat prisons statistics do not differ that much and according to their data from 2017 the number of convicted persons was in the Czech Republic 20,747 and this number is rather stable in the last couple of years. Since the Czech Republic is a country with approximately 10 million inhabitants the number of people in prison does not seem that big. However, when comparing prison statistics in the whole of Europe, the Czech Republic is not standing that well. Statista (2019) provides the number of convicted persons per hundred thousand inhabitants, a number that provides a better comparison of prison statistics between countries. The Czech Republic had 208.8 persons in prison per hundred thousand inhabitants in 2018 whereas neighboring Germany had only 77.5 and Austria 101.6. Poland and Slovakia are also doing better in these statistics, however, the difference is not that significant. For instance, Montenegro and Serbia are doing better in these statistics with 183.3 and 154.4 convicted persons respectively. Russia is by far the worst of these statistics with 418.3 people imprisoned per hundred thousand inhabitants and Georgia is the second worst with 252.2.

[9] The thesis uses data for 2018 as that is the most actual year which provides the necessary data for all estimates.

4.2 Recidivism in the Czech Republic

Not only that the Czech Republic has a very high incarceration rate but most of these convicted persons are recidivists. According to statistical yearbooks of the Prison Service of the Czech Republic (2018) only 36.9% of all people in prisons are convicted for the first time. Therefore, 63.1% of convicted persons are recidivists. Development of the total number of prisoners and the proportion of recidivists provides a table below [10].

Table 1: Share of recidivists in prison population in the Czech Republic

	2012	2013	2014	2015	2016	2017	2018
Total number of prisoners	20,429	14,301	16,433	18,850	20,501	20,271	19,677
Number of repeat offenders	13,130	10,133	11,348	12,377	12,892	12,723	12,416
Percentage of recidivist	64.27%	70.86%	69.06%	65.66%	62.88%	62.76%	63.10%

Source: Prison Service of the Czech Republic (2018), modified

As shown in Table 1, a significant decrease of people held in prison can be seen between the years 2012 and 2013. This decrease in data is due to the amnesty of the then President of the Czech Republic, Václav Klaus. The amnesty was announced by the President on January 1, 2013, during his New Year speech and came into effect the day after, on January 2, 2013. This amnesty liberated a total of 6,442 prisoners which was around 28% of all prison population at that time (Prison Service of the Czech Republic, 2018). However, the relative share of recidivists in prisons increased and then converted to the previous state as well as the number of total imprisoned people.

Such a big share of imprisoned re-offenders suggests that a strive to reduce recidivism must be a priority in order to relieve the prison system and to decrease the crime rate in general.

Table 2 shows the share of solved crimes in the total number of crimes committed for which recidivists are responsible provided by Police of the Czech Republic (2018). In the last 3 years, a decreasing trend is observed. The decline of the share of recidivists on the total number of crimes registered is also driven by an overall decrease in criminality. The number of prosecuted and investigated persons decreased again year-on-year, this time by about 2.5% (Diblíková et al., 2019).

[10] The values in the Table 1 are always as of December 31 of the given year.

Table 2: The share of recidivists on solved cases

	2016	2017	2018
Number of registered cases	218,162	202,303	192,405
Number of solved cases	101,678	94,890	92,795
Clearance rate	46.6%	46.9%	48.2%
Share of recidivists on solved cases	**53%**	**45.7%**	**44.3%**

Source: Police of the Czech Republic (2018), modified

4.3 Current approaches for reduction of recidivism in the Czech Republic

The Probation and Mediation Service of the Czech Republic (PMS) strives to integrate the accused or the offender into the life of society without further violation of the law. Apart from the integration of the offender back into society, the PMS has other two goals. That is the Participation of the injured party and Protection of society (PMS, 2020a). In general, the goal is to assist the criminal justice system in meeting goals such as reducing the number of prisoners, preventing crime, reducing recidivism, motivating to repair the damage caused, and leading a life free of conflicts via Mediation and Probation.

Probation aims, in particular, to organize and supervise over the accused, to control the execution of sentences not related to imprisonment, to monitor the behavior of a convicted person on probation during parole. Probation also includes individual assistance to the accused to lead a proper life as defined in §2., Par. 1., Act No. 257/2000 Coll.

Mediation is also defined in §2., Par. 2, Act no. 257/2000 Sb. as an extrajudicial proceeding conducted by a mediator, a mediator, in order to resolve a dispute between the accused and the injured party. This is an activity aimed at resolving the conflict in connection with criminal proceedings. Mediation can be performed only with the express consent of the accused and the injured party.

The PMS is operating in the Czech Republic since 2001. In 2017, a new concept for the development of probation and mediation was adopted until 2025 that defines three main goals: Divert offenders from criminal careers; Develop a systemic solution for victim services; Increase the security of society, and Ensure further effective functioning of PMS (PMS, 2017). The development of criminality and recidivism as briefly described in Chapter 4 may indicate positive results but that still might be an effect from previous programs. Or this might be just an effect of economic growth. As the literature suggests crime rate is linked to incentives of pursuing legal or illegal activities. Growing economic prosperity is negatively correlated with the crime rate. Moreover, the unemployment rate also plays an important role. Lower unemployment rate contributes to a decline in the crime rate (Wong, 1995). And in recent years, we have been living in a time of unprecedented

economic growth and the lowest unemployment rates.

A study by Scheinost et al. (2015) from the Institute for Criminology and Social Prevention evaluates the recidivism of convicts as a measure of the effectiveness of selected criminal sanctions with an emphasis on alternative sanctions. In this study, 88% of the individuals in the sample were recidivists (3,723 individuals). The authors examined the effectiveness of the imposed sanctions in the second phase of the research in July 2014. It was a question of finding out whether they had committed further criminal offenses during the two years that have elapsed since the first phase. It was judged based on an entry in the criminal record. 2,038 people had a new criminal record, i.e., 48.1% of the sample. In two years, almost every second offender had committed a crime again. Moreover, this ratio captures only officially registered and convicted crime. Two thirds of recidivists (65.9%) committed another crime within the first year (37.1% even during the first six months), for the remaining part (34.1%) in the interval of one to two years. This result also corresponds with the result of the thesis that suggests that a recidivist is most likely to commit another crime in the first six months up to three years after the release from prison in Chapter 5.2. Unfortunately, the overall results of Scheinost et al. (2015) suggest that the effectiveness of alternative sanctions such as probation is very limited in terms of preventing further crime.

5 Proposal of Social Impact Bond

As defined in the theoretical part of the thesis, SIB can attract investors to invest in social policies not only because of the vision of profit, but also because of the increase in social well-being. Another reason may be a better perception of society as was the case with Goldman Sachs in the Riker Island SIB (Phillips and Olson, 2013). Just as every company in the free market is driven by the vision of profit, the investor will do everything to deliver the desired results, whatever their motives. The SIB represents an opportunity to transfer the implementation of social policies to the free market and help it increase the general well-being of society while the risk shifts from the government to an investor.

The following chapters try to outline what such a SIB might look like and what it should focus on to be successful. Specifically, it is an estimate of the risk period after release from prison in which the individual has the greatest probability to commit another crime. Furthermore, an analysis of individuals' basic characteristics that affect the most the probability of committing a crime. Also, it is an estimate of the cost of recidivism, according to which the government can determine the amount at which the SIB may be issued based on cost savings from reduced recidivism, and a basic analysis of the profitability of the SIB in various scenarios. Finally, an evaluation method for a SIB is proposed to determine its success rate.

5.1 Costs of recidivism

Crime, in general, imposes great costs on the public at different times. Costs of crime were estimated in detail in Brand and Price (2000). Later on, Heeks et al. (2018) updated the costs of crime following the same logic as Brand and Price (2000) and the same approach is used in this thesis. The authors split the costs by the time of the cost occurring and that is

- **Anticipation costs** - costs of preventing the crime (car alarms, etc.);
- **Consequence costs** - costs as a consequence of the crime (damaged property, etc.);

- **Response costs** - costs in response to a crime (costs to the police, the judicial system, prison services, etc.).

The result is a comprehensive estimate of the total annual cost of recidivism in 2018 in the Czech Republic[11]. The result can also be transformed into an estimate of the annual cost of one offense committed by a recidivist. This estimate is crucial for setting the price of the SIB, i.e., how much the government would save, for instance by reducing recidivism by 10%, and thus how much it can afford to invest in the SIB.

5.1.1 Anticipation costs

The anticipation costs of crime are the costs to prevent or anticipate the crime before its happening. These costs are incurred by all, not just victims of crime (Heeks et al., 2018). A great indicator of such costs is the Insurance administration because they are reflecting peoples' risk aversion, or in other words, their willingness to pay to avoid the risk. Such information is publicly available in the database of the Czech Insurance Association (ČAP, 2018). For the purpose of this thesis, information about money spent on theft insurance is used for individuals as well as for businesses. Other types of insurance are not relevant for the thesis.

Statistics on criminality in the Czech Republic are provided by the Police of the Czech Republic. The database includes data about the number of registered offenses in each year separately, as well as a percentage of solved offenses. Solved cases include information if the crime was committed by a recidivist or not. This known proportion of solved cases on recidivists is further approximated to the total number of registered cases. Given that the insurance relates to property, only cases belonging to the category of property crime are considered in estimating the costs of recidivism.

Property crime is the category in which recidivism is the most common. Therefore, the costs are very high. In 2018, more than CZK 2.3 billion was spent on theft insurance and 98,670 cases were registered which means that the average costs of 1 detected crime in 2018 were CZK 23,421. In the same year, repeat offenders accounted for 64% of all

[11] The most up-to-date data are available from 2018 as of April 18, 2020.

Table 3: Private property insurance, in thous. CZK

	2016	2017	2018
Civil insurance			
Theft insurance	1,690,380	1,362,765	1,372,649
Business insurance			
Theft insurance	946,037	944,449	938,324
Total expenditure	**2,636,417**	**2,307,214**	**2,310,973**
Number of registered cases (property crime)	118,082	108,497	98,670
Units of CZK per 1 detected case	22,327	21,265	23,421
Share of recidivists in property crime	72%	65%	64%
Total costs of recidivism	**1,898,220**	**1,499,689**	**1,479,023**

Source: ČAP (2018), Police of the Czech Republic (2018), modified

cases. Thus, the total anticipation costs accounted for recidivism were estimated to be approximately CZK 1.5 billion.

5.1.2 Consequence costs

This type of cost is related directly to the offense. Public criminal statistics provided by the Police of the Czech Republic contains also information on total damage to property as a result of a crime. The logic in estimating is the same. Once again, for each category of offenses[12], the ratio of recidivists responsible for the total number of solved cases is known. For each category of offenses, the ratio of recidivists responsible for the total number of solved cases is known. This ratio is then extrapolated to all registered cases. This ratio also derives the costs of offenses committed by repeat offenders to the total damage property. Similarly, it is possible to estimate the number of cases of recidivism and, consequently, the average cost of one offense committed by a recidivist in each category of offenses. Table 4, Table 5 and Table 6 provides the estimations for years 2016, 2017 and 2018 consequently.

At first glance, it can be seen that the largest item consists of crimes of an economic nature. However, in 2018, only 22% of all the offenses belonging to the Economic crime category

[12]The categories are determined according to TSK (Tactical Statistical Classification) by the Police of the Czech Republic. This classification divides offenses into seven basic categories: Violent crime, Moral crime, Property crime, Other crime, Remaining crime, Economic crime and Military and Unconstitutional crime (military and unconstitutional offenses are not considered in the thesis since recidivism account for no or only a small fraction of offenses at negligible cost)

Table 4: Property damage caused by recidivists in 2016

	Percentage of cases attributable to recidivists	Property damage caused by recidivists, in thous. CZK	Number of offenses attributable to recidivism	Units of CZK per 1 crime committed by a recidivist
Violent crime	48%	53,004	6,910	7,671
Moral crime	29%	42	671	62
Property crime	72%	2,997,594	83,719	35,805
Other crime	59%	308,554	14,175	21,768
Remaining crime	41%	191,725	11,535	16,621
Economic crime	34%	4,797,021	10,916	439,458
Total		**8,347,940**	**127,926**	**65,256**

Source: Police of the Czech Republic (2016), own calculations

Table 5: Property damage caused by recidivists in 2017

	Percentage of cases attributable to recidivists	Property damage caused by recidivists, in thous. CZK	Number of offenses attributable to recidivism	Units of CZK per 1 crime committed by a recidivist
Violent crime	41.5%	59,324	5,712	10,386
Moral crime	22%	7	526	14
Property crime	65%	2,472,015	68,640	36,014
Other crime	50%	654,033	11,440	57,171
Remaining crime	35%	63,859	8,561	7,459
Economic crime	24.5%	2,427,114	7,405	327,776
Total		**5,676,352**	**102,284**	**55,496**

Source: Police of the Czech Republic (2017), own calculations

Table 6: Property damage caused by recidivists in 2018

	Percentage of cases attributable to recidivists	Property damage caused by recidivists, in thous. CZK	Number of offenses attributable to recidivism	Units of CZK per 1 crime committed by a recidivist
Violent crime	40%	45,326	5,457	8,306
Moral crime	20%	35	533	66
Property crime	64%	2,538,450	61,107	41,541
Other crime	50%	425,181	12,195	34,864
Remaining crime	33%	378,077	7,967	47,458
Economic crime	22%	1,629,629	6,606	246,689
Total		**5,016,698**	**93,866**	**53,445**

Source: Police of the Czech Republic (2018), own calculations

were attributable to recidivists. It is clear, that between the years 2016 and 2018 the most problematic category in terms of recidivism is Property crime followed by Other crime[13]. If the Economic crime is excluded, it is the Remaining crime that has the highest costs per 1 committed by a recidivist. In this category belongs for example car accidents.

A very important component of the costs is Physical and Emotional harm to the victim. These are the cost of reducing the quality of life or recovery time. Heeks et al. (2018) used the QALY approach that estimates the negative percentage impact on a persons' quality life. Authors used the same approach for all the crimes which is a very important improvement compared to Brand and Price (2000) where the authors used the QALY method only to calculate the costs for the violent crimes whereas the costs for non-violent ones were estimated by asking the victims for an approximate estimate of how much money would compensate them for the physical and emotional damage they suffered as a result of the crime. Since this method is very inaccurate Heeks et al. (2018) used the QALY approach for all the crimes.

The quantification of these costs for the Czech Republic is beyond the scope of this thesis and for this reason, the thesis uses the estimations of the Heeks et al. (2018), which are subsequently adjusted to prices for the Czech Republic. Heeks et al. (2018) in the study focuses on offenses against individuals and does not consider offenses against society, such as possession of drugs, as well as this thesis. Categorization of crimes by Heeks et al. (2018) is very general and therefore very different from the Tactical-statistical classification (TSK) of crimes by the Police of the Czech Republic. For this reason, the author of the thesis assigned individual offenses from the TSK category to the categories of Heeks et al. (2018) based on his best conviction and judgment. The categorization of crimes used for this thesis is described in Table 7. TSK assigns individual crimes the code, which are included in the table for clarity. The actual definition of the crimes by the Police of the Czech Republic is then attached in Appendix B in Table 22.

The estimations in the Heeks et al. (2018) are based on crime statistics from the year 2016 and are estimated for one offense in the category. To transfer the estimates for prices in 2018 a GDP deflator was used (WB, 2019). Then, the prices have been multiplied by a GDP per capita in Purchasing Power Parity to adjust them for the Czech economy

[13]To the Other crime category belongs crimes such as hooliganism, spray painting, fires, etc.

Table 7: Categorization of crimes

Categorization by Heeks et al. (2018)	Categorization by the Police of the Czech Republic (TSK)
Homicide	101-106
Violence with injury	115, 116, 141, 142, 143, 151, 161, 171, 185, 186, 252
Violence without injury	122, 172, 173, 174, 181
Rape	201
Other sexual offences	202, 211, 212, 231, 214, 241, 251
Robbery	131, 132
Domestic burglary	371, 372, 373, 451
Theft of vehicle	431, 432
Theft from vehicle	433, 434
Theft from person	413, 411, 412
Arson	651
Other criminal damage	589, 611
Fraud	511
Commercial burglary	311 - 490 except for Domestic burglary, Theft of or from vehicle and Theft from person
Other commercial criminal damage	814, 613

Source: Police of the Czech Republic (2018), Heeks et al. (2018), modified

(WB, 2019). Finally, to transfer those prices from GBR to CZK an exchange rate from 1.1.2018 was used (CNB, 2020). Following the same logic as previously, the known proportion of solved cases on recidivists in each crime is further approximated to the total number of registered cases of each crime which leads to the estimation of the total number of offenses attributable to recidivists in each classification. Thus, the product of the quantified cost of a given crime and the number of cases attributable to recidivists will give the estimation of the total cost of physical and emotional harm for each category of crime in the Czech Republic. The results are provided by Table 8.

Table 8: Estimated physical and emotional costs of crime in 2018

	Units of GBR per case	Units of CZK per case	Number of offenses attributable to recidivism	Total physical and emotional costs, in thous. CZK
Homicide	2,163,808	54,227,827	39	2,122,780
Violence with injury	8,562	241,575	2,162	463,956
Violence without injury	2,920	73,174	1,394	101,984
Rape	25,343	635,131	181	114,905
Other sexual offences	3,845	96,350	249	24,039
Robbery	3,730	93,486	637	59,597,118
Domestic burglary	1,237	30,988	5,134	159,098
Theft of vehicle	281	7,031	1,870	13,150
Theft from vehicle	145	3,646	11,455	41,762
Theft from person	426	10,677	8,004	85,453
Arson	1,018	25,520	296	7,555
Other criminal damage	281	7,031	4,158	29,234
Fraud	208	5,208	2,065	10,754
Commercial burglary	530	13,281	28,541	379,041
Other cml. criminal damage	62	1,562	957	1,495
Total			**67,143**	**3,614,809**

Source: Police of the Czech Republic (2018), Heeks et al. (2018), WB (2019), CNB (2020), own calculations

As stated earlier, this classification does not account for all types of crimes. From Table 6 it is clear that the total number of offenses attributable to recidivism is 93,866. However, only two-thirds of the offenses could be categorized and their costs quantified. This estimate of more than CZK 3.6 billion is, therefore, significantly underestimated.

The Consequence costs also include the loss of output. That consists of two main parts: (a) Time taken off from work as a result of crime, and (b) Reduced productivity at work as a result of physical and emotional injuries as described in Heeks et al. (2018). These costs are based on an assumption that a victim of a crime needs some time off work to recover and, more importantly, being a victim of a crime affects productivity. Lost hours per one criminal offense in each category were estimated by Heeks et al. (2018). To quantify the costs, an average monthly wage for 2018 was used out of which an average hourly wage was calculated CZSO (2019b). The number of criminal cases attributable to recidivism remains the same as in the case of physical and emotional costs which means that not

all offenses attributable to recidivism are taken into account and it can be argued that the results are also underestimated. The estimated loss of output in 2018 was almost CZK 360 million as shown in Table 9.

Table 9: Estimated lost of output due to recovery from crime in 2018

	Lost hours per case	Number of offenses attributable to recidivism	Lost output
Homicide	13,902	39	108,391,452
Violence with injury	112	2,162	48,233,780
Violence without injury	37	1,394	10,271,039
Rape	322	181	11,602,912
Other sexual offences	61	249	3,031,291
Robbery	50	637	6,348,686
Domestic burglary	24	5,134	24,542,165
Theft of vehicle	8	1,870	2,980,149
Theft from vehicle	3	11,455	6,844,836
Theft from person	7	8,004	11,159,033
Arson	19	296	1,120,421
Other criminal damage	4	4,158	3,312,608
Fraud	3	2,065	1,233,859
Commercial burglary	21	28,541	119,376,524
Other cml. criminal damage	2	957	381,223
Total		**67,143**	**358,829,978**

Source: Heeks et al. (2018), CZSO (2019b), Police of the Czech Republic (2018), own calculations

Surely, more types of costs could be found in the consequence cost category. For instance, costs associated with medical requirements like necessary surgeries, used medical material for treatment, Ambulance services, etc. Or costs for victims' support associated with the traumatic experience (Heeks et al., 2018). Unfortunately, these costs could not be estimated since very detailed data about individual offenses would be necessary. Even though these costs would certainly not be the largest item of the total cost, their lack of quantification once again contributes to underestimating the overall costing.

5.1.3 Response costs

The biggest cost item in the Response cost category is Police costs. At the same time, to estimate the part of Police costs that is related to recidivism is the most difficult part due to lack of publicly available data and a couple of assumptions are inevitable.

Firstly, Ministry of Justice (2018) provides information on the total annual expenditures of the Police of the Czech Republic which were more than CZK 41 billion. For the purpose of the thesis, only costs of a variable nature are taking into account. Therefore, only expenditures on salaries, mandatory insurance premiums, and transfers of Cultural and Social needs fund are considered as shown in Table 10. The rest of the costs, such as capital expenditures or expenditures for R&D are omitted. The total number of employees was 50,295 in 2018[14]. However, not all police departments of the Czech Republic deal with the criminal agenda. For instance, the main purpose of Traffic Police of which expenditures are also included in the total expenditures provided by Ministry of Justice (2018), is not related to criminal agenda but rather to ensure the fulfillment of tasks in the field of road traffic (Police of the Czech Republic, 2020) and so, its costs have to be excluded from the analysis.

To estimate the costs of the Police of the Czech Republic attributable to criminal activity and then to recidivism, the study tries to estimate the number of employees of the Police of the Czech Republic dealing with the criminal agenda. The same methodology is lately used to estimate the Judicial costs of recidivism as well as Public Prosecutor costs of recidivism. Unfortunately, in the case of Police, data on employees employed in specific departments are not publicly available, however, the author of the thesis requested the data from the Police Presidium of the Czech Republic and managed to obtain part of the necessary data (Kaminská P., 2020). This method certainly has its drawbacks, as it includes all crimes, including murder, car theft, etc., which vary considerably in resource requirements.

One of the departments dealing with the criminal agenda is the Riot Police. Within the riot police service, hundreds of executive organizational units of the Police of the Czech Republic perform direct services. These are mainly the District (Local) Department of the Police of the Czech Republic, the Patrol Service Department, the Emergency Motorized Unit, Special Law Enforcement Units, Intervention Units, the Department of Diving Activities and Training, the Cynology and Hippology Department, etc. Their main mission is the protection of the safety of persons, property and public order. One of the main tasks of the riot police is to prevent criminal activity and prevent the commission of illegal

[14]As of 31 December 2018. This includes both the number of employees (9,561) and the number of employees of the security forces and the armed forces in the service (40,734).

acts by its preventive action. In the event of a non-legal act has already taken place, it ascertains and takes other necessary actions to clarify it (Hrinko, 2014). In 2018, the Riot Police of the Czech Republic had a total of 17,882 members of the Police of the Czech Republic and 698 were employed (Kaminská P., 2020). Given no further information, the thesis assumes that 40% of members of the Riot Police are involved in criminal matters.

The largest police department dealing with criminal activity is the Criminal Police and Investigation Service (SKPV[15]). The SKPV specializes in the detection and investigation of criminal activity committed in all its forms and types in the Czech Republic, but also in the international context. One of the key ideas of the work of the SKPV is not only an isolated highly specialized activity but especially the ability to deal with crime as a whole (Police Presidium of the Czech Republic, 2015). The requested data include information on the percentage of criminal police in the total number of police officers. In 2018 the criminal police consisted of 10,713 police members (26.3%) and 947 employees (9.9%). Since the total number of police members and employees in that year was 50,295, a total of 17,866 police members and 1226 employees could be linked to the criminal agenda which is approximately 38% of the total number of police officers (Kaminská P., 2020).

Data on salaries are further broken down into police members' and staff's salaries. In order to obtain the most accurate estimate possible, the wage data were converted into an annual cost per police officer and employee respectively and then multiplied by the appropriate number of individuals dealing with the crime agenda. A similar approach was used to estimate the costs on mandatory insurance premiums and transfers to CSNF, where, however, only the total number of individuals dealing with the criminal agenda was used.

Finally, in 2018 approximately 44.3% of all criminal offenses were committed by the recidivists, and therefore, the thesis assumes that 44.3% of the costs related to criminal agenda could be associated with recidivism. In the end, the total estimated costs attributable to recidivism are slightly more than CZK 5.7 billion as shown in Table 10.

The judicial system is another cost item. The costs of the Judicial system are provided by Ministry of Justice (2018). However, the entire Judicial system does not only address

[15]Czech abbreviation.

Table 10: Police costs of recidivism in 2018, in thous. CZK

	Total
Salaries	24,522,119
Mandatory insurance premiums	8,164,604
Transfers of CSNF	487,583
Criminal agenda	
Salaries of police officers	9,373,365
Salaries of civil employees	384,302
Mandatory insurance premiums	3,099,230
Transfers of CSNF	185,083
Total costs of criminal agenda	**13,041,981**
Share of recidivists	43.3%
Total costs of recidivism	**5,775,885**

Source: SSP (2019), Ministry of Justice (2018), Police of the Czech Republic (2018), Kaminská P. (2020), own calculations

the criminal agenda and not all the costs are necessary for estimating costs of recidivism. The calculation includes expenditures on salaries, mandatory insurance, and transfers of Cultural and Social needs fund since these costs are a variable costs nature. On the other hand, for instance, capital expenditures can be considered as fixed costs and therefore will not be considered in the calculation. The proportion of criminal agenda for the Judicial system is derived from the total number of judges.

762 judges out of 2,978 are specialized on agenda related to criminal law. That is approximately 25.6%. Therefore, 25.6% of the total expenditures are considered to be relevant for the thesis (Ministry of Justice, 2019). In 2018, only 54,448 persons were convicted which is the least in the last 5 years (CZSO, 2019a). By dividing the costs of the criminal agenda by the total number of convicts, the amount per 1 convicted person is derived. Since in that year approximately 44.3% of the whole criminal offenses were committed by the recidivists the thesis assumes that this proportion applies also to convicts. Total costs attributable to recidivism are estimated to be more than CZK 1.1 billion as shown in Table 11.

Criminal law is also related to the Public Prosecutor that bears considerable costs. Even though the Public Prosecutor's agenda contains some non-criminal thing, the vast majority of the agenda is related to criminality (SSP, 2019). For that reason, the whole expenditures of variable cost nature are taken into account. That is expenditures on salaries,

Table 11: Judicial costs of recidivism in 2018, in thous. CZK

	Total	Criminal agenda
Salaries	7,583,861	1,940,531
Mandatory insurance premiums	2,490,578	637,280
Transfers of CSNF	150,667	38,552
Total	**10,225,106**	**2,616,364**
Persons convicted		54,448
Units of CZK per 1 convicted person		48,053
Share of recidivists		44.3%
Total costs of recidivism		**1,158,705**

Source: Ministry of Justice (2019), Ministry of Justice (2018), CZSO (2019a), Police of the Czech Republic (2018), own calculations

mandatory insurance premiums, and transfers of Cultural and Social needs fund. Following the same logic as in the case of Judicial system, the 44.3% of the 209,829 records of the commencement of criminal proceedings against a physical person that were recorded in 2018 can be assigned to recidivism.

Table 12: Public Prosecutor costs of recidivism in 2018, in thous. CZK

	Total
Salaries	2,033,360
Mandatory insurance premiums	678,284
Transfers of CSNF	40,737
Total	**2,752,382**
Number of records	209,829
Units of CZK per 1 case	13,113
Share of recidivists	44.3%
Total costs of recidivism	**1,218,943**

Source: SSP (2019), Ministry of Justice (2018), Police of the Czech Republic (2018), own calculations

A significant item of the cost of crime is Prison Service. As previously shown in Table 1, the share of recidivists in the prison population is more than 60%. Besides that, Prison Service of the Czech Republic (2018) contains detailed information about expenditures. For 2018, binding indicators of budget expenditures were set at the Prison Service of the Czech Republic in the amount of CZK 10.9 billion. In the end, actual expenditures did not exceed CZK 10.8 billion. As Table 13 below shows, average daily costs per prisoner were CZK 1,348 in 2018. However, this indicator is not completely indicative as it also includes long term fixed costs such as capital expenditure, pension expenditure, and social benefits.

For that reason, these costs are omitted and daily costs were recalculated per prisoner per Organizational unit which includes expenditures on salaries, insurance, other material expenses, and transfers of Cultural and Social needs fund. The annual costs of recidivists in 2018 were estimated to be more than CZK 5.1 billion.

Table 13: Average annual cost of recidivists to Prison services

	2016	2017	2018
Daily costs per prisoner	1,093	1,187	1,348
Daily costs per prisoner per OU*	914	998	1,129
Number of recidivists in prison	12,892	12,723	12,416
Annual costs of recidivists, in thous. CZK	**4,300,900**	**4,634,607**	**5,116,447**

*Organizational Unit

Source: Prison Service of the Czech Republic (2018), own calculations

Another significant cost item is health insurance paid by the government. The persons for whom the government pays health insurance premiums are determined by Section 7 (1) of Act No. 48/1997 Coll. This includes persons in security detention or custody, persons in prison, or persons in institutional protective treatment (VZP, 2020) and, therefore, these costs have to be included as well. As Table 14 shows, the monthly premium paid by the government in 2018 was CZK 968 (VZP, 2020), which makes an annual amount of CZK 11,628. This value is multiplied by the number of recidivists in prison which was in 2018 12,416 (Prison Service of the Czech Republic, 2018) making the total premium paid by the government for recidivists amounts to nearly CZK 150 million.

Table 14: Health insurance paid by the government for recidivists

	2016	2017	2018
Monthly premium	870	920	969
Annual insurance	10,440	11,040	11,628
Number of recidivists in prison	12,892	12,723	12,416
Premiums paid for recidivists, in thous. CZK	**134,592**	**140,462**	**144,373**

Source: VZP (2020), Prison Service of the Czech Republic (2018), own calculations

5.1.4 Summary of the costs

The social costs of recidivism are calculated as the sum of the aggregate costs of crime prevention, the consequence of the crime, and the costs of remedial action caused by

recidivism. The same approach is parallelly used to estimate the total costs of crime. Table 15 shows the total social costs of recidivism in comparison to the total costs of crime in 2018. In the case of estimated police, judicial and prosecutor costs of recidivism can be expected to be overestimated. The ratio of 44.3% of the costs attributed to recidivism corresponds to the number of cases committed by recidivists, but the reality may vary. Recidivists are registered and their investigation and conviction may be easier using fewer resources. Despite this, it can be assumed that the total estimated costs of almost CZK 26 billion are still underestimated.

As mentioned before, the physical and emotional costs could not be estimated for all the crimes attributable to recidivists as some offenses against businesses or society such as drug possession are omitted from the study by Heeks et al. (2018). Also, the costs are significantly limited and underestimated by the very fact that the thesis focuses exclusively on officially registered crime. The same applies for the estimation of the total costs of crime. In 2018 a total of 192,405 crimes were registered but the calculation of physical and emotional costs includes only 116,471. Moreover, it is known and repeatedly confirmed by criminological research that only a part of criminal offenses is reported to the police or detected by the police, and as a result solved, prosecuted, and convicted. Other offenses remain latent, i.e.,'hidden' in the field of crime, which is undetectable by this type of research (Scheinost et al., 2015). Another fact is, that the average clearance rate of all cases in 2018 was slightly less than 50%. More importantly, the clearance rate of property crime cases which is most typical for recidivists is only around 26%. For these reasons, this number can be taken as a lower limit of the total cost of crime and recidivism.

Although the costs are underestimated, one of the partial goals of the thesis was to estimate the cost of recidivism to set the amount at which the SIB might be issued. These estimated costs may not only be perceived as a cost to society caused by recidivists but in particular, can serve as an analysis to the government of how much money it can save if recidivism is reduced by a certain percentage.

By dividing the total cost of recidivism by the number of cases per recidivist, the average cost per case committed by a recidivist can be obtained, which is CZK 287,363. However, not every case ends with a custodial sentence, while the highest unit costs are the costs of imprisonment. It is thus necessary to recalculate the costs for 1 case committed by

Table 15: Comparison of total estimated costs of crime and recidivism in 2018, in thous. CZK

	Estimated costs of crime	Estimated costs of recidivism
Property insurance	2,310,973	1,479,023
Property damage	18,029,435	5,016,698
Physical and Emotional costs	9,692,333	3,614,809
Lost output	810,455	358,830
Police	13,041,981	5,775,885
Judicial system	2,616,364	1,158,705
Public prosecutor	2,752,382	1,218,944
Prison services	8,108,597	5,116,447
Health insurance	228,804	144,373
Total	**57,591,323**	**25,417,153**

Source: Own calculations

a recidivist ending in a custodial sentence. Table 16 provides average cost per one case committed by a recidivist. The data in the table are extracted from the individual tables in the Chapter 5.1. The majority of the costs are simply average costs per 1 case, i.e., total costs divided by the number of total detected cases. In the case of physical and emotional costs and lost of output, the total costs are divided by a number of offenses attributable to recidivism. Table 16 assumes that the offender will end up in prison with a custodial sentence of 1 year. Therefore, daily costs per prisoner from Table 13 and health insurance paid by the state for prisoner from Table 14 were adjusted for a period of 1 year.

Table 16: Average costs per 1 offense committed by a recidivist ending up in prison

Property insurance	23,421
Property damage	53,445
Physical and Emotional costs	53,837
Lost output	5,344
Police	62,155
Judicial system	48,053
Public prosecutor	13,113
Prison services	412,085
Health insurance	11,628
Total	**683,082**

Note: Estimation might differ based on whether the individual that committed the offense ends up in prison and for how long. Since the estimation assumes a 1 year custodial sentence, it is the upper bound of the estimate.

Source: Own calculation

Given that the estimate assumes that the crime ends with a custodial sentence of 1 year,

these estimated costs can also be considered as the cost of 1 recidivist who ends up in prison for the crime committed.

5.2 Critical time period to focus on after release from prison

First of all, it is not very realistic for a SIB to focus on all people released from prisons in a long time. SIB has to be focused on a shorter, specific time period. It is the period during which the offenders are most likely to commit another crime. Survival analysis, described in the Chapter 3.1, is used to estimate such a period of time.

5.2.1 Dataset

Dataset has been provided by my thesis Supervisor. It comes from the Prison Directorate of the Czech Republic and it is not publicly available. Data are used for Survival analysis, the dataset contains 317,952 observations from the beginning of 2007 until April 26, 2019, where the data collection ended. Each observation stands for a stay in prison or a stay in freedom of a particular offender. Every observation contains time t_0 which indicates the time a person leaves the prison and time t_1 which indicates the time of going back to prison or, more specifically, experiencing the event - failure. Therefore, the time between t_0 and t_1 is survival time.

However, some observations entered the experiment but did not fail. Those persons were released from prison during the time of the experiment, therefore, they entered the experiment, but did not commit the crime until the end of the experiment, i.e., did not experience the event before the study has ended. In other words, people were tracked up until the time t without observing the event of interest - being imprisoned again (Dickman and Hakulinen, 2003). For those people the exact survival time is unknown, however, the survival time is equal or bigger than the observed survival time t in the experiment. This phenomenon, where the exact survival time is unknown, is called censoring. More specifically, this type of censoring, where the survival time is equal or bigger than the observed survival time t, is called right-censoring since these observations are 'cut off' from the right side.

Even tough right-censoring is more common, left-censoring can occur as well. Left-censored data are data where the survival time is less than or equal to that person's observed survival time (Kleinbaum and Klein, 2012). Such data occur in this particular

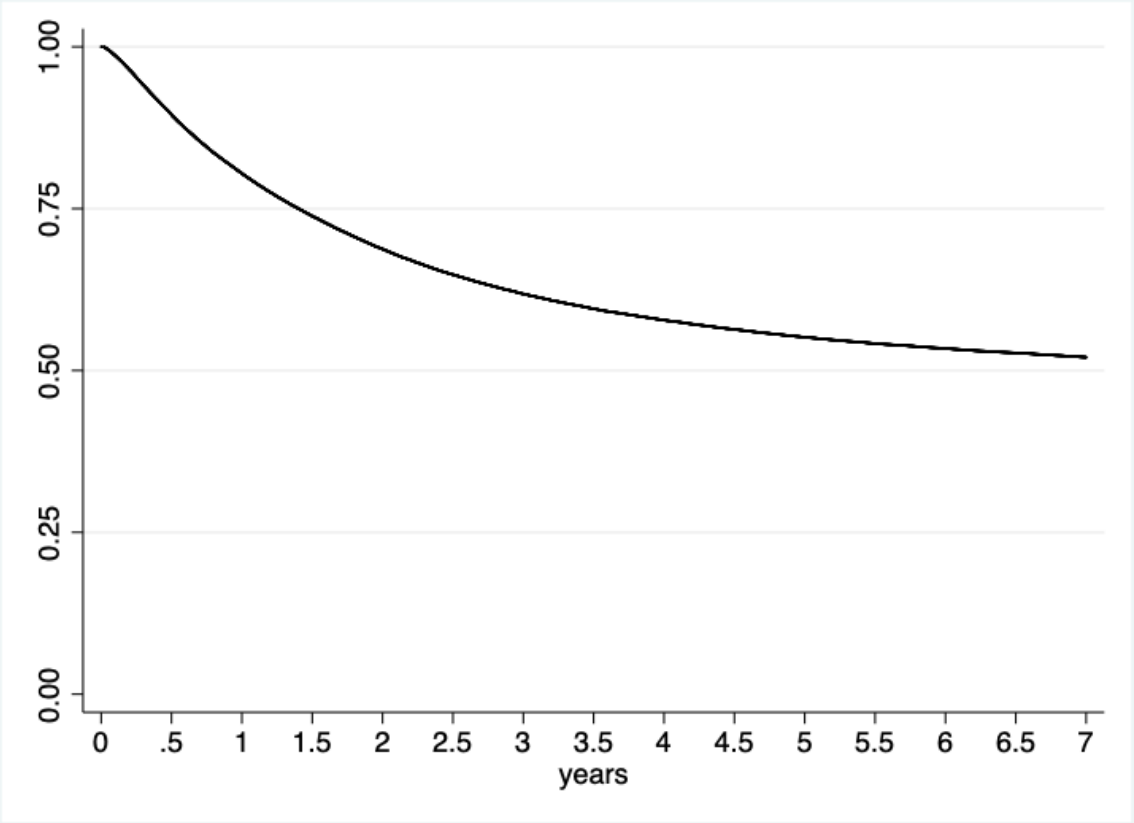
dataset as well. Left-censoring is caused by people in the dataset that were re-imprisoned during the observation period but they were released from the prison before the experiment had started and so their t_0 is unknown. Such observations are 'cut off' from the left side and are omitted in the analysis (Kleinbaum and Klein, 2012).

The remaining 317,335 observations are used for analysis. The data set also contains information about what a person was imprisoned for. Whether it is theft, murder, robbery, etc. It also contains data on the number of previous sentences and what the prison sentence was. The data set also contains information on the length of the sentence and whether the sentence was committed by a man or a woman. It also includes the age of the offender. All of this can be compared separately.

5.2.2 Survivor function

As described in the Methodology section, in Chapter 3.1.1, the Survivor function expresses the probability of an event occurring. In the thesis, it can be interpreted as a probability of re-imprisonment.

Figure 2: Survival estimate of the released prisoners



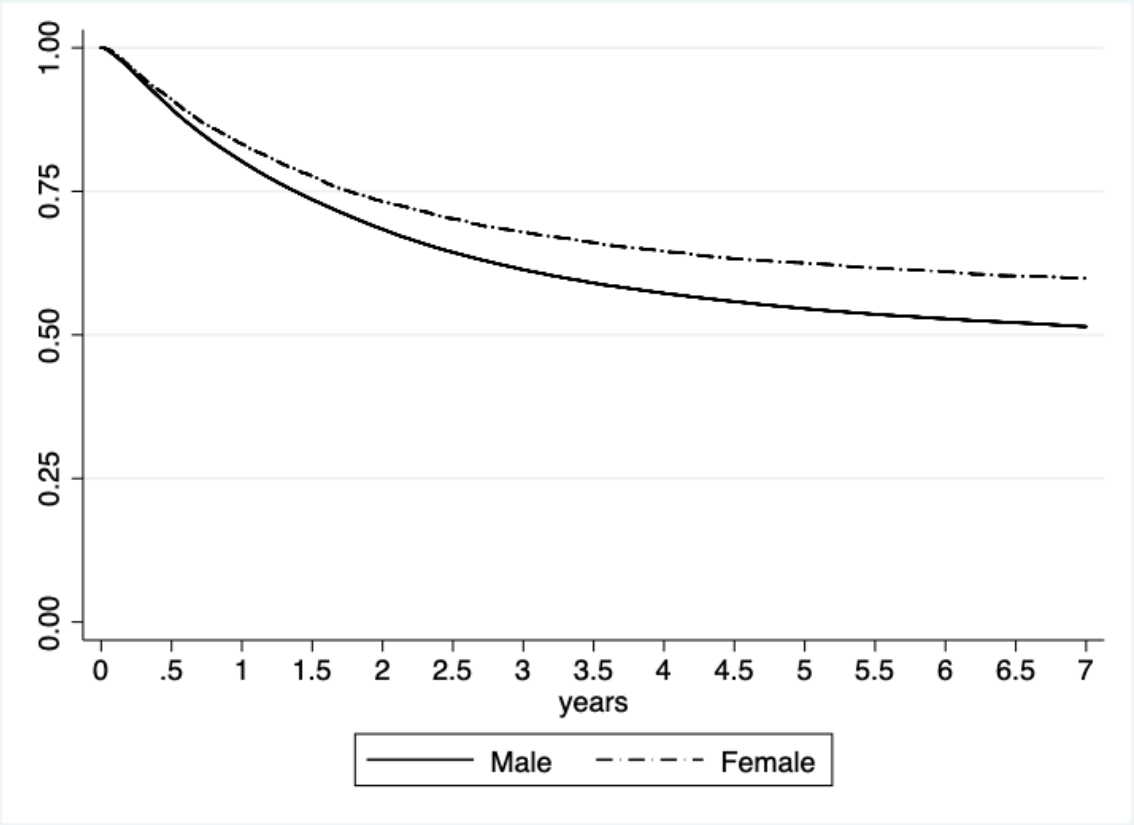
Note: The figure contains offends committed by offenders that were released from prison between 2007 and 2017 with a time spent in freedom up to 7 years.

Source: Own calculation

Figure 2 shows the survivor function for the whole dataset. The x-axis represents the time, starting with zero. The y-axis represents the share of individuals of the sample who have not experienced the event at a given time relative to the x-axis. Or the probability of surviving to the next period t. Therefore, the plot can be interpreted quite straightforwardly. The curve starts at one since the time starts at $t = 0$, meaning that the whole sample has not experienced the event yet. Or that the probability of surviving for an individual is 1 at time $t = 0$. As time goes on, the curve decreases. Especially, between $t = 0$ and $t = 3$ the slope of the curve is the steepest. This suggests that the first three years after release from prison are far more critical than any other year thereafter. The curve converging to probability 0.5 of being re-convicted after 7 years in freedom which means that after 7 years from release from prison almost 50% of offenders in the sample had experienced the event of re-conviction.

With the dataset so detailed a further analysis can be performed. For instance, a comparison of male and female offenders can be provided. From Figure 3 it is clear that the survivor curve for men is below the curve for women. That means women are less likely to experience the event of being imprisoned again. However, for both men and women, the curve decreases faster in the first two years than in the remaining years.

Figure 3: Survival estimate of the released prisoners by gender



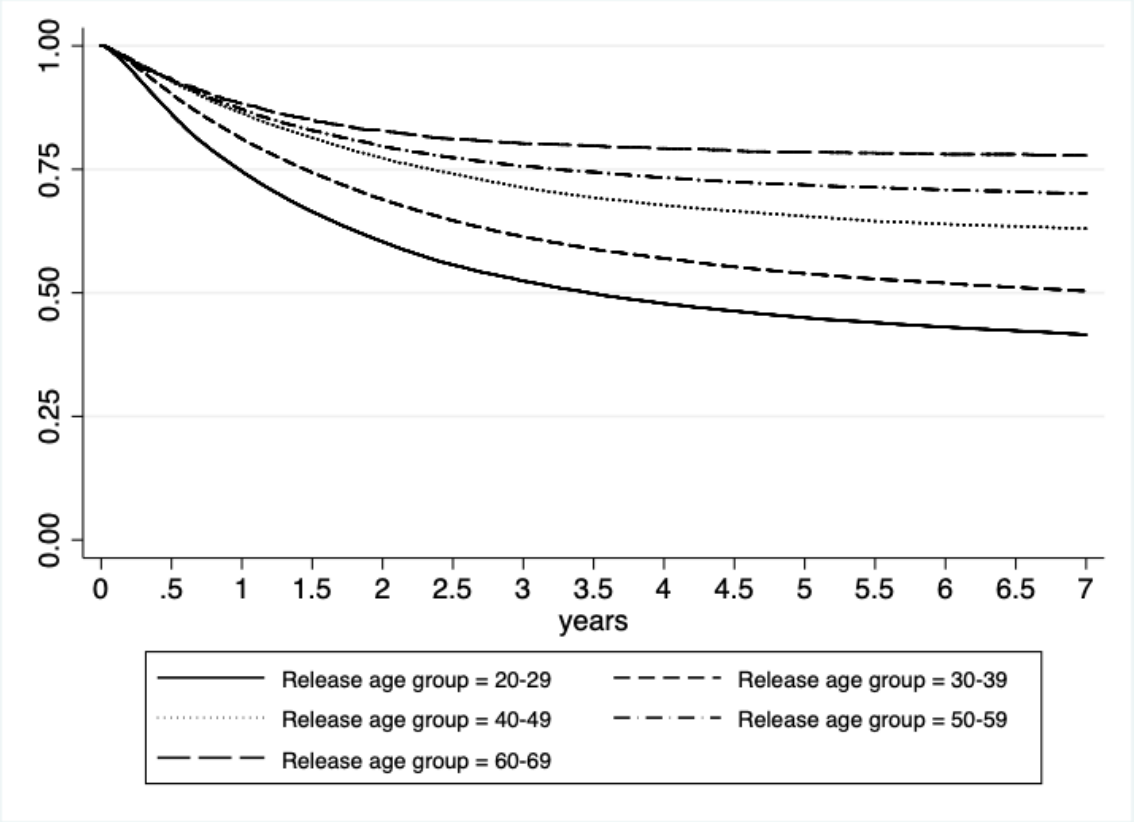
Note: The figure contains offends committed by offenders that were released from prison between 2007 and 2017 with a time spent in freedom up to 7 years.

Source: Own calculation

What can also be helpful for a SIB proposal is not only the crucial time period but also what age group is the most vulnerable to commit another crime. As Figure 4 shows the most vulnerable age group is the one with the lowest survival function which are individuals released from prison between the ages of 20 and 29, followed by an age group of 30 and 39 years, and so on. Therefore, it must be borne in mind that the younger a person released from prison is, the greater the probability of returning to it. This result is also supported by Scheinost et al. (2015) who shows that the sooner a crime occurs, the

higher the individual's probability that his or her criminal career will be longer and the number of offenses committed will increase.

Figure 4: Survival estimate of the released prisoners by age group

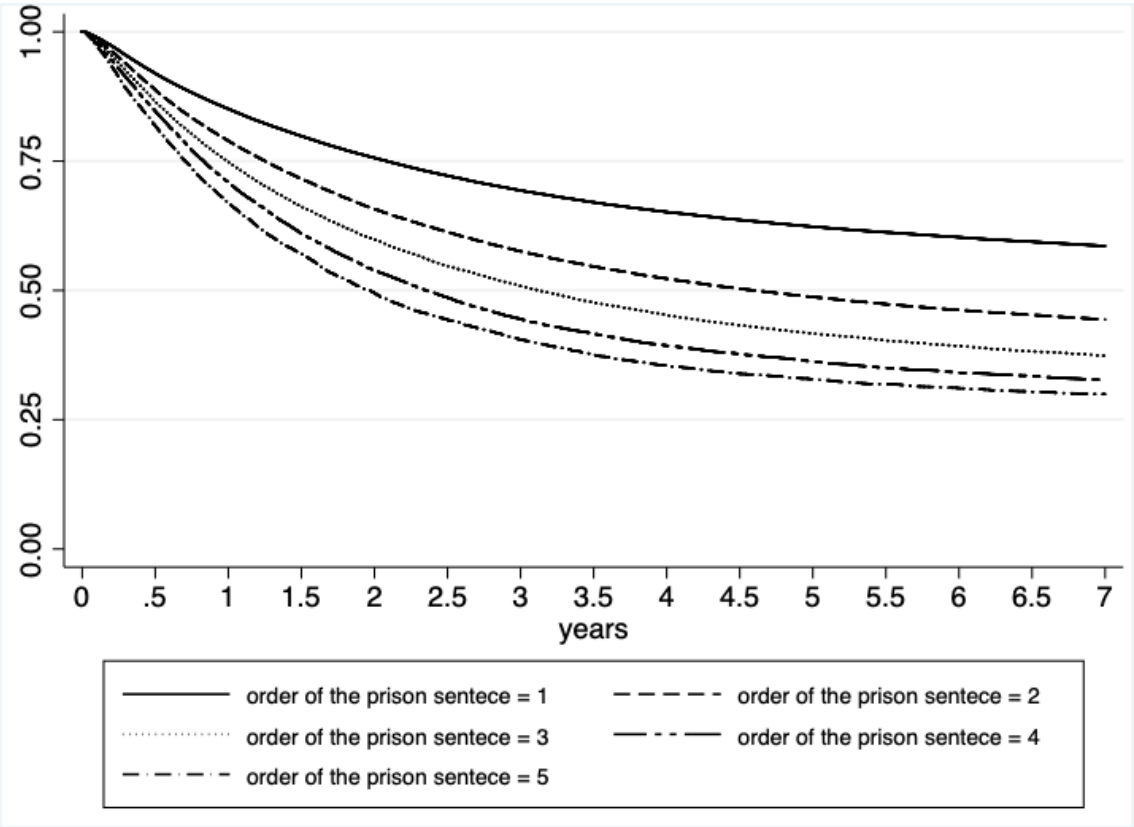


Note: The figure contains offends committed by offenders that were released from prison between 2007 and 2017 with a time spent in freedom up to 7 years.

Source: Own calculation

Survivor functions for individuals broken down by order in which they committed the crime during the observed years provide Figure 5 which indicates the conclusion that the more the crime is committed, the more likely a person will be imprisoned again. Thus, when drawing up the SIB, more attention should be paid to people with more imprisonment sentences.

Figure 5: Survival estimate of the released prisoners by the order of a prison sentence



Note: The figure contains offends committed by offenders that were released from prison between 2007 and 2017 with a time spent in freedom up to 7 years.

Source: Own calculation

Appendix A provides the rest of the figures. For instance, another possibly important information in proposing SIB comes from the analysis of survivor functions for different types of crimes committed by individuals. As Figure 11 shows, people with the lowest survivor function, i.e., people that are most likely to commit another crime, are the ones that were convicted of theft. On the other hand, for those convicted of homicide, the probability of returning to prison is the least likely. However, people convicted of homicide are usually in prison far longer than those convicted of theft and so this estimate cannot be taken as a rule. The insignificance caused by a different length of punishment is also supported by Figure 12 which displays survivor functions by the length of a sentence. The two lowest survivor functions belong to the shortest sentence which indicates that the shorter sentence the higher probability of being imprisoned again. However, given the above and the length of the study, the conclusions cannot be taken as a rule. Lastly, Fig-

ure 13 provides survivor functions according to educational attainment. Not surprisingly, the highest probability of surviving, i.e., not being re-incarcerated, belongs to individuals who have attained tertiary education. On the other hand, people with secondary education are more likely to be incarcerated again than people who only have primary education.

Table 17 shows a life table for estimates of both survivor and hazard function for the whole dataset. Column (4) gives a chance of surviving beyond each interval. In the first interval Y1Q1, i.e., the first three months after release from prison, a total of 143,076 observations are present. In this first quarter, a total of 6,822 subjects were imprisoned again. That gives a probability of surviving to the next period of 0.95. The probability of surviving decreasing as offenders are getting imprisoned again. In the time period from 9 months to 1 year in freedom (Y1Q4), 120,945 subjects are still present at the beginning of the time period. During this period, 5,826 individuals were imprisoned again. Therefore, for the whole sample, the probability to remain out of prison for more than a year after being released is 0.80. The probability of staying in freedom two years after being released from prison is 0.64.

From the analysis, it is clear that the riskiest period (for re-offending) is considered to be the first 6 months after release from prison and the maximum number of re-offenders commits a new offense within 3 years after release as during this period the survival function is the steepest. A similar conclusion is also reached by Marešová et al. (2011).

Table 17: Comparison of Survival and Hazard estimates

Time period	Beg. Total	Deaths	Survival	Cum. Failure	Hazard
(1)	(2)	(3)	(4)	(5)	(6)
Y1Q1	143,076	6,822	0.9523	0.0477	0.0005
			(0.0006)		(0.0006)
Y1Q2	136,254	8,210	0.8949	0.1051	0.0007
			(0.0008)		(0.0008)
Y1Q3	128,044	7,099	0.8453	0.1547	0.0006
			(0.0010)		(0.0010)
Y1Q4	120,945	5,826	0.8046	0.1954	0.0005
			(0.0010)		(0.0010)
Y2Q1	115,119	5,158	0.7685	0.2315	0.0005
			(0.0011)		(0.0011)
Y2Q2	109,961	6,277	0.7247	0.2753	0.0006
			(0.0012)		(0.0012)
Y2Q3	103,684	6,270	0.6809	0.3191	0.0007
			(0.0012)		(0.0012)
Y2Q4	97,414	5,556	0.6420	0.3580	0.0006
			(0.0013)		(0.0013)
Y3Q1	91,858	5,036	0.6068	0.3932	0.0006
			(0.0013)		(0.0013)
Y3Q2	86,822	4,281	0.5769	0.4231	0.0006
			(0.0013)		(0.0013)
Y3Q3	82,541	3,737	0.5508	0.4492	0.0005
			(0.0013)		(0.0013)
Y3Q4	78,804	3,350	0.5274	0.4726	0.0005
			(0.0013)		(0.0013)
Y4Q1	75,454	2,999	0.5064	0.4936	0.0004
			(0.0013)		(0.0013)
Y4Q2	72,455	2,583	0.4884	0.5116	0.0004
			(0.0013)		(0.0013)
Y4Q3	69,872	2,459	0.4712	0.5288	0.0004
			(0.0013)		(0.0013)
Y4Q4	67,413	2,176	0.4560	0.5440	0.0004
			(0.0013)		(0.0013)
Y5Q1	65,237	2,108	0.4412	0.5588	0.0004
			(0.0013)		(0.0013)
Y5Q2	63,129	1,866	0.4282	0.5718	0.0003
			(0.0013)		(0.0013)
Y5Q3	61,263	1,806	0.4156	0.5844	0.0003
			(0.0013)		(0.0013)
Y5Q4	59,457	1,692	0.4037	0.5963	0.0003
			(0.0013)		(0.0013)
Y6 - .	57,765	57,765		1.0000	

The life table uses the sample for offenders released from prison between 2007 and 2017.

(1) Time interval that is after 91 days for 5 years.

(2) Number of observations that were present in beginning of time interval.

(3) Number of offenders that have been imprisoned again during the time interval.

(4) Survival estimate.

(5) Cumulative failure.

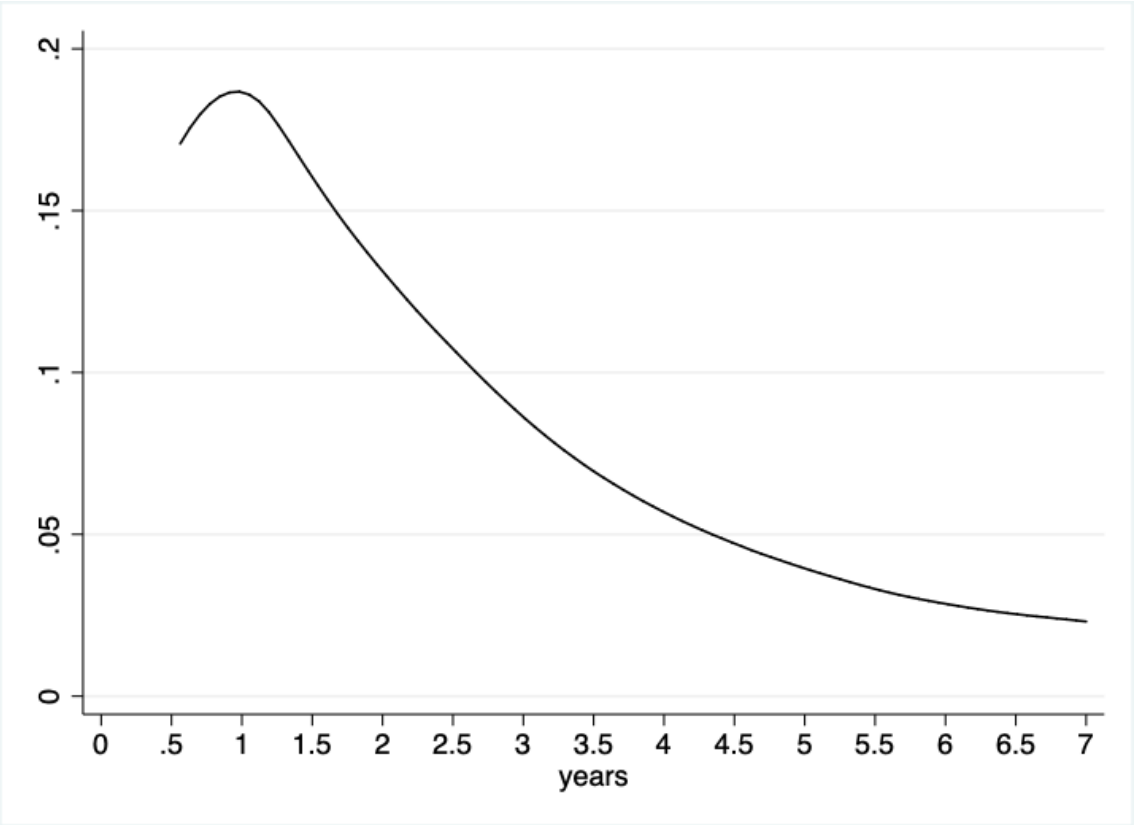
(6) Hazard estimate.

Source: Own calculations

5.2.3 Hazard function

Firstly, Table 17 provides a comparison of survivor and hazard estimates. As mentioned in Chapter 3, the difference is in the interpretation. Hazard (6) is an instantaneous event rate that can be interpreted as a probability that an individual will experience the event during a particular time period of t. Thus, the highest hazard of being imprisoned again is in the period Y1Q2 spent in freedom and over the time period from Y2Q3 where the hazard 0.007. A hazard of 0.006 lasts up to Y3Q2 of time spent in freedom, i.e. 2 and a half years, indicating that the riskiest period for recidivism is considered to be the first 6 months after release from prison and the maximum number of re-offenders commits a new offense within 2 and a half years after release. Results are consistent with the ones from previous chapter as well as supported by Marešová et al. (2011). Figure 6 provides a Hazard function for the whole dataset with a peak somewhere around one year in freedom. Then the hazard decreases along with the time spent in freedom.

Figure 6: Hazard estimate of the released prisoners

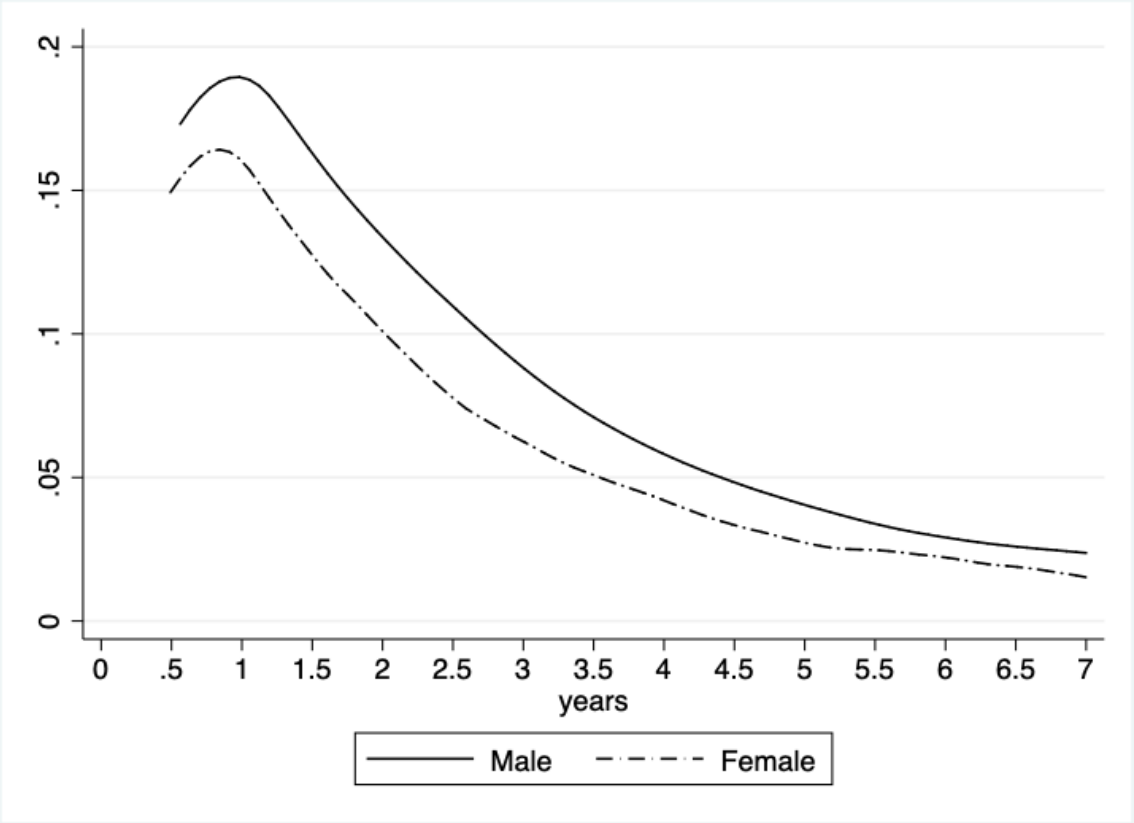


Note: The figure contains offends committed by offenders that were released from prison between 2007 and 2017 with a time spent in freedom up to 7 years.

Source: Own calculation

Just like in the case of survivor function, a deeper analysis of hazard functions is provided. Figure 7 shows the hazard function for men and women separately. The curve representing men is in the whole interval above the curve representing women which means that hazard of being re-incarcerated is bigger for men than for women.

Figure 7: Hazard estimate of the released prisoners by gender

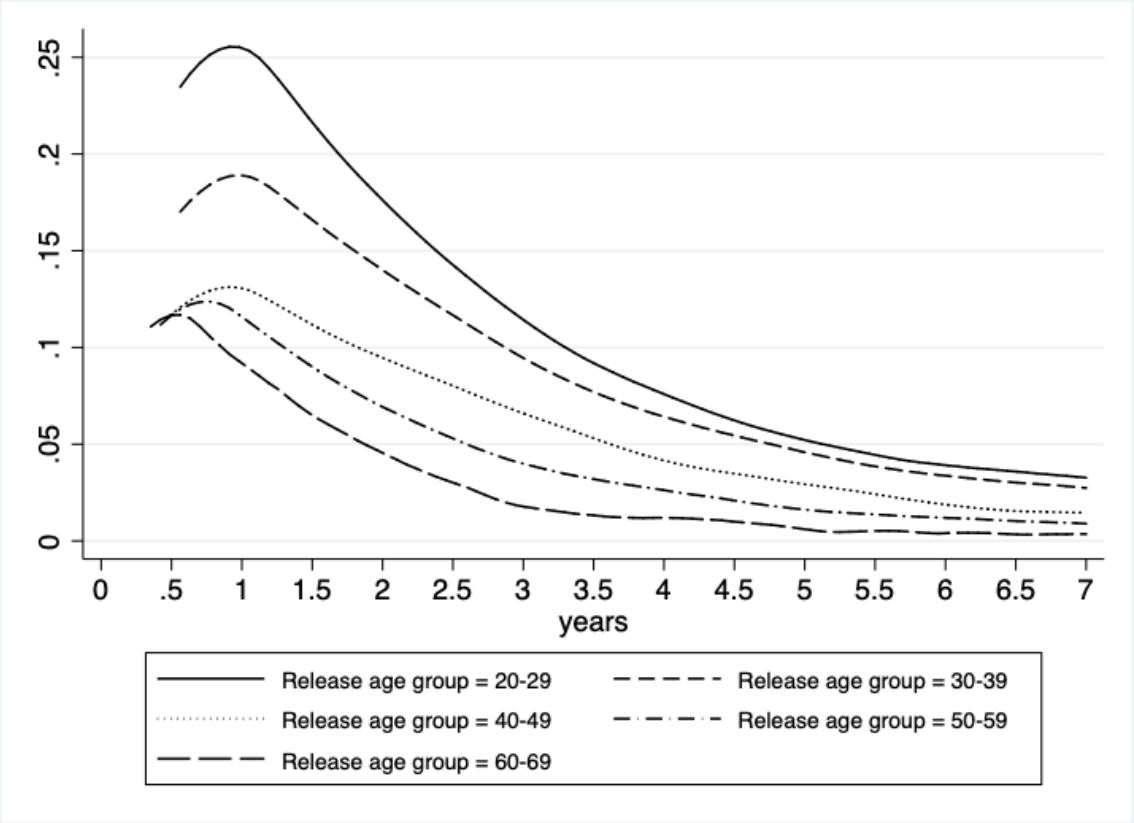


Note: The figure contains offends committed by offenders that were released from prison between 2007 and 2017 with a time spent in freedom up to 7 years.

Source: Own calculation

The hazard of being re-incarcerated is the biggest for individuals in the age group from 20 to 29 years followed by the age group from 30 to 39 years. The hazard of individuals falling into these two groups exceeds by far the hazard of the other age groups. This suggests that the younger an individual is the bigger hazard of being re-incarcerated.

Figure 8: Hazard estimate of the released prisoners by age group

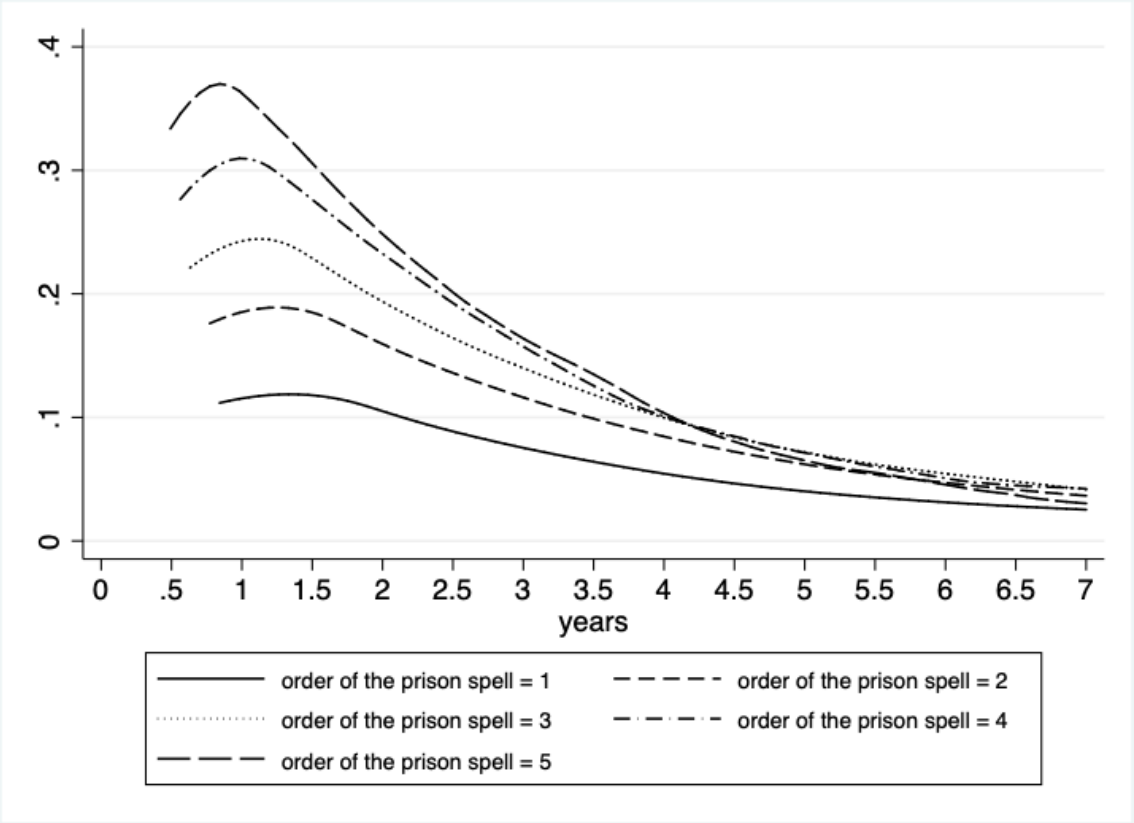


Note: The figure contains offends committed by offenders that were released from prison between 2007 and 2017 with a time spent in freedom up to 7 years.

Source: Own calculation

Estimates of hazard functions broken down according to the order in Figure 9 in which the conviction was committed again shows the more previous convictions, the greater the hazard of returning to prison.

Figure 9: Hazard estimate of the released prisoners by the order of a prison sentence



Note: The figure contains offends committed by offenders that were released from prison between 2007 and 2017 with a time spent in freedom up to 7 years.

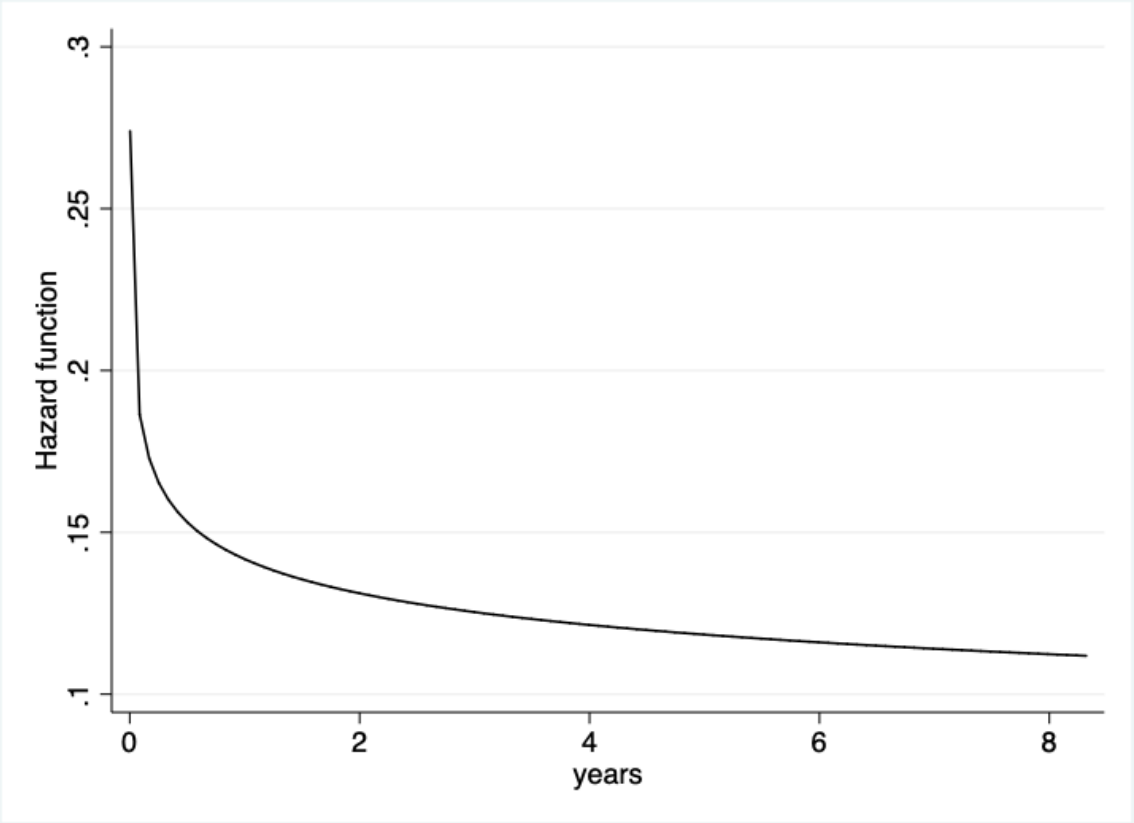
Source: Own calculation

As in the case of survivor function, the biggest hazard of being re-incarcerated are undergoing individuals that were convicted of theft, individuals imprisoned for a shorter term and people with secondary education in the first two years after their release of prison as Figure 14, Figure 15 and Figure 16 in Appendix A suggest respectively.

5.2.4 Weibull regression model

As mentioned in Chapter 3.1.3 and seen in Figure 10 below, the parameter $\alpha < 1$ meaning that the hazard is decreasing and convex. That can be interpreted as with time spend on freedom the risk of being re-incarcerated is decreasing.

Figure 10: Weibull regression



Source: Own calculation

However, the regression gives more interesting and relevant results shown in Table 18. For instance, the second regression in Table 18, including information about gender and the highest level of education can be written as follows:

$$\lambda(t) = \lambda_0(t) * exp(female_i\beta_1 + educ\_secondary_i\beta_2 + educ\_tertiary_i) * \eta_i$$

$$where\ \lambda_0(t) = \gamma\alpha t^{\alpha-1}$$

where $\lambda_0(t)$ is the baseline hazard which depends on t. It summarizes duration dependence, assumed to be common between observations. $exp(x'\beta)$ is a person specific function that shifts the baseline function according to individual characteristics. The exponential term makes sure that hazard rates are positive for all x_i and η_i is a term for unobserved heterogenity (gamma distributed). According to proportionality assumptions the shift is the same (proportional) along with the whole baseline hazard.

The used dataset contains just a little characteristic information about offenders and their offenses. Such information is stored in SARPO (Czech abbreviation of Complex Analysis of Offenders' Risk and Needs (Jiricka et al., 2014)), which is a predictive tool for assessing the risks and criminogenic needs of convicts, which is part of the Prison Information System (VSCR, 2020). Unfortunately, this data is not public. As in the previous analysis, the regressions contain offenders that were released between the years 2007 and 2017. During this period, the characteristics data for 40,958 observations are known.

Even though the characteristics data about the individuals who committed the crimes are very limited, the thesis still provides some interpretable results consistent with the previous findings. Table 18 shows the results in five specifications. Results are interpreted in hazard ratios which may seem at first slightly counter-intuitive.

The first estimation contains only variable $female$, i.e., characteristic about gender. Since the results are interpreted in hazard ratios, the coefficient in (1) is interpreted as follows. When the hazard ratio $exp(\beta_i) = 0.782$ then an increase of unit variable x_i increases the hazard rate by $(0.782 - 1) = -0{,}218$, therefore, by -21.8%. And so, women have a 21.8% lower hazard rate than men, i.e., the chance of being re-imprisoned is lower by 21.8% for women compared to men.

The second estimation includes also characteristics of the level of education. The results correspond to the ones in Figure 13 and Figure 16 as offenders with secondary education have 15% higher risk of being re-incarcerated than offenders with primary education and offenders with tertiary education have 30.6% lower risk of returning into prison than the ones with primary education. Even though these results are all significant at 1% of the confidence interval as stated earlier the dataset contains 40,958 observations out of which only 687 subjects have tertiary education.

The third estimation includes dummy variables about the number of sentences where $sent\_two$ belongs to offenders to whom the sentence was the second one $sent\_three$ to offenders who finished their third sentence, and $sent\_more$ for individuals who have served 4 and more sentences. Variable $sent\_one$ for the ones who have served their first sentence is omitted to avoid perfect collinearity and becomes a reference variable and, therefore, this group of observations becomes the reference group. Clearly, the results show that

with multiple prison sentences the higher risk of being re-incarcerated again. For individuals who have experienced two prison sentences the chance of being re-imprisoned is higher by 9.4% as $1 - 1.094 = 0.094$ compared to the ones who served their first sentence. Individuals who have already served 3 prison sentences, the chance of being re-incarcerated is higher by 44.7% compared to the ones who served just one prison sentence. This correlation is also proven by Scheinost et al. (2015).

The fourth estimate includes also information about the length of the sentence where $length\_year1$ indicates a prison sentence lasting up to 1 year. Variable $length\_year2$ is for a prison sentence lasting up to 2 years, and so on. The reference group consists of individuals whose sentence lasted 6 or more years. It is clear from the results that the shorter a person's stay in prison, the greater the risk of returning to prison. However, these results cannot be very telling as the regression envisages a 10-year period, and individuals whose sentence lasted for a shorter period of time spent more time in freedom in the reporting period and thus had more time to commit another offense. On the other hand, data on criminality by Police of the Czech Republic (2018) show that recidivism is mostly connected with property crime, which is generally associated with shorter sentences of imprisonment.

The last regression contains information about the age of offenders where the variable $young$ is a dummy variable equals 1 if an individual is not older than 29 years. $midage$ includes people in the age between 30 and 49 and the rest of the sample, i.e., individuals over 50, are included in the variable old. Reference variable is in this case the variable $young$. This characteristic information seems to be also very influential as people over the age of 50 are less likely to be imprisoned again by 54.3% than those under the age of 30. To a similar conclusion about the effect of age on recidivism comes also the study by Jiricka et al. (2014) in their pilot study using the SARPO tool but even their study is limited by the data as, by the time of the study, SARPO tool was in place just couple of years. Nevertheless, young age turns out to be a significant factor in future recidivism. That is also supported by Scheinost et al. (2015) who show that at the younger age the crime is committed the higher is individual's probability that his or her criminal career will be longer and the number of offenses committed will increase. However, by including all variables, a previous variable $educ\_tertiary$ becomes insignificant. Apart from that,

there are no drastic changes in the hazard ratios of previous variables whilst including more variables into regression.

As previously stated, the dataset does not contain characteristic information for all the individuals. Besides, the information does not tell much about the type of person, so it is not possible to estimate a coherent profile of a convict who would be most likely to re-offend. Additional data, such as information on parents, whether or not the individual has been a victim of violence in childhood (Marshall and English, 1999), whether the individual is or has been addicted to drugs (Hepburn and Albonetti, 1994), or, for instance, if an individual experienced any school problems, would certainly help further refine the results as those characteristics have been proven by numerous studies to be significant in estimating a coherent profile of a recidivist. For instance, Visher, Lattimore, and Linster (1991) focus on predicting recidivism by examining the profile of recidivists and trying to find a pattern that would help target potential future recidivists.

The greatest drawback of these results is certainly in the absence of more detailed data. Furthermore, the results would benefit from a longer study period. Despite this, the thesis provides some characteristics of individuals that can help when setting up the SIB. It is also worth mentioning that the analysis of determinants affecting repeat offenders in their behavior is not the main question of this thesis. At the same time, there is a huge potential for further research.

Table 18: MODEL: Weibull regression

	(1)	(2)	(3)	(4)	(5)
female	0.782***	0.781***	0.768***	0.753***	0.748***
	(-7.37)	(-7.44)	(-7.93)	(-8.50)	(-8.70)
secondary		1.150***	1.166***	1.187***	1.246***
		(7.26)	(7.97)	(8.91)	(11.33)
tertiary		0.694***	0.722***	0.758***	0.929
		(-5.44)	(-4.86)	(-4.14)	(-1.09)
sent_two			1.094***	1.149***	1.127***
			(4.91)	(7.46)	(6.44)
sent_three			1.447***	1.512***	1.452***
			(16.97)	(18.59)	(16.76)
sent_more			1.846***	2.010***	1.907***
			(22.83)	(25.17)	(23.20)
length_year1				1.715***	1.618***
				(16.48)	(14.67)
length_year2				1.684***	1.591***
				(16.67)	(14.83)
length_year3				1.604***	1.527***
				(14.41)	(12.90)
length_year4				1.567***	1.496***
				(12.33)	(11.04)
length_year5				1.361***	1.330***
				(7.13)	(6.60)
midage					0.708***
					(-21.70)
old					0.457***
					(-24.77)
/					
ln_p	0.875***	0.876***	0.885***	0.883***	0.888***
	(-20.41)	(-20.28)	(-18.82)	(-19.14)	(-18.27)
N	40958	40958	40958	40958	40958

Exponentiated coefficients; t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5.3 Setup of SIB

5.3.1 SIB as an Investment

The estimated costs can also be perceived as an indication of how the government should value the potential reduction in recidivism. Therefore, the cost savings from recidivism reduction can thus also represent the amount for which the SIB can be issued. Table 19 shows a simple evaluation assuming the SIB is issued for 5 years, i.e., its evaluation is done after 5 years. For instance, in a scenario (3), the reduction in recidivism would bring cost savings in the amount of almost CZK 1.3 billion. If the investor would be willing to invest in a social intervention CZK 220 million every year, the IRR would be 5% if the SIB would be successful. In addition, programs of this type very often receive financial support in the form of a grant, for example from the European Union (PMS, 2020b). Such a grant could serve as a risk-reducing insurance, in which case the investor would not lose the entire amount if the required outputs are not met. Also, the SIB is issued based on cost savings made from 1 year only. It can be expected that the decrease will occur in each year and not just in the last year. The same applies for future years where recidivism is expected to be lower. Therefore, the government would also make a profit. Or a government may choose to issue the SIB for even higher price.

Table 19: Investments under different scenarios of reduction of recidivism

	(1)	(2)	(3)
Reduction of recidivism	10%	7.5%	5%
Costs savings (mil. CZK)	2,542	1,906	1,271
Length of the experiment (years)	5	5	5
IRR	5%	5%	5%
Annual investment (mil. CZK)	440	330	220

Source: Own calculation

Furthermore, as mentioned in the theoretical part, the SIB is especially attractive for philanthropists and impact investors as SIB generates social returns as well (Roundy, Holzhauer, and Dai, 2017). Unfortunately, due to the complexity of the analysis of Social Return on Investment (SROI), the analysis exceeds the dimensions of this thesis (Millar and Hall, 2013). As described in Krátký (2012), SROI depends heavily on a deep analysis of all involved stakeholders affected by the implemented social policy. To determine any

change that has occurred to interested parties, it is necessary to obtain this information directly from them and to have these allegations verified through the records collected. Although the thesis lacks this analysis, at the same time the thesis assumes that the SROI would support the hypothesis that it is a profitable investment, as reducing recidivism positively affects all people in society. This opens possibilities for further research.

However, it is unlikely for SIB to target recidivism as a whole as not every recidivist ends up in prison after committing another crime. On the other hand, those who end up in prison have gone through the whole system and are covered by part of the costs from each category of estimated costs. Moreover, to evaluate the results, there needs to be a control group so the SIB can be properly evaluated. A possible method is described later on in Chapter 5.3.2. The SIB could be issued on a much smaller scale to serve more as a research aid or guidance and to show which way to go to reduce recidivism. For instance, a successful Peterborough SIB (Anders and Dorsett, 2017) was aimed at the prison population in one prison. Other SIBs are also more likely to be location-specific. A SIB must be properly tested before it is implemented in a bigger magnitude. In this way, the intermediary may also test the intervention of reduction of recidivism in various scenarios and then evaluate and find what is the most effective and cost-benefit way.

5.3.2 Final setup and measurement

Reasons mentioned in the previous chapter suggest that the SIB should be tried on a smaller scale, focusing on the most problematic recidivists, i.e., those who end up in prison. Moreover, as shown in the Table 16, the largest cost component per recidivist is expenditure on prison services. Focusing only on offenders ending up in prison thus makes the most sense from a cost-benefit point of view. Thus, social measures could be targeted and tested only on persons released from prisons with characteristics affecting recidivism the most. Not only is there more information about these individuals, but it is also easier to follow during research. Also, being part of this research could be mandatory for those released on probation. The treatment group could thus consist of individuals released from certain prisons and the control group could consist of individuals with the same characteristics from prisons where treatment would not be introduced.

In 2018, a total of 10,928 individuals were released from prisons[16] (Prison Service of the Czech Republic, 2018). Table 20 shows the gradual release of prisoners in each month of 2018. The number of released prisoners in each month is relatively stable, at around 900 which gives a sufficient sample.

Table 20: Total released offenders in 2018

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Probation	214	220	203	232	264	255	206	238	244	241	292	186
Unconditional	685	653	681	709	681	686	646	671	656	710	694	661
Total	**899**	**873**	**884**	**941**	**945**	**941**	**852**	**909**	**900**	**951**	**986**	**847**

Source: Prison Service of the Czech Republic (2018), modified

Following Anders and Dorsett (2017), a smaller sample may be divided into two cohorts by 1,000 individuals with similar characteristics - treatment and control group. As Table 16 shows, an average cost per 1 recidivist ending up in prison with a custodial sentence of 1 year is CZK 683,082. As shown in Table 1, the share of recidivists in prison population is 63.1%. Thus, the thesis assumes that 631 recidivists will return to prison under current settings. Therefore, 631 recidivists represent a cost of CZK 431 million. Table 21 shows three possible scenarios of reduction of recidivism among this cohort. Scenario (0) represents the baseline[17].

Table 21: Investments under different scenarios of reduction of recidivism among 1,000 released offenders

	(0)	(1)	(2)	(3)
Reduction of recidivism (by percentage points)	0%	10%	12.5%	15%
Expected recidivism rate	63.1%	53.1%	50.6%	48.1%
Expected number of re-incarcerated recidivists	631	531	506	481
Estimated societal costs caused by recidivist (mil. CZK)	431	363	346	329
Estimated cost savings (mil. CZK)		68	85	103
Length of the experiment (years)		4	4	4
IRR		5%	5%	5%
Annual investment (mil. CZK)		15	19	22.5

Source: Own calculation

All scenarios consider a length of 4 years, while the first two years should be devoted to

[16] Of which 2,795 on probation and 8,133 unconditionally.

[17] What would be if no treatment was applied (current state).

the overall setting of the social program, ending with its introduction. The remaining 2 years should already belong to the experiment itself and its evaluation.

For instance, scenario (1), a reduction of recidivism by 10 percentage points would lead to expected recidivism rate of 53.1%. That would lead to estimated cost savings of CZK 68 million which may also serve as the amount at which the SIB might be issued. To keep the SIB as an investment profitable with the targeted IRR of 5%, an annual spending of CZK 15 million could be made if the experiment would last for 4 years.

Probably the most difficult part is the SIB's evaluation as mentioned in the theoretical part of the thesis, discussed in Chapter 1.3.4 focusing on the importance of measurement. This is crucial since the evaluation decides whether the SIB had met the agreed criteria. The evaluation needs to be done by independent assessors and the methodology must be agreed on before even beginning of the SIB.

As the literature suggests, to estimate the effectiveness of introduced social policy, a PSM method seems to be the preferred one (Apel and Sweeten, 2010). This method is also used in the first SIB (Cave et al., 2012). The idea behind matching is to reproduce the treatment group among the non-treated by pairing each participant with members of the non-treated group based on observable characteristics in vector **X**. Then, the average outcome, i.e., change in recidivism level, for the untreated matched group identifies the mean counterfactual outcome for the treated, i.e., what would happen if there was no treatment what so ever (Cameron and Trivedi, 2005). Therefore, each individual experiences a response under two simultaneous conditions (Apel and Sweeten, 2010).

To formalize and to apply this approach in the case of reducing recidivism, suppose that the sample of 2,000 individuals have the potential outcome Y_i^1 under treatment and outcome Y_i^0 under non-treatment and d_i that equals 1 or 0 when treatment is or is not received (Apel and Sweeten, 2010). To calculate the treatment effect a Conditional independence assumption (CIA) must apply for Y_i^0

$$Y_i^0 \perp d_i | X_i$$

which means that unobservable variables **X** play no role in the treatment assignment and

outcome determination which implies:

$$E[Y_i^0|d_i = 1, X_i] = E[Y_i^0|d_i = 0, X_i] = E[Y_i^0|X_i]$$

Then, supposing that treating individuals are matched in term of all observable characteristics and all differences are between the groups are controlled, then, the average treatment effect (ATE) may be written as:

$$\begin{aligned} & E[Y_i^1|d_i = 1] - E[Y_i^0|d_i = 0] \\ = E[Y_i^1 - Y_i^0|d_i = 1] + & \{E[Y_i^0|d_i = 1] - E[Y_i^0|d_i = 0]\} \end{aligned} \tag{13}$$

where $E[Y_i^1 - Y_i^0|d_i = 1]$ is the desired average treatment effect on the treated (ATT) and $\{E[Y_i^0|d_i = 1] - E[Y_i^0|d_i = 0]\}$ is the bias which is equal to zero if the division into treatment and control groups was random (Cameron and Trivedi, 2005).

By using this method on a smaller sample the social intervention may be tried and measured. Moreover, there might be two treatment groups with different types of social interventions that might be compared with the control group. After the evaluation, a better intervention may be chosen and adapted to a bigger scale.

5.4 Summary of proposed SIB

As described in Table 21, scenario (2), the SIB might aim for a reduction of recidivism in the cohort of 1000 individuals released from prison by 12.5 percentage points given the current situation of recidivism rate of 63.1%. Reduction of recidivism by 12.5 percentage points would generate cost savings of CZK 85 million as the estimated costs per 1 recidivist is approximately CZK 683,082. These cost savings may also represent the amount at which the SIB can be issued. To maintain the IRR of 5%, the investor could afford to invest CZK 19 million per year into the whole SIB, provided that the entire SIB takes place within 4 years. The first two years should be devoted to its preparation and proper implementation. The next 2 years should be focused on its observation and evaluation. A PSM method should be used for final evaluation.

Detailed Survival analysis provides specifics that the intermediary should take into account. The SIB should aim primarily at the first year after the release as the biggest probability of re-offending occurs in that year. Since the motivation behind the SIB is meeting targeted outcomes, it should also aim at individuals with certain characteristics. Unfortunately, the thesis works with only limited data on the characteristics of individuals. Even though the study would need further research in this area, few results can be used. Firstly, the SIB should aim at younger offenders as those are the ones most vulnerable to re-offend. Secondly, education and gender play an important role. The thesis comes to the conclusion that females and tertiary educated individuals have a much lower probability of re-offending than others. Therefore, the SIB should focus its attention primarily on less educated males. Thirdly, the number of previous sentences is also something that the SIB intermediary should consider as the thesis concludes that the more previously committed crimes, the higher the probability of committing the crime again. The length of the sentence plays also its part. Results show that the longer the sentence the lower probability of re-offending and therefore, the intermediary should focus on offenders that served shorter sentences. Also, as it is clear from the crime statistics (Police of the Czech Republic, 2018), recidivism is most often monitored in property and moral crime.

Conclusion

The Czech Republic is generally at the forefront of statistics in the number of convicts per 100,000 inhabitants even though the crime rate exhibits a decreasing trend. Besides, the majority of the prison population is made up of recidivists. Recidivism in the Czech Republic is a long-term problem bearing huge social costs. For this reason, the thesis aimed to provide an estimate of these social costs and to present the SIB as a new way to implement social measures cheaper and more effectively, which is gaining great popularity abroad.

The theoretical part of the thesis explained what SIB is and how it works. Furthermore, the study addressed in detail the potential benefits, but also the theoretical problems related to SIB. This part resulted in the presentation of criteria of success without which the SIB could not function. The conclusion of the theoretical part was devoted to the current SIBs in the world, especially their settings and results. These practical examples also serve as a basis for the design of the SIB evaluation presented at the end of the empirical part.

The theoretical part concludes that setting up a SIB is definitely not easy and may not always be successful. At the same time, however, a SIB does not always have to be successful to be successful. In other words, if the SIB meets the agreed criteria, the investor gets paid by the government from the saved social costs or is partially covered by a third party. SIB is also a risky investment and success is not guaranteed. If the SIB does not deliver the agreed outputs, the investor will lose his investment, but the government does not have to pay anything at all. However, for the investor it can mean an interesting advertisement of how to be visible in a good light as in the case of Riker Island SIB (Phillips and Olson, 2013). In addition, even such a failed SIB can further assists in research in a given area of research through the data collected and the analysis of the failure. In both cases, the government has nothing to lose.

The empirical part focuses completely on a proposal of SIB for the reduction of recidivism in the Czech Republic. Firstly, for the government to know for how much the SIB can be issued, it must know the amount of cost of recidivism. The costs can be divided into three categories, namely Anticipation costs, Consequence costs, and Response costs

as defined in Heeks et al. (2018). The thesis estimated that the total cost of recidivism was almost CZK 26 billion. Although this number may seem high, it is more of a lower limit. This is mainly due to the fact that the thesis had to be based on the official number of registered crimes, whilst many other crimes being of a latent nature (Scheinost et al., 2015). Furthermore, due to the difficulty of quantifying physical and emotional harm, the study took estimates from study by (Heeks et al., 2018), which only covers part of the crimes.

Secondly, for social intervention within the SIB to be effective, the time after release in which the individual is most prone to committing another crime must be defined. With the help of Survival analysis, the thesis concluded that the highest probability of committing another crime is within 3 years of release. However, the probability varies based on the characteristics of criminals, which is of interest the thesis further addressed. Weibull regression was used to evaluate individual determinants. The thesis concluded that women have a lower chance of being re-incarcerated than men by approximately 22%. Education also plays an important role, individuals with a university degree are being far less likely to commit another crime than individuals with primary and secondary education. The thesis further concluded that the more previous crimes an individual committed, the greater the chance that he or she will commit another crime. Last but not least, age turned out to be one of the most important characteristic. An individual over the age of 50 is 54.3% less likely to commit another crime than an individual under the age of 29. Thanks to this analysis, the SIB can be focused on the most problematic period for the most problematic individuals and thus achieve the desired results.

In the third part of the empirical part, the thesis dealt with the evaluation of SIB as an investment for investors. Reducing recidivism by 5% would save costs of CZK 1.27 billion in just one year. This is based on data from 2018. The SIB could thus be issued for this amount. This means that if the SIB was issued for 5 years, then with an investment of CZK 220 million per year in the social program, the Internal Rate of Return would be 5%. At the same time, social support is very often provided in the form of a grant for social investments, which would thus reduce the risk of such an investment to a certain extent. However, it is unlikely that the social program would be targeted at all recidivists. For this reason, the thesis proposes to apply the social program to a sample of 1,000 offenders released from prison. At the same time, these offenders represent the greatest

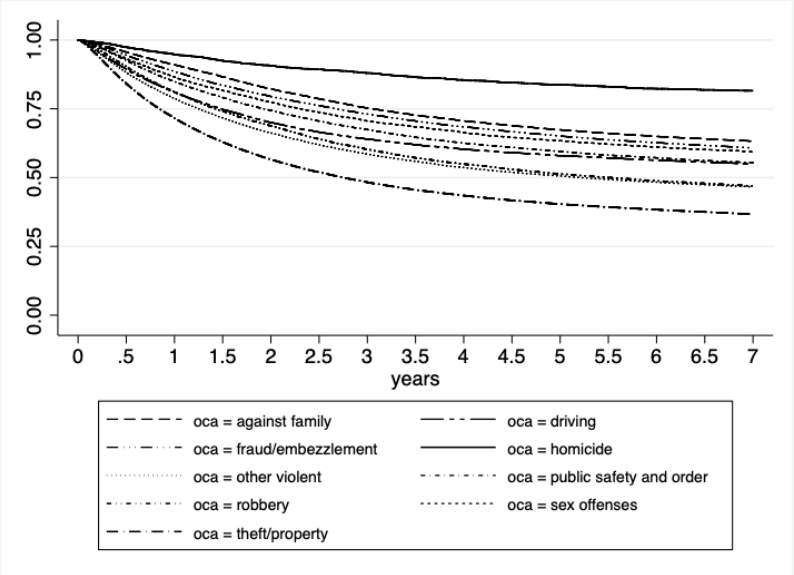
costs to society due to the high cost of prison services. Reducing recidivism by 12.5 percentage points compared to the current situation would save costs of CZK 85 million. This amount could thus also represent the amount for which the SIB will be issued. Based on the literature research, the Propensity Score Matching method was chosen as the best method for the SIB evaluation.

The thesis certainly has its shortcomings. SIB is a very new approach, so far very few SIBs have been evaluated and most of them are currently underway. Nevertheless, it is already possible to derive certain criteria for success, according to which it is necessary to adhere to the assembly as successfully described in the theoretical part of the thesis. As already indicated, the problem of the empirical part is the lack of data. In the case of estimating the costs of recidivism, it is impossible to include latent crimes. When defining the characteristics of the offender most likely to commit another crime, only a limited amount of data with basic attributes was available. Although the thesis came to some conclusions, such as that younger criminals are at greater risk of committing another crime, as other studies also confirm (Scheinost et al., 2015), more detailed data, such as data on parents, family crime, etc., would help to refine and define other key determinants. The social program within the SIB could again be more precisely focused and more effective.

The aim of the thesis was primarily to propose a SIB for the Czech Republic to reduce recidivism. This was fulfilled based on available data, but each section would deserve further detailed research. Whether it is defining the profile of a criminal most likely to commit another crime, or it is an estimate of the physical and emotional costs of crime specifically for the Czech Republic.

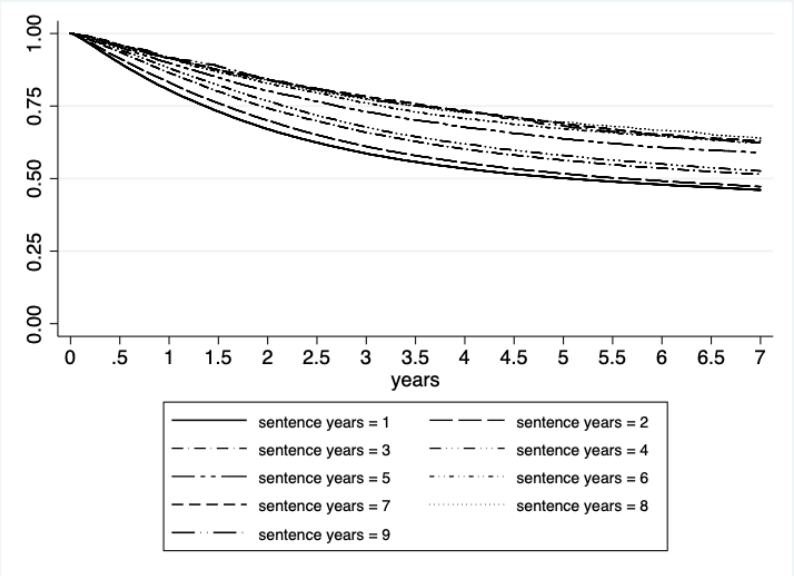
A Appendix

Figure 11: Survival estimate of the released prisoners by type of crime committed



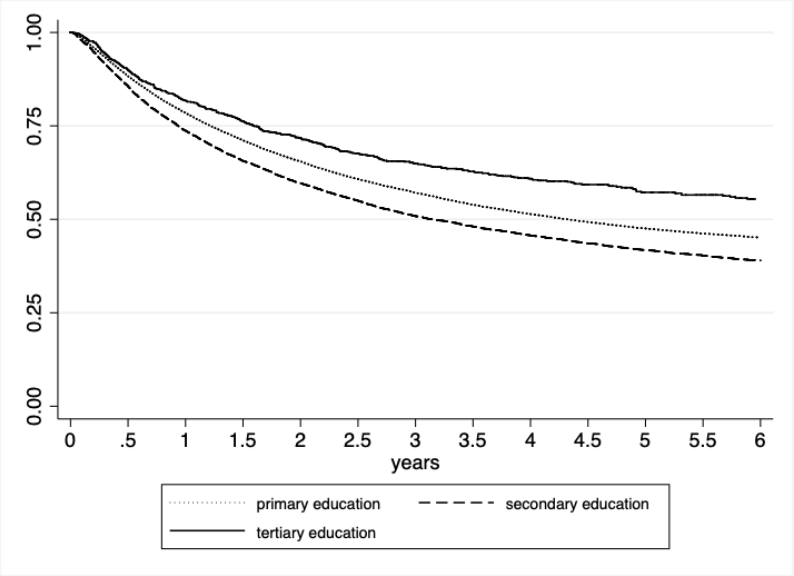
Source: Own calculation
Note: The figure contains offends committed by offenders that were released from prison between 2007 and 2017 with a time spent in freedom up to 7 years.

Figure 12: Survival estimate of the released prisoners by sentence length



Source: Own calculation
Note: The figure contains offends committed by offenders that were released from prison between 2007 and 2017 with a time spent in freedom up to 7 years.

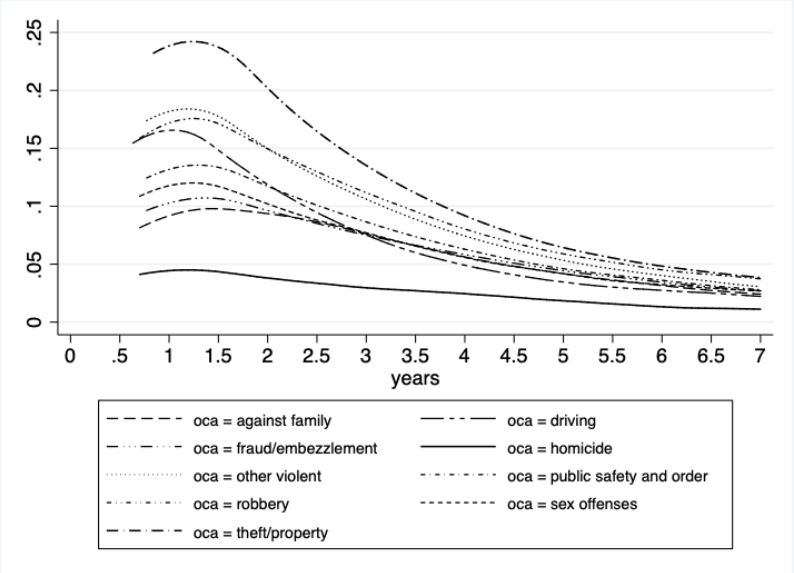
Figure 13: Survival estimate of the released prisoners by education



Source: Own calculation

Note: The figure contains offends committed by offenders that were released from prison between 2007 and 2017 with a time spent in freedom up to 7 years for which the data about education are available.

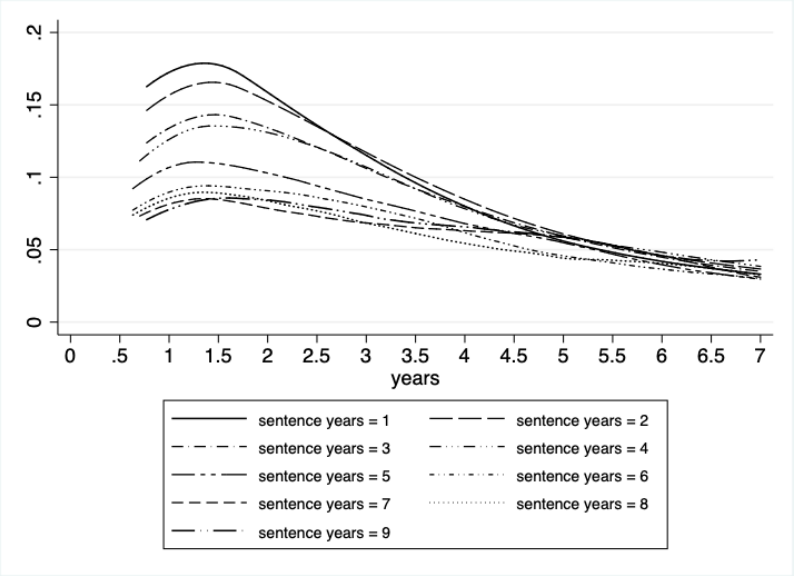
Figure 14: Hazard estimate of the released prisoners by type of crime committed



Source: Own calculation

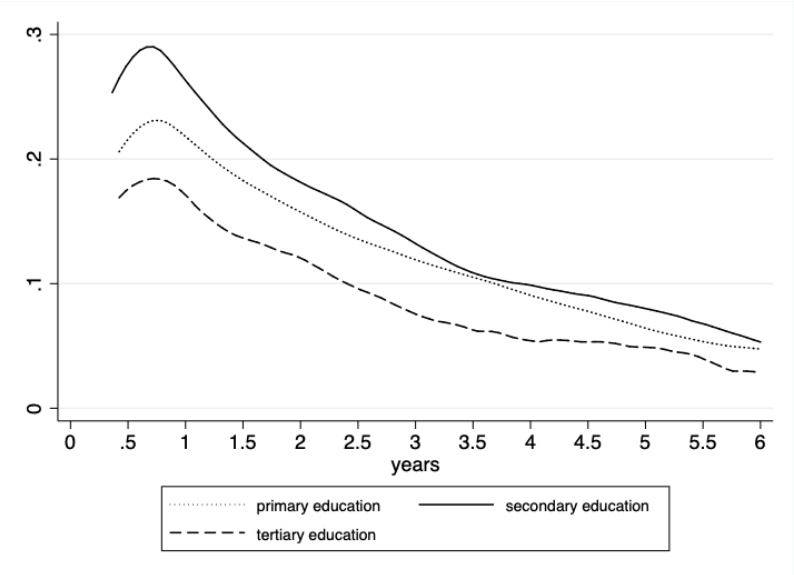
Note: The figure contains offends committed by offenders that were released from prison between 2007 and 2017 with a time spent in freedom up to 7 years.

Figure 15: Hazard estimate of the released prisoners by sentence length



Source: Own calculation
Note: The figure contains offends committed by offenders that were released from prison between 2007 and 2017 with a time spent in freedom up to 7 years.

Figure 16: Hazard estimate of the released prisoners by education



Source: Own calculation
Note: The figure contains offends committed by offenders that were released from prison between 2007 and 2017 with a time spent in freedom up to 7 years for which the data about education are available.

B Appendix

The Appendix B provides a definitions of selected TSK categories in Table 22 used in Chapter 5.1 in table 7.

Table 22: TSK Categorization of crimes by the Police of the Czech Republic

TSK Categorization	Designation
101-106	Homicide (§ 140, § 142)
115	Manslaughter (§ 141)
116	Culpable homicide (§ 143)
122	Abduction of a child
	and a person suffering from a mental disorder (§ 200)
131	Robbery (§ 173)
132	Robberies in financial institutions (§ 173)
141	Violence against an official - outside the police
142	Violence Against an Official - State Police (§ 323 - 326)
143	Violence Against an Official - Municipal Police (§ 323 - 326)
151	Intentional bodily harm (§ 145 - 146a)
161	Fight (§ 158)
171	Violence against a group of people and individuals (§ 352)
172	Hostage taking (§ 174)
173	Dangerous threats (§ 353)
174	Dangerous persecution (§ 354)
181	Extortion (§ 175)
185	Abuse of the person entrusted (§ 198)
186	Abuse of a person living in a common dwelling (§ 199)
201	Rape (§ 185)
202	Sexual coercion (§ 186)
211	Sexual abuse in dependence (§ 187/2)
212	Other sexual abuse (§ 187/1, 3, 4)
214	Other forms of sexual abuse (§ 187/1, 3, 4)
231	Other sexual deviations (§ 358)

Continued on next page

Table 22 – *Continued from previous page*

TSK Categorization	Designation
241	Moral threat (§ 191)
251	Endangerment of venereal disease (§ 155)
252	Deliberate bodily harm to human disease (§ 145, 146, 152)
371	Burglary into apartments (§ 178, 205)
372	Burglary at weekend huts (§ 178, 205)
373	Burglary into family houses (§ 178, 205)
411	Pocket theft (§ 205)
412	Sexual theft (§ 205)
413	Theft of persons, others (§ 205)
431	Theft of motor vehicles (§ 205, 207)
432	Theft of two-wheeled motor vehicles (§ 205, 207)
433	Car theft (§ 205)
434	Theft of motor vehicle components (§ 205)
451	Theft in apartments (§ 205)
311 - 490	Other theft and burglary
511	Fraud (§ 209)
589	Damage to a foreign object (§ 228)
611	Disorderly activities (§ 358, 359)
613	Spray painting (§ 228/2)
651	Fires (§ 228, 272, 273)
814	Damage to a foreign object (§ 228)

Source: Police of the Czech Republic (2018)

References

Anders, JD and R Dorsett (July 2017). HMP Peterborough Social Impact Bond - cohort 2 and final cohort impact evaluation. *Ministry of Justice: London, UK*. **available**: http://www.gsef-net.org/sites/default/files/publication/peterborough-social-impact-bond-cohort-2-results-report_1.pdf.

Apel, Robert J. and Gary Sweeten (2010). *Propensity Score Matching in Criminology and Criminal Justice. Handbook of Quantitative Criminology*. Springer New York: New York, NY. Chap. 26, 543–562. DOI: 10.1007/978-0-387-77650-7{_}26. **available**: http://link.springer.com/10.1007/978-0-387-77650-7_26.

Arena, Marika et al. (Oct. 2016). Social Impact Bonds: Blockbuster or Flash in a Pan? *International Journal of Public Administration* **39**(12), 927–939. ISSN: 15324265. DOI: 10.1080/01900692.2015.1057852.

Azemati, Hanna et al. (2013). Social Impact Bonds: Lessons Learned So Far. *Federal Reserve Bank of San Francisco*, 23–33. **available**: http://projects.iq.harvard.edu/files/siblab/files/social-impact-bonds-lessons-learned.pdf.

Berlin, Gordon L (2016). *Learning from experience: A Guide to Social Impact Bond Investing*. Tech. rep. New York: MDRC, 35. **available**: https://eric.ed.gov/?id=ED565239.

Brand, Sam and Richard Price (2000). *The economic and social costs of crime*. Tech. rep. London: Home Office Research Study. **available**: https://www.researchgate.net/publication/247849478.

Cameron, A. Colin and K. Pravin Trivedi (2005). *Microeconometrics: Methods and Applications*. Cambridge University Press: New York. ISBN: 978-0-511-12581-2.

Cave, Sion et al. (2012). *Peterborough Social Impact Bond: an independent assessment Development of the PSM methodology*. Tech. rep. Ministry of Justice. **available**: www.justice.gov.uk/publications/research-and-analysis/moj.

CNB (2020). *Central bank exchange rate fixing*. **available**: https://www.cnb.cz/en/financial-markets/foreign-exchange-market/central-bank-exchange-rate-fixing/.

Collins, Gary S. and Yannick Le Manach (Aug. 2012). Comparing treatment effects between propensity scores and randomized controlled trials: improving

conduct and reporting. *European Heart Journal* **33**(15), 1867–1969. DOI: 10.1093/eurheartj/ehs114. **available**: https://academic.oup.com/eurheartj/article-abstract/33/15/1867/468702.

CZSO (Nov. 2019a). *Justice, Crime, Accidents*. **available**: https://www.czso.cz/csu/czso/29-soudnictvi-kriminalita-nehody-brtq4tezbp.

CZSO (2019b). *Wages - time series*. **available**: https://www.czso.cz/csu/czso/pmz_ts.

ČAP (2018). *Annual Report ČAP 2018*. Tech. rep. Czech Insurance Association. **available**: http://www.cap.cz/images/o-nas/vyrocni-zpravy/2018_vyrocni_zp.pdf.

Dehejia, Rajeev H. and Sadek Wahba (Feb. 2002). *Propensity score-matching methods for nonexperimental causal studies*. DOI: 10.1162/003465302317331982.

Diblíková, Simona et al. (2019). *Analýza trendů kriminality v České republice v roce 2018*. Institute for Criminology and Social Prevention: Prague. ISBN: 978-80-7338-179-0. **available**: www.kriminologie.cz.

Dickman, Paul W and Timo Hakulinen (2003). *Population-based cancer survival analysis*. Tech. rep. **available**: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.723.4761&rep=rep1&type=pdf.

European Parliament, Think Tank (2014). *Social impact bonds: Private finance that generates social returns - Think Tank*. **available**: http://www.europarl.europa.eu/thinktank/en/document.html?reference=EPRS_BRI(2014)538223.

Fairley, William and Henry D Jacoby (Aug. 1975). *Investment Analysis Using the Probability Distribution of the Internal Rate of Return*. Tech. rep. 12. Management Science, 1428–1437. **available**: https://www.jstor.org/stable/2630057.

Fox, Chris and Kevin Albertson (2011). Payment by results and social impact bonds in the criminal justice sector: New challenges for the concept of evidence-based policy? *Criminology & Criminal Justice* **11**(5), 395–413. ISSN: 17488966. DOI: 10.1177/1748895811415580.

Fraser, Alec, Stefanie Tan, Kristy Kruithof, et al. (2018). *Evaluation of the social impact bond trailblazers in health and social care: Final report*. Tech. rep. London: Policy Innovation Research Unit.

Fraser, Alec, Stefanie Tan, Mylene Lagarde, et al. (Jan. 2018). Narratives of Promise, Narratives of Caution: A Review of the Literature on Social Impact Bonds. *Social Policy & Administration* **52**(1), 4–28. ISSN: 01445596. DOI: 10.1111/spol.12260. **available**: http://doi.wiley.com/10.1111/spol.12260.

Gotsis, Tom (2017). Social Impact Bonds and recidivism : A new solution to an old problem ? *NSW Parliamentary Research Service*(1), 1–17. **available**: https://www.parliament.nsw.gov.au/researchpapers/Documents/Social%20Impact%20Bonds%20and%20Recidivism.pdf.

Heeks, Matthew et al. (2018). *The economic and social costs of crime*. Tech. rep. Home Office.

Helbitz, Alisa et al. (2016). *Social Impact Bonds*. Tech. rep. Social Finance. **available**: https://www.socialfinance.org.uk/sites/default/files/publications/sibs-early-years_social_finance_2016_final.pdf.

Hepburn, John R. and Celesta A. Albonetti (June 1994). Recidivism Among Drug Offenders: A Survival Analysis of the Effects of Offender Characteristics, Type of Offense, and Two Types of Intervention. *Journal of Quantitative Criminology* **10**(2), 159–179. DOI: 10.2307/23366041. **available**: https://www.jstor.org/stable/23366041.

Hrinko, Martin (Jan. 2014). *Zpráva o činnosti služby pořádkové policie za rok 2013 - Policie České republiky*. **available**: https://www.policie.cz/clanek/zprava-o-cinnosti-sluzby-poradkove-policie-za-rok-2013.aspx.

Irwin C., Timothy (2007). *Government Guarantees: Allocating and Valuing Risk in Privately Financed Infrastructure Projects*. The World Bank: Washington, D.C. ISBN: 0-8212-6859-1. **available**: https://books.google.cz/books?id=uei7q4YCaqUC&printsec=frontcover&hl=cs#v=onepage&q&f=false.

Jiricka, Vaclav et al. (2014). Prediction of Offending: SARPO—The Czech Tool for Assessment of Offenders' Criminogenic Risk and Needs. *Journal of Criminology* **2014**, 1–8. DOI: 10.1155/2014/592341. **available**: https://www.researchgate.net/publication/269862444_Prediction_of_Offending_SARPO-The_Czech_Tool_for_Assessment_of_Offenders'_Criminogenic_Risk_and_Needs.

Jolliffe, Darrick and Carol Hedderman (2014). *Peterborough Social Impact Bond: Final Report on Cohort 1 Analysis Prepared for Ministry of Justice*. Tech. rep. University of Leicester. **available**: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/341684/peterborough-social-impact-bond-report.pdf.

Kaminská P., Jindřiška (2020). *Request for information*. Prague.

Kleinbaum, David G. and Mitchel Klein (2012). *Introduction to Survival Analysis*. Springer Science+Business Media, 1–54. DOI: 10.1007/978-1-4419-6646-9{_}1.

Krátký, Jiří (2012). *Porovnání přístupů měření společenské návratnosti investice (SROI) ve vybraných zemích EU*. Tech. rep. Koalice nevládek Pardubicka o. s.

Liang, Max et al. (2014). *An Overview of Social Impact Bonds*. Tech. rep. 2, 267–281. **available**: http://scholarlycommons.law.hofstra.edu/jiblhttp://scholarlycommons.law.hofstra.edu/jibl/vol13/iss2/3.

Marešová, Alena et al. (2011). *Kriminální recidiva a recidivisté (charakteristika, projevy, možnosti trestní justice)*. Institut pro kriminologii a sociální prevenci: Praha. ISBN: 978-80-7338-119-6. **available**: www.kriminologie.cz.

Marshall, David B. and Diana J. English (Nov. 1999). Survival analysis of risk factors for recidivism in child abuse and neglect. *Child Maltreatment* **4**(4), 287–296. ISSN: 10775595. DOI: 10.1177/1077559599004004002. **available**: http://journals.sagepub.com/doi/10.1177/1077559599004004002.

Mäsiarová, Lucie (2018). *Statistická ročenka Vězeňské služby České republiky*. Tech. rep. Odbor správní Generálního ředitelství Vězeňské služby České republiky. **available**: https://www.vscr.cz/wp-content/uploads/2019/05/Statistick%C3%A1-ro%C4%8Denka-2018.pdf.

McKinsey&Company (May 2012). From Potential to Action: Bringing Social Impact Bonds to the US, 68. **available**: https://www.mckinsey.com/industries/social-sector/our-insights/from-potential-to-action-bringing-social-impact-bonds-to-the-us.

McHugh, Neil et al. (2013). Social impact bonds: A wolf in sheep's clothing? *Journal of Poverty and Social Justice* **21**(3), 247–257. ISSN: 17598273. DOI: 10.1332/204674313X13812372137921.

Millar, Ross and Kelly Hall (Sept. 2013). Social Return on Investment (SROI) and Performance Measurement: The opportunities and barriers for social enterprises in health and social care. *Public Management Review* **15**(6), 923–941. ISSN: 14719045. DOI: 10.1080/14719037.2012.698857. **available**: http://www.tandfonline.com/doi/abs/10.1080/14719037.2012.698857.

Ministry of Justice (2014). *Peterborough Social Impact Bond: Result for cohort 1*. Tech. rep. Ministry of Justice. **available**: www.gov.uk/government/uploads/system/uploads/attachment_data/file/341444/peterborough-.

Ministry of Justice (2018). *Closing account of the chapter*. Tech. rep. Prague: Ministry of Justice. **available**: https://justice.cz/web/msp/statni-zaverecny-ucet.

Ministry of Justice (2019). *Czech Judiciary 2018: Annual Statistical Report*. Tech. rep. Prague: Ministry of Justice.

Mitropoulos, Angela and Bryan Dick (2015). Social benefit bonds: Financial markets inside the state. *Markets, rights and power in Australian social policy*, 153–168. **available**: https://mfr.osf.io/render?url=https://osf.io/whr9d/?action=download%26direct%26mode=render&initialWidth=684&childId=mfrIframe.

Mulgan, Geoff et al. (2010). *Social Impact Investment: the challenge and opportunity of Social Impact Bonds*. Tech. rep. The Young Foundation. **available**: www.youngfoundation.org.

Nazari Chamaki, Foroogh, Glenn Paul Jenkins, and Majid Hashemi (Jan. 2018). Social Impact Bonds: Implementation, Evaluation, and Monitoring. *International Journal of Public Administration* **42**(4), 289–297. DOI: 10.1080/01900692.2018.1433206.

NFF (2018). *Pay for Success*. **available**: https://www.payforsuccess.org/project/new-york-state-increasing-employment-and-improving-public-safety.

Phillips, Andrea and John Olson (2013). Rikers Island: the first Social Impact Bond in the United States. *Community Development Investment Review*, 097–101.

PMS (2017). *Koncepce rozvoje Proba ce a Mediace do roku 2025*. Tech. rep. **available**: https://www.pmscr.cz/download/2017_Koncepce_PM_do_roku_2025.pdf.

PMS (2020a). *PMS - PROBAČNÍ A MEDIAČNÍ SLUŽBA - poslání a cíle*. **available**: https://www.pmscr.cz/poslani-a-cile/.

PMS (2020b). *Zpráva o činnosti a hospodaření PMS*. Tech. rep. Prague: Probační a Mediační služba, 28.

Police of the Czech Republic (2016). *Statistical Surveys of Crime in 2016*. **available**: https://www.policie.cz/clanek/statistiky-kriminalita-statisticke-prehledy-kriminality-za-rok-2016.aspx.

Police of the Czech Republic (2017). *Statistical Surveys of Crime in 2017*. **available**: https://www.policie.cz/clanek/statisticke-prehledy-kriminality-za-rok-2017.aspx.

Police of the Czech Republic (2018). *Statistical Surveys of Crime in 2018*. **available**: https://www.policie.cz/clanek/statisticke-prehledy-kriminality-za-rok-2018.aspx.

Police of the Czech Republic (2020). *Dopravní policie - Policie České republiky*. **available**: https://www.policie.cz/clanek/o-nas-clanky-dopravni-policie.aspx.

Police Presidium of the Czech Republic (Nov. 2015). *Rozvoj Policie České republiky v letech 2016 - 2020*. Tech. rep. Prague.

Prison Service of the Czech Republic (2018). *Prison Services Statistical yearbooks*. Tech. rep. **available**: https://www.vscr.cz/informacni-servis/statistiky/statisticke-rocenky-vezenske-sluzby/.

Ragin, Luther and Tracy Palandjian (2013). *Social Impact Bonds: Using Impact Investment to Expand Effective Social Programs A New Vehicle for Impact Investors*. Tech. rep. Federal reserve Bank of San Francisco, 63–67. **available**: http://www.givingusa.org..

Ramsden, Peter, Antonella Noya, and Stellina Galitopoulou (2016). *Social Impact Bonds: State of Play and Lessons Learnt*. Tech. rep. OECD. **available**: https://www.oecd.org/cfe/leed/SIBs-State-Play-Lessons-Final.pdf.

Rogers, William H and Jan Hanley (1982). *Weibull regression and Hazard estimation*. Tech. rep. The Rand Corporation. **available**: https://www.researchgate.net/publication/268341176.

Roundy, Philip, Hunter Holzhauer, and Ye Dai (2017). Finance or philanthropy? Exploring the motivations and criteria of impact investors. *Social Responsibility Journal* **13**(3), 491–512. DOI: 10.1108/SRJ-08-2016-0135.

Scheinost, Miroslav et al. (2015). *Trestní sankce – jejich uplatňování, vliv na recidivu a mediální obraz v televizním zpravodajství*. Institute for Criminology and Social Prevention: Prague. ISBN: 978-80-7338-148-6. **available**: www.kriminologie.cz.

Sinclair, Stephen et al. (June 2014). Social impact bonds: Shifting the boundaries of citizenship. *Social Policy Review 26*, 119–136. DOI: 10.1332/policypress/9781447315568.003.0007. **available**: https://www.researchgate.net/publication/263004415.

SSP (2019). *Report on the activities of the Public Prosecutor 's Office in 2018*. Tech. rep. Supreme State Prosecutor.

Statista (Aug. 2019). *Incarceration rate in Europe 2018 — Statista*. **available**: https://www.statista.com/statistics/957501/incarceration-rate-in-europe/.

Thaler, Richard H. and Cass R. Sunstein (2009). *Nudge : improving decisions about health, wealth, and happiness*, 312. ISBN: 9780141040011.

The National Lottery Community Fund (July 2017). *Directory of Social Impact Bond (SIB) Providers*. Tech. rep. The National Lottery Community Fund. **available**: https://www.tnlcommunityfund.org.uk/media/documents/full-cost-recovery/Commissioning-Better-Outcomes/CBO_directory_of_SIB_providers.pdf?mtime=20181214114430.

Tomkinson, Emma (2012). An Australia snapshot - Social Impact Bonds (. November), 16.

Tripodi, Stephen J. (2010). The influence of social bonds on recidivism: A study of Texas male prisoners. *Victims and Offenders* **5**(4), 354–370. ISSN: 15564886. DOI: 10.1080/15564886.2010.509660.

Visher, Christy A., Pamela K. Lattimore, and Richard L. Linster (Aug. 1991). Predicting the recidivism of serious youthful offenders using Survival Models. *Criminology* **29**(3), 329–366. DOI: 10.1111/j.1745-9125.1991.tb01070.x. **available**: http://doi.wiley.com/10.1111/j.1745-9125.1991.tb01070.x.

VSCR (2020). *What is SARPO - Directorate - General*. **available**: https://www.vscr.cz/o-nas/sarpo/co-je-sarpo/.

VZP (2020). *Assessment base and calculation of premiums*. **available**: https://www.vzp.cz/platci/informace/stat/vymerovaci-zaklad-a-vypocet-pojistneho.

Warner, Mildred (2012). *Profiting from Public Value? The Case of Social Impact Bonds*. Tech. rep. Cornell University.

Warner, Mildred E. (2013). Private finance for public goods: Social impact bonds. *Journal of Economic Policy Reform* **16**(4), 303–319. ISSN: 17487870. DOI: 10.1080/17487870.2013.835727.

WB (2019). *GDP deflator (base year varies by country)*. **available**: https://data.worldbank.org/indicator/NY.GDP.DEFL.ZS?end=2018&locations=GB&start=2014&view=chart.

Wong, Yue-Chim Richard (May 1995). An Economic Analysis of the Crime Rate in England and Wales, 1857-92. *Economica* **62**(246), 246. ISSN: 00130427. DOI: 10.2307/2554905. **available**: https://www.jstor.org/stable/2554905.

Zhang, Zhongheng (2016). Parametric regression model for survival data: Weibull regression model as an example. *Annals of Translational Medicine* **4**(24), 6. ISSN: 2305-5847. DOI: 10.21037/11446.

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